

Petty Corruption and Social Networks¹

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Abstract

In the access to public services, users can follow the formal procedures or they may try informal arrangements with the bureaucrats in charge. In the second case, both participate in petty corruption. While formal procedures are equally available for all users, informal arrangements are unequally available through social networks. As a result, better connected users have better chances to agree in corrupted exchanges with bureaucrats. Furthermore, relatively closer users can sustain cooperation with bureaucrats in the long term, but relatively further cannot. Hence, social distance also affects the characteristics of a corrupted exchange: the former users can exchange favors with the bureaucrats, but the latter users must give them money or gifts in exchange. Analysis of survey data from 16 African countries supports the claim that more connected individuals have a greater chance to be involved in petty corruption.

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I. Corruption as exchange

For the delivery of its services, the design of all public policies (such as the delivery of licenses, permits, subsidized medications, admission in public schools, etc.) establish rules and procedures that must be followed by bureaucrats and users. Petty corruption happens when, instead of following those rules, a public agent and a private one agree on exchanging the access to the service for money, a gift or the promise of a future favor. Central for what follows is to remark that, in this definition, petty corruption is a trade. Implicit on that, there is an important idea: as in any trade, a successful corrupted exchange requires (i) mutual gains and (ii) some credible enforcing mechanism that solves commitment problems that may emerge during the trade.

From this starting point, this paper studies the role of social networks (as informal enforcing mechanism) in the answers to three questions: Who are the private agents more inclined to participate in petty corruption? When do they bribe? And, finally, why petty corruption is rampant in some countries?

This setup requires a justification because it departs from what is normally done in the literature. Within it, corruption is usually defined as ‘the abuse of public office for private gains’² without a mention of any private agent that may be involved. Naturally, from that starting point, the literature has fundamentally focuses the attention on bureaucrats’ behavior. More precisely, researching efforts has been concentrated on the study of the interaction between the public agent and some given principal (his superior, the citizenry, a benevolent policy designer, etc...) who tries to align him with

² For example, in their websites, Transparency International defines corruption as “the misuse of entrusted power for private gains” (http://www.transparency.org/news_room/faq/corruption_faq) and the United State Agency for International Development (USAID) defines it as “the misuse of public office for private gains” (http://www.usaid.gov/our_work/democracy_and_governance/technical_areas/anti-corruption)

anticorruption policies. Then, making extensive use of the tools of the principal-agent framework, the literature has identified five broad reasons of bureaucrat's corruption:³ first, low wages among bureaucrats increase their temptation to accept bribes (Becker and Stigler, 1974; Ghura, 1998); second, agency problems, such as high monitoring costs, creates asymmetries of information that bureaucrats can use to extract some rent (Mookherjee and Pgn, 1992; Shleifer and Vishny, 1998); third, there is a certain level of bureaucrat's discretionary power that it is inherent to complex public policies, that some bureaucrats can misuse in their benefit (Rose-Ackerman, 1975); fourth, punishments to corrupted bureaucrats and or incentives to law enforcers may be insufficient or incredible (Becker and Stigler, 1974; Mookherjee and Pgn, 1995); and, finally, the selfish and rational designers of formals rules can make them imperfect with the purpose of extract rents for themselves (Olson, 2000; Schleifer and Vishny, 1993).

Now, the usual definition of corruption and the subsequently use of the principal-agent framework are not well suited to study corruption as an exchange because its assigns a secondary role to the private agent. Properly speaking, the private agent is not understood as an agent with capacity to behave in different ways but as a parameter in the relationship between the bureaucrat and his principal. This leaves no space for variations in the behavior of private agents, and, consequently, all forms of corrupted exchange are basically took as equivalent. In short, the framework does not allow us to explain why the participation of private agents in corrupted exchanges sometimes involves money, but in others, gifts, political support and even the promise of a future favor. All of them, expressions of petty corruption that the empirical literature documents again and again (see, for example, Blundo and Oliver de Sardan 2006 and Smith 2007). Of course, we

³ For reviews of the literature see Tanzi (1998), Jain (2001), Aidt (2003) and Treisman (2007).

could formulate a principal-agent model in which the private agent is explicitly considered. However, shortly, we will have to deal with a complex enough strategy space that will surely force us to impose incredible restrictions in order to find an equilibrium.

Once justified the approach, consider the interaction of the private and the public agent as a coordination problem. The first wants a given public service; the second has some control on its delivery. A formal procedure offers them a way to coordinate their interaction. Nevertheless, they can also coordinate the access to the service in a different way if they succeed to solve potential defections that may emerge during their interaction. Obviously, private and public agents cannot rest on the legal system to enforce their corrupted exchanges if one of them defeat. This immediately suggests that they need a kind of informal enforcing mechanism for that purpose. Consequently, in the delivery of a public service, the formal procedures give them just one possible solution to their coordination problem, but there may be an alternative informal one whose use immediately implies the breaking of the formal procedures (i.e. a corrupted exchange).

Now, as the new institutional literature demonstrates, informal mechanisms of coordination rest on repeated interactions (see for example, Macaulay 1967, Ostrom, 1990, Grief, 1993, and Dixit 2006) and consequently are embedded in social networks. Therefore, we can confidently deduce that the private and the public agent count with one and potentially with two alternative coordinating solutions to their interaction. First, they have the formal procedures that were designed to govern their exchange and, second, they may have an informal enforcing mechanism on which base a corrupted exchange.

The key point is that, in the same social system, different private agents will have different access to informal deals with the same bureaucrat as a consequence of their

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relative social closeness with him.⁴ Thus, while the formal procedures to get the public services are equally available for all, the informal procedures are unequally reachable for different individuals. That makes all the difference: while all private agents can get access to the bureaucrat through the formal procedures, some private agents can also get access to him through their acquaintances.

Now, when formal coordination is relatively cheap, well connected individuals do not have incentives to put in motion their contacts to get informal access to the public services controlled by the bureaucrat; but in contexts where bureaucratic procedures are expensive, it may be cheaper for them to try informal agreements. Conceptually, the intuition is fairly simple: for each interaction, rational individuals will select the institutional framework that is more efficient to solve their coordination problems. Thus, when formal institutions are weakly developed, informal institutions will be used to substitute them, but with the addition that the access to those informal rules is unequally distributed in the population.

This reasoning explains why some agents participate in corrupted exchanges while others do not. However, it is still pending a rationale for the different expressions of a corrupted exchange. As said above, in some corrupted exchanges, the bureaucrat will receive money; but in others he will get recommendations, political support, or even a debt of reciprocity that the private agent may fulfill in the future. Again, the relative social closeness among individuals in a social network can explain those differences. For example, a bureaucrat may accept to break the formal procedures in exchange for the

⁴ The literature in social network analysis clearly shows that relative position and, consequently, social distance, is central for the incentives and behaviors that emerge in networks (see, for example, Granovetter, 1983; Granovetter 1985; Burt, 1992; Uzzi, 1999; Lin 1999, Newman, 2002; Burt, 1999)

promise of a future payback, but only in deals with those private agents with whom he interacts more often or with whom he has long-term relationships. When that is not the case, he will require an immediate payback from the private agent. Thus, in circumstances where the request to break the formal procedures comes from a relative closer tie, the bureaucrat may accept to break the rules without receiving any immediate payback; but when the request comes from someone socially further, he will expect to receive money, gifts or something else in exchange.

I believe that this argument is valid for corrupted exchanges in general. Nevertheless, I decided to center the attention in petty corruption for two reasons. First, among all the steps in the policymaking process (from design to implementation), the delivery of the service is the most constrained. At that level, most of the rules are already defined, and essentially, the bureaucrat can decide either follow the procedures or break them. Second, it is reasonable to expect that the magnitudes of money involved in each petty corrupted exchange are negligible in comparison with the amounts involved in corrupted exchanges at higher levels of the bureaucratic hierarchy. Thus, the temptations of the money are comparatively lower in petty corruption than in other forms of corruption allowing a better comprehension of the role of social networks on its existence.

II. Modeling Petty Corruption

An example of petty corruption

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Up to 2006, Adanna was a young Nigerian who had graduate studies.⁵ A big success given the levels of education in Nigeria.⁶ However, her progress was not the result of her merits (her admission tests were not good enough to guarantee her a place in a senior secondary school and, later, in a university). Actually, she could make it thanks to her contacts, more precisely, her parents'. Her story is described in Smith(2006) and represents a marvelous example of petty corruption in a country where corruption is rampant and affecting all spheres of public service delivery.⁷ Part of the fascination of her story is giving by the fact that Daniel Smith, the American anthropologist who describes her case, is Adanna's uncle and, even better, he was also involved in the exchanges that allow her to get admission by informal means.

In 1996, in the admission process to senior secondary school, Adanna did not get good enough scores to be admitted in the federal school in which her parents wanted to put her. That school was located in a region where Smith had made some ethnographic research that put him in contact with some officials of the local department of education. For that reason, Adanna's father, and Smith's brother-in-law, asked him to intercede for her with the principal of the school. Although he did not know the principal in person,

⁵ The educational system of Nigeria is essentially publicly provided and consists in four levels. The first two (elementary school and junior secondary school) are universal and mandatory, but the access to the subsequent two levels (senior secondary school and tertiary education) are regulated by two tests of admission (the Junior Secondary Certificate Examination and the Joint Admission Matriculation Board, respectively)

⁶ According to the Encyclopedia Britannica, in 2003, only 9.1% of the population 25 years and older had some educational attainment beyond secondary education.

⁷ In the Corruption Perception Index prepared by Transparency International, Nigeria has persistently obtained low scores. In a scale from 0 (completely corrupt) to 10 (completely clean), Nigeria got: 1.0 (in 2001), 1.6 (in 2002), 1.4 (in 2003), 1.6 (in 2004), 1.9 (in 2005), 2.2 (in 2006) and 2.2 (in 2007). According with Transparency International all countries with scores below 3 are classified as affected by rampant corruption.

Smith reports that he talked with her. However, he could not get her help.⁸ He also informs that, in spite of that, Adanna could get admission thanks of the intervention of a friend of the sister of Adanna's mother who worked in the Ministry of Education. That woman asked on Adanna's behalf the help of the Minister, and the latter got her admission. Smith also indicates that Adanna's parents had to pay for the help offered by that women.

Six years later, in 2002, Adanna failed again in the admission test. This time, the failure happens in her attempt to be admitted at a university. Again, Adanna's parents request the collaboration of Mr. Smith. This time the favor requested from him was greater for two reasons. First, at that time, Mr. Smith was not living in Nigeria anymore (but in the United States) and second, he was expected to help them to get Adanna's admission in a university for which she was not applied at all, but one in which he (Mr.Smith) had worked during his staying in Nigeria. As he did six years before, Mr. Smith made the contacts. His description of the facts save additional comments: <<In addition to having taught at Abia State University in 1996 as a Fulbright Fellow, I had since maintained a continuous relationship with several faculty members with whom I collaborated on research. My best friend at the university had become a dean, and through him I also knew the vice chancellor, who is the university's chief executive officer. When I phoned my friend to explain Adanna's predicament, he said that I should instruct [her parents] to come to the university with all her documents. I remember his precise words 'you are one of us. Even if I have to perform magic, your niece will get

⁸ Thinking on the reason of his failure to get her collaboration, Smith writes: <<I believe my intervention failed precisely because I was not, in the eyes of the principal, part of a trusted social network. To her, I was an outsider with no roots in the community, no permanent identity, and no place in a web of social relations that she had a stake in perpetuating>> (p.71, italics mine).

admission'. Not only did my friend secure Adanna's admission but he also arranged it so that she would have university housing, a resource even scarcer than a place in the incoming class. [Adanna's parents] were ecstatic, and I was proud. I had proven myself to be a good in-law">> (p.72, brackets mine).

Adanna's case is not the exception but the norm in Nigeria, but also is a mirror of what happens in many different places around the world. Countries with different cultures, political regimes, and population located in Latin America, Africa and Asia shares the same features than Adanna's example: being endowed with wide social connections, some users rely on their social contacts to expedite the processing of their applications, to obtain services, avoid paperwork or taxes, etc... instead of following the formal procedures.⁹ Users obtain passports in just a few days or hours; licenses or authorizations to start up businesses in record time; a bed in a public hospital or an appointment for surgery that would otherwise take months; faster resolution of their lawsuits; faster repair of their sewer systems, or as commented above a placement for a children in a much sought-after public school. In all cases, the procedures are the same: through commonly shared contacts, users and bureaucrats manage to sustain informal deals in which formal access to public services is broken and access to them is traded for something else.

On the other hand, Adanna's example also highlights an additional point. Her parents did not need to pay for her admission to a university; but they had to pay for her admission to a senior secondary school. Both cases are expression of petty corruption, but

⁹ For additional anthropological evidence of the use of networks for obtaining privileged treatment by civil servants in African countries, see Olivier de Sardan (1999) and Smith (2001, 2006); for Latin American countries, see Lomnitz (1988), Barbosa (1992), Fitch (1998) and Duarte (2006); for Asian countries, see Gupta (2005) and Shieh (2005). For an excellent illustration of the tolerance of these practices in Italy, see Stanley (2001).

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only one was a case of bribery. It is clear that Adanna's family (Mr. Smith included) was socially closer to the bureaucrats in charge of admission at the university and socially further from the bureaucrats in charge of admission at the senior school.

We can use the concept of *social distance* to capture the difference between both cases. By social distance I mean the minimum number of social ties that must be contacted to put a bureaucrat and a private agent in touch. In any social system, each individual is at different social distance from others. The key point is that for any pair of individuals, their social distance determines their capacity to support their exchanges through informal enforcing mechanisms: the closer they are, the stronger the informal enforcing mechanism at their disposition will be. As a corollary, it should not surprise that two individuals will be able to make many imaginable sort of exchange of favors if they are very close to each other but they will not have a substitute to the formal institutions were they are complete strangers to each other. Between those extremes different degrees of informal cooperation will be available depending on how close or far they are in social networks.

The consequence of the above reasoning for the study of corruption is that the decision of a rational agent (whether a public or a private one) to participate on petty corruption will vary with the social distance that separate himself from his counterpart. A successful model of petty corruption as a coordination problem should be able to reflect that role of social distance.

The model

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In this section, I develop a formal model to study the strategic interaction between a user of a public service and the bureaucrat managing its provision. To obtain the public service, the user has two ways. First, he can follow the formal procedures that were designed for the provision of the service. Alternatively, he can contact the bureaucrat in charge of its delivery and offers him something in exchange for its delivery. The second alternative is a corrupted exchange because it requires a breaking of the formal procedures. Then, in the case that the user offers the corrupted exchange, the bureaucrat must decide whether he accepts it or not. Building on this simple framework is it shown that a corrupted exchange is more probable, the smaller the social distance between the user and the bureaucrat is.

Consider a social system formed by n agents represented as points in a line, where n is arbitrarily large. Agents are distributed in a line in a fashion that can be approximated by a normal distribution with mean zero and variance σ^2 . They fall in one of four categories (g , k , w and v) where g is a governmental bureaucrat, k is a user of the services provided by him, w includes all acquaintances of g , k or both; and v represents the set of those neither connected with the bureaucrat or the user.

The *social distance* between two individuals i and j is represented by the segment $ij = |i - j|$ separating them in the line. The set of *direct* acquaintances of i is represented by all individuals located at a distance ε or less from him. Thus, the proportion of individuals with whom i is directly connected or w_i can be expressed as the fraction of the population located in the segment $[i - \varepsilon, i + \varepsilon]$ or $\lambda_i = \int_{i-\varepsilon}^{i+\varepsilon} f(x)dx$, where f is the pdf of

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the distribution of individuals on the line. Given the symmetry of that distribution, the individual with the greatest proportion of social ties is located at the mean, such that $\max(\lambda_i) = \lambda_\mu$. Consequently, for an individual i , the proportion of n representing his social ties can be characterized as a function of his social distance from the mean ($i\mu$) or:

$$\lambda_i = \int_{i-\varepsilon}^{i+\varepsilon} f(x)dx = \lambda_i(i\mu) \quad (1)$$

Also, it is immediate that the derivative of $\lambda_i(\cdot)$ with respect to $i\mu$ is negative, because, given the distribution of n over the line, the further is an individual from the mean, the smaller is the proportion of agents with whom he is directly connected.

By construction, i also has a set of weak social ties formed by all agents at distances ε up to 2ε from him (i.e. ‘the friends of his friends’) and, for the sake of the argument, it is assumed that he is unconnected with the remaining population.¹⁰

Hence, an arbitrary pair i and j may be directly and indirectly connected to each other making possible an overlapping of their social ties. For a formal representation of that overlapping of their social networks, it is convenient to represent their relative position on the line with the symbols $>$ and $<$. Thus, if i is located at the left of j (or $i < j$), the set of individuals connected with both can be denoted as δ_{ij} and formalized as follow:

$$\delta_{ij} = \begin{cases} F(x \leq i + \varepsilon) - F(x \leq j - \varepsilon) & \text{if } i + \varepsilon \geq j - \varepsilon \\ 0 & \text{if } i + \varepsilon < j - \varepsilon \end{cases} \quad (2)$$

Finally, the set of individuals connected with either i or j can be denoted as γ_{ij} and expressed as:¹¹

¹⁰ Since individuals are allocated in a continuum, it is possible to conceptualize social distances of higher degree (such as ‘the ties of the ties of the ties of my ties’) establishing ranges $\varepsilon, 2\varepsilon, 3\varepsilon, \dots$ to formalize them. However, for the purpose of this exposition, there are no gains in analytical power by an explicit consideration of more than one set of indirect ties.

$$\gamma_{ij} = F(x \leq i + \varepsilon) - F(x \leq i - \varepsilon) + F(x \leq j + \varepsilon) - F(x \leq j - \varepsilon) - \delta_{ij}$$

Using (1), we can rewrite it as follow:

$$\gamma_{ij} = \lambda_i + \lambda_j - \delta_{ij} \quad (3)$$

The social and the legal norms

Suppose that social interaction is governed by a self-enforced *social norm of reciprocity*. Thus, all individuals play dominant strategies in which they follow the prescriptions of the social norm. Ethnographic (Ellickson, 1991) and historical evidence (Grief, 1993; Grief, Milgrom and Weingast, 1994) show that these kind of norms can discipline rational individuals to provide mutual help and help the ties of theirs by establishing multilateral enforcing mechanisms; such that, a possible narrative of the strategies involved in equilibrium goes as follow: by reciprocity, agents who deny help to acquaintances do not receive help from them nor from their acquaintances. Conversely, a helper restricts access to help to any tie (either direct or indirect) that punishes him for helping others and the same is done by other ties as well. Such that in equilibrium it is in the best interest of every individual to behave with reciprocity with individuals in his set λ_i .

In this environment, a rule for the provision of a public service is exogenously made available. The rule establishes a principle of equal treatment for all potential users (for example, a rule of first come first serve) and also establishes judicial costs for those

¹¹ Notice that in the definition of γ_{ij} the term δ_{ij} is subtracted to avoid double counting when i and j are directly connected.

breaking them. Then, Nature selects two individuals from the population to be a user, k , and a bureaucrat, g .

Consequently, the supply of the public service may impose a dilemma on g and k , were they socially connected: they could base their interaction as a user and a bureaucrat in the social norm of reciprocity that already govern their interaction in other spheres, or they may select for this particular interaction the formal procedures that have been designed with that purpose.

Thus, on one hand, the user must decide if he gives motion to the informal mechanism or to the formal one. On the other hand, the bureaucrat who is asked to coordinate through the informal mechanism must decide if he accepts or rejects to interact in that way with that particular user. The bureaucrat's dilemma is interesting: his decision to follow the informal rule implies a breaking of the formal one and, conversely, his decision to stand on the formal procedure breaks the informal one.

Sequence of the game

Nature randomly selects two individuals to be g and k and let everyone knows their positions in the line (each one also knows his own position). Then, k decides whether to put or not put in motion the informal mechanism in order to avoid bureaucratic costs. If he decides to attempt an informal coordination, g must decide between accepting the agreement or not. When an interaction between g and k happens, Nature openly informs of that fact with some positive probability, α , to the rest of the population. If Nature informs of a violation of the formal procedures, a judicial cost is imposed on the

bureaucrat and, perhaps, on the user. Additionally, a reputation cost is imposed by third parties who are not connected with any of them.

Payoffs

Figure 1 presents the game in its extensive form. The user wants a public service from which he gets K in benefits. In order to obtain the service, he faces bureaucratic costs of B (with $K > B$). If the user decides to follow the formal procedures, he obtains $K - B$ for sure, and the bureaucrat gets nothing beyond his salary normalized at zero. However, selecting the informal mechanism may open the door to mutual gains. For the user, those gains consist on the avoidance of B or part of it. For the bureaucrat, the gains are future favors G and/or a transfer from the user of a fraction Θ of his saving on bureaucratic costs B . Now, once the informal mechanism is put in motion both k and g will also face potentials punishments.

First, if k selects the informal mechanism and g rejects to break the formal rule, the user suffers an extra cost $L > 0$.¹² As a consequence, k 's payoff would be $K - B - L$. At the same time, if third parties are informed about his action, the bureaucrat will suffer a punishment from those socially connected with both the user and him because they will

¹² When $L=0$, the user is indifferent between requesting a favor or not and there is not interesting strategic action on his side. Conversely, a small L will incline them to avoid the informal mechanism when they are not sure that it will work. Reasons for a $L > 0$ are several. For instance, this will be the case if users are sensible to reputation costs associated with being labeled as "corrupting users", or when formal procedures impose fees on users attempting to corrupt public officials. Alternatively, that will be the case when the motion of the informal mechanism requires the investment of time or other resources. In this latter case, L must be also included as a parameter in the case that the bureaucrat accepts the corrupted exchange.

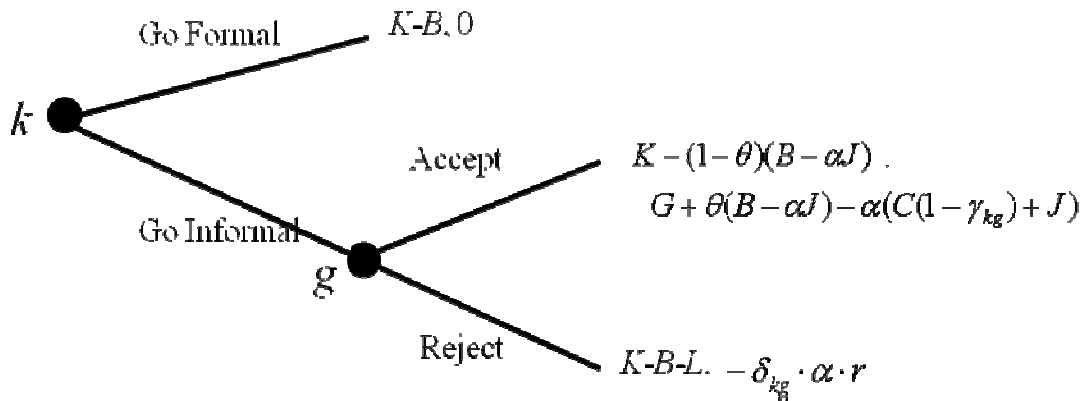
understand that he failed to reciprocate.¹³ Denoting the unitary cost of failing to reciprocate by r , g 's payoff will be $-\delta_{kg} \cdot \alpha \cdot r$.

Finally, consider the situation in which k selects the informal mechanism and g accepts to break the formal rule. The user has a potential saving of B but he knows that with probability α he will face a judicial cost of J . Consequently, his expected saving is $B - \alpha J$. Hence, if he must share part of the saving with g , his expected payoff is $K - (1 - \theta)(B - \alpha J)$. On the other hand, bureaucrat's acceptance of the deal, first, gives him access to future favors G and to an immediate transfer of $\theta(B - \alpha J)$, and, second, it exposes him to judicial costs J and reputational costs C that happens with probability α .¹⁴ However, only a fraction of the population (those not connected with either him or the user) will punish his reputation after knowing of his decision of breaking the formal rule. As a result, g 's payoff will be $G + \theta(B - \alpha J) - \alpha(C(1 - \gamma_{kg}) + J)$.

¹³ Gains from rejecting to break the law may also be included in the analysis. However, those reputation effects should be more relevant at higher level in the bureaucratic skeleton and will be explored in the annex.

¹⁴ The same reputation cost might be applied on k . In such a case, the structure of incentives of the bureaucrat and the user will be identical. However, a couple of differences between agents at the public and private side are relevant here and justify making reputation costs relevant only for the public agent. First, in general, private agents may hide their action on corporate names or anonymity, on the contrary, public agents are more exposed. Second, it is common that citizens have asymmetric expectation with respect to public and private agents, expecting fairness and neutrality from the former but not necessarily from the later. Thus, after the exposure of a corrupted exchange, a public agent may lose advancement in his public career, but his counterpart may still get clients for his businesses.

Figure 1. The Petty Corruption Game in Extensive Form



Additional assumptions: it is assumed that (a) $G + \theta(B - \alpha J) < C + J$, (b) $B \geq J$ and (c) $C = r$. The first inequality means that the bureaucrat is at least responsive to reputation threats when the favor is perfectly observed and everyone punishes him. The second that all users are inclined to ask for favors when they are perfectly observed, and the only reason to desist is an expected rejection. Finally, the last assumption means that the unitary cost of reputation for breaking formal rules (C) and the unitary cost of failing to reciprocate (r) are identical. Sociological work suggests that, in fact, that is not the case. In general, people are more sensible to a punishment imposed by close ties than from strangers (Granovetter 2005) and, therefore, a bureaucrat would be more willing to accept being rejected by a stranger (accusing him of being corrupt) than by a close ties (accusing him of failing to help one of his). Nevertheless, parsimony makes worthy to keep this assumption. With it, we erode qualitative differences and focus the attention on quantitative ones. In sum, what matters for bureaucrat's decision over his alternatives is how many will punish him not who will punish him if he fails to behave according to the

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formal or the informal rule. As a result, the model imposes more demanding requirements for a breaking of formal rules than those probably found in real contexts.

For the purpose of this analysis, the above structure will be sufficient. Further analysis interested on welfare implications will require extra assumptions. For example, the agreement between the user and the bureaucrat may imply negative externalities, say V ,¹⁵ on third parties.¹⁶

Equilibrium

For a given pair $\{g,k\}$ selected by Nature, there is a subset $H_g(k)$ such that the best strategy profile for g and k is $\{s_g^*, s_k^*\}$, where:

$$s_g^* = \begin{cases} \text{accept with proper transfer if } k \in H'_g(k) \\ \text{accept without transfer if } k \in H_g(k) \\ \text{reject} & \text{otherwise} \end{cases} \quad \text{(E)}$$

$$s_k^* = \begin{cases} \text{go informal without transfer} & \text{if } k \in H_g(k) \\ \text{go informal with proper transfer} & \text{if } k \in H'_g(k) \\ \text{go formal} & \text{otherwise} \end{cases}$$

Proof

¹⁵ Notice that if $G-B < V$ then the interchange of favors between the bureaucrat and the user is Pareto inefficient. However, it does not matter for this analysis whether that is or is not the case.

¹⁶ It may be realistic to say that both unconnected and connected third parties will be negatively affected by the lawbreaking of the user and the bureaucrat. However, since the latter are also connected, they know that they can use the same mechanism that the user puts in motion were they require it in the future. Therefore, if we make explicit the negative impact on them, that impact will be counterbalanced and the structure of the incentives will be identical with and without that extra information. Consequently, it may be a parsimonious assumption to say that both effects cancel each other. Nevertheless, there is one exceptional situation in which this simplification will not work: the extraordinary occasion in which there is only one remaining good/service to be allocated by the bureaucrat but two connected individuals who may be benefited by a corrupted exchange with him. For example, if k gets the last bed in the hospital by breaking the rules but one of his acquaintances also needed the bed at the same time.

The proof is by backward induction.

Step 1: The optimal decision of the bureaucrat

The bureaucrat is willing to break the legal norm when $EU_g(\text{accept}) \geq EU_g(\text{reject})$.

This means, when:

$$G + \theta(B - \alpha J) - \alpha((1 - \gamma_{kg})C + J) \geq -\alpha\delta_{kg}r \quad (4)$$

Replacing γ_{kg} by equation (3) and using assumption (c):

$$EU_g(\text{accept}) \geq EU_g(\text{reject}) \Leftrightarrow G + \theta(B - \alpha J) - \alpha \cdot (C \cdot (1 - \lambda_k - \lambda_g) + J) \geq 0 \quad (5)$$

Consequently, a given g is willing to help any k such that his network of ties λ_k fulfills the following condition:

$$\lambda_k \geq 1 - \lambda_g + \frac{J(1 + \theta)}{C} - \frac{G + \theta B}{\alpha C} + \delta_{kg} \frac{r - C}{C}$$

Using $C=r$

$$\lambda_k \geq 1 - \lambda_g + \frac{J(1 + \theta)}{C} - \frac{G + \theta B}{\alpha C} \quad (6)$$

$$\lambda_k \geq 1 - \lambda_g - \frac{1}{\alpha C} [G - \alpha J + \theta(B - \alpha J)] \quad (7)$$

Then, using expression (1) and recalling that $\partial \lambda_i(i\mu) / \partial i\mu < 0$:

$$k\mu = |k - \mu| \leq \lambda_k^{-1} \left(1 - \lambda_g - \frac{1}{\alpha C} [G - \alpha J + \theta(B - \alpha J)] \right) \quad (8)$$

Expression (8) means that, the bureaucrat's willingness to participate in a breaking of the formal rule increases as k becomes closer to the mean. In other words, the probability of a breaking of the formal rule increases with the size of k 's social network.

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Now, who (if anybody) can get access to the service by breaking the law without transferring part of his rent to the bureaucrat? To check for that possibility, set $\theta=0$. Expression (8) becomes:

$$k\mu = |k - \mu| \leq \lambda_k^{-1} \left(1 - \lambda_g - \frac{1}{\alpha C} [G - \alpha J] \right) \quad (9)$$

Thus, *ceteris paribus*, there are two individuals, denoted as k_{nt} , one at each side of the mean and both at the same distance $k_{nt}\mu$ from it, for whom the expression (9) holds with equality. All individuals closer to the mean than them will be able to agree with the bureaucrat without transferring part of their saving in B to him.

Thus, a set containing all possible users closer to the mean than k_{nt} can be defined as:

$$H_g(k; J, C, \alpha, G, \varepsilon) = \{k : k\mu \leq k_{nt}\mu\} \quad (10)$$

Individuals farther than them must transfer part of their saving on B to g to induce his cooperation. Let call k_t the user who must transfer his complete saving in bureaucratic costs to get an informal deal (i.e. for whom $\theta=1$). Then, it can be said that mutually beneficial informal deals with a bureaucrat can be reached only by a subset of the users located at distances $k_t\mu$ or less from the mean.

$$H'_g(k | J, C, \alpha, G, \varepsilon) = \{k : k\mu \leq k_t\mu\} \quad (11)$$

As a result, the optimal strategy for the bureaucrat can be stated as follow:

$$s_g^* = \begin{cases} \text{accept without transfer} & \forall k \in H_g(k), \\ \text{accept with proper transfer} & \forall k \in H'_g(k) \cap H_g(k)^C \\ \text{reject} & \text{otherwise} \end{cases} \quad (12)$$

Step 2: User's optimal decision

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Any k located at a higher distance from the mean than k_i is refrained from asking a favor to g because he obtains $K-B-L$ instead of $K-B$. Thus, k 's best strategy is given by:

$$s_k^* = \begin{cases} \text{go informal without transfer} & \text{if } k \in H_g(k) \\ \text{go informal with proper transfer} & \text{if } k \in H'_g(k) \cap H_g(k)^C \\ \text{go formal} & \text{otherwise} \end{cases} \quad (12)$$

Therefore the profile $\{s_g^*, s_k^*\}$ is the Subgame Perfect Equilibrium of the Petty Corruption Game ■

Main implications of the equilibrium

The analysis of the equilibrium allows us to answer the three questions presented at the beginning of this document and reproduced here: Who are the private agents more inclined to participate in petty corruption? When are bribes a component of that interaction and when they are not? Finally, why petty corruption is rampant in some countries?

According with this equilibrium, a non-empty set $H_g(k)$ always included the best connected individuals in the population. In other words, better connected individuals will use more often informal means to get public services, and consequently, petty corruption will be greater among better connected individuals. The model also reveals that a briber is a user who does not have good enough connections. Bribes arise because the perspective of mutual future favors is not strong enough to convince the bureaucrat to participate in the informal arrangement. Also, bribes must be greater the farther is the user from the mean. Thus, further and further users searching for informal deals have weaker informal mechanisms at their hand, and must transform the corrupted exchange in

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an immediate *quid pro quo*. Even though, the argument is focused in petty corruption, there are implications that can illuminate other cases of corruption as well. In particular, bribery will be practiced by lesser connected companies. On the other hand, well connected companies in a country will not bribe a bureaucrat of his own country, but they may be willing to bribe bureaucrats in other countries to compensate their lack of good connections there.

Finally, the model also illuminates the relevance of social density for the prevalence of petty corruption in a society. It does it by two means: the value of ε and the form of the distribution of individuals in the line $f(\cdot)$. Here, I comments on the term ε . In the appendix, I elaborate on the impact of $f(\cdot)$ in the context of the analysis of migration. As commented in footnote #10 above, the model reduces the social networks of an individual to only cover his ties and the ties of them and assumes as irrelevant social ties at further distances. The example of the girl who got into the senior school in Nigeria and then into the university makes clear that the assumption is too restrictive because in the corrupted exchange that benefited her were involved individuals at further social distances. Now, we can relax this restriction by explicitly including ties at higher distances. The simplest way to do that is to change the value of ε and observe how that impacts the incentives of the bureaucrat. As it is clear in equation (1), a greater ε expands the subset of the population that is part of the social network of an individual. Thus, a greater ε expands both λ_k and λ_g . Consequently, *ceteris paribus*, the subset of the population with whom he can reach an informal deal becomes greater. Thus, every else equal, in those social systems in which networks of reciprocity are comparatively larger, the set of users benefited by lawbreaking is greater. For this reasons, corrupted exchanges will be

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common in socially dense societies (places where more people know each other, or well, in which everybody knows somebody in conditions to put them in contact with a bureaucrat).

In sum, (a) more connected individuals have greater chances of being involved in corrupted exchanges, (b) bribery is a subset of corrupted exchanges among users and bureaucrats that are not sufficiently well connected to each other to transform the corrupted exchange in a trade of mutual favors, and (c) in social systems where social networks of reciprocity are broad, corrupted exchange will be more prevalent.

III. Petty Corruption in Sub-Saharan Africa

This section presents statistical analysis testing whether more connected individuals participate more often in petty corrupted exchanges. Equation (7) contains the core of the strategic interaction highlighted by the model and, consequently, it guides us in the searching of relevant data. From it, the probability of a corrupted exchange will be determined by:

- (a) the size of the social networks of the user and the bureaucrats: λ_k, λ_g , but also by,
- (b) the magnitude of the gains made possible by their exchange: G plus B
- (c) the punishment to bureaucrat's defection: J and C when he breaks the formal rule and r when he rejects to help a social tie. And finally,
- (d) the level of transparency or exposure with which the delivery of public services is designed: α

Therefore, the task is to study a relationship of the following form:

$$\Pr(\text{petty corruption between } k \text{ and } g) = f(\lambda_k, \lambda_g | G, B, J, C, r, \alpha)$$

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Consequently, an ideal dataset will include rich information at the micro and at the macro level. At the micro level, the dataset should specify: (i) every event in which every user tried to get a public service by following the formal procedures or by means of their social networks, (ii) details about the size of the social networks of each individual in the system, and (iii) details about additional characteristics of each of them. At the macro level, the dataset should have information on (i) the quality of formal institutions, including the formal procedures established to get a public service and (ii) some measure of how extended social norms of reciprocity are in the social system. Unfortunately, up to date, no dataset has been built that contains all the information suggested above.

To become as closer as possible to the required information in an ideal dataset, here, I exploit the information contained in the second wave of the *Afrobarometer Dataset*¹⁷ and complement it with country level variables provided by the World Bank.¹⁸ The second wave of *Afrobarometer* contains individual level data from face to face surveys applied on citizens across 16 African countries. According to a broadly used index developed by Transparency International, these countries have different levels of corruption from moderate (Botswana) to rampant (Zambia, Mozambique, Nigeria, Kenya, among others).¹⁹ The combination of the *Afrobarometer* with World Bank Indicators at the country level allows me to generate measures of users' participation in petty corrupted exchanges (i.e., $\Pr(\text{petty corruption})$), the size of their social networks (λ_k), the

¹⁷ The *Afrobarometer* is a public opinion research project emerged from the collaboration of Michigan State University, the Institute for Democracy in South Africa and the Center for Democratic Development in Ghana (details can be found in <http://www.afrobarometer.org/>).

¹⁸ Currently, there are three waves of *Afrobarometer* publicly available; but data for only a couple of countries has been released from the third wave. That is the reason why I selected the second one.

¹⁹ In the Corruption Perception Index 2006 (CPI), the best ranked country in the *Afrobarometer*'s Sample is Botswana (37th with a score of 5.6 over 10) and the worst ranked are Nigeria and Kenya (sharing the 142th place with a score of 2.2). In 2006, the mean CPI score among these countries was 3.1. For a comparison see footnote No.10 *supra*.

bureaucratic costs at the country level (B), the transparency and accountability existing in the delivery of public services (a mix of α , J and C), and the relevance of social norms of reciprocity within each country (r) plus additional controls at the individual and country level. However, to the extent that the dataset does not identify specific interactions between users and bureaucrats, measures of λ_g and G are omitted.

The data

Here, I describe the measure of petty corruption and the measures of the size of social network used in the analysis. The details for the rest of the variables are contained in Table A1 to A5 in the appendix.

Dependent variable: users' participation in petty corruption

The *Afrobarometer* contains a question about individuals' participation in corrupted exchanges. The question is the following:

Q.59: In the past year, how often (if ever) have you had to pay a bribe, give a gift, or do a favor to government officials in order to get a document of a permit?

There were four possible answers: Never, Once or Twice, A few times or Often. From those original values, I created the dummy *BROKEDOC* in which a value of 1 means that the individual broke the formal procedures (one or twice, a few times or often) and a value of 0 means that he never did it. Two additional situations of petty corruption in the access to a public service were also asked in the survey (“... in order to get a school-chair for their son or daughter”) and (“in order to get a household service”). I also

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create dummies for these two cases (BROKESCHOOL and BROKESERVICE, respectively) that I use for robustness check.

Explanatory variables: Individuals' network sizes

I follow standards in the social network analysis literature that use attained education level (e.g. Lin 1999, Mouw 2003) and degree of participation in voluntary organizations (Putnam, 1993, 2000) to proxy for the size of individual's social networks. I additionally create a third proxy based on contacts with political authorities and two indexes that combine them.

Proxy 1: Attained education level.

The survey asks "What is the highest level of education you have completed". The question allows for 9 valid answers from no schooling to post-graduate studies. I collapsed them in the variable EDUCATION that contains the following 6 values: no schooling, some primary schooling, primary school completed, some secondary school, secondary school completed, postsecondary education (either some or completed)

Proxy 2: Participation in voluntary organizations.

The survey asks "I am going to read out a list of groups that people join or attend. For each one, could you tell me whether you are an official leader, an active member, an inactive member, or not a member:" The list of groups is the following: a 'religious group', a 'trade union or farmers association/club/cooperative', a 'professional or business association' and 'a community development or self-help association'. I added

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the answer for each item building a variable with values from 0 to 12 that I labeled as CONNECTED.

Proxy 3: Contacts with political authorities

An important concern in the analysis of the causal effect of social networks in other variables is that the size of those social networks may vary. The Afrobarometer contains a variable that helps capture that possibility. The survey asks “During the past year, how often have you contacted any of the following persons for help to solve a problem or to give them your views_____?” The authorities included in the list were a ‘local government representative’, a ‘congressman’, an ‘official at a government ministry’, a ‘political party official’, a ‘religious leader’, a ‘traditional ruler’ and another ‘unidentified influential person’. The valid alternatives for the respondents were “never”, “a few times”, and “often”. I created the variable CONTACT1 (all authorities in the list) and CONTACT2 (only political authorities) to combine their answers. Now, there might be idiosyncratic differences among countries that make people be more prone to establish contacts with authorities in some of them than in others. Therefore, I standardized the answers by country for a better comparison. Thus, for each country the values were adjusted to have mean zero and standard deviation of one.

The same process was used to create two indexes. The first one, NETSIZE, consists in the simple sum of the standardized values (for each country in the sample) of EDUCATION and CONNECTED. I interpret this variable as the size or stock of the social network of each individual. This stock is augmented by the individuals’ attempts to

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be in contact with authorities. Therefore, I created a second index SOCIALNET that adds the values of NETSIZE and CONTACTS1 with equal weight.²⁰

Additionally, I include individual and country level data as controls in the estimation. The reasoning for the inclusion of variables is the following.

Controls at the individual level: I include the dummy HEAD with value 1 if the respondent is the head of the household because the responsibilities of the head of the family can make them more prone to participate in corrupted exchanges affecting the household. For similar reasons, I expect that men participate more in those exchanges and include the dummy FEMALE (1 if the respondent is a woman). On the other hand, relatively richer individuals can bribe more, consequently, it is added the variable INCOME that indicates the decile in which the respondent falls. Also, public workers may have an advantage to get privileged access to informal exchanges with other bureaucrats because they are “insiders” rather than because they have bigger social networks. To capture that possibility, I include the dummy PUBLICJOB with value 1 if the household contains public workers. A similar reasoning makes relevant to include POLIT_AFF, a dummy indicating respondent’s sympathy to a political party. Moreover, I decide to include two variables to capture ethical differences among respondents that may impose psychological restrictions on some of them to participate in corrupted exchanges. They are: RELIGION, a dummy with value 1 if the respondent adheres to a religion and RELIGIOSITY a variable that indicates the frequency with which the respondent attends his/her church. I also added EASY_DOC, the respondent’s perception about the easiness to get permit or licenses. Finally, I included the age of the respondent (AGE).

²⁰ Other combinations were also considered obtaining similar results

Controls at the country level: From the World Bank, I obtained the gross domestic product per capita in real terms for each country in the sample (GDPPC_REAL)²¹ plus two measures of the quality of the delivery of public services (CPIA_QPA that measure the quality of public administration and CPIA_TRANS). These variables attempt to measure actual policy rather than users' perception (as it is done, for example, in the Corruption Perception Index elaborated by Transparency International). Consequently, they are well-suited to capture bureaucratic costs and the extent to which public service procedures are transparent. As described in IAD(2006), CPIA_QPA is based on four criteria: (a) Policy coordination and responsiveness, (b) Service delivery and operational efficiency, (c) merit and ethics, (d) pay adequacy and management of the wage bill. On the other hand, CPIA_TRANS rests on assessments on three dimensions: (a) the accountability of the executive to oversight institutions and of public employees for their performance; (b) access of civil society to information on public affairs; and (c) state capture by narrow vested interests. Finally, from the *Afrobarometer Dataset*, I used the national average to a question about nepotism to capture the level of tolerance to corrupted exchanges.

The summary description of the data is in table No.1

Table No.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
brokedoc	20900	0.1562679	0.3631179	0	1
education	24178	2.287948	1.586477	0	5
connected	22516	2.425164	2.099807	0	12
contacts2	23198	-0.0079191	2.993907	-2.516321	24.71315
netsize2	23047	0.0012346	1.453445	-4.582734	4.89751
socialnet	20228	-0.0722312	4.989145	-8.880779	34.21555

²¹ In some estimations (non-reported) I used the natural logarithm of the gdp (no relevant differences were found).

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head	22910	0.4962025	0.4999965	0	1
female	24248	0.4992164	0.5000097	0	1
income	19768	3.111847	3.002753	0	10
age	23616	36.29472	14.76195	18	105
religion	24181	0.9371821	0.2426402	0	1
religiosity	23995	4.366243	1.586408	1	6
publicjob	22919	0.248222	0.4319907	0	1
polit_aff	24239	0.617971	0.4858936	0	1
easy_doc	23711	0.6106945	1.828708	-1.405216	4.663503
gdppc_real	24248	931.5855	1139.649	147.8814	4034.817
cpia_qpa	19449	3.068641	0.458021	2	4
cpia_trans	19449	3.138773	0.5641194	1.5	4.5
nepotism_c	23144	1.868223	0.3447746	1.440236	2.986744

With this data, I run probit models to obtain the impact of each proxy on BROKEDOC. In all cases, the null hypothesis states that more connected individuals should break more often the formal procedures through corrupted exchanges to get permits or licenses. Consequently, for each proxy, the coefficient should be positive and significant. The summary of the results is presented in the following table and details are provided in tables A6 to A9 in the appendix.

Table No.2: Probit Estimation of the effect of social networks on $\text{pr}(\text{BROKEDOC}=1)$

		Model 1	Model 2	Model 3	Model 4	Model 5
	Proxy	b/se	b/se	b/se	b/se	b/se
Individual's social network	education	0.061*** (0.01)				
	connected		0.053*** (0.01)			
	contacts2			0.041*** (0.00)		
	netsize1				0.066*** (0.01)	
	socialnet					0.031*** (0.00)
<i>Individual level controls: head of household, gender, income, age, adhere to a religion, intensity of involvement with his/her religion, dependency of a public job, sympathy with</i>						

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a political party, perception of the difficulty to get permits or licenses						
<i>Country level controls: Domestic product in real terms, quality of public administration, transparency in public service delivering, country's average tolerance of nepotism</i>						
	Constant	Yes	Yes	Yes	Yes	Yes
N		11963	11679	11810	11956	10550

*** p<0.01

Table No.2 presents the coefficients of the probit model, but not marginal or percentage change estimates. For interpretation, consider the change in predicted probabilities for Model 1 (in Table No.2) that is reproduced in the Table No.3. In the subsample used with EDUCATION as the proxy to the size of the individual social network, 17.7% of the respondents said that, during the last twelve months, they had broken the formal rules to get a permit. Holding all the other variables at their means, a changes on education from the minimum value (no schooling) to its maximum value (postsecondary studies) increases the probability of breaking the rules in 8% (from 14.3% to 22.33%) and a change of one standard deviation in EDUCATION (from ½ below the mean to ½ above the mean) increases the probability of breaking the formal rules in 2.52%

Table No.3: Changes in Predicted Probabilities for brokedoc in Model 1

	min->max	0->1	+1/2	+sd/2	MargEfct
education	0.0803	0.0143	0.0158	0.0252	0.0158
head	0.0285	0.0285	0.0285	0.0142	0.0285
female	-0.0342	-0.0342	-0.0344	-0.0171	-0.0344
income	0.0700	0.0063	0.0067	0.0198	0.0067
age	-0.0669	-0.0010	-0.0009	-0.0130	-0.0009
religion	0.0140	0.0140	0.0144	0.0027	0.0144
religiosity	-0.0302	-0.0064	-0.0059	-0.0090	-0.0059
publicjob	0.0090	0.0090	0.0089	0.0038	0.0089
polit_aff	0.0425	0.0425	0.0433	0.0210	0.0433
easy_doc	-0.1405	-0.0431	-0.0481	-0.0462	-0.0481
gdppc_real	0.1909	0.0001	0.0002	0.0405	0.0002
cpia_qpa	-0.0739	-0.0707	-0.0503	-0.0192	-0.0503
cpia_trans	-0.2175	-0.1270	-0.2194	-0.0945	-0.2204
nepotism_c	0.1103	0.0447	0.0666	0.0265	0.0667
	0	1			

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Pr (y x)	0.8229	0.1771
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Robustness checks were performed based on subsamples according to segments of age. Additionally, the possible impact of outliers was tested by dropping extreme cases in regression that used *netsize* and *socialnet* as explanatory variables. Interaction effects with age, gender, income, political affiliation, public job and other individual level variables resulted in most cases insignificant. Moreover, dummies for countries did not change the significance of the main explanatory variables. Now, extra robustness checks were performed using different dependent variables. As indicated before,, the Afrobarometer dataset also contains questions about corrupted exchanges done to get a child into a school (*BROKESCHOOL*) and to get household services (*BROKESERVICE*). Additional regressions were run for these alternative dependent variables confirming that the size of social network has positive and significant effect on the breaking of formal rules. Some of those additional analyses are summarized in Tables A10 and A11. In the regression using *BROKESERVICE* as a dependent variable, an additional variable (*LOCALINFRA*) was included. *LOCALINFRA* combines questions q112e to q112g in the *Afrobarometer Dataset*. These questions (filled by the interviewer after the interview) indicate whether the primary sampling unit has electricity grid, piped water systems and sewage systems that most houses could access.

Finally, the regressions using *BROKESCHOOL* as the dependent variable have an additional complication. We cannot use education as a proxy for the size of individual's social networks in the case of corruption at schools, because the son or daughter of a

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well-educated respondent has greater chances of getting into the school chair by merit.²² Then, instead, we must use the other two proxies. It is interesting to see in Table A.11 that education by itself is statistically insignificant if we include another proxy for the size of social network.

Testing for Endogeneity of Social Networks

The theory and the empirical analysis presented here assume that social networks are exogenous to lawbreaking. In other words, it is implicitly said that people do not build their social networks as an investment to get privileged access to public services. This approach is consistent with the sociological understanding of social networks as a byproduct of social interaction. I believe that variables like education are good candidates to refuse the idea that social networks are endogenous to incentives to break the formal procedures, because changes in educational attainment are by definition obtained in the long-run and the strategic interaction involved in public service delivery happens in short period of time.

Nevertheless, all the models tested above only explain a tiny proportion of the overall dispersion of data. For instance, the *Iroc* of the model 1 in table N.2 is only 0.68 in a measure that goes from 0.5 to 1, a poor performance according with standard conventions (See figure A.1). Therefore, it is highly possible that the measures of social networks used in the models are correlated with some omitted variables. Consequently, even though reverse causality is probably not an issue, endogeneity is still a complication.

²² This problem is identical to the one faced by the empirical literature that tries to identify the impact of social network on wages (see Lin, 1999 for an example and Mouw, 2003, for a critic).

A standard way to deal with this is the use of instrumental variables that are correlated with the size of social network, but that should not be considered part of the model. I suggest that the region (urban/rural, URBRUR) and the local infrastructure (LOCALINFRA) are both potential candidates for IVs. More educated individuals probably live in urban areas and in areas in which the local infrastructure is well developed. However, there is not a clear link between being a rural or urban citizen and having greater changes to participate in corrupted exchanges. Nor, having electricity, piped water and sewage in the sampling unit (the measures contained in LOCALINFRA) should be linked with having more participation in corrupted exchanges. Under this assumptions, a 2SLS estimation using LOCALINFRA and URBRUR as instrument for EDUCATION was run. The results are contained in table A.12 and are consistent with the previous results.

IV. Conclusion and final remarks

The theory and the empirical evidence presented here suggest a role for social networks to understand the persistence of corruption. In context where formal institutions are weak, informal institutions are used in their replacement. However, citizens differ in their real capacity to use those alternative forms of coordination. The persistency of corruption and the difficulty to improve formal institutions in those places strongly depend on that link between corrupted exchange and social networks. With all, the evidence is still preliminary.

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Appendix

Table NoA1: Dependent Variable Used in the Econometric Analysis

Name	variable	Description	Source
Dependent Variable			
Breaking of formal rules	brokedoc:	"In the past year, how often (if ever) have to had to pay a bribe, give a gift, or do a favour to government officials in order to get a document or a permit?" (never/once/a few times/often) Dummy No = 0 Yes =1 Alternative "Yes" adds (once + few times + often)	Source: Afrobarometer Merged Dataset (AII): question q59a
	brokeschool	Similar to brokedoc, but in this case the question was "In the past year,... in order to get a child into school?"	AII: q59b
	brokeservice	Similar to brokedoc, but in this case the question was "In the past year,... in order to get a household service (like piped water, electricity, or phone)?"	AII: q59c

Table NoA2: Main Independent Variable Used in the Econometric Analysis

Explanatory Variables				
Proxies				
Size of Individual's Social Network	Education	education	It has 6 values: no schooling, some primary schooling, primary school completed, some secondary school, secondary school completed, postsecondary education (either some or completed)	AII: q84
	Participation in voluntary organizations	connected	simple sum of participation in voluntary organizations (church/union/professional/associations/selfhelp communities). Original values: not a member/inactive member/active member/official leader	AII: q24a to q24d
	Contacts with political authorities	contacts	"During the past year, how often have you contacted any of the following persons for help to solve a problem of to give	AII: q29a to q29d

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			them you views:____” (local government representative/parliamentary representative/official of a government ministry/political party official). Original values: never/only once/a few times/often	
	Network's Size based on participation and educational level	netsize	For each country, the variables education and participation in voluntary organizations are standardized. The index contains the simple sum of those standardized values of education and connected.	AII: q24a to q24d and q84
	Network' resources	socialnet	The index combine the size of the network as measured by <i>netsize</i> and the investment to expand it, as measured by <i>contacts</i> (it gives equal weight to both)	AII: q24a to q24d, q84and q29a to q29d

Table NoA3: Instrumental Variables Used in the Econometric Analysis

Instrumental Variables					
IVs	Zone	Urban and rural area	urbrur	Urban=1, Rural=0	AII: urbrur
	Local Infrastructure	Sewage, Pipes and Electrical grid in the primary sampling unit	localinfra	“Were the following services present in the primary sampling unit/enumeration area: electricity grid that most houses could access/piped water systems that most houses.../sewage system that most houses...” Original values: Yes/No	AII: q112e to q12g

Table NoA4: Other Independent Variable Used in the Econometric Analysis – Individual level controls

Other Explanatory Variables - Controls					
Individual level controls	Being the head of the household	Head	Being head of the family or not		AII: q81
	Gender	female	Female=1, Male=0		AII: q96
	Household Income Level	Income	Organized by deciles from 1 to 10		AII: q90
	Age of respondent	Age	Population over 18 years old		AII: q80
	Adherence to a religion	Religion	Dummy that acquires the value 1 if the individual adheres to a religion		AII: q85
	Intensity of religiosity	Religiosity	Frequency with which the individual goes to his church (never if he does not adhere to a religion)		AII: q86
	Household dependence of a public job	Publicjob	“Do you or your household rely on the income of anyone who works for the government?” Original values: yes=1, no=0		AII: q91

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	Closeness to a political party	pol_aff	“Do you feel close to any particular political party or political organization” Yes=1, No=0	AII: q87a
	Perception of the difficulty to get a permit or license	easy_doc	“Based on your experience, how easy or difficult is to obtain the following services? Or do you never try and get these services from government? An identity document (such as a birth certificate, driver’s license or passport)	q58a

Table NoA5: Other Independent Variable Used in the Econometric Analysis – Country level controls

Country level controls	Economic development	Domestic Product per capita	gdpcap_real	Growth Domestic Product per capita - real (US\$ Constant 2000)	World Development Indicators - World Bank
	Quality of Formal Institutions	Quality of Public Administration	cpia_qpa	From 1 (very weak performance) to 6 (very strong performance). <<This criterion assesses the extent to which civilian central government staffs (including teachers, health workers, and police) are structured to design and implement government policy and deliver services effectively>> IDA (2006, p39)	World Development Indicators - World Bank / International Development Association (IDA): Country Policy and Institutional Assessment (CPIA)
		Transparency	cpia_trans	<<This criterion assesses the extent to which the executive can be held accountable for its use of funds and the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for the use of resources, administrative decisions, and results obtained. Both levels of accountability are enhanced by transparency in decision-making, public audit institutions, access to relevant and timely information, and public and media scrutiny>> IDA (2006, p41)	World Development Indicators - World Bank / Country Policy and Institutional Assessment (CPIA)
	Quality of formal institutions	National acceptance of nepotism	nepotism_c	National average tolerance of nepotism - based on sample “Which of the following statements is closest to your view? A: Since everyone is equal under the law, leaders should not favour their own family or group. B: Once in office, leaders are obliged to help their own family or group” (Agree Very strongly with A, Agree with A, Aggre with neither Agree with B, Agree Very Strongly with B)”	AII: q69

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Table No.A6: Probit Estimation of the effect of EDUCATION as a proxy for the impact of the size of individual's social network on pr(BROKEDOC=1)

	Model E0 b/se	Model E1 b/se	Model E2 b/se	Model E3 b/se
education	0.083*** (0.01)	0.030** (0.01)	0.056*** (0.01)	0.061*** (0.01)
head		0.145*** (0.03)	0.116*** (0.03)	0.110*** (0.03)
female		-0.160*** (0.03)	-0.135*** (0.03)	-0.132*** (0.03)
income		0.028*** (0.00)	0.027*** (0.01)	0.026*** (0.01)
age		-0.007*** (0.00)	-0.004*** (0.00)	-0.003** (0.00)
religion		0.249*** (0.07)	0 (0.08)	0.055 (0.09)
religiosity		0.019* (0.01)	-0.024* (0.01)	-0.023* (0.01)
publicjob		0.042 (0.03)	0.048 (0.03)	0.034 (0.03)
polit_aff		0.081** (0.03)	0.155*** (0.03)	0.167*** (0.03)
easy_doc		-0.213*** (0.01)	-0.171*** (0.02)	-0.185*** (0.02)
gdppc_real			0.001*** (0.00)	0.001*** (0.00)
cpia_qpa			-0.196*** (0.05)	-0.194*** (0.05)
cpia_trans			-0.709*** (0.07)	-0.848*** (0.08)
nepotism_c				0.257*** (0.05)
constant	Yes	Yes	Yes	Yes
N	20849	15830	11963	11963

Table No.A7: Probit Estimation of the effect of CONNECTED as a proxy for the impact of the size of individual's social network on pr(BROKEDOC=1)

	Model C0 b/se	Model C1 b/se	Model C2 b/se	Model C3 b/se
connected	0.080*** (0.01)	0.070*** (0.01)	0.050*** (0.01)	0.053*** (0.01)
head		0.115*** (0.03)	0.103** (0.03)	0.096** (0.03)
female		-0.165*** (0.03)	-0.154*** (0.03)	-0.153*** (0.03)
income		0.028*** (0.00)	0.032*** (0.01)	0.031*** (0.01)
age		-0.008*** (0.00)	-0.006*** (0.00)	-0.006*** (0.00)
religion		0.192** (0.07)	-0.041 (0.09)	0.014 (0.09)
religiosity		0.003 (0.01)	-0.028** (0.01)	-0.026* (0.01)
publicjob		0.056* (0.03)	0.083* (0.03)	0.071* (0.03)
polit_aff		0.064* (0.03)	0.137*** (0.03)	0.149*** (0.03)
easy_doc		-0.214*** (0.01)	-0.177*** (0.02)	-0.192*** (0.02)
gdppc_real			0.001*** (0.00)	0.001*** (0.00)
cpia_qpa			-0.236*** (0.05)	-0.235*** (0.05)
cpia_trans			-0.677*** (0.07)	-0.830*** (0.08)
nepotism_c				0.278*** (0.05)
constant	Yes	Yes	Yes	Yes
N	19290	15473	11679	11679

Table No.A8: Probit Estimation of the effect of CONTACT2 as a proxy for the impact of the size of individual's social network on pr(BROKEDOC=1)

	Model C20 b/se	Model C21 b/se	Model C22 b/se	Model C23 b/se
contacts2	0.047*** (0.00)	0.042*** (0.00)	0.041*** (0.00)	0.041*** (0.00)
head		0.125*** (0.03)	0.100** (0.03)	0.096** (0.03)
female		-0.139*** (0.03)	-0.125*** (0.03)	-0.124*** (0.03)
income		0.032*** (0.00)	0.035*** (0.01)	0.035*** (0.01)
age		-0.008*** (0.00)	-0.006*** (0.00)	-0.006*** (0.00)
religion		0.294*** (0.07)	-0.001 (0.09)	0.041 (0.09)
religiosity		0.012 (0.01)	-0.019 (0.01)	-0.017 (0.01)
publicjob		0.070* (0.03)	0.052 (0.03)	0.044 (0.03)
polit_aff		0.072** (0.03)	0.123*** (0.03)	0.133*** (0.03)
easy_doc		-0.231*** (0.01)	-0.174*** (0.02)	-0.185*** (0.02)
gdppc_real			0.001*** (0.00)	0.001*** (0.00)
cpia_qpa			-0.214*** (0.05)	-0.212*** (0.05)
cpia_trans			-0.731*** (0.07)	-0.848*** (0.08)
nepotism_c				0.209*** (0.05)
_cons	Yes	Yes	Yes	Yes
N	19935	15046	11810	11810

Table No.A9: Probit Estimation of the effect of CONNECTED as a proxy for the impact of the size of individual's social network on pr(BROKEDOC=1)

	Model N0 b/se	Model N1 b/se	Model N2 b/se	Model N3 b/se	Model S0 b/se	Model S1 b/se	Model S2 b/se	Model S3 b/se
netsize	0.098*** (0.01)	0.054*** (0.01)	0.067*** (0.01)	0.066*** (0.01)				
socialnet					0.037*** (0.00)	0.030*** (0.00)	0.031*** (0.00)	0.031*** (0.00)
head		0.141*** (0.03)	0.116*** (0.03)	0.110*** (0.03)		0.143*** (0.03)	0.118*** (0.04)	0.130*** (0.04)
female		-0.160*** (0.03)	-0.140*** (0.03)	-0.140*** (0.03)		-0.125*** (0.03)	-0.117*** (0.03)	-0.117*** (0.03)
income		0.027*** (0.00)	0.028*** (0.01)	0.028*** (0.01)		0.027*** (0.00)	0.033*** (0.01)	0.034*** (0.01)
age		-0.007*** (0.00)	-0.005*** (0.00)	-0.005*** (0.00)		-0.008*** (0.00)	-0.006*** (0.00)	-0.007*** (0.00)
religion		0.213** (0.07)	-0.037 (0.09)	0.011 (0.09)		0.348*** (0.08)	-0.052 (0.10)	-0.009 (0.10)
religiosity		0.014 (0.01)	-0.026* (0.01)	-0.023* (0.01)		-0.005 (0.01)	-0.026* (0.01)	-0.012 (0.01)
publicjob		0.037 (0.03)	0.05 (0.03)	0.042 (0.03)		0.065* (0.03)	0.042 (0.03)	0.039 (0.03)
polit_aff		0.079** (0.03)	0.150*** (0.03)	0.159*** (0.03)		0.053 (0.03)	0.107*** (0.03)	0.110*** (0.03)
easy_doc		-0.214*** (0.01)	-0.174*** (0.02)	-0.186*** (0.02)		-0.222*** (0.01)	-0.167*** (0.02)	-0.178*** (0.02)
gdppc_real			0.001*** (0.00)	0.001*** (0.00)			0.001*** 0	0.002*** 0
cpia_qpa			-0.238*** (0.05)	-0.236*** (0.05)			-0.188** (0.06)	-0.035 (0.06)
cpia_trans			-0.746*** (0.07)	-0.864*** (0.08)			-0.641*** (0.07)	-0.771*** (0.07)
nepotism_c				0.214*** (0.05)				0.617*** (0.07)
_cons	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	19754	15821	11956	11956	17108	13714	10550	10550

* p<0.05, ** p<0.01, *** p<0.01

Table No.A10: Probit Estimation of the effect of CONNECTED as a proxy for the impact of the size of individual's social network on pr(BROKESERVICE=1)

	Model HS1 all b/se	Model HS2 age>35 b/se	Model S3 all b/se	Model S4 age>35 b/se	Model S5 all b/se	Model S6 age>35 b/se
education	0.054*** (0.01)	0.052* (0.02)				
contacts1			0.036*** (0.00)	0.029*** (0.01)		
connected					0.073*** (0.01)	0.068*** (0.01)
head	0.033 (0.04)	0.13 (0.07)	0.028 (0.04)	0.067 (0.08)	0.017 (0.04)	0.131 (0.08)
female	-0.018 (0.04)	0.121 (0.06)	-0.005 (0.04)	0.119 (0.07)	-0.043 (0.04)	0.108 (0.07)
income	0.028*** (0.01)	0.036*** (0.01)	0.031*** (0.01)	0.042*** (0.01)	0.023*** (0.01)	0.031** (0.01)
age	-0.003 (0.00)	-0.003 (0.00)	-0.005*** (0.00)	-0.003 (0.00)	-0.005*** (0.00)	-0.004 (0.00)
religion	-0.049 (0.11)	-0.236 (0.18)	-0.155 (0.14)	-0.27 (0.22)	-0.13 (0.12)	-0.285 (0.20)
religiosity	0.019 (0.01)	0.046* (0.02)	0.027* (0.01)	0.049* (0.02)	0.015 (0.01)	0.044* (0.02)
publicjob	0.158*** (0.04)	0.198** (0.06)	0.165*** (0.04)	0.176** (0.07)	0.155*** (0.04)	0.182** (0.06)
polit_aff	0.199*** (0.04)	0.162** (0.06)	0.142*** (0.04)	0.137* (0.06)	0.202*** (0.04)	0.193** (0.06)
easy_doc	-0.117*** (0.01)	-0.113*** (0.02)	-0.156*** (0.01)	-0.161*** (0.02)	-0.151*** (0.01)	-0.157*** (0.02)
gdppc_real			0.001*** (0.00)			
cpia_qpa	-0.557*** (0.06)	-0.436*** (0.10)	-0.413*** (0.07)	-0.382** (0.12)	-0.606*** (0.06)	-0.473*** (0.10)
cpia_trans	-0.224* (0.09)	-0.478*** (0.13)	-0.227** (0.09)	-0.577*** (0.13)	-0.286** (0.09)	-0.605*** (0.13)
nepotism_c	0.407*** (0.06)	0.592*** (0.09)	0.721*** (0.10)	0.829*** (0.16)	0.476*** (0.07)	0.740*** (0.10)
localinfra	0.188*** (0.01)	0.188*** (0.02)	0.197*** (0.02)	0.190*** (0.02)	0.201*** (0.02)	0.203*** (0.02)
_cons	Yes	Yes	Yes	Yes	Yes	Yes
N	12538	5469	11106	4841	12091	5248

* p<0.05, ** p<0.01, *** p<0.01

Table No.A11: Probit Estimation of the effect of CONNECTED and CONTACTS1 as a proxy for the impact of the size of individual's social network on pr(BROKESCHOOL=1)

	Model ED0 all b/se	Model ED1 age>35 b/se	Model ED2 all b/se	Model ED3 age>35 b/se
connected	0.075*** (0.01)	0.070*** (0.01)		
contacts1			0.032*** (0.00)	0.027*** (0.01)
education	0.02 (0.01)	-0.002 (0.02)	0.021 (0.01)	-0.004 (0.02)
head	0.035 (0.04)	0.147* (0.07)	0.042 (0.04)	0.095 (0.07)
female	-0.084* (0.04)	0.033 (0.06)	-0.055 (0.04)	0.035 (0.06)
income	0.01 (0.01)	0.019* (0.01)	0.017** (0.01)	0.026** (0.01)
age	-0.004** (0.00)	-0.004 (0.00)	-0.003* (0.00)	-0.004 (0.00)
religion	-0.066 (0.10)	-0.224 (0.17)	-0.074 (0.11)	-0.247 (0.18)
religiosity	-0.013 (0.01)	0.005 (0.02)	-0.002 (0.01)	0.023 (0.02)
publicjob	0.069 (0.04)	0.086 (0.06)	0.066 (0.04)	0.084 (0.06)
polit_aff	0.153*** (0.03)	0.077 (0.05)	0.120*** (0.04)	0.061 (0.06)
easy_school	-0.347*** (0.02)	-0.359*** (0.03)	-0.351*** (0.02)	-0.364*** (0.03)
gdppc_real	0.000** (0.00)	0 (0.00)	0.001** (0.00)	0 (0.00)
cpia_qpa	-0.688*** (0.06)	-0.804*** (0.10)	-0.606*** (0.07)	-0.727*** (0.12)
cpia_trans	-0.681*** (0.09)	-0.580*** (0.13)	-0.646*** (0.09)	-0.622*** (0.13)
nepotism_c	0.510*** (0.06)	0.421*** (0.09)	0.481*** (0.08)	0.435*** (0.13)
_cons	Yes	Yes	Yes	Yes
N	13103	5797	12042	5347

* p<0.05, ** p<0.01, *** p<0.01

Table A.12 – Instrumented regression for brokedoc using urban/rual and localinfrastructure as instrument for education

2nd step						
	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
education	0.2603732	0.0452349	5.76	0.000	0.1717145	0.3490319
head	0.0946223	0.0335467	2.82	0.005	0.0288721	0.1603726
female	-0.0468258	0.035917	-1.3	0.192	-0.1172218	0.0235702
income	-0.0093854	0.0100556	-0.93	0.351	-0.029094	0.0103232
age	0.0032191	0.0018052	1.78	0.075	-0.0003191	0.0067573
religion	0.0353044	0.0843059	0.42	0.675	-0.1299322	0.2005409
religiosity	-0.0452906	0.0120857	-3.75	0.000	-0.068978	-0.0216032
publicjob	-0.1156888	0.0434571	-2.66	0.008	-0.2008632	-0.0305144
polit_aff	0.1867163	0.0294902	6.33	0.000	0.1289165	0.244516
easy_doc	-0.180038	0.015673	-11.49	0.000	-0.2107566	-0.1493194
gdppc_real	0.0002309	0.0001286	1.8	0.073	-0.0000212	0.0004829
cpia_qpa	-0.1684512	0.0518941	-3.25	0.001	-0.2701617	-0.0667406
cpia_trans	-0.7599644	0.0827535	-9.18	0.000	-0.9221583	-0.5977706
nepotism_c	0.3764695	0.054197	6.95	0.000	0.2702453	0.4826938
_cons	0.6681772	0.2896481	2.31	0.021	0.1004773	1.235877
1st step						
education						
head	0.0425517	0.0290641	1.46	0.143	-0.014413	0.0995163
female	-0.3538431	0.0266505	-13.28	0.000	-0.4060771	-0.3016092
income	0.1645936	0.0047466	34.68	0.000	0.1552904	0.1738968
age	-0.029214	0.0009125	-32.01	0.000	-0.0310025	-0.0274255
religion	-0.1743226	0.0698127	-2.5	0.013	-0.3111529	-0.0374923
religiosity	0.1452174	0.0087011	16.69	0.000	0.1281636	0.1622712
publicjob	0.5435183	0.0314646	17.27	0.000	0.4818487	0.6051878
polit_aff	-0.0427934	0.0259406	-1.65	0.099	-0.0936359	0.0080492
easy_doc	-0.0126186	0.0131658	-0.96	0.338	-0.0384231	0.0131859
gdppc_real	0.0014298	0.000077	18.58	0.000	0.0012789	0.0015806
cpia_qpa	-0.0079426	0.0466496	-0.17	0.865	-0.0993742	0.083489
cpia_trans	-0.3509867	0.0594003	-5.91	0.000	-0.4674092	-0.2345641
nepotism_c	-0.6748078	0.0465078	-14.51	0.000	-0.7659614	-0.5836541

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urbrur	0.2811385	0.0351209	8	0.000	0.2123027	0.3499743
localinfra	0.159978	0.0147664	10.83	0.000	0.1310364	0.1889197
_cons	3.968601	0.1649811	24.05	0.000	3.645244	4.291958
/athrho	-0.2861742	0.0655366	-4.37	0.000	-0.4146236	-0.1577247
/lnsigma	0.2552402	0.0061333	41.62	0.000	0.2432191	0.2672613
rho	-0.2786097	0.0604495			-0.3923915	-0.1564297
sigma	1.290772	0.0079167			1.275348	1.306382

Instrumented education

Instruments: head female income age religion religiosity publicjob polit_aff easy_doc gdppc_real cpia_qpa cpia_trans nepotism_c urbrur localinfra

Wald test of exogeneity (/athrho = 0): chi2(1)= 19.07 Prob > chi2 = 0.0000

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Figure A1: LROC curve for Model 1 in Table 2

