April 2013

Essays in Macroeconomics of Development

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A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

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(Thesis format: Integrated Article)

by

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Graduate Program in Economics

SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

SCHOOL OF GRADUATE AND POSTDOCTORAL STUDIES
THE UNIVERSITY OF WESTERN ONTARIO
LONDON, CANADA
APRIL 2013

Abstract

This thesis consists of three chapters on macroeconomics of development. The first chapter discusses the impact of educational corruption on economic development. Its main contribution lies in quantifying two channels of educational corruption: a *direct* channel, whereby incompetent workers affect production due to a misallocation of talent, and a dynamic *indirect* channel, which can be referred to as a teacher's effect on the availability of competent agents for production. The results suggest that, for the countries with the highest levels of educational corruption, the losses in output per capita induced by the indirect channel are ten times as large as the ones induced by the direct channel. The removal of educational corruption would increase the output per capita of these countries by more than 20%.

The second chapter examines corruption as a social norm and allows civil society to play a role in the fight against it. The theory shows that a more engaged civil society leads to lower levels of corruption but has an ambiguous effect on social capital (captured by the notion of honesty). Wage policies are proven to be ineffective in the proposed economic environment. The analysis of survey data from African countries indicates that the predictions of the model find empirical support and that the causality goes from civic engagement to corruption.

The third chapter investigates the factors shaping inter-ethnic relations through the links between one's trust in one's own ethnic group (*intra-ethnic* trust)

and one's trust in other ethnic groups (*inter-ethnic* trust). Based on survey data from African countries, it is shown that, even though most individuals have similar levels of intra- and inter-ethnic trust, differences exist for a non-negligible fraction of them. For *each* level of intra-ethnic trust, the analysis shows that characteristics at the individual, ethnic-group, and district levels, as well as sustained growth over long periods of time, are *consistently* associated with higher levels of inter-ethnic trust. A contrast between the *procyclicality* of inter-ethnic trust and the *countercyclicality* of intra-ethnic trust is also established.

Acknowledgements

I would like to thank all the people who made this thesis possible. First and foremost, I would like to thank my supervisor Igor Livshits for his insights, and his support throughout the entire program. I learned a lot about economics from our conversations, and without his guidance and persistent help this dissertation would not have been possible. I am indebted to Lance Lochner for his support, continuous availability, and for providing guidance on this thesis. It is with immense gratitude that I thank Elizabeth Caucutt for her availability, brilliant comments and suggestions.

Special thanks to Dr. Sylvain Dessy and Dr. Joanna Quinn for their comments and suggestions. I am also grateful for the assistance provided by faculty members of the Department of Economics including Jim Davies, Jim MacGee, Ben Lester, Kul Bhatia, Jacob Short, Aldo Colussi and Martijn Van Hasselt. I thank all staff members for their availability and cheerfulness. I would also like to express gratitude to my colleagues at SRDC for accommodating my schedule.

I would like to thank friends at Western who enriched my experience there: Chris Mitchell, Javier Cano-Urbina, “Juni” Takahata, Yao Li, Kai “Jackie” Zhao and Utku Suleymanoglu. I thank Koffi Kpélitsé and François Ouégnin for valuable conversations about my thesis.

J’aimerais aussi remercier Sandra, ma moitiée, pour son soutien permanent

et pour avoir enduré mes (continuels) sauts d'humeur. Un grand merci à mes amis Arnold, Éphrem, Frédo, Mohamed, Patrick, Régis, Stéphane et Wilfried pour leur soutien moral constant. *Last but not least*, cette thèse n'aurait jamais étée possible sans le soutien de ma famille, et particulièrement de Goulihi et Marie Pierre; on ne choisit pas ses parents mais si on devait le faire, c'est vous que j'aurais choisi. Merci pour tous vos sacrifices. Merci au Dieu Très-Haut.

À ma chère Côte d'Ivoire . . .

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Chapter 1

Introduction

My dissertation consists of three chapters, which share a unifying theme: the relationships between formal institutions (e.g., education system, bureaucracy), informal institutions (e.g., civil society organizations, social capital, ethnic relationships), and economic development (e.g., output and growth).

The first chapter studies the impact of educational corruption on economic development. Its main contribution lies in identifying and quantifying two broad mechanisms under which educational corruption affects the economy: a direct (static) channel and an indirect (dynamic) channel. A model is developed, and its key feature is a corruptible university. In other words, incompetent students can get diplomas if they pay a bribe. However, the presence of incompetent graduates affects the quality of the pool of workers and causes an adverse selection problem for firms. The induced misallocation of talent forces production to fall. This is the *direct* effect of corruption. Because teachers are

hired from the pool of graduates, corruption also undermines the quality of the teacher pool. Consequently, the creation of skills diminishes, fewer competent workers are available for production, and the skilled wage premium increases. This is the *indirect*, or feedback, effect of educational corruption. The feedback effect has dynamic long-term effects on output. Earlier studies have not analyzed the indirect channel and have relied on qualitative results only.

Based on data on educational corruption, the public sector, and college enrollment and completion rates, the model is then calibrated. The benchmark model allows to give an idea of the impact of corruption on the quality of teachers. Hence, the most corrupted countries (the countries with more than 10% percent of people paying a bribe in the education sector) have a teacher quality that is only 69% of the quality of other countries. Such a low quality of teachers has dramatic implications for the creation of knowledge. For example, a student with the highest ability level (θ=1) has only an 80% probability of becoming competent in the most corrupted countries. In comparison, this probability is close to 100% in the least corrupted countries.

To assess the respective roles of the direct and indirect mechanisms, counterfactual experiments are implemented. The results suggest that the most corrupted countries in the sample would gain 9% in output if the indirect mechanism was shutdown. These gains are ten times larger than those resulting from the direct channel. Furthermore, removing educational corruption would increase the output per capita of these countries by more than 20%.

The second chapter expands on a corruption framework with bureaucrats and citizens, and allows civil society to play a role in the fight against corruption. Corruption is treated as a social norm: agents can be *honest* (i.e., commit not to participate in corruption) or *opportunist* (i.e., participate in corruption if it is optimal to do so). The dynamic evolution of types within the population is affected by both pecuniary and non-pecuniary benefits in a manner that borrows from Francois and Zabojnik (2005). The engagement of civil society (modeled as its effectiveness in catching/punishing opportunist agents) affects the monitoring of agents directly and the creation of social capital (captured by the notion of honesty) indirectly.

It is found that greater involvement of civil society in the fight against corruption, leads to lower levels of corruption but has an ambiguous effect on social capital. Countries, therefore, enjoy lower levels of corruption not necessarily because they have more social capital, but rather because lower levels of corruption are tolerated for each level of honest citizens. Interestingly, wage policies are proven to be ineffective in the proposed economic environment.

The analysis of Round 3 of the Afrobarometer survey data indicates that the predictions of the model are supported empirically. In addition, the results suggest that the causality goes from civic engagement to corruption. The novel approach of this study complements existing work on the role of social norms and non-pecuniary motivation for corruption.

The third chapter examines the factors shaping inter-ethnic relations through

the links between one's trust in one's own ethnic group (the *intra-ethnic* trust) and one's trust in other ethnic groups (*inter-ethnic* trust). The study sheds light on whether or not individuals in Africa exhibit *gaps* in trusting members of other ethnic groups with respect to their own, and it determines the factors that contribute to reducing (and increasing) this gap.

Based on survey data from Round 3 of the Afrobarometer, it is first shown that, though most individuals have similar levels of intra- and inter-ethnic trust, differences exist for a non-negligible fraction of them. Then, for *each* level of intra-ethnic trust, a multivariate analysis is implemented to uncover the individual and socio-economic determinants that are significantly associated with inter-ethnic trust.

The factors that are *consistently* associated with higher levels of inter-ethnic trust include (i) the age of the individuals; (ii) their belonging to a group that does not feel treated unfairly by the government; (iii) their living in a district with socio-economic infrastructures like markets; (iv) their living in a country with homogeneous ethnic groups and with sustained growth over long periods of time. Gender and religious beliefs are weakly correlated with inter-ethnic trust. Surprisingly, education is ambiguously and inconsistently associated with inter-ethnic trust. Finally, a contrast between the *procyclicality* of inter-ethnic trust and the *countercyclicality* of intra-ethnic trust is also established and serves as motivation for a deeper analysis of the dynamic links between economic growth and intra- and inter-ethnic trust.

Chapter 2

The Direct and Indirect Channels of Educational Corruption

In short, places are few, applicants are too many and people are desperate ; a dangerous cocktail of circumstantial factors, making the teacher recruitment process an easy target for corrupt minded individuals to plan and conduct corrupt activities.

-The Teacher Service Commission Integrity Study, Kenya

In many professions such as the Police, the Gendarmerie, the Customs, the Ivorian Administration and in the private sector, you have people of quality mingled with others who are, at the same time, incompetent and dishonest.

-Jean Louis Billon, Fraternité Matin, May 13, 2010. [1]

[1] The first citation is from Transparency International Kenya (2006). The second citation is translated from French by the author. Jean Louis Billon was at that time the President of the Chamber of Commerce and Industry of Côte d'Ivoire.

2.1 Introduction

This chapter looks at the significance of educational corruption as a determinant of education quality and economic development. It defines educational corruption as the buying of diplomas in exchange for bribes and shows that such corruption affects economies through two broad mechanisms: a *direct* channel, whereby incompetent workers affect production, and an *indirect* channel, which can be referred to as a teacher's effect. The teacher's effect is induced by the fact that some of the incompetent students of today become the incompetent teachers of tomorrow. It will be shown that the lesser known indirect channel is quantitatively more important.

Educational corruption is prevalent in many regions of the world. Cases of educational corruption have been reported in poor, emerging and rich countries – from Africa to Eastern Europe, from China to Italy. In fact, Transparency International, a non-governmental organization (NGO) that fights corruption, reported in its Global Corruption Barometer 2007 that, worldwide, education is the fourth most common sector where people pay a bribe (second sector in Africa and in the former USSR). Transparency International further provided evidence that in 22 countries, more than 10% of the people who had a contact with the education sector confessed that they had paid a bribe in the education sector.[2] Such high levels of educational corruption affect output. Figure 2.1 illustrates the negative relationship between output per capita and educational

[2] This is an average for the 2006-2008 period, as estimated by the author. For more details on the data, please consult Section 2.2.

corruption, as measured by the proportion of people who paid a bribe in the education sector. This negative relationship is statistically significant and robust to various specifications, including control for bureaucratic corruption. In this respect, it is found in Section 2.2 that an increase of one standard deviation of the measure of educational corruption lowers output per capita from 21% to 45%.

The main idea of the paper is that educational corruption affects the economy through two broad mechanisms: a direct (static) channel and an indirect (dynamic) channel. The direct channel arises because incompetent students with diplomas do not have specific or adequate skills, thereby decreasing production. The dynamic indirect effect arises because the incompetent students with diplomas alter the *quality* of the institutions of the economy, thereby affecting the next generations. The paper considers a specific and obvious dynamic effect: the effect on the education system. Specifically, the dynamic indirect channel presented in the model is the impact that the incompetent students of today, who become the incompetent teachers of tomorrow, have on the economy. The key result of the paper is that the indirect mechanism has a significantly greater impact than the direct one. It establishes that the most corrupted countries in the sample could increase output by 9% on average if the quality of their pool of teachers was perfect. These gains are ten times larger than those resulting from the direct channel. Furthermore, removing educational corruption would increase the output per capita of these countries by more than 20%.

A dynamic general equilibrium OLG framework that incorporates both channels is developed. The model features a public and a private sector with two types of occupations: skilled and unskilled. There are two stages of education, basic and advanced (university); the latter is required for public servants and skilled workers in the private sector. The government-run university is in charge of developing student skills and a screening technology, the *diplomas*. The development of skills depends on the quality of the teachers, and the diplomas are in principle awarded to competent students. Only the competent students are productive workers in the private skilled occupations and in the public sector..

The key assumption of the model is that the university is (exogenously) corruptible. The form that corruption takes is the buying of diplomas at exit.[3,4] This corruption generates two effects. First, when incompetent students bribe officials in order to get a diploma, the quality and quantity of the pool of graduates are affected. The presence of incompetent graduates affects the quality of the pool of workers and creates an adverse selection problem for firms. The induced misallocation of talent lowers output. This is the direct (static) effect of corruption. Second, since teachers are hired from the pool of graduates, corruption also undermines the quality of the pool of teachers. Consequently, the creation of skills declines, and fewer competent workers are available for

[3] It should be noted that educational corruption takes various forms such as academic fraud, diversion of resources, grants attribution, and bribes for grades or for admission into an educational institution. See Transparency International (2005) for a list of common forms of educational corruption.

[4] One can think of diplomas as the result of a succession of good grades, so the idea can be generalized to a story where students can buy good grades. It is just easier to work with the idea of diplomas. Furthermore, corruption at exit is supported by the available data (see Figure 2.3 in Section 2.2).

production. This is the indirect (dynamic) effect of educational corruption.

Equilibria in which incompetent workers with diplomas can work in either the public or the private sector are analyzed. It is assumed that the private sector is better at monitoring (i.e., detecting/firing) incompetence. Hence, incompetent graduates tend to end up in the public sector. Importantly, education is predominantly public. Individual decisions over entry and bribing are characterized in the model. Output and wages are determined endogenously in equilibrium: output falls and skilled wage premium increases with corruption. The rise in wages is a consequence of the scarcity of competence.

The model is then calibrated to match the countries' educational aggregates and educational corruption rates. Finally, in a thought experiment that aims to assess their respective roles, the direct and indirect mechanisms are sequentially shut down. It is established that the loss in output induced by the feedback effect are quantitatively larger that the ones induced by the direct effect.

This chapter relates to the literatures on human capital and schooling quality. There is a consensus that admits the crucial role of human capital for economic growth [see Lucas (1988) for example]. Moreover, recent studies have emphasized the importance of educational and human capital quality on development. Hanushek and Kimko (2000) found that the quality of schooling is an important ingredient for human capital production and that it is positively correlated with cross-country productivity differences. Erosa, Koreshkova, and Restuccia (2010) demonstrated that differences in schooling quality across countries are quantitatively important. Specifically, using a model

where agents can invest in both the quality and the quantity of schooling, they found that only a 5-fold difference in Total Factor Productivity (TFP) across countries accounts for a 20-fold difference in the output per worker. In contrast, without human capital accumulation, an 18-fold difference in TFP is required to explain the income difference. Similarly, Manuelli and Seshadri (2005) argued that the quality of human capital is the major contributor to cross-country differences in output. On the same subject, Pritchett (2001) showed that despite worldwide increases in education attainment, the rates of growth of output per worker are widely different. He advanced that educational quality were so low in some countries that additional years of schooling would create no human capital. This is consistent with the model presented in this paper.

Motivation for this chapter of the dynamic mechanism includes recent studies that depict the *quality* of teachers as a relevant input in the formation of skills or human capital. Rivkin, Hanushek, and Kain (2005) found that an increase by one standard deviation in the quality of teachers generates at least 0.11 standard deviations higher achievements in mathematics, and 0.10 standard deviations higher achievements in reading. They found that these effects are bigger than the benefits resulting from a reduction in class size. Hanushek and Wößmann (2007) emphasized that "teachers' quality is enormously important in determining student achievement". They showed that the institutional structure and school incentives, rather than simply their available resources, matter the most. Wößmann (2000) defended similar arguments, he found that

the cross-country variability of institutional features where teachers work significantly influenced student performance.[5] For instance, he found a significant negative significant effect of teacher unions on student performance. He further found a positive influence of teachers' education on student performance. Finally, evidence presented in Section 2.2 illustrates the negative impact that educational corruption exerts on teacher quality.

This chapter is also linked to the large literature that establishes a strong negative correlation between corruption and economic development.[6] This relationship is often analyzed with frameworks in which investments and growth are deterred by rent-seeking bureaucrats.[7] Most models, however, abstract from the links between education, corruption, and development. Two exceptions are World Bank (2010) and Shaw (2007). Indeed, some aspects of educational corruption overlap with the World Bank's concept of "quiet corruption", which indicates "various types of malpractice of frontline providers (teachers, doctors, inspectors, and other government representatives)". For instance, teachers' absenteeism or diversion of school resources for one's own purpose could be included in a broader definition of educational corruption. The second exception, Shaw (2007), establishes qualitative links between educational corruption and economic growth. His work suggests that corruption at entry

[5] The institutional features Wößmann (2000) refers to are the size of the private schooling sector, the centralization of examinations and of other decision-making powers, and the responsibilities and influence of different educational agents. For a theoretical treatment of the effect of different institutional features of the education system on student performance, see Bishop and Wößmann (2004). These features include central examinations, centralization versus school autonomy, teachersinfluence, parental influence, and competition from private schools.

[6] See Mauro (1995).

[7] An important nuance is Murphy, Andrei Shleifer, and Vishny (1991) that shows how rent-seeking activities deteriorate economic growth through the misallocation of talent.

implies lower attainment and growth as well as, and higher wage premia. He finds empirical evidence for both. This chapter departs from Shaw (2007) on four major theoretical and empirical issues. First, this chapter studies corruption at exit and considers a role for adverse selection, which is not present in Shaw (2007). The presence of adverse selection enhances the negative impact of corruption on production. Second, even though Shaw (2007) has a dynamic setup, he does not discuss the effects of corruption on the education system itself. Hence, the novel feature presented in this chapter is that corruption has a dynamic long-term component: the indirect effect. Third, the chapter goes beyond qualitative illustrations and offers quantitative results that assess these channels of corruption. Finally, unlike Shaw (2007), the data used here is not a (general) corruption index but rather a true measure of educational corruption.

This chapter therefore complements the existing literature in several respects. It is the first paper with both analytical and quantitative implications of educational corruption. It also adds to the understanding of the links between institutions and the quality of education. Finally, this chapter emphasizes a new facet of corruption: its indirect (dynamic) effect on the economy.

The rest of the chapter is organized as follows. Section 2.2 provides empirical background and evidence. Section 2.3 discusses the model, while Section 2.4 characterizes decisions and defines the equilibrium concept of the model. Section 2.5 presents the calibration and the quantitative results, while section 2.6 tests the robustness of these results. Section 2.7 concludes the chapter.

2.2 Empirical Evidence

The description of the empirical evidence starts with the available data on educational corruption. It continues with a discussion of evidence that backs up the main hypothesis of the paper, which is that educational corruption affects output through education quality, and, specifically, through a teacher's effect. Finally, the relevance of corruption at exit is also shown.

2.2.1 Educational Corruption

A data source for educational corruption is Transparency International's Global Corruption Barometer (GCB). The GCB is a survey that assesses public opinion regarding (1) corruption in the public sector, (2) government actions against corruption, and (3) the evolution of corruption. Respondents are men and women aged 15+, and the samples are weighted to bring them in line with national and global populations. According to Transparency International's website, "GCB is the only worldwide public opinion survey on perception and experience of corruption." A particularity of GCB is that it includes information about educational corruption. To my knowledge, this rich data set has never been used in economics literature. The measure of educational corruption that I use is the proportion of people who paid a bribe in the education sector.[8] The data is available for 80 countries, and I take the average of all data over the

[8] A complete description of the GCB can be found at http://www.transparency.org. I use the proportion of respondents who answered yes to the following question: "In the past 12 months, have you or anyone living in your household paid a bribe in any form to each of the following institution/organization? Education system". This proportion is in percentages of those, in the survey, who came in contact with the education system in the past 12 months.

2006-2008 period. Table 2.1 shows summary statistics of this measure of educational corruption by geographical regions. It can be seen that educational corruption is a worldwide phenomenon. Africa is the most affected region, while North America and Western Europe are exceptions, with low levels of educational corruption. High levels of variability also exist within regions.[9]

Table 2.1: Summary Statistics for Constructed Educational Corruption (EC) Measure

	All Countries	**Africa**	**Cent. East. Europe**	**Middle East**	**Asia**	**Cent. South. America**	**N. Amer and W. Euro.**
Mean, EC (%)	11.91	23.87	9.14	7.89	7.6	7.13	1.34
Std Deviation	8.82	19.73	10.66	8.17	7.95	4.08	0.79
Minimum	0	1	1	1	0	0.33	0.33
Maximum	65	65	38	21	23	13.67	2.67

Notes: *EC*: mean of available data for the 2006-2008 period of the proportion of persons who had contact with the education sector and that Paid a Bribe in the Education Sector (GCB, Transparency International).
Africa: Cameroon, Congo (Republic of), Gabon, Ghana, Kenya, Liberia, Nigeria, Senegal, Sierra Leone, South Africa, Uganda, and Zambia.
Central European Countries: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Czech Republic, Croatia, Georgia, Hungary, Lithuania, Macedonia, Moldova, Montenegro, Poland, Russia, and Ukraine.
Middle East: Iraq, Israel, Kuwait, Lebanon, Morocco, and Turkey.
Asia: Brunei, Cambodia, Fiji, Hong Kong, India, Indonesia, Japan, Korea(Republic of), Malaysia, Mongolia, Pakistan, Philippines, Singapore, Taiwan, and Thailand.
Central and South America: Argentina, Bolivia, Chile, Colombia, Dominican Republic, El Salvador, Mexico, Panama, Paraguay Peru, Romania, and Venezuela.
North America and Western Europe: Austria, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States.

[9] Another piece of evidence of the prevalence of educational corruption, but that's geographically more restrictive, comes from Round 3 of the Afrobarometer surveys. The Afrobarometer "measures the social, political, and economic atmosphere in Africa" and is designed for cross-country comparisons.Round 3 of the Afrobarometer covers 18 countries. One of the questions it asks is "How many of the following people do you think are involved in corruption?" and one possible answer is "Teachers and school administrators". An average of 19% (median of 17%) of the respondents perceive that most or all of the teachers or school administrators are corrupted.

2.2.2 Educational Corruption and Output per Capita

Figure 2.1 illustrates the relationship between (ln) output per capita and educational corruption. The measure of output per capita is constructed from the series RGDPCH from the Penn World Tables 6.3 described in Heston, Summers and Aten (2009). We observe a clear negative relationship between the two variables.[10]

Figure 2.1: Average (ln) real GDP per capita and educational Corruption

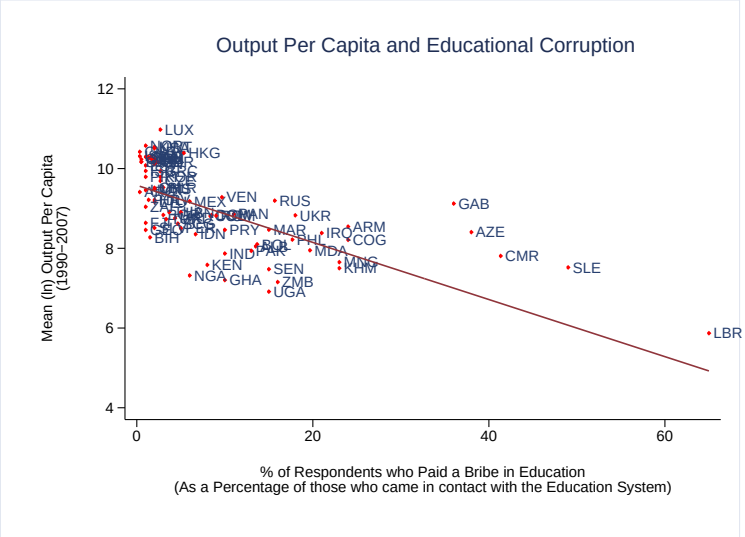


Table 2.2 investigates the significance and robustness of this negative relationship. To underline the fact that the results are not driven by outliers, I show only estimates for regressions that do not include the five countries with more than 35% of respondents reporting a bribe.[11] All regressions control for

[10] The fitted line is from column 3 of Table 2.2.

[11] The outliers that I exclude are Azerbaijan, Cameroon, Gabon, Liberia, and Sierra-Leone. All estimates and their significance are robust to the introduction of the outliers. The only regression for which the estimate of educational corruption loses significance includes Gabon and controls for bureaucratic corruption. I interpret this as a peculiarity of Gabon: an oil-producing country with a small population.

Table 2.2: Output Per Capita and Educational Corruption

	Dependent Variable: ln Real Gdp per Capita		
Variables	**(1)**	**(2)**	**(3)**
Educational Corruption (EC)	-0.066***	-0.057***	-0.030**
	(0.013)	(0.015)	(0.012)
Tertiary Education Enrollment		0.008	0.007
(% relevant age)		(0.005)	(0.005)
Bureaucratic Corruption			-0.022***
			(0.005)
Intercept	10.501***	8.577***	9.874***
	(0.302)	(0.093)	(0.319)
Countries	75	71	70
R^2	0.73	0.744	0.838

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Huber-White estimated standard errors are in parentheses. All regressions include continental dummies.
Definition and Sources:
(ln) **Real Gdp per Capita**: mean of available series RGDPCH from PWT 6.3 on 1990-2007.
EC: Proportion of persons who had a contact with the education sector and that Paid a Bribe in the Education Sector (GCB, Transparency International).
Tertiary Education Enrollment : student enrolled in tertiary education as a % of the relevant age group. Means of available data 1997-2008 (UNESCO).
Bureaucratic Corruption: 10*(10 - mean of the Corruption Perception Index (CPI)) 1995-2007 (Transparency International). This transformation of the CPI implies that a higher index means that a country is more corrupted.

regional dummies. For all regressions, I find that educational corruption has a strong, robust, and significant negative impact on output per capita.

Controlling for a measure of the quantity of skills/human capital (UNESCO's percentage of agents in the relevant age range enrolled in tertiary schooling over the 1997-2008 period) does not alter the significance found in column 1.[12] To address the possibility that the measure of educational corruption simply captures the degree of corruption in a country, I also control for a proxy of bureaucratic corruption (column 3). This proxy is a (transformed) average Corruption Perception Index (CPI) for the 1995-2007 period.[13] A striking result is that educational corruption is still significant after including this proxy, although the estimate declines by half.[14]

These regressions tell us that an increase of one standard deviation of educational corruption lowers output per capita by 21% to 45%.[15] Thus educational corruption is an important determinant of lower economic development.[16] It is now shown that educational corruption affects output per capita through the

[12] Using data from Barro and Lee (2000) yields similar results. In particular, the significance and robustness are maintained. I use UNESCO's data because it covers more countries for which data for EC is also available. Similar results are obtained when using other levels of education.

[13] The CPI ranks countries in terms of the degree to which corruption is perceived to exist among public officials and politicians. It is a composite index, a poll of polls, drawing on corruption-related data from expert and business surveys carried out by a variety of independent and reputable institutions. CPI data is available at http://www.transparency.org

[14] The measures for EC and bureaucratic corruption are not comparable: EC is expressed as a percentage while the bureaucratic corruption is an index. Hence, from these regressions, one cannot directly say what kind of corruption is more important.

[15] The standard deviation of EC for each regression is 6.83, 6.91 and 6.95, respectively. For regression 3, for example, we have -0.03 $\times$ 6.95 $\simeq$ -0.21. This means that if EC increases by one standard deviation, output per capita falls by 0.21 log points and, therefore, by approximately 21%.

[16] It would be interesting to investigate the causality between output and both kinds of corruption; unfortunately the data does not allow me to do so.

quality of education.

2.2.3 Educational Corruption, Quality of Schooling, and Teacher Quality

The literature provides evidence of the key role educational or human capital quality play on output per capita.[17] The model in the current paper gives teacher quality a role as well. It would be ideal to directly link corruption to cross-country measures of teacher quality. Unfortunately, this is not possible. Instead, I follow Hanushek and Kimko (2000) and use International Test Scores (ITS) as a measure of teacher/schooling quality.[18] Figure 2.2 illustrates the negative relationship between education quality and educational corruption.[19] As shown in Table 2.3, this relationship is significant. The negative effect of corruption is robust to the introduction of output per capita (column 3) and bureaucratic corruption (column4). Thus educational corruption affects the quality of education.

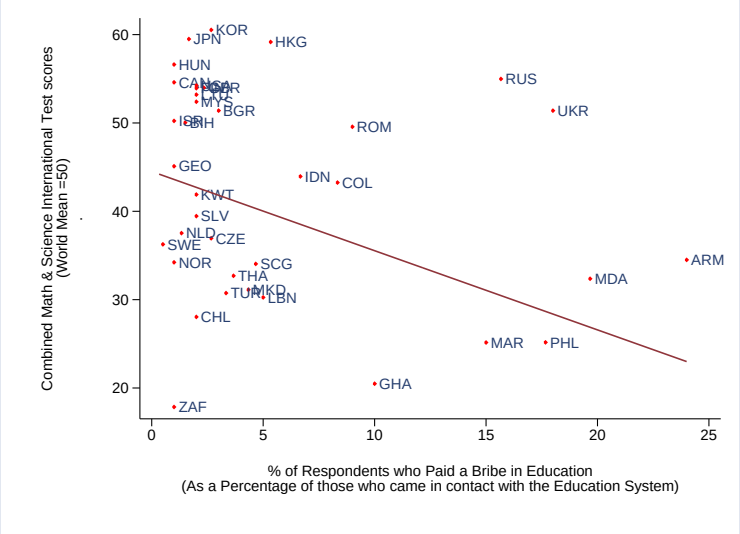
Additional evidence links corruption to teacher quality. First, countries where corruption in the classroom is institutionalized offer a poor environment and few incentives for teachers. Hanushek and Wößmann (2007) showed that

[17] See for example Hanushek and Kimko (2000), Manuelli and Seshadri (2005) and Erosa, Koreshkova, and Restuccia (2010).

[18] I transform the raw ITS data for the years 1999, 2003 and 2007 and rely on the same methodology used by Hanushek and Kimko (2000) to construct their variable *QL1*. Specifically, I convert each available performance series to a mean of 50, and, for each country, I take the weighted average over all available transformed test scores. The weights are the inverse of the country-specific standard error.

[19] The fitted line is from column 3 in Table 2.3.

Figure 2.2: Quality of education and educational corruption



these features are key for teacher effectiveness. Second, Transparency International (2005) pointed out that unqualified individuals who obtained academic degrees in exchange for bribes are put in positions of authority, and teachers are no exception. Corruption also affects the schools in which teachers are trained. For example, Transparency International (2006) reported that the Teacher Service Commission in Kenya-in charge of establishing and monitoring teaching standards, training, and fitness to teach of prospective teachers in Kenya-was the second most corrupted institution in the eyes of the Kenyan public.

Table 2.3: Quality of Education and Educational Corruption

	Dependent Variable: Combined Math and Science International Test Scores			
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Educational Corruption (EC)	-0.421*	-0.609**	-0.414*	-0.419*
	(0.233)	(0.256)	(0.234)	(0.239)
Tertiary Education Enrollment	0.278***	0.208**	0.169*	0.164*
(% relevant age)	0.077	(0.085)	(0.092)	(0.091)
(ln) Gdp Per Capita			3.804	2.698
			(2.957)	(4.318)
Bureaucratic Corruption				-0.068
				(0.249)
Intercept	18.861***	40.942***	3.735	16.867
	(4.191)	(6.174)	(29.447)	(47.298)
Countries	36	34	34	34
R^2	0.564	0.567	0.592	0.594

Significance levels : $*$: 10% $**$: 5% $***$: 1%

Notes: Huber-White estimated standard errors are in parentheses. All regressions include continental dummies. Columns 2 to 4 remove the outliers Russia and Ukraine.
Definition and Sources:
Combined Math and Science International Test Scores: See the text.
EC: Proportion of persons who had a contact with the education sector and that Paid a Bribe in the Education Sector (GCB, Transparency International).
ln **Real Gdp per Capita**: mean of available series RGDPCH from PWT 6.3 on 1990-2007.
Tertiary Education Enrollment : student enrolled in tertiary education as a % of the relevant age group. Means of available data 1997-2008 (UNESCO).
Bureaucratic Corruption: 10*(10 - mean of the Corruption Perception Index (CPI)) 1995-2007 (Transparency International). This transformation of the CPI implies that a higher index means that a country is more corrupted.

2.2.4 Corruption at Exit

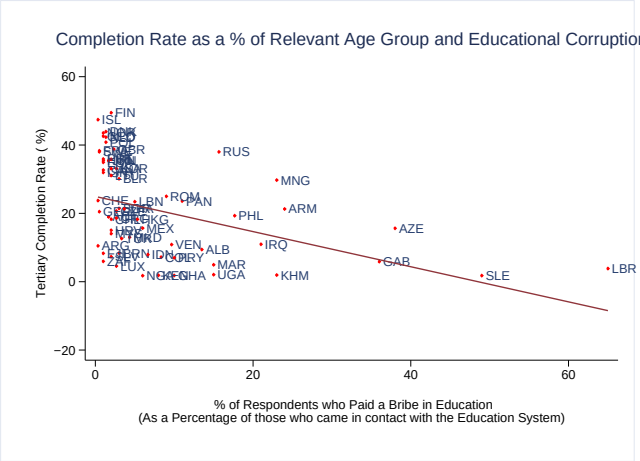
There exist various kinds of educational corruption. This paper focuses on the buying of grades or diplomas, which can be classified as corruption at exit. Figure 2.3 illustrates evidence of this form of corruption.[20] The top panel shows that countries with more corruption have lower tertiary schooling completion rates. The completion rate is a percentage of the relevant age group. When these completion rates are expressed in percentages of enrollment rates, the trend is inverted: countries with more educational corruption tend to have higher completion rates per enrollee.[21] This highlights the effect that corruption at exit might play on the quality of schooling: despite higher graduation rates *per enrollee* in corrupted countries, the lower selection metric implied by corruption lowers the quality of the pool of graduates.

More evidence exists on the buying and selling of grades or diplomas. Citing UNESCO, Transparency International (2005) reports that the buying and selling of grades and diplomas is a frequent occurrence, particularly in Southeast Europe and the former Soviet Union. This kind of corruption occurs either between students and faculty members (bribes in exchange for good grades) or students and administrators if exams are sold. A recent example is the scandal that erupted in 2008 at the University of Bari in Italy, where lecturers

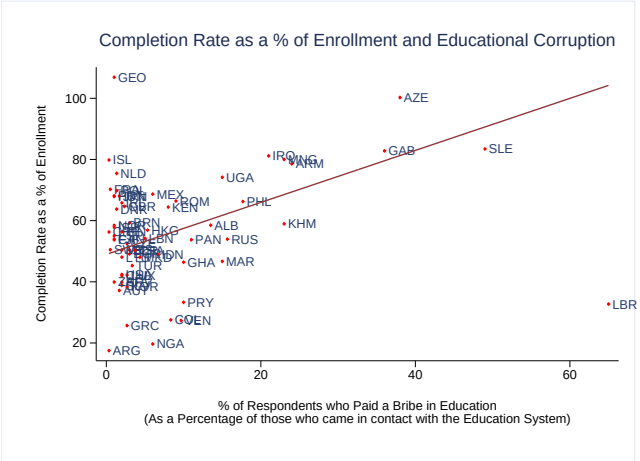
[20] Both fitted lines are from regressions (STATA command rreg) that control for the mean real GDP per capita, EC, the proportion of surveyed people who came into contact with the education system, enrollment in tertiary schooling, and continental dummies.

[21] Note that some completion rates in terms of enrollment exceed 100%. This emerges from the fact that both enrollment and completion rates are expressed in percentages of a theoretical age group.

Figure 2.3: Evidence of Corruption at Exit



(a) Tertiary Completion Rate and Educational Corruption



(b) Tertiary Completion Rate as a % of Enrollment and Educational Corruption

were convicted of selling degree exams and theses to economics and finance students. A last example is the traffic of diplomas involving hundreds of Chinese students at the management school of the University of Toulon in France.[22] This section has shown that educational corruption, is an important ongoing phenomenon that deserves more attention from economics literature.

2.3 The Model

In this section, a model of educational corruption is developed. It incorporates the following main features: the quality of the pool of teachers determines the creation of skills (or competence); incompetent students can bribe and pretend they are competent; the presence of incompetent workers affects the quality of workers and, therefore, alters production and the quality of teachers. Sections 2.5 and 2.6 will assess the impact of both the *direct* and *indirect* effects on production.

The economy is populated by a continuum of two-period lived agents in an overlapping generations setup. The size (measure) of each generation is normalized to one. Agents evolve in an open economy with an exogenous interest rate and no mobility. There is a public sector that runs a *university* and a private sector characterized by two activities, skilled and unskilled, to which I shall return.[23] The university has a key role in the economy. First, it develops skills with some students becoming *competent*. Competent students are

[22] Source: *Le Monde*, April 16, July 29, and October 19, 2009.

[23] Although the model discusses publicly funded universities, corruption may also affect private universities. Unfortunately, the data does not allow me to examine the relationships between the institutional features of universities and corruption.

those who acquired skills that make them productive in the public sector and in the skilled occupation of the private sector. The *incompetent* workers are productive only in the unskilled occupation. A second role for the university is to implement a screening technology (i.e., *diplomas*), which is, in principle, attributed to competency. Finally, the central assumption of the model is that the university is corruptible. Hence, it is possible for incompetent students to obtain a diploma if they bribe the university.[24] Corruption, therefore, induces two effects on the economy. First, when incompetent people get a diploma, this *directly* changes the value of the diploma and generates an adverse selection problem that affects production. Second, it alters the quality of the pool of teachers and *indirectly* (or, dynamically) affects the likeliness of becoming competent.

2.3.1 The Agents

Agents are heterogenous with respect to wealth (ω) and innate ability (θ), both of which are observable at birth by the agent. The distribution of wealth and ability are time invariant in the population such that each generation is born identical in terms of its wealth and innate ability.[25] I further assume that agents are credit constrained.

Agents decide on whether to work or go to university (automatically), which

[24] Note that in the real world, however, competent students might be required to bribe to receive grades or diplomas they do indeed deserve. Allowing this feature would not affect the qualitative results presented here, it would only reinforce the mechanisms.

[25] Having the agents not observing their ability at birth but, rather, a noisy signal of ability gives similar results. Furthermore, it would be interesting to investigate endogenous distributions of wealth or ability, but this complicates the model without much gain, and requires one to make assumptions about the evolution of both across generations.

implies giving up wage earnings. Those who decide to start working immediately, work as unskilled workers in a private firm their entire life and earn w_L each period. Those who decide to attend university, pay a direct cost c_e and faces a probability $p(\theta, Q_t)$ of becoming competent, with $Q_t \in [0, 1]$ the (equilibrium) quality of the pool of teachers at time t. I thus consider that the creation of competence is a function of both student ability and the quality of the pool of teachers. Ability only matters in university: wages, which are conditional on occupation, are independent of it. If the students become competent, they get a diploma and work either in the skilled occupation or in the public sector in the second period. If they become incompetent, they must decide whether to participate in corruption and buy a diploma or drop out and work as unskilled workers. Corruption takes the form of an exogenous bribe b that "guarantees" a diploma to its payer.[26]

It is assumed that the government is able to screen/fire a fraction ϕ_{PS} of its incompetent workers. Similarly, firms are able to screen/fire a fraction ϕ_{F} of the incompetent workers in the skilled occupation. I assume that $\phi_{\text{PS}} < \phi_{\text{F}}$; this assumption is motivated by two facts. First, the absence of profit motives and competition among workers in government activities makes it harder to screen those who are incompetent. Second, the firing process is usually more difficult in the public sector due to collective bargaining agreements, and other regulations.[27] Let π_t be the (anticipated) probability, at time t, that a graduate

[26] Having an endogenous bribe in this framework would considerably complicate the model. For instance, the expectations over being a public servant would be affected and would require further assumptions to characterize the model.

[27] For the role of unions on teachers' wages in the United States, see Gilpin and Kaganovich (2009). Related to that point, Wößmann (2000) found a negative effect of teacher unions on student performance.

incompetent student earns the skilled wage in time $t+1$. In other words, π_t is the *ex ante* probability that an incompetent agent with a diploma will work in the public or in the skilled private occupation without being caught. If we let γ_t be the (*ex ante*) probability to work in the public sector, it follows that $\pi_t \equiv 1 - \gamma_t \phi_{\text{PS}} - (1-\gamma_t)\phi_F$.

2.3.2 The Representative Firm

The private sector consists of a representative firm that uses skilled and unskilled workers as distinct inputs. The production function is inspired by Caucutt and Kumar (2003) and takes the following form:

$$\begin{aligned} \mathbf{Y}_t &= A\left[A_H\left(N_{H,t} + \delta N_{L,t}\right)^{\rho} + A_L\left(N_{L,t} + \epsilon N_{H,t}\right)^{\rho}\right]^{1/\rho} \\ \Leftrightarrow \quad \mathbf{Y}_t &= A\left[A_H\left(N^C_{H,t} + N^I_{H,t} \times 0 + \delta N_{L,t}\right)^{\rho} + A_L\left(N_{L,t} + \epsilon(N^C_{H,t} + N^I_{H,t} \times 0)\right)^{\rho}\right]^{1/\rho}, \end{aligned}$$

where A is TFP, $A_H + A_L = 1$, $\rho < 1$, $\epsilon > 0$, $\delta < 1$ and $\delta \ll \epsilon$, $N_{H,t}$ denotes the number of agents with a diploma that are employed as skilled by the firm. The quantity $N_{H,t}$ is composed of $N^I_{H,t}$ incompetent workers who have not been caught and $N^C_{H,t}$ competent workers. $N_{L,t}$ denotes the number of unskilled agents employed by the firm; it is composed of agents who did not enter university, of university dropouts, and of incompetents workers with diplomas who had been caught.

As formulated by Caucutt and Kumar (2003), one can think of the first and second terms in the bracket as "brain" and "brawn", respectively. Competent workers are the primary suppliers of "brain" (hence $\delta < 1$), and both types of

workers contribute to "brawn". Incompetent workers are unable to solve complex tasks, and thus they produce 0 (hence, $N_{H,t}^{I} \times 0$) in brain activity. They are also unproductive in brawn activity as they miss specific skills. For instance, the role of college graduates in the brawn activity could be to manage workers or solve tasks that unskilled workers cannot.[28] The contribution of unskilled workers to brain activity is smaller than the skilled category's contribution to brawn activity (hence, $\delta \ll \epsilon$). The parameter ρ controls the elasticity of substitution between the two activities.

Wages are determined in equilibrium and are just the marginal product of competent and unskilled workers. Denote the wage for the unskilled (or **L**ow-skill) jobs as $w_{L,t}$ and the wage for the skilled (or **H**igh-skill) jobs as $w_{H,t}$, it follows that

$$w_{H,t} = A^{\rho}\left[A_H\left(N_{H,t}+\delta N_{L,t}\right)^{\rho-1}+A_L\epsilon\left(N_{L,t}+\epsilon N_{H,t}\right)^{\rho-1}\right]Y_t^{1-\rho}, \quad (2.1)$$

$$w_{L,t} = A^{\rho}\left[A_H\delta\left(N_{H,t}+\delta N_{L,t}\right)^{\rho-1}+A_L\left(N_{L,t}+\epsilon N_{H,t}\right)^{\rho-1}\right]Y_t^{1-\rho}. \quad (2.2)$$

2.3.3 The University and the Creation of Skills

As stated before, the main role of the public sector in this model is to run the university, and all public servants are hired from the pool of graduates. The size of the public sector during period t, $N_{\mathrm{PS},t}$, is exogenously set to a fraction F

[28] The idea of having different types of problems in the production function comes from Garicano and Rossi-Hansberg (2004). They analyzed the interactions between workers and the organizational aspect of the interactions. In their setup, the aggregate production result in applying production time to tasks faced by agents. The agents differ in their ability to solve tasks: they solve them and produce or they are not able to solve them and require the help of a manager who either solves them or does not. Thus, without the necessary skills, production is zero.

of the population not in school. The public sector in period t, $N_{\text{PS},t}$, is composed of $N^{C}_{\text{PS},t}$ competent agents and $N^{I}_{\text{PS},t}$ incompetent agents. It is assumed that the government can screen/fire only a fraction ϕ_{PS} of the incompetent agents hired in the public sector. For convenience, government wages are always set exactly equal to the skilled wage.[29]

I define the quality of the public sector as the fraction of competent workers among public servants. Formally,

$$Q_t\left(\Lambda_t\right) \equiv \frac{N^{\text{C}}_{\text{PS},t}}{N_{\text{PS},t}},$$

where Λ_t denotes the aggregate state of the economy, which will be defined below. I further assume that the quality of the pool of teachers is the same as the overall quality of the pool of public servants. This simple assumption allows me to be agnostic about other government activities.[30]

It is assumed that the probability of becoming competent is a function of both innate ability θ and the quality of the pool of teachers $Q\left(\Lambda_t\right)$. There are several ways to model this relationship, and I investigate other specifications in Section 2.6.[31] The preferred probability function takes the form

$$p\left(\theta,\, Q(\Lambda_t)\right) = \alpha\theta + (1-\alpha)\theta\, Q\left(\Lambda_t\right), \tag{2.3}$$

where $\alpha \in [0,\, 1]$ is a parameter that weights the respective importance of innate ability and the quality of teachers. Thus student ability and educational

[29] This assumption allows me to characterize decisions.

[30] It should be noted that Q_t can be interpreted as the quality of the whole educational system. With such an interpretation, the model is consistent with the idea that corruption affects all levels of education. In this respect, it is possible to write a model that explicitly distinguishes between different levels of education. However, calibrating such a model would require refined data such as information on corruption at each level of education.

[31] In particular, I investigate a Cobb Douglas specification $\theta^{\alpha}\, Q\left(\Lambda_t\right)^{1-\alpha}$.

quality interact positively and, more specifically, the incidence of teacher quality on competence depends on one's innate ability. In other words, better students make better use of the quality of their teachers. This complementarity has received support from the literature. Gilpin and Kaganovich (2009), for instance, constructed a model where more able students derive greater benefits from higher quality education; the authors depict this as an "ability premium". In his model of educational corruption, Shaw (2007), required a probability function for prospective students to become managers (i.e., skilled agents). He considered a specification that allows for an interaction between ability and bribes. The incidence of bribes in his setup can easily be interpreted as a reflection of the quality of the education system. Furthermore, in Bishop and Wößmann (2004), students' educational performance is a combination of effort, innate ability, and, notably, the institutional features of the schooling system in which teachers evolve. These institutional features are related to educational quality as they shape teachers' incentives and ability to influence the education process.

Equation (2.3) further captures the dynamic long-term impacts of corruption. The first impact is that economies with better quality teachers will, *ceteris paribus*, produce more competent students. A second effect pertains to the decision that agents make: with lower quality teachers, agents might decide not to go to school at all since they do not learn much.[32] Finally, lower quality teachers render corruption more likely and affect constrained people

[32] These effects are similar to the ones from quiet corruption in the education sector as depicted in World Bank (2010). This underlines the close relationship between the concept of educational corruption depicted in this paper and the World Bank's quiet corruption.

more. The sequence of events for an agent born at the beginning of period t is given below:

1. Given ability θ, wealth ω, the aggregate state Λ_t, and the wages (current and future), the agent decides whether to enter university. She earns $w_L(\Lambda_t)$ if she does not enter university.

2. Just before the end of period t, the agent becomes competent with probability $p(\theta, Q_t)$.

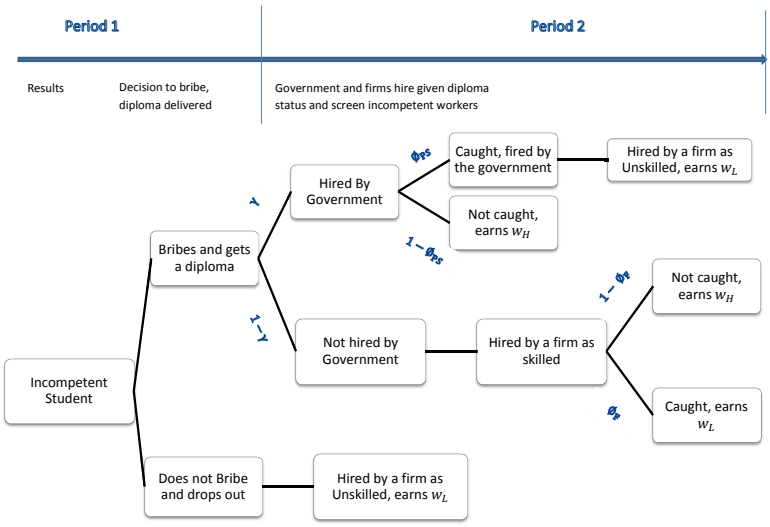
   - If the agent fails and bribes the university, she has an *ex ante* probability γ_t to work in the public sector in period $t+1$. If caught, she goes to the private skilled activity where she faces another probability of getting caught. On the other hand, if she does not bribe, she drops out and works as an unskilled worker in the private sector in period $t+1$.

   - If the agent is competent, she earns the diploma and works in the public or the private skilled occupation in period $t+1$.

3. At the beginning of period $t+1$, the quality of teachers $Q(\Lambda_{t+1})$, the wages $w_H(\Lambda_{t+1})$ and $w_L(\Lambda_{t+1})$, and the probabilities (γ_{t+1} and π_{t+1}) are updated.

Figure 2.4 illustrates the decision tree a student faces if she fails at the examination.

Figure 2.4: Decision tree of a student who fails at examination.



2.3.4 Value Functions

Aggregate quantities and value functions are described next. Let N_t^{E}, N_t^{D} and N_t^{G} denote the number of agents who enter university, who drop out, and who graduate, respectively, at the beginning of period t. The graduate students are composed of N_t^{C} competent students and N_t^{I} incompetent students who paid for their diplomas (i.e $N_t^{\mathrm{C}} + N_t^{\mathrm{I}} = N_t^{\mathrm{G}}$).[33]

Formally, the size of the public sector is

$$N_{\mathrm{PS},t} = F \times (2 - N_t^{\mathrm{E}}),$$

[33] It should be clear that $N_t^{\mathrm{G}} = N_{t-1}^{\mathrm{E}} - N_t^{\mathrm{D}}$ i.e the number of graduates in time t is equal to the number of entrants from $t-1$ minus the dropouts of time t. The dropouts are the failing students that do not to participate in corruption.

with F an exogenous fraction.[34]

These (equilibrium) quantities together with the direct cost (c_e), the bribe level (b), firm interventions (ϕ_{F}), and government intervention (ϕ_{PS}) define the aggregate state for this economy as $\Lambda_t \equiv \left(c_e, b, \phi_{\mathrm{PS}}, \phi_{\mathrm{F}}, N_t^{\mathrm{E}}, N_t^{\mathrm{D}}, N_t^{\mathrm{G}}, N_t^{\mathrm{C}}, N_{\mathrm{PS},t}\right)$. Finally, let β be the inter-temporal discount factor. The value of <u>not</u> attending university becomes:

$$V_{\mathrm{NU}}\left(\omega, \Lambda_t, \Lambda_{t+1}\right) \equiv \ln\left(\omega + w_L\left(\Lambda_t\right)\right) + \beta \ln\left(w_L\left(\Lambda_{t+1}\right)\right). \tag{2.4}$$

The agent earns a wage $w_L\left(\Lambda_t\right)$ in each period as she works in the unskilled occupation. Note that this value function is independent of ability. If an agent attends university, she becomes competent with a probability $p\left(\theta,\, Q\right)$ and has the following value function:

$$V_{\mathrm{U}}\left(\theta, \omega, \Lambda_t, \Lambda_{t+1}\right) \equiv\, p\left(\theta, Q_t\right)\, V_{\mathrm{Cpt}}\left(\omega, \Lambda_t, \Lambda_{t+1}\right) + \left(1 - p\left(\theta, Q_t\right)\right) V_{\mathrm{Fail}}\left(\omega, \Lambda_t, \Lambda_{t+1}\right), \tag{2.5}$$

with V_{Cpt} and V_{Fail} representing the value functions of being a competent student or of failing, respectively. Formally, this gives

$$V_{\mathrm{Cpt}}\ \left(\omega, \Lambda_t, \Lambda_{t+1}\right) \equiv \ln\left(\omega - c_e\right) + \beta \ln\left(w_H\left(\Lambda_{t+1}\right)\right), \tag{2.6}$$

where, in the first period, the student consumes her wealth minus the cost of education c_e and, in the second period, she works in the public or private sector, earning the skilled wage $w_H\left(\Lambda_{t+1}\right)$. If the student fails, she must decide whether to bribe the university and receives the utility

$$V_{\mathrm{Fail}}\ \left(\omega, \Lambda_t, \Lambda_{t+1}\right) \equiv \max\left\{V_{\mathrm{Drop}}\left(\omega, \Lambda_t, \Lambda_{t+1}\right),\ V_{\mathrm{Incpt}}\left(\omega, \Lambda_t, \Lambda_{t+1}\right)\right\}, \tag{2.7}$$

[34] When I calibrate the model, this fraction is obtained from the data and is country specific.

where V_{Drop} and V_{Incpt} are the values that represent dropping out and bribing, respectively. We have

$$V_{\text{Drop}}(\omega, \Lambda_t, \Lambda_{t+1}) = \ln(\omega - c_e) + \beta \ln(w_L(\Lambda_{t+1})), \tag{2.8}$$

and

$$\begin{aligned} V_{\text{Incpt}}(\omega, \Lambda_t, \Lambda_{t+1}) &= \text{U(Bribe in Period1)} + \ldots \\ &\quad +\beta\{\text{(Prob. Work in Government} \times \text{Prob. Not caught) U(skilled wage)}\} \\ &\quad +\beta\{\text{(Prob. Work In Firm} \times \text{Prob. Not caught) U(skilled wage)}\} \\ &\quad +\beta\{\text{ (Prob. Work in Government} \times \text{Prob. Caught) U(Unskilled wage)}\} \\ &\quad +\beta\{\text{ (Prob. Work In Firm} \times \text{Prob. Caught) U(Unskilled wage)}\} \end{aligned}$$

$$V_{\text{Incpt}}(\omega, \Lambda_t, \Lambda_{t+1}) = \ln(\omega - c_e - b) + \beta[\pi \ln(w_H(\Lambda_{t+1})) + (1-\pi)\ln(w_L(\Lambda_{t+1}))] \tag{2.9}$$

If an incompetent student does not bribe (equation (2.8)), she drops out, joins the low occupation, and earns $w_L(\Lambda_{t+1})$ in the second period. If she decides to bribe, she pays an amount b and has a probability π to be employed as a skilled worker without being caught. Recall that $\pi_t \equiv 1 - \gamma_t\phi_{\text{PS}} - (1-\gamma_t)\phi_F$ with $\gamma_t \equiv \max\left\{\frac{N^I_{\text{PS},t}}{N^{\text{I}}_t}, 1\right\}$, the *ex ante* probability that an incompetent graduate is hired in the public sector.[35] An incompetent student bribes only if V_{Incpt} yields a higher utility than V_{Drop}. Finally, an agent enters university simply if V_{U} yields more utility than V_{NU}.

[35] In principle one could set γ_t equal to $\frac{N_{\text{PS},t}}{N^{\text{G}}_t}$ (i.e., the expected probability that a *college graduate* is hired in the public sector). I do not use this formulation because, in the framework, competent agents are indifferent when it comes to working in the public or private sectors, unlike incompetent agents.

2.4 Characterization

Next, the model is formally analyzed. Although, it is not possible to solve the full model analytically, one can characterize the agents' behaviour. There are two major decisions in the model: (1) whether or not to enter university, and (2) whether or not to bribe if one fails the examination. These decisions can be characterized with backward induction. For notational sake, the probability that an agent becomes competent is rewritten as $p(\theta, Q) \equiv \theta\Psi$ with $\Psi \equiv \alpha + (1 - \alpha)Q$. Also, the aggregate state and time subscripts are not carried over.

2.4.1 Agents' Decision to Bribe and to Enter University

At the end of the first period, the failing students decide whether or not to bribe. Formally, a failing student with wealth ω would bribe if $V_{\text{Incpt}}(\omega, \Lambda) \geq V_{\text{Drop}}(\omega, \Lambda)$. This leads to a first proposition for those who enter university.

Proposition 1. *Given a level of bribe b, government and firm screening/firing efficiency ϕ_{PS} and ϕ_F, respectively, there exists a cutoff $\underline{\omega}(c_e, b, \phi_{PS}, \phi_F, \gamma, \frac{w_L}{w_H}) \equiv c_e + \frac{b}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}}$, such that:*

- *all failing students with wealth ω participate in corruption if and only if $\omega \geq \underline{\omega}\,(c_e, b, \phi_{PS}, \phi_F, \gamma)$; and*
- *other failing students do not participate in corruption and dropout.*

Furthermore, $\underline{\omega}(c_e, b, \phi_{PS}, \phi_F, \gamma, \frac{w_L}{w_H})$ is increasing in c_e, b, ϕ_{PS}, ϕ_F and decreasing in γ and the skilled wage premium $\frac{w_H}{w_L}$.

The details of the proof are in Appendix A. All effects are intuitive. As bribes become more expensive, and similarly, as government or firm screening becomes more effective, fewer agents find it in their interests to pay for a diploma. Easier access to government jobs, however, renders corruption more attractive. Hence, in more corrupted countries (countries with low b, ϕ_{PS}, and ϕ_{F} or high γ), incompetent students will be induced to bribe. Proposition 1, therefore, implies that the quality of graduates (and hence of workers) would be affected by corruption as the selection metric is bypassed by wealthy incompetent agents. I abuse notation and rewrite $\underline{\omega}(\Lambda)$ where Λ is the aggregate state vector defined earlier. I henceforth define those with wealth above $\underline{\omega}(\Lambda)$ as the "rich" and the others as the "poor".

At the beginning of the first period, given $\underline{\omega}\left(\Lambda\right)$ and $p(\theta,\, Q)$ the probability that an agent with ability θ becomes competent, agents decide whether or not to enter university. Typically, agents with ability θ and wealth ω will enter university if $V_{\text{U}}\left(\theta,\omega,\Lambda\right)$ is greater than $V_{\text{NU}}\left(\theta,\omega,\Lambda\right)$. This leads to a second proposition.

Proposition 2. *Given decision rule $\underline{\omega}\left(\Lambda\right)$, there exists cutoffs of ability*
$\underline{\theta}_P(\omega,\, c_e,\, b,\, \phi_{PS},\, \phi_F,\, \gamma,\, \frac{w_H}{w_L},\, Q) \equiv \frac{\ln\left(\frac{\omega+w_L}{\omega-c_e}\right)}{\beta\Psi\ln\left(\frac{w_H}{w_L}\right)}$ *and*
$\underline{\theta}_R(\omega, b, \phi_F, \phi_{PS}, \gamma, \frac{w_H}{w_L}, Q) \equiv \frac{\ln\left(\frac{\omega+w_L}{\omega-c_e-b}\right)-\beta\pi\gamma\left(\ln\frac{w_H}{w_L}\right)}{\Psi\left[\ln\left(\frac{\omega-c_e}{\omega-c_e-b}\right)+\beta(1-\pi)\ln\left(\frac{w_H}{w_L}\right)\right]}$ *such that*

- *Agents with wealth $\omega < \underline{\omega}\left(\Lambda\right)$ (the poor) would enter university if and only if $\theta \geq \underline{\theta}_P\left(.\right)$; and*
- *Agents with wealth $\omega \geq \underline{\omega}\left(\Lambda\right)$ (the rich) would enter university if and only if $\theta \geq \underline{\theta}_R\left(.\right)$.*

Furthermore,

- $\underline{\theta}_R(.) < \underline{\theta}_P(.)$*;*
- $\underline{\theta}_P(.)$ *is decreasing in* ω *and* Q*. However the partial effect of* b*,* ϕ_F*,* ϕ_{PS} *and* γ *are nil; and*
- $\underline{\theta}_R(.)$ *is decreasing in* ω*,* γ *and* Q *and increasing in* b*,* ϕ_F *and* ϕ_{PS}*.*

The details of the proof are in Appendix A. Proposition 2 establishes cutoffs of ability for optimal decisions for education. The cutoffs depend on how the agent anticipates the bribing decision in the event she fails. Note that the cutoff for the rich is lower than that of the poor, and that both cutoffs decrease in wealth ω and teacher quality Q. Hence, wealth and a better quality of teachers induce more students to enroll. Because the poor anticipate that they will not bribe, their cutoff is not affected by the bribe level b, firm and government screenings (ϕ's) and market tightness γ. The cutoff for the rich, on the other hand, increases in the size of b and in the ϕ's. In other words, *ceteris paribus*, in corrupted countries, wealthy individuals with low ability may go to college since they know ahead of time that they will bribe the university if they fail.

Proposition 2 illustrates a dichotomy that emerges because of corruption: a corrupted education system implies that the rich and the poor implicitly face different kinds of constraints, which affect their decision to develop skills. It reveals the long-term consequence of corruption on the quality of the pool of students. Let $\hat{b}(\omega, \Lambda)$ and $\hat{d}(\omega, \theta, \Lambda)$ denote the optimal policy rules induced by Propositions 1 (decision over bribing) and 2 (decision over university attendance), respectively.

2.4.2 University Aggregates

Using Propositions 1 and 2, one can derive expressions for the number of entrants (N^{E}), graduates (N^{G}), competent agents (N^{C}), and incompetent agents (N^{I}) in the economy. N^{E} is the sum of agents, rich or poor, whose ability exceeds the respective cutoffs. Because rich incompetent agents are able to bribe, they obtain a diploma; N^{G} is thus the sum of all rich students and only poor competent students. The total number of competent agents N^{C} is the sum of competent students, rich or poor, who entered university. Finally, the number of incompetent students is the difference between the number of graduates and the number of competent students. Appendix B shows how these expressions are derived. For notational sake, the aggregate state variable Λ is not carried over. Let $f(\theta)$ and $g(\omega)$ denote the probability distributions of θ and ω on $[0,\, 1]$ and $[0, \omega^{\max}]$ respectively; both distributions are assumed to be uniform. Recall that the probability to become competent is $p(\theta, Q) = \theta\Psi$. It follows that

$$N^{\mathrm{E}} = 1 - \frac{1}{\omega^{\max}} \left[\int_0^{\underline{\omega}} \underline{\theta}_P(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R(\omega)\, d\omega \right], \tag{2.10}$$

$$N^{\mathrm{G}} = 1 - \frac{1}{\omega^{max}} \left[\underline{\omega} \left(\frac{\Psi}{2} \int_0^{\underline{\omega}} \underline{\theta}_P^2(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R(\omega)\, d\omega \right) \right], \tag{2.11}$$

$$N^{\mathrm{D}} = N^{\mathrm{E}} - N^{\mathrm{G}}, \tag{2.12}$$

$$N^{\mathrm{C}} = 1 - \frac{\Psi}{2\omega^{\max}} \left[\left(\int_0^{\underline{\omega}} \underline{\theta}_P^2(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R^2(\omega)\, d\omega \right) \right], \tag{2.13}$$

$$N^{\mathrm{I}} = N^{\mathrm{G}} - N^{\mathrm{C}}. \tag{2.14}$$

2.4.3 Labour Market

The aggregate quantities pertaining to the labour market are now derived. The public sector hires from the pool of graduates and so do firms for their skilled occupation. Public sector employment has already been discussed above so we are left with the private sector.

All competent students who have not been hired by the government are employed as skilled by a firm. Only a fraction $(1 - \phi_{\mathrm{F}})$ of the incompetent graduates without a job become employed in the skilled occupation, the others become unskilled workers. The group of unskilled workers is thus composed of agents who do not enter university, dropouts, and incompetent graduates who have been caught.[36] The labour market is summarized by the equations below.

For the public sector,

$$\text{The size of the Public sector:} N^{\mathrm{PS}} = F \times (2 - N^{\mathrm{E}}) \tag{2.15}$$

$$\text{Incompetent in the Public sector:} N^{I}_{\mathrm{PS}} = \min\left\{(1 - \phi_{\mathrm{PS}})N^{\mathrm{I}}, N_{\mathrm{PS}}\right\} \tag{2.16}$$

$$\text{Competent in the Public sector:} N^{C}_{\mathrm{PS}} = \max\left\{N_{\mathrm{PS}} - N^{I}_{\mathrm{PS}},\ N^{C}\right\} \tag{2.17}$$

For the firms we further have

$$\text{Competent in the Firm:} N^{C}_{H} = N^{C} - N^{C}_{\mathrm{PS}} \tag{2.18}$$

$$\text{Incompetent in the Firm:} N^{I}_{H} = (1 - \phi_{\mathrm{F}})(N^{C} - N^{C}_{\mathrm{PS}}) \tag{2.19}$$

$$\text{Workers Employed as Skilled by the Firm:} N_{H} = N^{I}_{H} + N^{C}_{H} \tag{2.20}$$

$$\text{Workers Employed as Unskilled by the Firm:} N_{L} = 2(1 - N^{\mathrm{E}}) + (N^{\mathrm{E}} - N^{\mathrm{G}}) + N^{\mathrm{I}} \tag{2.21}$$

[36] Note that those who do not enter university are either young or old agents, whereas incompetent graduates are old.

The concept of equilibrium can now be defined.

2.4.4 Steady State Competitive Equilibrium

Given distributions of endowment (ω) *and ability* (θ)*, an exogenous size of the public sector relative to the active population* (F)*, a probability of becoming competent* $(p(\theta, Q))$*, and government and firm screening/firing efficiency (*ϕ_{PS} *and* ϕ_F*, respectively), a steady state competitive equilibrium for this economy is a collection of decision rules* $(\hat{d}(\omega, \theta, \Lambda)$ *and* $\hat{b}(\omega, \Lambda))$*, educational aggregate quantities* $(N^E, N^D, N^G, N^C, N^I)$*, labour aggregate quantities* $(N_{PS}, N^I_{PS}, N^C_{PS}, N_H, N^I_H, N^C_H, N_L)$*, quality of teachers* $(Q(\Lambda))$ *and prices* $(w_L(\Lambda)$ *and* $w_H(\Lambda)$ *with* $\Lambda \equiv \left(c_e, b, \phi_{PS}, \phi_F, N^E, N^G, N^C, N_{PS}\right))$ *such that:*

- An incompetent graduate has a probability $\pi \equiv 1 - \gamma\phi_{\mathrm{PS}} - (1-\gamma)\phi_{\mathrm{F}}$ to be employed as skilled with $\gamma \equiv \max\left\{\frac{N^I_{\mathrm{PS}}}{N^{\mathrm{I}}}, 1\right\}$.
- $\hat{b}(\omega, \Lambda)$ and $\hat{d}(\omega, \theta, \Lambda)$ satisfy Propositions 1 and 2. Specifically,
  - Given $w_H(\Lambda)$, $w_L(\Lambda)$ and π, the decision rule $\hat{b}(\omega, \Lambda)$ solves the corruption decision problem of the incompetent (2.7).
  - Given $w_H(\Lambda)$, $w_L(\Lambda)$, $p(\theta, Q)$ and $\hat{b}(\omega, \Lambda)$, the decision rule $\hat{d}(\omega, \theta, \Lambda)$ solves the university attendance decision (2.5).
- Educational aggregate quantities are consistent with individuals' decisions; that is, N^{E}, N^{D}, N^{G}, N^{C} and N^{I} satisfy equations (2.10) to (2.14).
- The labour market clears. Specifically, N^{PS}, N^I_{PS}, N^C_{PS}, N^C_H, N^I_H, N_H, and N_L satisfy equations (2.15)to (2.21).

- The quality of teachers is equal to $Q \equiv \frac{N_{\text{PS}}^{\text{C}}}{N_{\text{PS}}}$.
- Given wages, the firm maximizes profits. That is, $w_L(\Lambda)$ and $w_H(\Lambda)$ satisfy (2.2) and (2.1).

2.5 Quantitative Experiments

In this section, the quantitative importance of the direct and indirect channels of educational corruption are assessed. In particular, the assessment uses counterfactual experiments that evaluate what happens when each channel is sequentially shut down. First, the model described above is calibrated. Then, using the same parameters, economies free of each channel are sequentially recomputed. The comparisons between different scenarios assess the loss in output induced by these channels. Table 2.4 summarizes the data used for the quantitative exercise; details on the data can be found in Appendix C. The experiments are based on 25 countries.[37]

2.5.1 Calibrating the Economy

Strategy

The calibration strategy is guided by a desire to broadly match model predictions of educational corruption, university enrollment, university graduates,

[37] Unfortunately, the most corrupted countries are under-represented in the quantitative exercise. This is mostly due to the lack of comprehensive data on the size of their public sector.

Table 2.4: Description of the Data

Data	Source	Period (means)	Interpretation in the Model
Gross Completion Ratio	UNESCO	1997-2008	N^{G}
Gross Enrolment Ratio	UNESCO	1997-2008	N^{E}
Output per Capita	PWT 6.3 (CGDP series)	1990-2007	Ay
% of People who Paid a Bribe in Education Sector	Transparency International (GCB Barometer)	2006 - 2008	$\frac{N^{\mathrm{I}}}{N^{\mathrm{E}}}$
Skilled Wage Premia	Freeman and Oostendorp (2005)	1990 - 2003	$\frac{w_H}{w_L}$
(1) Employment by Level of Education	International Labour Office	1990-2007	
(2) Total Active Population Aged 15+	International Labour Office	1990-2007	**(1)**×**(2)**×**(3)**: F
(3) Public Sector Employment	International Labour Office	1990-2006	

Notes:
(1)×**(2)**: Share of the Total Active Population with College Education
(1)×**(2)**×**(3)**: Fraction of Active Population with College Education Working in the Public Sector$\equiv F$ and, in the Model, $N_{\mathrm{PS}} = F \times (2 - N^{\mathrm{E}})$.

and skilled wage premia with individual country data. The data on the percentage of respondents who paid a bribe in the education sector is taken as the equivalent to the model's proportion of students who pay a bribe.[38]

The model has 11 parameters that need to be calibrated: one utility parameter (β); five production parameters (A, ρ, ϵ, δ, and A_H or A_L); three university parameters (α, c_e, and b); and two screening/firing parameters (ϕ_{PS} and ϕ_{F}).

The generational discount factor is set at $\beta = 0.82$, which corresponds to a yearly discount factor of 0.98 compounded over 10 years. The benchmark parameters for production, except for the TFP (discussed below), are taken from

[38] This is equivalent to assuming that, in the data, individuals who pay a bribe in the education sector are all incompetent students.

Caucutt and Kumar (2003). These authors calibrated the production function for the U.S. in a model that has similar features to the model presented here: an OLG two-period model with a decision over college attendance and a probability to drop out. This has the advantage of providing a nice benchmark for the analysis. Thus, the elasticity of substitution (ρ) is set equal to 0.35; the share of skilled workers in the unskilled activity (ϵ) is set equal to 0.1, and the share of unskilled workers in the skilled activity (γ) is set to 0.02. Finally, the TFP (A) is a pure scale parameter used to normalize individual countries per capita output to their level in the data.[39]

Ability and wealth distributions are assumed to be uniform, and the utility function is $U(c) = \ln(c)$. The parameter α controlling the incidence of the quality of teachers in the probability of becoming competent is set to 0.5 for the benchmark analysis. Table 2.5 summarizes the benchmark parameters.

Table 2.5: Parameters

	Variable	Interpretation	Value
Production	ρ	Controls the Degree of Elasticity of Substitution	0.35
From Caucutt and Kumar	A_H	Coeff. Associated with Brain Activity	0.5
(2003)	A_L	Coeff. associated with Brawn Activity	0.5
	ϵ	Share Skilled in Brawn Activity	0.1
	δ	Share Unskilled in Brain Activity	0.02
Education	$F(\theta)$	Distribution of Ability	$F(\theta) = \theta$
	$p(\theta, Q)$	Probability of Being Competent	$p(\theta, Q) = 0.5\theta + 0.5\theta Q$
Miscellaneous	β	(Generational) Inter-Temporal Discount Factor	$(0.98)^{10} \simeq 0.817$
	$G(\omega)$	Distribution of Wealth	$G(\omega) = \omega$

[39] Total output in the model consists of private production (equation (2.1)) plus the government's value added, where the latter is evaluated at its cost (salaries).

The aforementioned parameters (except of course, TFP) are common to all countries. The remaining four parameters (c_e, b, ϕ_{PS}, and ϕ_{F}) are country specific.[40] They are calibrated to minimize a country-specific sum of weighted squared differences between moments from the model and the data. The chosen moments are the percentage of respondents who paid a bribe (as a percentage of enrollment), university attendance and completion rates, and skilled wage premia. These moments are chosen because they critically depend on the parameters. Enrollment is not only a function of the cost of education, but also of the expectations prospective students make about failure at the examination; these expectations are affected by the bribe level and the screening technology. Obviously, the percentage of respondents who pay a bribe and, consequently, the number of graduates, depends on both the size of the bribe and the screening technology. Finally, the skilled wage premia motivate participation in corruption as well as reflect the scarcity of skills among graduates.

Results

All the results from the calibration can be found in Appendix D. Figure D.1 illustrates the goodness of fit of the calibration exercise. In each panel, the diagonal corresponds to a perfect fit. Overall, the benchmark model fits the data fairly well. This is particularly true for university attendance and the proportion of students paying a bribe. However, the model tends to overestimate the

[40] There are, therefore six parameters common to all countries, four parameters that are calibrated for each country (i.e., 25×4 calibrated parameters in total) and 25 country-specific TFPs.

number of graduates and underestimate the skilled wage premia.[41] The calibrated parameters are collected in Table D.1 where countries are ranked in ascending order of corruption. What does the model predict?

The first set of predictions relates to the effects of corruption on the education system. Because of the lack of data on educational corruption, these intuitive results are of interest. The top panels of Figure D.2 show that the number of incompetent graduates increases (top left panel) and the quality of the pool of graduates decreases (top right panel) with the degree of corruption. This lower quality graduate pools in corrupted countries leads to a lower quality of teacher pool, as measured by the fraction of competent workers among public servants (bottom left panel). It is established that the most corrupted countries (the countries with more than 10% of their students paying a bribe) have a teacher quality that is only 69% of the quality of other countries.[42] Such a low quality of teachers has dramatic implications for the creation of knowledge, as depicted in the bottom right panel for three levels of innate ability. For example, a student with the highest ability level (θ=1) has only an 80% probability of becoming competent in the most corrupted countries. In comparison, this probability is close to 100% in the least corrupted countries.

The second set of predictions concerns the labour market and production. On one hand, the fraction of incompetent graduates working in the public sector increases with corruption. On the other hand, the fraction of incompetent

[41] The skilled wage premia increase with the degree of corruption, which is consistent with Shaw (2007) who illustrated the positive relationship that exists in the data between corruption and returns to education. An intuition for this result is that competence is scarce (and thus more valuable) in countries where educational corruption is prevalent.

[42] The mean quality for the most corrupted countries is 0.62 versus 0.90 for the remaining countries.

graduates working in the skilled private occupation remains constant (top panels of Figure D.3). We can also see that TFP (relative to the U.S. TFP) falls with corruption (bottom panel of Figure D.3).[43] This is consistent with the idea that the level of technology is higher in countries with less educational corruption. The model, therefore, captures important qualitative and quantitative features of the world and can be used to run experiments.

2.5.2 Experiments

Description

The broad objective of this subsection is to quantitatively assess the loss in output induced by each channel of educational corruption. This goal is achieved through numerical simulations-by comparing the effects of four alternative policy interventions on output per capita. All experiments rely on the parameters calibrated above.

In the first three experiments, I mimic the effects of unanticipated changes in the economic environment. Formally, the calibrated measures and the composition of enrolled students are maintained; in other words, experiments one to three start with the (country-specific) measures N^{E} that have been previously calibrated. However, depending on the nature of the experiments, the number and the composition of graduates, the employment aggregates and the

[43] Recall that TFP is a scale factor that matches individual country output predictions (from the model) to output (from the data). I simply divide each country's TFP by the U.S. TFP to obtain a TFP relative to the U.S.

composition of skills may change. In the last experiment, a fully dynamic adjustment of the economy is implemented: agents are *allowed* to anticipate the changes and update their expectations accordingly.

The first experiment assesses the loss in output induced by the presence of incompetent workers (the direct effect). This loss is identified by banning incompetent workers from the skilled private occupation. Specifically, I keep track of the equilibrium quantities and compositions of N^{E} and N^{G}, and I fix the employment aggregates and the skill composition by sector. However, N_H^I, the measure of incompetent workers in the private sector, is set to 0. It should be noted that this experiment is equivalent to a partial equilibrium response of imposing $\phi_{\mathrm{F}} = 1$ while holding agents'expectations over entrance and corruption equal to their (pre-policy) levels.

The second experiment assesses the loss in output induced by the presence of incompetent teachers (the direct effect). I consider economies that have no incompetent teachers, yet still have incompetent workers in the skilled private sector. Specifically, from the calibrated economy, I keep track of the agents who enter university, and using these same agents, I recompute the model by setting $Q = 1$.[44] N^{E} therefore remains unchanged, but N^{G} and the quality of the pool of graduates may change. In particular, with better quality of teachers, more competent graduates emerge from university, and production changes.

[44] In the second experiment, I do not actually ban incompetent workers from working in the public sector; I simply set $Q = 1$. One can interpret this as having no incompetent teachers while other public activities have incompetent workers. Furthermore, I assume that the competent graduates who come in excess of the calibrated values do not mechanically *replace* the now missing incompetent workers in the public sector. I thus assume that the *excess* competent graduates are all assigned to production.

The third experiment combines the first and second experiments. Specifically, I set $Q = 1$ and impose that there are no incompetent workers in the skilled private occupation.[45]

The interpretation of these changes in endogenous variables requires explanation. I am interested in gauging the effects of corruption on output that emerge exclusively because of incompetent workers (experiment 1) and the quality of teachers (experiment 2). In experiment 2, for example, by starting with the same N^{E} and imposing $Q = 1$, I can exactly identify the role of teacher quality: using the same agents, it tells us what is the potential gain that results from better teachers.[46] These experiments mimic unanticipated changes in the economic environment and can, therefore, be thought of as myopic or *partially dynamic* experiments. In the next experiment, on the other hand, agents take such changes into account, making it possible to assess the *fully dynamic* effects of corruption.

In the last experiment, I start with an environment similar to that of experiment 3 (i.e., no direct or indirect effects); I further ban corruption and allow the number of agents entering university to vary.[47] Therefore, in this experiment, agents anticipate that there is no corruption and update their expectations accordingly. Comparing outcomes of all four experiments assesses the partial and full losses in output induced by the direct and indirect channels of educational

[45] Note that the third experiment does not correspond to perfect screening because incompetent public servants are allowed to work in activities other than education.

[46] A partial equilibrium effect (i.e., imposing $\phi_{\mathrm{PS}} = 1$ in the government while holding ϕ_{PS} fixed in agents' expectations) would correspond to a slightly different experiment since not all public servants are teachers.

[47] To be specific, I use the features of experiment 3 (i.e., $\phi_{\mathrm{F}} = 1$ and $Q = 1$) and rely on its wages as the starting wages. Moreover, I impose that there is no corruption and that $\phi_{\mathrm{PS}} = 1$.

corruption.

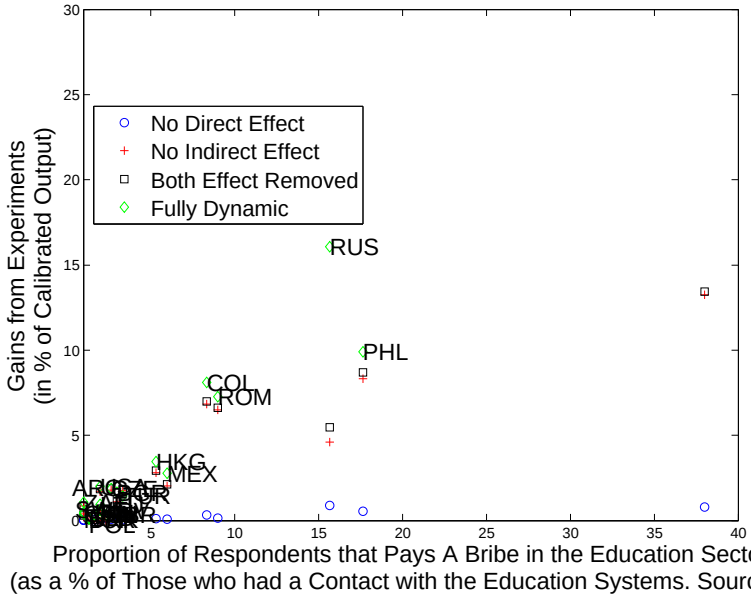
Results and Discussion

The gains in output per capita from each experiment are calculated as a percentage of the calibrated model output. Figure 2.5 illustrates these gains for each country and Table 2.6 breaks these gains down by levels of corruption.

First, we can see that for all experiments, the most corrupted countries always benefit more from the removal of channels of corruption; this is intuitive. A second key result is that the losses in output induced by the indirect channel outweigh those induced by the direct channel. In other words, the dynamic effect of educational corruption is more important than the static effect. Hence, the most corrupted countries could gain, on average, close to 9% in GDP per capita if the partially dynamic channel was removed whereas this number would be only 0.7% for the direct effect (Table 2.6). In other words, the losses in output per capita induced by the feedback channel are more than ten times as large as the ones induced by the direct channel. Furthermore, the gains that result from removing both channels of educational corruption (column 3) emerge, almost entirely, because of the removal of the feedback channel.

Finally, removing corruption (column 4) induces bigger gains in output. It is also important to note that the gains increase with the incidence of educational corruption; in particular, the countries that suffer the most from corruption could gain, on average, 22% in output. Column 4 therefore highlights the burden that educational corruption imposes on economies.

Figure 2.5: Gains in output



Note: The fully dynamic effect of removing educational corruption in Azerbaidjan (39.6%) is not shown.

Table 2.6: Gains Resulting from the Removal of Each Channel of Corruption (%)

Country Categories By % of People Bribing in Education (Data)	**Experiment 1 Removing the Direct Effect**	**Experiment 2 Removing the Indirect Effect**	**Experiment 3 Removing Both Effects**	**Experiment 4 Removing the Fully Dynamic Effects**
Less than 5%	0.075	0.633	0.706	0.812
5 to 10%	0.168	4.547	4.665	5.366
More than 10%	0.736	8.731	9.198	21.926

The impact of the feedback channel is consistent with evidence from the literature on the long-term impact of education. The feedback channel could, for example, partially explain why Pritchett (2001) was concerned about low rates of growth of output per worker despite increases in education attainment. Furthermore, as a key element of educational quality, the feedback channel story corroborates cross-country evidence on the quantitative importance of education/human capital quality [Manuelli and Seshadri (2005) and Erosa, Koreshkova, and Restuccia (2010)] and also micro-evidence on the role of teacher quality [Hanushek and Wößmann (2007)]. Finally, the impact of incompetent teachers is hard to dissociate from another issue described in World Bank (2010), which is the fact that teachers may be exerting low efforts. Hence, the issue might not just be competence but also shirking. Both phenomena affect the creation of skills but, likely imply different policies as they mix elements of adverse selection and moral hazard. Understanding the nuance between the two deserves further attention.

2.6 Sensitivity Analysis

The robustness of the results are now investigated. In particular, the validity of the results is tested for different values of key parameter, and for modified assumptions about the production function of human capital.

Table 2.7 reports the results when the degree of elasticity of substitution (ρ) and the parameter controlling the incidence of the quality of teachers on

the production of human capital (α) are sequentially modified. All other parameters remain at their benchmark values. Only the gains resulting from the removal of the feedback channel are shown since these are the main findings of the paper. Even though the gains change slightly, the key results are robust to changes in the values of parameters.[48]

Table 2.7: Sensitivity Analysis of ρ and α

Country Categories By % People Bribing in Education (Data)	Experiment 2: No Indirect Effect (in %)				
		ρ		α	
	Benchmark	0.2	0.5	0.3	0.7
Less than 5%	0.633	0.822	0.224	0.889	0.3
5 to 10%	4.547	5.897	3.365	6.435	3.124
More than 10%	8.731	9.817	7.734	13.128	5.657

Notes: Benchmark values: $\rho = 0.35$ and $\alpha = 0.5$.

For the most corrupted countries, when the elasticity of substitution between competent workers and unskilled workers is low (ρ=0.2), the impact of the feedback effect is larger than in the benchmark. Similarly, when the role of the quality of teachers is more important ($\alpha = 0.3$), the gains resulting from the removal of the indirect channel increase.

The next sensitivity analysis deals with the production function of human capital. Specifically, I modify the specification of the production of human capital (equation (2.3)) and test the validity of the previous results by using the

[48] The other experiments, not reported here, are also consistent with the benchmark analysis.

following Cobb Douglas specification:

$$p\left(\theta,\ Q(\Lambda)\right) = \theta^{\alpha}\, Q\left(\Lambda\right)^{1-\alpha}, \tag{2.22}$$

Again, the results are not significantly different (Table 2.8).

Table 2.8: Sensitivity Analysis of the Production of Human Capital

Country Categories By % People Bribing in Education (Data)	Experiment 2: No Indirect Effect (%)	
	Benchmark	$\theta^{\alpha}\, Q\left(\Lambda\right)^{1-\alpha}$
Less than 5%	0.633	2.37
5 to 10%	4.547	5.062
More than 10%	8.731	11.189

Notes: The benchmark specification for becoming competent is $p\left(\theta,\ Q(\Lambda)\right) = \alpha\theta + (1-\alpha)\theta\, Q\left(\Lambda\right)$.

2.7 Conclusion

This paper has provided evidence pertaining to the importance of educational corruption. It develops a simple model whose key feature is a corruptible university. Specifically, incompetent students can get a diploma if they pay a bribe. The presence of incompetent graduates affects the quality of the pool of workers and causes an adverse selection problem for firms. The induced misallocation of talents forces production to fall. This is the *direct* effect of corruption. Because teachers are hired from the pool of graduates, corruption also undermines the quality of the pool of teachers. Consequently, the creation of

skills diminishes, fewer competent workers are available for production, and the skilled wage premium increases. This is the indirect or feedback effect of educational corruption. The feedback effect has dynamic long-term effects on output.

Based on data on educational corruption, the public sector, and college enrollment and completion rates, the model is then calibrated. The benchmark model is able to replicate qualitative and quantitative features of the data. It also gives an idea of the impact of corruption on the quality of teachers. Hence, the most corrupted countries (the countries with more than 10% of people paying a bribe in the education sector) have lower teacher quality-only 69% of the quality of other countries.

Finally, counterfactual experiments are implemented. Specifically, each channel of corruption is sequentially shut down, and its quantitative importance is assessed. The key result from these experiments is that the feedback channel is quantitatively more important than the direct channel. For instance, the most corrupted countries in the sample could gain 9% in output if the indirect channel was removed, representing roughly tenfold the gains resulting from the removal of the direct channel. Moreover, removing corruption in these countries would yield a 22% gain in output. These experiments highlight the untold consequence of corruption: the potential impact of incompetent teachers.

Many questions are still open for debate. For instance, which institutions support prevalent levels of educational corruption? What policies can be implemented to prevent educational corruption? What are the links with other

troubling behaviour such as absenteeism? These challenging questions serve as motivation for a better understanding of the institutionalization of educational corruption that is happening in many countries. Doing so will help design policies that enable countries to tackle corruption.

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Chapter 3

Civic Engagement, Social Capital and Corruption

Corruption starts within the family unit and spreads in all levels of society.

-Precept #120, 1000 Préceptes d'éthique de civisme et de vie morale.[1]

3.1 Introduction

Corruption is a worldwide phenomenon that affects all sectors and actors of a country's economy.[2] Despite the large body of work on the subject, the institutions that support prevalent levels of corruption are not well understood. In this respect, in many countries where there is a *culture* of corruption (i.e., where it has been accepted as a norm in the society), traditional policies based

[1] Teaching manual on Civic and Moral Education (Bénin). Translated from french by the author. Source: http://www.moralisation.gouv.bj/ddl/Education_Civique.pdf.

[2] For theoretical analysis of corruption, see Becker and Stigler (1974), Murphy, Shleifer, and Vishny (1991) and Acemoglu and Verdier (2000). Mauro (1995) provides empirical evidence of the impact of corruption on output. Also, a report by the World Bank (2010) depicts the concept of "quiet corruption" which indicates "various types of malpractice of frontline providers (teachers, doctors, inspectors, and other government representatives)".

only on pecuniary incentives (e.g., audits and wage increases) may have only limited results since they are likely not to change the bad habits enrooted in the society.[3] It is therefore important that economic models aiming to understand corruption take society's culture, norms, and social capital into consideration.

This chapter considers corruption as an endemic social phenomenon and analyzes the role that civil society can play in reducing it. It is argued that civic engagement can be effective at reducing corruption through the shaping of citizens' behaviour, and the monitoring of bureaucrats. Civic engagement in the model is defined as the effectiveness with which a society catches/punishes agents participating in corruption.[4] Hence, a more engaged civil society is one that is more effective at catching/punishing misbehaving agents. Theoretical and empirical evidence-including evidence that causality goes from civic engagement to corruption-are offered. The model expands on a simple corruption framework with bureaucrats and citizens by allowing a role for civil society.[5] The economy has an infinite horizon and agents live for one period. The role of bureaucrats is to deliver (mandatory and identical) licenses to citizens, for which they earn a salary.[6] It is assumed that each bureaucrat delivers only one license but has discretion over the *speed* of its delivery. Hence, bureaucrats

[3] On policies targeting wages see Besley and McLaren (1993) and Di Tella and Schargrodsky (2003). Di Tella and Schargrodsky (2003) and Savedoff (2008) provide evidence of non-statistical effects of wages on corruption. See also World Bank (2010) for a discussion of policies against corruption.

[4] The concept of civil society in this chapter should be understood as any organization able to exert pressure on public servants and citizen. Also, the notion of civic engagement proposed here differs from other definitions such as the participation in political activities (e.g. voting).

[5] The corruption framework is similar to Becker and Stigler (1974).

[6] One can think of driving licenses, or licenses to produce or sell goods or services. This example of corruption aims to facilitate the discussion and examples of other forms of corruption are also provided throughout the paper.

can deliver licenses *quickly* in exchange of bribes. Citizens derive utility from obtaining a licence quickly.[7]

Citizens can be one of two types, *honest* or *opportunist*. Honest citizens commit not to participate in corruption, while opportunistic citizens participate in corruption if it is optimal to do so. This contrasts with bureaucrats who are only opportunists. Hence, corruption occurs when bureaucrats accepts (an endogenously determined) bribe from opportunistic citizens. When caught, agents face sanctions that are proportional to the gains from corruption. In this respect, the engagement of the civil society is modeled as its effectiveness in catching/punishing misbehaving agents.

The evolution of honesty within the population is affected by both pecuniary (e.g., wages and the probability of getting caught) and non-pecuniary benefits (e.g., moral). It follows that civil society affects the monitoring of agents *directly* and the creation of social capital, captured through the notion of *honesty*, *indirectly*.[8]

The evolutionary mechanism of types borrows from Francois and Zabojnik (2005), which is discussed below. Although these authors do not study corruption, their formal approach to social capital can be applied to it. Citizens' type is a trait that they acquire when young, influenced by their parents and by the frequency of types in the economy. Specifically, the intergenerational

[7] An implicit assumption is that all citizens, even when they are not participating in corruption, end up with licenses.

[8] It should be acknowledged that the notion of social capital differs slightly from other pieces (e.g., Putnam (1993) or Fukuyama (1995)) who define social capital as a set of informal values or norms shared among members of a group that permits them to cooperate with one another. However, it can be argued that the notion of honesty relates to trust and, therefore, relates in a broad sense to this definition.

transmission of preferences for citizens follows a stochastic socialization process determined directly by parents (who maximize children's expected welfare based on their own preference type) and indirectly by the imitation of someone outside of the family. The model embeds this process of preference evolution into an environment where agents' returns depend crucially on the actions of profit maximizing bureaucrats. The evolution of honesty within the population and, therefore, social capital, is in turn affected by bureaucrats' decisions. This interrelation between the society's social capital and the actions of bureaucrats is key to the institutionalization of corruption.

As in Francois and Zabojnik (2005), and to reflect the sociological treatment of honesty as a personality disposition, the adjustment of the types of citizens is modeled to be relatively slow to changes in the economy. This contrasts with the decisions of bureaucrats who are assumed to react instantaneously to new opportunities. The complementarity between the relatively quick-to-change decisions of bureaucrats and the relatively slow-changing types of citizens captures the idea that social capital adjusts relatively slowly in comparison with corporations (e.g., bureaucracy).

The framework is then utilized to run an experiment that consists of increasing the involvement of civil society in the fight against corruption. Specifically, misbehaving agents are more likely to get caught. It is established that the whole economy converges to a steady state with fewer corrupted bureaucrats and lower levels of corruption. However, the change in the number of honest citizens is ambiguous, which stresses an important result: countries

enjoy lower levels of corruption, not necessarily because they have more honest citizens (i.e., more social capital), but rather because for each level of honest citizens, lower levels of corruption are *tolerated*. This is similar to the idea of an access to a better *technology*. Interestingly, increases in the bureaucrats' wages are proven to be ineffective at reducing corruption in the proposed economic environment.

Based on individual survey data from the Afrobarometer surveys (year 2005-2006), the predictions of the model are confirmed empirically. The empirical results also indicate that causality goes from civic engagement to corruption.[9]

The paper therefore complements the existing literature in several respects. It provides explanations for why civic engagement can effectively fight corruption. It contributes to the literature by formally capturing and applying a dynamic notion of *social capital* to the issue of corruption. It also discusses formal mechanisms under which civil society affects the latter. This novel approach complements existing work on the role of social norms and nonpecuniary motivations for corruption.

The definition of civil society varies considerably across conceptual paradigms and country contexts. CIVICUS, an international association of civil society organizations (CSOs), defines civil society as:"the sphere of institutions, organizations, and individuals located between the Family, the State and the Market, in which people associate voluntarily to advance common interests". Putnam (1993 and 2000) has a similar definition when he argues that civil society is

[9] The limitations of the data - like the fact that it is not longitudinal - makes the causality results only indicative.

composed of groups, which crosscut ties of kinship and patronage. The concept of civil society in this paper should be understood as any organization able to exert pressure on public servants and citizens. Examples of such groups include the media and NGOs fighting against corruption. Indeed, the media contribute to the monitoring mechanism, and support the implementation of anti-bribery instruments. For example, they can lead to the resignation of public officials even in countries plagued with corruption.[10]

In addition, corruption is an important field of activity for NGOs and many - like Transparency International - are involved in the monitoring of public servants.[11] The role of CSOs has received attention from institutions like the World Bank and the Organization for Economic Cooperation and Development (OECD). For instance, the OECD acknowledges that CSOs are crucial in its anti-corruption and corporate governance initiatives.[12] CSOs have also become important partners for the World Bank, especially with respect to the delivery and monitoring of social services and development programs. The World Bank officially considers CSOs as a "complement to government action, especially in regions where government presence is weak".[13] This perception *vis-à-vis* CSOs is supported by recent studies demonstrating that projects are less affected by corruption when CSOs participate in the design, monitoring, evaluation, and

[10] Concrete examples of media's achievements include the coverage of a financial scandal that led to the resignation of a Minister of Education in Ghana in January 2012. Other examples include press articles about a fake University Professor in Côte d'Ivoire that led to a reevaluation of hiring procedures (*Fraternité Matin*, September 12-13th 2009 and *Notre Voie*, September 30th 2009).

[11] See Transparency International (2005).

[12] See OECD (2003).

[13] The citation is taken from http://go.worldbank.org/4CE7W046K0.

management of public services.[14] Finally, on a different but related subject, the absence of an independent, non-partisan civil society can be linked to ineffective, or "de façade" democratic regimes, especially in Africa. Hence, CSOs' engagement may contribute to the enforcement of good behaviour and practice from public officials.

Of particular relevance for African countries, civil society can also take the form of kin-based and ethnic organizations. These organizations can act as a moral authority able to shape public opinions and monitor bureaucrats.[15]

This chapter relates to the literature on civil society which spans multiple disciplines beyond economics, including sociology and political science. The role of civil society in the literature is largely seen as beneficial. For example, civil society is advantageous for the formation of trust: Putnam (1993) suggests that Northern Italy's economic progress over the country's southern parts is mainly explained by the dense networks of voluntary associations in the North. Similarly, Fukuyama (1995) depicts how economic success depends on social institutions that can "generate extra-familial bonds of social trust". In their review of the literature, Anheier and Kendall (2000) provide other evidence-from the economic, political science and sociological literature-of the link between the notions of trust and civil society. Therefore, civic engagement may contribute to long-term growth, if only through building trust.[16]

[14] World Bank (2011) reports a speech of the President of the World Bank on the matter.

[15] See Lewis (2001) for descriptions and examples of a broader view of civil society in Africa.

[16] It is important to note that civil society might be ineffective due to the taming of NGOs by government officials. Studying this key issue, however, goes beyond the scope of this paper. For a discussion of the limitations of the positive effects of civil society, see Howell, Ishkanian, Obadare, Seckinelgin, and Glasius (2006).

The chapter also relates to recent reports and studies [e.g.,World Bank (2010)] analyzing the quality of "frontline service providers" in developing countries. Finally, the paper is linked to the literature on evolutionary economics, social norms, and culture like Platteau (2000). In particular, the evolution of types borrows from Francois and Zabojnik (2005). They adapt the theoretical framework of Bisin and Verdier (2001) and investigate the roles of society's norms, culture, or social capital in the process of economic development. In their model, social capital is captured by the "trustworthiness" of agents and affects the productive processes through contractual agreements. Specifically, trustworthiness considerations determine the reliability of trading partners and, therefore, the type of production that will be feasible. It follows that social capital and modern production are complements, so that the evolution of trustworthiness within the population is affected by firms' production decisions. This concept of social capital can be adapted to traditional corruption framework, which allows exploring a "culturalist" perspective to the issue of corruption.

The chapter proceeds as follows: Section 3.2 sets up the model determining steady states and dynamics; Section 3.3 provides an economic experiment and derives the main results; Section 3.4 provides empirical background and evidence in support of the model; and Section 3.5 concludes.

3.2 The Model

The model captures in a simple and formal way, the interaction between bureaucrats, citizens and civic engagement. It adapts the approach of social capital of Francois and Zabojnik (2005) to a corruption framework. To facilitate the discussion, corruption takes the form of bribes for permits or licenses; however, the framework can capture other pervasive types of corruption such as educational corruption, petty corruption or tax evasion.

The economy has an infinite horizon, and each period is denoted by a t subscript. In each period a unit measure of identical bureaucrats is born. Bureaucrats live for one period and their roles is to deliver (mandatory and identical) licenses, for which they earn a salary w_B.[17] It is assumed that each bureaucrat can deliver only one license, but has discretion over the *speed* with which it is delivered.[18] A key feature of the model is that bureaucrats are corruptible, that is, in exchange of a bribe they provide licenses *quickly*. As it will be discussed in the next paragraph, this is valuable to some citizens. It is assumed that bureaucrats care only about expected returns: their choice of whether to act opportunistically (i.e., giving licences quickly) is determined by the conditions of the economy. If bureaucrats participate in corruption, they get a bribe b_t (on top of their salary), but face a probability $p(\lambda_t)$ of being caught, where $\lambda_t \in [0, 1]$

[17] For example, one can think of driving licenses, or licenses to produce or sell goods or services.

[18] Because this is not the key purpose of the model, I am not explicit about the exact process through which bureaucrats deliver licenses. Again, this example aims to facilitate the discussion and alternative examples could work too. For example, instead of bureaucrats, one could think of policemen that can spend more or less time, or ask for more or less documents in their controls. Another example is to think of nurses or doctor who *decide* of the order with which they treat patients in an hospital.

denotes the number of misbehaving bureaucrats. When caught, bureaucrats are sanctioned financially and the sanction δ_B is proportional to the gain of corruption (i.e., $\delta_B < 1$).

In each period, a unit measure of citizens is also born; they live for one period as well.[19] Citizens are heterogenous with respect to their behaviour regarding corruption. Some citizens, called *opportunists* are willing to bribe bureaucrats in order to get licenses *quickly*, while other citizens, called "honest" never participate in corruption. To obtain a licence *quickly* yields a gain ω in utility metric.[20] The citizens who participate in corruption pay the bribe b_t and, just like bureaucrats, face a probability $p(\lambda_t)$ of getting caught.[21] When caught, citizens are also sanctioned financially and the sanction δ_C is proportional to the gain of corruption (i.e., $\delta_C < 1$).

The probability of catching misbehaving agents (bureaucrats and citizens) is linked to civic engagement: for a given level of misbehaving agents, a *more* engaged civil society catches/punishes *more* of them. The probability that a misbehaving agent is caught increases with the number of corrupted bureaucrats and the increase occurs at a decreasing rate. Formally, it is assumed that

[19] The equal measure of bureaucrats and citizens is not necessary here. Without loss of generality, a larger population of citizens could be assumed.

[20] One can interpret ω as the benefits from obtaining a licence quickly. In other examples of corruption, ω could represent the gains from tax evasion, or, in the case of the buying of a diploma, the expected gain from pretending to be competent on the labour market.

[21] Imposing that misbehaving citizens face a different probability of being caught, for instance one that does not depend on λ_t, would not affect the results of the model.

$p'(\lambda_t) \geq 0$, and $p''(\lambda_t) \leq 0$.[22] In other words, for a given level of civic engagement, misbehaving agents are caught with low probabilities when there are only a few corrupted bureaucrats, but the probability of being caught increases with the number of corrupted bureaucrats. It follows that the upper and lower bounds for the probability are $p^u \equiv p(1)$, and $p^l \equiv p(0)$, respectively.

Finally, the size of the bribe is determined endogenously by the matching that occurs between the misbehaving bureaucrats and the bribing citizens.

3.2.1 Preferences

As mentioned earlier, citizens are one of two types: honest or opportunist. These features are intrinsic to the individual and are influenced by social conditioning (described in the next section). The honest citizens commit to never participate in corruption, that is, they are moral citizens who do not consider participating in corruption. They receive a psychological, non-pecuniary, benefit γ when making good on their commitment.[23,24] Such rewards find support in the socio-psychological literature. For instance, Platteau (2000), Elster (1989)

[22] It is possible to achieve similar results by imposing $p'(\lambda_t) \leq 0$. However, additional assumptions are necessary. Indeed, with $p'(\lambda_t) \leq 0$ (and without additional assumptions), an increase in the number of corrupted bureaucrats always leads to further increases of their number, which is not desirable. Examples of additional hypothesis include allowing w_B to be a function of λ and imposing restrictions on $\frac{\partial w_B}{\partial \lambda} < 0$. Another alternative is to allow bureaucrats to be heterogenous too and impose restrictions on their behaviour. With such hypotheses, increases in the number of corrupted bureaucrats will not *always* lead to a further increase of their number.

[23] An implicit assumption is that, even when they are matched with corrupted bureaucrats, honest citizens are still able to get a licence.

[24] Alternatively, one could consider preferences that carry - in addition to γ - a cost arising from the reduced set of options that the honest type has available. Such a specification is adopted by Bisin and Verdier (2001) and Francois and Zabojnik (2005). Doing so would not affect the qualitative results of this chapter.

or Coleman (1990) examine such intrinsic motivations.[25]

An Honest Citizen living in period t has the following lifetime utility:

$$U_C^H(t) = \begin{cases} 0, & \text{if } \underline{\text{not}} \text{ matched with a corrupted bureaucrat}, \\ \gamma, & \text{otherwise}. \end{cases}$$

The opportunistic citizens care only about their expected returns and, therefore, try to bribe for licenses if it is optimal to do so.[26] In exchange for a bribe b_t, an opportunist obtains a license *quickly* from a corrupted bureaucrat, which yields a gain in utility metric (ω). The opportunists face a probability $p(\lambda_t)$ of getting caught, in which case they lose a fraction δ_C of ω, with $\delta_C < 1$. An Opportunist's lifetime utility at time t is thus

$$U_C^O(t) = \begin{cases} 0, \text{ if } \underline{\text{not}} \text{ able to find a corrupted bureaucrat}, \\ (1 - p(\lambda_t))\ (\omega - b_t)\ +\ p(\lambda_t)\,(\omega - b_t - \delta_C\omega)\,, \text{ otherwise}. \end{cases}$$

The bureaucrats are opportunists. They earn a wage w_B and decide whether to participate in corruption or not. When they do so, they receive the bribe b_t unless they get caught, in which case they get the bribe and only a fraction δ_B of the benefit ω, with $\delta_B < 1$.[27] Given the number of misbehaving bureaucrats λ_t, the lifetime utility of a bureaucrat is

$$U_B^O(t) = \begin{cases} w_B, \text{if } \underline{\text{not}} \text{ participating in corruption}, \\ (1 - p(\lambda_t))\ (w_B + b_t)\ +\ p(\lambda_t)\,(w_B + b_t - \delta_B\omega)\,, \text{ otherwise}. \end{cases}$$

[25] Specifically, Platteau (2000) analyzes such psychological benefit under the heading of "moral norms."

[26] Honest citizens are also optimizers though, just with different preferences.

[27] Imposing that the sanction is proportional to the benefit of corruption ω, guarantees limited liability. Alternatively, one could impose that the sanction is proportional to the wage w_B and/or that the bribe is lost, and get qualitatively similar results, except for one result in the experiment section, for which I will be explicit.

The matching process of bureaucrats and citizens can now be discussed.

3.2.2 The Matching Process and the Size of the Bribe

Bureaucrats are randomly matched with citizens and it is assumed that each bureaucrat matches with at most one citizen. Let β_t and $(1-\beta_t)$ respectively denote the fractions of honest (H type) and opportunists (O type) citizens at time t. Successful matchings, the ones generating corruption, depend on the number of opportunists $(1-\beta_t)$ and the number of misbehaving bureaucrats λ_t. It follows that:

$$\begin{aligned}\text{Prob. (a corrupted bureaucrat meets an opportunistic citizen)} &= (1-\beta_t),\\ \text{Prob. (opportunistic citizen meets a corrupted bureaucrat)} &= \lambda_t.\end{aligned}$$

Let $V_B(b_t)$ and $V_C^O(b_t)$ respectively denote the value functions of bureaucrats and citizens who participate in corruption when the size of the bribe at time t is b_t.

$$\begin{aligned}V_B(b_t) &= \text{Prob. Match} \times \text{Value of a Match} + \text{Prob. } \textbf{No} \text{ Match} \times \text{Value of } \textbf{No} \text{ Match}\\ &= (1-\beta_t)\left[p(\lambda_t)(w_B+b_t-\delta_B\omega)+(1-p(\lambda_t))(w_B+b_t)\right]+\beta_t w_B\\ V_B(b_t) &= w_B+(1-\beta_t)\left[b_t-p(\lambda_t)\delta_B\omega\right]. \qquad (3.1)\end{aligned}$$

and

$$\begin{aligned}V_C^O(b_t) &= \text{Prob. Match} \times \text{Value of a Match} + \text{Prob. } \textbf{No} \text{ Match} \times \text{Value of } \textbf{No} \text{ Match}\\ &= \lambda_t\left[p(\lambda_t)((1-\delta_C)\omega-b_t)+(1-p(\lambda_t))(\omega-b_t)\right]+(1-\lambda_t)\times 0\\ V_C^O(b_t) &= \lambda_t\left[\omega(1-p(\lambda_t)\delta_C)-b_t\right]. \qquad (3.2)\end{aligned}$$

It follows that the participation constraints (*P.C.*) are

$$\text{P.C. Bureaucrats:} \quad V_B^O(b_t) - w_B > 0 \Leftrightarrow (1-\beta_t)\left[b_t - p(\lambda_t)\delta_B\omega\right] > 0,$$

$$\text{P.C. Opportunist Citizens:} \quad V_C^O(b_t) - 0 > 0 \Leftrightarrow \lambda_t\left[\omega(1-p(\lambda_t)\delta_C) - b_t\right] > 0.$$

Using a simple Nash Bargaining solution, yields the optimal size of the bribe b_t^*:

$$b_t^* = \frac{\omega}{2}\left[1 - p(\lambda_t)(\delta_C - \delta_B)\right].$$

The optimal bribe thus splits the surplus that participants (bureaucrats and citizens) receive, and also reflects the risk they face.

Using b_t^*, the expected lifetime utility of citizens of either type at time t becomes:

$$\begin{aligned} E\left[U_C^H(t)\right] &= \lambda_t\gamma, \\ &\text{and} \\ E\left[U_C^O(t)\right] &= \lambda_t\left[\omega(1-p(\lambda_t)\delta_C) - b_t^*\right] \\ &= \frac{\lambda_t\,\omega}{2}\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]. \end{aligned}$$

In the same manner, the expected lifetime utility for bureaucrats is:

$$\begin{aligned} E\left[U_B^O(t)\right] &= w_B + (1-\beta_t)\left[b_t^* - p(\lambda_t)\delta_B\omega\right] \\ &= w_B + \frac{(1-\beta_t)\omega}{2}\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]. \end{aligned}$$

3.2.3 Cultural Evolution of Preferences of Citizens

A citizen's type is determined by an evolutionary process of cultural selection inspired by Bisin and Verdier (2001) and Francois and Zabojnik (2005), from

which this section borrows. The principal feature of this approach is that the evolution of type is influenced by the parents, who rely on their own preferences to evaluate the lifetime returns of their child.

There is asexual one-for-one reproduction with the possibility of only two types in the population-the honest and the opportunists. The intergenerational transmission of preferences occurs through a stochastic socialization process. There is a probability that parents socialize a child to have the same preferences as themselves; this is called direct socialization. There is also a probability that an individual's characteristics will be determined by imitating someone outside the family, a process called indirect socialization. The probability that an honest parent directly socializes her child into being honest is denoted $d^H(\beta_t, \lambda_t)$. Similarly, let $d^O(\beta_t, \lambda_t)$ denote the probability that an opportunistic parent directly socializes her child into being opportunistic. Both probabilities are allowed to be functions of the respective numbers of honest agents and corrupted bureaucrats in the population. I will return to the precise relationship subsequently.

If a child from a family with trait i = H or O is not directly socialized by her parent, then she is indirectly socialized with a trait by imitating a randomly chosen non-family member. This person may be a teacher, a more distant family member, or anyone else with influence, but the upshot is that the probability of a type simply reflects the frequency of that type in the population. For example, given a parent of type H, if with probability $1 - d^H(\beta_t, \lambda_t)$ the child is not directly socialized by the parent, then with probability β_t the child is indirectly

socialized to be H anyway (and, with probability 1-β_t, she is indirectly socialized to be O-type). Let $P^{i,j}$ be the probability that a citizen with a parent of type i is socialized to trait j. It turns out that, by the law of large numbers, $P^{i,j}$ will also denote the fraction of children with a type i parent who have preferences of type j. The following equations describe these probabilities:

$$\begin{aligned} P^{H,H} &= d^H(\beta_t, \lambda_t) + \left[1 - d^H(\beta_t, \lambda_t)\right] \beta_t \\ P^{H,O} &= \left[1 - d^H(\beta_t, \lambda_t)\right] (1 - \beta_t) \\ P^{O,O} &= d^O(\beta_t, \lambda_t) + \left[1 - d^O(\beta_t, \lambda_t)\right] (1 - \beta_t) \\ P^{O,H} &= \left[1 - d^O(\beta_t, \lambda_t)\right] \beta_t. \end{aligned} \tag{3.3}$$

From these probabilities, it follows that the difference equation for β is

$$\begin{aligned} \beta_{t+1} - \beta_t &= P^{H,H}\, \beta_t + P^{O,H}\, (1 - \beta_t) - \beta_t \\ &= \beta_t(1 - \beta_t) \left[d^H(\beta_t, \lambda_t) - d^O(\beta_t, \lambda_t)\right]. \end{aligned}$$

Using a continuous time limit of this equation produces:

$$d\beta_t = \beta_t(1 - \beta_t) \left[d^H(\beta_t, \lambda_t) - d^O(\beta_t, \lambda_t)\right]. \tag{3.4}$$

This differential equation describes how the socialization process determines the evolution of β_t in the population. From equation (3.4), it is clear that the direction of evolutionary change depends critically on the relative probability $d^H(\beta_t, \lambda_t) - d^O(\beta_t, \lambda_t)$. Intuitively, this states that evolutionary pressures lead to an increase in type H if the probability of direct socialization by honest parents exceeds the one of opportunistic parents, and vice versa. This also formalizes the evolution of social capital (captured by honesty) in the economy.

Direct Socialization and Relative Returns

Even though there is no explicit parental decision, direct socialization occurs as if parents put efforts in socializing their children after themselves. This follows Bisin and Verdier (2001).[28] The parents, therefore, evaluate the expected lifetime utility of a person of their own type, and the better a person does relative to those of the other type, the higher the probability of direct socialization. Because the evaluation is in terms of the parents' own preferences, it can involve more than just income.

A reduced-form modelling approach is taken here. Hence, it is assumed that $d^H(\beta_t, \lambda_t)$ is increasing in $E[U_C^H(t)] - E[U_C^O(t)]$ when evaluated using type H's preferences, and that $d^O(\beta_t, \lambda_t)$ is increasing in $E[U_C^O(t)] - E[U_C^H(t)]$ when evaluated using type O's preferences. The reasoning here is spelled out in Bisin and Verdier (2001): parents have what has been termed "partial empathy", which they use to determine how much effort they spend inculcating their child to be the same type. When doing so, they consider the expected lifetime outcomes that their child would obtain conditional upon the child's realized type; the empathic part. However, parents are able to evaluate these outcomes only by using their own preferences; hence the partialness of the empathy. When they estimate a large gain in expected outcome from inculcating the child to be like themselves, they will expend great effort to make this so. These efforts involve actions like instructing and monitoring the child in behaviour, disciplining, selecting their contacts, and so forth. It is assumed that parents can exert some

[28] It is possible to model explicitly the efforts of parents [as in Bisin, Topa, and Verdier (2002)] and to obtain qualitatively similar results.

influence over the outcome but that control is not perfect; hence the d's remain probabilities only. It is, moreover, assumed that parents are unable to inculcate for a type that is not their own; a H-type parent simply does not have access to the inculcation technology required to make an O-type offspring.

The difference in parental types' evaluations of outcomes arises from the nonpecuniary γ term, which enters for the honest parents only. Thus, with λ_t corrupted bureaucrats, the evaluation from the perspective of honest parents yields: $d^H(\beta_t, \lambda_t)$ is increasing in $E[U_C^H(t)] - E[U_C^O(t)] = \lambda_t \left[\gamma - \frac{\omega}{2}\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]\right]$. Similarly, the evaluation from the perspective of opportunistic parents yields: $d^0(\beta_t, \lambda_t)$ is increasing in $E[U_C^O(t)] - E[U_C^H(t)] = \lambda_t \left[\frac{\omega}{2}\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]\right]$, where the only difference is that the γ is not evaluated by these parents. It thus follows directly that the difference in probability $d^H(\beta_t, \lambda_t) - d^O(\beta_t, \lambda_t)$, is increasing in the expression $Z \equiv \lambda_t \left[\gamma - \omega\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]\right]$.

Let Φ: R$\rightarrow$[-1,1] define the mapping from Z to the probability difference $d^H(\beta_t, \lambda_t) - d^O(\beta_t, \lambda_t)$. Apart from $\Phi' > 0$, it is assumed that Φ is continuous and that $\Phi(0) = 0$. The parametric restrictions that will be imposed below rule out cases when one type clearly dominates so that the evolutionary dynamics implied by (3.5) does not lead to only one type.

$$d\beta_t = \beta_t(1 - \beta_t)\Phi\Big(\lambda_t\left[\gamma - \omega\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]\right]\Big). \tag{3.5}$$

Note that there is a "slow" adjustment implied by such an evolutionary specification. If direct parental socialization favours increased honesty ($d^H > d^O$) then evolution will produce more honest individuals, but the population will adjust only gradually and will not immediately consist entirely of H-types.

3.2.4 Dynamic Adjustment of Bureaucrats

The law of motion for λ_t is discussed next. From the lifetime utility of bureaucrats, they participate in corruption if and only if the expected gains from corruption are positive. Formally, they participate in corruption if and only if $\chi(\beta_t,\, \lambda_t) \equiv \frac{(1-\beta_t)\omega}{2}\left[1 - p(\lambda_t)(\delta_C + \delta_B)\right] > 0$.

The critical assumption here is that the measure of honest (and corrupted) bureaucrats adjusts quickly relative to the speed at which citizens' characteristics change. It is assumed that all adjustment occurs immediately.[29] In particular, define $\lambda_t^* \in R$ such that $\chi(\beta_t,\, \lambda_t^*) = 0$ so that $d\lambda = 0$. The law of motion of corrupted bureaucrats can thus be described by the following equation. For a given λ_t

$$\left.\begin{array}{l} \text{if } \chi(\beta_t\,, \lambda_t) < 0, \text{ then } \lambda_t > \lambda_t^* \text{ and the measure of corrupted bureaucrats} \\ \qquad\qquad\qquad\qquad\qquad\qquad \text{decreases so that } \lambda_t = \max\{0, \lambda_t^*\}; \\ \text{if } \chi(\beta_t\,, \lambda_t) > 0, \text{ then } \lambda_t < \lambda_t^* \text{ and the measure of corrupted bureaucrats} \\ \qquad\qquad\qquad\qquad\qquad\qquad \text{increases so that } \lambda_t = \min\{1, \lambda_t^*\}; \\ \text{if } \chi(\beta_t\,, \lambda_t) = 0, \text{ then } \lambda_t = \lambda_t^* \text{ and there is no change in } \lambda_t. \end{array}\right\} \tag{3.6}$$

Equation (3.6) ensures that λ_t is a jump variable. It implies that the number

[29] Intuitively, this assumption captures the idea that a corporation (here the bureaucracy) adjusts more quickly than the society as a whole. This is analogous to firm adjustment being quicker than that of individual types in Francois and Zabojnik (2005) and Nelson and Winter (1982). Moreover, the model can be modified by allowing evolutionary considerations to affect bureaucrats. For instance, one could obtain similar results by assuming that the bureaucrats who commit not participate in corruption receive a psychological, non-pecuniary benefit when making good on their commitment. However, it will still be required that they adjust more quickly than citizens.

of corrupted bureaucrats immediately adjusts to the environment. As demonstrated in the appendix, $\chi(\beta_t, \lambda_t)$ is downward sloping in the $(\beta,\ \lambda)$ space: as the number of honest citizens increases, the critical mass of corrupted bureaucrats that can support corruption, λ^*, decreases.

Therefore, the evolution of the numbers of citizens and bureaucrats depends on both pecuniary benefits (the probability of being caught and sanctions) and non-pecuniary benefits (psychological benefit). Also, it should be noted that civic engagement affects the monitoring of agents *directly* and the creation of social capital (captured by the notion of honesty) *indirectly*.

3.2.5 Parameter Restrictions

Parameters restrictions are imposed to insure one type of agent does not always dominate. Recall that $p^l \equiv p(0)$, and $p^u \equiv p(1)$ are the lower and upper bounds on the probability a misbehaving agent gets caught.

Assumption 1.

$$\gamma - \omega \left[1 - p^u(\delta_C + \delta_B)\right] > 0.$$

This assumption ensures that the net benefit of being honest is positive when the probability of catching misbehaving bureaucrats is at its maximum. If this was not the case, evolutionary forces would never favour the selection of the honest type. However, in order to prevent that honesty is always prevalent the following must also be imposed:

Assumption 2.

$$\gamma - \omega \left[1 - p^l(\delta_C + \delta_B)\right] < 0.$$

Hence, when the probability of catching misbehaving bureaucrats is at its lowest, selection cannot favour honest citizens. Conversely, the following assumptions insure that when the probability of being caught is low (high), there is an incentive for bureaucrats to be dishonest (honest).

Assumption 3.

$$1 - p^l(\delta_C + \delta_B) \; > \; 0,$$

Assumption 4.

$$1 - p^u(\delta_C + \delta_B) \; < \; 0.$$

Therefore, assumptions 1 through 4 insure that citizens and bureaucrats' behaviour are consistent with each other. Finally, restrictions on $p(\lambda)$ and its derivatives are also imposed:

Assumption 5.

5.1 p^u *and* p^l *are finite valued. In particular,* $p(0) < 1$ *and* $p(1) > 0$.

5.2 $\forall\lambda,\ p'(\lambda),$ *and* $p''(\lambda)$ *are finite valued. Furthermore,* $\forall\lambda,\ -\dfrac{\lambda\, p''(\lambda)}{p'(\lambda)} < 2.$

Assumption 5 puts restrictions on the probability function and imposes that the coefficient of relative risk aversion, $-\frac{\lambda\, p''(\lambda)}{p'(\lambda)}$, does not exceed 2; in other words, agents are required not to be risk-lovers.

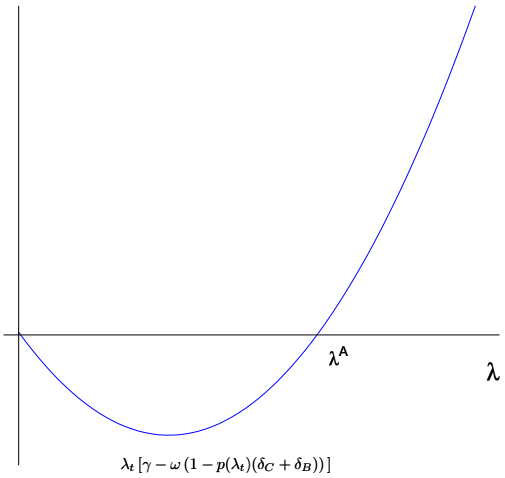
3.2.6 Steady States

The interaction between equations (3.5) and (3.6) determines the model's steady states. From (3.5), the term in large parentheses describes the expected returns to honesty relative to opportunism, $E[U_t^H] - E[U_t^O]$:

$$\lambda_t \left[\gamma - \omega \left[1 - p(\lambda_t)(\delta_C + \delta_B)\right]\right]. \tag{3.7}$$

The sign of (3.7) determines the direction of evolutionary changes, $d\beta$, for $\beta \neq 0$ or 1. It can be shown that the first derivative with respect to λ_t is indeterminate: negative for low values of λ_t and positive for high values of λ_t. Intuitively, when the number of corrupted bureaucrats is low, the proportion of honest citizen is decreasing in λ_t. For high levels of corrupted bureaucrats, the fraction of honest citizens is increasing in λ_t. It can also be shown that, given the parameter restrictions and the properties of $p'(\lambda_t)$ and $p''(\lambda_t)$, the second derivative of function (3.7) is always positive. It follows that function (3.7) initially slopes downward, reaches a unique turning point, changes slope and increases thereafter. This is depicted in Figure 3.1.

Figure 3.1: Evolutionary Incentives as a function of λ.



The existence proposition for interior steady states can now be established.

Proposition 3. *Under assumptions 1-5, there exists a unique stable interior equilibrium, (λ^A, β^A), if, and only if, there exists at least one value of* $\lambda \in (0,1)$ *such that* $\lambda\left[\gamma - \omega\left[1 - p(\lambda)(\delta_C + \delta_B)\right]\right] < 0$.

In this equilibrium,

$$\beta^A(1-\beta^A)\Phi\Big(\lambda^A\left[\gamma - \omega\left[1 - p(\lambda^A)(\delta_C + \delta_B)\right]\right]\Big) = 0, \tag{3.8}$$

and

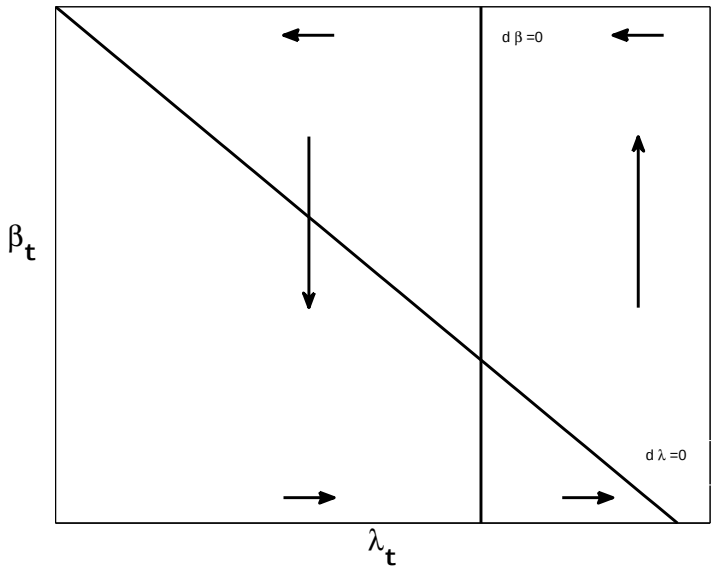
$$\chi(\beta^A, \lambda^A) = 0, \tag{3.9}$$

with $\chi(\beta^A, \lambda^A)) \equiv \frac{(1-\beta^A)\omega}{2}\left[1 - p(\lambda^A)(\delta_C + \delta_B)\right]$.

The formal proof of this Proposition is contained in Appendix E. The dynamics of the model, however, can be understood diagrammatically (Figure 3.2).

At low and intermediary levels of λ, evolutionary incentives favour opportunism. Graphically, this is depicted by the benefit line in Figure 3.1 being

Figure 3.2: Loci for dλ=0, and dβ=0.



below zero. However, as λ increases, the probability of being caught also increases. It follows that, for higher values of λ, evolutionary incentives favour honesty. Because the benefits of citizens' honesty are independent of β, it follows that the movements are in the vertical β direction in the $(\beta,\ \lambda)$ space, as illustrated by the vertical arrows in figure 3.2. The $d\beta = 0$ line corresponds to the crossing point between the curved line and the horizontal axis in Figure 3.1.

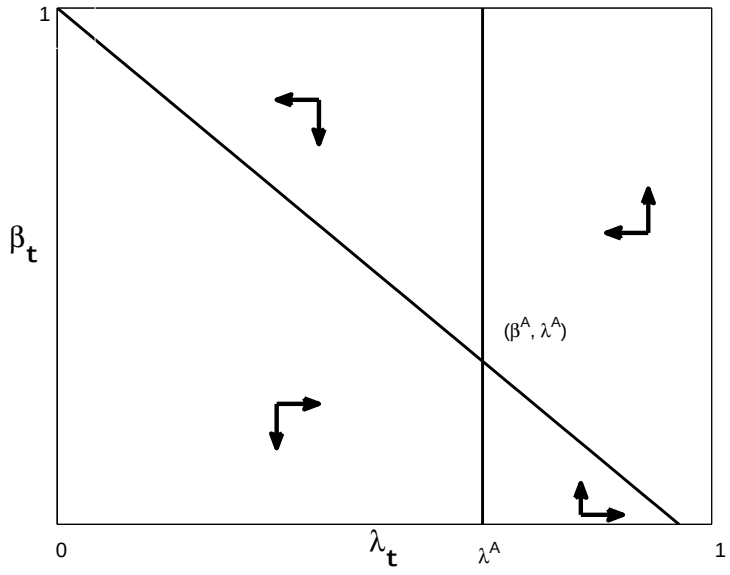
The behaviour of bureaucrats, determined by equation (3.6), can also be analyzed diagrammatically. The $d\lambda = 0$ loci correspond to the combinations of β and λ for which the bureaucrats are indifferent between participating in corruption or not; this happens when $\chi(\beta, \lambda) = 0$. As mentioned above, because a higher proportion of honest agents can only support lower levels of corruption, this relationship is downward sloping in the $(\beta,\ \lambda)$ space (as depicted in Figure

3.2). The horizontal arrows illustrate the directional changes in λ.

Clearly, an interior steady state requires evolutionary incentives to be balanced. This occurs where both $d\lambda = 0$ and $d\beta = 0$. Assumptions 1 to 5 are sufficient to ensure that the crossing points between the loci of $d\beta = 0$ and $d\lambda = 0$ are in the interior of the phase space. In figure 3.2, this condition occurs at one value of λ.

At the stable steady state (β^A, λ^A), any *shock* is offset by evolutionary forces, illustrated by the arrows in 3.3, so that the equilibrium is maintained.

Figure 3.3: Interior Steady States.



Hence, though by construction, opportunist agents always do better than honest agents in a pecuniary sense, the (nonstandard) evolutionary dynamics used here ensure the existence of an interior steady state with both types of agents. It should be noted that an unstable steady state with no corruption exists at one corner.

Proposition 4. *Under Assumptions* $1-5$ *there exists a steady state with only honest citizens and no opportunistic bureaucrats* $(\beta = 1, \lambda = 0)$. *This steady state is unstable. The corner with only opportunistic agents* $(\beta = 0, \lambda = 1)$ *is not a steady state.*

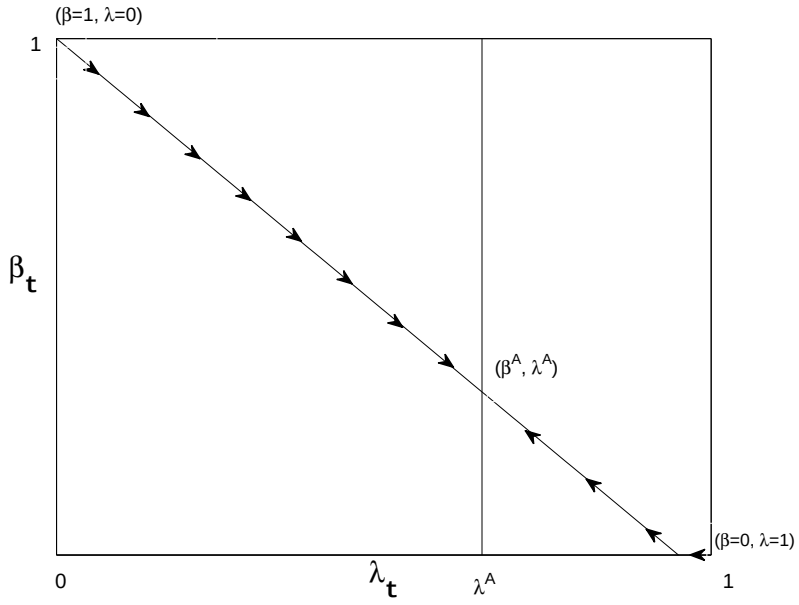
When there are no corrupted bureaucrats $(\lambda = 0)$, citizens can only be honest ($\beta = 1$). However, this equilibrium is unstable since the evolutionary incentives favour opportunism for low values of λ. Hence, the economy cannot stay in the *good* equilibrium without corruption. The other corner, with only opportunistic agents is not an equilibrium, since the payoffs for being honest move agents away from opportunism. The dynamics of the model are discussed next.

3.2.7 Dynamics

Figure 3.4 depicts the dynamics of the system. Recall that the mass of corrupted bureaucrats adjusts instantaneously, while the evolution of the types of citizens is gradual. Hence, from any point not on the $d\lambda = 0$ loci, adjustment involves immediate changes in λ until the $d\lambda = 0$ loci is reached.

The interior steady state (β^A, λ^A) is stable. At this point, a small increase in λ increases the psychological benefit of being honest and offsets its cost so that evolutionary incentives favour honesty, and β rises. The increase in β leads, in turn, to a decrease in λ, which eventually returns to λ^A. The direction of any adjustment away from a steady state is also depicted in Figure 3.4.

Figure 3.4: Convergence paths.



3.3 Fighting Corruption Through an Engaged Civil Society

The framework can now be used to inform the debate about the role of an engaged civil society against corruption. The influence of Civil Society Organizations (CSOs) on public policies has increased in recent decades. Examples of this include worldwide advocacy campaigns around issues including debt relief, environmental protection, and the fight against hunger and poverty. Of particular relevance to this paper, is the observance that civic engagement can generate political will, can monitor and enforce good behaviour from public officials through multilateral actions that include regular interventions in the media, and support for the implementation of anti-bribery instruments.

In a field experiment conducted in India, Duflo, Hanna, and Ryan (2010) showed that citizens can contribute to the monitoring of "frontline service providers" like teachers. In their paper, students monitored their teacher's attendance by taking photographs with time and date stamps. The authors found that not only did the absence rate of teachers fall by 21 percentage points relative to the control group, but that children's test scores increased by 0.17 standard deviations. This experiment demonstrates that engaged citizens, empowered with appropriate tools, can be effective at tackling the misbehaviour of public officials.

Another example of the effective impact of changes in civic engagement is found in Indonesia. During the Suharto's regime, few institutions or people denounced the systemic corruption that involved government officials and corporate organizations. In the late nineties CSOs and the media began to expose many cases of corruption, including scandals related to the Suharto ranches, and to scams pertaining to the displacement of people for the construction of a dam ; CSOs have also conducted research into the bribery of judges (Holloway (2001)). All of these actions contributed to a decrease in corruption.

CSOs can shape the behaviour of economic actors through outreach activities. For example, a report of the OECD (2003) cited the role of civil society in South East Europe. Until recently, civil society's participation was perceived as irrelevant for public policy. However, CSOs have increasingly been involved in mobilizing against corruption and enhancing the institutional environment. The USAID noticed a similar pattern in Benin in recent years, and reported that CSOs' awareness campaigns, and media coverage, forced public officials to

denounce corruption perpetrated at all levels.[30]

Around the world, the increase in activity of civil society has led to enhanced actions against corruption. A 2011 report from the World Bank discusses how, for instance, in Mexico, CSOs contributed to the enactment of accountability mechanisms, and how in South Africa, CSOs helped monitor the implementation of better financial regulations and service delivery.

These facts provide examples of how *changes* in the engagement of the civil society can affect corruption outcomes. The experiment presented below adds a formal basis to the discussion.

3.3.1 Modeling a more Engaged Civil Society

In this section, the effects of a *more* engaged civil society on the unique stable equilibria are analyzed. Formally, this is captured by an exogenous change in the model: the values of $p(\lambda)$ increase at all levels of λ. In words, opportunists are more likely to get caught. Let $p^N(\lambda)$ denote this new function.[31] To ensure existence of a stable steady state, p^N needs to satisfy the parameter restrictions contained assumptions 1 through 5.

A change in civic engagement has an effect on the equilibrium (β^A, λ^A). Substituting $p^N(\lambda)$ for $p(\lambda)$ in the two differential equations governing the dynamics of the system (equations (3.8) and (3.9)), and solving for points at which $d\beta = 0$ and $d\lambda = 0$ yields a new equilibrium. Graphically, the increase in $p(.)$

[30] The report, which collects specific descriptions of actions of civil society in Benin, is available at http://africastories.usaid.gov .

[31] It should be clear that all parameters other than $p(.)$ are unaffected.

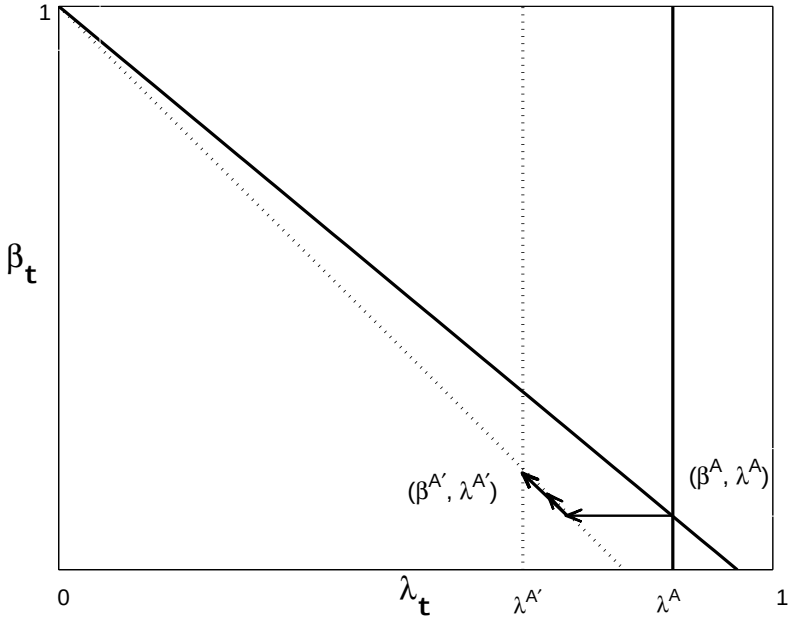
implies an upward shift in Figure 3.1. This shift implies a leftward shift in the locus $d\beta = 0$ at the stable steady state as illustrated in Figure 3.5.

The effect on the differential equation of bureaucrats is also intuitive: for each level of β, a lower level of λ is *tolerated*. Graphically, this is illustrated by a downward shift of the loci $d\lambda = 0$ through the corner $(\beta = 1, \lambda = 0)$. Figure 3.5 depicts the transition of the economy from the old to the new steady state $(\beta^{A\prime}, \lambda^{A\prime})$. In the new steady state, the number of corrupted bureaucrats is unambiguously lower. However, the effect on β is ambiguous since it depends on the effects on the loci $d\beta$ and $d\lambda$: if the effect on $d\beta$ is greater (smaller), β increases (decreases).

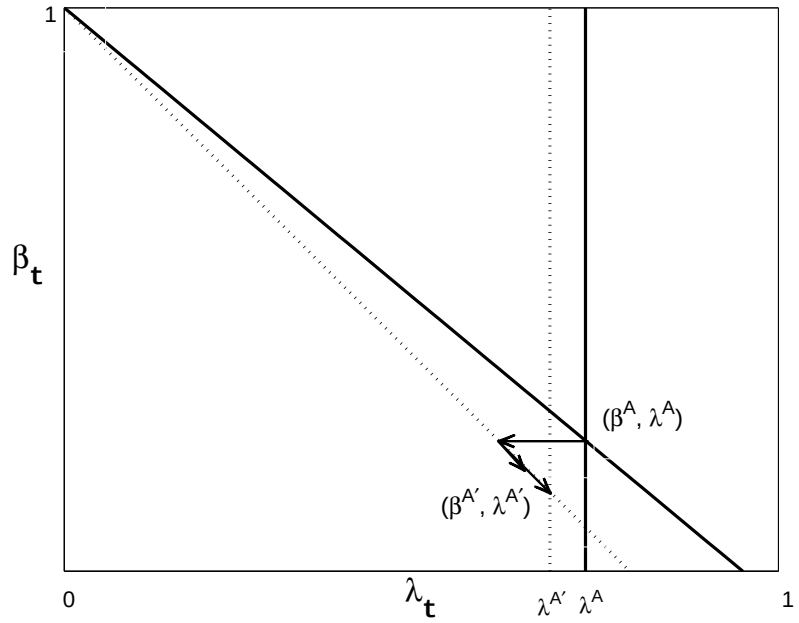
As civil society becomes more engaged, there is an immediate decrease in the number of corrupted bureaucrats, while the level of honest citizens is unchanged; this is illustrated by a horizontal left arrow in both panels of Figure 3.5. In the case where the effect on $d\beta$ is bigger (top panel), the evolutionary forces lead to an increase in β such that the initial decline in λ is followed by subsequent decreases in λ. These decreases are the result of the increasing difficulty of finding citizens willing to participate in bribery. The system finally stabilizes at the new steady state $(\beta^{A'}, \lambda^{A'})$. Therefore, under this scenario, the change in civic engagement generates a virtuous circle whereby more social capital emerges (more honest bureaucrats and citizens) and corruption falls.

In the scenario where the effect on $d\beta$ is smaller (bottom panel), the evolutionary forces favour opportunism and the mass of citizens willing to bribe increases. It follows that, after an initial decrease, the number of corrupted bureaucrats increases. Indeed, the increased ease with which bureaucrats can

Figure 3.5: Convergence paths: corruption falls.



(a) Effect on $d\beta$ is greater: λ decreases and β increases.



(b) Effect on $d\lambda$ is greater: λ decreases and β decreases.

find citizens willing to bribe, and the increased size of bribes, attracts more bureaucrats into being corrupted. The system finally stabilizes at the new steady state $(\beta^{A'}, \lambda^{A'})$.

Therefore, in the new equilibrium, the change in the number of honest agents is ambiguous, while the number of corrupted bureaucrats falls unambiguously. Empowering civil society is thus effective in the fight against corruption, and the dynamics of adjustment, outlined here, provide a possible explanation for why countries that developed engaged civil society have been able to reduce corruption. Furthermore, the ambiguous effect on β stresses an important result. Countries enjoy lower levels of corruption, not necessarily because they have more honest citizens (i.e., more social capital), but rather because, for each level of honest citizens, lower levels of corruption are *tolerated*. This is similar to the idea of an access to a better *technology*.

It is interesting to contrast the effect of civic engagement with the fact that wage policies are ineffective in this setup. Specifically, increasing the bureaucrats' wages w_B would have no effects on the loci $d\beta$ and $d\lambda$, and would, therefore, be ineffective at reducing corruption.[32] This prediction is consistent with several empirical works that found no statistical significant relationship between wages and corruption.[33]

[32] It should be acknowledged that this result depends on the specification of the sanction. If the sanction on bureaucrats is made proportional to wages, wage policy can affect corruption level. In addition, civic engagement tends to be higher in countries with higher levels of wages. Hence, it cannot be ruled out that wage policies could play a role - even indirectly through civic engagement - in the fight against corruption.

[33] For example, using data from public hospitals in Argentina, Di Tella and Schargrodsky (2003) find no statistical relationship between pay and corruption - even after making adjustments for hospital size, experience, and other factors. Savedoff (2008), in a note on the issue, depicts similar patterns in Venezuela. For a list of papers on the relationships between wages and corruption, see Di Tella and Schargrodsky (2003).

This section has demonstrated that civic engagement can play a role in the fight against corruption by shaping citizens' behaviour and monitoring bureaucrats. The theory predicts three important results that can be tested empirically. First, a negative relationship between civic engagement and corruption. Second, an ambiguous relationship between corruption and social capital. Third an ineffective role for wage policies. The next section demonstrates that these results (except result three due to a lack of data) are supported by the data.

3.4 Empirical Evidence

This section provides empirical support for the predictions of the model. The data is taken from Round 3 of the Afrobarometer surveys, which were conducted from March 2005 to February 2006. The Afrobarometer "measures the social, political, and economic atmosphere in Africa", and is designed for cross-country comparisons. The Afrobarometer is particularly suited for this paper since it provides direct data on corruption, and variables that perform well as proxies for the engagement of civil society. Round 3 of the Afrobarometer covers the following 18 countries: Benin, Botswana, Cape Verde, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda, Zambia, Zimbabwe. Dropping all missing observations on age and education leaves $25,021$ potential observations. The section begins with a presentation of the variables that support the analysis, followed by a discussion of the regression results.

3.4.1 Empirical Definitions of Corruption, Social Capital and Civic Engagement

A detailed description of the variables is provided in Appendix G. Five indicators of corruption contained in the survey are considered. These are: *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:* (1) Get a document or a permit; (2) Get a child into school; (3) Get a household service (like piped water, electricity, or phone); (4) Get medicine or medical attention; and (5) Avoid a problem with the police (passing a checkpoint, avoid a fine or arrest). Specifically, dummy variables indicating whether individuals paid bribes *A Few Times* or *Often* are constructed.[34]

Social capital in the model relates to the trait of character (a preference parameter) determining whether individuals would participate in corruption. To capture this notion empirically, a dummy variable is constructed to indicate whether an individual would bribe in *any* of the following situations :[35]

- if encountering a misbehaving school or clinic official;
- if his/her name is off the voters roll;
- if encountering delays to get a government permit or license;
- in the event of a wrongful arrest in his/her family;

[34] The possible answers to the questions are *Never*, *Once or Twice*, *A Few Times* and *Often*. It should be noted that relying on ordered probit to analyze the corruption levels yields results that are qualitatively similar to the ones presented here.

[35] Alternatively, one could rely on each *individual* indicator and obtain similar results.

- in the event of a wrongly seized family land.

Finally, the notion of civic engagement is analyzed through an indicator that is constructed at the country level. The indicator is the propensity that citizens have (or would have) joined others to raise an issue *several times* or *often*.[36]

The aforementioned measures of corruption and social capital are sequentially regressed on the proxy of civic engagement. Doing so allows us to investigate the effect of civic engagement, at the country level, on the individual's decision to participate in corruption, and the individual's level of social capital.

Besides civic engagement, the regressions of corruption include other controls such as the respondent's gender, age (and age^2), education level dummies (primary or postsecondary), and employment status.[37] Because corruption is likely to be more common in cities, the specification controls for whether the respondent lives in an urban district. To account for institutional differences attributable to colonization, a dummy for former British colonies is introduced. A dummy variable for West African countries is also included, which is meant to capture potential unobserved cross-country regional features. Finally, a respondent's social capital dummy is also included to align with the model.[38]

The specification that has social capital as the dependent variable controls for gender, age, age^2, the urban district dummy, and civic engagement. These variables tell something about variation across individuals. To align with the

[36] Possible answers are *No, would never do this*; *No, but would do if had the chance*; *Yes, once or twice*; *Yes, several times* and *Yes, often*.

[37] The education category that is left out is secondary education.

[38] Removing the social capital indicator from the corruption regressions yields similar result.

model, the specification also controls for the country-average social capital. To perfectly align with the model, one would include the social capital of parents, however this variable is unavailable.

All specifications correct for heteroscedasticity, and the residuals are clustered at the district level. This formulation intends to capture the possibility that formal institutions vary within a country, possibly at the district level.[39]

3.4.2 OLS Results

The predictions from the model are compared with empirical results herein contained. Specifically, I expect (1) a negative relationship between civic engagement and corruption, and (2) an ambiguous relationship between corruption and social capital.[40]

Table 3.1 reports the empirical finding with respect to the relationships between corruption and civic engagement. A seemingly counterintuitive result is the positive estimate associated with civic engagement when using OLS (odd columns in Table 3.1). However, this estimate can be interpreted as a correlation resulting from the endogeneity of civic engagement: corruption might well be the reason why citizens join others to raise an issue (the empirical definition of civic engagement). Indeed, *ceteris paribus*, citizens are more likely to feel

[39] It should be noted that the results are qualitatively robust to the introduction of output per capita as measured by the real chain-weighted series RGDPCH, year 2005, of the P.W.T. 6.3 Heston, Summers, and Aten (2009).

[40] The prediction pertaining to the ineffectiveness of wage policy has not been tested due to the lack of data. For example, the wage database of Freeman and Oostendorp (2005) contains little information on the countries of the Afrobarometer database: beyond the year 2000, it only provides wage observations for Madagascar and Malawi.

Table 3.1: Corruption and Civic Engagement

	Dependent variables: Pay bribe for / to									
	A document or permit		School Placement		Household Services		Get medicine or medical attention		Avoid problem with police	
	OLS [1]	IV [2]	OLS [3]	IV [4]	OLS [5]	IV [6]	OLS [7]	IV [8]	OLS [9]	IV [10]
Female	-0.023***	-0.023***	-0.004	-0.004*	-0.008***	-0.009***	-0.008**	-0.009**	-0.032***	-0.032***
	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
Age	0.001	0.001	0.001**	0.001**	0.000	0.000	0.000	0.000	0.001*	0.001*
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
Age^2	-0.010*	-0.010*	-0.009**	-0.009**	-0.004	-0.004	-0.008	-0.008	-0.014**	-0.014**
	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)	(0.006)
Primary Education	-0.010**	-0.003	-0.001	0.004	-0.005	0.002	0.002	0.017***	-0.017***	-0.005
	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)
Postsecondary Education	0.029***	0.026***	0.006	0.004	0.017***	0.014**	-0.000	-0.005	0.022***	0.018**
	(0.008)	(0.008)	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
Urban	0.010**	0.011**	0.007*	0.007*	0.019***	0.020***	-0.009*	-0.007	0.014***	0.015**
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.006)	(0.006)
Work	0.005	0.008**	0.002	0.005	0.005	0.008**	0.01**	0.017***	0.010**	0.015***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)
Would Bribe	0.085***	0.088***	0.032***	0.035***	0.038***	0.041***	0.07***	0.075***	0.095***	0.099***
	(0.008)	(0.009)	(0.003)	(0.005)	(0.006)	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)
Former British Colony Dummy	-0.011*	-0.024***	0.001	-0.009	0.021***	0.008	-0.012	-0.038***	0.032***	0.011
	(0.006)	(0.007)	(0.005)	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)	(0.008)	(0.009)
West African Dummy	0.022***	0.002	0.015***	-0.001	0.039***	0.017**	-0.010	-0.054***	0.014**	-0.020*
	(0.006)	(0.009)	(0.005)	(0.007)	(0.005)	(0.008)	(0.006)	(0.011)	(0.007)	(0.012)
Join Others to Raise Issues	**0.001****	**-0.001****	**0.001****	**-0.001****	**0.001****	**-0.002****	**0.002****	**-0.003****	**0.001****	**-0.002****
	(0.000)	**(0.001)**	**(0.000)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**	(0.000)	(0.001)
N Obs.	22,208	22,208	22,211	22,211	22,121	22,121	22,237	22,237	22,210	22,210
Root MSE	0.23	0.23	0.17	0.17	0.18	0.18	0.24	0.24	0.24	0.24
KP Wald F-1st		34.11		34.19		34.28		34.07		33.89
Hansen's J (p-value)		0.31 (0.58)		0.55 (0.46)		0.04 (0.84)		0.50 (0.48)		1.24 (0.26)

Significance levels : * = 10% ** = 5% *** = 1%

Notes: In the estimating equations, the unit of observation is the individual. A constant was included in all regressions. The standard errors (in parentheses) correct for heteroscedasticity and are clustered at the district level. Coefficients and standard errors associated with Age^2 are multiplied by 1,000. The variable *Would Bribe* captures the propensity to bribe in various situations (see the text for details). Endogenous variable in IV analysis is the country-level measure of civic engagement (*Join Others to Raise Issues*) estimated using Ivreg2 in STATA 11.1. KP Wald F-1st is the Kleibergen-Paap rk Wald F statistic of the first stage of the IV analysis. The Root MSE is the standard error of the regression. A description of each variable is offered in the appendix.

concerned with, and be engaged against corruption when their country is plagued with issues affecting public life like corruption.[41] It follows that the OLS regressions from Table 3.1 might just capture this mechanism. Thus, in order to identify a causal impact of civic engagement on corruption, an instrumental variable approach (discussed in the next subsection) will be implemented.

Table 3.2 reports the relationships between social capital and civic engagement. It is found by OLS (first column) that civic engagement has no significant effect on social capital. This empirical result is consistent with the prediction of the model, which showed that higher levels of civic engagement lead to positive, negative or no changes in social capital. However, just like in the case of corruption, civic engagement is likely to be endogenous to social capital, which also requires an analysis of causal relationships.

3.4.3 Instrumental Variables

Civic engagement is likely to be endogenous with respect to corruption and social capital. It is therefore important to test the robustness of the (OLS) results contained in Tables 3.1 and 3.2, and to assess causal relationships, for instance, with instrumental variable techniques.[42]

Two country-level variables are used as excluded instruments for civic engagement. The first is the percentage of respondents who frequently use media;

[41] This can be linked to the assumption $p'(\lambda) > 0$ of the model: *ceteris paribus* when the level of corruption increases, civil society is more likely to focus on it and corrupted bureaucrats are more likely to be punished.

[42] As another robustness test (not shown here), a fully joint system of corruption and social capital is also estimated. The simultaneous equations system is estimated by three-stage least squares and yields similar results.

Table 3.2: Social Capital and Civic Engagement

	Dependent variables: Social Capital Measure: *Would Bribe*	
	OLS	IV
Female	-0.021***	-0.021***
	(0.005)	(0.005)
Age	-0.002***	-0.002***
	(0.001)	(0.001)
Age^2	0.015*	0.016*
	(0.009)	(0.009)
Urban	0.007	0.007
	(0.009)	(0.007)
Would Bribe	0.010***	0.010***
(Country Average)	(0.000)	(0.000)
Join Others to	**0.0001**	**0.0002**
Raise Issues	**(0.0004)**	**(0.001)**
N Obs.	22,350	22,350
Root MSE	0.33	0.23
KP Wald F-1st		55.64
Hansen's J (p-value)		0.020 (0.89)

Significance levels : * = 10% ** = 5% *** = 1%

Notes: In the estimating equations, the unit of observation is the individual. A constant was included in all regressions. The standard errors (in parentheses) correct for heteroscedasticity and are clustered at the district level. Coefficients and standard errors associated with Age^2 are multiplied by 1000. The variable *Would Bribe* captures the propensity to bribe in various situations (see the text for details). Endogenous variable in IV analysis is the country-level measure of civic engagement (*Join Others to Raise Issues*) estimated using Ivreg2 in STATA 11.1. KP Wald F-1st is the Kleibergen-Paap rk Wald F statistic of the first stage of the IV analysis. The Root MSE is the standard error of the regression. A description of each variable is offered in the appendix.

the second is the percentage of respondents who *very strongly agree* that women should have the same chance of being elected to political office as men. To be valid, instruments are required to (a) be correlated with civic engagement, and (b) not influence the participation in corruption directly (the exclusion restriction).

The frequent use of media is associated with civic knowledge, which intuitively relates to civic engagement.[43] Similarly, the role of women in the society has been historically associated with civil rights and the emergence of civic engagement. Therefore, these instruments are thought to be correlated with civic engagement. Furthermore, theoretically, there is no reason why any of these instruments should *directly* affect the participation to corruption.

As in Lassen (2007), I evaluate the validity of a) by considering the F-statistic from the first stage regression, while the validity of the exclusion restriction is investigated indirectly with an overidentification test (Hansen test).[44] Specifically, the Kleibergen-Paap Wald F statistic of the first stage regression captures the ability of the instruments to explain the variations in civic engagement. For the Hansen's J statistics, the null hypothesis is that the

[43] For instance, Dee (2004) defines the quality of civic knowledge as the frequency of newspaper readership. For this chapter, it should be noted that, similar results as the ones depicted here were obtained using the knowledge of the constitutionality, or the knowledge of the presidential term instead of the use of media. The major drawback of these variables is that they were not asked in Zimbabwe.

[44] Because the number of instruments is greater than the number of endogenous variables, the instrumenting equation is overidentified. The Hansen test, a test of whether the overidentifying restrictions are valid, provides some insight, but no definitive answer, into the appropriateness of maintaining the exclusion restriction.

specification is not overidentified, hence a high p-value confirms that the overidentifying restrictions are not violated, which suggest that the exclusion restriction is valid. The two bottom rows of Tables 3.1 and 3.2 report information on instrument validity. Together, the Kleibergen-Paap Wald F, the Hansen's J statistics suggest that the proposed instruments are valid.

Interestingly, when the endogeneity with respect to corruption of civic engagement is accounted for (Table 3.1), civic engagement has the expected sign. Importantly, its significant effect is consistent and robust to all definitions of corruption. In other words, in countries where civic engagement is high, individuals have a lower probability to participate in corruption. Furthermore, though the effects are similar across measures of corruption, they tend to be higher for bribes related to obtaining medical attention, bribes that avoid confrontations with the police, and bribes that help acquiring household services.

Similarly, the IV estimates confirm that civic engagement has no significant effect on social capital, which is consistent with the prediction of the model. Therefore, the predictions from the model are consistent with the empirical evidence contained herein.

3.4.4 Limitations

Although the F-test statistics, the stable mean squared error, and the Hansen's J statistics confirm the validity of the instruments, the results should be taken with caution. Indeed, the observations are available only for a single year, which puts restrictions on an analysis of the full dynamic interactions between

civil society, social capital, and corruption. With a sufficiently long time series, one could, for instance, analyze how *changes* in corruption are affected by *changes* in civic engagement. Also, as mentioned earlier, the effect of wages has not been tested empirically. Finally, the estimation of endogenous social effects like civic engagement is generally difficult.[45] A refinement of the data, which would allow for a better link between civic engagement, corruption, and social capital is therefore required to definitively address these issues.

Nevertheless, despite these limitations, the empirical results indicate that the predictions of the model consistent with the data. Throughout, I find that civic engagement reduces the level of corruption but does not significantly affect social capital. These results are robust to correcting for the endogeneity of civic engagement.

3.5 Conclusion

This chapter sheds light on the institutions that support high levels of corruption. It considers the latter as a social endemic phenomenon and analyzes the role that civil society can play in reducing it. Both empirical and theoretical evidence have been presented.

The theoretical model expands on a simple corruption framework with bureaucrats and citizens. Citizens can be honest (i.e., commit not to participate in corruption) or opportunist (i.e., participate in corruption if it is optimal to

[45] For a discussion of issues pertaining to the estimation of social effects, see Manski (1993).

do so) while bureaucrats are opportunists. The engagement of the civil society is modeled as its effectiveness in catching/punishing misbehaving agents. The model is dynamic and the evolution of honesty within the population is affected by both pecuniary (e.g., wages or the probability of getting caught) and non-pecuniary benefits (e.g., morality). It follows that civil society affects the monitoring of agents directly and the creation of social capital-captured through the aforementioned notion of honesty-indirectly. The mechanism that drives the evolution of types is borrowed from Francois and Zabojnik (2005), whose formal approach to social capital is applied to corruption. The adjustment of citizens' types is modeled to be relatively slow to changes in the economic environment; this feature reflects the sociological treatment of honesty as a personality disposition. Conversely, bureaucrats are allowed to adjust to new opportunities instantaneously.

It is found that a greater involvement of civil society can effectively reduce the level of corruption. In particular, when civic engagement increases, the whole economy converges to a steady state with fewer corrupted bureaucrats and lower levels of corruption. However, the change in the mass of honest agents is ambiguous, which stresses an important result: countries, therefore, enjoy lower levels of corruption not necessarily because they have more social capital, but rather because lower levels of corruption are tolerated for each level of honest citizens. Interestingly, wage policies are proven to be ineffective in this economic environment.

Despite limitations, the analysis of the Afrobarometer survey data suggests

that the predictions of the model are supported by the data. The results indicate that higher levels of civic engagement are associated with lower levels of corruption, but do not have any statistical significant effect on social capital. The results are robust for several specifications, including five different definitions of corruption, as well as for controlling for the endogeneity of civic engagement by using an instrumental variable approach. In addition, the results suggest that the causality goes from civic engagement to corruption.

The paper therefore contributes to the literature by formally capturing and applying a dynamic notion of *social capital* to the issue of corruption. This novel approach complements existing work on the role of social norms and non-pecuniary motivations for corruption.

The chapter analyzed the role of civil society has being largely beneficial. However, the emergence of a civil society that satisfies this feature is challenging. Indeed, civil society organizations (CSOs) need to be sufficiently empowered to undertake an active role for the participation of citizens and the monitoring of government. In order to succeed, CSOs in developing countries need technical and financial capacities that are often lacking. Furthermore, CSOs do not necessarily agree on issues: constituencies may have conflicting interests, especially in poor societies [Rajan (2009)]; it can also be the case that CSOs are financed by corrupted officials so that they become ineffective.[46]

Finally, the effectiveness of civil society in reducing corruption is an empirical question. For instance, the intergenerational/dynamic aspect of the effects

[46] See Lewis (2001) for a discussion of the adaptation of the concept of civil society in Africa.

of civic engagement on corruption deserves more attention if one wants to investigate the socialization process. Also, the effects of civic engagement should be compared to other practices used against corruption. For example, using data from Indonesia, Olken (2007) showed that grassroots community was less effective at reducing corruption than traditional top-down monitoring (e.g., audits). It is, therefore, crucial for future research to find out which methods work best and determine the best practices against corruption. This would inform both policy makers and CSOs that are engaged in the fight against corruption.

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Chapter 4

An Empirical Investigation of Ethnicity and Trust in Africa

Well-considered, carefully planned initiatives (. . .) that bring communities together, foster dialogue, and achieve long-term reconciliation could allow Africans to rise above competitive, and often petty, politics at the level of micro-nations (i.e., ethnic groups) and address the pressing larger issues confronting the nation-state.

-Wangari Maathai, The Challenge for Africa.[1]

4.1 Introduction

Ethnic fragmentation has received considerable attention in economic literature, which has shown that ethnic fragmentation is associated with negative outcomes in the efficient provision of public goods, the accumulation of human capital, and growth.[2] Despite a plethora of hypotheses, why, where, and when

[1] Wangari Maathai is the Nobel Peace Prize laureate of 2004.

[2] See Alesina, Baqir, and Easterly (1999) for evidence in the United States, Gradstein and Justman (2000) for a theoretical implication on human capital, and La Porta, Lopez de Silanez, Shleifer, and Vishny (1999), Easterly and Levine (1997) and Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003) for cross-country evidence.

ethnic origin is relevant to individuals and economic activities is largely unclear. This chapter intends to shed light on this matter.

The main idea of the chapter is to study the relevance of ethnicity through a particular facette: the links between ethnic origin and trust. The connections between one's trust in one's own ethnic group (*intra-ethnic* trust) and one's trust in other ethnic groups (*inter-ethnic* trust) are examined. Hence, if ethnicity is irrelevant, individuals should trust the members of other ethnic groups just as much as they trust the members of their own group. However, if ethnic origin matters for individuals, they should exhibit a gap between their levels of intra- and inter-ethnic trust. If these differences in trust exist, they could potentially add inefficiencies similar to the ones depicted in the literature on trust and which can be summarized by this quote: "When people trust each other, transaction costs in economic activities are reduced, large organizations function better, governments are more efficient."[3]

The chapter focuses on Africa since it is a continent with vivid ethnic tensions in some countries and none in many others. Nevertheless, most conclusions can also apply to other geographic regions. The determinants of inter-ethnic trust are examined using data provided by Round 3 of the Afrobarometer. It is first shown that, though a majority of individuals have identical levels of intra- and inter-ethnic trust, a non-negligible fraction of them exhibit differences. This result suggests that ethnic origin matters for trust.

For each level of intra-ethnic trust, a multivariate analysis is implemented

[3] Quoted from Alesina and La Ferrara (2002).

to uncover the individual and socio-economic determinants that are significantly associated with inter-ethnic trust. This procedure makes it possible to determine whether or not variables are *consistently* (i.e., across levels of intra-ethnic trust) associated with inter-ethic trust levels. For instance, it is found that individuals tend to exhibit higher levels of inter-ethnic trust with age. Gender and religious beliefs are weakly correlated with inter-ethnic trust, and education is ambiguously and *inconsistently* associated with inter-ethnic trust. Unsurprisingly, individuals who belong to an ethnic group that feels that's it's treated unfairly by the government tend to attach lower levels of trust towards other ethnic group.

It is also shown that living in a country with more homogenous ethnic groups increases inter-ethnic trust, while ethnic diversity at the district level is insignificant. These results suggest that ethnic diversity undermines the formation of trust; this is consistent both with the idea that conflicts are being more likely to occur in multi-ethnic countries and with the literature that predicts lower levels of trust among heterogeneous communities. The contrast between national and district ethnic diversity could be explained by endogenous sorting: individuals who trust other ethnic groups more are *more* likely to live with other ethnic groups. The implications of such a sorting are consistent with conflicts potentially occurring in multi-ethnic countries where whole districts (or neighbourhoods) are homogenous even though little trust exists across communities.

Another result pertaining to district characteristics is that living in a district with socio-economic infrastructures (e.g., a market) is associated with

higher levels of inter-ethnic trust. The importance of district level characteristics suggests that the availability of socio-economic infrastructures increases inter-ethnic trust or, alternatively, that areas with more inter-ethnic trust lead to more of such infrastructures.

The study then draws a link between economic growth and inter-ethnic trust. It is determined that growth levels over long periods (15 and 25 years) are strongly associated with higher levels of inter-ethnic trust. However, the association between recent growth (5 years) and inter-ethnic trust is insignificant. In other words, sustained growth over long periods of time is correlated with inter-ethnic relationships. On one hand, this result is consistent with recessions undermining the formation of inter-ethnic trust. On the other hand, the result might capture the endogeneity of growth with respect to inter-ethnic trust: countries with higher levels of inter-ethnic trust should, *ceteris paribus*, experience higher levels of economic growth. Unfortunately, the direction of causality cannot be determined with the data at hand.

Interestingly, key variables have different correlations (signs or significance) with inter- or intra-ethnic trust. These differences stress the importance of analyzing inter-ethnic trust in relation to intra-ethnic trust instead of general trust only. For example, with respect to inter-ethnic trust, living in an urban district becomes insignificant when controlling for ethnic composition and socio-economic infrastructures. This suggests that ethnic composition and socio-economic infrastructures "explain" the role of the variable *urban* for inter-ethnic trust. However, the variable *urban* is negatively associated with intra-ethnic trust, and remains significant when controlling for ethnic composition

and socio-economic infrastructures. This suggests that city-specific features (other than ethnic composition and the socio-economic infrastructures) matter for intra-ethnic trust. This result highlights the importance of cities in the formation of trust in African countries: cities not only provide opportunities for interaction between members of different ethnic groups, but they also deeply affect intra-ethnic interactions.

Growth is another important variable that offers a contrast. Indeed, the results of the chapter suggest that inter-ethnic trust is *procyclical*, while intra-ethnic trust is *countercyclical*. One interpretation of this is that long recessions undermine social cohesion since they increase the gap between intra- and inter-ethnic trust. This view might explain why, despite decades of stability without particular ethnic tensions, ethno-political crises erupted in some African countries (e.g., Côte d'Ivoire or Kenya) during long and deep economic recessions. Another interpretation simply suggests that countries with bigger gaps between intra- and inter-ethnic trust (and thus, implicitly, lower social cohesion) tend to have lower growth rates.

The chapter makes important methodological contributions. First, it looks at the two sides of ethnic relationships: relations with one's own ethnic group and relations with other ethnic groups. This departs from other papers on the subject [e.g., Bannon et al. (2004), and Eifert et al. (2010)], which focus only on an individual's ethnic identity without analyzing the key relationship with other ethnic groups. Second, the chapter provides multi-layer evidence of factors at the individual, ethnic, district, and country levels, which consistently

contribute to higher levels of inter-ethnic trust across different levels of intra-ethnic trust.

As foreseen earlier, the results pertaining to district characteristics, ethnic diversity, and growth do not address causality. Unfortunately, the data does not allow me to determine the direction of causality, so their coefficients can have different interpretations. Nevertheless, these results are still interesting to analyze since so little is known about inter- and intra-ethnic trust. Furthermore, regardless of the direction of causality, the results presented in the study are consistent with the idea of self-reinforcing mechanisms between socio-economic infrastructures, growth, and ethnic relations.

The chapter is organized as follows. Section 4.2 discusses the main hypotheses that guide the empirical work. Section 4.3 presents the data. Sections 4.4 and 4.5 display the regression results pertaining to intra- and inter-ethnic trust, respectively. Section 4.6 concludes.

4.2 Ethnicity and Trust-Why Should We Care?

Ethnic relations are examined through the lenses of trust. The interest is in determining whether individuals trust their own and other ethnic groups *differently*. This is one, and certainly not the only, expression of ethnicity that presents the advantage of available data. This section provides evidence for the relevance of the question for economists, and it lays out the major hypotheses that will be investigated in the empirical section.

This chapter aims to understand the factors that are associated with inter- and intra-ethnic trust. Ethnicity, specifically ethnic fragmentation, has received attention from economists. A large empirical literature demonstrates the negative impact of ethnic fragmentation, especially for developing countries. Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003), for example, showed that ethnic fragmentation has a negative effect on the efficiency of the provision of public goods. Mauro (1995) established a negative link between ethnic fragmentation and corruption. Gradstein and Justman (2000) developed a model where social/ethnic fragmentation diminishes incentives for investment in human capital through a less efficient public provision of education. With U.S. data, Alesina, Baqir, and Easterly (1999) found that the provision of public goods is more efficient in districts that are racially homogeneous.

With respect to the issue of trust, experimental and empirical evidence has established that the level of trust and the degree of trustworthiness decrease with ethnic diversity. For example, Glaeser, Laibson, Scheinkman, and Soutter (2000) found that trustworthiness declines when partners are of different races or nationalities; Alesina and La Ferrara (2002) found that the individuals who live in racially heterogeneous localities exhibit lower levels of trust. Another paper linking trust to ethnic diversity is Lassen (2007) who, using cross-country evidence, found that the size of the informal sector increases in the degree of ethnic fragmentation. His mechanism is that ethnic fragmentation (i) leads to a decrease of the level of trust, which decreases tax compliance and (ii) increases the unwillingness to contribute to financing public goods to

the extent that these (primarily) benefit other ethnic groups. Recently, Rohner, Thoenig, and Zilibotti (2011) found that cross-community distrust about peaceful trade could lead to civil conflicts, war, and further collapse of trust and social capital. In another paper, the same authors found evidence of the negative effect of civil conflict on social capital using survey data from Uganda (Rohner, Thoenig, and Zilibotti, 2012). Moreover, they established the causal effects of outbursts of ethnic conflicts on trust and ethnic identity.

Using aggregate data, Easterly and Levine (1997) showed that ethnic fragmentation has a negative impact on growth. Chang and Kerr (2009) provided empirical evidence that ethnic insiders, defined as individuals of the same ethnic origin as the president, are more likely to turn a blind eye to corruption. Furthermore, and regarding the political economy of Africa, the home regions of public officials have often benefited from access to basic commodities, infrastructures, and megalomaniac monuments and palaces (at the expense of the State). Nepotism on an ethnic basis is also a norm for access to various favours such as jobs. There is, therefore, evidence that ethnicity plays a significant role in social capital and the political economy of nations and regions.

Unfortunately, the literature is unclear about the reasons why ethnicity is relevant in some countries and not others. This question also stands within countries: Why is ethnicity an issue in some regions/cities and not in others? The "endogeneity" of ethnic relations, therefore, raises important questions regarding economic development and public policies. Wangari Maathai, the Nobel Peace Prize laureate of 2004, stresses the importance of understanding ethnic relations. In her book, *The Challenge for Africa*, two chapters discuss the

issue of ethnicity and call for a better understanding of the complex relations that exist between ethnic groups as well as ethnic groups and the nation-state.

An important dimension that has also been omitted in the economic literature is the dynamic evolution of the relations between races or ethnic groups. For instance, until recently, several Western democracies denied voting rights to some groups and even banned interracial marriages. Closer to the African context and to this chapter, many ethno-political crises emerged in countries that seemed free of ethnic clashes for a long period of time. Such crises deserve more attention from economists.[4]

To understand the relevance of ethnicity to individuals, the chapter examines an observable variable that captures traits of ethnic relations: the gap that may exist between the trust in one's own ethnic group (intra-ethnic trust) and the trust in other ethnic groups (inter-ethnic trust). If individuals have the same levels of intra- and inter-ethnic trust, the gap is low, and ethnicity is likely not to be relevant.[5]

[4] In Section 4.4, it will be shown that an important determinant of these evolutions is likely to be long-term growth: economic recessions may induce ethnic tensions over control of smaller "shares of the pie".

[5] The economics literature on trust is rich and essentially exhibits its role for the transaction costs. Putnam (1993) and Fukuyama (1995), for instance, showed that trust is associated with greater cooperation and efficiency of "large" organizations such as firms, cities or states. Furthermore, La Porta, Lopez de Silanez, Shleifer, and Vishny (1997) illustrated the positive significant effect of trust on the performance of government. The authors found that the effect is essentially realized through enhanced judicial efficiency, anti-corruption measures or bureaucratic quality.

4.2.1 Hypotheses

Before showing empirical results, this subsection reviews possible channels of what might determine levels of inter- and intra-ethnic trust. The variables are classified into four categories: an individual's characteristics, ethnic group characteristics, the characteristics of the district in which the individual lives, and growth.

First, both types of ethnic trust can be influenced by an individual's (e.g., age, religion, and gender). It can also be expected that education plays a role since it may instill civic values or expose individuals to more heterogenous people. Living in a city, recent traumatic experiences and stress might also affect ethnic trust levels.

Second, inter- and intra-ethnic trust may be associated with ethnic group characteristics. In particular, if an ethnic group perceives(correctly or incorrectly) that it is discriminated against by the government, its members might trust people from other groups relatively less. This behaviour towards trust would be a manifestation of an introverted assertion of one's identity. Examples of this include perceptions of economic and political discrimination, and the feeling of being treated unfairly by the government. The relative size of the ethnic group (at the district and country levels) may also matter in shaping individuals' ethnic trusts levels.[6]

[6] It should be noted that other causes, such as the legacy of wars or other conflicts between groups, could also affect inter-ethnic trust, especially specific trust between one ethnic group and another ("one-to-one" inter-ethnic trust). Unfortunately, the data that will support the analysis does not allow me to investigate such "one-to-one" inter-ethnic trust. Indeed, it captures trust in other ethnic group as a *whole*, rather than trust in each other ethnic group *individually*.

Third, the district in which the individual lives may be associated with her inter- and intra-ethnic trust levels. Indeed, district characteristics determine the environment in which individuals from different groups interact. For instance, we can expect higher inter-ethnic trust in districts with facilities that foster social interactions (e.g., recreational or sport areas) or with any other facilities where individuals get together (e.g., markets). We can also expect that the heterogeneity of the district (or country) plays a role in shaping ethnic relations.

Finally, economic growth may also affect ethnic trusts levels. Economic recessions may lead to lower levels of inter-ethnic trust, especially if citizens feel like the fair "share of the pie" of their group is threatened. The district and country's factors, therefore, stress the importance of harmonious social interactions in the building of inter-ethnic trust.

4.3 Data and Descriptive Statistics

The empirical analysis relies on data from Round 3 of the Afrobarometer surveys. These surveys, which "measure the social, political, and economic atmosphere in Africa," are particularly well-suited for the purpose of the study as they include questions on trust and ethnicity, and they are designed for cross-country comparisons. Round 3 of the Afrobarometer was conducted from March 2005 to February 2006 and covered the following 18 countries: Benin, Botswana, Cape Verde, Ghana, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, Tanzania, Uganda,

Zambia, and Zimbabwe.[7] Figure 4.1 presents the countries of the survey. Cape Verde Islands and Zimbabwe were dropped because the ethnicity of respondents was not recorded for these countries. This, along with other restrictions imposed during the cleaning of the data, leaves out $20,926$ potential observations.[8]

This chapter focuses on the trust individuals attach to their own ethnic group and to other ethnic groups. The answers to the following Afrobarometer questions were collected:

1. *How much do you trust people from your **own** ethnic group?*

2. *How much do you trust people from **other** ethnic groups?*

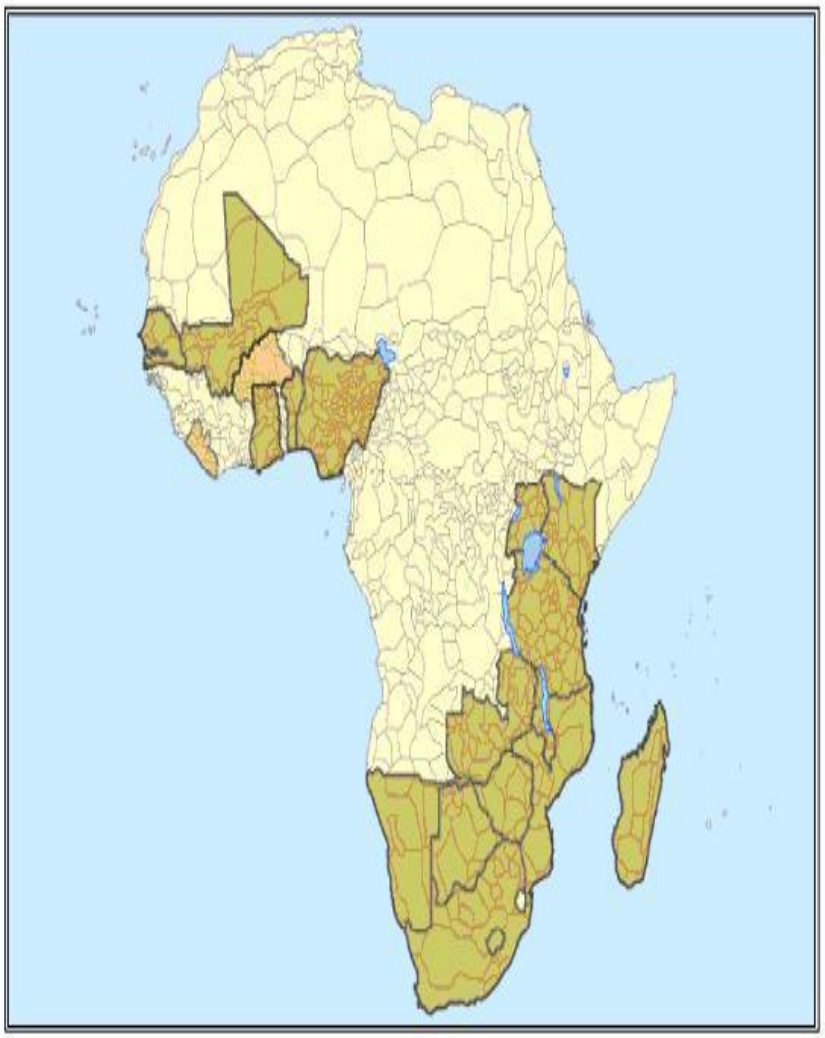
The answers to these questions gauge *intra-* and *inter-ethnic* trust levels, respectively. The categories for both questions are *Not at All* (0), *Just a Little* (1), *Somewhat* (2) and *A Lot* (3).

The levels of intra-ethnic trust are reported in the first column of Tables H.1 in Appendix J. They tend to be low since only 56% of the whole sample have *Some* or *A lot* of trust in members of their own ethnic group. However, the level varies across countries: it is as low as 40% in Botswana and Nigeria and 52% in South Africa, and as high as 75% in Mali and 82% in Senegal.

[7] The Afrobarometer dataset has already been used by researchers interested in trust Lavallée, Razafindrakoto, and Roubaud (2008); Nunn and Wantchekon (2008) and/or political sciences.

[8] Observations with missing data on age, education and intra- and inter-ethnic trust questions were removed, and only ethnic groups with at least 10 members were kept.

Figure 4.1: Round 3 countries. Source: Nunn and Wantchekon (2008)



4.3.1 Do Individuals Trust Members of Other Ethnic Groups the Same as Members of Their Own Ethnic Group?

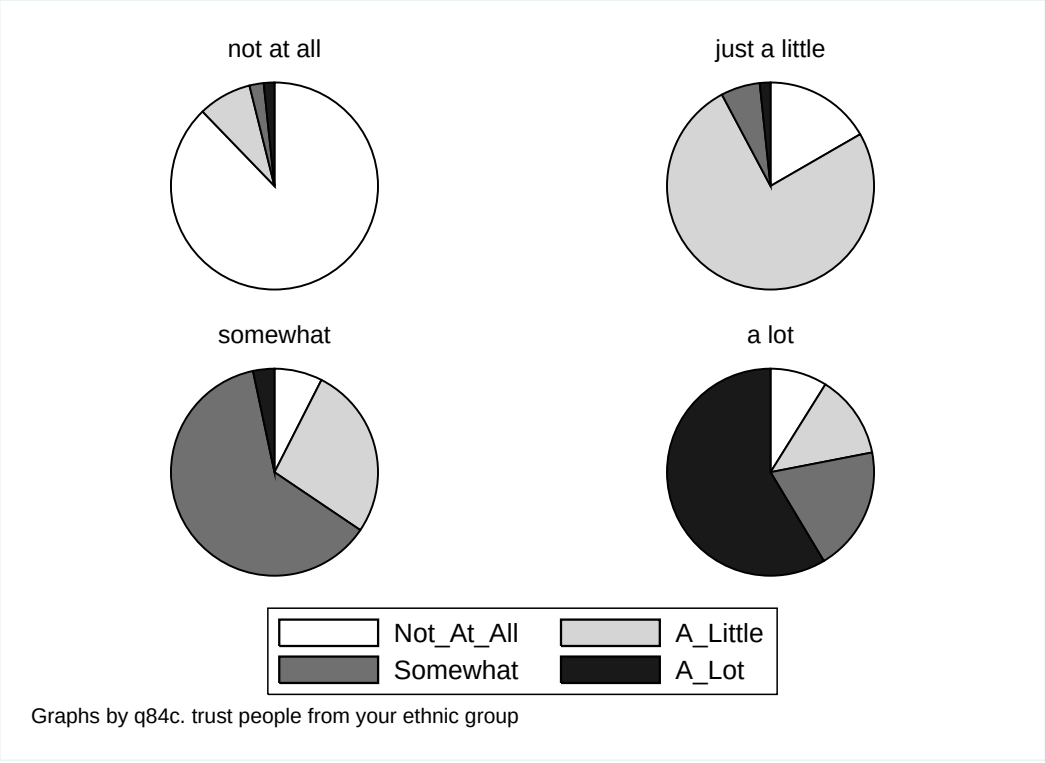
The analysis starts by asking whether individuals exhibit similar levels of intra- and inter-ethnic trust. If ethnic origin does not influence trust, a significant fraction of respondents should have identical levels of intra- and inter-ethnic trust.

For each level of intra-ethnic trust, the distribution of inter-ethnic trust is computed. Figure 4.2 illustrates these distributions, and each pie depicts a level of intra-ethnic trust. In each pie, the biggest share of inter-ethnic trust is of the same level as the one of intra-ethnic trust. For example, the individuals who *Somewhat* trust their own group tend to *Somewhat* trust other groups. Hence, individuals tend to trust members of other ethnic groups just as much as they trust members of their own group.[9] Nevertheless, individuals exhibit non-negligible differences in intra- and inter-ethnic trust. In particular, when they don't trust individuals from other ethnic groups like their own group, individuals tend to trust them less. In Appendix H, it is shown that this result also holds true at the country level (Table H.1).

It is, therefore, important to understand the various factors that shape ethnic trust. The rest of the chapter sheds light on the matter by analyzing the factors associated with higher levels of intra- and inter-ethnic trust.

[9] This result can be related to Bannon, Miguel, and Posner (2004) who found that fewer than one-third of African respondents identify themselves in ethnic terms. Indeed, "the majority identify, instead, in terms of non-ethnic affiliations such as occupation." The authors also found important disparities across countries.

Figure 4.2: Inter-Ethnic Trust by Levels of Intra-Ethnic Trust (Whole Sample)



4.4 Determinants of Intra-Ethnic Trust

Before examining regressions of inter-ethnic trust for each level of intra-ethnic trust in the next section, this section analyzes the determinants of intra-ethnic trust. This analysis helps us think about the factors that are likely to be important for trust, and it provides a nice contrast for factors affecting inter-ethnic trust. The characteristics of the individual, the ethnic group, the district, and growth are included in an ordered probit regression whose marginal effects are presented in Table 4.1.[10] Each column in Table 4.1 depicts a level of intra-ethnic trust. The detailed description of each variable is presented in Appendix J.

4.4.1 Individual Characteristics

Most individual variables are strongly and significantly associated with the intra-ethnic group.[11] For instance, living in an urban district is associated with lower levels of intra-ethnic trust. We will see in the next section that this result contrasts with inter-ethnic trust. The regressions suggest that primary education increases the probability that an individual trusts her own ethnic group more; however but that post-secondary education is insignificant.

[10] The regression relies on the same variables as the *preferred* regression that will be utilized to examine inter-ethnic trust below.

[11] For religions, the category *Traditional religion* is a category that is left out. The *Primary education* dummy indicates no formal schooling, informal schooling only(which includes Koranic schooling), some primary schooling, or primary school completed. The *Post-secondary education* dummy indicates post-secondary qualifications other than university, some university, university completed, or post-graduate. The category of education that is left out is secondary education.

Table 4.1: Marginal Effects for *Intra-Ethnic Trust*

	Marginal Effects of the Ordered Probit Estimates ($\frac{dP_i}{dX_i}$)							
Levels of Trust in Own Ethnic Group	**Not At All** [A]		**A Little** [B]		**Somewhat** [C]		**A Lot** [D]	
Female	0.014***	(0.003)	0.013***	(0.003)	-0.005***	(0.001)	-0.022***	(0.005)
Urban	0.040***	(0.006)	0.038***	(0.006)	-0.014***	(0.003)	-0.063***	(0.010)
Age	-0.003***	(0.001)	-0.003***	(0.001)	0.001***	(0.000)	0.004***	(0.001)
Age^2	0.026***	(0.006)	0.024***	(0.006)	-0.009***	(0.002)	-0.041***	(0.010)
Personal Living Conditions	-0.006***	(0.002)	-0.005***	(0.002)	0.002***	(0.001)	0.009***	(0.003)
Primary Education	-0.056***	(0.005)	-0.053***	(0.006)	0.020***	(0.002)	0.089***	(0.010)
Post-secondary Education	0.003	(0.006)	0.003	(0.006)	-0.001	(0.002)	-0.005	(0.009)
Full-Time Worker	0.023***	(0.005)	0.022***	(0.005)	-0.008***	(0.002)	-0.036***	(0.008)
Stressed	0.011**	(0.005)	0.010**	(0.005)	-0.004**	(0.002)	-0.018**	(0.009)
Christian	-0.005	(0.008)	-0.005	(0.007)	0.002	(0.003)	0.008	(0.012)
Muslim	-0.117***	(0.011)	-0.111***	(0.010)	0.043***	(0.005)	0.186***	(0.017)
West African Dummy	0.047***	(0.011)	0.045***	(0.010)	-0.017***	(0.004)	-0.074***	(0.018)
Perception about the Ethnic Group: Unfair Treatment by the government	0.015**	(0.007)	0.014**	(0.007)	-0.005**	(0.003)	-0.023**	(0.011)
Ethnic Share (District)	0.004	(0.011)	0.004	(0.010)	-0.002	(0.004)	-0.007	(0.017)
Ethnic Share (Country)	0.038	(0.026)	0.036	(0.025)	-0.014	(0.010)	-0.061	(0.041)
Ethnic Diversity (District)	0.016	(0.016)	0.016	(0.015)	-0.006	(0.006)	-0.026	(0.025)
Ethnic Diversity (Country)	0.024***	(0.005)	0.023***	(0.005)	-0.009***	(0.002)	-0.038***	(0.008)
Market Stalls	-0.002	(0.006)	-0.002	(0.005)	0.001	(0.002)	0.003	(0.009)
Average Growth $(1980 - 2004)$	0.008**	(0.003)	0.007**	(0.003)	-0.003**	(0.001)	-0.012**	(0.005)

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Marginal effects are reportedly evaluated at the means. Standard errors are corrected for heteroscedasticity and cluster the residuals at the district level. Each column represents a level of trust in other ethnic groups. Coefficients and standard errors associated with Age^2 are multiplied by 1000, and the ones associated with the country level index of ethnic diversity are divided by 10. A description of each variable is offered in Appendix J.

4.4.2 Ethnic Group Determinants

Perceptions of unfair treatment of an ethnic group by the government are utilized to capture a role for perceptions of discrimination at the ethnic group level. The variable is constructed using the median of respondents' answers at the ethnic group level. The results suggest that this variable lowers intra-ethnic trust.

A second set of ethnic group characteristics crosses district and country characteristics: the share of the ethnic group and ethnic heterogeneity (or ethnic diversity). The index of ethnic diversity is inspired by Alesina and La Ferrara (2002) and is given by the following formula:

$$\text{Diversity}_l = 1 - \sum_g S_{g,l}^2$$

where l represents a location (district or country), g an ethnic group present in location l, and $S_{g,l}$ the share of ethnic group g in location l. It is found that the share of the ethnic group (at both the district and national levels) is insignificant. Ethnic diversity is associated with lower levels of intra-ethnic trust at the national level, but its effect is insignificant at the district level. This peculiar result might be explained by endogenous sorting: those who are trusting their own ethnic group more may be less likely to live with other ethnic groups. Interestingly, a notion of endogenous sorting will also help understand the relationship between ethnic diversity and inter-ethnic trust.

4.4.3 District Characteristics

The district characteristics is another factor that potentially influences an individual's trust. Specifically, Table 4.1 illustrates that the presence of socio-economic infrastructures (e.g., market stalls) in a district is insignificant to intra-ethnic trust. This contrasts with the positive correlation found for inter-ethnic trust in the next section.

4.4.4 A Role for Economic Growth?

Finally, the link between intra-ethnic trust and growth rates is also examined. Growth rates for the 1980-2004 period are collected from the Penn World Tables, Mark 6.3 as described in Heston, Summers, and Aten (2009). The average growth rates for this period 1980-2004 are significantly and negatively associated with intra-ethnic trust.[12]

This seemingly counter-intuitive result is, nonetheless, consistent with recessions increasing the formation of intra-ethnic trust. This is in line with the idea that recessions lead to introverted assertion of one's identity, whereby members of the same ethnic group tend to rely more on each other in periods of hardship. Such reliance on one's ethnic group is in accordance with evidence (from Africa or elsewhere) pertaining to coping mechanisms for income fluctuations.[13] A second interpretation-the reverse causality - will be discussed below

[12] I also looked at the estimates associated with the average growth rates for 1990-2004, 1995-2004, and 2000-2004. I find that the estimates are negative for 1990-2004, positive for 1995-2004, and insignificant for 2000-04. The fact that growth over longer periods is significant (while recent growth is not) is consistent with the results from inter-ethnic trust. However, the association with inter-ethnic trust has the opposite sign.

[13] For example, Rosenzweig and Stark (1989) depicted how families in rural India rely on

when the determinants of inter-ethnic trust are analyzed.

As it will be clear in the next section, though most factors *generally* affect intra- and inter-ethnic trust in the same manner, important differences exist. In particular, the signs or significance of the estimates associated with the variables *urban*, and *growth* differ. These differences stress the importance of analyzing inter-ethnic trust in relation to intra-ethnic trust instead of general trust only. Inter-ethnic trust can now be studied for each individual category of intra-ethnic trust.

4.5 Determinants of Inter-Ethnic Trust

For each level of intra-ethnic trust, I analyze regressions where the dependent variable is the level of inter-ethnic trust. In all specifications, the interest is in determining the variables (1) that are *significantly* associated with inter-ethnic trust and (2) whose significance is *consistent* across levels of intra-ethnic trust.[14] Since the chapter contains numerous results, the emphasis is put on the variables with strong and uniform significance across groups.

To determine whether variables increase the probability of occurrence of

marital arrangements to smooth consumption. Udry (1994) showed the extent to which individuals rely on informal credit transactions within villages in northern Nigeria. In these papers, the family and the village, respectively, offer mechanisms that allow individuals to resist income fluctuations. The coping mechanism involves a reduction of the commitment problems (e.g., through marital arrangements) and informational problems (e.g., assessment of one's financial situation). One's ethnic group could provide such mechanisms as well.

[14] It should be noted that individuals who trust other ethnic groups more than their own are *not* excluded. For example, the first specification in Table 4.2 relies on individuals with no trust in their own group and, therefore, only on individuals with trust in other ethnic groups that is greater than or equal to their trust in their own group.

any given category, the analysis utilizes ordered probit specifications. For convenience, only the coefficients and not the marginal effects from the specifications are reported. The reader must bear this in mind and refrain from comparing estimates across different groups.[15] The marginal effects (evaluated at characteristic means) of the preferred regression are shown in Appendix I (Tables I.1 to I.4).

All specifications include characteristics of the individual, the ethnic group, and the district as well as growth. They correct for heteroscedasticity and cluster the residuals at the district level. This formulation captures the possibility that formal institutions vary within a country, possibly at the district level.

4.5.1 Individual Characteristics

I start by regressing the levels of inter-ethnic trust on a set of individual characteristics. The ordered probit coefficients are presented in Table 4.2, where each column depicts a level of intra-ethnic trust. The detailed description of each independent variable is presented in appendixJ.

Age is strongly associated with higher levels of inter-ethnic trust across all groups. This result-especially since it is the same as the one for intra-ethnic trust-is consistent with the idea that trust in others increases with age, albeit at a declining rate, as shown in Alesina and La Ferrara (2002). Gender, the

[15] Because there are more than two categories of inter-ethnic trust, the sign of the ordered probit coefficients predicts the direction of the marginal effects in the extreme categories of inter-ethnic trust (*Not at All* and *A Lot*) only. The coefficients do not determine the direction of the marginal effects in the middle categories (*A Little* and *Somewhat*). In other words, the signs of the coefficient estimates are always qualitatively consistent with the marginal effects in the extreme categories, but not necessarily with the ones in the middle categories.

Table 4.2: Individual Determinants of Inter-Ethnic Trust by Level of Intra-Ethnic Trust

Level of Intra-Ethnic Trust	**Not At All** [A]		**A Little** [B]		**Somewhat** [C]		**A Lot** [D]	
	$\hat{\beta}$	$\hat{\sigma}_\beta$	$\hat{\beta}$	$\hat{\sigma}_\beta$	$\hat{\beta}$	$\hat{\sigma}_\beta$	$\hat{\beta}$	$\hat{\sigma}_\beta$
Female	0.039	(0.062)	-0.070*	(0.036)	-0.029	(0.031)	-0.096***	(0.034)
Urban	-0.078	(0.076)	0.071*	(0.040)	0.089**	(0.040)	0.035	(0.048)
Age	-0.011	(0.010)	0.016***	(0.006)	0.013**	(0.005)	0.025***	(0.006)
Age^2	0.121	(0.113)	-0.150**	(0.067)	-0.111*	(0.060)	-0.203***	(0.064)
(Pers.) Living Condition	0.031	(0.025)	0.013	(0.017)	0.029*	(0.016)	0.047***	(0.017)
Primary Education	-0.051	(0.076)	-0.015	(0.040)	-0.050	(0.039)	0.098**	(0.044)
Post-secondary Education	-0.055	(0.100)	-0.113**	(0.048)	0.122**	(0.057)	-0.011	(0.078)
Full-Time Worker	0.068	(0.084)	0.009	(0.041)	-0.090**	(0.044)	0.022	(0.047)
Stressed	0.076	(0.078)	-0.035	(0.039)	-0.090**	(0.039)	-0.138***	(0.039)
Christian	-0.081	(0.102)	-0.022	(0.056)	0.020	(0.061)	0.057	(0.089)
Muslim	0.165	(0.139)	-0.013	(0.082)	0.066	(0.077)	0.261***	(0.101)
West African Dummy	-0.014	(0.088)	-0.045	(0.048)	-0.030	(0.050)	0.047	(0.065)
Intercept, cut 1	0.998***	(0.237)	-0.654***	(0.141)	-1.075***	(0.147)	-0.506***	(0.169)
Intercept, cut 2	1.587***	(0.235)	1.753***	(0.142)	-0.037	(0.144)	0.070	(0.170)
Intercept, cut 3	2.010***	(0.249)	2.469***	(0.145)	2.212***	(0.147)	0.636***	(0.168)
N Obs.	2,821		6,287		6,098		5,129	
Pseudo Rsq	0.005		0.003		0.005		0.014	

Significance levels : * = 10% ** = 5% *** = 1%

Notes: In the estimating equations, the unit of observation is an individual. $\hat{\beta}$'s are ordered probit coefficients. $\hat{\sigma}_\beta$'s are standard errors corrected for heteroscedasticity and clustering the residuals at the district level. Coefficients and standard errors associated with Age^2 are multiplied by 1000. A description of each variable is offered in Appendix J.

urban district dummy (to which I will return in the district characteristics subsection), and religion are all only weakly associated with inter-ethnic trust.

An important variable is education. The specifications show that education, as measured by primary and post-secondary education is inconsistently associated with inter-ethnic trust.[16] For example, more education is positively associated with inter-ethnic trust for those with *Some* trust in their group, but the correlation is negative for those with *A little* or*A lot* of trust in their group. The fact that education has no effect or opposite effects for different groups of individuals is surprising. Indeed, the hypothesis that education strengthens "good" citizenry has received considerable support in the literature.[17] The result can be related to the ambiguous role played by the elites (i.e., the more educated) in Africa. As depicted by Maathai (2009), the latter often lack true leadership and are ill disposed and ready to play the ethnic card if it suits their interests. The result is also consistent with Eifert, Miguel, and Posner (2010), who found that "ethnic identities matter in Africa for instrumental reasons: because they are useful in the competition for political power." The results from Table 4.2, therefore, reopen the discussion on the role that education plays in the formation of an informed and engaged citizenry, especially in Africa.

[16] The education category that is left out is secondary education.

[17] For example, Alesina and La Ferrara (2002) found a positive effect of education on trust. For a review of the benefits of education in general and on citizenship in particular, see Lochner (2011).

4.5.2 Ethnic Group Determinants

Table 4.3 adds ethnic group level controls in the specifications of Table 4.2, whose coefficients are qualitatively unaffected. These controls are meant to capture perceptions of discriminations at the ethnic group level. Specifically, I rely on respondents' perceptions about the evolution of the economic and political conditions of their ethnic group as well as on their perceptions about unfair treatment of their ethnic group by the government. The controls are then constructed using the medians of the respective variables at the ethnic group level.

The perceptions of unfair treatment of the ethnic group by the government (bottom panel) are the most significantly associated with lower levels of inter-ethnic trust. This finding is consistent with the idea that discrimination, either real or perceived, plays a significant role in trust and social cohesion. The result is also consistent with Nunn and Wantchekon (2008) who found that ethnic group characteristics, such as the number of slaves shipped out of Africa, negatively and significantly affect various measures of interpersonal trust in Africa.[18]

In Table 4.4, it is found that the share of the ethnic group at the district and country levels (as defined earlier) has limited incidence on inter-ethnic trust.

Even though ethnic diversity at the district level is never significant, ethnic diversity at the country level is strongly and consistently associated with

[18] The number of slaves in Nunn and Wantchekon (2008) is computed at the ethnic group level and consists of the slaves that were shipped out of Africa during the 1400-1900 period.

Table 4.3: Ethnic Group Determinants of Inter-Ethnic Trust by Level of Intra-Ethnic Trust - Perceptions of Discriminations

Level of Intra-Ethnic Trust	**Not At All [A]**	**A Little [B]**	**Somewhat [C]**	**A Lot [D]**
Perception of Discrimination: Worse Economic Condition of the Ethnic Group	0.055 (0.063)	-0.027 (0.039)	-0.054 (0.034)	-0.015 (0.036)
Pseudo Rsq	0.006	0.003	0.005	0.014
Perception of Discrimination: Worse Political Condition of the Ethnic Group	0.109 (0.082)	-0.040 (0.052)	-0.104** (0.042)	-0.183*** (0.062)
Pseudo Rsq	0.006	0.003	0.006	0.015
Perception of Discrimination : Unfair Treatment by Government	-0.014 (0.060)	-0.107*** (0.035)	-0.088*** (0.032)	-0.082** (0.041)
Pseudo Rsq	0.006	0.005	0.006	0.014
N Obs.	2,821	6,287	6,098	5,129

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Coefficients are ordered probit coefficients. In the estimating equations the unit of observation is an individual. The standard errors (in parentheses) are corrected for heteroscedasticity and cluster residuals at the district level. The perceptions of discrimination are constructed at the ethnic group level using medians of respondents' answers. All specifications include the variables listed in Table 4.2. A description of each variable is offered in Appendix J.

Table 4.4: Ethnic Group Determinants of Inter-Ethnic Trust by Level of Intra-Ethnic Trust - Ethnic Share and Ethnic Diversity

Level of Intra-Ethnic Trust	**Not At All [A]**	**A Little [B]**	**Somewhat [C]**	**A Lot [D]**
Urban	-0.051	-0.001	0.019	-0.023
	(0.078)	(0.041)	(0.041)	(0.048)
Perception about the Ethnic Group: Unfair Treatment	-0.050	-0.078**	-0.068**	-0.092**
	(0.064)	(0.036)	(0.033)	(0.042)
Ethnic Share (District)	0.545***	-0.130	-0.115	0.030
	(0.203)	(0.095)	(0.093)	(0.096)
Ethnic Share (Country)	-0.565*	-0.215	0.053	0.030
	(0.294)	(0.141)	(0.158)	(0.188)
Ethnic Diversity (District)	0.268	0.167	0.141	0.184
	(0.238)	(0.120)	(0.111)	(0.135)
Ethnic Diversity (Country)	-0.135***	-0.117***	-0.128***	-0.298***
	(0.050)	(0.029)	(0.032)	(0.041)
N Obs.	2,821	6,287	6,098	5,129
Pseudo Rsq	0.013	0.010	0.011	0.027

Significance levels : * = 10% ** = 5% *** = 1%

Notes: Coefficients are ordered probit coefficients. In the estimating equations, the unit of observation is an individual. The standard errors (in parentheses) are corrected for heteroscedasticity and for clustering of the residuals at the district level. The trust in the opposition is constructed at the ethnic group level using medians of respondents' answers. Coefficients and standard errors associated with the country level index of ethnic diversity are divided by 10. All specifications include the variables listed in Table 4.2. A description of each variable is offered in Appendix J.

lower levels of inter-ethnic trust. This result stresses the difficulty of establishing trustworthy inter-ethnic relationship in countries where individuals are from different ethnic origins. It also highlights the difficulty to put in practice Maathai's view (2009) that African nation-states would flourish if ethnic groups worked and lived together. Just like in the case of intra-ethnic groups, the fact that ethnic diversity at the national level has a negative correlation with inter-ethnic trust while no consistent correlation is found at the district level might be explained by endogenous sorting: those who are *more* trusting of other ethnic groups may be more likely to live with other ethnic groups.[19] The implications of such a sorting are potentially consistent with conflicts occurring in multi-ethnic countries where whole districts (or neighbourhoods) are homogenous, yet little trust exists across communities. Another plausible but simple explanation is that ethnic diversity at the national level is simply more relevant for inter-ethnic trust since it is likely to relate to national politics and national issues.

The results from Tables 4.1 and 4.3 suggest that ethnic diversity undermines the formation of trust; this is consistent with the literature, which predicts lower levels of trust among heterogeneous communities [e.g., Easterly and Levine (1997); Alesina and La Ferrara (2002)].

The importance of the ethnic group level determinants underlines the complex interactions between one's own ethnic group identity, other ethnic groups,

[19] Recall the previous notion of endogenous sorting (discussed in the section pertaining to intra-ethnic trust): those who are more trusting of their own ethnic group may be less likely to live with other ethnic groups. Though the two notions are slightly different, they do not contradict each other.

and the nation-state.[20] As Maathai (2009) put it: "for many African peoples, a threat to their micro-nation [her word for ethnic group] or those they consider their leaders within their micro-nation, carries more weight than a threat to the nation-state". To foster and build higher levels of inter-ethnic trust, feelings of threat or discrimination shall, therefore, be addressed.

The coefficients associated with the variable *urban* are reported since, with respect to Table 4.2, they lose significance when ethnic group level characteristics are introduced. The interpretation of this result is left for the next subsection.

4.5.3 District Characteristics

The district characteristics is another factor that potentially influences an individual's inter-ethnic trust. Specifically, the social interactions that exist within districts plausibly shape interpersonal trust, as demonstrated by Alesina and La Ferrara (2002). In Table 4.5, I add district characteristics to the estimating equation that includes the controls listed in both Tables 4.2 and 4.4. I also continue to report the coefficients associated with the *urban* variable.

We can see that the estimates associated with most facilities or infrastructures have limited significance. However, market stalls are significantly correlated with more than one category of intra-ethnic trust. Along with recreational facilities, they are good examples of places where inter-ethnic interactions are possible and common. Recall that such infrastructures are

[20] An interesting thing to do would be to investigate the interaction of inter-ethnic marriages with inter-ethnic trust. Unfortunately, this data is not available in the Afrobarometer.

Table 4.5: District Determinants of Inter-Ethnic Trust by Level of Intra-Ethnic Trust

Level of Intra-Ethnic Trust	**Not At All [A]**	**A Little [B]**	**Somewhat [C]**	**A Lot [D]**
Urban	-0.141*	-0.005	0.015	-0.020
	(0.085)	(0.045)	(0.046)	(0.050)
Services present in the district				
School	0.222**	0.036	-0.053	0.010
	(0.113)	(0.051)	(0.062)	(0.059)
Temple	-0.129	-0.010	-0.007	-0.004
	(0.100)	(0.053)	(0.059)	(0.053)
Recreational Facilities	0.008	0.096**	0.030	0.021
	(0.084)	(0.0428)	(0.042)	(0.045)
Community Building	0.020	-0.059	-0.025	0.019
	(0.078)	(0.045)	(0.046)	(0.057)
Market Stall	0.137*	0.045	0.038	0.103**
	(0.081)	(0.043)	(0.043)	(0.050)
N Obs.	2,592	5,846	5,704	4,810
Pseudo Rsq	0.022	0.013	0.011	0.028
Urban	-0.085	-0.012	0.009	-0.041
	(0.082)	(0.042)	(0.042)	(0.048)
Market Stall	0.201***	0.072*	0.034	0.113**
	(0.073)	(0.039)	(0.039)	(0.044)
N Obs.	2,775	6,203	6,001	5,042
Pseudo Rsq	0.017	0.011	0.011	0.029

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Coefficients are ordered probit coefficients. In the estimating equations, the unit of observation is an individual. The standard errors (in parenthesis) are corrected for heteroscedasticity and for clustering of the residuals at the district level. All specifications include the variables listed in Table 4.2 and Table 4.4. The bottom panel is the preferred regression. A description of each variable is offered in Appendix J.

ambiguously, if not insignificantly, associated with intra-ethnic trust (Table 4.1). These results are, therefore, in line with the idea that the presence of social infrastructures in a district can contribute to positive relations between ethnic communities, not necessarily between ethnic groups. Interestingly, social facilities are at the heart of conflict mediation policies advocated by the United Nations Development Program (also known as "infrastructures for peace" programs) or the World Bank (conflict prevention or post-conflict programs). The estimates also suggest that districts with more inter-ethnic trust lead to more of such infrastructures. The estimates also suggest that districts with more inter-ethnic trust lead to more of such infrastructures. Unfortunately, disentangling between the two interpretations is not feasible here. The preferred regression (bottom panel in Table 4.5) keeps only market stalls; it should be noted that the significance of the coefficient associated with market stalls increases when I pull out other facilities.

This subsection concludes with an analysis of the coefficients associated with the variable *urban*. It is interesting to note that, unlike regressions of intra-ethnic trust (Table 4.1), controlling for ethnic composition and socioeconomic infrastructures in the regressions of inter-trust specification affects the significance of the variable *urban* (Tables 4.4 and 4.5). This suggests that ethnic composition and infrastructures "explain" the role of the variable urban for inter-ethnic trust, but other features specific to cities matter for intra-ethnic trust. In particular, the negative correlation between the *urban* variable and intra-ethnic trust might be explained by the fact that individuals living in cities have to, de facto, renege on part or all of the norms/traditions of their ethnic

group. Ethnicity could, therefore, be a burden for individuals in cities (and hence, a lack of trust) especially if these people have to support other members of their group.[21] The results highlight the importance of cities on the formation of trust in African countries: not only do cities provide opportunities for interaction between members of different ethnic groups, but they also deeply affect intra-ethnic interactions.

4.5.4 A Role for Economic Growth?

The last part of this section presents a key result of the chapter: the link between inter-ethnic trust and growth rates (Table 4.6).[22] It is established that growth rates over the 15 or 25 years that preceded the survey are consistently, significantly, and positively associated with inter-ethnic trust. However, the association between recent growth rates (5 years) and inter-ethnic trust is insignificant. Higher levels of inter-ethnic trust are thus correlated with sustained growth over long periods of time. Because causality between growth and trust is likely to be an issue, two interpretations are plausible.

On one hand, the result is consistent with recessions undermining the formation of inter-ethnic trust, which can be linked to evidence from the literature, which finds an effect of economic activities on ethnic relationships

[21] Such a behaviour can be linked to the concept of acculturation, which has been studied in psychology and sociology.

[22] Recall that growth rates are collected for the 1980-2004 period from the Penn World Tables, Mark 6.3, as described in Heston, Summers, and Aten (2009).

Table 4.6: Growth and Inter-Ethnic Trust by Level of Intra-Ethnic Trust

Level of Intra-Ethnic Trust	**Not At All [A]**	**A Little [B]**	**Somewhat [C]**	**A Lot [D]**
Average Growth	-0.045	0.061***	0.082***	0.063*
(1980 − 2004)	(0.043)	(0.020)	(0.024)	(0.038)
Pseudo Rsq	0.018	0.012	0.013	0.029
Average Growth	0.026	0.026*	0.038***	-0.010
(1990 − 2004)	(0.039)	(0.013)	(0.014)	(0.021)
Pseudo Rsq	0.018	0.017	0.012	0.029
Average Growth	0.017	0.006	0.021*	-0.020
(1995 − 2004)	(0.030)	(0.010)	(0.012)	(0.016)
Pseudo Rsq	0.018	0.011	0.012	0.029
Average Growth	0.004	0.000	0.008	-0.009
(2000 − 2004)	(0.012)	(0.004)	(0.005)	(0.006)
Pseudo Rsq	0.018	0.011	0.012	0.029
N Obs.	2,775	6,203	6,001	5,042

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Coefficients are ordered probit coefficients. In the estimating equations, the unit of observation is an individual. The standard errors (in parentheses) are corrected for heteroscedasticity and for clustering of the residuals at the district level. All specifications include the variables listed in Tables 4.2, 4.4, and the preferred regression from 4.5.

[e.g., Peil (1975); Rohner et al. (2011 and 2012)].[23] On the other hand, the level of growth is likely to be endogenous with respect to the level of inter-ethnic trust: countries with higher levels of inter-ethnic trust should, *ceteris paribus*, experience higher levels of economic growth. This is in line with Putnam (1993) or LaPorta et al. (1997 and 1999). The regressions from Table 4.6 might just capture this relation.

It is interesting to link the estimates from this section to the ones observed for intra-ethnic trust. Tables 4.1 and 4.6 respectively show that intra-ethnic trust is *countercyclical*, whereas inter-ethnic trust is *procyclical*, which suggests important relationships between growth and the dynamics of trust. For instance, one interpretation is that long recessions undermine social cohesion since they increase the gap between intra- and inter-ethnic trust.[24] This view contributes to understanding why, despite decades of stability, ethno-political crises erupted in some African countries (e.g., Côte d'Ivoire or Kenya) during their long and deep economic recessions. Another interpretation simply suggests that countries with bigger gaps between intra- and inter-ethnic trust (and implicitly lower social cohesion) tend to have lower growth rates.

Regardless of the direction of causality, the results presented here are consistent with the idea of self-reinforcing mechanisms between growth and social capital. They serve as motivation for a deeper analysis of the links between

[23] Specifically, Peil (1975) found that inter-ethnic conflicts in Nigeria are "really about economic and political power". Rohner, Thoenig, and Zilibotti (2011) showed that conflicts across communities lead to less trade, which perpetuates further collapse of trust and social capital. The same authors found a causal effect of conflicts on ethnic trust in Uganda [Rohner et al. (2012)].

[24] The implicit assumption here is that social cohesion is likely to be hampered when individuals exhibit gaps between inter- and intra-ethnic trust.

economic growth and the dynamics of intra- and inter-ethnic trust, which, unfortunately, cannot be addressed with the data at hand.

4.6 Conclusion

This study analyzes the determinants of inter-ethnic relations by focusing on the relationship between inter- and intra-ethnic trust. Using survey data from the Afrobarometer, it is first found that, though most individuals have similar levels of intra- and inter-ethnic trust, differences exist for a non-negligible fraction of them. In simple words, ethnic origin matters to trust. The study investigates the factors that are significantly associated with inter-ethnic trust for each level of intra-ethnic group. By means of ordered probit regressions, it is shown that four categories of factors matter and that the strongest factors associated with higher levels of inter-ethnic trust are

1. an individual's characteristics (e.g., age);
2. ethnic group characteristics (e.g., belonging to a group that does not feel treated unfairly or politically discriminated against);
3. district characteristics including living in a district with social infrastructures (e.g., markets); and
4. country characteristics (e.g., living in a country with homogeneous ethnic groups and sustained growth over long periods of time).

Gender and religious beliefs are weakly associated with inter-ethnic trust. Surprisingly, the relationship between education and inter-ethnic trust is ambiguous: its coefficients are often not significant, and its signs change with the intra-ethnic trust category. This result can be related to the ambiguous role played by the elites ("the most educated") in Africa, and it reopens the discussion on the role that education plays in the formation of good citizenry, especially in Africa.

Interestingly, key variables, such as district characteristics and growth, have different correlations with inter- or intra-ethnic trust. First, this comparison shows the importance of cities on the formation of trust in African countries: cities not only provide opportunities for interaction between members of different ethnic groups, but they also deeply affect intra-ethnic interactions. Second, the contrast between the procyclicality of inter-ethnic trust and the countercyclicality of intra-ethnic trust supports the idea that long recessions undermine social cohesion since they increase the gap between intra- and inter-ethnic trust. Alternatively, they also suggest that countries with bigger gaps between intra- and inter-ethnic trust (and implicitly lower social cohesion) tend to have lower growth rates.

The results of the chapter serve as motivation for a deeper analysis of the dynamic links between economic growth and intra- and inter-ethnic trust. In this respect, the interaction between long-term growth and some variables, (e.g., infrastructure) demands more attention. The construction of social infrastructures is, indeed, related to growth rates, especially in Africa, where the

government is a key investor. For example, countries that were hit by deep economic crises in the 1980-1990s agreed to Structural Adjustment Plans and had to stop investing in social infrastructure (e.g., recreational facilities). Hence, a thorough understanding of the complex links between growth and inter-ethnic relations requires a refinement of the data. Understanding what are the channels of transmission and self-reinforcement between growth and trust will help design better national and international policies.

4.7 Bibliography

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Chapter 5

Conclusion

This thesis makes several contributions to the literature related to the macroeconomics of development. The first chapter provides evidence on the importance of educational corruption. It develops a model whose key feature is a corruptible university. Specifically, incompetent students can get diplomas if they pay a bribe. This generates two channels by which corruption affects the economy. The first is a direct channel in which incompetent students with diplomas lower production due to their lack of skills. The second is an indirect, or feedback, effect that undermines the quality of the teacher pool (as teachers are hired from the pool of graduates). Consequently, the creation of skills diminishes, and fewer competent workers are available for production. This channel has not been previously discussed in the literature.

Based on data on educational corruption, the public sector, college enrollment and completion rates, the model is then calibrated. The benchmark model is able to replicate key features of the data. It also gives an idea of the impact of

corruption on the quality of teachers. Hence, the most corrupted countries (the countries with more than 10% of people paying a bribe in the education sector) have a teacher quality, that is only 69% of the quality of other countries. Such a low quality of teachers has dramatic implications for the creation of knowledge. For example, a student with the highest ability level (θ=1) has only an 80% probability of becoming competent in the most corrupted countries. In comparison, this probability is close to 100% in the least corrupted countries

Finally, counterfactual experiments are implemented. The key result from these experiments is that the feedback channel is quantitatively more important than the direct channel. For instance, the most corrupted countries could gain 9% in output if the indirect channel was removed; this represents roughly tenfold the gains from the removal of the direct channel. Moreover, removing corruption in these countries would yield a 22% gain in output.

The second chapter of this thesis sheds light on the institutions that support high levels of corruption. It considers the latter as a social endemic phenomenon and analyzes the ways in which civil society can help to in reduce it. This novel approach complements existing work on the role of social norms and non-pecuniary motivations for corruption.

The model expands on a simple corruption framework with bureaucrats and citizens, and the engagement of the civil society is modeled as its effectiveness in catching/punishing misbehaving agents. The dynamic evolution of honesty within the population is affected by both pecuniary (e.g., wages or the probability of getting caught) and non-pecuniary benefits (e.g., morality) in a manner that borrows from Francois and Zabojnik (2005). It is found that a greater

involvement of civil society can effectively reduce the level of corruption but has an ambiguous effect on social capital. This stresses an important result: countries enjoy lower levels of corruption not necessarily because they have more honest citizens (i.e., more social capital), but rather because lower levels of corruption are tolerated for each level of honest citizens. Interestingly, wage policies are shown to be ineffective at reducing corruption in this economic environment.

Despite limitations, the analysis of the Afrobarometer survey data suggests that the predictions of the model are supported by the data. The results are robust for several specifications, including five different definitions of corruption, as well as for controlling for the endogeneity of civic engagement by using an instrumental variable approach. In addition, the results suggest that the causality goes from civic engagement to corruption.

The final chapter analyzes the determinants of inter-ethnic relations by focusing on the relationship between inter- and intra-ethnic trust. Based on survey data from the Afrobarometer, it is first found that, even though most individuals have similar levels of intra- and inter-ethnic trust, differences exist for a non-negligible fraction of them. Therefore, ethnic origin matters for trust. The chapter then investigates the factors that are significantly associated with inter-ethnic trust for each level of intra-ethnic group.

By means of ordered probit regressions, it is established that the factors consistently associated with higher levels of inter-ethnic trust include (i) the age of the individuals; (ii) their belonging to a group that does not feel treated unfairly by the government; (iii) their living in a district with socio-economic

infrastructures like markets; (iv) their living in a country with homogeneous ethnic groups and with sustained growth over long periods of time. Gender and religious beliefs are weakly correlated with inter-ethnic trust. Surprisingly, education is ambiguously and inconsistently associated with inter-ethnic trust.

Interestingly, key variables such as district characteristics and growth have different correlations with inter- and intra-ethnic trust. First, this comparison shows the importance of cities in the formation of trust in African countries. Cities not only provide opportunities of interaction between members of different ethnic groups, but they also deeply affect intra-ethnic interactions. Second, the contrast between the procyclicality of inter-ethnic trust and the countercyclicality of intra-ethnic trust supports the idea that long recessions undermine social cohesion since they increase the gap between intra- and inter-ethnic trust. Alternatively, they also suggest that countries with bigger gaps between intra- and inter-ethnic trust (and, implicitly, lower social cohesion) tend to have lower growth rates.

Appendix A

Proofs of Propositions 1 and 2

A.1 Proposition 1: Bribe or Not?

Proposition 1 establishes a cutoff $\underline{\omega}\left(c_e, b, \phi_{\text{PS}}, \phi_{\text{F}}, \gamma, \frac{w_L}{w_H}\right)$ of agents who shall bribe. Formally, a student with wealth ω would bribe if

$$\begin{aligned}
& & V^{B}_{\text{Incpt}}(\omega) &\geq V^{\bar{B}}_{\text{Incpt}}(\omega) \\
\Leftrightarrow\ & \ln(\omega - c_e - b) + \beta\left[\pi \ln(w_H) + (1-\pi)\ln(w_L)\right] &\geq \ln(\omega - c_e) + \beta \ln(w_L) \\
\Leftrightarrow\ & \ln\left(\frac{\omega - c_e - b}{\omega - c_e}\right) &\geq \ln\left(\frac{w_L}{w_H}\right)^{\beta\pi} \\
\Leftrightarrow\ & \omega \geq c_e + \frac{b}{1 - \left(\frac{w_L}{w_H}\right)^{\beta\pi}} &\equiv \underline{\omega}(c_e, b, \phi_{\text{PS}}, \phi_{\text{F}}, \gamma, \frac{w_L}{w_H})
\end{aligned}$$

where $\pi \equiv 1 - \phi_{\text{PS}}\gamma - (1-\gamma)\phi_{\text{F}}$ and $\gamma \equiv \max\left\{\frac{N_{\text{PS}}}{N^{\text{I}}}, 1\right\}$. Hence an agent with wealth ω would bribe if and only if his wealth exceeds $\underline{\omega}(c_e, b, \phi_{\text{PS}}, \phi_{\text{F}}, \gamma, \frac{w_L}{w_H})$. $\square$

I then investigate the effects of the direct cost of education (c_e), the amount of the bribe (b), the government and firms' screening (ϕ_{PS} and ϕ_{F}) and the probability an incompetent get hired in the public sector (γ). First I establish the behaviour of π, I find

$$\frac{\partial \pi}{\partial \phi_{\text{F}}} = -(1-\gamma) < 0 \quad ; \quad \frac{\partial \pi}{\partial \phi_{\text{PS}}} = -\gamma < 0 \quad ; \quad \frac{\partial \pi}{\partial \gamma} = \phi_{\text{F}} - \phi_{\text{PS}} > 0.$$

Using the latter derivatives and the fact that $w_L < w_H$, it follows that

$$\frac{\partial \underline{\omega}}{\partial c_e} = 1 > 0 \quad ; \quad \frac{\partial \underline{\omega}}{\partial b} = \frac{1}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}} > 0 \quad ; \quad \frac{\partial \underline{\omega}}{\partial \pi} = \beta \left(\frac{w_L}{w_H}\right)^{\beta} \ln\left(\frac{w_L}{w_H}\right) < 0$$

$$\frac{\partial \underline{\omega}}{\partial \phi_{\mathrm{F}}} = \frac{\partial \underline{\omega}}{\partial \pi}\frac{\partial \pi}{\partial \phi_{\mathrm{F}}} > 0 \quad ; \quad \frac{\partial \underline{\omega}}{\partial \phi_{\mathrm{PS}}} = \frac{\partial \underline{\omega}}{\partial \pi}\frac{\partial \pi}{\partial \phi_{\mathrm{PS}}} > 0 \quad ; \quad \frac{\partial \underline{\omega}}{\partial \gamma} = \frac{\partial \underline{\omega}}{\partial \pi}\frac{\partial \pi}{\partial \gamma} \quad < 0$$

$$\frac{\partial \underline{\omega}}{\partial \frac{w_L}{w_H}} = \frac{b\beta\pi\left(\frac{w_L}{w_H}\right)^{\beta\pi-1}}{\left[1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}\right]^2} \quad > \quad 0$$

Thus an increase of either the direct cost of education, the size of the bribe or government and firm's screening raise the threshold. An easier access to government jobs for incompetent and an increase of the skilled wage premium ($\frac{w_H}{w_L}$) decreases the threshold and makes corruption more appealing. This completes the proof of Proposition 1. ■

A.2 Proposition 2: Enter University or Not?

I now characterize the decision to enter University. I abuse notation and rewrite $\underline{\omega}(\Lambda)$ where Λ is the aggregate state vector as defined in the text. I use the cutoff $\underline{\omega}(\Lambda)$ from Proposition 1. Hence I have two cases depending on whether an agent's wealth exceeds $\underline{\omega}(\Lambda)$ or not. Let agents with wealth below the cutoff be referred as the *Poor* and those above as the *Rich*. Recall that $p(\theta, Q)$ is the probability to become competent and takes the form

$$p(\theta, Q) \equiv \alpha\theta + (1-\alpha)\theta Q \equiv \theta\Psi$$

where $\Psi \equiv \alpha + (1-\alpha)Q$ and the last equivalence is used for notational sake.

First Case: The Poor, $\omega < \underline{\omega}(\Lambda)$
Such agents know they cannot bribe in the event they become incompetent. They would enter University if

$$\begin{aligned}
& V_{\mathrm{U}}(\theta; \omega < \underline{\omega}) \geq V_{\mathrm{NU}}(\theta; \omega) \\
\Leftrightarrow \quad & \ln(\omega - c_e) + \beta\left[p(\theta, Q)\ln(w_H) + (1 - p(\theta, Q)\ln w_L)\right] \geq \ln(\omega + w_L) + \beta\ln(w_L) \\
\Leftrightarrow \quad & \ln(\omega - c_e) + \beta\left[\theta\Psi\ln(w_H) + (1 - \theta\Psi\ln w_L)\right] \geq \ln(\omega + w_L) + \beta\ln(w_L) \\
\Leftrightarrow \quad & \beta\theta\Psi\ln\left(\frac{w_H}{w_L}\right) \geq \ln\left(\frac{\omega + w_L}{\omega - c_e}\right) \\
\Leftrightarrow \quad & \theta \quad \geq \quad \frac{\ln\left(\frac{\omega + w_L}{\omega - c_e}\right)}{\beta\Psi\ln\left(\frac{w_H}{w_L}\right)} \equiv \underline{\theta}_P(\omega, c_e, b, \phi_{\mathrm{PS}}, \phi_{\mathrm{F}}, \gamma, \frac{w_H}{w_L}, Q)
\end{aligned}$$

Hence a poor would enter University if and only if her ability is above the cutoff $\underline{\theta}_P(.)$. The cutoff directly depends on ω, $\frac{w_H}{w_L}$ and Q, and indirectly (through $\underline{\omega}(\Lambda)$) on b, ϕ_{F} and ϕ_{PS}.

Let's see the comparative-statics induced by a change in ω, Q, $\frac{w_H}{w_L}$, b, ϕ_{F} and ϕ_{PS}. It is easy to see that

$$\frac{\partial \underline{\theta}_P}{\partial \omega} = -\frac{1}{\beta\Psi \ln\left(\frac{w_H}{w_L}\right)} \frac{(w_L+c_e)}{(\omega-c_e)(\omega+w_L)} < 0 \quad ; \quad \frac{\partial \underline{\theta}_P}{\partial Q} = -\frac{\beta(1-\alpha)\ln\left(\frac{w_H}{w_L}\right)\ln\left(\frac{\omega+w_L}{\omega-c_e}\right)}{\left[\beta\Psi \ln\left(\frac{w_H}{w_L}\right)\right]^2} < 0$$

$$\frac{\partial \underline{\theta}_P}{\partial\left(\frac{w_H}{w_L}\right)} = -\frac{\beta\Psi\left(\frac{w_H}{w_L}\right)\ln\left(\frac{\omega+w_L}{\omega-c_e}\right)}{\left[\beta\Psi \ln\left(\frac{w_H}{w_L}\right)\right]^2} < 0 \quad ; \quad \frac{\partial \underline{\theta}_P}{\partial b} = \frac{\partial \underline{\theta}_P}{\partial \gamma} = \frac{\partial \underline{\theta}_P}{\partial \phi_{\text{PS}}} = \frac{\partial \underline{\theta}_P}{\partial \phi_{\text{F}}} = 0.$$

The first derivative tells us that wealth diminishes the ability cutoff hence wealthier agents tends to enter University. Similarly, the quality of teachers induces more students to enroll; since corruption affects Q in equilibrium (the feedback effect) one should expect more corruption to induce fewer entries. The third derivative says that if the skilled premium increases more people will enter University. The last four effects are nil highlighting the fact that once an agent anticipates she cannot pay the bribe, the amount of the bribe, the government intervention and the tightness for public sector jobs do not matter anymore for the decision to enter University. □

Second Case: The Rich, $\omega \geq \underline{\omega}(\Lambda)$
Such agents know they can bribe and obtain a diploma in the event they are incompetent. Hence they would enter University if

$$\begin{aligned}
& V_{\text{U}}(\theta; \omega \geq \underline{\omega}) \geq V_{\text{NU}}(\theta, \omega) \\
\Leftrightarrow \quad & \theta\Psi\left[\ln(\omega - c_e) + \beta \ln(w_H)\right] + \ldots \\
& (1-\theta\Psi)\left\{\ln(\omega - c_e - b) + \beta\left[\pi \ln(w_H) + (1-\pi)\ln(w_L)\right]\right\} \geq \ln(\omega + w_L) + \beta \ln(w_L) \\
\Leftrightarrow \quad & \theta\Psi\left\{\ln\left(\frac{\omega - c_e}{\omega - c_e - b}\right) + \beta\left[(1-\pi)\ln\left(\frac{w_H}{w_L}\right)\right]\right\} \geq \ln\left(\frac{\omega + w_L}{\omega - c_e b}\right) - \beta\pi \ln\left(\frac{w_H}{w_L}\right) \\
\Leftrightarrow \quad & \theta \geq \frac{\ln\left(\frac{\omega+w_L}{\omega-c_e-b}\right) - \beta\pi \ln\left(\frac{w_H}{w_L}\right)}{\Psi\left\{\ln\left(\frac{\omega-c_e}{\omega-c_e-b}\right) + \beta\left[(1-\pi)\ln\frac{w_H}{w_L}\right]\right\}} \equiv \underline{\theta}_R(\omega, c_e, b, \phi_{\text{F}}, \phi_{\text{PS}}, \gamma, \frac{w_H}{w_L}, Q)
\end{aligned}$$

with $\pi \equiv 1 - \gamma\phi_{\text{PS}} - (1-\gamma)\phi_{\text{F}}$

Working the comparative statics using $\underline{\theta}_R(.)$ is cumbersome. I rather rely on the Implicit Function Theorem which simplifies tremendously the analysis.

Hence I rewrite the expression of the last equivalence as

$$\Upsilon\left(\underline{\theta}_R,\omega,b,c_e,\pi,\tfrac{w_H}{w_L},\Psi\right)=\underline{\theta}_R\times\Psi\left\{\ln\left(\tfrac{\omega-c_e}{\omega-c_e-b}\right)+\beta\left[(1-\pi)\ln\left(\tfrac{w_H}{w_L}\right)\right]\right\}-\ln\left(\tfrac{\omega+w_L}{\omega-c_e-b}\right)+\ldots$$
$$\ldots+\beta\pi\ln\left(\tfrac{w_H}{w_L}\right)=0$$

It follows that first order derivatives for Υ are

$$\begin{aligned}
\frac{\partial\Upsilon}{\partial\underline{\theta}_R} &= \Psi\left\{\ln\left(\frac{\omega-c_e}{\omega-c_e-b}\right)+\beta\left[(1-\pi)\ln\left(\frac{w_H}{w_L}\right)\right]\right\}>0\\
\frac{\partial\Upsilon}{\partial\omega} &= \frac{1-\underline{\theta}_R\Psi}{\omega-c_e-b}+\frac{\underline{\theta}_R\Psi}{\omega-c_e}-\frac{1}{\omega+w_L}>0\\
\frac{\partial\Upsilon}{\partial\Psi} &= \underline{\theta}_R\left\{\ln\left(\frac{\omega-c_e}{\omega-c_e-b}\right)+\beta\left[(1-\pi)\ln\left(\frac{w_H}{w_L}\right)\right]\right\}>0\\
\frac{\partial\Upsilon}{\partial b} &= -\frac{1-\underline{\theta}_R}{\omega-c_e-b}<0\\
\frac{\partial\Upsilon}{\partial\pi} &= \beta(1-\underline{\theta}_R\Psi)\ln\left(\frac{w_H}{w_L}\right)>0\\
\frac{\partial\Upsilon}{\partial\frac{w_H}{w_L}} &= \beta\frac{w_L}{w_H}\left[\pi+(1-\pi)\underline{\theta}_R\right]>0
\end{aligned}$$

Further we have $\frac{\partial\Psi}{\partial Q}>0$, $\frac{\partial\pi}{\partial\phi_{\text{PS}}}<0$, $\frac{\partial\pi}{\partial\phi_{\text{F}}}<0$ and $\frac{\partial\pi}{\partial\gamma}>0$. Using the Implicit Function Theorem it follows that

$$\frac{\partial\underline{\theta}_R}{\partial\omega}=-\frac{\Upsilon_\omega}{\Upsilon_{\underline{\theta}_R}}<0\quad;\quad\frac{\partial\underline{\theta}_R}{\partial Q}=-\frac{\Upsilon_\Psi\times\frac{\partial\Psi}{\partial Q}}{\Upsilon_{\underline{\theta}_R}}<0$$
$$\frac{\partial\underline{\theta}_R}{\partial\frac{w_H}{w_L}}=-\frac{\Upsilon_{\frac{w_H}{w_L}}}{\Upsilon_{\underline{\theta}_R}}<0\quad;\quad\frac{\partial\underline{\theta}_R}{\partial b}=-\frac{\Upsilon_b}{\Upsilon_{\underline{\theta}_R}}>0$$
$$\frac{\partial\underline{\theta}_R}{\partial\phi_{\text{PS}}}=-\frac{\Upsilon_b\times\frac{\partial\pi}{\partial\phi_{\text{PS}}}}{\Upsilon_{\underline{\theta}_R}}>0\quad;\quad\frac{\partial\underline{\theta}_R}{\partial\phi_{\text{F}}}=-\frac{\Upsilon_\pi\times\frac{\partial\pi}{\partial\phi_{\text{F}}}}{\Upsilon_{\underline{\theta}_R}}>0$$
$$\frac{\partial\underline{\theta}_R}{\partial\gamma}=-\frac{\Upsilon_\pi\times\frac{\partial\pi}{\partial\gamma}}{\Upsilon_{\underline{\theta}_R}}<0$$

The analysis of $\underline{\theta}_R(.)$ is thus similar to the one of $\underline{\theta}_P(.)$. Hence the first derivative tells us that wealth diminishes the ability cutoff hence wealthier agents tends to enter University. Similarly, the quality of teachers induces more students to enroll; since corruption affects Q in equilibrium (the feedback effect) one should expect more corruption to induce fewer entries. The third

derivative says that if the skilled premium increases more people will enter University. The size of the bribe and the probability of being caught increase the cutoff of ability: if it is costly to bribe students with higher probability to become incompetent won't enter University.

Finally, is $\underline{\theta}_R(.)$ greater or smaller than $\underline{\theta}_P(.)$? First we know that

- $\underline{\theta}_R(.)$ is decreasing in ω and is defined on $\left[\underline{\omega}(\Lambda),\, \omega^{Max}\right]$. Therefore the maximum value for $\underline{\theta}_R(.)$ is achieved at $\underline{\omega}(\Lambda)$.
- $\underline{\theta}_R(.)$ is decreasing in ω and is defined on $[0,\, \underline{\omega}(\Lambda)[$. Therefore the minimum value for $\underline{\theta}_P(.)$ is achieved at $\underline{\omega}(\Lambda)$.

Using the expression for $\underline{\omega}(\Lambda)$, it can be shown that

$$\underline{\theta}_P(\underline{\omega}, c_e, b, \phi_{\text{F}}, \phi_{\text{PS}}, \gamma, \frac{w_H}{w_L}, Q) = \frac{\ln\left[1 + \left(1 - \left(\frac{w_L}{w_H}\right)^{\beta\pi}\right) \times \frac{c_e + w_L}{b}\right]}{\beta\Psi \ln \frac{w_H}{w_L}} \tag{A.1}$$

Further by evaluating $\underline{\theta}_P(.)$ at $\underline{\omega} - \epsilon$ with $\epsilon \in \mathbb{R}_+$ close to zero, we get

$$\begin{aligned}
\underline{\theta}_P(\underline{\omega} - \epsilon, c_e, b, \phi_{\text{F}}, \phi_{\text{PS}}, \gamma, \frac{w_H}{w_L}, Q) &= \frac{\ln\left(\frac{c_e + w_L - \epsilon + \frac{b}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}}}{\frac{b}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi} - \epsilon}}\right)}{\beta\Psi \ln \frac{w_H}{w_L}} \\
&> \frac{\ln\left(\frac{c_e + w_L + \frac{b}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}}}{\frac{b}{1-\left(\frac{w_L}{w_H}\right)^{\beta\pi}}}\right)}{\beta\Psi \ln \frac{w_H}{w_L}} \\
&= \frac{\ln\left[1 + \left(1 - \left(\frac{w_L}{w_H}\right)^{\beta\pi}\right) \times \frac{c_e + w_L}{b}\right]}{\beta\Psi \ln \frac{w_H}{w_L}} = \underline{\theta}_R(\underline{\omega}, .)
\end{aligned}$$

where the inequality comes from the fact that adding ϵ to both the numerator and the denominator increases the top expression. It is then immediate that the maximum value for $\underline{\theta}_R(.)$ (expression (A.1)), is lower that the minimum value of $\underline{\theta}_P(.)$. Cutoffs of ability for rich are therefore lower that the ones of poor. This completes the proof of Proposition 2. ■

Appendix B

Aggregate Measures of Entrants, Graduates and Competent

Using Propositions 1 and 2, one can derive expressions for the number of entrants (N^{E}), graduates (N^{G}) and competent (N^{C}) in the economy. N^{E} is the sum of agents, rich or poor, whose ability exceeds the respective cutoff. Because incompetent rich are able to bribe they obtain a diploma and N^{G} is the sum of all rich and competent poor. Finally the number of competent, N^{C} would be the sum of competent rich and poor that enter University.

For notational sake I abstract from the aggregate Λ. Let $f(\theta)$ and $g(\omega)$ denote the probability distributions of θ and ω on $[0,\,1]$ and $[0, \omega^{\max}]$ respectively; both distributions are assumed uniform. Recall that the probability to become competent is $p(\theta, Q) = \theta\Psi$, it follows that

$$\begin{aligned} N^{\mathrm{E}} &= \int_0^{\underline{\omega}} \int_{\underline{\theta}_P(\omega)}^1 f(\theta)g(\omega)\, d\theta d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \int_{\underline{\theta}_R(\omega)}^1 f(\theta)g(\omega)\, d\theta d\omega \\ &= \frac{1}{\omega^{\max}} \left[\int_0^{\underline{\omega}} (1 - \underline{\theta}_P(\omega))\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} (1 - \underline{\theta}_R(\omega))\, d\omega \right] \\ N^{\mathrm{E}} &= 1 - \frac{1}{\omega^{\max}} \left[\int_0^{\underline{\omega}} \underline{\theta}_P(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R(\omega)\, d\omega \right] \end{aligned}$$

$$
\begin{aligned}
N^{\mathrm{G}} &= \int_0^{\underline{\omega}} \int_{\underline{\theta}_P(\omega)}^1 \theta\Psi f(\theta)g(\omega)\, d\theta d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \int_{\underline{\theta}_R(\omega)}^1 f(\theta)g(\omega)\, d\theta d\omega \\
&= \int_0^{\underline{\omega}} \frac{1}{\omega^{\max}} d\omega - \int_0^{\underline{\omega}} \frac{\Psi}{\omega^{\max}} \int_0^{\underline{\theta}_P(\omega)} \theta d\theta d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \int_{\underline{\theta}_R(\omega)}^1 f(\theta)g(\omega)\, d\theta d\omega, \\
N^{\mathrm{G}} &= 1 - \frac{1}{\omega^{max}} \left[\underline{\omega}(\frac{\Psi}{2} \int_0^{\underline{\omega}} \underline{\theta}_P^2(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R(\omega)\, d\omega \right]
\end{aligned}
$$

$$
\begin{aligned}
N^{\mathrm{C}} &= \int_0^{\underline{\omega}} \int_{\underline{\theta}_P(\omega)}^1 \theta\Psi f(\theta)g(\omega)\, d\theta d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \int_{\underline{\theta}_R(\omega)}^1 \theta\Psi f(\theta)g(\omega)\, d\theta d\omega \\
&= 1 - \frac{\Psi}{2\omega^{\max}} \left[\int_0^{\underline{\omega}} \underline{\theta}_P^2(\omega)\, d\omega + \int_{\underline{\omega}}^{\omega^{\max}} \underline{\theta}_R^2(\omega)\, d\omega \right]
\end{aligned}
$$

$$
N^{\mathrm{I}} = N^{\mathrm{G}} - N^{\mathrm{C}}.
$$

Appendix C

Description of the Data for the Parametrization

This section describes the data used in the quantitative section of Chapter 2. Specifically, data on corruption in the education sector, education aggregates, public sector employment, employment of the College educated and output per capita are collected.

As a measure of the proportion of incompetent who pays a bribe, I rely on the proportions of people who paid a bribe in the education sector from Transparency International's Global Corruption Barometer (GCB).[1]

The GCB is a survey that assesses public opinions regarding corruption in public sectors, government actions against corruption and the evolution of corruption. Respondents are men and women aged 15+ and samples have been weighted to bring them in line with national and global populations. According to Transparency International's website,"GCB is the only worldwide public opinion survey on perception and experience of corruption."[2] A clear limitation for the purpose of the chapter is that the GCB does not make any distinction between education levels and the reason of the payment. This constraint may

[1]Specifically I use those who answered "yes" to the question: *" In the past 12 months, have you or anyone living in your household paid a bribe in any form to each of the following institution/organization? Education system"*

[2]For a complete description of the GCB go to http://www.transparency.org

impose a bias on my calibration. I nevertheless rely on GCB for 3 reasons: (1) it is the closest measure of corruption in University that I am aware of; (2) it covers a big set of countries, and (3) it is comparable year to year.[3] This gives us data on corruption for 81 countries for years 2006 to 2008. Table 2.1 shows summary statistics for this education corruption measure.

As a measure of University attendance (N^{E}) and University Graduates (N^{G}) I rely on UNESCO data. I use available data on the period 1997-2008 of Gross Enrollment Ratio and Gross Completion Ratio at the tertiary level (ISCED 5 and 6); these rates are expressed in percentage of the relevant age group.

The measure of output per capita is obtained from the real chain-weighted series RGDPCH of the Penn World Table, Mark 6.3 which is detailed in Heston, Summers and Aten (2009). I extract all available data for years 1990 to 2007. We next collect data on the public sector.

Recall that public servants (N_{PS}) in the model are hired from the pool of college graduates. Unfortunately cross-national data set on active population by education level and occupation are not available. To remedy this shortcoming I construct a variable that approximates the fraction of graduate that works in the public sector. I first collect data on public sector employment (Total Government) from International Labour Office(ILO)'s LABORSTA. This measure gives me a figure of the size of the public sector, say P. From the same source, I then collect data on employment by level of education and data on the total active population aged 15+. I combine the 2 data sets and construct a variable, say F, that stands for the fraction of the total active population with University education. I finally apply this fraction to the size of the public sector (i.e I do $F \times P$) to obtain a crude approximation of the share of the active population that works in the public sector and has a College Education. By doing this I implicitly assume that the fraction of public servants with college education is the same as the fraction of college educated in the economically active population. The data runs from 1990 to 2007.

For the skilled wage premia, I use data from the Occupational Wages around the World (OWW) Database as depicted in Freeman and Oostendorp (2005). The authors collect wages from diverse occupations and industries over the world. Specifically, I use the "x3wl" data set which uses a country-specific

[3]Another measure of corruption widely used is the Corruption Perception Index (CPI) also available from Transparency International. The advantage of CPI is that it has been collected since 1995 and it covers more than a hundred countries. Shaw (2007) for example uses CPI to highlight the effect of educational corruption. A limit of CPI however is that it is a measure of bureaucratic corruption and it does not focus on education.

and uniform calibration with lexicographic weighting. I then compute average wages by occupation over the period 1990-2003 and retrieve the associated percentiles distribution. I finally construct the skilled wage premia by taking the ratio of the 80th to 20th percentiles of the distribution.

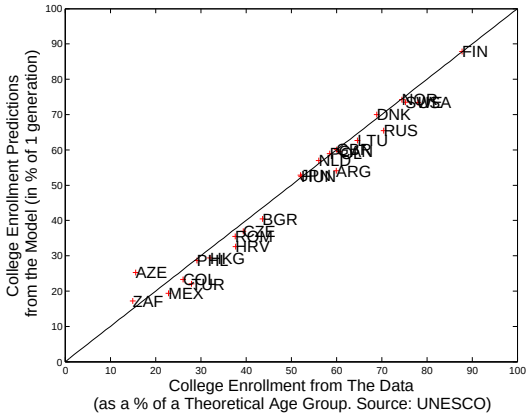
For all variables, I consider the means of all available data. The final sample consists of countries that have observations for all variables. This yields 25 countries.[4] The most restrictive data set is the one concerning the public sector: around 40 countries, mostly among the most corrupted countries, do not have data on the public sector.

[4] It should be acknowledged that the data set is limited. The most obvious problem is that the periods covered and the length of the series are not the same. This is particularly true for the educational corruption variable. Another issue is the fact that the share of College educated in the public sector might be higher or lower than in the active population.

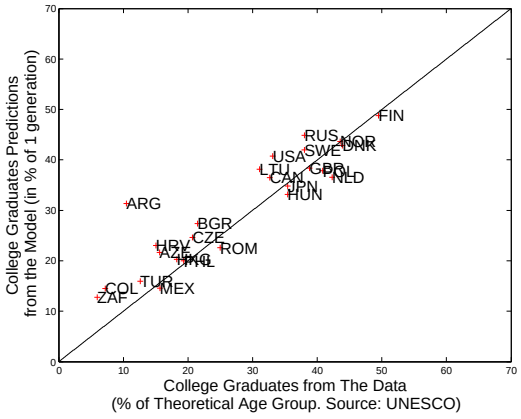
Appendix D

Parametrization Results

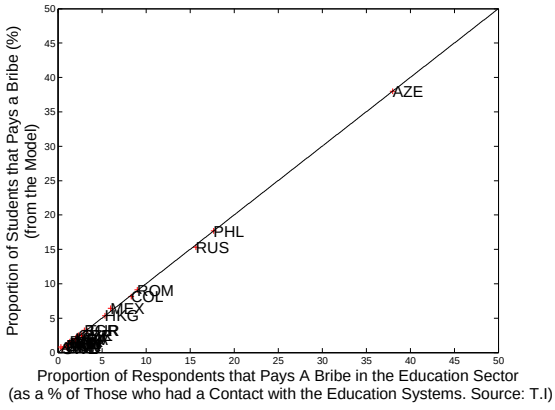
Figure D.1: Targets of Calibration.



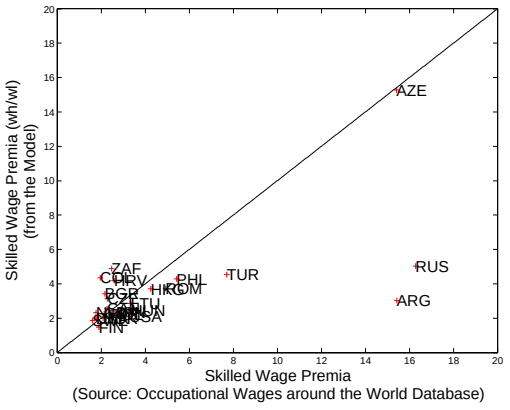
(a) College Enrollments.



(b) College Graduates.

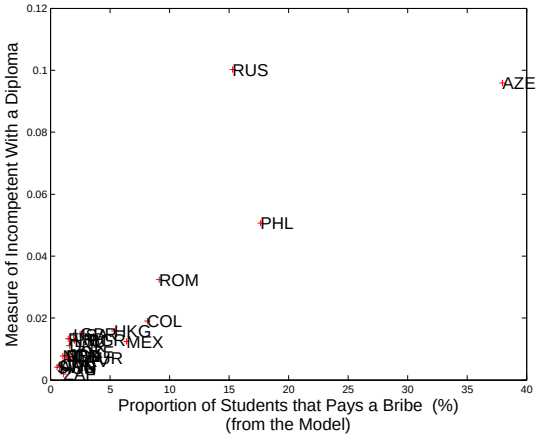


(c) Proportion of Students Paying a Bribe.

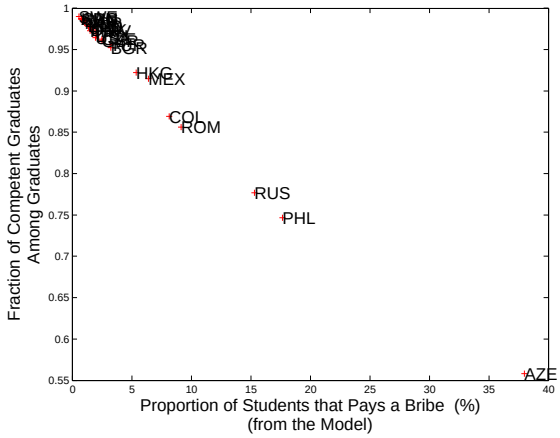


(d) Skilled Wage Premia.

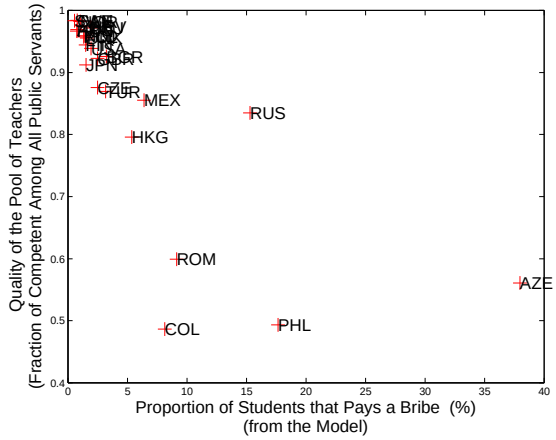
Figure D.2: Predictions from the model for the University.



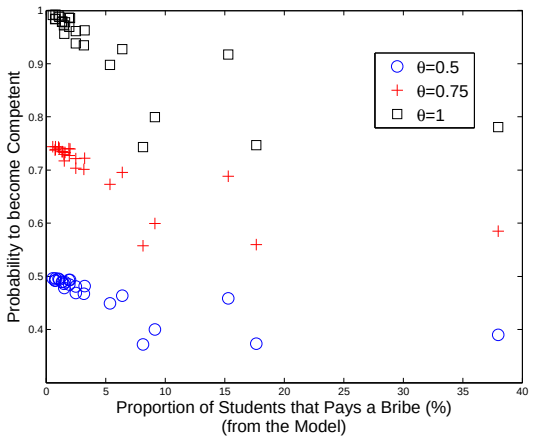
(a) Measure of Incompetent Graduates.



(b) Quality of the Pool of Graduates.

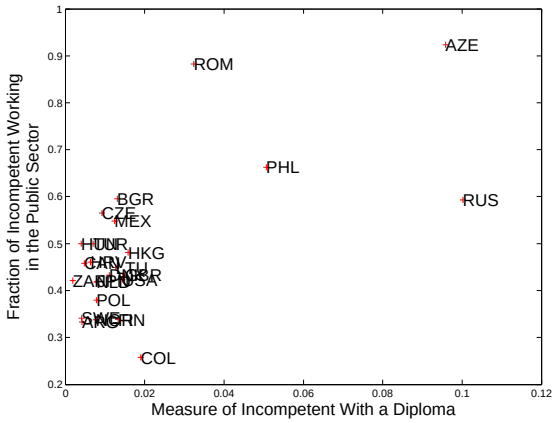


(c) Quality of The Pool of Teachers.

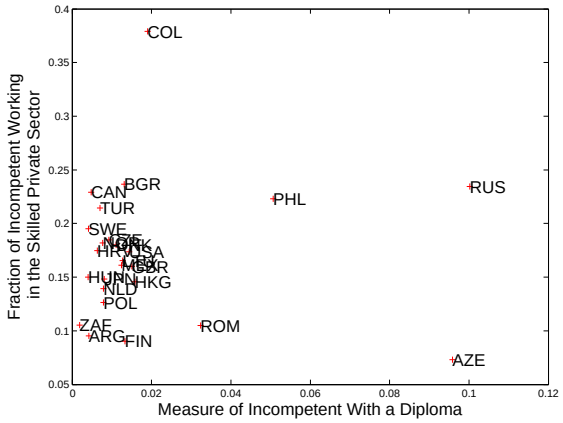


(d) Probability to Become Competent for Different Levels of Ability.

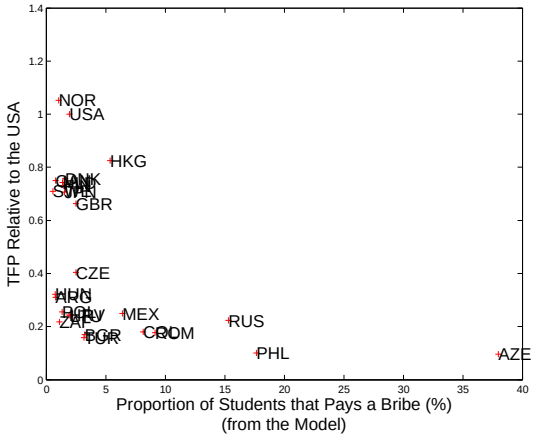
Figure D.3: Predictions from the model for the Labor Market and Production.



(a) Fraction of Incompetent Working in the Public Sector.



(b) Fraction of Incompetent Working in the Skilled Private Sector.



(c) (Output) Scale Parameter relative to US, TFP.

Table D.1: Calibrated Values

Country	**Cost of Education** c_e **(%** $\omega^{\mathbf{Max}}$**)**	**Size of the Bribe** b **(%** $\omega^{\mathbf{Max}}$**)**	**Government Screening** $\phi_{\mathbf{PS}}$	**Firm Screening** $\phi_{\mathbf{F}}$
Argentina	0.1146	0.1446	0.6735	0.8734
Sweden	0.0298	0.1415	0.6499	0.7138
Norway	0.0323	0.1582	0.6639	0.7176
Hungary	0.1027	0.2388	0.5053	0.6954
Canada	0.0831	0.2566	0.5511	0.5785
South Africa	0.3997	0.2060	0.5834	0.7748
Denmark	0.0409	0.1948	0.5648	0.6842
Poland	0.0761	0.1817	0.6176	0.7971
Netherlands	0.0848	0.2135	0.5853	0.7662
Japan	0.1003	0.2065	0.5825	0.7535
United States	0.0345	0.1817	0.5788	0.7060
Finland	0.0035	0.0940	0.6598	0.8598
Lithuania	0.0819	0.2427	0.5494	0.6965
Croatia	0.2599	0.2661	0.5366	0.6670
United Kingdom	0.0738	0.2095	0.5674	0.7199
Czech Republic	0.1887	0.2907	0.4366	0.5872
Bulgaria	0.1860	0.3467	0.4081	0.4186
Turkey	0.3409	0.2809	0.4942	0.5791
Hong Kong	0.2467	0.2347	0.5209	0.7188
Mexico	0.3700	0.2611	0.4509	0.6394
Colombia	0.2723	0.3076	0.4865	0.4868
Romania	0.1951	0.4500	0.1175	0.1175
Russia	0.1050	0.3815	0.4069	0.4247
Philippines	0.2420	0.3445	0.3369	0.3369
Azerbaijan	0.4726	0.3124	0.0765	0.1128

Appendix E

Proof of Proposition 3

(This section borrows from Francois and Zabojnik (2005).)

I establish the existence of the interior-valued steady state, and then show that it is always stable.

Consider the expected returns to honesty relative to opportunism $E[U_t^H] - E[U_t^O]$ as given by expression Z. Suppose the sufficient condition holds so that there exists at least one value of λ, denoted λ' such that $\lambda' \left[\gamma - \omega \left(1 - p(\lambda')(\delta_C + \delta_B)\right)\right] < 0$. Then there must exist another value of λ denoted λ^A with $\lambda' < \lambda^A < 1$ such that $\lambda^A \left[\gamma - \omega \left(1 - p(\lambda^A)(\delta_C + \delta_B)\right)\right] = 0$. This follows immediately from the continuity of p in λ, and Assumption 1. Moreover, by the properties of the first and second derivatives of (3.7), and assumption (5) this point is unique. At this point, which is point A in Figure 3.1, we have that the first derivative is

$$\gamma - \omega \left(1 - p(\lambda^A)(\delta_C + \delta_B)\right) + \omega(\delta_C + \delta_B)\, p'(\lambda^A) \; > \; 0.$$

Note that for $\lambda > \lambda^A$, $Z \equiv \lambda \left[\gamma - \omega \left(1 - p(\lambda)(\delta_C + \delta_B)\right)\right] > 0$. However, for $\lambda < \lambda^A$, the opposite holds (this is from the continuity and boundedness of p, from the properties of the first and second derivatives of (3.7), and from assumption (2)). The evolutionary implications of these λ ranges for $d\beta$ in the β, λ space are depicted by the vertical arrows in Figure 3.2.

Now consider how bureaucrats' behaviour is affected by types in the population. That is, consider expression (3.6). The critical relationship in $(\beta,\, p)$ space is:

$$d\lambda \; = \; \chi(\beta, \lambda) \; = \; 0 \tag{E.1}$$

with $\chi(\beta,\lambda) \equiv (1-\beta)\left[\frac{\omega}{2}\left(1-p(\lambda)(\delta_C+\delta_B)\right)\right]$.

On this locus of β and p values, bureaucrats are indifferent between honesty and corruption and $d\lambda = 0$. Intuitively, the condition states that for higher levels of β, only lower levels of corruption can be supported in the economy. Since $\frac{\partial\chi(\beta,\lambda)}{\partial\beta} < 0$ and since under (5) $\frac{\partial\chi(\beta,\lambda)}{\partial\lambda} < 0$, this function is downward sloping in the $(\beta,\, p)$ space. Thus, to maintain the condition, an increase (decrease) in β is offset by an immediate decrease (increase) in λ.

Moreover, for values of β and p above the function, we have that $d\lambda = \chi(\beta,\lambda) < 0$, so that there is an adjustment towards bureaucrats being honest. The converse is true for points below the function.

When $\beta = 1$, $\chi(1,\,\lambda) = 0, \forall\ \lambda$, at $\lambda = 0$ in particular. When $\lambda = 1$, from Assumption 4, (E.1) can never hold, even for $\beta = 0$; thus for $\beta = 0$, (E.1) only holds for $\lambda < 1$. Let λ^C be s.t. $\chi(0,\lambda^C)$=0. It can be proven by contradiction that λ^C is greater than λ^A depicted above.[1]

Thus the $d\lambda = 0$ function is downward sloping, cuts the vertical axis at 1 at $\lambda = 0$, and below 0 at $\lambda = 1$. The dynamics for bureaucrats are depicted in Figure 3.2.

The steady states occur when $d\beta = 0$ and $d\lambda = 0$. Since for all values of $\lambda \in [0,1]$, the $d\lambda = 0$ locus takes positive values of β, with $\beta < 1$, and since, under the assumed sufficient condition λ^A and λ^B are elements of $(0,1)$, it follows, necessarily that there exist two such points. I denote these by $(\beta^A,\, \lambda^A)$ and $(\beta^B,\, \lambda^B)$. Figure 3.3 illustrates the steady states and phase spaces.

Stability:
I now show that $(\beta^A,\, \lambda^A)$ is locally stable.

First from the law of motion of bureaucrats, in the interior, necessarily, $d\lambda = 0$ always. Furthermore, $\frac{d\lambda}{d\beta} < 0$ in the interior. Since the λ adjustment is immediate to ensure this equality, the stability of the system is determined by an analysis of the $d\beta$ equation. Recall this equation is:

$$d\beta = \beta(1-\beta)\Phi\left(\lambda\left[\gamma - \omega\left(1-p(\lambda)(\delta_C+\delta_B)\right)\right]\right)$$

The derivative with respect to β is:

$$d^2\beta \;=\; \frac{d}{d\beta}\left[\beta(1-\beta)\right]\Phi\left(.\right) + \beta(1-\beta)\frac{d\Phi\left(.\right)}{d\beta}$$

[1] Suppose that $\lambda^A > \lambda^C$ then $p(\lambda^A) > p(\lambda^C)$ and it follows that $\frac{\omega}{2}\left(1-p(\lambda^A)(\delta_C+\delta_B)\right) < \frac{\omega}{2}\left(1-p(\lambda^C)(\delta_C+\delta_B)\right) = 0$ meaning that $\omega\left(1-p(\lambda^A)(\delta_C+\delta_B)\right) < 0$. This latter expression implies that $\lambda^A\left[\gamma-\omega\left(1-p(\lambda^A)(\delta_C+\delta_B)\right)\right] > 0$ which contradicts that it should be 0 (the condition that determines λ^B). Thus λ^A must be smaller than λ^C.

At the interior steady state, $\Phi(.) = 0$, so that the first term cancels. The sign then depends on the second term which can be re-expressed as follows:

$$d^2\beta \;=\; \beta(1-\beta)\frac{d\Phi(.)}{d\beta} \;=\; \beta(1-\beta)\frac{d\Phi(.)}{d\lambda}\,\frac{d\lambda}{d\beta}$$

From above $\frac{d\lambda}{d\beta} < 0$, and $\frac{d\Phi}{d\lambda} = \Phi'\left\{\gamma - \omega\left(1 - p(\lambda)(\delta_C + \delta_B)\right) + \omega(\delta_C + \delta_B)\,p'(\lambda)\right\}$.

Since from the assumed properties of $\Phi(.)$, we have $\Phi' > 0$, it follows that the sign of $\frac{d\Phi}{d\lambda}$ depends on the expression in brackets. At $(\beta^A,\, \lambda^A)$, we have

$$\gamma - \omega\left(1 - p(\lambda^A)(\delta_C + \delta_B)\right) + \omega(\delta_C + \delta_B)\,p'(\lambda^A) \;>\; 0.$$

where the sign follows from (E). Thus, since this implies $d^2\beta < 0$, the steady state is stable at A. ■

Appendix F

Proof of Proposition 4

If $\lambda = 1$, $d\beta > 0$ from assumption 1. If $\beta = 0$, we have $\chi(\beta, \lambda) < 0$ so that $d\lambda < 0$. It follows that ($\beta = 0$, $\lambda = 1$) is not a steady state. □

From (3.6), $\beta = 1$ implies $d\lambda = 0$. Also, if $\lambda = 0$, $d\beta = 0$ from (3.7). These results imply that ($\beta = 1$, $\lambda = 0$) is a steady state. To verify stability, consider perturbations around the equilibrium. Near $(\beta = 1, \lambda = 1)$, the evolutionary incentives induced by assumptions 1 to 5, favour opportunism so that any perturbations around the equilibrium leads to movement away it. Hence, $\beta = 1$, $\lambda = 0$) is not a stable steady state.■

Appendix G

Description of the Data for Chapter 3

This section presents the variables that are utilized in Section 3.4. All variables are obtained from Round 3 of the Afrobarometer surveys

Measures of corruption (Dependant variables)

> ***Pay bribe for / to A Document or a Permit; School Placement; Household Services; Get Medicine or Medical Attention; Avoid Problem w/ Police***: individual's answer to the question *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 or a permit; Get a child into school; Get a household service (like piped water, electricity, or phone); Get medicine or medical attention; Avoid a problem with the police (passing a checkpoint, avoid a fine or arrest)*. Answers are "Never" (0), "Once or Twice" (1), "A few Times" (2) or "Often" (3).

Social Capital (Dependant variables)

> ***Would Bribe if encountering a misbehaving school or clinical***: by country, fraction of individuals who answer "Offer tip or bribe" to the question: *What, if anything, would you do to try and resolve each of the following situations: You suspected a school or clinic official of stealing?*

Would Bribe if encountering delays to get a government permit: by country, fraction of individuals who answer "Offer tip or bribe" to the question: *What, if anything, would you do to try and resolve each of the following situations: You were waiting for a government permit or license, but kept encountering delays?*

Would Bribe in the event of a wrongful arrest in the family: by country, fraction of individuals who answer "Offer tip or bribe" to the question: *What, if anything, would you do to try and resolve each of the following situations: The police wrongly arrested someone in your family?*

Would Bribe in the event of a wrongly seized family land: by country, fraction of individuals who answer "Offer tip or bribe" to the question: *What, if anything, would you do to try and resolve each of the following situations: Someone wrongly seized your familys land?*

Would Bribe in the event of a wrongly seized family land: by country, fraction of individuals who answer "Offer tip or bribe" to the question: *What, if anything, would you do to try and resolve each of the following situations: Election officials left your name off the voters roll?*

Civic Engagement

Join Others to Raise an Issue: by country, fraction of individuals who answer "Yes, several times" or "Yes, often" to the question: *For each of these, please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: Got together with others to raise an issue?*

Instruments

Frequent Use of Media: by country, fraction of individuals who get news at least a few times a week from either the radio, television or newspapers.

Women as Leaders: by country, fraction of individuals who "very strongly agree" that women should have the same chance of being elected to political office as men.

Miscellaneous Data

Primary Education: Constructed from the education question (Question q90). Dummy variable that takes value 1 if the respondent has any the following education level: *No formal Schooling*, *Informal Schooling only (includes Koranic Schooling)*, *Some Primary Schooling* or *Primary School Completed*.

Post Secondary Education: Constructed from the education question (Question q90). Dummy variable that takes value 1 if the respondent has any of the following education level: *Post-secondary qualifications, other than university*, *Some University*, *University Completed*, or *Post-Graduate*.

West Africa: Dummy variable that takes value 1 for the following countries Benin, Ghana, Mali, Nigeria and Senegal.

Ethnic Diversity: The index of ethnic diversity follows Alesina and La Ferrara (2002) and is given by the following formula:

$$\text{Fragmentation}_c = 1 - \sum_g S_{g,d}^2$$

where c represents a country, g an ethnic group present in country c and $S_{g,c}$ the share of ethnic group g in country c.

Appendix H

Mean Distributions of Intra- and Inter-Ethnic Trust by Country

We can see that the tendency observed for the whole sample is confirmed at the country level: individuals tend to trust members from other groups like they trust members of their own group. When they don't trust individuals from other ethnic groups like their own group, respondents tend to trust them less. In Table H.1 this concept is captured by the fact that, for each country, shares are bigger on the left than on the right of the diagonal.

Table H.1: Intra and Inter Ethnic Trust - Mean Distributions by Country

Countries	**Trust in Own Ethnic Group (% Population)**		**Trust in Other Ethnic Groups (cross-tabulations)** *Not at All*	*Just a Little*	*Somewhat*	*A Lot*
Benin	*Not at All*	21.2	**89.5**	7.3	1.6	1.6
	Just a Little	35.8	15.8	**80.1**	2.4	1.7
	Somewhat	22.3	5.0	42.3	**50.0**	2.7
	A Lot	20.7	8.3	10.8	11.6	**69.3**
Botswana	*Not at All*	28.7	**92.7**	5.1	1.6	0.6
	Just a Little	30.6	11.5	**79.9**	7.1	1.5
	Somewhat	20.6	7.1	11.0	**74.9**	7.1
	A Lot	20.1	8.6	7.7	15.3	**68.5**
Ghana	*Not at All*	15.4	**84.1**	8.5	5.7	1.7
	Just a Little	28.7	12.5	**80.5**	5.5	1.5
	Somewhat	30.9	12.2	21.8	**63.6**	2.5
	A Lot	25.1	9.1	13.9	18.5	**58.5**
Kenya	*Not at All*	8.01	**86.0**	12.8	1.3	0.0
	Just a Little	44.6	26.5	**68.2**	4.8	0.6
	Somewhat	32.6	7.7	35.6	**55.0**	1.7
	A Lot	14.9	15.0	22.7	20.1	**42.3**
Lesotho	*Not at All*	19.7	**93.8**	4.0	1.3	0.9
	Just a Little	32.5	11.5	**79.3**	7.9	1.3
	Somewhat	30.2	6.7	22.2	**67.4**	3.7
	A Lot	17.5	10.8	19.3	25.7	**44.2**
Madagascar	*Not at All*	6.1	**84.6**	10.0	3.5	2.0
	Just a Little	42.3	11.7	**82.6**	5.6	0.1
	Somewhat	42.8	7.1	34.2	**58.5**	0.2
	A Lot	8.8	10.1	16.4	28.0	**45.6**
Malawi	*Not at All*	7.2	**81.0**	15.2	3.8	0.0
	Just a Little	19.9	19.1	**70.0**	5.0	5.9
	Somewhat	18.3	10.4	25.2	**60.4**	4.0
	A Lot	54.6	13.0	11.5	9.8	**65.8**
Mali	*Not at All*	7.0	**80.6**	8.5	9.5	1.4
	Just a Little	16.6	20.5	**65.5**	10.6	3.4
	Somewhat	30.6	10.7	28.9	**56.0**	4.4
	A Lot	45.8	9.7	17.6	21.0	**51.7**

Notes: Countries' means are computed *by* Trust in one's own ethnic group. Means are weighted using the variable *combinwt*.

Table H.2: Intra and Inter Ethnic Trust - Mean Distributions by Country (continued)

Countries	**Trust in Own Ethnic Group (% Population)**		**Trust in Other Ethnic Groups (cross-tabulations)** *Not at All*	*Just a Little*	*Somewhat*	*A Lot*
Mozambique	*Not at All*	12.0	**79.4**	8.7	5.6	6.3
	Just a Little	21.9	18.8	**68.6**	8.3	4.4
	Somewhat	25.5	8.6	18.7	**64.0**	8.6
	A Lot	40.5	9.2	9.7	17.2	**63.9**
Namibia	*Not at All*	17.1	**88.2**	10.1	0.6	1.1
	Just a Little	35.9	13.1	**78.0**	7.8	1.1
	Somewhat	34.2	6.5	21.3	**66.6**	5.6
	A Lot	12.8	0.8	8.3	21.1	**69.9**
Nigeria	*Not at All*	24.7	**89.9**	8.0	1.4	0.6
	Just a Little	36.4	23.1	**70.5**	5.9	0.4
	Somewhat	25.3	8.6	31.3	**56.4**	3.7
	A Lot	13.6	12.6	14.4	33.0	**40.0**
Senegal	*Not at All*	5.3	**86.4**	8.5	1.7	3.4
	Just a Little	13.3	9.5	**85.1**	2.0	3.4
	Somewhat	23.5	3.4	8.4	**84.7**	3.4
	A Lot	58.0	3.6	4.6	14.1	**77.7**
South Africa	*Not at All*	18.9	**87.1**	9.1	2.1	1.7
	Just a Little	29.5	25.8	**65.8**	7.7	0.7
	Somewhat	32.4	9.0	26.0	**62.2**	2.8
	A Lot	19.2	14.0	15.4	29.5	**41.1**
Tanzania	*Not at All*	2.5	**68.6**	18.9	6.2	6.3
	Just a Little	15.9	8.0	**80.1**	9.0	3.0
	Somewhat	48.3	4.6	18.1	**75.3**	2.0
	A Lot	33.3	7.1	6.6	24.3	**62.0**
Uganda	*Not at All*	7.0	**83.7**	10.2	2.8	3.4
	Just a Little	30.5	17.2	**73.6**	7.9	1.4
	Somewhat	35.9	7.4	38.7	**51.1**	2.8
	A Lot	26.6	8.5	24.7	28.6	**38.3**
Zambia	*Not at All*	7.9	**91.1**	6.7	1.1	1.1
	Just a Little	45.8	14.7	**79.4**	4.4	1.5
	Somewhat	29.6	6.2	31.0	**61.4**	1.5
	A Lot	16.8	7.3	17.2	31.8	**43.8**

Notes: Countries' means are computed *by* Trust in one's own ethnic group. Means are weighted using the variable *combinwt*.

Appendix I

Marginal Effects for Chapter 4

This section presents the marginal effects of the covariates of the *preferred* specification (top panel in Table 4.6), which includes individual, ethnic group and district characteristics as well as growth over the period 1980-2004. For convenience, I organized the estimates in four tables, one for each level of **intra**-ethnic trust; each column depicts presents the marginal effects on **inter**-ethnic trust, evaluated at the average of covariates. Standard errors (in parentheses) are also provided.

The reader should note that there are more than 2 categories of inter-ethnic trust, the sign of the ordered probit coefficients predicts the direction of the marginal effects in the *extreme* categories of inter-ethnic trust (*Not at All* and *A Lot*) only. Indeed, the coefficients do not determine the direction of the marginal effects in the *middle* categories (*A Little* and *Somewhat*).

Table I.1: Marginal Effects for Individuals with *No Trust* in their Own Ethnic Group

	Marginal Effects of the Ordered Probit Estimates ($\frac{dP_i}{dX_i}$)							
Levels of Trust in Other:	**Not At All**		**A Little**		**Somewhat**		**A Lot**	
Ethnic Group	[A]		[B]		[C]		[D]	
Female	-0.006	(0.012)	0.003	(0.007)	0.001	(0.003)	0.001	(0.002)
Urban	0.017	(0.016)	-0.010	(0.010)	-0.004	(0.004)	-0.003	(0.003)
Age	0.002	(0.002)	-0.001	(0.001)	-0.001	(0.000)	-0.000	(0.000)
Age^2	-0.025	(0.023)	0.015	(0.013)	0.006	(0.005)	0.004	(0.004)
Personal Living Condition	-0.006	(0.005)	0.003	(0.003)	0.001	(0.001)	0.001	(0.001)
Primary Education	0.010	(0.015)	-0.006	(0.009)	-0.002	(0.003)	-0.002	(0.003)
Postsecondary Education	0.014	(0.020)	-0.008	(0.012)	-0.003	(0.005)	-0.002	(0.004)
Fulltime Worker	-0.008	(0.017)	0.005	(0.010)	0.002	(0.004)	0.001	(0.003)
Stressed	-0.010	(0.016)	0.006	(0.009)	0.002	(0.004)	0.002	(0.003)
Christian	0.022	(0.020)	-0.013	(0.012)	-0.005	(0.005)	-0.004	(0.003)
Muslim	-0.029	(0.029)	0.017	(0.017)	0.007	(0.007)	0.005	(0.005)
West African Dummy	0.027	(0.020)	-0.016	(0.012)	-0.007	(0.005)	-0.005	(0.004)
Perception about the Ethnic Group:	0.016	(0.013)	-0.009	(0.007)	-0.004	(0.003)	-0.003	(0.002)
Unfair Treatment by the government								
Ethnic Share (District)	-0.102***	(0.040)	0.060***	(0.023)	0.024***	(0.010)	0.018***	(0.007)
Ethnic Share (Country)	0.101*	(0.057)	-0.060*	(0.034)	-0.024*	(0.014)	-0.018*	(0.010)
Ethnic Diversity (District)	-0.052	(0.048)	0.030	(0.028)	0.012	(0.011)	0.009	(0.008)
Ethnic Diversity (Country)	0.027**	(0.011)	-0.016**	(0.006)	-0.006**	(0.003)	-0.005**	(0.002)
Market Stalls	-0.038***	(0.015)	0.023***	(0.009)	0.009***	(0.004)	0.007***	(0.003)
Average Growth $(1980 - 2004)$	0.009	(0.008)	-0.005	(0.005)	-0.002	(0.002)	-0.002	(0.001)

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Marginal effects are reported evaluated at the means. Standard errors (in parentheses) are corrected for heteroscedasticity and cluster the residuals at the district level. Each column represents a level of trust in other ethnic groups. Coefficients and standard errors associated with Age^2 are multiplied by 1000, and the ones associated with the country level index of ethnic diversity are divided by 10.

Table I.2: Marginal Effects for Individuals with *Little Trust* in their Own Ethnic Group

	Marginal Effects of the Ordered Probit Estimates ($\frac{dP_i}{dX_i}$)							
Levels of Trust in Other Ethnic Group	**Not At All** [A]		**A Little** [B]		**Somewhat** [C]		**A Lot** [D]	
Female	0.017*	(0.009)	-0.007*	(0.004)	-0.007*	(0.004)	-0.003*	(0.001)
Urban	0.003	(0.011)	-0.001	(0.005)	-0.001	(0.004)	-0.001	(0.002)
Age	-0.004***	(0.001)	0.002***	(0.001)	0.002***	(0.001)	0.001***	(0.000)
Age^2	0.043**	(0.017)	-0.018**	(0.007)	-0.018**	(0.007)	-0.007**	(0.003)
Personal Living Condition	-0.005*	(0.004)	0.002*	(0.002)	0.002*	(0.002)	0.001*	(0.001)
Primary Education	0.005	(0.010)	-0.002	(0.004)	-0.002	(0.004)	-0.001	(0.002)
Postsecondary Education	0.021	(0.012)	-0.009	(0.005)	-0.009	(0.005)	-0.003	(0.002)
Fulltime Worker	-0.000	(0.010)	0.000	(0.004)	0.000	(0.004)	0.000	(0.002)
Stressed	0.005	(0.010)	-0.002	(0.004)	-0.002	(0.004)	-0.001	(0.002)
Christian	0.004	(0.014)	-0.002	(0.006)	-0.002	(0.006)	-0.001	(0.002)
Muslim	0.001	(0.021)	-0.000	(0.009)	-0.000	(0.009)	-0.000	(0.003)
West African Dummy	0.025*	(0.015)	-0.011*	(0.006)	-0.010*	(0.006)	-0.004*	(0.002)
Perception about the Ethnic Group: Unfair Treatment by the government	0.015*	(0.009)	-0.006*	(0.004)	-0.006*	(0.004)	-0.002*	(0.001)
Ethnic Share (District)	0.032	(0.024)	-0.014	(0.010)	-0.013	(0.010)	-0.005	(0.004)
Ethnic Share (Country)	0.061*	(0.035)	-0.026*	(0.015)	-0.025*	(0.015)	-0.009*	(0.006)
Ethnic Diversity (District)	-0.027	(0.030)	0.012	(0.013)	0.011	(0.012)	0.004	(0.005)
Ethnic Diversity (Country)	0.038***	(0.008)	-0.016***	(0.004)	-0.016***	(0.003)	-0.006***	(0.001)
Market Stalls	-0.020**	(0.010)	0.009**	(0.004)	0.008**	(0.004)	0.003**	(0.002)
Average Growth $(1980 - 2004)$	-0.015***	(0.005)	0.007***	(0.002)	0.006***	(0.002)	0.002***	(0.001)

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Marginal effects are reported evaluated at the means. Standard errors are corrected for heteroscedasticity and cluster the residuals at the district level. Each column represents a level of trust in other ethnic groups. Coefficients and standard errors associated with Age^2 are multiplied by 1000, and the ones associated with the country level index of ethnic diversity are divided by 10.

Table I.3: Marginal Effects for Individuals with *Some Trust* in their Own Ethnic Group

	Marginal Effects of the Ordered Probit Estimates ($\frac{dP_i}{dX_i}$)							
Levels of Trust in Other Ethnic Group	**Not At All** [A]		**A Little** [B]		**Somewhat** [C]		**A Lot** [D]	
Female	0.004	(0.004)	0.007	(0.007)	-0.008	(0.009)	-0.002	(0.002)
Urban	-0.001	(0.006)	-0.001	(0.010)	0.001	(0.013)	0.000	(0.003)
Age	-0.002***	(0.001)	-0.004***	(0.001)	0.005***	(0.002)	0.001***	(0.000)
Age^2	0.019**	(0.008)	0.031**	(0.014)	-0.041**	(0.018)	-0.009**	(0.004)
Personal Living Condition	-0.004*	(0.002)	-0.007*	(0.004)	0.009*	(0.005)	0.002*	(0.001)
Primary Education	0.009*	(0.005)	0.015*	(0.009)	-0.020*	(0.012)	-0.005*	(0.003)
Postsecondary Education	-0.021***	(0.006)	-0.035***	(0.010)	0.045***	(0.013)	0.011***	(0.003)
Fulltime Worker	0.015**	(0.007)	0.025**	(0.013)	-0.032**	(0.017)	-0.008**	(0.004)
Stressed	0.014**	(0.005)	0.023**	(0.009)	-0.030**	(0.012)	-0.007**	(0.003)
Christian	-0.003	(0.009)	-0.005	(0.014)	0.006	(0.019)	0.002	(0.004)
Muslim	-0.016	(0.011)	-0.026	(0.018)	0.034	(0.023)	0.008	(0.005)
West African Dummy	0.027***	(0.008)	0.045***	(0.014)	-0.058***	(0.018)	-0.014***	(0.004)
Perception about the Ethnic Group: Unfair Treatment by the government	0.008*	(0.005)	0.013*	(0.008)	-0.017*	(0.010)	-0.004*	(0.002)
Ethnic Share (District)	0.014	(0.013)	0.023	(0.021)	-0.030	(0.028)	-0.007	(0.006)
Ethnic Share (Country)	-0.001	(0.022)	-0.001	(0.037)	0.001	(0.048)	0.000	(0.011)
Ethnic Diversity (District)	-0.016	(0.016)	-0.026	(0.026)	0.034	(0.034)	0.008	(0.008)
Ethnic Diversity (Country)	0.024***	(0.004)	0.040***	(0.008)	-0.052***	(0.010)	-0.012***	(0.002)
Market Stalls	-0.007	(0.005)	-0.011	(0.009)	0.014	(0.011)	0.003	(0.003)
Average Growth $(1980 - 2004)$	-0.011***	(0.003)	-0.019***	(0.006)	0.025***	(0.007)	0.006***	(0.002)

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Marginal effects are reported evaluated at the means. Standard errors are corrected for heteroscedasticity and cluster the residuals at the district level. Each column represents a level of trust in other ethnic groups. Coefficients and standard errors associated with Age^2 are multiplied by 1000, and the ones associated with the country level index of ethnic diversity are divided by 10.

Table I.4: Marginal Effects for Individuals with *A Lot of Trust* in their Own Ethnic Group

	Marginal Effects of the Ordered Probit Estimates ($\frac{dP_i}{dX_i}$)							
Levels of Trust in Other Ethnic Group	**Not At All** [A]		**A Little** [B]		**Somewhat** [C]		**A Lot** [D]	
Female	0.013***	(0.005)	0.012***	(0.005)	0.009***	(0.003)	-0.034***	(0.013)
Urban	0.006	(0.007)	0.006	(0.006)	0.004	(0.005)	-0.016	(0.019)
Age	-0.004***	(0.001)	-0.004***	(0.001)	-0.003***	(0.001)	0.010***	(0.002)
Age^2	0.033***	(0.010)	0.029***	(0.009)	0.022***	(0.006)	-0.083***	(0.024)
Personal Living Condition	-0.005**	(0.003)	-0.005**	(0.002)	-0.004**	(0.002)	0.014**	(0.006)
Primary Education	-0.016**	(0.007)	-0.014**	(0.006)	-0.010**	(0.005)	0.040**	(0.017)
Postsecondary Education	-0.012	(0.012)	-0.011	(0.011)	-0.008	(0.008)	0.030	(0.032)
Fulltime Worker	-0.005	(0.007)	-0.004	(0.006)	-0.003	(0.005)	0.012	(0.018)
Stressed	0.019***	(0.006)	0.017***	(0.005)	0.013***	(0.004)	-0.049***	(0.015)
Christian	-0.007	(0.013)	-0.006	(0.012)	-0.005	(0.009)	0.017	(0.034)
Muslim	-0.050***	(0.015)	-0.044***	(0.014)	-0.033***	(0.010)	0.127***	(0.039)
West African Dummy	0.046***	(0.013)	0.041***	(0.012)	0.031***	(0.009)	-0.119***	(0.034)
Perception about the Ethnic Group: Unfair Treatment by the government	0.013**	(0.006)	0.012**	(0.005)	0.009**	(0.004)	-0.034**	(0.016)
Ethnic Share (District)	-0.004	(0.015)	-0.003	(0.013)	-0.002	(0.010)	0.009	(0.037)
Ethnic Share (Country)	-0.004	(0.028)	-0.003	(0.025)	-0.002	(0.019)	0.009	(0.073)
Ethnic Diversity (District)	-0.018	(0.021)	-0.016	(0.018)	-0.012	(0.014)	0.047	(0.052)
Ethnic Diversity (Country)	0.053***	(0.007)	0.047***	(0.006)	0.035***	(0.005)	-0.136***	(0.017)
Market Stalls	-0.018***	(0.007)	-0.016***	(0.006)	-0.012***	(0.004)	0.045***	(0.017)
Average Growth $(1980 - 2004)$	-0.010*	(0.006)	-0.009*	(0.005)	-0.006*	(0.004)	0.025*	(0.015)

Significance levels : $*$ = 10% $**$ = 5% $***$ = 1%

Notes: Marginal effects are reported evaluated at the means. Standard errors are corrected for heteroscedasticity and cluster the residuals at the district level. Each column represents a level of trust in other ethnic groups. Coefficients and standard errors associated with Age^2 are multiplied by 1000, and the ones associated with the country level index of ethnic diversity are divided by 10.

Appendix J

Description of the Data for Chapter 4

This section describes the variables that are utilized in Chapter 4. They are all obtained from Round 3 of the Afrobarometer surveys, except for the growth variables that are obtained from the Penn World Tables 6.3.

J.0.1 Individual Characteristics

Personal Living Condition: Answers ordered from Very bad (1) to Very Good (5) to the question *In general, how would you describe: Your own present living conditions?* (Question q4b)

Primary Education: Constructed from the education question (Question q90). Dummy variable that takes value 1 if the respondent has any the following education level: *No formal Schooling*, *Informal Schooling only (includes Koranic Schooling)*, *Some Primary Schooling* or *Primary School Completed*.

Post Secondary Education: Constructed from the education question (Question q90). Dummy variable that takes value 1 if the respondent has any of the following education level: *Post-secondary qualifications, other than university*

e.g. a diploma or degree from a technical / polytechnic / college, *Some University*, *University Completed*, or *Post-Graduate*.

Fulltime Worker: Dummy variable that takes value 1 if the respondent answers any of *Yes, full time (not looking)* or *Yes, full time (looking)* to the question *Do you have a job that pays cash income? Is it full-time or part-time? And are you presently looking for a job (even if you are presently working)?* (Question q94).

Stressed: Answer ordered from Never (0) to Always (3) to the question *In the last month, how much of the time: Have you been so worried or anxious that you have felt tired, worn out, or exhausted?* (Question q96b).

West Africa: Dummy variable that takes value 1 if an individual lives in one of the following countries Benin, Ghana, Mali, Nigeria and Senegal.

J.0.2 Ethnic Characteristics

Worse Economic Condition: Median (constructed at the ethnic group level) of the answers to the question *Think about the condition of ___ [Rs Ethnic Group]. Are their economic conditions worse, the same as, or better than other groups in this country?* (Question q80a). The answers are *Much worse* (5), *Worse* (4), *Same* (3), *Better*(2) and *Much Better* (1).

Worse Political Condition: Median (constructed at the ethnic group level) of the answers to the question *Think about the condition of ___ [Rs Ethnic Group]. Do they have less, the same, or more influence in politics than other groups in this country?* (Question q80b). The answers are *Much less* (5), *Less* (4), *Same* (3), *More* (2) and *Much more* (1).

Unfair Treatment: Median (constructed at the ethnic group level) of the answers to the question *How often are___ [Rs Ethnic Group] treated unfairly by the government?* (Question q81). The answers are *Never* (0), *Sometimes* (1), *Often* (2) and *Always* (3).

Ethnic Share: Share of the ethnic group at the district or country level.

Ethnic Fragmentation: The index of ethnic fragmentation follows Alesina and La Ferrara (2002) and is given by the following formula:

$$\text{Fragmentation}_d = 1 - \sum_g S_{g,l}^2$$

where l represents a location (district or country), g an ethnic group present in location l and $S_{g,l}$ the share of ethnic group g in location l.

J.0.3 District Characteristics

School, Temple, Recreational Facilities, Community Building, Market Stall: Dummy variable that takes value 1 if the interviewer answered *Yes* to the following question *Were the following services present in the primary sampling unit / enumeration area?* (question 116).

J.0.4 Country Characteristics

Average Growth: Average annual growth rate in real output per capita. The average is taken on the periods $1980-2004$, $1990-2004$ and $2000-2004$. The measure of output per capita is obtained from the real chain-weighted series RGDPCH of the P.W.T. 6.3 as detailed in Heston, Summers and Aten (2009).

Curriculum Vitae

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Related Work Experience:

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