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**Voice or Public Sector Management?**  
***An Empirical Investigation of Determinants of Public Sector Performance***  
***based on a Survey of Public Officials***

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***Abstract***

Drawing on an in-depth governance micro-survey of public officials within a country, we address empirically the question of the relative importance of the various determinants of governance. We investigate the causes of poor governance, and show that commonly made inferences about policy based on simple correlation can be highly misleading, because the high correlation between the various governance (and public sector management) determinants, as well as the endogeneity in these variables. We find that undue emphasis may have been given in previous work to a number of conventional public sector management variables (such as civil servant wages, internal enforcement of rules, autonomy of agency by fiat, etc.), while undermining the priority due to more ‘external’ (to public sector management) variables, such as external voice, transparency, and politicization. The latter set of ‘voice’-related variables has larger affect on the quality of service and corruption than the more traditional public sector management type of variables. Further work drawing in depth on country-specific surveys in other settings is warranted to ascertain with more confidence whether a shift towards more prominence to transparency and ‘voice’-type of variables is needed, backstopping the results for Bolivia in this paper.

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## 1. Introduction

Efficient governance has been long recognized as an important element in improving welfare and economic growth. Yet many countries are plagued with incompetent bureaucracy, mismanagement and corruption. Recently, a number of these countries have undertaken policies to fight corruption and improve their governance. While the empirical literature is growing, to date there is however a limited theoretical and empirical findings to guide these policies. A particular gap in this area is country-relevant empirical research, where findings and policy recommendations are adapted to the particular country setting. Much of the empirical work is through cross-country regressions, and thus with limited policy applicability to a particular country.

Furthermore, when country-specific data is available, inferences are often made on the basis of simple correlation between variables. As a result, reviewing the writings in the governance field one encounters that a very long list of governance-related variables matter for performance, whether related to public sector management and compensation, voice and accountability, political economy, public finance and the like. Indeed, in the existing studies on the subject, which tend to point to the importance of public sector determinants of performance, it is rarely presented that, contrary to conventional wisdom, some specific governance or public sector management variable may *not* be a significant determinant for performance -- or at least not as important as others. It is even rare to find writings ascertaining that the significance of oft-touted public sector factors (such as civil servant wages, or agency autonomy, for instance) *cannot* be ascertained.

At the same time, the cumulative effect of studies at different aspects of public sector performance matters (often without shedding light on the others) has tended to result in overly long ('Christmas tree-like') lists of recommendations to improve performance, without sense of providing priorities, and that such priorities may vary significantly from one country to another.

Drawing on an in-depth governance micro-survey within a country, the purpose of this paper is to address in depth the question of the relative importance of the various determinants of governance. For that, we undertake to estimate empirically the causes of poor governance, using a unique data set from detailed responses of public officials working in public sector agencies and municipalities in Bolivia. Based on these estimates

we try to shed light on suggested priorities to improve the quality of governance and reduce the level of corruption.

In spite of the pernicious effect of poor governance most policy recommendations to fight corruption and improve governance and public sector management are based on conclusions from simple correlation between policy variables and various measures of governance quality and corruption, usually contained in economic reports at times covering a broad spectrum but often excluding rigorous econometrics. Unconditional correlation, however, may be misleading if other factors that affect governance are correlated with the policy variable in question. For example, mechanisms ensuring transparency are usually correlated with enforcement of rules and regulations, as they are often designed simultaneously. In this case, if transparency improves the quality of governance, one would find high correlation between enforcement of rules and quality of governance even if enforcement has no affect on the quality of governance.

Additional complications may arise because several policy variables may be endogenous. For example, on one hand, poor transparency may lead to higher level of corruption as public official have more discretionary power. On the other hand, corruption may lead to poor transparency, as corrupt agents, reluctant to be exposed, attempt to weaken information flow. In this case, even conditional correlation (i.e., multiple regression) may be misleading. In the appendix, we analyze in more detail the bias when one ignores the fact that the variables may be endogenous.

These econometric problems are not the only source of bias in policy recommendations. In the governance literature often when econometrics are utilized, recommendations for a particular country setting are often made on the basis of cross-country regression results, without in-depth agency specific results within the country under study. For example, Broadman and Recanatini (2000) investigate the role of market institutions on corruption in transition economies. Ades and Di Tella (1999) analyze the link between foreign competition and corruption, and Treisman (2000) explores the effects of historical and cultural traditions, and political institutions on corruption. While these cross-country empirical papers shed some light on some of the causes of corruption, their scope is somewhat limited. Due to data constraints, they are able to analyze only a few policy variables based on cross-country differences.

In general, policies to improve governance can be divided between policies that emphasize the important of voice, transparency and accountability and policies that emphasize the importance of the structure of the institutions such as autonomy, decentralization, rules, and wages. Thanks to a unique in-depth public official survey carried out in Bolivia, the data set used in this paper allows a comparison of these policies utilizing a large set of variables. We find that the voice related variables have larger affect on corruption and the quality of services than institutions. Thus, policies to improve the quality of governance and reduce corruption should emphasize transparency and voice first rather than institutions.

This paper is organized as follows. In the next section, we discuss the theoretical considerations and present a simple model. Section 3 explains the data and the econometric model. In section 4 we present the estimation results. Section 5 discusses possible caveats and robustness tests and section 6 concludes.

## **2. Theoretical Considerations**

Economic analyses of the determinants of corruption follow Becker's seminal model of crime and punishment (Becker (1968)) or the principal agent theory (e.g., Becker and Stigler (1974), Rose-Ackerman (1975), Tirole (1986), Mookherjee and Png (1992, 1995)). Becker (1968) argues that an individual chooses to undertake illegal activity if the expected payoffs from illegal activity are greater than the expected payoff from legal activities. Policies to fight corruption, therefore, should focus on increasing rewards (wage) on the one hand and enforcement (punishment) on the other hand. Becker and Stigler (1974) extended the analysis to a principal-agent setting where because of incomplete information the higher-level manager (the "principal") cannot observe the public official (the "agent") actions. In this model, incomplete information enables the corrupt public official to hide his/her corrupt activities<sup>1</sup>. Tirole (1986, 1992) extends the classic principal-agent framework to a three-tier principal-supervisor-agent hierarchies where a supervisor is hired by the principal to monitor the agent. The supervisor's

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<sup>1</sup> The agent may also face some information problems, too. If the public official does not have complete information about the individuals' characteristics, he may use some signaling mechanism (Banerjee (1997)) argues that red-tape is one of these instruments that is used to learn about private agents' willingness to pay bribe.

usefulness can be compromised if he chooses to collude with the agent rather than reveal the information.

Many scholars have argued that raising officials' pay will reduce corruption (see, for instance, Becker and Stigler, (1974), Klitgaard, (1989), and Haque and Sahay (1996)). However, the required pay raise may be prohibitively expensive and it may be cost-effective for governments to pay "capitulation wages" (that attract only the dishonest) rather than raise wages to the high levels required in order to deter corruption (Besley and McLaren (1993), Dabla-Norris (2000), and Wane (2000)). Even it is feasible to pay high government wage, it may cause misallocation of talent across public and private sector (Acemoglu and Verdier (1998)). Effectiveness of pay hikes as a policy tool to combat with corruption has also been criticized. Di Tella and Schargrodsky (2000) argues that when control mechanisms are too weak or too strong, wages do not have any impact on corruption. Van Rijckeghem and Weder (1997) argue that the agent may engage in corrupt activities only if there is a differential between the actual wage and the "fair" wage as perceived by the agent.

Weakness of hierarchical control mechanisms in corrupt government systems exacerbates the harm of corruption, because officials do not coordinate their corrupt activities and internalize the externalities (see Shleifer and Vishny (1993), and Walter (2000)). In this context even a "stationary bandit" who monopolizes bribe collection is preferable to the anarchy of independent agencies (McGuire and Olson, (1996)).

Rauch and Evans (2000) argue that when jobs and promotions in public service are based on political connections, public officials would have less incentive to stay "clean" because their prospect in their job is linked to "whom they serve" rather than to their performance. Thus, a bureaucracy that offers long-term careers with chances of advancement based on merit would result in lower level of corruption. Politicization of institutions, on the other hand, causes economic distortion and corruption through inflated budgets and high government pay (Menes, (1999)).

Another major determinant of corruption is the structure of the private market. It was first emphasized by Krueger (1974) that restricting the operation of the market through quantitative restrictions causes more welfare cost than the tariff equivalent, since shortage economy leads to rent-seeking. It is often argued that market competition reduces corruption, but it is also possible that corrupt officials may destroy competition to

create room for bribe. Rose-Ackerman (1975) argued that market competition is not sufficient to prevent bribery, if firms can play with the terms of contract to create excess profit from which the bribe is paid. On the empirical front, however, there is less ambiguity. Ades and Di Tella (1997,1999) showed that lack of competition (measured as share of imports, antitrust law, market dominance, distance to world markets) is associated with more corruption (see also Laffont and Tchetche (1999), Svensson (2000), Acemoglu and Verdier (2000), and Lerrain and Terrares (2001)).

In addition to hierarchical systems of administrative control systems based on rewards and penalties, accountability mechanisms may also build upon citizen voice (the capacity of “outsiders” to express their views to the government officials) and exit (switching to privately supplied services, or moving away from jurisdictions with poor public services). People can compare the performances of local governments and if they are dissatisfied they can vote the incumbent out of power (Besley and Case 1995, Porto and Porto 2000, Gordon and Wilson 2001). Alternatively, they can “vote by their feet” or by “their pocket”. In this case, a “Bertrand-style” competition takes place and the agencies which outbid each other to the bottom until their bribe demand diminishes to zero (Tiebout 1956, Besley and Case 1995, Porto and Porto 2000, Gordon and Wilson 2001). Gray-Molina et. al. (1999) find that over-pricing and informal payments to municipal health service providers in Bolivia decline significantly in places where citizens participate in health board meetings and there exists an exit option in the form of private health service provision. Furthermore, they find that formal control and supervision mechanisms have no significant affect on corruption behavior. Kuncoro (2000) shows decentralization of administration of business licenses in Indonesia has created locational preference on the part of individual firms to choose to region with lower or optimal bribe.

State structure, particularly the degree of (political) decentralization has also been analyzed in the context of quality of governance. As Bardhan and Mookherjee (2000b) pointed out lack of accountability arises from two factors: political capture by the special interest, and the bureaucratic corruption due to agency problem. The second factor is less problematic in local governments, whereas more problematic in centralized systems (Carbonara 2000). Local capture may be less or more prevailing depending on a multitude of diverse factors, such as heterogeneity within a district (more heterogeneity

leads to more local corruption), the nature of electoral system (in proportional representation limits discretionary power), the size of the country (larger countries have more agency problems - thus, more corruption) etc. (Bardhan and Mookherjee 2000a). Seabright (1996) argues that decentralization should improve the quality of government by bringing officials closer to the people and by encouraging competition between local governments. Other scholars, however, argue that corruption is more prevalent at the local level. Tanzi (1995) argues that high patronage politics and clientelism emerged from closer interaction between local governments and citizens. Moreover that inefficiencies due to vertical and horizontal coordination problems, lack of qualified employees and effective monitoring mechanisms at the local level may increase corruption at the local level (Prud'homme, (1994)). Empirical research on the premises of decentralization is inconclusive. Fisman and Gatti (2000) and de Mello and Barenstein (2001) report that fiscal decentralization is associated with lower corruption. Treisman (2000) finds that corruption is higher in federally structured states and in countries that have a more tiers of government.

This paper offers several contributions to the theoretical analyses of governance. First, we assert that corruption and lack of transparency, while related, are *conceptually distinct concepts* and manifestations of misgovernance. While corruption relates to the abuse of power to private gains, transparency relates to the availability of information within the institution and outside the institution.

Second, we develop a model where the resulting level of corruption, transparency and quality/level of service delivery are the three key decision variables in the hands of the public official. The public official decides on their level that maximizes her welfare subject to constraints of course: higher levels of corruption being subject to bargaining with the private agent and to reputational costs; lower levels of transparency subject to internal rule-based constraints, lower level of service subject to lower earnings/promotion prospects.

This joint determination of the three key decision variables by the public official extends the literature by highlighting the importance of public official incentive structure and behavior along these dimensions in *determining the level/quality of public service delivery*. In particular, incorporating possibility that the link between bribery and service delivery may be either a positive or a negative one. This contrasts much of the literature

which either: i) did not model such link with public service delivery at all, ii) modeled it as a simplistic one pre-determined direction where bribery is either 'grease' helping businesses by getting around red tape (see for example Lui, (1988)), or "sand" exacerbating the red-tape (Kaufmann and Wei, (2000)), iii) modeled 'public service' rather superficially, typically as signatures/red tape/licenses, rather than actual public goods crucial for development and poverty alleviation. Hence, our model is a more integrative model of governance and public service delivery. Furthermore, in contrast to other models where the level of Corruption, Transparency or Service Delivery is determined taking the level of the other two variables as given, in our model, the levels of Corruption, Transparency and Service Delivery are *endogenous and determined simultaneously*. Policies to improve service delivery, corruption or transparency (as well as empirical estimations), therefore, should utilize this complex simultaneous system to devise efficient policies. Furthermore, while exogenous, politicization (external negative influence) and voice (external positive feedback/pressure) have an important and explicit affect on the incentives of public official to settle for a lower (higher) equilibrium in the joint determination of the levels of corruption, transparency and service delivery.

Third, the model formally integrates the importance of *institutional norms*. Deviations from the institutional norms are subject to penalty, etc. This highlights the importance of institutions culture standards. An individual who works in an institutions with high level of service quality and well established guidelines and policies will provide higher level of quality than an individual who works in an institution with low level of service quality (this is the egg and the chicken difficulties in improving governance – If one can improve the average level of service then individual public officials will improve the level of their services, but until public officials do so the average level will not rise.) Furthermore, it emphasizes the positive (negative) externalities of having honest (corrupt) public official.

## **2.1 A Simple Model of Corruption, Transparency and Service Delivery**

Consider an economy that is composed of a representative public official who provides services to  $n$  heterogeneous agents (individuals or groups). Let agent's  $i$  utility depends on two elements: the agent's individual preferences over public services,  $X_i$  and the service that she receives from the public official,  $Z_i$ . For example,  $X_i$  could be thought

of as the individual preference for the water or sanitation service to the agents' house, the qualities of roads in the neighborhood, the amount of taxes (tariffs) for a given good or service, building permit and so on, and  $Z_i$  as the level that is provided. Specifically, let the agent's utility function be

$$U_i = -(X_i - Z_i)^2 \quad (1)$$

The agent attains maximum utility when the provided service is equal to her individual preferences, and declines the larger the difference between the individual preferences and the services received. Note that the optimal amount of service is not infinity, but rather a finite amount that depends on the individual's preferences (for example, building too many roads, telephone poles, collecting garbage 10 times a day and so on may be greater than the level that will maximize the individual welfare).

We assume that the institution's utility is different from the sum of the individual's utility due to externalities or limited resources. For example, construction permits may have negative externalities such as traffic congestion or pollution, or the agency has enough resources to collect garbage only once a month. Specifically, let the institution utility be

$$SW = \sum_{i=1}^n -(\beta X_i - Z_i)^2 \quad (2)$$

Where  $\beta$  is a parameter that captures the difference between the social welfare and the individual welfare (externalities). If  $\beta < 1$  then the service involves negative externalities (or the institution resources are limited). On the other hand, If  $\beta > 1$  then the service involves positive externalities. In order to simplify the exposition we present the solution for the case where  $\beta < 1$ , which we believe is a more realistic case.<sup>2</sup> We assume that the institution has to issue the same policy to each individual (i.e., it can not issue a policy that links  $Z_i$  to  $X_i$ . For example, the institution cannot collect garbage only from some houses or requires permits/regulations only from some individuals). The institution, therefore, has to choose a common standard level of service that will be given to each

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<sup>2</sup> Note that similarly, one could solve the model for the case where  $\beta > 1$ .

individual that will maximize its social welfare. This level which we denote as  $Z^*$  can be calculated from equation (2) as

$$Z^* = b\bar{X} \quad (3)$$

where  $\bar{X}$  is the average level of preferred service. Equation (3) states that the services with negative externalities or institutions with lower resources will set lower level of service.

The public official who is in charge of supplying  $Z$ , however, has a different objective. The public official objective is to maximize her expected income (welfare) given a set of incentives that are set by the institution, and the individuals' demand for the services he is providing. In particular, the public official controls the standard level of service that is given to every individual unless he pays bribe,  $Z^p$ ; the level that he delivers to individual  $i$  in return for a bribe,  $Z_i$ ; and the level of transparency of the service to the individual,  $T$  (i.e., the information that the individual has about  $Z^*$ ). Specifically, let  $b_i$  be the amount of bribe that individual  $i$  is willing to pay in return for service  $Z_i$ . The amount of bribe that individual  $i$  is willing to pay as a function of the standard service and the new service is the difference between the utility given the standard service,  $(X_i - Z^p)^2$ , and her utility given the new service,  $(X_i - Z_i)^2$ ,

$$b_i = (X_i - Z^p)^2 - (X_i - Z_i)^2 \quad (4)$$

We assume that the value of the bribe to the public official, or alternatively the amount of bribe that the public official receive for a given deviation from  $Z^p$  to  $Z_i$ , declines with the level of transparency (i.e., the information available to the individual). Intuitively, higher level of transparency reduces the bargaining power of the public official and hence he can capture a smaller share from the individual gains. Alternatively, higher level of transparency increases the probability of being caught and hence reduces the value of the bribe. Even if there is negligible chance of getting caught or punished in the near future, the official is reluctant to gain a reputation of being a corrupt person. Often, excepting bribes involved besides the intangible costs, such as the probability of

losing future employment opportunities, also the danger of being sacrificed as a villain in a political crisis, and disapproval and censure from the public<sup>3</sup>. To capture this affect of transparency, we assume that the value of a bribe to the public official is discounted according to the level of transparency and other exogenous variables such as honesty of the public official and so on,  $g(T)$  where  $g'(T) < 0$ .<sup>4 5</sup>

In the absent of any restrictions and incentives set by the institution, the public official can maximize the amount of bribe by setting the standard level of service,  $Z^P$  and transparency at their lowest possible levels. The institution, however, set incentives and regulations in order to improve the standard level of services and reduce the amount of bribes. Accordingly, the public official's expected utility depends on three elements. First, it depends on the difference between the optimal level of service,  $Z^*$  and the standard level,  $Z^P$ . Every organization provides some rules and policies to guide the decision making process in the administration. Officials who deviate from the institutional norm have lower (higher) probability of promotion (demotion). Second, it depends on the deviation between the service that individual  $i$  gets and the standard level of service. The more the public officials deviate from the standard practices and do favors to individuals the larger the risk of being caught and punished. Third, it depends on the deviation from the transparency standards  $T^*$ , set by the institution. These standards depends on exogenous variables such as quality of rules, citizen voice, well organized civic groups and so on. The public official can reduce the transparency level within the institution by hiding or changing records, withholding information, not reporting transactions, etc. However, the larger are the discrepancies, the lower (higher) the probability of promotion (demotion).

Given this set of incentives the public official wishes to maximize his welfare by choosing the standard level of services,  $Z^P$ , the level of transparency,  $T$ , the service and

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<sup>3</sup> Tirole (1996) models the reputation of a group as an aggregate of individual reputations, and shows that when the individual behavior is observed with noise, the past behavior of the group can be used to predict the member's individual behavior. This kind of corporate punishment discourages individuals to engage in corruption because if they are caught they are also condemned by their peers. Wittman (1989) also cites reputation as an important factor that may mitigate the principal-agent problem.

<sup>4</sup> Alternatively,  $g(T)b_i$  can be seen as the rent paid to the official and  $(1-g(T))b_i$  is the rent captured by the individual. In a more transparent environment the individual would have inside information about the formal and informal procedures. Hence, greater transparency would increase the bargaining power of the individual and consequently the public official would capture a smaller share of the rent.

the bribe of individual  $i$ ,  $Z_i$  and  $b_i$  respectively. Specifically, the public official solves the following maximization,

$$\begin{aligned} \max_{Z^P, Z_1, \dots, Z_n, T} V &= g(T) \sum_i b_i - f_1 \sum_i (Z_i - Z^P)^2 - f_2 (Z^* - Z^P)^2 - \frac{f_3}{2} (T^* - T)^2 \\ \text{st.} \quad b_i &= (X_i - Z^P)^2 - (X_i - Z_i)^2 \end{aligned} \quad (5)$$

where  $f_1, f_2, f_3 > 0$  are parameters that represents the various incentives and  $T^*$  and  $Z^*$  are the transparency and corruption norm that are set (exist) in the institution.

The first part of the utility function of the public official is the value of total bribe receipts. The remaining terms represent the incentives (the probability of promotion and demotion), which consists of three parts: (i) the variance of the services,  $(Z_i - Z^P)^2$ , (ii) the deviation between the standard level and the level set by the institution,  $(Z^* - Z^P)^2$ , and (iii) the deviation from the norm level of transparency,  $(T^* - T)^2$ .

The parameters  $f_1, f_2, f_3$  represents the importance of each of the above policy incentives. The parameter  $f_1$  captures the costs associated with the variance of service,  $f_2$  captures the costs associated with deviation from the institutional norm, and  $f_3$  represents the costs associated with deviation from the institutional norm of transparency. All three parameters would be higher in institutions that are successful in monitoring their employees effectively and enforcing their internal rules consistently. On the other hand, in highly politicized institutions where patronage politics and favoritism is rampant  $f_1$  and  $f_2$  would be small.

In general, the incentive structures (i.e.,  $f_1, f_2$ , and  $f_3$  times the respective element) represent the loss in the *expected lifetime earnings* (the change in lifetime promotion-career path and pension) given a set of action (i.e.,  $Z^P, Z_i, b_i$  and  $T$ ). In other words, it represents the combination of the present value of lost earnings times the probability of penalty being carried out in the face of (various types of) norm deviation. The fact that promotion prospects depend differently on the various deviations is captured by the

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<sup>5</sup> One could consider also other forms of transparency. For example, transparency about the deviation of the standard level from the norm or the variance of services. We leave these forms of corruption for future research.

distinct  $f$ 's. In general, in institution where lifetime earnings are pitifully low (and there is no pension), or the alternative life time earnings (e.g., the wage in the private sector) is relatively high the costs that is captured by the various  $f$ 's would never constitute a serious cost factor for the public official, regardless of how transparent/voice-full the institutional regime is. Thus, one would expect that higher wages would be associated with higher losses of expected lifetime earning (i.e., high  $f$ 's). Note, however that in general it is not the current level of wages that matters but the changes in all future wages that is important.

The public official chooses the level of  $Z^P$ ,  $Z_i$ , and  $T$  to solve his optimization problem specified in (5). The standard level of service,  $Z^P$ , the individual service,  $Z_i$ , and the level of transparency,  $T$ , are given by the first order conditions of equation (5) with respect to  $Z^P$ ,  $Z_i$ , and  $T$  respectively, provided that  $f_1$  and  $f_2$  are sufficiently large to satisfy the second order conditions <sup>6</sup>:

$$-g(T)\sum_i(X_i - Z^P) + f_1\sum_i(Z_i - Z^P) + f_2(Z^* - Z^P) = 0 \quad (6)$$

$$g(T)(X_i - Z_i) - f_1(Z_i - Z^P) = 0 \quad (7)$$

$$g'(T)\sum_i b_i + f_3(T^* - T) = 0 \quad (8)$$

Equation (6) states that the public official sets the standard level of service such that the increase in bribes from decreasing the standard service by one unit (the first term) are equal to the costs from such an increase (the increase in the variability and the larger deviation from the institutional norm, the second and the third terms respectively).

Equation (7) states that the level of service provided to each individual is such that the increase in bribes from providing another unit to individual  $i$  (the first term) is equal to the costs of deviating from the standard level. Finally, equation (8) states that the level of transparency set by the public official is such that the increase in the value of bribes due to lower transparency (the first term) is equal to the costs from decreasing transparency (the second term).

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<sup>6</sup> These second order conditions are (i)  $ng(T) - f_1n - f_2 < 0$ , and (ii)  $ng^2(T) - f_1f_2 - f_2g(T) < 0$ . When the second order conditions do not hold the solution is to set the standard level at minus infinity.

Equations (6)-(8) can be solved to yield the optimal (from the public official point of view) standard level of service, the level provided to each individual and the level of transparency respectively

$$Z^P = Z^* - \frac{ng(T)^2}{f_2(g(T) + f_1) - ng(T)^2} (\bar{X} - Z^*) \quad (9)$$

$$Z_i = \frac{g(T)}{g(T) + f_1} X_i + \frac{f_1}{g(T) + f_1} Z^P \quad (10)$$

$$T = T^* - \frac{g'(T)}{f_3} \sum_i b_i \quad (11)$$

The standard level of services is given in equation (9)<sup>7</sup>. Since  $Z^* < \bar{X}$  (as long, as there are negative externalities in the provision of public services or the institution has limited resources,  $b < 1$ ), the public official sets a standard service that is below the institutional norm. Intuitively, the public official by reducing the standard level increases her leverage in providing higher service and hence the possible bribe. In other words, by setting the standard level at a level below the norm, the public official can capture bribes by simply providing individuals the norm. Higher transparency reduces the benefits from bribe and hence reduces the incentives to lower the standard level and attain larger amount of bribes. Likewise, larger costs of deviating from the norm,  $f_2$ , and large costs of deviating from the standard level,  $f_1$ , increase the standard level. The larger these costs are the closer the standard level to the norm.

Equation (10) describes the service level provided to individual  $i$  who pays bribe,  $Z_i$ . This level is a weighted average of the individual preferences ( $X_i$ ) and the standard service level, where the weights are given by  $g(T)$  and  $f_1$  respectively. The lower the transparency (higher  $g(T)$ ) and the smaller the costs of deviating from the norm, ( $f_1$ ), the closer is the level provided to individual  $i$  to her preferences (i.e.,  $Z_i$  is closer to  $X_i$ ). In other words, when transparency is poor, or the costs of providing difference levels is

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<sup>7</sup> Note that from the second order condition the denominator is positive.

small, individuals can pay bribe and get the service they wish. Transparency creates a distinction between the value of bribe to the individual and the value to the public official and hence reduces the amount of favoritism that an individual can buy.

Finally, the level of transparency is given in equation (11). Transparency depends positively on the norm level,  $T^*$ , and the costs of deviating from this level,  $f_3$ , and it depends negatively on the amount of bribes and the affect of a change in the level of transparency on the value of the bribe  $g'(T)$ .

The amount of bribe that each individual will pay can be calculated by substituting the values of  $Z_i$  and  $Z^P$  from equations (9) and (10) in equation (4),

$$b_i = \left( 1 - \frac{f_1^2}{(g(T) + f_1)^2} \right) (X_i - Z^P)^2 \quad (12)$$

The amount of bribe that individual  $i$  pays depends on the difference between the individual preference and the standard level. Individuals with large preferences,  $X_i$ , pay larger bribe while individuals whose preferences are equal to the standard level will not pay any bribe. Likewise, an increase in the costs of favoritism,  $f_1$ , will reduce the level of bribe that individual  $i$  pays.

The total amount of bribe can be calculating simply by aggregating over all individuals,

$$\sum_i b_i = \left( 1 - \frac{f_1^2}{(g(T) + f_1)^2} \right) \sum_i (X_i - Z^P)^2 \quad (13)$$

While some individuals may pay lower bribe if the standard level is lower (and benefit from the lower level), overall since  $Z^* < \bar{X}$  the lower the standard level the larger the total amount of bribe (and the lower the total welfare) average utility of those who pay bribe and those who do not pay bribe).

It is important to note that corrupt behavior itself need not impose a social cost since it involves transfer payments from bribe payers to the bureaucrats. In this model the social loss from corruption arises from the deviation of the effective standard service

level,  $Z^p$  from the socially optimal level,  $Z^*$ . in other words, the public official sets lower level of service in order to increase the demand for his services.

Note that transparency (equation (11)) does not depend directly on the costs of preferential treatment,  $f_1$ , or the cost of deviating from the institutional norm,  $f_2$ . These costs affect the level of transparency through their affect on the level of corruption, but do not affect transparency once the affect of corruption is controlled. Similarly, the level of corruption (equation (12)) does not depend on the cost of deviating from the transparency standards,  $f_3$ , nor on the standard level of transparency,  $T^*$ , or on the change in the value of bribe when transparency changes,  $g'(T)$ . Thus, although service performance, corruption and transparency are endogenous variables that are determined simultaneously, because some variables are excluded from each equation it is possible to estimate the system.

### 3. Data and econometric estimations

#### 3.1 Econometric Model and Data source

Equations (9), (11), and (13) present a simultaneous system of equations that can be estimated using an econometric techniques. Specifically, the model implies the following system of equations:

$$\begin{aligned}
 \text{ServicePerformance} &= h_1(\text{Corruption}, \text{Transparen cy}, Z^*, f_1, f_2, g(\cdot)) \\
 \text{Corruption} &= h_2(\text{ServicePer formance}, \text{Transparen cy}, f_1, g(\cdot)) \\
 \text{Transparen cy} &= h_3(\text{Corruption}, T^*, f_3, g(\cdot))
 \end{aligned} \tag{14}$$

Note that we also add corruption to the service quality equation to capture the possibility of potential effect of corruption on service quality.

Theoretically speaking the system can be estimated if the number of excluded variables is greater than the number of endogenous variables in each equation. In particular,  $f_3$  and  $T^*$  are excluded from the service performance equation;  $f_2$ ,  $f_3$ ,  $Z^*$  and  $T^*$  are excluded from the corruption equation, and service performance,  $f_1$ ,  $f_2$  and  $Z^*$  are excluded from the transparency equation. The empirically task is to construct (identify)

variables that represent the variables/ parameters of the model and then estimate the system using these variables.

The source of our data set is survey of 1250 public officials working in 110 public institutions in Bolivia. These public institutions include top executive branches (e.g. offices of the President and Vice President); ministries (e.g. education, health, finance); line agencies (e.g. customs, tax, immigration); autonomous agencies (e.g. central bank); departmental institutions; and municipal governments. Each institution in the sample delivers services demanded by at least five percent of the population. Within each institution, a stratified random sample of at least 1 percent of all staff was selected at each of the following decision-making ranks: top management, middle management, and rank and file.

Each observation represents the average response of all agents in the same organization. Thus, each observation point in our data set is a public agency. For quality purposes, only agencies with at least five respondents are used. Based on the Public Officials Survey we constructed the following variables that we use in the econometric analysis (see Table 1). A detailed description of the survey questions we used to construct each variable is reported in the appendix.

**Table 1: Description of the Variables**

Variable	Measure
Service Performance	The average of three standardized service delivery indicators (if applicable): quality, quantity, and accessibility. The index is re-scaled using the mean and standard deviation of national service, such that high numbers correspond to high performance in service delivery.
Bribery Index	The average of two standardized bribery indicators: frequency of bribery, and bribe/official income ratio. The index is re-scaled using the mean and standard deviation of corruption at the national level, such that high numbers correspond to high corruption.
Corruption Index	The average of four standardized corruption indicators: frequency of bribery, bribe/official income ratio, percent of jobs purchased, and percent of budget diverted illegally. The index is re-scaled using the mean and standard deviation of corruption at the national level, such that high numbers correspond to high corruption.
Transparency	Percent of cases where the actions of the public officials and the decision making are transparent
Enforcement	Percent of the cases where rules, guidelines, regulations, and processes in the personnel, budget, and service management are strictly monitored and enforced
Meritocracy	Percent of the cases where the decisions on personnel management issues are based on level of education, or professional experience, merit, and performance.
Politicization	Percent of cases where decision on personnel, budget, and service management are free from political interference
Autonomous Agencies	Central Bank, Bank and Finance Superintendence, Telecommunication Superintendence Hierarchical Affairs Superintendence, Transportation Superintendence, National Comptroller, Electoral Court, Constitutional Tribunal, Supreme Court, Ombudsman, Judicial Council.
Resources	Percent of cases where the physical, financial, and human resources of the agency are adequate
Values	The probability that if a public official was overpaid by an administrative error, the public official will return the money given that there is 100% chance of not getting caught and the superiors are doing the same without getting caught.
Voice	An index representing the existence of consumer feedback and complaint mechanisms
Wages	The extent of satisfaction with the wages and other benefits.

The variables constructed above can be used to identify/construct the various parameters of the model. In the next section we estimate these parameters using various methods, including ordinary-least-squares (OLS), two-stage-least-squares (2SLS), and three-stage-least-squares (3SLS).<sup>8</sup>

<sup>8</sup> It might be argued that in case of endogeneity problem, an instrumental variable technique (2SLS/3SLS) should always be preferred as the OLS estimator is known to be biased inconsistent. However, the choice of an estimator in a "small" sample remains a puzzle in the literature. In many empirical studies the OLS estimator is often found to be close to the 2SLS/3SLS estimator, which is not surprising since nearly all applications are based on small samples and 2SLS/3SLS may produce biased estimators in small samples. Similarly, although system methods (3SLS) are to be preferred to single-equation methods (2SLS), Monte Carlo studies suggest that the advantage of the system estimators in finite samples is more modest than the asymptotic results would suggest (Intriligator 1984). Green (2000) argues that "it is often found that OLS estimator is surprisingly close to the structural estimator". Nakamura and Nakamura (1985) show that the asymptotic bias of the OLS estimator will be smaller if (i) a larger proportion of the variability in

Recall from the discussion in the model that  $g(\cdot)$  is the discount value of the bribe that the public official receives. Thus, it depends on the moral values of the public official (and transparency of course);  $Z^*$  is the norm of the service which is captured by the resources of the institution, decentralization, and the citizen voice;  $f_1$ , the costs of deviating from the standard service level and  $f_2$ , the costs of deviating from the service norms depends on the enforcement of rules, politicization, resources of the institution (“monitoring capacity”), meritocracy, and wage; while  $f_3$ , the costs of deviating from the transparency norms depends on the variables above except meritocracy;  $T^*$  the norm level of transparency depends on the level of education – the norm for transparency is higher in institutions with more educated workers, agency autonomy, and the citizen voice – existence of user feedback mechanisms enhances internal transparency.

The considerations above yield the following model of simultaneous equations that we estimate below using several methods,

$$\begin{aligned} \text{ServicePerformance} = & \mathbf{a}_0 + \mathbf{a}_1 \text{Bribery} + \mathbf{a}_2 \text{Transparency} + \mathbf{a}_3 \text{Decentralization} + \mathbf{a}_4 \text{WageSatisfaction} + \\ & + \mathbf{a}_5 \text{RuleEnforcement} + \mathbf{a}_6 \text{IndividualValues} + \mathbf{a}_7 \text{Politicization} + \\ & + \mathbf{a}_8 \text{ResourceEnvelope} + \mathbf{a}_9 \text{Meritocracy} + \mathbf{a}_9 \text{Voice} + \mathbf{e}_1 \end{aligned}$$

$$\begin{aligned} \text{Bribery} = & \mathbf{b}_0 + \mathbf{b}_1 \text{ServicePerformance} + \mathbf{b}_2 \text{Transparency} + \mathbf{b}_3 \text{Meritocracy} + \\ & + \mathbf{b}_4 \text{WageSatisfaction} + \mathbf{b}_5 \text{RuleEnforcement} + \mathbf{b}_6 \text{IndividualValues} + \\ & + \mathbf{b}_7 \text{Politicization} + \mathbf{b}_8 \text{ResourceEnvelope} + \mathbf{e}_2 \end{aligned}$$

$$\begin{aligned} \text{Transparency} = & \mathbf{c}_0 + \mathbf{c}_1 \text{Bribery} + \mathbf{c}_2 \text{WageSatisfaction} + \mathbf{c}_3 \text{RuleEnforcement} + \\ & + \mathbf{c}_4 \text{IndividualValues} + \mathbf{c}_5 \text{Politicization} + \mathbf{c}_6 \text{ResourceEnvelope} + \\ & + \mathbf{c}_7 \text{Voice} + \mathbf{c}_8 \text{AgencyAutonomy} + \mathbf{c}_9 \text{Education} + \mathbf{e}_3 \end{aligned}$$

As discussed above the model is identifiable since in each equation the number of excludable variables is greater than the number of endogenous regressors<sup>9</sup>. Specifically, education, and agency autonomy are excluded from the service performance equation;

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the endogenous regressor is explained by the instrumental variables, and (ii) the goodness-of-fit is larger in the structural equation of the endogenous regressor. Moreover, standard asymptotic approximations to the distributions of instrumental variables break down if the instruments are weak. If the instruments are weak 2SLS estimator is biased in the direction of the OLS estimator.

<sup>9</sup> This condition, known as order condition, is necessary but not sufficient for identification. The rank condition of identification of an equation, which is necessary and sufficient, requires the rank of the matrix of coefficients in *other* equations is not less than the number of endogenous regressors.

decentralization, voice, education, and agency autonomy are excluded from the corruption equation; and meritocracy, and decentralization are excluded from the transparency equation.

### **3.2 Econometric Estimations**

We estimate the system using four methods. First, we use simple correlation between the variables. Second, we estimate a linear least square of each equation separately. Third, we estimate the system using two-stage-least-square (2SLS) and finally we estimate the system using three-stage-least-square (3SLS). First, we use the bribery index as a measure of craft. The results presented in Table 2a. Then, we repeat the same exercise in Table 2b using corruption index which is a broader index capturing illegal budget diversion and purchase of public positions, as well as frequency and level of bribery.

Note that the simple correlations are substantially different than the other estimations as reported in Tables 2a and 2b. This highlight again the large bias in simple correlation and the danger in designing policies based on simply correlation. Second, OLS, 2SLS and 3SLS, provide similar estimates for most of the variables, with the exception of the effect of transparency on service delivery and corruption.

A more detailed examination of the result yield the following conclusions: quality of services depends negatively on the level of corruption and positively on the voice of the citizens and transparency. Corruption depends positively on politicization and negatively on transparency and meritocracy. Finally transparency is affected positively by voice, and negatively by corruption and politicization. In particular, there is no evidence that institutional variables such as wage and enforcement of rules have any significant direct effect on corruption.

**Table 2a: Estimation results for Bribery Index**

All variables are scaled from 0 to 100. Service performance index is the average of three standardized service delivery indicators (if applicable): quality, quantity, and accessibility. Bribery index represents the average of two standardized bribery indicators: frequency of bribery and bribe/official income ratio. The indices are re-scaled using the mean and standard deviation of national service quality and bribery, respectively such that high numbers correspond to high performance and high corruption. Number of observations in each public institution is chosen as the weight of each institution in the regression. In the first stage 8 region dummies are used as additional exogenous variables. Sample size is 89. \*\*\* Significant at 1%, \*\* significant at 5%, \* significant at 10%, † significant at 15 %.

		Dependent Variable: Service Delivery				Dependent Variable: Bribery				Dependent Variable: Transparency				
Variable	Model	Simple Correlation	OLS	2SLS	3SLS	Simple Correlation	OLS	2SLS	3SLS	Simple Correlation	OLS	2SLS	3SLS	Variable
Service Performance						-0.46***	-0.17 (-1.11)	0.65 (0.39)	0.78 (0.99)	0.72***				Service Performance
Bribery		-0.46***	-0.29** (-2.27)	-0.27* (-1.78)	-0.24** (-2.12)					-0.46***	-0.19*** (-4.01)	-0.22* (-1.78)	-0.31** (-2.47)	Bribery
Transparency		0.72***	0.30** (2.42)	0.40† (1.61)	0.45** (2.23)	-0.54***	-1.10** (-4.17)	-1.54** (-2.29)	-1.61*** (-2.62)					Transparency
Resource Envelope	Z*, f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.62 ***	0.25** (1.92)	0.24† (1.59)	0.17† (1.54)	-0.39***	-0.08 (-0.41)	-0.10 (-0.65)	-0.11 (-0.74)	0.52***	-0.07 (-0.69)	-0.07 (-0.58)	-0.08 (-0.84)	Resource Envelope
Politicization	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	-0.32***	-0.06† (-1.41)	-0.04 (-0.67)	-0.09 (-1.14)	0.40***	0.32** (2.49)	0.29** (2.12)	0.33** (2.35)	0.47***	-0.13** (1.99)	-0.13** (-2.40)	-0.13** (-2.21)	Politicization
Wage Satisfaction	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.13	0.13 (0.68)	0.03 (0.87)	0.11 (0.60)	-0.21**	-0.75† (-1.60)	-0.81 (-1.04)	-0.87† (-1.52)	0.32***	0.24** (1.98)	0.26* (1.76)	0.21† (1.52)	Wage Satisfaction
Rule Enforcement	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.58***	0.13 (1.15)	-0.04 (-0.65)	-0.04 (-0.64)	-0.33***	-0.41 (-1.30)	-0.28 (-1.19)	-0.21 (-1.12)	0.61***	0.24** (2.49)	0.20* (1.90)	0.21** (2.00)	Rule Enforcement
Individual Values	g(.)	0.03	0.01 (0.35)	-0.02 (-0.40)	-0.04 (-0.80)	-0.03	-0.06 (-0.68)	0.14 (0.81)	0.03 (0.69)	0.10	0.03 (0.75)	0.04 (0.95)	0.06 (1.22)	Individual Values
Meritocracy	f <sub>1</sub> , f <sub>2</sub>	0.45***	-0.08 (-0.70)	0.06 (0.54)	0.14 (0.74)	-0.42***	-0.53** (-2.09)	-0.34* (-1.82)	-0.30** (-2.01)					Meritocracy
Decentralization	Z*	-0.04	-1.87 (-1.19)	-3.67 (-1.33)	-6.55* (-1.91)									Decentralization
Voice	Z*, T*	0.68***	0.44*** (2.67)	0.41** (2.44)	0.39** (2.36)					0.72***	0.60*** (3.92)	0.58*** (3.15)	0.38*** (2.65)	Voice
Agency Autonomy	T*									0.26***	-1.74 (-0.65)	-2.17 (-0.70)	-2.45 (-0.67)	Agency Autonomy
Education	T*									0.23**	3.89 (1.23)	2.75 (1.32)	4.19† (1.43)	Education
Adj.R2			0.64	0.55	0.44		0.47	0.39	0.38		0.63	0.61	0.55	Adj.R2

**Table 2b: Estimation results – for Corruption Index**

All variables are scaled from 0 to 100. Service performance index is the average of three standardized service delivery indicators (if applicable): quality, quantity, and accessibility. Corruption index represents the average of four standardized corruption indicators: frequency bribery, bribe/official income ratio, job purchases, and budget diversion. The indices are re-scaled using the mean and standard deviation of national service quality and bribery, respectively such that high numbers correspond to high performance and high corruption. Number of observations in each public institution is chosen as the weight of each institution in the regression. In the first stage 8 region dummies are used as additional exogenous variables. Sample size is 83. \*\*\* Significant at 1%, \*\* significant at 5%, \* significant at 10%, † significant at 15%.

Variable	Model	Dependent Variable: Service Delivery				Dependent Variable: Corruption				Dependent Variable: Transparency				Variable
		Simple Correlation	OLS	2SLS	3SLS	Simple Correlation	OLS	2SLS	3SLS	Simple Correlation	OLS	2SLS	3SLS	
Service Performance						-0.36***	-0.21 (-1.29)	0.40 (0.51)	0.21 (0.30)	0.72***				Service Performance
Corruption		-0.46***	-0.22** (-2.09)	-0.26† (-1.62)	-0.30* (-1.65)	1.00				-0.43***	-0.09*** (-3.06)	-0.09** (-1.92)	-0.10† (-1.52)	Corruption
Transparency		0.72***	0.35*** (2.69)	0.67** (2.10)	0.91** (2.43)	-0.43***	-1.16** (-4.34)	-1.65*** (-2.72)	-1.44*** (-2.63)					Transparency
Resource Envelope	Z*, f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.62 ***	0.22** (2.12)	0.12† (1.51)	0.14* (1.67)	-0.33***	-0.12 (-1.26)	-0.11 (-1.13)	-0.12 (-1.31)	0.52***	-0.05 (-0.57)	-0.04 (-0.42)	-0.05 (-0.68)	Resource Envelope
Politicization	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	-0.32***	-0.06 (-0.88)	-0.02 (-0.29)	-0.07 (-0.89)	0.44***	0.37*** (2.55)	0.36** (2.44)	0.32** (2.31)	0.47***	-0.11* (1.87)	-0.12* (-1.89)	-0.14** (-2.10)	Politicization
Wage Satisfaction	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.13	0.11 (0.81)	0.04 (0.39)	0.19 (0.58)	-0.27***	-0.86* (-1.64)	-0.92* (-1.81)	-0.51 (-1.26)	0.32***	0.27** (2.01)	0.27* (1.80)	0.20† (1.47)	Wage Satisfaction
Rule Enforcement	f <sub>1</sub> , f <sub>2</sub> , f <sub>3</sub>	0.58***	0.15 (1.34)	0.11 (0.47)	0.13 (0.58)	-0.34**	-0.23 (-1.12)	-0.36 (-1.23)	-0.34 (-1.21)	0.61***	0.19* (1.89)	0.16† (1.54)	0.17* (1.83)	Rule Enforcement
Individual Values	g(.)	0.03	0.00 (0.01)	-0.01 (-0.23)	-0.01 (-0.12)	-0.07	-0.06 (-0.85)	-0.06 (-0.78)	-0.06 (-1.06)	0.04	0.04 (1.22)	0.04 (1.05)	0.01 (0.89)	Individual Values
Meritocracy	f <sub>1</sub>	0.45***	0.01 (0.15)	0.14 (0.61)	0.15 (0.69)	-0.29***	-0.46** (-2.12)	-0.46† (-1.61)	-0.46† (-1.45)					Meritocracy
Decentralization	Z*	-0.04	-2.33† (-1.44)	-2.84 (-0.94)	-4.08† (-1.40)									Decentralization
Voice	Z*, T*	0.68***	0.47** (2.78)	0.31** (2.15)	0.39** (2.42)					0.72***	0.45*** (3.02)	0.39*** (2.98)	0.37*** (3.05)	Voice
Agency Autonomy	f <sub>1</sub> , T*									0.26***	-1.02 (-0.33)	-2.58 (-0.88)	-2.54 (-0.69)	Agency Autonomy
Education	T*									0.29**	5.39** (2.03)	6.68* (1.95)	7.01** (2.23)	Education
Adj.R2			0.55	0.43	0.36		0.50	0.47	0.49		0.59	0.58	0.56	Adj.R2

When there are several variables that are determined endogenously the full effect of a change in any of the exogenous variable may be very different from the direct effect. For example, an increase in voice will improve transparency that will reduce corruption that will increase transparency even further. In order to estimate the full effect of policy variables one has to calculate the reduced form equations using the estimates of the structural equations (i.e. incorporating the linkage between the various endogenous variables). Table 3 presents the effects of various exogenous variables calculated from the reduced form equations. The effect of many policy variables is substantially larger when one considers the full effect. The effect of voice on corruption increases due to its effect on transparency, which has a significant impact on corruption. Similarly, the effect of politicization on corruption also becomes stronger because corruption causes less transparency that, in turn, leads to even more corruption. However, none of the public sector management factors, such as rule enforcement and government pay, or individual characteristics such as moral values and education do not seem to have a significant impact on corruption.

Table 3: Estimation of Reduced Form Parameters of Bribery and Service Quality

Equations: Simple Effect versus Full Effect

The simple effect (“direct effect”) is based on the 3SLS estimates of the structural parameters reported in Table2. Full effect (“direct” plus “indirect” effect) results are based on the relationship between the structural variables and the dependent variables in the reduced form equations of the system. It uses the 3SLS technique and transform the coefficients considering the interactions between variables. For each variable the value of the effect is equal to moving an agency one standard deviation from the worst practice to the best practice, keeping remaining variables constant at their previous levels for that agency. The percent improvement is calculated by taking the ratio of improvement to the existing level.

	Improvement of Service Quality as a result of One Standard Deviation Improvement in Policy Variable		Decrease in Bribery as a result of One Standard Deviation Improvement in Policy Variable		Increase in Transparency as a result of One Standard Deviation Improvement in Policy Variable	
	Simple Effect	Full Effect	Simple Effect	Full Effect	Simple Effect	Full Effect
Bribery*	3.7 %	9.1 %			4.3 %	4.3 %
Transparency*	9.1 %	19.1 %	64.1 %	71.3 %		
Voice	7.2 %	22.6 %		50.8 %	7.2 %	16.2 %
Politicization	2.6 %	20.7 %	18.1 %	73.6 %	4.1 %	17.3 %
Enforcement of Rules	2.1 %	9.6 %	4.0 %	18.0 %	2.6 %	7.6 %
Wages Satisfaction	0.5 %	6.6 %	7.6 %	15.7 %	1.0 %	5.6 %
Resource Envelope	3.6 %	3.1 %	3.5 %	2.0 %	-1.2 %	-1.5 %
Individual Values	0.3 %	1.7 %	2.1 %	3.2 %	1.5 %	2.6 %
Meritocracy	0.5 %	5.2 %	9.3 %	12.3 %		4.0 %
Decentralization	- 7.7 %	- 7.3 %		- 3.4 %		-0.6 %
Agency Autonomy		4.7 %		4.2 %	-3.6 %	-5.9 %
Education		4.5 %		7.0 %	2.1 %	4.9 %

\* Since bribery and transparency are endogenous variables, they are not part of the reduced form equations. The full effect is calculated based on the two equations in which the dependent variable is different (i.e. transparency and service equations for the bribery, bribery and service equations for the transparency)

Overall the results show that policy recommendations on the basis of simple correlations can be highly misleading. An undue emphasis may have been given in a number of conventional public sector management variables (such as civil servant wages, internal enforcement of rules, autonomy of agency by fiat, etc), while undermining the priority due to more ‘external’ (to public sector management) variables, such as external voice and transparency, and to the absence of politicization. The latter set of ‘voice’-related variables come out clearly significant and accounting for a much larger share of the variation in public sector performance and corruption than the former, more traditional public sector management type of variables.

#### 4. Decentralization and Corruption

It is often argued that decentralization is the main cause of corruption and lack of services quality. Indeed, comparing institutional performance at the local and central level reveals large differences. Table-4 presents the differences between local and central agencies in our data set regarding service quality and corruption. For example, local agencies are short in delivering adequate quantity of public services but are more successful in being accessible to the poor and reducing poverty than other agencies. Bribery and budget diversion are more prevalent at the local level, but ratio of bribe to official income is higher at the central level.

**Table 4: Decentralization and Governance**

Mean score of agencies within each group is reported. All indices are between 0 and 100. A two-sample t-test is performed to test the hypothesis that the variable has the same mean within municipalities and other agencies. \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%, † significant at 15%.

Variables	Full Sample (n=83)	Municipal Agencies (n=16)	Other Agencies (n=67)
Service Performance Index	61.10	63.33	60.63
Quality	60.91	59.61	61.57
Quantity	55.13	51.34*	57.73
Accessibility	55.53	60.12**	53.56
Corruption Index	67.37	68.80	67.05
Frequency of Bribery	33.41	40.43**	31.03
% of Jobs Purchased	10.72	9.12	11.23
% of Budget Diverted	8.73	11.82**	7.12
Bribe / Official Income Ratio	10.34	7.96**	11.98

As argued above, however, one should be very careful from reaching any conclusions based solely on these differences since the correlation can be an outcome of other variables. For example, it could be that public officials in local agencies are less educated and hence transparency is lower (and corruption is higher). In this case, centralization will not reduce corruption since the cause is the low level of education rather than decentralization per se. A comparison of governance characteristics between local and national agencies indeed reveals significant differences (see Table 5). Municipalities are more politicized, less meritocratic and have less educated personnel. However, citizen voice is more prevalent at the local level. Thus, the differences in the

level of corruption is not because decentralization but rather because decentralized institutions have different characteristics. Future research is needed to determine whether these characteristics depend on the level of decentralization or are exogenous to decentralization.

**Table 5: Decentralization and Institutional Characteristics**

Mean score of agencies within each group is reported. All indices are between 0 and 100. A two-sample t-test is performed to test the hypothesis that the variable has the same mean within municipalities and other agencies. \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%, † significant at 15%.

Variables	Full Sample (n=83)	Municipal Agencies (n=16)	Other Agencies (n=67)
Transparency Index	66.31	66.63	66.24
Meritocracy Index	63.02	59.13*	63.94
Autonomous Agency	0.08	0.00*	0.09
% of University Education	61.35	42.45***	65.35
Rule Enforcement	60.43	62.98	59.87
Politicization Index	40.08	47.92***	38.36
Resource Envelope Index	51.27	51.71	51.18
Individual Honesty Index	43.93	42.68	44.20
Voice Index	34.17	38.92†	33.07
Wage Satisfaction Index	34.44	34.64	34.41

## 5. Caveats and Robustness tests

### 5.1. Measurement Errors in Variables

The Public Officials survey is based on the perceptions of public officials about the service performance and the institutional characteristics of the institutions they are working in. Although this approach is useful in cases where hard data is difficult or impossible to produce, it is subject to respondent bias and other measurement problems. We classify these problems into two groups: i.) individual bias, and ii.) institutional bias.

First, public officials may overstate or understate particular aspects of their institution (such as corruption level) due to differences in their perception caused by differences in their individual characteristics such as education, age, gender, working experience, etc. However, the sample in each institution is very diverse (it covers young, senior, less educated, male, female and so on) and is similar across institutions. Since we

use institutional average as an observation unit, these perception errors caused by individual characteristics do not carry over to the institutional level.

Second, it is possible that all individuals working in a particular agency may be more pessimistic or optimistic in their perceptions due to working conditions within their organization. This is a major concern particularly in cross-country studies in which a common reference point or criteria to measure qualitative variables might be impossible to find due to cultural differences between societies. We do not believe that this is the case in our data since all observations are from the same country, sharing a common culture, norms, and moral values. Therefore, it is reasonable to assume that each person uses the same criteria to make a judgment about the conditions of their own institution and differences in perceptions (if any) are individual-specific rather than institutional specific.

To test the validity of our arguments above we use a survey question, which should presumably be answered in the same way by all public officials: the corruption level in the Bolivian public sector in general. Deviation from the sample average captures the influence of individual characteristics as well as the institution effect. We find that institutional bias is very small and hence conclude that the bias is very small or nil.

## **5.2 Model Specification and Instruments**

The instruments used in the first stage of the 2SLS and 3SLS estimation are the entire set of exogenous variables of the model. The choice of adequate instruments for corruption and service delivery performance is not extensively addressed in the literature (see, however, Bai and Wei, 2000, Svensson, 2000, Kaufmann, Kraay and Zoido-Lobaton, 1999)) and even almost non-existent for transparency. In the context of 2SLS and 3SLS two requirements for a variable to be used as a good instrument are that it is not correlated with the error term of the dependent variable and that it is correlated with the endogenous regressor it is instrumented for.

It is possible that some of the exogenous variables are endogenous as well. Since we use these exogenous variables as instruments for the dependent variables, their endogeneity may undermine the quality of instruments and cause biased estimates. For example, one could argue that wage which we assume is an exogenous variable in the corruption equation is endogenous. That is, the wage rate may depend on the level of

corruption, if agencies with large corruption might pay high wage.. We use Hausman Test to test the possibility that some of the exogenous variables are indeed endogenous, but find no evidence that any of the exogenous variables are indeed<sup>10 11</sup>.

When it comes to measure the “goodness: of an instrument,  $R^2$  of the first stage regression is a practical measure used extensively in the literature. The first stage regressions for the three endogenous variables yield high adj. $R^2$  (0.51 for service delivery, 0.55 for corruption, and 0.70 for transparency). Shea (1998) argued that  $R^2$  can be a useful measure of relevance only in the case of univariate models and proposed a new  $R^2$  measure when there are multiple endogenous variables. For each of the three endogenous variables, this statistics is also found to be around 0.71.

One possible model specification error is that we excluded exogenous variable from a specific equation incorrectly. For example, it is possible that meritocracy affects the level of transparency and hence it should not be excluded from the transparency equation. We test the overidentifying restrictions using Hausman test and fail to reject the hypotheses that a variable was excluded from a given equation correctly<sup>12</sup>.

## 7. Conclusions

Drawing on an in-depth governance micro-survey within a country, the purpose of this paper was to address empirically the question of the relative importance of the various determinants of governance at the micro-level. We estimated empirically the

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<sup>10</sup> The test is based on the existence of two alternative estimators: one is consistent and asymptotically efficient under the null hypothesis and the other is consistent under null and alternative hypothesis, but not efficient under the null hypothesis. The null hypothesis states that the variables which are assumed to be exogenous are indeed exogenous. In the alternative hypothesis a variable that enters to the system exogenous previously is treated as endogenous and estimated using other exogenous variables (without specifying a structural equation). 3SLS is used for estimation of coefficients in the system. The estimates are consistent under both hypothesis but not efficient under null hypothesis. On the other hand, our original 3SLS results are consistent under the null hypothesis but inconsistent under the alternative hypothesis. If the difference between estimates are “large enough” we reject the null hypothesis that variable in question is exogenous.

<sup>11</sup> Although the Hausman test shows that there is no evidence of endogeneity problem in the model, this test result should be interpreted with caution. The Hausman Test as well as other specification tests in the literature are based asymptotic properties which may not be justified in small samples. Both theoretical studies and Monte-Carlo experiments (such as Nakuman and Nakuman 1985, Newey 1985) conclude that any such test may fail against misspecification of the model.

<sup>12</sup> The test is based on regressing the residuals from each equation to the entire set of exogenous variables. Under the null hypothesis of overidentifying restrictions, the test statistic,  $NR^2$  (N is the sample size and  $R^2$  the goodness of fit) has a  $\chi^2$  distribution with  $K-T$  degrees of freedom, where K is the number of exogenous variables and T is the number of endogenous variables. The value of the test statistic (and corresponding p values) are found as 11.01 (0.82), 15.65 (0.55), 18.03 (0.42).

causes of poor governance, using a unique data set from detailed responses of public officials working in public sector agencies and municipalities in Bolivia. We show that commonly made inferences about policy based on (at best) simple correlation can be highly misleading, given the high degree of multicollinearity between the various governance (and public sector management) determinants, as well as the endogeneity in these variables – implying existence of reverse causality. In fact, if policy recommendations were to have been made on the basis of simple correlations, undue emphasis would have been given to certain public sector management variables (such as relative wages, internal enforcement of rules, autonomy of agency by fiat, etc), while undermining the priority due to a different set of (more ‘external’ to public sector management) variables such as external voice and transparency and to the absence of politicization. The latter set of ‘voice’-related variables come out clearly significant and accounting for a much larger share of the variation than the former, more traditional public sector management type of variables.

By making the case on the importance of studying in depth with micro-level data a particular country setting, we need to be particularly wary of implying that the above results would necessarily hold in other countries. Indeed, our claims at this early stage of this type of research with this new type of survey data ought to be modest. While we are confident about claiming that in any country there will be a set of potential determinants that matter for performance significantly more than others (and we need to stress that some conventional variables may not matter significantly as commonly thought), the nature of which particular variables matter most may vary from setting to setting. Furthermore, we need to keep in mind that the nature of these data sets imply a margin of error due to the subjective nature of many of its questions (although significant effort went into survey question design and utilization of the various related questions under each category). In a separate effort, we are testing whether the results are consistent with the individual level public official behavior (vs. agency-level performance, as in this paper). We are also starting to undertake a similar analysis of agency performance in other countries for which we have gathered data.

## References

- Acemoglu D. and Verdier T., 1998, "Property Rights, Corruption and the Allocation of Talent: A General Equilibrium Approach", *The Economic Journal* 108, pp.1381-1403.
- Acemoglu D. and Verdier T., 2000, "The Choice Between Market Failures and Corruption." *The American Economic Review* 90: 194-213.
- Ades, Alberto; Di Tella, Rafael; 1997: "National Champions and Corruption: Some Unpleasant Interventionist Arithmetic", *Economic Journal* 107, pp.1023-1042
- Ades A. and Di Tella R., 1999, "Rents, Competition and Corruption," *American Economic Review*, Vol. 89, No. 4, pp. 982-993.
- Bai,Chong-En ; Wei, Shang-Jin; 2000, "The Quality of the Bureaucracy and Capital Account Policies" , World Bank Working Paper 2575
- Banerjee A. 1997, "A Theory of Misgovernance" *Quarterly Journal of Economics* 62, pp. 1289-1332.
- Bardhan P. and Mookherjee D, 2000a, "Capture and Governance at Local and National Levels," *American Economic Review* ,forthcoming
- Bardhan, P. and Mookherjee D., 2000b, "Corruption and Decentralization of Infrastructure Delivery in Developing Countries", Institute for Economic Development, Boston University, mimeo.
- Bardhan P. and Mookherjee D., 2000c, "Corruption and Decentralization of Anti-Poverty Program Delivery in Developing Countries", Institute for Economic Development, Boston University, mimeo.
- Becker G. S., 1968: "Crime and Punishment: An Economic Approach", *Journal of Political Economy* 76, pp.169-217.
- Becker G. S. and Stigler G. J., 1974: "Law Enforcement, Malfeasance, and Compensation of Enforcers", *Journal of Legal Studies* 3, pp.1-18.
- Besley T. and McLaren J., 1993: "Taxes and Bribery: The Role of Wage Incentives", *Journal of Legal Studies* 103, pp.119-141.
- Besley, T. and A. Case, (1995), "Incumbent Behavior: Vote-Seeking, Tax-Setting, and Yardstick Competition", *The American Economic Review* 85(1), pp. 25-45.
- Broadman H. and Recanatini G., 2000, "Seeds of Corruption, Do Market Institutions Matter?" The World Bank, mimeo.

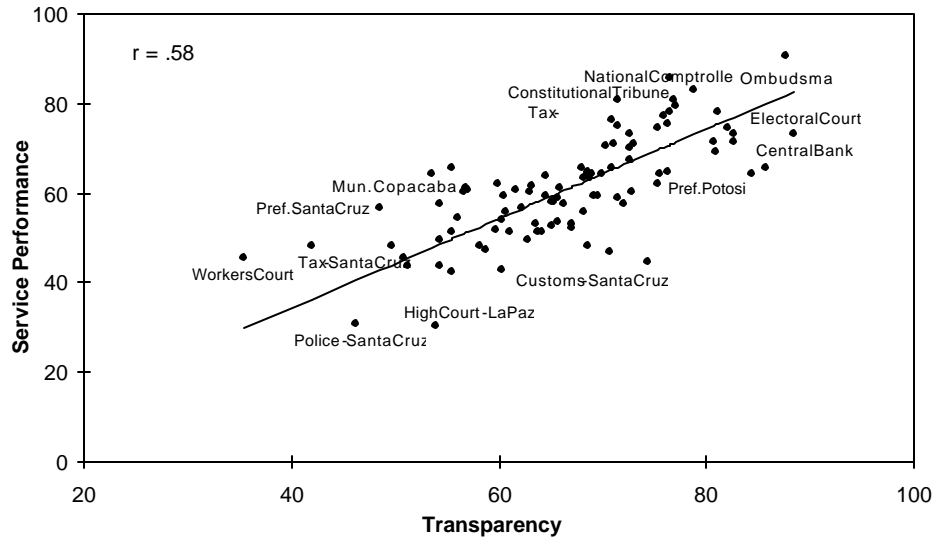
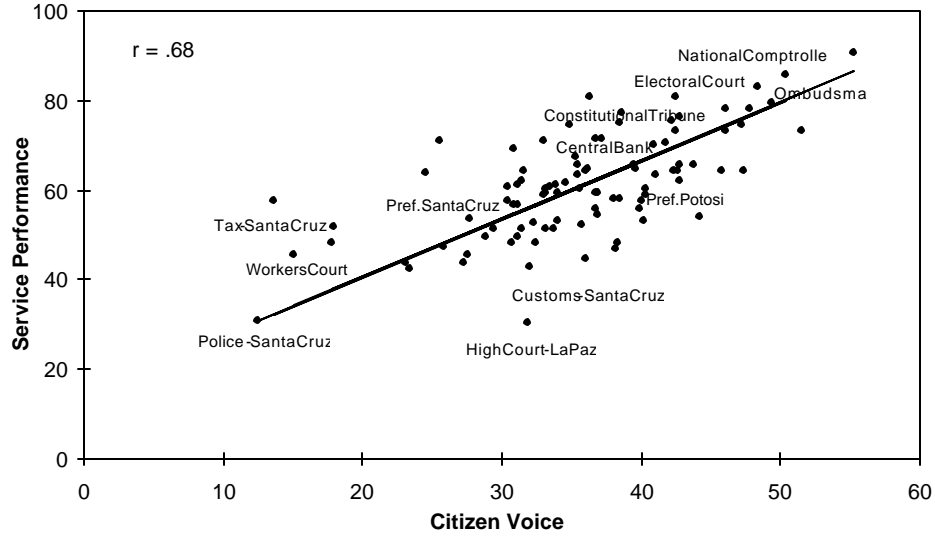
- Carbonara, A. (2000), "Corruption and Decentralization", mimeo., Working Paper WP 342/83, University of Bologna , Bologna, Italy
- Dabla-Norris, Era; 2000, "A Game-Theoretic Analysis of Corruption in Bureaucracies", IMF Working Paper WP/00/106,
- Di Tella R. and Schargrodsky E. (2000): "The Role of Wages and Auditing during a Crackdown on Corruption in the City of Buenos Aires", mimeo.
- Evans P. and Rauch J. (1997): "Bureaucratic Structure and Economic Performance in Less Developed Countries", IRIS Working Paper 175, Maryland: IRIS
- Fisman R. and Gatti R., 1999, "Decentralization and Corruption: Evidence Across Countries," Working Paper, Development Research Group, World Bank.
- Gordon, R.H. and J.D. Wilson, (2001), "Expenditure Competition", NBER Working Paper 8189, Cambridge, MA.
- Gray-Molina G., de Rada E.P. and Yáñez E., 1999, "Transparency and Accountability in Bolivia: Does Voice Matter?", Working Paper no. R-381, Inter-American Development Bank, Washington, D.C.
- Green W., 2000, *Econometric Analysis*, Prentice Hall, Englewood Cliffs, NJ 07632.
- Gupta S., Davoodi H. and Alonso-Terme R., 1998, "Does Corruption Affect Income inequality and Poverty? "Working Paper no. WP/98/76, International Monetary Fund, Fiscal Affairs Department, Washington, D.C.
- Haque, Nadeem Ul; Sahay, Ratna; 1996, "Do Government Wage Cuts Close Budget Deficits: Costs of Corruption", *IMF Staff Paper* 43 (4)
- Intriligator M.D., 1984, *Econometric Models, Techniques, and Applications*, Prentice Hall Press, NJ
- Kaufmann, Daniel; Kraay, Aart; and Zoido-Lobaton, Pablo, 1999, "Governance Matters", World Bank Policy Research Working Paper 2195.
- Kaufmann D, Wei S., 2000, "Does "Grease Money" Speed Up the Wheels of Commerce?", Policy Research Working Paper 2196, World Bank Institute.
- Klitgaard R. (1989): "Incentive Myopia", (1989) *World Development* v17, n4 (April 1989): 447-59
- Krueger A., 1974, "The Political Economy of Rent-Seeking Society", *American Economic Review* 64, pp.291-303

- Kuncoro, A. (2000), "The Impact of Licensing Decentralization on Firm Location Choice: The Case of Indonesia", Annual Bank Conference on Development Economics, Washington, D.C.
- Laffont J.J. and Martimort D., 1997, "Collusion under Asymmetric Information", *Econometrica* 65 pp.875-911
- Larrain F., Tevares J., 2001, "Can Openness Deter Corruption?", mimeo.
- Lui F., 1985, "An Equilibrium Queuing Model of Bribery", *Journal of Political Economy* 93, pp-760-781.
- McGuire M.C. and Olson M., 1996, "The Economics of Autocracy and Majority Rule: The Invisible Hand and the Use of Force," *Journal of Economic Literature* 34, pp.72-96.
- Menes R., 1999, "The Effect of Patronage Politics on City Government in American Cities, 1900-1910", NBER Working paper 6975, Cambridge, MA.
- Mookherjee, Dilip; Png, IPL; 1992, "Monitoring vis-à-vis Investigation in Enforcement of Law", *American Economic Review* 82, pp.556-565.
- Mookherjee D., Png I.P.L., 1995. "Corruptible Law Enforcers: How Should They Be Compensated" *Economic Journal* 105, pp.145-159.
- Nakamura A. and Nakamura, M., 1985, "On the Performance of Tests by Wu and By Hausman for Detecting the Ordinary Least Squares Bias Problem", *Journal of Econometrics* 29, 213,227.
- Newey W.W, 198, "Generalized Method of Moments Specification Testing", *Journal of Econometrics* 29, pp.229-256.
- Porto, A. and N. Porto (2000), "Fiscal Decentralization and Voters' Choices As Control, *Journal of Applied Economics*3(1), pp.135-167.
- Prud'homme R., 1994, "On the Dangers of Decentralization", World Bank Policy Research Paper no. 1252, World Bank Institute, Washington D.C.
- Rose-Ackerman, 1975, "The Economics of Corruption", *Journal of Public Economics* 4, pp.187-203
- Seabright P., 1996, "Accountability and Decentralization in Government: An Incomplete Contracts Model", *European Economic Review*, vol.40, pp.
- Scheepens J.P., 1995, "Bankruptcy Litigation and Optimal Debt Contracts", *European Journal of Political Economy* 11, pp. 535-556.

- Shleifer A., Vishny R., 1993, "Corruption", *Quarterly Journal of Economics* 108, pp. 599–617.
- Tanzi, V., 1993, "Corruption: Arm's-Length Relationships and Markets", *The Economics of Organized Crime* eds. Fiorentini G. and Peltzman S., Cambridge University Press, NY, pp. 161–180.
- Tiebout, C., 1956, "A Pure Theory of Local Expenditures." *Journal of Political Economy*, 64: 416-424.
- Tirole, J., 1986, "Hierarchies and Bureaucracies: On The Role of Collusion in Organizations", *Journal of Law, Economics and Organizations* 2, pp.182–214.
- Tirole J., 1992, "Collusion and The Theory of Organizations", Chapter 3 in J.J. Laffont (ed.) *Advances in Economic Theory, 6<sup>th</sup> World Congress*, Vol.II, Cambridge University Press
- Tirole, J., 1996, "A Theory of Collective Reputations (with Applications to the Persistence of Corruption and to Firm Quality)", *Review of Economic Studies* 63, pp.1-22.
- Treisman D., 2000, "The Causes of Corruption: A Cross National Study," *Journal of Public Economics* 76, pp. 399-457
- Van Rijckeghem C. and Beatrice W., 1997, "Corruption and Rate of Temptation: Do Low Wages in the Civil Service Cause Corruption?", IMF Working Paper 97/73, Washington: International Monetary Fund.
- Walter, Christopher J.; Verdier, Thierry; Gardner, Roy, 2000, "Corruption: Top-Down or Bottom-Up?", mimeo., University of Kentucky.
- Wane, Waly; 2000, "Tax Evasion, Corruption, and the Remuneration of Heterogeneous Inspectors", World Bank Working Paper 2394

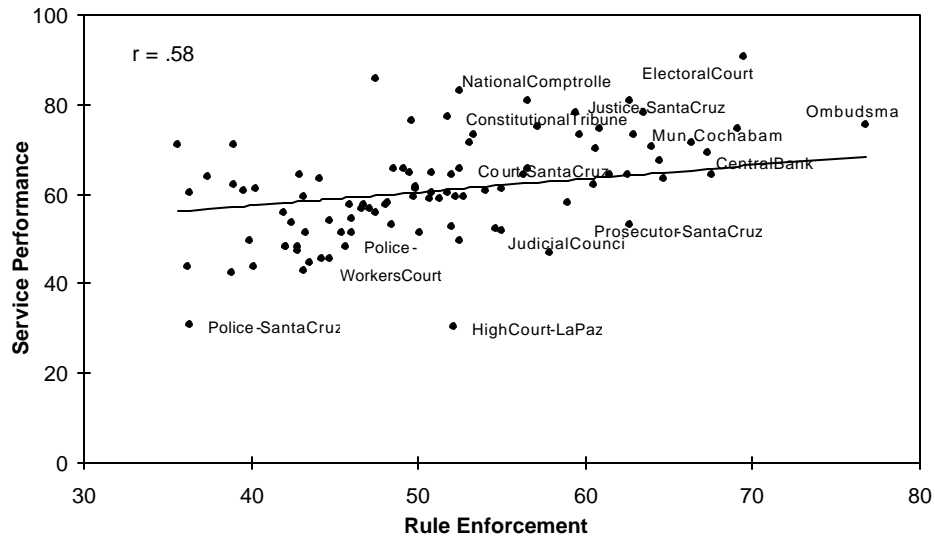
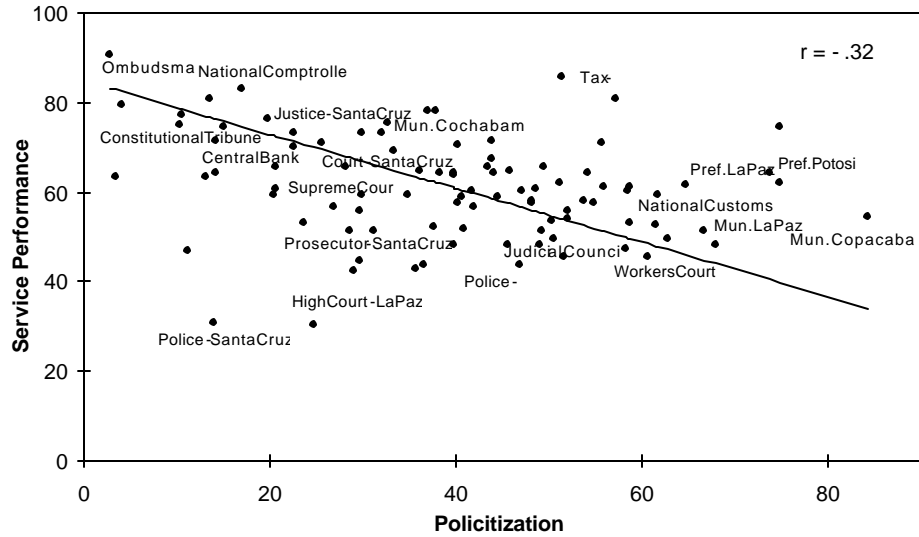
## The Effect of Various Governance Dimensions on Service Performance

In the plotgram below, each point represents a public sector (central, departmental, or municipal) agency. The fitted line is the predicted linear link between the dependent variable and the independent variable, which is calculated from the reduced form equation using the 3SLS estimates of the system (From Tables 2 and 3). The simple correlation ( $r$ ) is reported at the top.



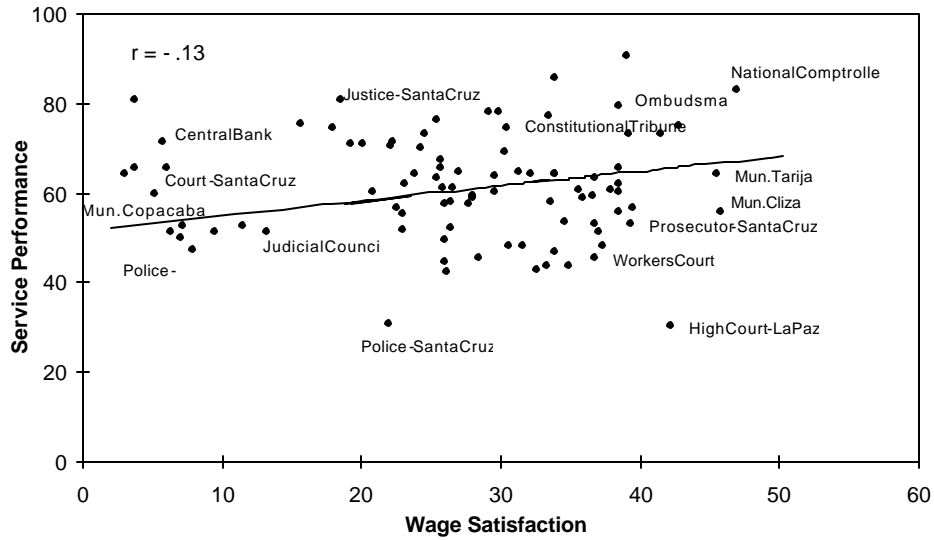
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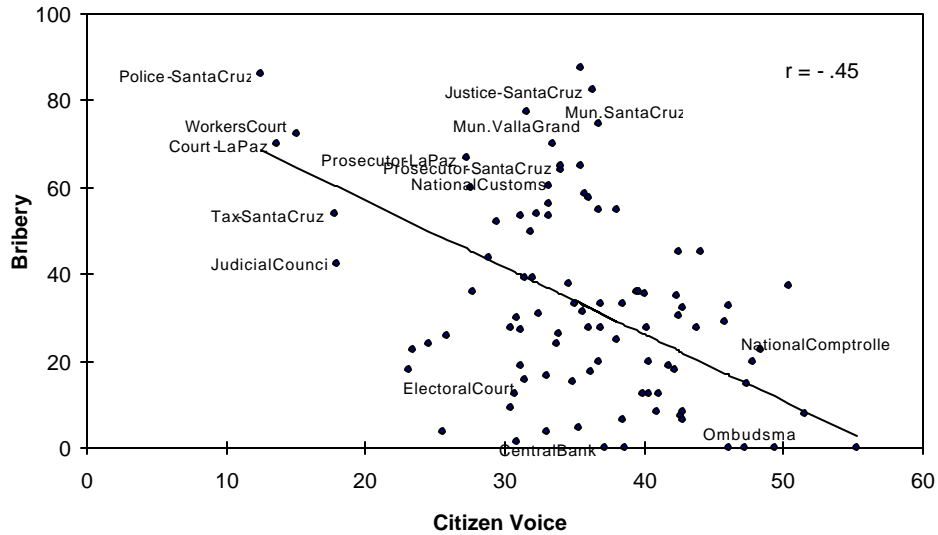
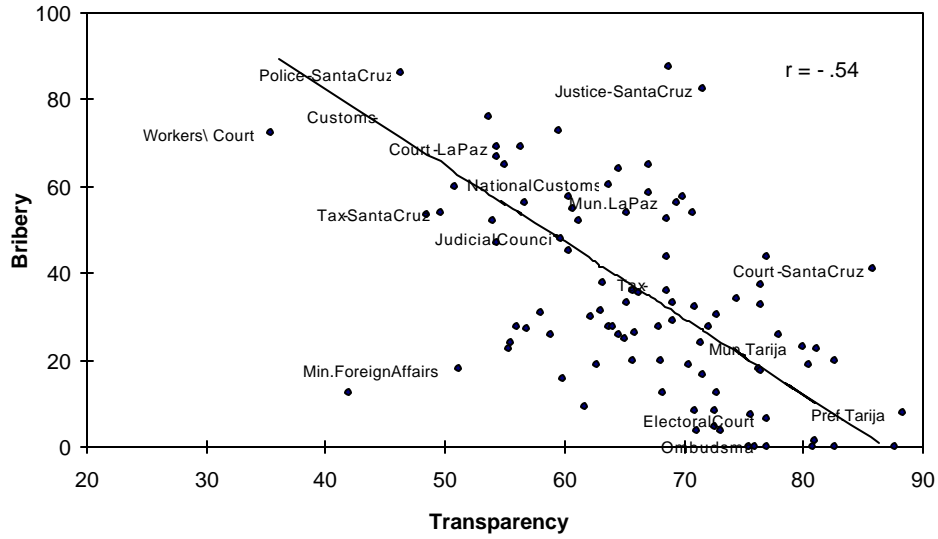
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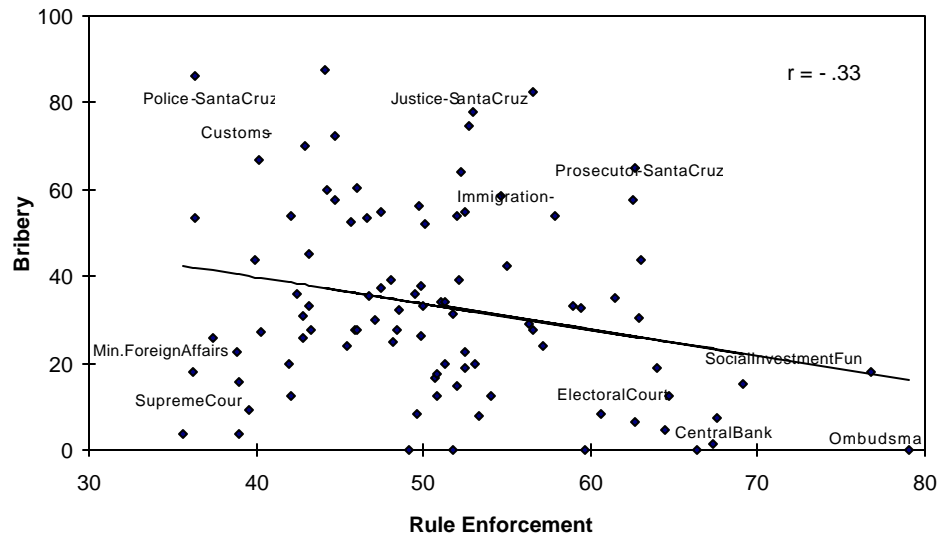
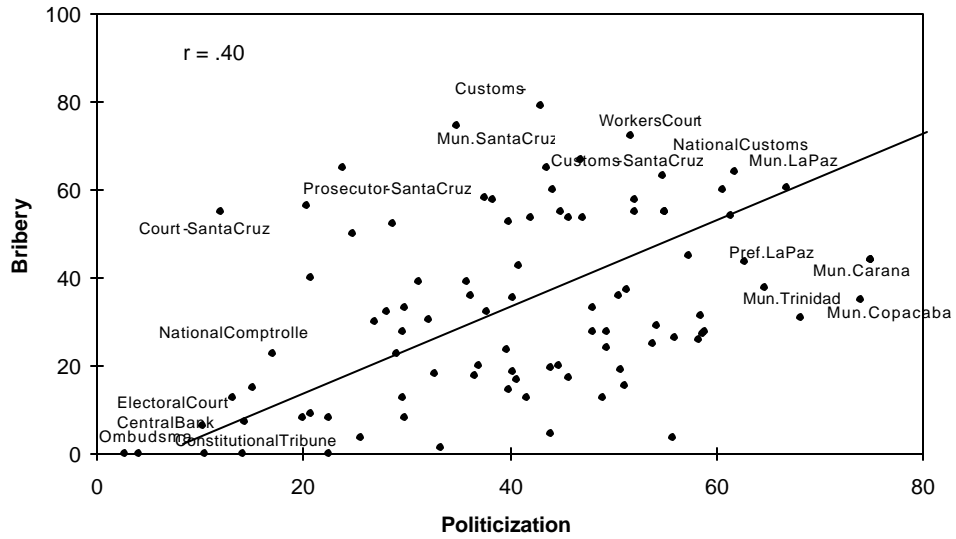
## The Effect of Various Governance Dimensions on Corruption

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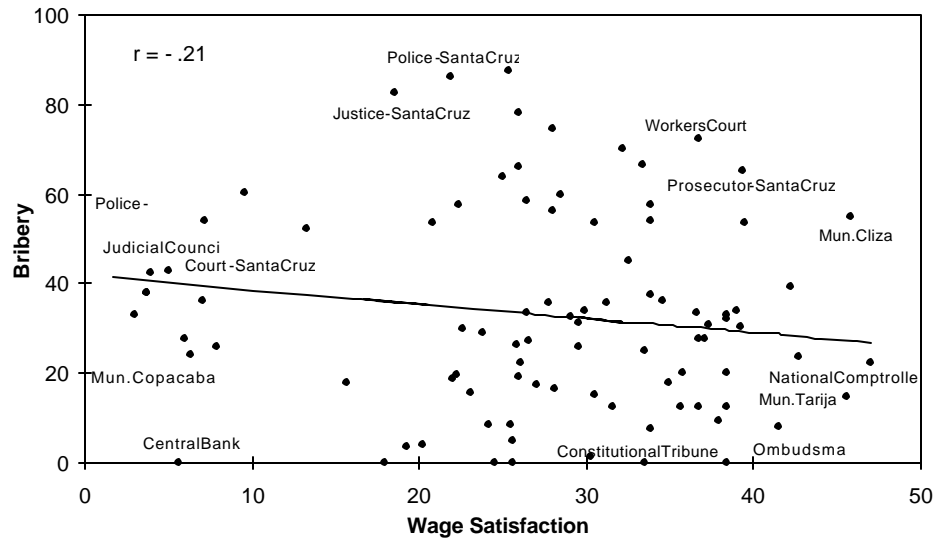
## The Effect of Various Governance Dimensions on Corruption

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## Appendix - Misleading statistics

It is important to describe how making the wrong assumptions or using the wrong estimation method may result in wrong and misleading conclusions. In particular, we focus on two cases. First, we discuss why simple correlation may be very misleading. Second, we discuss the bias in estimating each equation separately using OLS, which ignores the fact that some of the variables are endogenous.

### Simple correlation

Suppose that one wishes to learn about the effect of  $x$  on  $y$  (e.g., the effect of transparency on corruption). One possible way is to calculate the correlation between  $x$  and  $y$ . Alternatively, one could graph the data points with  $x$  on the horizontal axes and  $y$  on the vertical axes and visualize the relationship between  $x$  and  $y$ . Formally, this is equivalent to regressing  $y$  on  $x$  and a constant,

$$y = \mathbf{a} + \mathbf{b}x + \mathbf{e} . \tag{1}$$

where  $\mathbf{e}$  is a random noise with zero mean. Note that  $\beta$  is the element that the graphical presentation tries to identify and is very closely related to the simple correlation between  $x$  and  $y$ . Specifically, let  $r_{xy}$  be the correlation between  $x$  and  $y$ , then

$$r_{xy} = \beta \frac{S_x}{S_y} \tag{2}$$

where  $S_x$  and  $S_y$  are the standard deviation of  $x$  and  $y$  respectively. Since standard deviation is always positive, the slope of the regression and the correlation have the same sign and differ only by the ratio of the standard deviations.

If  $y$  depends on other variables as well (which is often the case) and these variables are correlated with  $x$ , then the simple correlation ( $\beta$ ) may be very misleading (i.e., different from the real effect of  $x$  on  $y$ ). To see it consider the case where the true model is

$$y = \alpha + \beta x + \gamma z + \varepsilon \tag{3}$$

If one regresses  $y$  on  $x$  and a constant as in equation (1) then the estimation of  $\beta$  (the correlation between  $x$  and  $y$ ) is bias, if  $x$  and  $z$  are correlated. Specifically, the expectation of the estimation of  $\beta$ ,  $b$ , is

$$E(b) = \beta + \gamma \frac{\text{Co variance } (x, z)}{\text{Variance } (x)}. \quad (4)$$

The bias depends on the covariance between the omitted variable,  $z$  and  $x$ , and on  $\gamma$ , the effect of  $z$  on  $y$ . It is obvious that this bias could be very large. In other words, it is possible to find a strong positive (negative) correlation between  $x$  and  $y$  even though the real effect of  $x$  on  $y$  is negative (positive). In general, simple correlation will be misleading whenever the dependent variable depends on other variables that are correlated with the variable we wish to learn about.

### Multiple Regression

Multiple regression in the example above, assuming that one includes all the relevant variable, will yield the right effect of  $x$  on  $y$ . Multiple regression, however, may be misleading as well (i.e., different from the real effect of  $x$  on  $y$ ) if several of the independent variable are endogenous. To see it consider the following system

$$\begin{aligned} y &= \alpha + \beta x + \gamma z + \varepsilon \\ x &= \lambda + \delta y + \eta \end{aligned} \quad (5)$$

where  $\eta$  and  $\varepsilon$  are uncorrelated random noises with zero mean and variance of  $\sigma_\varepsilon^2$  and  $\sigma_\eta^2$  respectively. The problem with estimating the  $y$  equation in (5) using OLS in this case is that  $x$  is correlated with the error term,  $\varepsilon$ , and hence the estimation of  $\beta$  will be bias. To see it note that the reduced form of the equation on  $x$  is

$$x = \frac{\lambda + \delta\alpha}{1 - \delta\beta} + \frac{\delta\gamma z}{1 - \delta\beta} + \frac{\delta\varepsilon + \eta}{1 - \delta\beta}. \quad (6)$$

Thus,

$$\text{Co variance}(x, \varepsilon) = \frac{d}{1 - db} \mathbf{s}_\varepsilon^2. \quad (7)$$

Since the error term in the  $y$  equation is correlated with  $x$ , If one use OLS to estimate the equation on  $y$  the estimation of  $\beta$  will be bias, although there are no omitted variable in thi equation (i.e. the equation is fully specified). Specifically, the bias is,

$$E(b) - b = \frac{d}{1 - db} \frac{\mathbf{s}_\varepsilon^2}{\mathbf{s}_x^2} \quad (8)$$

Since  $\mathbf{s}_x^2$  in this simple system depends on  $z$  and  $\epsilon$ , we can substitute for  $\mathbf{s}_x^2$  in equation (8) and get

$$E(b) - b = d(1 - db) \frac{\mathbf{s}_e^2}{(\mathbf{g}^2 d^2 \mathbf{s}_z^2 + d^2 \mathbf{s}_e^2 + \mathbf{s}_h^2)} \quad (9)$$

The bias depends on two elements. First, the difference between the effect of  $x$  on  $y$  in the first equation,  $\beta$ , and one over the effect of  $y$  on  $x$  in the second equation,  $1/\delta$  (i.e., the difference in the relationship between  $x$  and  $y$  in the two equations). The similar the effects, the smaller the bias. For example, if the effect of  $x$  on  $y$  in the first equation is positive and the affect of  $y$  on  $x$  in the second equation is negative then the bias from regressing  $y$  on  $x$  may be very large. On the other hand, if the affects are similar than the bias will be very small. Second the bias is smaller, the smaller the affect of  $y$  on  $x$  (i.e., the smaller  $\delta$ ). If  $y$  has large affect on  $x$  and one ignores it and estimate the equation of  $y$  using OLS the coefficient on  $x$  may be very bias.

Our system is, of course, more complicated than this simple model. Specifically, we have three endogenous variables and many exogenous variables. Thus, it is hard to calculate analytically the bias when one uses OLS, 2SLS or 3SLS. Our results indicate, however, that the effect of the endogenous variables are larger and more significant when we use two or three SLS to estimate the system compare to multiple regression.

It is important to note however, that in a finite sample OLS may still perform very well compare to all other methods. For example, Intriligator (1984) claims that "while OLS yields estimators that are biased and inconsistent, it should not be rejected as estimation technique for simultaneous-equation systems... as little is known concerning the finite sample properties of any estimators, OLS may be as good as any other method of estimators estimation." Likewise Green (2000) argues that "it is often found that OLS estimator is suprisingly close to the structural estimator". Nakamura and Nakamura (1985) show that the asymptotic bias of the OLS estimator will be smaller if (i) a larger proportion of the variability in the endogenous regressor is explained by the instrumental variables, and (ii) the goodness-of-fit is larger in the structural equation of the endogenous regressor.

## **Construction of Governance Variables**

The Public Officials Survey consists of more than 200 questions that are mostly related to different aspects of governance. Although it is possible to choose one representative question for each dimension of governance, we choose to group several similar answers together for two reasons. First, choosing only one question is bound to be arbitrary since it is not based on objective criteria. Second, one question may be too “noisy” because of potential measurement errors or because it may fail to measure the aspect of governance we are interested in.

One way of grouping several questions is by taking the simple average. This is not, however, the best method since it gives each question the same weight regardless of its deviation from the mean. Instead, we use factor analytic techniques to detect the common structure in the information content of the questions. Thus, the aggregate variable represents only the information that is common to all of its sub-components.<sup>13</sup> The reliability of all governance variables was checked using the Cronbach's alpha test. The alpha coefficient is never less than 0.80. In most of the cases, the coefficient is higher than 0.90.

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<sup>13</sup> Preliminary results suggest that the two aggregation methods yield qualitatively similar results.

**Table 1: Survey Questions Used to Construct Governance Variables**

Governance Variable	Question
ENFORCEMENT of Rules in Personnel/Budget/Service Management	There exists some formal procedure to evaluate the performance of the employees.
	The policy/guidelines/regulations of personnel management are well supervised (violations are always exposed).
	The policy/guidelines/regulations of personnel management are strictly enforced (violations are always punished).
	The policy/guidelines/regulations of budget management are well supervised (violations are always exposed).
	The policy/guidelines/regulations of budget management are strictly enforced (violations are always punished).
	The policy/guidelines/regulations of service management are well supervised (violations are always exposed).
POLITICIZATION	Decisions on personnel management are based on political connections / party affiliations / political pressures.
	Decisions on budget management are based on political connections / party affiliations / political pressures.
	Decisions on service management are based on political connections / party affiliations / political pressures.
TRANSPARENCY of decisions in personnel/budget/service management	Decisions on personnel management are done transparently (everybody knows who were designated, promoted, transferred, ascended, or received wage increases and why).
	Decisions on budget management are done transparently (everybody knows who were designated, promoted, transferred, ascended, or received wage increases and why).
	Decisions on service delivery/performance of daily tasks are done transparently (everybody knows who were designated, promoted, transferred, ascended, or received wage increases and why).
	Decisions on service delivery/performance of daily tasks are announced and opened to the internal of the institution (and also to the outside if they are applicable).
	There is a clear understanding of what our tasks and responsibilities are.
	I/My colleagues understand clearly what we have to do and that is why our performance is evaluated.
MERITOCRACY	Percent of the cases the decisions on personnel management issues are based on professional experience.

	Percent of the cases the decisions on personnel management issues are based on professional merit and performance.
	Percent of the cases the decisions on personnel management issues are based on level of education.
VOICE	We all consider that citizens and users are our clients.
	Decisions on service delivery/performance of daily tasks are done based on users complaint.
	Clearly defined mechanisms exist to ask users about their needs.
	Clearly defined mechanisms exist so that the users can express their preferences.
WAGES	Percent of employees very satisfied or somewhat satisfied with their wages.
	Percent of employees very satisfied or somewhat satisfied with their benefits (pension, health, etc.)
HONESTY	The probability that if a public official was overpaid by an administrative error. The public official will return the money given that there is 100% chance of not getting caught and the superiors are doing the same without getting caught.
RESOURCES	Quantity of resources of the agency is adequate.
	Quality of resources of the agency is adequate.
	Personnel and their training of the agency are adequate.
	Office supplies / Computers of the agency are adequate.
	Space/ Offices of the agency are adequate.