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ECONOMICS OF CORRUPTION:

GAME-THEORETIC MODELLING OF TRAFFIC POLICE BRIBERY

IN TRANSITION COUNTRIES

Master's Thesis

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INTRODUCTION

Is eradication of corruption a myth or a reality—can a pervasively corrupt traffic police system of a former Soviet Union country transform from 'rotten pigs' (*menty poganiye*) to 'reputable inspectors', which do not take bribes? Employing a game-theoretic approach, this thesis develops a model of micro-level traffic police bribery in order to demonstrate, both theoretically and empirically, that given the right combination of changes that affect the incentives of drivers and traffic policemen alike, the answer can be "Yes" and successful curbing of corruption is not a myth, but within policy reach.

Corruption is most commonly defined as 'abuse of a position of power for private gain'. Although such behaviour is not a new phenomenon, it has been receiving an increasing amount of attention in the past several decades. In academic literature, in public policy discourse, among practitioners of international development and in the business environment, the word 'corruption' is now commonly used, sometimes pejoratively and sometimes as a statement of fact. Several main classifications have emerged based on who the participants are: corporate corruption[1], political corruption[2], bureaucratic corruption[3]; there can also be a supply-side and demand-side analysis, where the actor on the demand side of corruption is in a position of power, while the actor on the supply side provides the payment. A distinction is usually made between grand corruption and petty corruption, based primarily on the size of the private gain[4] and the number of actors involved. Further basic taxonomy includes one-time interactions versus repeated interactions, extortive[5] versus voluntary[6] corruption,

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[1] At least one of the actors is corporate.
[2] Involves an elected official and is most often referred to in the context of paying to influence the voting outcome.
[3] Involves a government official, most typically with reference to issue of licensing, permits, etc.
[4] The size of the bribe in many cases.
[5] by person in the position of power.
[6] by person in the position of supply.

payment in order to expedite a legal procedure[7] as opposed to payment for illegal purposes, such as misreporting information or not reporting a violation so as to avoid official punishment. Last but not least, corruption can be analysed through the dynamics of a particular sector, such as construction, education, health and medicine, utilities, insurance, inspection of a polluting plant, traffic police, etc.

This thesis has a sectoral, regional and methodological focus. The sectoral focus is on traffic police bribery, an interaction between a driver and a traffic policeman—driver on the supply side and policeman on the demand side—which takes place when a traffic police officer stops the driver for violating some traffic law[8]. The regional focus is on the post-socialist countries of Central and Eastern Europe and Former Soviet Union, which have in common a historical past of authoritarian police and have undergone, partially or fully, economic transition from central planning to free market. Traffic police bribery is modelled and tested using game theory, a mathematical method[9].

From the economics standpoint, bribery is often either an unnecessary cost or an efficiency-improving mechanism. The author of this thesis takes neither a pre-established approach to corruption—as 'negative' or 'positive'—nor a moral undertone. Bribery is examined neutrally as a transaction of choice, in order to better understand the micro-level economic incentives behind it. The 'efficiency-improving' approach to corruption is not applicable in this case of traffic police bribery because this is a case where driver pays the traffic policeman to not file an official protocol of administrative or criminal violation of traffic law, as opposed to other possible cases of police bribery[10].

The phenomenon of corruption is prevalent in developed, less-developed and under-developed countries, and hence is a topical subject. General consensus is that corruption hinders development via its negative impact on economic growth, the rule of law, institutions, income inequality, FDI, regime legitimacy, and so forth[11]. On a

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[7] Also referred to as "speed money"
[8] Regardless of whether the driver actually violated some traffic law or not.
[9] The theoretical framework of interactive choice, rationalities, utility-maximization and game theory is presented in Chapter I.
[10] A 'speed money' example of police bribery could be expediting the legal processing of driving license or license plates. However, unofficial payment to illegally obtain a driving license or license plates without prescribed testing or inspection cannot be considered 'speed money'.
[11] See literature review section of this thesis for more details.

worldwide level, there has been a large amount of debate and initiatives worldwide specifically aimed at curbing or eradicating corruption. Yet, most recent anti-corruption programmes have not lead to a significant reduction in the level of corruption (Svensson 2005, pp.34-36, 40).

The transition countries of Central and Eastern Europe, the Baltics, and the remaining Former Soviet Union countries represent a regional set that is interesting to study. Emerging from the similar economic and rule-of-law systems characteristic of planned economies and communist societies, these countries had similarly high level of corruption following the dissolution of Soviet Union. In all these countries, from Hungary to Kazakhstan, shadow economy was significant, economic transactions were frequently informal or under-reported, while personal relationships were important for access to deficit goods and services. Moreover, police was authoritarian and served as a mechanism for purposes of societal control rather than public goods provision. Subsequently, following independence, these countries implemented different sets of economic, political, and institutional reforms with measures that led to a varying degree of impact on the level of corruption in general, and on the pervasiveness of traffic police bribery in particular.

Figure 1 shows transition dynamics in terms of the level of corruption, highlighting that the greatest positive change over the shortest period of time took place in Georgia. It is noteworthy that the starting level of corruption also mattered, particularly for countries like Estonia and Poland. Countries like Ukraine and Russia have not been dramatically successful, while Belarus exhibited the opposite trend of worsening corruption.

Figure 1. Change in the level of corruption in select transition countries,1998-2009
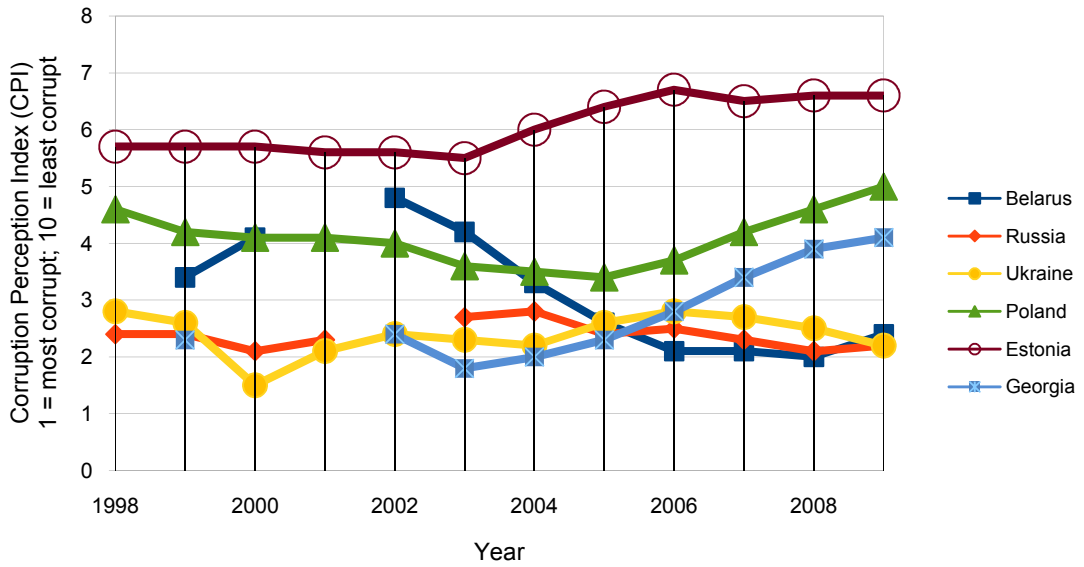
In terms of contribution that traffic police bribery carries towards economic and socio-political development of a country, classification 'petty' is a misnomer. Extortive traffic police corruption represents an added uncertainty (hence risk and cost) for freight and other road-based shipments, negatively impacting businesses and the national investment climate, and along with it the level of FDI and economic growth. The ability to pay one's way out of severe traffic violations undermines the rule of law and the criminology system of deterrents and penalties in place. Ample possibilities to bribe traffic policemen encourage and perpetuate violation of traffic laws, negatively impacting road safety[12]. The comparative statistics in Figures 2 and 3 show that road safety is worse in CEE and FSU region than in many developed countries.

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[12] In an extreme case, a driver who plans to drink and knows that traffic police is corruptible, can set aside some money intended for the traffic policeman in case s/he is stopped for drunk driving. As a result, the traditional fine deterrent of crime no longer works in the presence of bribery and there are likely to be more traffic fatalities.

Figure 2. Traffic Fatality Rate in CEE and FSU versus Select Developed Countries, in 2009
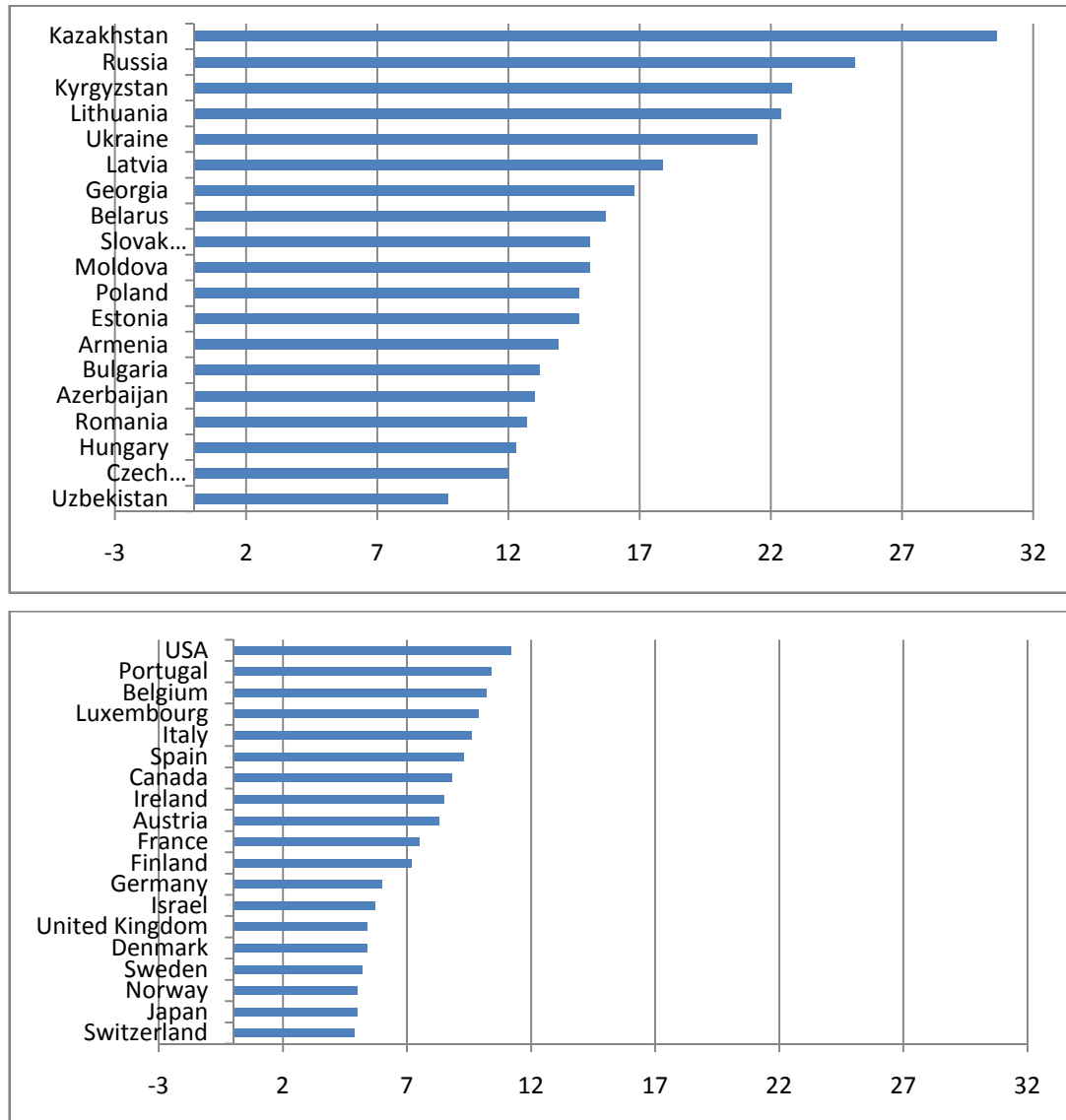
Source: World Health Organization (2009)

The scatter plot of the level of corruption versus traffic fatality rate (Figure 13 found in Appendix 1) also reveals interesting results: among corrupt countries, some have very high traffic fatality rate of 25-50 deaths per 100,000 and some have a relatively low fatality rate of 10-25 deaths per 100,000. However, among lesser-corrupt countries (with Corruption Perception Index over 7.0 points), there is little variation regarding

traffic fatality rate, which is in the low range of 5-10 deaths per 100,000[13]. Last but not least, widely-known presence of corruption in police also undermines regime legitimacy and trust of the government institutions, which is particularly important in post-socialist and formerly authoritarian societies transitioning to democratic principles (Caparini and Marenin, 2005).

The aim of the research is to develop a game-theoretic framework for modelling of traffic police bribery. In order to accomplish this aim, the first task is to build a model, and the second task is to apply empirical cases to the model in order to test it. Hence, the first task is to find conditions when both the driver and traffic policeman end up in a no-corruption equilibrium, and the relevant policy tools to influence the change from a corruption to a no-corruption outcome. The next task is applying the scenarios from real cases of traffic police reform on the theoretical model to determine whether the model explains the difference in outcome of the Georgian and Ukrainian cases. In other words, the task is to determine whether the results of the anti-corruption practice were in line with the model's predictions and policy tools; if not, the task is to determine why the model did not hold.

Hence, this thesis is both a theoretical and anempirical examination of traffic police bribery: three game-theoretic models are developed; then tested with an empirical application. Two types of methods are use—qualitative and mathematical. In-depth interviews are used to generate the variables in the theoretical models. Two case studies of anti-corruption traffic police reform in Georgia and Ukraine are used as empirical applications. In-depth interviews and case studies are part of qualitative research method, while three game-theoretic models are part of mathematical modelling method.

The overarching research question of the study is "What measures impact the level of traffic police bribery, and to what extent?". The answer to the research question shows what determinants of drivers' and police officers' behaviour, and to what extent, need to be affected by an anti-corruption programme in order to make such programme successful. Based on theoretical and empirical parts, the research question can be broken down into sub-questions:

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[13] Although there is probably no direct causality link between the level of corruption and traffic fatalities, the correlation shows that there could be an indirect connection, thus confirming the potential safety significance of anti-corruption in traffic police.

1. "What combination of changes in salary, fine, probability of detection, etc. generates the shift from a corruption equilibrium to no-corruption equilibrium?"
2. "How have changes in salary, fine, probability of detection, etc. impacted the level of traffic police bribery in transition countries like Georgia and Ukraine?"

The two cases of Ukraine and Georgia are best to test the application of a theoretical model. Ukrainian reforms targeted one set of variables, while Georgian reforms targeted another set of variables. In the case of both, reform measures were drastic enough and generated concrete impact on the frequency of traffic police bribery—substantial decrease in Georgia, and moderate increase in Ukraine.

Based on current literature, the micro-variables that determine payoffs in game-theoretic set-up (and therefore the individual decisions) include the amount of bribe, probability of getting caught, punishment if caught, official salary, and so forth. One of the three theoretical models is in part based on Bowles-Garoupa and Chang-Lai-Yang models, and extended by the addition of several variables. The other two models are author's own work. The insight to use additional variables, for all three models, comes from in-depth interviews with several drivers and traffic policemen from transition countries. This can be visually represented in the following manner:

Figure 3. Thesis overview
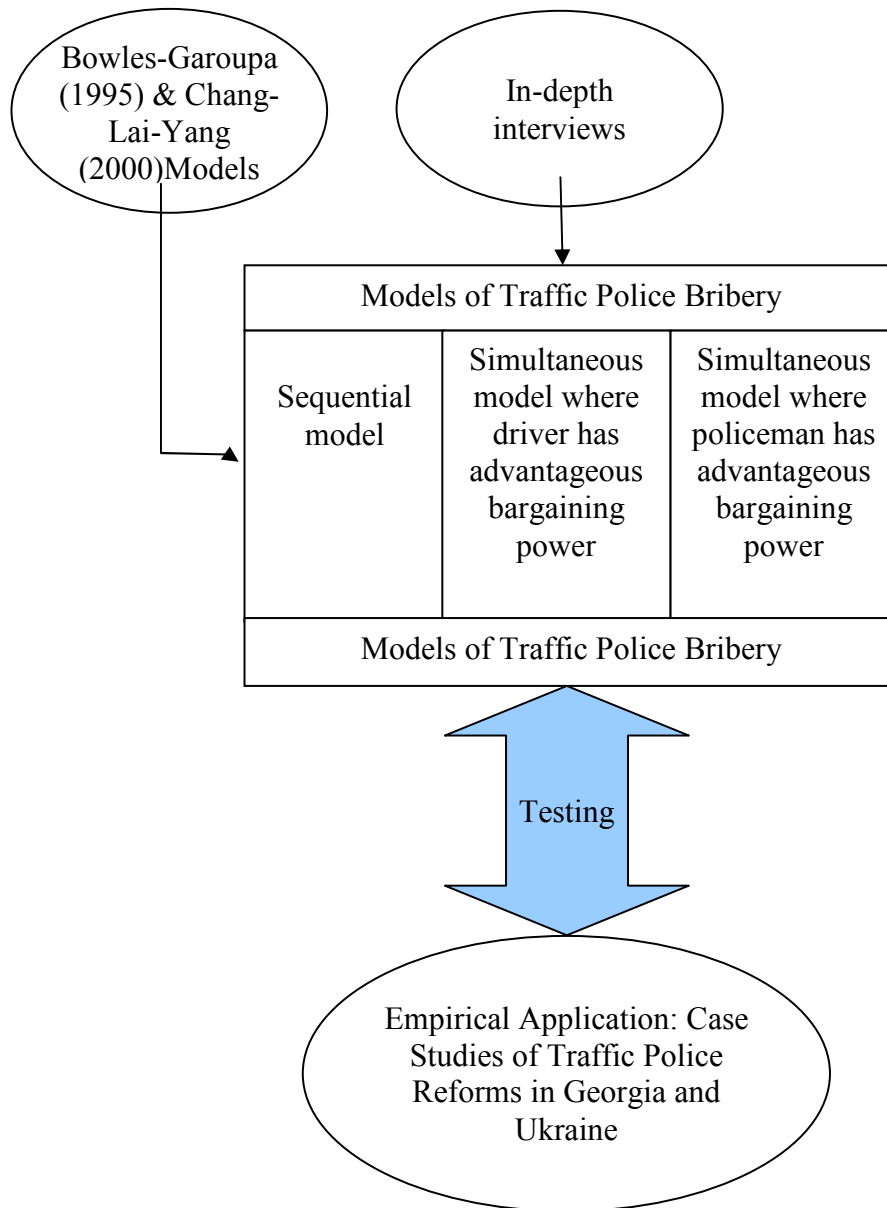
Human rationality is the underlying theoretical framework of game theory and of the models. The questionable assumptions of this approach—including informational processing capacity of individuals, as well as presence of various types of rationalities—are acknowledged and mitigated by using insights from the in-depth interviews to produce a more accurate model. Furthermore, testing the model with case studies allows questioning the accuracy of the underlying assumptions.

The hypothesis answering the research question is that increasing the determinants of bribery on traffic policeman's side—salary, probability of detection,

penalty for accepting a bribe, and premiums—decreases corruptibility of traffic police officers. Among these, I speculate that increasing policeman's salary has the greatest impact potential in transition countries. On the driver's side, an increase in procedural ease of paying for the ticket and a decrease in repercussions to the driver for having a traffic violation on file also negatively impact the level of traffic police bribery. I also speculate that both measures—decreasing the difference and decreasing repercussions—have relatively same amount of impact. If the anti-corruption programmes for traffic police in transition countries do not lead to a significant reduction in the level of corruption, that is because the reforms target insignificant determinants and/or insufficiently affect the significant determinants and therefore do not induce a shift from a corruption to no-corruption equilibrium.

Although the amount of literature on corruption (spanning from sociology, to political science and economics) is vast and increasing, it is highly fragmented, not exhaustive and many aspects of this phenomenon remain poorly or completely unexplained. The key advantage of this study is combining a theoretical game-theoretic model with its empirical application. Methodologically, corruption research to-date is frequently scrutinised because it relies on subjective measures or aggregate data at the national level (Mocan 2004). This thesis takes a novel approach to the methodological challenge of corruption research. Neither subjective nor national data is used; instead, interviews provide forty-two cases of real driver-policemen interactions that took place, on the basis of which a generic game-theoretic model for the interaction is derived. This provides a contribution to the theoretical work of Bowles-Garoupa (1995) and Chang-Lai-Yang (2000) by addition of variables and a modelling distinction based on bargaining power. Last but not least, outcomes and conclusions of the research are meant to provide additional insight for ongoing experimentation and evaluation of new tools to combat corruption. For instance, decreasing corruption in the traffic police seems to be on the agenda of Russian president Medvedev following several recent scandals, but no tangible measures have been taken yet.

Basic possible limitations of research include low sample size of interview respondents and national case studies, access to literature and possible bias of the English-language literature on the Georgian reform. Nevertheless, this research employs innovative approaches, uses original data, and provides a substantial contribution to the

study of traffic police bribery and anti-corruption, from an economic and policy perspective.

The thesis is structured in the following manner. First, the analytical framework of the research is set-up in detail in Chapter I. Following brief overview of the underlying theories of human rationality and decision-making, a case is made that traffic police bribery is best examined through a game-theory perspective. Examination of economic literature on corruption, including several key mathematical models and economic models of crime, reveals a gap that examination of traffic police bribery (both theoretical and empirical) can fill with a multi-method approach. Methodology of the research is then presented in detail; limitations and solutions acknowledged.

Second, the three models are set-up, developed and analysed in Chapter II. Additional variables and insights are first derived and summarised based on the in-depth interviews. Then, Bowles-Garoupa and Chang-Lai-Yang models are augmented with additional variables. By challenging a key assumption of the Bowles-Garoupa and Chang-Lai-Yang model, a case is made to model situations where there is positive rent to be gained by both players, but they cannot agree to split it. The resulting two models—one where a driver has a bargaining advantage and one where a police officer has a bargaining advantage—are presented and anlaysed. In sum, the findings and respective anti-corruption tools from the three models are compared.

Third, two cases of traffic police reform are presented in Chapter III. The impact of anti-corruption changes is compared to the anticipated impact from the theoretical models. All in all, the usefulness of models is evaluated. Lastly, in Chapter IV, policy recommendations are elaborated in greater depth; the anti-corruption tools effective both theoretically and in practice and presented. Conclusions are drawn from the research with a special focus on support for traditional and new anti-corruption theories, types of human rationality, and applicability of game-theory. Several possibilities for future research on the subject are suggested.

CHAPTER I. FRAMEWORK

This chapter presents the framework of the study—the theoretical basics, relevant literature on economics of corruption, and research methodology. First, underlying theories of human rationality and decision-making are presented and a case is made that traffic police bribery involves interactive choices and therefore micro-level modelling requires a game-theoretic approach. Next, main approaches in the economics literature on corruption are outlined and past mathematical modelling of corruption is presented in greater detail to demonstrate that a gap in examination of single-sector bribery, like the case of traffic police, can be filled with a study that is both theoretical an empirical, employing an approach that combines qualitative and mathematical methods. Lastly, research methodology is described in detail, acknowledging the limitations and ways used to mitigate such limitations.

Theories of Choice

When approaching the study of corrupt behaviour on the micro level, it is first necessary to take a step back and look at the underlying theoretical framework of human behaviour and decision-making. The theoretical framework in this case concerns the question "How do people choose?"[14], a question when applied to traffic police bribery becomes, "how does a driver choose to offer/give or not to offer/give a bribe?" and "how does traffic policeman choose to ask/take or not to ask/take a bribe?". Even though for anti-corruption purposes the main question is why people choose to engage in a corrupt transaction, it is nevertheless important to look at the 'how' side as well;

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[14] In other words, which factors influence decision-making

because 'how' people choose influences the actual choice. Heap et al (1992) succinctly address this question in *The Theory of Choice: A Critical Guide*, which forms a basis for this section. This section first presents the theories relevant to the study of corrupt behaviour from an economic perspective. Next, the soundness of these theories are briefly weighted against their limits. Last but not least, a case is made that game theory is most suitable for understanding traffic police bribery and modelling it.

Types of individual rationality

An 'individual choice', where only one person is involved, is different from an 'interactive choice', where two or more people are involved and one person's choice is affected by another person/s' choice(s). In case of an individual choice, the individual acts with certain rationality when s/he has a set of identifiable objectives, and makes a choice that is most likely to satisfy those objectives (Heap et al 1992, p.3). Given this definition of rationality, three classifications of rationalities are possible, describing how an individual makes a choice:

1) instrumental and utility-maximizing rationality: individual compares utility generated by each action and acts so as to maximise utility;

2) bounded rationality: an individual uses rules of thumb, simple procedures, expectations and past experience due to the limited computational capacity of the brain and limited information or time;

3) expressive rationality: an individual is guided by the value of the outcome, incorporating personal beliefs and cultural norms.

These three types of individual rationality are not mutually exclusive, but rather complementary insights into human motivation, and depending on the circumstances, an individual can act as an instrumental and utility-maximizing agent, as a rationally-bounded agent, or based on a matter of principle. (p.24)

The economics discipline and economic literature on corruption to date is primarily concerned with the first type of rationality, and sometimes incorporates elements of the second type[15][16]. The notion that humans are self-interested beings who have the ability to make judgment towards their subjectively defined ends also fits

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[15] Using dynamic models that include past experience, for instance

[16] An exception is work by Rothstein (2007), which calls for a dynamic and evolutionary approach that incorporates the perception of corruption and therefore belief about actions of all others in society.

within the positivist epistemology. Procedurally, the advantage of utility-maximising rationality is the relative ease of calculating the expected result and predictability of that result. Yet there are limits to the notion of instrumentality (that the individuals have the 'instruments' to calculate). For one, in empirical studies, the utility-maximisation result obtained based on assumptions of that rationality differs from the result people actually choose. Thus, the theoretical assumptions of the informational structure frequently do not hold.

The combination of utility-maximising and satisficing logic explains well how people choose individually—when one individual's action does not affect anyone else and nobody else's actions affect that individual, or when the individual is a tiny part of a large competitive economy and the individual's choice of which milk to buy, for example, does not affect the price of milk the producer establishes, given that the price of milk affects the individual's decision regarding which milk to buy. However, in all other circumstances, when an individual's choice is not based solely on his/her objectives, but also on the anticipated actions or reactions of others, then using simple utility-maximising or satisficing logic is no longer sufficient (p.93). In such circumstances, the problem is that of an interactive choice.

Game theory: an interactive choice

The primary framework of an interactive choice approach is game theory. The 'game' here is a situation in which the actions of one person perceptibly affect the behaviour of another and vice versa. In this approach, common in microeconomics, individuals are still both rational and utility-optimisers. Yet with an added twist. The basic method of game theory is such that in making a choice, individuals try to predict what other(s) will do in reply to their own actions, and then optimise their actions on the understanding that other(s) are thinking in the same way.

Rational behaviour, in the basic form, can be expressed mathematically as a calculation of all potential costs and benefits. Game theory takes this to the next level, where rational players evaluate their cost and benefit depending on the choices of others. For instance, in a simple two-player game, where each player has two strategies, the payoff for one player depends on the choice of the second player. The figure below illustrates this concept as well as the normal presentation of a two-player, two-strategy

game. In this game, a dominant strategy emerges when regardless of strategy of Player B, Player A's payoff is always greater. In other words, a dominant strategy of a player is such that whatever the opponent does, the player will always be better off. When both players have a dominant strategy, then there is an equilibrium of the game.

Figure 4. Game-theoretic set-up for a simultaneous game

		Player A	
		Strategy 1	Strategy 2
Player B	Strategy 1	Payoff for B / Payoff for A	Payoff for B / Payoff for A
	Strategy 2	Payoff for B / Payoff for A	Payoff for B / Payoff for A

Such normal presentation is for simultaneous games, where both players decide and act simultaneously. When the game is not simultaneous, i.e., sequential or dynamic, the extensive form is used to denote which player decides on the strategy and acts first:

Figure 5. Sequential game-theoretic set-up
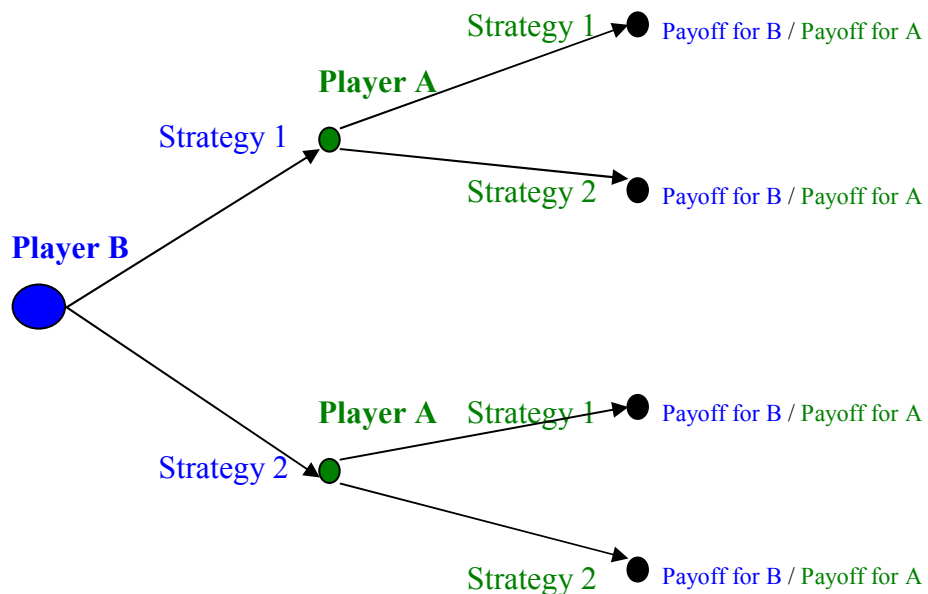
The primary critique of game theory is based on informational constraints of the human brain. Where complex calculations are involved, or the game is said to involve iterated strategies, it is doubtful that individuals go through the technical optimising approach that involves substantial calculations of the formal game theory. As such,

game theory is more valid when individuals have clear dominant strategies that are relatively straightforward and intuitive to calculate.

The following section demonstrates that bribery in general, and particularly involving traffic policemen, is very much a game. Moreover, game-theoretic approach is valid for this study because the calculations for players involved are relatively simple and straightforward given their objectives.

Traffic police bribery as a game

Corruption is commonly defined as abuse of position of power for private gain, implying economic incentives in the very definition via 'private gain'. In micro-level interaction of people with bureaucrats who provide and control public services, the person in a position of power has the monopolistic supply of service; the person in a weaker position is in a position to demand the service. Private gain of additional income for the monopolistic supplier by circumventing, speeding up or in some other way altering the application of the law, is a basic economic incentive for the bribe-receiving part. For the supplier of a bribe, decreasing the processing time, or obtaining the desired result where it otherwise would not be possible or would be more complicated, is also an economic incentive—saving time and avoiding hassle.

In this sense, many interactions where bribery could potentially occur can be seen as a two-player, two-strategy game. The person in a position of power has two options: to accept or not to accept a bribe, while the person in the requesting position has the option to suggest or not to suggest a bribe. In each circumstance, the perceived benefits and cost to each player depend on the strategy selected by the other player. Payoffs can be shown mathematically for each scenario as costs and benefits, that influence the decision and therefore game theory is applicable.

Conceptually, bribery in a situation where a traffic policeman stops a driver who violated some traffic rule can be mostly seen as a sequential game. In most cases this interaction involves a 'signal'—overt or covert on behalf of either party regarding their preferred strategy—or a straightforward first action by one of the two players. Traffic police bribery is a one-time interaction that is not repeated over time between the same two actors; this is also petty corruption in the sense that it involves modest sums of money and takes place literally on the street level. This type of bribery can be both

extortive or voluntary: extortive in the case when policeman forces the driver into a bribe; voluntary in the case when the driver is the first mover. A third kind, in between extortive and voluntary, can also take place with signalling on behalf of the policeman or the driver.

Literature Review

Economic literature on corruption is vast and fragmented. Mathematical models, including game-theoretic ones, are not very common. This section overviews the main approaches in the study of corruption from an economic perspective and the mathematical models of corruption. It is demonstrated that a mixed-method approach of this thesis, alongside several other contributions to mathematical modelling, are most substantial contributions of this thesis.

Main economic approaches

The theoretical literature on corruption address the questions of definitions, measurement issues, relationship to efficiency—as a question of higher transaction costs versus 'speed money'—also corruption's magnitude, pervasiveness, as well as causes (i.e., determinants) and consequences (i.e. impact on economic growth, etc.). Jain's (2001) survey of literature on corruption, for instance, outlines three overarching elements that have to coexist in order for corruption to be present: (1) someone must have discretionary power, (2) there need to be economics rents associated with this power, (3) the national legal/judicial system must offer sufficiently low probability of detection and/or penalty for the wrongdoing. In other words, "corruption occurs when higher rents are associated with misuse of the discretionary powers, net of any illegal payments and penalties associated with such a misuse" (Jain 2001, p.77). This approach mirrors Becker's (1968) approach to the model of 'crime and punishment', which provides an underlying foundation to the Bowles-Garoupa model used in this essay.

Current empirical research on economics of corruption primarily addresses the question of determinants and consequences. Methodologically, such research is frequently scrutinised based on its two common characteristics: (1) it exclusively relies

on subjective measures of corruption through surveys and indices of corruption perception; (2) corruption data are available only at national level, thus researchers have focused on explaining cross-country variations[17] (Mocan 2004). Perception-based measurement of corruption has numerous critics: Andvig (2005) and Abramo (2005) argue that perception-based indices, instead of reflecting the level of corruption, reflect the quality of institutions in the country; Bjornskov (2006) finds that Kaufmann et al.'s (1999) six indices of governance, which include a measure of perceived corruption, cannot be separated statistically and actually measure one underlying factor—level of governance; Galtung's (2005) critical analysis of Corruption Perception Index demonstrates that the index is unsuitable to measure short-term trends or even to capture genuine reforms. Hence, an econometric analysis using indices over time is not sufficiently reliable. When explaining cross-country variations, researchers aggregate corruption level by using several indices. However, as Knack (2006) argues regarding Eastern Europe and Central Asian region, statistical precision gains from aggregating sources of corruption are not very high due to interdependence among data sources. An alternative to cross-country variation are micro-level surveys of corruption. Yet despite the advantages put forth put by Reinikka and Svenson (2006), any survey where respondents are asked about their perception of corruption faces criticism outlined in the previous paragraph. In this light, measurement of corruption has been a 'catch 22'[18].

As for the determinants and consequences of corruption found in empirical literature, the following Tables 1 and 2 provide a summary.

Table 1. Determinants of corruption based on empirical literature

Determinants	Relationship	Literature
Macro-level		
Level of economic development	Negative	Treisman (2000)
Quality of institutions	Negative	Acemoglu, Johnson and Robinson (2001)
Legal system (common law, former British colony)	Negative	Treisman (2000)
Legal system (civil law, socialist state)	Positive	La Porta et al. (1998)
Federal structure, fiscal centralisation	Unclear	Positive: Treisman (2000) Negative: Fisman and

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[17] Two exceptions are Swamy et al (2001) and Svensson (2003)
[18] Some interesting alternatives have been developed by Dreher, Kotsogiannis and McCorriston (2007), Golden and Picci (2005)

		Gatti (2002)
Large endowments of raw materials	Positive	Ades and Di Tella (1999)
Income inequality	Positive	You and Khagram (2004)
Micro-level		
Income, composite consumption good (sum of earned legal income and illegal income)	Positive	Mocan (2004)
Gender (male)	Positive	Mocan and Rees (1999), Swamy et al. 2001

Table 2. Impact of corruption on indicators based on empirical literature

Indicator	Direction of impact	Literature
Level of development	Negative	Mauro (1995)
Economic growth	Unclear	Negative: Acemoglu, Johnson and Robinson (2001), Acemoglu, Johnson and Thaicharoen (2003) No impact: Mocan (2004) [19]
Income inequality and poverty	Positive	Positive: Gupta, Davoodi and Alonso-Terme (2002) Complex: Li, Xu and Zou (2000)
Firm inefficiency	Positive	Dal Bo and Rossi (2007)
FDI	Negative/Unclear	Negative: Wei (2000) Negative unless there is no change in the level of corruption and it is predictable: Cartier-Bresson (2000)
Interpersonal trust	Negative	Seligson (2008)
Legitimacy of governing regime	Negative	Seligson (2008)

The gap in current literature that this thesis contributes can be seen two-fold: (1) combination of theoretical and empirical research in one study, specific to one under-researched sector; (2) mixed-methodology approach of both qualitative and mathematical methods.

Mathematical models

Literature that falls under 'economics of corruption' often contains mathematical models, and there are many. Levin and Tsirik's (1998) meta-study of

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[19] Controlling for the quality of institutions, corruption does not have a direct impact of growth

corruption as an object of mathematical modelling distinguishes between mathematical models of two primary types: (1) study of acts of external corruption, and (2) study of how an organisation becomes or is internally corrupted. The authors also classify a third dimension of theoretical study, concerning (3) multiple equilibrium outcomes, cyclical nature, and persistence of corruption. From a technical perspective, in the case of (1) corruption is expressed as a game between actors; as a principal-agent problem in case (2); and in case of (3)—dynamically, looking at time-based changes or lack thereof. This thesis work thus clearly falls under the first classification of Levin and Tsirik (1998): it is a study of corruption separately from the organisation, modelled using a game-theoretic basis.

Rose-Ackerman (1975) and Macrae (1982) are main two scholars whose modelling work on corruption forms the theoretical basis for expressing corrupt interaction mathematically and using the game-theory basis. Rose-Ackerman (1975) has pioneered economics of corruption where profit incentives are defined mathematically and utility is maximised, by looking at public procurement corruption scenarios. In this model, gain to public official and profit to seller are expressed and analysed with presence of bribes to secure the contract, under three different circumstances related to government project specifications and number of firms competing.

Furthermore, Macrae (1982) has used game-theoretic modelling for public procurement bribery scenarios to demonstrate 'why does a decision to be corrupt occur in the first place?'—because it is a dominant strategy. The pitfalls of a utility-maximising approach have been first recognised by Beenstock (1979, p.21), who noted the need for a game-theoretic approach to answer questions of bargaining dynamics, which the expected utility-maximising approach is unable to deal with. Macrae's (1982) explanation of the merit from a game-theoretic approach is particularly insightful:

> "The utility-maximising approach attempts to answer the first question by postulating a corruptibility condition which must be satisfied if a corrupt decision is to be possible. However, the specification of such a condition is incomplete. It does not incorporate the likely gains under the alternative assumptions—corrupt or not corrupt—nor, for each of these cases, varying assumptions about rival behaviour which will, surely influence a decision to make or take bribes. It is for dealing with such situations where anticipation of rival strategies is important that game theory is particularly suited" (p.680)

Looking at specific game-theory based interactions between two players, several models involving a polluting plant and corruptible inspector (like Moohkerjee and Png (1995) and Mishra (2006) models) share similarities with the scenario between a driver who is stopped for violation traffic rules and a traffic policeman. In Mishra's (2006) model of inspector-polluting plant interaction, the sequence of events and decisions is the following two-stage game[20]:

> Stage 1: Each firm chooses whether to pollute or not, each officer chooses the level of enforcement effort.
> Stage 2: "A simple bribe game—if the officer and the firm agree on a bribe (including a bribe of zero), the firm is not reported. Otherwise, the firm is reported. The firms and the officer work out the expected payoffs in this stage" (p.352)

Varying several of the model variables, such as the level of effort, leads to resulting two types of enforcers—informed or uninformed—and Mishra (2006) uses this distinction to check for implications and arrive at two possible equilibria, high compliance and low compliance, as the analytical conclusion.

With reference to police, I have come across two works with mathematical models, Bowles and Garoupa (1997) and it's further adaptation by Chang, Lai and Yang (2000). Bowles and Garoupa (1997) extend Becker's (1968) standard economic model of crime by incorporating collusion between police officer and offender in the form of a bribe. The basic set-up of the model follows in Figure 8, with the following variables:

p is probability of detection of a criminal; q is probability of detection of corrupt police officer conditional on the fact that s/he has been bribed by a detected criminal; F is the fine imposed on convicted criminal; S is the fine imposed on corrupt police officer; b is the prospective gain from crime; R is the size of the bribe; r is probability of successful bribe, conditional on a criminal being detected; v is the policeman's cost of being corrupted.

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[20] The game is similarly set up in Mookherjee and Png (1995) as well

Figure 6. Basic set-up of the Bowles-Garoupa model

Prospective Criminal's Decision	The Police Officer's Decision
Each citizen contemplating a crime confronts three possible states of the world:	The police officer detects a crime and makes a decision about whether to offer the criminal immunity from prosecution in return for a bribe. If corrupted, a risk-neutral officer faces two possible states of the world:
a. the crime is not detected, with probability 1-p; income from crime is b	
b. the crime is detected and the citizen does not a bribe, with probability p (1-r); Income is b-F	a. the corruption is not detected, with probability 1-q, in which income is R
c. the crime is detected and the citizen pays a bribe, with probability pr. Income is b-R-qF.	b. the corruption is detected, with probability q, in which case income is R-S-v
Risk-neutral criminal compares the returns and costs from crime and decides to commit crime if it offers positive return. His/her expected utility is greater than the alternative income of zero if: $$(1-p)b + p(1-r)(b-F) + pr(b-R-qF) > 0$$ $$b > p[(1-r) + rq]F + pR$$	If not corrupted, the officer received an alternative income of zero. His/her expected utility is greater than the alternative income of zero if: $$(1-q)R + q(R-S-v) > 0$$ $$R > qS + qv$$

Source: Bowles and Garoupa (1997) pp.77-79

Proceeding from this set-up, Bowles and Garoupa find the equation for an equilibrium bribe based on the Nash bargain solution—where the officer and the criminal bargain in a static setting over how to split the rent created by the arrangement and consequently determine the size of the bribe R. Substituting the equilibrium R into prospective driver's decision, Bowles and Garoupa reach similar conclusions to Becker's economic model of crime, plus findings that: corruption weakens deterrence; anticorruption moves through increasing probability of detection of corruption and increasing the punishment on police officers are never counterproductive. Substituting the equilibrium R into officer's decision, Bowles and Garoupa also find the probability of a particular officer being corrupt, and come to a conclusion that a higher fine may deter crime but encourages corruption. Thus, Bowles-Garoupa model shows that increasing the fine is no longer an optimal deterrent in the presence of corruption.

This Bowles-Gaoupa model is augmented by Chang, Lai and Yang (2000) through incorporation of social norms as psychological costs onto the corrupt officer. Interpreting Bowles-Garoupa's v term as psychological costs, related to social norms, results in:

$$v = \epsilon \cdot Z = \epsilon \, (1\text{-}r)^{\delta}; \qquad 0 \leq \delta \leq 1.$$

"Where ϵ is an officer's subjective personal taste (or sensitivity indicator), and Z $(=(1\text{-}r)^{\delta})$ represents the objective social sanction stemming from being a caught corrupt officer...with δ representing the degree of social sanction or pressure from the police officer community....Here, the psychological costs inflicted on an individual caught officer depend not only on his own view of the code of honor (i.e., ϵ), but also on the portion of the police population adhering to the norm (i.e., 1-r)" (Chang, Lai and Yang 2000, p.38)

Substituting the equilibrium bribe into officer's decision, Chang, Lai and Yang (2000) find the critical ϵ^* that makes an officer just indifferent between taking a bribe and not. Further, the authors use this to demonstrate presence of two equillibria: one unstable where widespread corruption becomes a social norm as r approaches 1; one stable where corruption is very low. In case where corruption density of officers is somewhere between the two equilibrium points, an officer is less likely to be corrupt if there exist enough other who do not choose to be corrupt either and at the same time an officer is likely to be corrupt if there exist enough others who are corrupt, i.e., a "conditional cooperation"(p.41). This demonstrates how two similar countries may end up with very different levels of corruption. Chang, Lai and Yang (2000) use this analysis of multiple equilibria to take the Bowles-Garoupa result further, by showing that raising fines could actually be counter-productive in deterring crimes, and not just ineffective, if status quo corruption is widespread.

The Bowles-Garoupa and the Chalg-Lai-Yang models—showing the economics of crime—represent the significant basis for modelling traffic police bribery. In the model presented in Chapter II, the crime aspect is removed from the analysis and additional variables are incorporated based on the insights from in-depth interviews with several drivers and traffic policemen in transition countries, including a total of forty-two real cases of driver-officer interactions. Where in Mookherjee and Png (1995) and Mishra's (2006) models it was assumed that "if [actors] agree..., then...", the two models of this thesis make instances of agreement between the driver and traffic policeman, or lack of agreement, endogenous to the model, not exogenous. This represents an additional theoretical contribution to game-theoretic modelling.

Police corruption in post-communist societies

It is also useful to look at criminology, political science and trust literature on police corruption in post-communist societies. Although this thesis is not meant to fully address the institutional measures of police reform, several insights can be drawn from this literature that are directly applicable to this study. First, because post-communist societies have inherited a highly centralized, politicized and militarized police force, with a history of repression, traffic policeman has a greater position of power than in societies that are not post-communist; this can be applied as a greater bargaining power to policeman in his/her interaction with a driver. Second, lack of trust can be translated as drivers being more likely self-interested and rational. A driver who does not trust, does not respect, or in some sense abhores a traffic policeman, is more likely to act using instrumental rationality rather than having an irrational logic like altruism. Hence, lack of police trustworthiness in post-communist societies provides additional support of using rationality-based modelling and portraying the interaction as a game of self-interested actors.

During the Soviet Union, argue Caparini and Marenin (2005), policing was ideologically framed; exercising control and coercion was a means to an end. With time, the Soviet-style militia evolved from a militarised body used to counter opposition to a law enforcement body with the goal of public order, the organisation remained highly authoritarian and closely tied to the part-state. Meanwhile in Western democracies, policing underwent liberalisation; currently, transition countries are in need of democratic policing, which includes: the focus on service to civic society rather than service to the state, transparency and accountability, representativeness of population characteristics in police personnel, integrity management, semi-autonomous status of police organisations, high professionalism, efficient and effective job performance. (Caparini and Marenin 2005, pp.2-4)

As a whole, post-socialist republics of Central and Eastern Europe exhibit high levels of fear of crime and feelings of insecurity; the public continues to perceive the police as "corrupt or as serving the interests of the state or private interests rather than those of the community" (Krajewski 2005 p.5). In Russia, Bulgaria, Croatia, Yugoslavia, Hungary, Lithuania, the Slovak Republic and Georgia, the public perceives police as the public officials most frequently involved in corruption (Caparini and

Marenin 2005 p.6). Althout some post-socialist states have made significant progress towards accountable and legitimate police—GDR, Hungary, the Czech Republic, Poland and Slovenia—in many other Soviet successor states, police organisations continue to demonstrate authoritarian tendencies and remain militarised, centralised, and politicised. (Caparini and Marenin, 2005, p.8 and Beck, 2005). Despite declarations, slogans of reform and signing of international conventions are commonplace, real change is slow.

The starting point in developing and post-authoritarian countries, Goldsmith (2005) argues, is the absence of public trust in police. The police's historical role, structural relationships, degree of effectiveness and repertoire of practices in dealing with ordinary people (technologies and attitudes and dispositions by police) play a large part in explaining the deficit of trust. Trust-diminishing behaviour of police includes neglect, indifference, incompetence, venality (petty corruption), extortion, discrimination, inconsistency, intimidation, excessive force, brutality; the practice among police officers of seeking small bribes or favours is commonplace in low-trust societies (Goldsmith, 2005). While this practice of petty corruption can be seen as a simple transaction cost on one hand, on the other hand, when the public associates police service with capacity to pay, this undermines the trustworthiness of police as an institution. Citizens become and remain critical of the policemen's motives for entering the police service, and do not expect high standard of service. Hence, the problem of trust and petty corruption can be seen as self-reinforcing vicious circle of post-communist societies, and ties to high rationality behind the players' decisions' within game-theoretic framework.

Methodology

In this thesis, a model is developed and tested, hence this thesis is both theoretical and empirical. Two types of methods are used: qualitative and mathematical. In-depth interviews used for the insights into the models, and the case studies used as an empirical application of the model, are part of qualitative research. Three game-

theoretic models are part of mathematical modelling research. I combine two methods because a single-methodology analysis of anti-corruption programmes would not be as robust. Mixed-methodology allows for triangulation, i.e., testing the consistency of finding obtained through different instruments. A combination of methodology also allows for complementarity, thus clarifying and illustrating results from one method with the use of another method. In the development process, the results from one method shape subsequent methods or steps in the research process, thus stimulating new research questions or challenges obtained through one method, i.e., initiation. Lastly, combination of several methods allows for expansion via richness and detail to the study. In this section, I briefly discuss several aspects of qualitative and mathematical methodology.

Interviews were conducted with six drivers and three traffic policemen, thus a total of nine respondents. The respondents were identified through family or friends' connections, which pre-established a basic amount of trust and towards the interviewer and confidence in lack of malicious intentions. Interview respondents were evenly distributed across personal characteristics, such as age, income bracket, gender; four respondents were Georgian, four respondents were Ukrainian and one was Russian. I also used the snow-balling effect to extend the interviews to the family and friends of the respondent question, this way increasing the sample to include as many observations as possible.

Procedurally, the in-depth interviews were conducted in person, over the telephone or via internet using Skype, in a semi-structured manner, in Russian or Ukrainian language. Only in one instance, a former Georgian traffic policeman asked to participate in the interview without any technology involved, and in this case, his/her answers were recorded on paper and transcribed into an electronic format by author's friend in Georgia[21][22]. Before commencing the interview, I always provided the interviewees with the following information about the research purpose, interview process, anonymity considerations and their rights, thus taking account ethical considerations:

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[21] In this instance, the friend was provided with detailed instructions of the interview scope, question-techniques, and issues of trust-building and ethical considerations, in order to keep this interview procedure as close to the other ones as possible.
[22] This interview took place in Georgian.

"The aim of this research is to better understand the determinants of traffic police bribery in a country like (name here). In other words, what factors influence the decision of a driver/policeman to offer/ask for, or to give/accept a bribe. The interview is meant to be semi-structured, so besides answering the basic question, feel free to provide additional relevant information, explanations of the context, or your personal opinion. You may abstain from participation in the research and have the right to stop the interview at any time. Your replies will be kept confidential. Neither your first name, nor your last name, will be used in the final version of the research."

The detailed topic guide for the interviews can be found in Appendix 2, but the key result of the interviews were real stories of respondents' past interaction in a driver-policeman setting. A sample question for the driver was worded in the following manner: *"Do you recall the very first time you were stopped by a traffic policeman? Please tell me when was it and what happened, step by step."* For the policeman: *"Please describe the last time you stopped a driver: what did you say and do, what did the driver say and do, how the interaction took place, and how the situation ended."* Thus, none of the questions directly asked "Did you give or receive a bribe?". Following basic stories, I asked follow-up questions about the factors that affected the respondent's decision to act a certain way and not another in that particular situation that s/he described. I also asked about general determinants of behaviour across all driver-policeman settings. Basic characteristics of the respondents (age, gender, education, region) were also collected. Both drivers and policemen provided an average of five stories each; even when there was potential for more cases, I attempted to keep the interview to the one-hour limit in order to give each respondent equal weight. The exceptions were the three interviews with traffic policemen, particularly for questions involving context of their decision-making.

Unlike numerous surveys on corruption which ask regarding attitudes towards corrupt behaviour, or subjective perception of corruption, the explicit advantage of these in-depth interviews is gathering detailed cases of real driver-policeman interactions that actually took place—those that involved an official fine, traffic policeman letting go of the driver, or payment of a bribe to overlook enforcement of a traffic violation. Clear shortcomings is the small sample (total of 10 respondents); non-balanced sample (more drivers than traffic policemen); respondent bias (the respondents

who agreed to talk about bribery could be morally biased either against corruption or in terms of active practice[23]). However, for a secretive topic, a small, non-balanced sample is better than no sample at all; the alternative would be mathematical modelling based only on author's subjective perception of traffic police bribery and limited experience with it. Given that the number of drivers in society outweighs the number of traffic policemen, the imbalance in the sample is acceptable. Moreover, the subject of corruption, no matter how petty or frequent, is still sensitive; police respondents showed a lack of desire to discuss the topic of bribery with reference to their personal actions. Hence, finding 3 traffic policemen to conduct an interview with involved maximum possible effort, taking into account time limitations, and the fact that I lived in Estonia—a country without a substantial level of traffic police bribery—and therefore had to rely on friends and relatives to seek out the respondents for me.

In order to test the quality of the model, I undertook two in-depth case studies of both successful and unsuccessful anti-corruption programmes aimed at reforming traffic police in transition countries. For case study selection, I relied on information-oriented sampling, as opposed to random sampling. The purpose of the case study is to reveal insights, and the statistically average case is often not the richest in information. I consider the successful programme in Georgia vis-a-vis the unsuccessful programme in Ukraine. In both cases, concrete anti-corruption reforms in the traffic police were implemented, but the impact of these reforms on the level of corruption was different. Issues of informational availability and accessibility (language barrier) are also taken into account.

Georgia represents an extreme case in that the reform measures were so harsh/drastic, and the outcome successful. An average statistical case involved slow-paced reforms, with not nearly as drastic measures. Availability of information is relatively high, given widespread publicity of the successful reform, and therefore lack of Georgian language fluency and lack of Georgian-language sources is not a significant problem. Ukraine represents a good case for comparison in that the reform measures were also harsh/drastic, but ultimately affecting different determinants—the determinants that were not significantly affected in the Georgian case. Availability of

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[23] The seven respondents so far showed a spectrum of opinion, from active practice to passive bribery; though none thought is was immoral and therefore never did it.

information is relatively high because of use of Ukrainian and Russian language sources (otherwise it would have been a problem).

The data for the case studies came from both official, academic, news, media and unofficial sources. Official sources include legislative documents, news articles on the ministries' websites, as well as speeches or public interviews with officials involved with the reform. Academic sources include print and electronic publications; news sources include the national and international media; media sources refer to internet videos of traffic police reform, while unofficial sources refer to blogs, anonymous comments on news articles, and forums relating the issues of traffic police reform and bribery level. For the case of Ukraine, the sources in the original language are heavily used (both Russian and Ukrainian), except for some academic and official publications in English, or Russian-language sources from Russia. For the case of Georgia, the proportion of official and unofficial sources in English is substantial, but for purposes of similarity, one Georgian-language source has been translated using an on-line dictionary[24], and several Russian-language sources are used as well.

I do not use the data acquired from in-depth interviews for case studies, as evidence of change or lack of change resulting from anti-corruption reforms. Testing the model with the data that was used to generate the model in the first place would lead to 'endogeneity' bias of sorts and would not be appropriate.

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[24] This refers to Ministry of Internal Affairs (2006)

CHAPTER II. GAME-THEORETIC MODELS

In this chapter, the three models are set-up, developed and analysed. First, insights from interviews are presented in the form of additional insights; the structured summaries of the interview transcripts can be found in Appendix 3. Second, Bowles-Garoupa and Chang-Lai-Yang models are augmented with these variables and analysed to find the condition for a no-corruption equilibrium. Third, a key assumption of Bowles-Garoupa and Chang-Lai-Yang model is challenged (that whenever there is positive rent to be gained, both players will always agree), and two models are derived where agreement is endogenised. The two models—one where a driver has a bargaining advantage and one where a police officer has a bargaining advantage—are presented and analysed. Lastly, the findings and respective anti-corruption tools from the three models are compared.

Insights from Interviews

Structured summaries of all interviews can be found in Appendix 3, including forty-two real cases of driver-traffic policeman interactions as well as quotes related to incentives, factors, insights, and environment in general that influences the respondent to act one way or another. In the following section, reference 'D1, Case 1.4' denotes driver respondent number one, case number four in Appendix 3; similarly P1 denotes police respondent number one. This section outlines basic findings about the interaction process (including the signal, bargaining), and various factors that influence both the driver and the traffic policeman, according to the interview respondents. References to the cases and statements in Appendix 3 are included below.

In the interaction process, there is often a sign on behalf of either police officer or the driver used to indicate that s/he could also consider a bribe instead of official fine. Typical phrases are "maybe we will think of some solution" "should we solve this problem differently?" used by both driver and traffic policeman (P1 statement 6); "what will we do about this, Mr...?" used by both (D3 cases 3.2 and 3.3, D6 case 6.3); "I could pay the fine for you myself" on behalf of the police officer (D4 statement 2). Additional signals could be frequent reiteration of the magnitude of the official fine, purposefully inflating the amount of the fine in order to scare the driver into a briber (D6 case 6.2), or straightforward asking—to give a specific amount instead of the fine (D2 case 2.2 and D1 case 1.3), by drivers and policemen alike. Simple presence of a signal does not actually indicate the other player understands it as such (D6 case 6.3). Altogether, it was not possible to determine with certainty whether usually the driver signals first, or the traffic policeman. Hence, certain conclusion about who is the first actor when the game is sequential cannot be achieved, and both sequential and simultaneous game-theoretic models should be used for modelling this interaction.

Bargaining over the size of the bribe sometimes takes place (D2 case, D4 statement 1, and D1 case 1.5), where the policeman's objective is to get a higher bribe, while the driver's objective is to give the least amount possible as a bribe. The bargaining outcome frequently depends on how well the driver articulates his/her situation, how much cash has in the wallet, how expensive the driver's car is[25], etc, which can be translated as different bargaining powers in different cases (P2 statement 8). This provides support to use Nash bargaining as do Bowles-Garoupa and Chang-Lai-Yang models.

As for the determinants of bribery, the classical preventative factors like probability of detection and penalty indeed play a significant role. For instance, every time driver respondent no.2 recorded the interaction with a camera, the outcome was always formal protocol of violation of traffic rules (D2 statement 4). Low probability of detection 1-10% (P1 statement 1, P2 statement 9, P3 statement 6) solidifies the financial incentives to accept a bribe. Flexibility of penalty depending on policeman's connections within the department (P1 statement 1) provides possibilities for bribery with insignificant punishment and did not act as a strong deterrent. Lack of penalty for

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[25] This is also sometimes a signal about wealth, which can indicate the bargaining position of the driver with respect to income and financial considerations.

the bribe-giving driver encourages the drivers to give bribes (D3 statement 7 and D5 statement 4).

Salary and other financial considerations turned out to be significantly stronger factors than Bowles-Garoupa and Chang-Lai-Yang models portray. Low salary that is insufficient for decent living is the key motivating factor to make additional income in the form of bribes (P1 statement 3, P2 statements 13 and 11 and P3 statement 5). If in practice, traffic police are not given any—or sufficient—funds to pay for patrol car's fuel, maintenance and cleaning, additional informal income needs to cover at least that much. Before the fines were increased and when the revenue from bribes was relatively low in Ukraine, the majority of the money a low-level traffic policeman got was spent on lunches, coffee, gas, and so forth, with maximum 20% of daily revenue left over, which was split between partners at the end of the day (P1 statement 3). On the driver side, financial factors—paying less than the fine—are strong motivating factors (D3 case 3.3 and statement 4, D5 statement 3). For a driver, a low-value single bill like 10 lari or 50 UAH is a small amount to worry about (D1 statements 1 and 5, D3 case 3.3). This insight provides substantial support to normalising the actors' payoffs to monthly salary, hence looking at relative payoffs, not grand payoffs.

For the driver, the most important factor behind usefulness of bribery is saving time, directly on the road: it takes 20-30 minutes to write out a formal protocol of violation, in rare cases up to 45 minutes, plus the additional 30 minutes to wait in a queue in a bank to for a fine (D1 cases 1.2 and 1.4, D2 case 2.1 and so forth). Instead, bribing takes 5-10 minutes (D2 case 2.3 and statement 3, D3 case 3.2, D6 case 6.2, D1 case 1.3, P2 case 2.3). Interview cases demonstrated that every time a driver is in a rush, he/she will be prone to attempt bribery; the long time it takes to write out the protocol is primarily because formal procedures are complex: 4 documents to transcribe information from by hand, 2 copies of the final protocol (P1 statement 5). The motivating factor of saving time also applies to unintended repercussions and hassle as a result of an official fine, either as the long time it takes to pay for the fine or another issue that arises as a result of the fine, related to car inspection, insurance, and so forth (D3 case 3.5). Specifically, several drivers noted that the easier it is to pay a fine— online, at the bank if there are no queues and no paperwork—the less incentive there is to bribe (D4 statement 6 and D5 case 5.7 and statement 8). This insight from interviews

supports the addition of time variable, linked to actor's per hour salary, as a motivating factor.

For traffic policemen, presence of unofficial performance requirements (referred to as 'quotas') is a substantial factor that has not been included in Bowles-Garoupa and Chang-Lai-Yang models. If an officer has to write a minimum of one protocol of a serious violation during the shift as a proof of work (P3 statement 9, P2 statement 12, P1 statement 2), in case where officer stops the violator at the beginning of the shift, he/she will be highly inclined to take a bribe, whereas in case where officer stops a violator at the end of a slow shift, the officer will not be taking bribe, because he/she needs to fill the quota (D2 statement 7). Similarly, in case the 'acceptable work' quota is slightly higher (P2 statement 12). This insight from interviews also supports the addition of a quota variable, linked to policeman's official salary, as a motivating factor.

Furthermore, the level of legal education and acumen of the driver influences his/her decision (D3 case 3.2, D6 case 6.7, D2 case 2.1 and statements 4 and 5). Drivers with legal education or good knowledge of own rights and how the judiciary system works, are less likely to offer bribes if there is no sufficient evidence and can anticipate that the final fine will not be levied (D2). On the other hand, if the violation is serious and the driver has no case to present to the court, then the driver is ready to pay a bribe to decrease the overall cost (D2 statement 2). In the opposite scenario, when the laws change frequently and the driver is uninformed about the latest rules of the road, such driver is more susceptible to extortive bribery (D3 case 3.3). Based on this insight, the models that follow include this differentiation via difference in bargaining power of traffic police officer and driver. Lastly, human factors and special circumstances also alter the bargaining power to an actor's advantage or a disadvantage, which include articulating an extenuating personal circumstance like first time driving or coming back from a wedding, being a pregnant woman, having a child in the back of the car, being an important person, and so forth (D2 case 2.4, D5 case 5.2, D6 case 6.5 and P2 case 2.2).

Interviews also highlighted the importance of past experience, word of mouth and common knowledge about the level of bribery and perceived actions of other drivers influencing both drivers' and traffic officers' decisions regarding bribery (D3 statement 1, D5 statement 9, D6 case 6.2, P2 statement 14, D1 statement 4 and case

1.1). Incorporating this insight would require dynamic modelling and is beyond the practical scope of this study, but presents a potential for further study, as with evolutionary game theory, for instance.

Exogenous Agreement Model

In this section, Bowles-Garoupa and Chang-Lai-Yang models are augmented with several variables and analysed to find the condition for a no-corruption equilibrium.

Set-up

In the basic set-up, the driver is stopped by policeman, regardless of whether they actually violated traffic laws or not. The additions to the Bowles-Garoupa and the Chang-Lai-Yang-Lai models include:

- Salaries (i.e., net payoff relative to the salary)
- Driver's time spent during and as a result of being stopped (both the time spent during issuance of ticket and paying the fine afterwards and the time spent paying for the bribe)
- Quotas for policemen (number of violators to be caught per month)
- Penalty on the driver for bribing, if corruption is discovered

The following diagram illustrates the two-stage game between the driver and the traffic policeman. In the diagram, r denotes the probability of bribery taking place and q denotes the probability of bribery being detected. Similarly, $1\text{-}r$ is the probability that bribery does not take place, and $1\text{-}q$ is the probability that bribery is not detected.

Figure 7. Temporal representation of the model
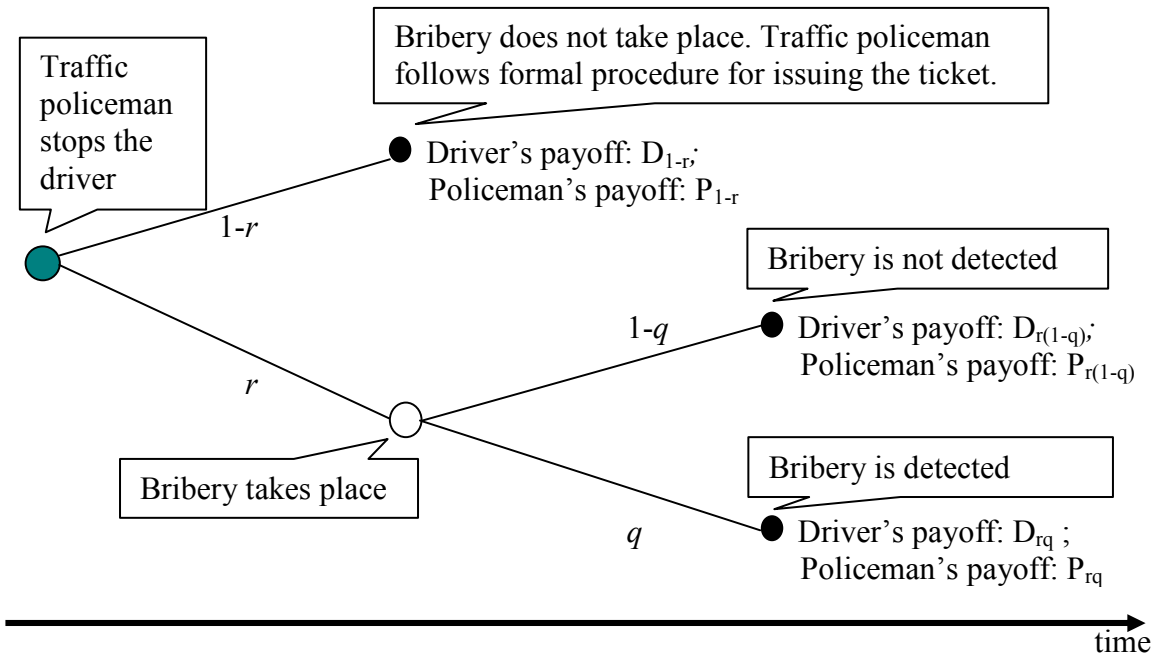
In the case where bribery does not take place, the driver pays the fine, and his/her relative payoff that includes the cost of the time spent is:

$$D_{1\text{-}r} = \frac{-F - t_1 m}{M}$$

where *F* is the fine for the traffic violation, t_1 is the time the interaction takes (number of hours), and *m* is the driver's hourly salary. The payoff is normalized to driver's monthly salary, *M*, in order to denote the net value. The traffic policeman's payoff in this case is determined as the value of the ticket in terms of the quota (N/v), where *N* is the policeman's monthly salary, and *v* is the minimum monthly quota (number of drivers to catch in a month). When the payoff is normalized to the policeman's monthly salary it simplifies to:

$$P_{1\text{-}r} = \frac{\dfrac{N}{v}}{N} = \frac{1}{v}$$

The relative value of policeman's payoff is a share that this ticket represents among all the tickets required from the policeman in a month. In case where policeman is not subject to a quota, policeman's payoff $P_{1\text{-}r}$ is equal to 0, as the policeman receives no material incentive for each legally-processed fine. I do not include the cost of the time

spent in policeman's equation because that is policeman's remunerated job; this is contrary to a driver, where the time spent on being stopped by the policeman represents foregone income.

In the case where bribery takes place and is not detected, the driver pays policeman a bribe, and his/her net payoff that includes the cost of the time spent is :

$$D_{r(1-q)} = \frac{-R - t_2 m}{M}$$

where R is the bribe e, t_2 is the time the corrupt interaction takes (number of hours), and m is the driver's hourly salary. The payoff is similarly normalized to driver's monthly salary, M, in order to denote the relative value. Traffic policeman's payoff is the value of the bribe relative to his/her monthly salary, N:

$$P_{r(1-q)} = \frac{R}{N}$$

In the case where bribery takes place and then is detected, in addition to $D_{r(1-q)}$ the driver has to also pay the original fine F, an additional penalty imposed on the driver for bribery T (if it exists). Driver's payoff is therefore:

$$D_{rq} = \frac{-R - F - T - (t_1 + t_2)m}{M}$$

where $t_1 + t_2$ is the time originally spent on bribing and then on paying the fine post detection, m is the driver's hourly income rate, and the payoff is similarly standardized to the driver's monthly salary M.

The policeman's payoff, P_{rq}, in addition to $P_{r(1-q)}$, includes the penalty imposed on the policeman for bribery S, as well as the psychological costs denoted by ϵZ, following the Chang-Lai-Yang model (2000):

$$P_{rq} = \frac{R - S - \epsilon Z}{N}$$

I also[26] assume that the policeman does not have to return the bribe originally received. The psychological cost of corruption is two-fold: ϵ represents the officer's subjective personal taste regarding bribery, while Z stands for the objective social sanction from being caught as corrupt. In other words, Z is the degree to which corruption is accepted in the society, and

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[26] Bowles and Garoupa (1995) follow similar logic.

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$$Z = (1\text{-}r)^\delta$$

where 1-r is the proportion of non-corrupt officers in the total population and δ is the degree of social sanction or pressure from the police officer community, as in the Chang-Lai-Yang model.

Hence, when the driver is stopped by the traffic policeman, he faces two options:

i. Corruption does not take place. Driver has to pay a fine.

$$\text{Payoff: } D_{1\text{-}r} = \frac{-F - t_1 m}{M}$$

ii. Corruption takes place, with the possibility of getting caught.

Figure 8. Variables of the model

q = probability of corruption being detected (a leak)
F = fine imposed for the traffic violation
S = fine imposed for corruption on the police officer
T = fine imposed for corruption on the driver (if none, =0)
R = bribe
r = probability of bribery taking place
ϵ = officer's subjective personal taste regarding bribery
$Z = (1\text{-}r)^\delta$ = objective social sanction from being caught a corrupt officer
M = driver's monthly salary
m = driver's hourly salary
N = traffic officer's monthly salary
t_1 = time it takes for issuance of a ticket, and payment for it
t_2 = time it takes to negotiate and pay a bribe
v = monthly quota of how many tickets to write

$$\text{Payoff: } D_r = D_{r(1\text{-}q)}\,(1\text{-}q) + D_{rq}\,(q) =$$

$$\frac{-R - t_2 m}{M}(1\text{-}q) + \frac{-R - F - T - (t_1 + t_2)m}{M}(q) =$$

$$\frac{-R - t_2 m + qR + qt_2 m - qT - qF - qR - q(t_1 + t_2)\,m}{M} =$$

$$\frac{-R - t_2 m - qF - qT - qt_1 m}{M}$$

The driver will be prone to corruption (to bargain over a bribe with the traffic police officer) if the payoff from the corrupt scenario is greater than the payoff from the non-corrupt scenario[27], i.e., if $D_r > D_{1\text{-}r}$:

$$\frac{-R - t_2 m - qF - qT - qt_1 m}{M} > \frac{-F - t_1 m}{M}$$

$$-R - t_2 m - qF - qT - qt_1 m > -F - t_1 m$$

$$(R + t_2 m + qF + qT + qt_1 m\,)(-1) > (F + t_1 m)(-1)$$

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[27] Since the payoffs are negative values for the driver, in more intuitive terms, the driver will be prone to corruption if it is cheaper to pay the policeman off. Meaning, that if the loss from corrupt scenario is less than the loss from non-corrupt scenario, i.e. if $|P_r| < |P_{1\text{-}r}|$ or $D_r > D_{1\text{-}r}$.

$$R + t_2m + qF + qT + qt_1m < F + t_1m$$

Equation 1. The driver is prone to corruption (1)

$$R < F + (t_1 - t_2)m - q(F + T + t_1m)$$

Hence, the driver will be prone to corruption if the size of the bribe is less than fine and the associated time savings less the potential losses if caught.

The police officer faces two options when s/he stops a driver:

i. Corruption does not take place. Driver pays a fine and the officer records it towards the quota.

$$\text{Payoff: } P_{1\text{-}r} = \frac{1}{v}$$

ii. Corruption takes place. Officer does not issue a formal ticket and does not record the violation towards the quota, with the possibility of getting caught.

$$\text{Payoff: } P_r = P_{r(1\text{-}q)}(1\text{-}q) + P_{rq}(q)$$

$$\frac{R}{N}(1\text{-}q) + \frac{R - S - \epsilon Z}{N}(q) = \frac{R - qR + qR - qS - q\epsilon Z}{N} =$$

$$\frac{R - q(S + \epsilon Z)}{N}$$

Police officer will prefer for bribery to take place and will engage in bargaining if payoff from the corrupt scenario is greater than payoff from the non-corrupt scenario, i.e, if $P_r > P_{1\text{-}r}$

$$\frac{R - q(S + \epsilon Z)}{N} > \frac{1}{v}$$

$$\frac{R}{N} > \frac{1}{v} + \frac{q(S + \epsilon Z)}{N}$$

$$R > \left[\frac{1}{v} + \frac{q(S + \epsilon Z)}{N} \right] * N$$

Equation 2. Police officer is prone to corruption (2)

$$R > \frac{N}{v} + q(S + \epsilon Z)$$

Policeman will be prone to bribery is the amount of the bribe is more than income forgone registering towards a quota and income savings should the police officer be caught.

Both the driver and police officer will be prone to bargaining if (1) and if (2) are simultaneous:

$$\begin{cases} R < F + (t_1 - t_2)m - q(F + T + t_1m) \\ R > \dfrac{N}{v} + q(S + \epsilon Z) \end{cases}$$

hence, both parties will be prone to corruption if the size of the bribe falls within the following interval:

Equation 3. Both parties are prone to corruption (3)

$$\frac{N}{v} + q(S + \epsilon Z) < R < F + (t_1 - t_2)m - q(F + T + t_1m)$$

Bargaining

When both the traffic policeman and the driver are better off should they agree on a bribe, there is a positive rent created as a result of corrupt interaction. The size of the bribe, *R*, will therefore be the outcome of the players' bargaining over how to divide the rent among them. Following Bowles-Garoupa and Chang-Lai-Yang models, this situation represents a Nash bargaining game, used to model bargaining interactions. In the Nash bargaining game, "two players must split one unit of a desirable good and that if they fail to reach agreement, neither receives anything..." (Osborne, 2004, p.481). If *d* is the payoff function of the driver and *p* is the payoff function of the policeman, the two players will seek to maximise

$$|d(x) - d(0)|^{\beta} * |p(y) - v(0)|^{(1-\beta)}$$

where *d*(0) and *p*(0), are the status quo payoffs, obtained if the player decides not to bargain with the other player; β is driver's bargaining power, $0 < \beta < 1$ and 1-β is the traffic policeman's bargaining power (Osborne, 2004, pp.486-488). The maximisation solution, therefore, will be:

$$(1\text{-}\beta)\,[d(x) - d(0)] = \beta\,[p(y) - v(0)]$$

Hence, the product, also referred to as the Nash product, is $(D_r - D_{1\text{-}r})^{\beta} * (P_r - P_{1\text{-}r})^{(1-\beta)}$:

$$\left(\frac{-R - t_2m - qF - qT - qt_1m}{M} - \frac{-F - t_1m}{M}\right)^{\beta} * \left(\frac{R - q(S + \epsilon Z)}{N} - \frac{1}{v}\right)^{(1-\beta)}$$

$$\left(\frac{-R + (1-q)F - qT + (t_1 - t_2 - qt_1)m}{M}\right)^{\beta} * \left(\frac{R - q(S + \epsilon Z)}{N} - \frac{1}{v}\right)^{(1-\beta)}$$

The Nash bargaining solution is[28]:

$$(1-\beta)\left(\frac{-R + (1-q)F - qT + (t_1 - t_2 - qt_1)m}{M}\right) = (\beta)\left(\frac{R - q(S + \epsilon Z)}{N} - \frac{1}{v}\right)$$

Solved for *R*:

$$R = \frac{N(1-\beta)[(1-q)F - qT + (t_1 - t_2 - qt_1)m] + M\beta q(S + \epsilon Z)}{N + \beta(M - N)} - \frac{MN\beta}{v[N + \beta(M - N)]}$$

Even though driver's salary is not a factor that influences the outcome of the driver-policeman interaction, all the factors—including driver's salary—influence the size of the bribe as a result of bargaining. It is noteworthy from this equation that higher fine F, penalty imposed on the driver, and greater time difference between officially processing a ticket and paying a bribe, lead to a higher bribe size. A higher penalty imposed on the traffic policeman leads to a lower equilibrium bribe size. An increase in unofficial quota requirements v, imposed on the traffic policeman, leads to an increase in the bribe size[29].

No-corruption equilibrium

Conversely to (1), (2), and the joint (3), both parties will not even consider bargaining for a bribe—will end up in a no-corruption equilibrium of the game—if:

$$\begin{cases} R > F + (t_1 - t_2)m - q(F + T + t_1 m) \\ R < \dfrac{N}{v} + q(S + \epsilon Z) \end{cases}$$

This is the point where the equilibrium bribe size is too large for the driver to offer and too small for the traffic police officer to take, i.e. when the size of the bribe falls in the following interval:

$$F + (t_1 - t_2)m - q(F + T + t_1 m) < R < \frac{N}{v} + q(S + \epsilon Z)$$

which can be re-arranged to:

Equation 4. Both parties are not prone to corruption (4)

$$(1-q)F - qT + (t_1 - t_2 - qt_1)m < R < \frac{N}{v} + q(S + \epsilon Z)$$

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[28] Calculation shortcut based on Osborne (2004, pp.486-488).
[29] Increasing v decreases the second fraction since v is in the denominator; a decreased second fraction increases the overall right hand side.

Therefore, an anti-corruption initiative aimed at curbing traffic police bribery should (separately or simultaneously) increase $\frac{N}{v}$ + q (S+ ϵ Z) and decrease (1-q)F – qT + (t$_1$ – t$_2$ – qt$_1$)m. The following table illustrates how this could be achieved by impacting individual variables.

Table 3. Anti-Corruption tools of the exogenous agreement model

Code	Variable	Affecting	Change with an anti-corruption impact	Level of effectiveness
N	Salary of the traffic policeman	Traffic policeman	Increase	High[30]
v	Monthly quota how many tickets to write	Traffic policeman	Inconclusive	
S	Penalty for taking a bribe	Traffic policeman	Increase	Low[31]
q	Probability of detection of traffic police bribery	Traffic policeman and driver	Increase	High
F	Fine for traffic violation	Driver	Decrease	Medium-high[32]
T	Penalty for giving a bribe	Driver	Increase	Low[33]
t_1	Time for issuance and payment of a ticket	Driver	Decrease	High[34]

For example, simplifying the procedures for issuance of the ticket to the bare minimum, as well as removing inconvenient repercussions like having one's license confiscated, would carry a significant weight in reducing economic incentives for bribery because it decreases t$_1$.

Even though from (4) it is evident that a decrease in v—monthly quotas imposed on traffic policemen—would result in an anti-corruption impact, the direction of the change is inconclusive once the role of quotas is examined further. Consider scenario A,

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[30] Lack of any multiplier
[31] Because of q multiplier, $0 \leq q \leq 1$, and in practice q approaches 0 in transition countries
[32] Presence of a *(1-q)* multiplier, $0 \leq q \leq 1$, means that this is not a very effective tool. However, in practice, q approaches 0 in transition countries, hence *(1-q)* approaches 1 and the impact is significant.
[33] Because of a q multiplier, $0 \leq q \leq 1$
[34] Presence of an *m* multiplier (driver's hourly salary), with *m >0* unless the driver is unemployed. Since m is typically quite large, effect on *t* would be significant.

when officer's quota is yet unfilled, and there is still time to fill it. Then, the payoffs

hold: $P_r = \dfrac{R - q(S + \epsilon Z)}{N}$, and $P_{1-r} = \dfrac{1}{v}$. Then officer's corruptibility condition, $P_r > P_{1-r}$ is:

$$\frac{R - q(S + \epsilon Z)}{N} > \frac{1}{v}$$

$$R > \frac{N}{v} + q(S + \epsilon Z)$$

However, now consider scenario B, when officer's quota is already filled, so each

additional officially-processed ticket represents 0 payoff. Then: $P_r = \dfrac{R - q(S + \epsilon Z)}{N}$, and

$P_{1-r} = 0$. Then officer's corruptibility condition, $P_r > P_{1-r}$ is:

$$\frac{R - q(S + \epsilon Z)}{N} > 0$$

$$R > q(S + \epsilon Z)$$

Lastly, consider scenario C, when officer's quota is not yet filled, and he/she has a last

opportunity to fill it during the shift; if he/she does not fill a quota, a non-fulfillment

penalty L will be imposed on the traffic policemen by his/her supervisors. Then, $P_r =$

$\dfrac{R - L - q(S + \epsilon Z)}{N}$, and $P_{1-r} = \dfrac{1}{v}$. In this scenario, officer's corruptibility condition,

$P_r > P_{1-r}$ is:

$$\frac{R - L - q(S + \epsilon Z)}{N} > \frac{1}{v}$$

$$R > q(S + \epsilon Z)$$

$$R > \frac{N}{v} + L + q(S + \epsilon Z)$$

Comparison of the three conditions, as seen in Table 4 below, reveals
that depending on a point in time of the officer's shift when he/she stops a driver, and
whether the officer has already filled the quota or not, the traffic police officer is either
very corruptible or a lot less corruptible. Decreasing the quotas could mean that an
officer will be able to fill the quota faster and reach scenario B sooner. Increasing the
quotas could mean that an officer will fill the quotas slower and could end up in
scenario C. If the new quotas are unrealistically high, this could lead to overly-
aggressive patrolling. Given the difficulty of aligning the expected quota with the

number of violations a traffic police officer will encounter and have a potential to officially process, quotas are a problematic tool in anti-corruption policy. A further examination would be appropriate for future research, beyond this basic analysis, in order to examine which tool, meant to provide positive material incentives for traffic police officers to officially-process every ticket, is the most effective in the presence of widespread corruption.

Table 4. Role of quotas in the exogenous agreement model

Scenario	Officer's corruptibility condition	Interpretation
A: quota is unfilled, not end of the shift	$R > \frac{N}{v} + q\,(S + \epsilon\,Z)$	Traffic police officer is an average on the corruptibility scale.
B: quota is filled	$R > q(S + \epsilon\,Z)$	Traffic police officer is most corruptible, willing to accept the lowest possible level of bribe.
C: quota is unfilled, end of the shift	$R > \frac{N}{v} + L + q\,(S + \epsilon\,Z)$	Traffic police officer is least corruptible, willing to accept the level of bribe at least higher than the penalty for non-fulfillment of the quota, L.

Furthermore, national income inequality can be included in this analysis. Recall that the driver will be prone to corruption if $R < (1-q)F - qT + (t_1 - t_2 - qt_1)m$, where $t_1 - t_2$ is the difference between time it takes to issue a ticket and time it takes to give a bribe. A closer look reveals that the higher the hourly salary of the driver, m, the greater the role complexity of procedures plays, through the time it takes the upper-income driver. On the other hand, for drivers with low values of m, the time spent is less important. Fighting corruption is therefore more difficult in countries with high income inequality—like the transition countries where business oligarchs and political elites are common—since the threshold point for upper-income citizens will be much higher and not always within policy reach.

Endogenous Agreement Models

The set-up of a sequential game illustrated in the previous section, clearly shows the payoffs for "Bribe" - "Bribe" and "Not Bribe" – "Not Bribe" strategies of the driver and policeman, but not the payoffs for the players in two "Not Bribe – "Bribe" scenarios.

Figure 9. Simultaneous set-up of the exogenous agreement model revisited

D

		Bribe	Not Bribe
P	Bribe	Policeman: $\frac{R-q(S+\epsilon Z)}{N}$ Driver: $\frac{-R-t_2m-qF-qT-qt_1m}{M}$	Policeman: unknown Driver: unknown
	Not Bribe	Policeman: unknown Driver: unknown	Policeman: $\frac{1}{v}$ Driver: $\frac{-F-t_1m}{M}$

In order to find the unknown payoffs, I modify the basic set-up to represent a simultaneous game and present two situations: (1) when the driver has advantageous bargaining power; (2) when the policeman has advantageous bargaining power. The main advantage of this different set-up is looking at the outcome of the scenarios where the strategies of the driver and traffic policeman do not align. These are cases when the driver chooses "Not to Bribe", and the policeman chooses "Bribe"; when the driver chooses "Bribe" and the policeman chooses "Not to Bribe". The previous model, based on Bowles-Garoupa and Chang-Lai-Yang models, does not take these scenarios into account—it implicitly assumes that as long as there is rent to be gained by both players, they will bargain and come to an agreement. In the following models, I challenge this assumption and look at cases where there is rent to be gained by both players, but they cannot come to an agreement. Additionally, the second advantage of using this modified model is being able to incorporate the possibility of policeman letting go of the driver

45

without neither a payment of a fine, nor a bribe, and the differentiation between passive bribery and extortive bribery.

Set-Up: driver has advantageous bargaining power

The driver can have advantageous bargaining power when: driver is someone important, knows the rules and the legal system very well (i.e., knows that a policeman does not have sufficient evidence and can successfully challenge the fine in court and not have to pay it); policeman is in a hurry (i.e., if the policeman is standing in a sweet spot where he can catch many violators, so the goal is to maximise number of cars stopped, not each individual bribe). Specific examples of cases where driver had advantageous bargaining power are D3 case 3.2, D6 case 6.7, D4 case 4.1 and D2 case 2.1 and statements 4 and 5, found in Appendix 3. If the bargaining power of the driver is greater than the bargaining power of the policeman, i.e., $\beta > \beta-1$, then in the case where the driver chooses "Not Bribe" he/she has an advantage and the outcome will be the formal process, or being let go[35], even if the policeman chose the "Bribe" option (in other words, the driver is immune to extortive bribery). Similarly, in the case where driver chooses "Bribe" and the police officer chooses "Not Bribe", the outcome will be either a "Bribe"-"Bribe" or a formally-processed fine outcome, "Not Bribe-Not Bribe" since the higher bargaining power of the driver might allow him/her to convince the police officer. Given that the driver's bargaining power is β , this is also the probability that the driver will be able to influence the traffic policeman towards a driver-favourable outcome[36]. The set-up of a simultaneous game-theoretic matrix will look like this:

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[35] Being let go without a bribe or an official fine is equivalent to having a payoff of zero for the driver
[36] This is an author's assumption. In Nash bargaining, β is used to determine what share of the rent the actor gets; in this thesis, the author also uses β in a similar manner, used to also determine with what likelihood the actor will be able to convince or influence another actor.

Figure 10. Simultaneous game set-up if the driver has advantageous bargaining power

D*

	Bribe	Not Bribe
Bribe	Policeman: $\frac{R - q(S + \epsilon Z)}{N}$ Driver: $\frac{-R - t_2 m - qF - qT - qt_1 m}{M}$	**'Let go' or Fine** Policeman: $\beta(0) + (1-\beta)\frac{1}{v}$ Driver: $\beta(0) + (1-\beta)(\frac{-F - t_1 m}{M})$
Not Bribe	**Bribe or Fine** Policeman: $\beta(\frac{R - q(S + \epsilon Z)}{N}) + (1-\beta)\frac{1}{v}$ Driver: $\beta(\frac{-R - t_2 m - qF - qT - qt_1 m}{M})$ $+ (1-\beta)(\frac{-F - t_1 m}{M})$	Policeman: $\frac{1}{v}$ Driver: $\frac{-F - t_1 m}{M}$

(where **P** labels the rows)

* bargaining power advantage, $0 < \beta < 1$ and $\beta > 0.5$

Driver's reasoning follows. "If the policeman chooses "Not Bribe" I will prefer the strategy with a greater payoff, comparing the payoffs:

$$\beta(\frac{-R - t_2 m - qF - qT - qt_1 m}{M}) + (1-\beta)(\frac{-F - t_1 m}{M}) \text{ and } \frac{-F - t_1 m}{M}$$

Further, "If the policeman chooses "Bribe", then my payoff can either be:

$$\frac{-R - t_2 m - qF - qT - qt_1 m}{M}, \text{ or } \beta(0) + (1-\beta)(\frac{-F - t_1 m}{M})"$$

On the policeman's side, his/her reasoning follows. "If the dominant driver chooses "Not Bribe", then my payoff can be:

$$\beta(0) + (1-\beta)\frac{1}{v}, \text{ or } \frac{1}{v}$$

If the dominant driver chooses "Bribe", then my payoff can be:

$$\frac{R - q(S + \epsilon Z)}{N}, \text{ or } \beta(\frac{R - q(S + \epsilon Z)}{N}) + (1-\beta)\frac{1}{v}"$$

No-corruption equilibrium

For anti-corruption purposes, the goal is to align incentives so that both the driver and the traffic policeman have "Not Bribe" as their dominant strategy. The driver's dominant strategy will be "Not Bribe" if:

$$\begin{cases} \dfrac{-F-t_1 m}{M} > \beta\left(\dfrac{-R-t_2 m-qF-qT-qt_1 m}{M}\right) + (1-\beta)\left(\dfrac{-F-t_1 m}{M}\right) \\ (1-\beta)\left(\dfrac{-F-t_1 m}{M}\right) > \dfrac{-R-t_2 m-qF-qT-qt_1 m}{M} \end{cases}$$

$$\begin{cases} -F-t_1 m > \beta(-R-t_2 m-qF-qT-qt_1 m) + (1-\beta)(-F-t_1 m) \\ (1-\beta)(-F-t_1 m) > -R-t_2 m-qF-qT-qt_1 m \end{cases}$$

$$\begin{cases} (\beta)(-F-t_1 m) > \beta(-R-t_2 m-qF-qT-qt_1 m) \\ (1-\beta)(-F-t_1 m) > -R-t_2 m-qF-qT-qt_1 m \end{cases}$$

$$\begin{cases} -F-t_1 m > -R-t_2 m-qF-qT-qt_1 m \\ (1-\beta)(-F-t_1 m) > -R-t_2 m-qF-qT-qt_1 m \end{cases}$$

$$\begin{cases} R > F+t_1 m-t_2 m-qF-qT-qt_1 m \\ R > (1-\beta)(F+t_1 m)-t_2 m-qF-qT-qt_1 m \end{cases}$$

Since $(1-\beta)(-F-t_1 m)-t_2 m-qF-qT-qt_1 m < F+t_1 m-t_2 m-qF-qT-qt_1 m$, in order for both inequalitites to hold simultaneously, R has to be greater than the bigger of the two terms, $F+t_1 m-t_2 m-qF-qT-qt_1 m$. Thus,

Equation 5.Driver's dominant strategy is 'Not Bribe' (5)

$$R > F+t_1 m-t_2 m-qF-qT-qt_1 m$$

Is the condition when driver is better off to pick the 'Not Bribe' strategy no matter what traffic policeman chooses.

Traffic policeman will have "Not Bribe" as a dominant strategy if :

$$\begin{cases} \dfrac{1}{v} > (1-\beta)\dfrac{1}{v} \\ \beta\left(\dfrac{R-q(S+\epsilon Z)}{N}\right) + (1-\beta)\dfrac{1}{v} > \dfrac{R-q(S+\epsilon Z)}{N} \end{cases}$$

Since $\dfrac{1}{v}$ is always greater than $(1-\beta)\dfrac{1}{v}$ because $0 < \beta < 1$, we only need to consider the second condition and express it in terms of R:

$$(1-\beta)\dfrac{1}{v} > (1-\beta)\left(\dfrac{R-q(S+\epsilon Z)}{N}\right)$$

$$\dfrac{1}{v} > \left(\dfrac{R-q(S+\epsilon Z)}{N}\right)$$

$$\dfrac{N}{v} > R-q(S+\epsilon Z)$$

Equation 6. Traffic policeman's dominant strategy is 'Not Bribe' (6)

$$\dfrac{N}{v} + q(S+\epsilon Z) > R$$

Only when the bribe is less than the foregone income from the protocol, traffic policeman will be better off to select the strategy 'Not Bribe', regardless of what the dominant driver does.

Therefore, in a situation when the driver has advantageous bargaining power, both the driver and the policeman will both have "Not Bribe" as their dominant strategy, (5) and (6) need to hold simultaneously:

$$\begin{cases} R > F + t_1m - t_2m - qF - qT - qt_1m \\ \dfrac{N}{v} + q(S + \epsilon Z) > R \end{cases}$$

$$\begin{cases} F + t_1m - t_2m - qF - qT - qt_1m < R \\ R < \dfrac{N}{v} + q(S + \epsilon Z) \end{cases}$$

$$\overline{\qquad\qquad\qquad\qquad}$$

$$F + t_1m - t_2m - qF - qT - qt_1m < R < \frac{N}{v} + q(S + \epsilon Z)$$

Equation 7. The dominant strategy of both parties is 'Not Bribe' (7)

$$(1 - q)F + (t_1 - t_2 - qt_1)m - qT < R < \frac{N}{v} + q(S + \epsilon Z)$$

Similarly to the exogenous agreement model, (7) represents the interval of R for a no-corruption equilibrium. This is the condition when the maximum bribe that a driver can offer is lower than the minimum bribe that the policeman can accept.

In order to increase the set R that would fall in that interval, the anti-corruption measures should be targeted to reduce $(1 - q)F + (t_1 - t_2 - qt_1)m - qT$ and increase $\frac{N}{v} + q(S + \epsilon Z)$. This includes:

Table 5. Anti-Corruption tools of the endoogenous agreement model where driver has advantageous bargaining power

Code	Variable	Affecting	Change with an anti-corruption impact	Level of effectiveness
N	Salary of the traffic policeman	Traffic policeman	Increase	High[37]
v	Monthly quota how many tickets to write	Traffic policeman	Inconclusive	
S	Penalty for taking a bribe	Traffic policeman	Increase	Low[38]

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[37] Lack of any multiplier
[38] Because of *q* multiplier, $0 \leq q \leq 1$, and in practice q approaches 0 in transition countries

q	Probability of detection of traffic police bribery	Traffic policeman and driver	Increase	High
F	Fine for traffic violation	Driver	Decrease	Medium-high[39]
T	Penalty for giving a bribe	Driver	Increase	Low[40]
t_1	Time for issuance and payment of a ticket	Driver	Decrease	High[41]

The outcomes and respective anti-corruption tools for this case, when the driver has advantageous bargaining power and agreement is endogenous, are identical to the exogenous agreement model. This indicates that the Bowles-Garoupa and Chang-Lai-Yang set-up is for the situations where bribery is passive, but not for situations where bribery is extortive, as represented in the next set-up when policeman has advantageous bargaining power.

Set-Up: policeman has advantageous bargaining power

The situations when policeman has advantageous bargaining power include: driver is in a hurry, or does not know the laws, can easily be scared, etc; policeman scares the driver with his psychological pressure tactics, or is positioned in a location where numerous drivers are prone to the same traffic violation (some examples are D5 case 5.3, P3 statement 4). If the bargaining power of the policeman is greater than the bargaining power of the driver, then if the policeman chooses "Bribe" and the driver chooses "Not Bribe" two things can happen: policeman will either be able to extort the bribe from the driver, or the policeman will inflate the value of the fine by finding many violations and spending a significant amount of time on the interaction, hoping to extract a bribe after all. Similarly, if the policeman chooses "Not Bribe" and the driver chooses "Bribe"—this can happen when the policeman has one last opportunity to fulfil his/her quota—then the outcome will be the same as the "Not Bribe"-"Not Bribe" outcome and the driver wont' be able to convince the policeman for a bribe no matter

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[39] Presence of a *(1-q)* multiplier, $0 \le q \le 1$, means that this is not a very effective tool. However, in practice, q approaches 0 in transition countries, hence *(1-q)* approaches 1 and the impact is significant.
[40] Because of a q multiplier, $0 \le q \le 1$
[41] Presence of an *m* multiplier (driver's hourly salary), with *m >0* unless the driver is unemployed. Since m is typically quite large, effect on *t* would be significant.

how hard he tries, because in this case the policeman has advantageous bargaining power. For specific example, see D1 case 1.4 in Appendix 3. Given that the probability with which the policeman can achieve an outcome in his/her favour is 1-β, $0 < β < 1$ and $β < 0.5$, where β is driver's bargaining power and consequently 1-β is policeman's bargaining power. Hence, the set-up of game-theoretic matrix looks like this:

Figure 11. Simultaneous game set-up if the policeman has advantageous bargaining power

$β < β-1$ **Driver**

		Bribe	Not Bribe
			Bribe or Fine
	Bribe	Policeman: $\frac{R - q(S+ \epsilon Z)}{N}$ Driver: $\frac{- R-t_2m - qF- qT- qt_1m}{M}$	Policeman: $(1 - β) \frac{R - q(S+ \epsilon Z)}{N} + (β)\frac{1}{v}$ Driver: $(1 - β)\frac{- R-t_2m - qF- qT- qt_1m}{M} +$ $(β)\frac{-\widehat{F}-\widehat{t_1}m}{M}]$
Policeman*	Not Bribe	**Fine only** Policeman: $\frac{1}{v}$ Driver: $\frac{-F - t_1m}{M}$	Policeman: $\frac{1}{v}$ Driver: $\frac{-F - t_1m}{M}$

* bargaining power advantage
^ inflated value by policeman

Driver's logic follows. "If the policeman chooses "Not Bribe", the driver is indifferent between two strategies available to me because payoffs would be both $\frac{-F - t_1m}{M}$". If the policeman chooses "Bribe", the driver will choose the greater payoff between:

$$\frac{- R - t_2m - qF- qT- q\,t_1m}{M} \text{ and } (1 - β)\frac{- R - t_2m - qF - qT - q\,t_1m}{M} + (β)\frac{-\widehat{F}-\widehat{t_1}m}{M}$$

Traffic policeamn's logic follows similary. "If the drives chooses "Not Bribe", then he/she compares payoffs:

$$(1 - β)\frac{R - q(S+ \epsilon Z)}{N} + (β)\frac{1}{v} \text{ and } \frac{1}{v}.$$

Similarly, if the drives chooses "Bribe", the policeman compares:

$$\frac{R - q(S+ \epsilon Z)}{N} \text{ to } \frac{1}{v}.$$

No-corruption equilibrium

For both the driver and traffic policeman to end up in the no-corruption equilibrium, both the traffic policeman and the driver need to have "Not Bribe" as the dominant strategy. That will be driver's dominant strategy if:

$$(1 - \beta)\frac{- R - t_2 m - qF - qT - qt_1 m}{M} + (\beta)\frac{- \hat{F} - \hat{t_1} m}{M} > \frac{- R - t_2 m - qF - qT - qt_1 m}{M}$$

$$(\beta)\frac{- \hat{F} - \hat{t_1} m}{M} > (\beta)\frac{- R - t_2 m - qF - qT - qt_1 m}{M}$$

$$-\hat{F} - \hat{t_1} m > - R - t_2 m - qF - qT - qt_1 m$$

Policeman's dominant strategy will be "Not Bribe" if and only if:

$$\begin{cases} \dfrac{1}{v} > (1 - \beta)\dfrac{R - q(S + \epsilon Z)}{N} + (\beta)\dfrac{1}{v} \\ \dfrac{1}{v} > \dfrac{R - q(S + \epsilon Z)}{N} \end{cases}$$

$$\begin{cases} (1 - \beta)\dfrac{1}{v} > (1 - \beta)\dfrac{R - q(S + \epsilon Z)}{N} \\ \dfrac{1}{v} > \dfrac{R - q(S + \epsilon Z)}{N} \end{cases}$$

$$\frac{1}{v} > \frac{R - q(S + \epsilon Z)}{N}$$

$$\frac{R - q(S + \epsilon Z)}{N} < \frac{1}{v}$$

$$R - q(S + \epsilon Z) < \frac{N}{v}$$

i.e., when the officer's net gain from protocol exceeds net gain from bribe, policeman's dominant strategy will be 'Not Bribe' regardless of what the opponent does:

Equation 8. Policeman's dominant strategy is 'Not Bribe' (8)

$$R < \frac{N}{v} + q(S + \epsilon Z)$$

In the situation where traffic policeman has advantageous bargaining power, both players will end-up in a no-corruption equilibrium, by having "Not Bribe" as the dominant strategy, if:

$$\begin{cases} -\hat{F} - \hat{t_1} m > - R - t_2 m - qF - qT - qt_1 m \\ R - q(S + \epsilon Z) < \frac{N}{v} \end{cases}$$

$$\begin{cases} -\hat{F} - \hat{t_1}m > -R - t_2m - qF - qT - qt_1m \\ \dfrac{N}{v} > R - q(S + \epsilon Z) \end{cases}$$

$$\begin{cases} R > \hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m \\ R > -\dfrac{N}{v} - q(S + \epsilon Z) \end{cases}$$

To solve these two inequalities, we need to compare:

$$\hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m \text{ to } -\dfrac{N}{v} - q(S + \epsilon Z).$$

$$\hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m > -\dfrac{N}{v} - q(S + \epsilon Z)$$

because $-\dfrac{N}{v} - q(S + \epsilon Z)$, $0 < q < 1$, q approaches 0 in transition countries and therefore $\hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m$ is likely to be positive. In order for the two inequalities to hold simultaneously, R has to be larger than the greater of the two terms, hence:

Equation 9. Driver's dominant strategy is 'Not Bribe' (9)

$$R > \hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m$$

In order for both parties to have 'Not Bribe' as their dominant strategy, (8) and (9) have to hold simultaneously:

$$\begin{cases} R < \dfrac{N}{v} + q(S + \epsilon Z) \\ R > \hat{F} + \hat{t_1}m - t_2m - qF - qT - qt_1m \end{cases}$$

$$\begin{cases} R < \dfrac{N}{v} + q(S + \epsilon Z) \\ \hat{F} - qF - qT + (\hat{t_1} - t_2 - qt_1)m < R \end{cases}$$

Equation 10. Both parties have 'Not Bribe' as their dominant strategy (10)

$$\hat{F} - qF - qT + (\hat{t_1} - t_2 - qt_1)m < R < \dfrac{N}{v} + q(S + \epsilon Z)$$

Double inequality in (10), like in the previous two models, also represents a case where the maximum size of the bribe the driver is willing to give exceeds the minimum size of the bribe that it is profitable for the policeman to take.

Therefore, an anti-corruption initiative aimed at curbing traffic police bribery should (separately or simultaneously) increase $\dfrac{N}{v} + q(S + \epsilon Z)$ and decrease

$\hat{F} - qF - qT + (\hat{t}_1 m - t_2 - qt_1)m$. This would widen the interval that satisfies this double inequality and increase the possible sets of R possible. The following table illustrates how this could be achieved by impacting individual variables.

Table 6. Anti-Corruption tools when policeman has bargaining advantage

Code	Variable	Affecting	Change with an anti-corruption impact	Level of effectiveness
N	Salary of the traffic policeman	Traffic policeman	Increase	High[42]
v	Monthly quota how many tickets to write	Traffic policeman	Inconclusive[43]	
S	Penalty for taking a bribe	Traffic policeman	Increase	Low[44]
q	Probability of detection of traffic police bribery	Traffic policeman and driver	Increase	High
$F\wedge$	Inflated fine for traffic violation	Driver	Decrease	High[45]
F	Real fine for traffic violation	Driver	Increase	Low[46]
T	Penalty for giving a bribe	Driver	Increase	Low[47]
$\hat{t}_1$	Time for issuance and payment of a ticket, inflated by the traffic police officer	Driver	Decrease	High[48]

Decreasing the inflated fine for traffic violation, a tool with high effectiveness based on the above analysis, could be translated as decreasing the possibility for the traffic police officer to inflate the fine. In practical terms, this includes simple rules of the road that do not change frequently, with minimum subjective interpretation, and narrow fine margins for any single violation.

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[42] Lack of any multiplier
[43] See the analysis of quotas for the sequential model
[44] Because of q multiplier, $0 \leq q \leq 1$, and in practice q approaches 0 in transition countries
[45] Note absence of any multiplier
[46] Because of a q multiplier, $0 \leq q \leq 1$
[47] Because of a q multiplier, $0 \leq q \leq 1$
[48] Presence of an *m* multiplier (driver's hourly salary), with *m >0* unless the driver is unemployed. Since m is typically quite large, effect on *t* would be significant.

Summary of Findings

In this chapter, different modelling set-ups of driver-policeman interactions were used to generate a mathematical condition (a double inequality) for a no-corruption equilibrium. Specifically, the double inequality indicated a bribe interval, where the maximum bribe a rational and utility-maximising driver is willing to offer is lower than the minimum bribe a rational and utility-maximising traffic policeman is willing to accept. Utilising this condition, measures were derived to increase this bribe interval that leads to a no-corruption equilibrium of the game—the anti-corruption measures of the models. In sum, the modified Bowles-Garoupa and Chang-Lai-Yang models generated measures similar to the simultaneous models where either the driver or the traffic policeman has a bargaining advantage, but not identical, as seen from Table 6 below.

Table 7. Summary of anti-corruption measures

Code	Variable	Affecting	Modified B-G and C-L-Y Model	"Driver has advantageous bargaining power" Model	"Policeman has advantageous bargaining power" Model
			Change with an Anti-Corruption Impact		
N	Salary of the traffic policeman	Traffic policeman	Increase**	Increase**	Increase**
v	Monthly quota how many tickets to write	Traffic policeman	Inconclusive	Inconclusive	Inconclusive
S	Penalty for taking a bribe	Traffic policeman	Increase	Increase	Increase
q	Probability of detection of traffic police bribery	Traffic policeman and driver	Increase**	Increase**	Increase**
$F^{\wedge}$	Inflated fine for traffic	Driver	--	--	Decrease**

	violation				
F	Real fine for traffic violation	Driver	Decrease*	Decrease*	Increase
T	Penalty for giving a bribe	Driver	Increase	Increase	Increase
$t_1, \widehat{t_1}$	Time for issuance and payment of a ticket, real and inflated	Driver	Decrease**	Decrease**	Decrease**

** high effectiveness
* medium-high effectiveness
lack of a * indicates low effectiveness

Using all three models makes the anti-corruption measures more robust, regardless of whether the assumption of agreement is exogenised or not. The third model where traffic policeman has advantageous bargaining power provides two additional policy tools, linked to potential inflation of the fine by the traffic policeman.

Based on this modelling, effective policy tools to decrease the level of traffic police bribery in transition countries are: (1) increasing the salary of traffic policemen, (2) increasing the probability of detection of corruption, (3) decreasing the time it takes to issue, process and pay for a formally-issued ticket of traffic violation and decreasing the repercussions of each fine on record, (4) decreasing the possibility for fine-inflation on behalf of the traffic policeman, which can also be done via (5) increasing drivers' bargaining advantage and public awareness through clear and simple laws that do not change. Quotas, which provide positive material incentive to formally register a set amount of violations a month, are nevertheless a questionable policy tool in the presence of corruption. Income and financial incentives are significant determinants of corruption, which lends support to wage theories of anti-corruption policy, advocating for at least efficiency wages for government bureaucrats. Nevertheless, presence of high income inequality among transition countries makes traffic police bribery also more difficult to tackle.

Only three out of five key policy measures could have been generated solely with the modified Bowles-Garoupa and Chang-Lai-Yang models. The inclusion of models with agreement outcome derived by the model, as opposed to assumed exogenous, provided insight regarding the importance of increasing driver's bargaining

advantage and decreasing the possibility of fine-inflation on behalf of traffic policemen—both effective anti-corruption tools. The latter translates into practical terms as simple rules of the road that do not change frequently, with minimum subjective interpretation, and narrow fine margins for any single violation. If the rules are simple and do not change, then an increase in driver's bargaining power, relative to traffic policeman's, will take place automatically. Currently, transition countries are still characterised by authoritarian police. A transition to 'democratic policing' and a culture of public service, as outlined by Caparini and Marenin (2005), would further increase driver's bargaining power by reducing policeman's opportunities to psychologically and physically intimidate the driver.

CHAPTER III. EMPIRICAL APPLICATION

This section is an empirical application of the models to real anti-corruption reforms in traffic police bribery that took place. The theoretical models represent individual interactions and provide micro-level changes necessary to shift the equilibrium of the game from a corruption to a non-corruption outcome. The national level of traffic police bribery can be conceptualised as the set of micro-level interactions that result in a corruption equilibrium of the game. The greater the proportion of micro-level interactions that result in a no-corruption equilibrium, the lower the national level of traffic police bribery. This makes it possible to test the micro-level theoretical models with case studies of national traffic police reform, because a macro measure—such as increasing salaries of all policemen across the board—influences individual decisions of traffic police officers in every interaction with the driver, thus reducing the number of micro-level interactions that result in corruption.

Several countries have implemented macro measures in traffic police reform, at various points in time during the transition, with varying strength of measures, and with varying impact on the level of corruption. Besides Ukraine and Georgia, reforms were also implemented in the Czech Republic, Estonia, and Poland; a comparative reform table can be found in Appendix 4. In Estonia, for instance, significant personnel changes took place[49] as a result of the first wave of traffic police reform in early 1990s and good command of Estonian language was introduced as a new mandatory requirement. Two subsequent waves of traffic police reform, in 1999 and 2004, resulted in higher salaries and creation of new jobs by cost-cutting (Savina, 2007). The Czech reform of traffic police also included a salary increase, albeit by only 7% (Savina, 2007). In the Polish case, the salaries grew two-fold, coupled with abolition of cash

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[49] By 1993, 50% of 5,504 police officers were inexperienced new hires, with 37% younger than 25 and "between 1993 and 1997, 3975 new police officers were recruited...during this same period 1386 officers were released from duty" (Saar, 1999)

fines—discretionary and motivating unofficial payments—which also led to reduction in the level of traffic police bribery (Savina, 2007). However, such measures were implemented as part of the general police reform package, not specifically aimed against corruption. In Georgia and Ukraine, the reforms were aimed at corruption-curbing within the traffic police, and the measures were more harsh than in the Estonian, Czech and Polish cases. Therefore, based on comparison between traffic police reforms in these transition countries, the two cases of Ukraine and Georgia were selected as the best cases to test whether the theoretical model is in line with the results in practice.

Ukrainian reforms of 2005-2008 targeted one set of variables, while Georgian reforms of 2004 targeted another set of variables. In the case of both, reform measures were drastic enough to generate substantial change. In the case of Georgia, the level of traffic police bribery substantially decreased. In the case of Ukraine, the level of traffic police bribery moderately increased or remained the same, depending on the measure. The following Table 6 presents a reform summary of what variables were affected by the two reforms and how.

Table 8. Comparison of Georgian and Ukrainian reform measures

Variable	Georgia	Ukraine
Dependent variable		
Level of traffic police bribery	Significant decrease in frequency of traffic police bribery	Some increase in frequency of traffic police bribery; Increase in the size of the bribe
Explanatory variables present in the models		
Salaries of traffic police officers	Increased; 8-fold	Increased; 2- or 3-fold
Fines and possibilities for fine-inflation	No change in fines. Decrease in repercussions of traffic violations. Decrease in possibilities for fine-inflation	Substantial increase in fines and repercussions; on average at least a 10-fold increase in fines. No change in possibilities for fine inflation: increase in possibilities due to legislation, decrease due to heightened driver awareness
Probability of detection	Significant increase; upgrade of technology	No change

	(cars, radar equipment, office, processing software)	
Time to process and pay for the ticket	Substantial decrease	No change
Quotas	Abolished; focus on accurate and thorough recording, not on total numbers	No change; focus on total numbers as indicators of performance
Penalty for bribery	Increased to up to 9 years in prison (for taking bribes)	No change
Explanatory variable not present in the models		
Past experience	Significant decrease: 15,000 officers fired, very few hired back	No impact (organisational reshuffling): number of officers fired = number of officers re-hired in other police departments

All reform measures implemented in the case of Georgia and Ukraine, except for one, are directly reflected in the theoretical models. The theoretical models also accurately predicted the dynamics of increasing or decreasing the variables in practice. In Georgia, for instance, an 8-fold increase in salaries of traffic policemen was hailed as one of the significant changes that led to a decrease in traffic police bribery. This is in line with the model and supports the classical policy literature in favour of efficiency wages for government bureaucrats. In Ukraine, on the other hand, the fines and repercussions for traffic violations were increased 10-fold, resulting in higher bribe size and moderately higher frequency of bribery; this is also in line with the model—higher fine leads to a higher equilibrium bribe size.

Only one reform measure—replacement of old police officers with new ones— was not present in the theoretical models. Since past experience of corruption and exposure to it cannot be changed in each individual traffic policeman, an alternate reform measure with the same aggregate impact is replacement of every traffic police officer. Such organisational replacement of old traffic policemen with newly trained recruits was a defining measure of the Georgian case, and absent in the Ukrainian one. The theoretical models do not include the variable of past experience and exposure to corruption because that would require additional dynamic modelling and inclusion of evolutionary game-theoretic elements, which were deemed beyond the practical scope of this study. All in all, further analysis regarding the quality and usefulness of the

models in light of empirical evidence can be found at the end of this Chapter, where a calibration exercise is presented to show that the models generated accurate predictions regarding the change in level of traffic police bribery in Georgia and in Ukraine.

Georgian Case Study

In Georgia, several tough measures were implemented to fight corruption in traffic police, and the overall level of traffic police bribery substantially fell. This section describes the Georgian traffic police reform in greater depth and contrasts the reform outcomes with the findings from the models. Following a brief introductory background, the reform measures are analysed, variable-by-variable.

Background

Anti-corruption campaigns have a long tradition in Georgia. In soviet times they disguised political purges. Under the former president Eduard Shevarnadze, the practice of corruption became institutionalised on many levels (Magradze, 2007). Shevarnadze's anti-corruption campaigns were primarily intended at satisfying international creditors and hence the Georgian population had grown sceptical of official anti-corruption declarations by the time president Saakashvili took office (Di Puppo, 2005). Following the Rose Revolution in November 2003, new President Saakashvili declared eradication of corruption as a main policy priority, alongside the restoration of Georgia's territorial integrity, and controversially fired several top officials[50] connected to Shevarnadze immediately after taking office (Di Puppo, 2005).

The differences in institutional approaches to police and corruption between Shevarnadze's and Saakashvili's administrations were stark. Shevarnadze's discourse was that corruption is a phenomenon inherent to Georgian mentality. Saakashvili's discourse, on the other hand, denied this argument and presented corruption as a phenomenon that could be eradicated. Overall, Saakashvili's national anti-corruption strategy was two-fold: (1) targeting of "power ministries"—the interior ministry, state

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[50] The chief of Georgian railways, the former energy minister and Shevardnadze's son-in-law were arrested and charged with tax evasion and embezzlement.

security, ministry of defence; (2) introducing meritocracy by increasing salaries of tax police officers, judges, customs officers. (Di Puppo, 2005)

Reform measures

In the summer of 2004, Saakashvili fired the entire traffic police force—nearly 15,000 officers—regardless of ideological, political or other affiliations of police officers (Saakashvili, 2005). Then, the recruitment competition was announced: newly assembled personnel staff included 2,000 policemen (Anon, 2006a), a net 87% reduction in personnel. Only 15% of the new staff had worked as traffic policemen before, and 85% were new recruits with no past experience in law enforcement agencies. The short-term drawback of this measure is serious lack of qualified personnel and understaffed road safety patrols (Savina, 2007). The long-term shortcoming of this measure involved a challenging task of re-employment and re-integration of 14,000 policemen and high social costs in unemployment benefits; this resulted in large police demonstrations took place and instability within the police (Boda and Kakachia, 2005). On the other hand, 85% of new recruits had no past experience taking bribes as traffic policemen, and had no co-workers or supervisors to learn it from. Although the variable of 'past experience' is not present in game-theoretic modelling of this study, the case of Georgia demonstrates that impacting this variable is an important anti-corruption tool.

All the recruited people were sent to the police academy for a 3-month training, where the emphasis was placed on service to the citizens and citizens' rights. Patrolling the streets, ensuring safety, even resolving domestic disputes was instructed as provision of public service, as opposed to an authoritarian responsibility. This change from authoritarian policing to democratic policing decreased the bargaining power of the traffic police officer and increased the bargaining power of the driver.

A key reform measure was an 8-fold increase in the salaries of traffic policemen. Prior to the reform, the official salary was 50 USD per month. As a result of the reform, salary became 400 USD per month (Siegel, 2005). According to other sources, monthly salaries were raised to 350-500 lari, equivalent to 150-210 EUR, or 300 USD per month (Boda and Kakachia 2005). To further decrease the financial burden of traffic policemen and the financial motivation that a desire for status entails, the traffic policemen were provided with status items. In the words of Saakashvili: "we gave them

new nice uniforms ...we gave them new German cars, American radios, the US-looking badges [with emblems]" (Siegel, 2005). Both the interviews and the models highlighted the significant role of financial incentives—or the lack of adequate income—as determinants of bribery on the side of traffic policeman, which indicates that practice is in line with the theory

Furthermore, the penalty for taking bribes was increased to up to nine years in prison and since the reform, about 100 criminal cases against bribery were brought (Savina, 2007). There is now zero tolerance towards torture and intimidation tactics (Siegel, 2005), including extremely tough penalties upon detection. Furthermore, significant technological upgrade (Siegel, 2005) also produced an increase in the probability of detection. In the theoretical models, increasing the penalty (on both the bribe-taker and the bribe-giver) turned out to be an anti-corruption tool with a lower effectiveness level, compared to increasing salaries and reducing the time for processing and payment of the official ticket. In the Georgian case, however, the penalty increase was substantial, though it is unclear to what extent this measure alone would have led to lower traffic police bribery.

As for the quotas—unofficial statistical requirements—this practice was abolished. "The staff were told, that the percentage of crimes uncovered is not the most important thing. The new most important thing was for everything to be recorded" (Siegel, 2005). This new approach that provides a positive material incentive to the traffic policeman for official processing of violations represents a better alternative than the system of unofficial quotas and statistics, which the models have shows to be a questionable motivational tool given widespread corruption.

Change in traffic police bribery

According to the survey conducted in Georgia in 2000[51], 57% of households felt that corruption was worse relative to 4 years ago, and noted that corruption was an essential or useful part of doing business. The institution of traffic police generally received the worst ratings in terms of bribery, honesty and integrity, and is considered a corruption "hot spot". According to the households in contact with the traffic police,

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[51] Survey conducted by Georgian Opinion Research Bureau International with the collaboration and support of the Government of Georgia and with funding from The World Bank and USAID

bribes are required on average in 7 out of 10 contacts, which is illustrated in Figure 14 below:

Figure 12. Frequency of unofficial payments by households to various agencies
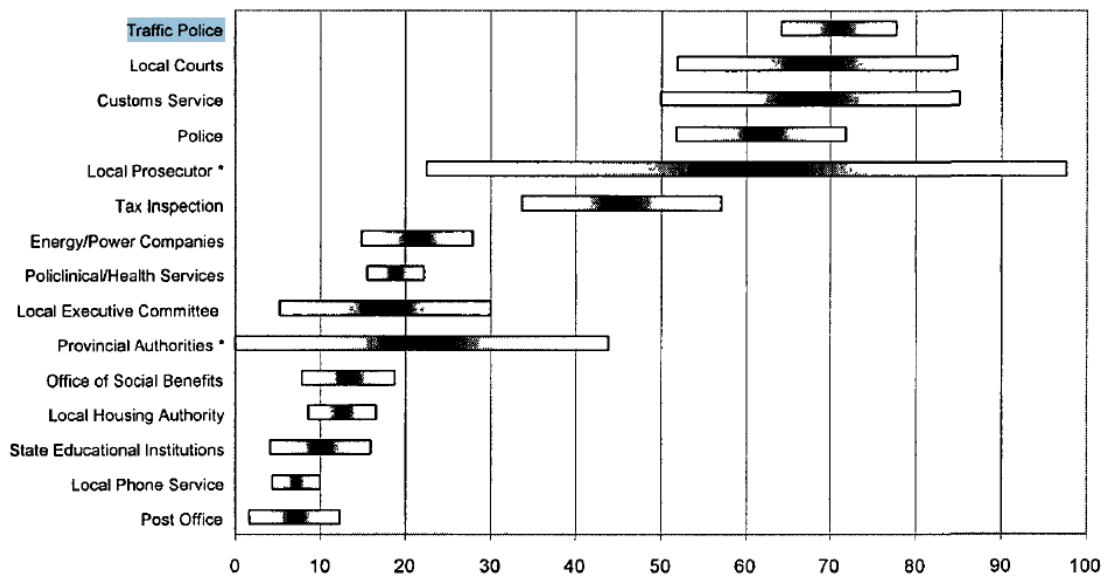
Prior to the reform, the most feared and hated people in Georgia were the traffic police, not the KGB goons, the criminal militias or the fat-cat business pals and wealthy relatives of the former president (McDonald, 2007). Via arbitrary fines, Georgian households were forced to pay as much as 30% of total unofficial payments to traffic police, as illustrated by the Figure below. Transfers to traffic police therefore represented 0.84% of household income among the households that admitted to paying bribes. (*Source: Corruption in Georgia: Survey Evidence, The World Bank.*). Specifically

> "Before the traffic police reform, traffic cops would station themselves on city streets or rural highways, using their white batons to wave over motorists at random. Their arbitrary, on the spot fines could easily equal a week's wages for the average Georgian. Arguing a fine could result in a beating, the loss of one's vehicle or worse. Part of each officer's daily take was kicked up to his superiors, further links in the chain of corruption."

Source: Firing of traffic police force stands as a symbol of hope in Georgia, 2005

Following the reform, the impact was substantial and immediate visible, according to several sources:

> "People were used to dirty/untidy policemen taking money on every corner, and suddenly they were replaced by young/new people, on modern Volkswagens, who did not take bribes" (Savina, 2007).
> "Car-drivers are no longer stopped and asked to pay bribes by policemen at improvised road check points and the disappearance of the corrupt traffic police"
> (Di Puppo, 2005)

According to Alexander Rondeli, presidential adviser and former Georgian diplomat, after the reform police as an institution started to be liked and gain respect among the population: "People actually like the police now, it shows people that the very worst part of our society could be reformed, shows' there is hope" (McDonald, 2007). Further in support of the qualitative statements, social surveys demonstrate that 96% of the population admits that police is not corrupt—an average of only 3.8% of drivers surveyed in 2006 admitted to giving bribes to traffic policemen after the reforms (Ministry of Internal Affairs, 2006):

Table 9. Traffic police bribery in Georgia, 2005-2006

Proportion of respondents who have given a bribe to a traffic policeman in 2005	
In villages	3.7%
In small- and medium-size town	3.9%
In Tbilisi	4.1%
Average	3.8%

Source: Ministry of Internal Affairs (2006)

Even RIA Novosti, a Russian news source typically very critical of Georgia, notes that the reform managed to "win over" (Anon, 2006a) the bribery on Georgian roads.

Ukrainian Case Study

The Ukrainian traffic police reform aimed at curbing corruption at first looked like a carbon copy of the Georgian reform measures, but over time turned out to include only one drastic measure—increase in fines—and marginal impact on the other variables. The overall level of traffic police bribery remained the same or even increased by some accounts. This section describes the Ukrianian traffic police reform

in greater depth and contrasts the reform outcomes with the findings from the models. Following a brief introductory background, the reform measures are presented and analysed, variable-by-variable.

Background

During transition, the emergence of private sector in the Ukrainian services prone to corruption (university admissions, medical services, telephone installations, etc.) has reduced the amount of petty corruption. Yet the traffic police—as well as other services offered by other law enforcement offices—has remained the monopoly of the state. As a result, bribes were often offered and taken for speeding up the procedure, evading or easing punishment, etc. The main reasons for post-Soviet corruption, namely the over-regulation of economic and social activities, weak administrative control and judicial review, coupled with low salaries for public officials, remained in force. On the supply side of bribery, post-Soviet factors also play a role. Offering additional payments as a way of smoothing otherwise lengthy and complicated official procedures was a habit inherited from the Soviet times when "petty bribery and connections were the main and often the only way of obtaining deficit goods and services". (Pavlenko, 2001)

In police force, "very little progress has been made in democratizing police relations with the public despite numerous declarations, presidential edicts, and even changes to the law" (Beck, 2005). Up to 2005, The Ministry of the Interior retained a strong centralized structure (Beck, 2005), militia had not been yet fully demilitarised, and police salaries lacked appropriate increases (Hobbing, 2005). Although in 2007 the Ministry of the Interior had developed a concept note and specific goals, objectives and operationalised tasks in order to bring Ukrainian policing to European democratic standards of law enforcement, this element of the reform had not been followed through.

Reform measures

Specifically, the reform of Ukrainian traffic police—called State Auto Inspection in Ukrainian and also known as 'DAI'—began in the summer of 2005, with the original intention to follow the Georgian example. On 18 July 2In July 2005, the President Viktor Yushchenko announced the liquidation of DAI in one single day, with the aim to stop DAI's bribe-seeking raids, particularly 'from out of the bushes'

(Chyrfush, 2005). However, mass publicity of a 20% spike in traffic accidents and lobbying to reinstate DAI back (Morzharetto, 2005) ultimately resulted in prolonging the time required for reform and significant down-scaling of the measures. The re-written reform agenda was based on organizational restructuring and minor reduction in overall personnel levels[52]. By August, deputy minister of Internal Affairs announced that DAI had not been liquidated and instead, reforming the ministry will take three months. The plan in force remained to narrow DAI down to 3,000 employees via reshuffling and reorganization with the patrol services (Morzharetto, 2005). By the end of 2006, however, when the structural reorganisation of DAI had been completed, only organisational reshuffling took place. As a result, DAI personnel number decreased 2-fold, while the patrol service personnel increased 40%. Hence, total personnel numbers remained equally high; disbanding and hiring new recruits, like in Georgia, did not take place.

The only substantial and harsh measure of the reform was an increase in fines. This took place during the second wave of traffic police reform in November-December 2008[53]. Below are several of the changes in administrative fines; the fines amount has been also converted to USD at the rate of 5.78UAH per USD[54] which was in effect in November 2008, in order to show that the fines that were previously low by international standard, were sharply raised to a significantly high level, particularly for a country with a yearly per capita income estimated at 7,400 USD (PPP) in 2008[55].

Table 10. Changes in fines for traffic violations in Ukraine

Violation	Previous fine	New fine	Times increase
Not wearing a seat belt Art. 121 Code of administrative violations	From 3.4 to 8.5 UAH **(0.58 to 1.47 USD)**	From 51 to 85 UAH **(8.82 to 14.71 USD)**	10 to 15
Inadequate technical	From 17 to 34 UAH	From 340 to 425 UAH	13 to 20

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[52] from 23,000 DAI employees, 10,000 will be blended with the 'foot patrol', creating a single patrol entity; 3,000 employees will remain as post controllers, with 2,500 present on highway checkpoints. The patrol service is supposed to be enforcing safety on the streets and house yards, while the 'new state auto inspection' is supposed to operate only in major towns and the new staff/personnel levels are supposed to be significantly lower (Morzharetto, 2005).

[53] Act of changes to several legislative acts of Ukraine with reference to improvement of regulation of traffic safety, 2008.

[54] Based on November 2008 exchange rate. National Bank of Ukraine historical currency data available at: http://www.bank.gov.ua/Fin_ryn/OF_KURS/Currency/SearchPeriod.aspx

[55] See, for instance, CIA World Factbook at: https://www.cia.gov/library/publications/the-world-factbook/geos/up.html

condition, outdated technical inspection Art. 121 Code of administrative violations	**(2.94 to 5.88 USD)**	**(58.82 to 73.53 USD)**	
Lacking/dirty license plates, lack of technical inspection sticker Art. 121 Code of administrative violations	From 34 to 85 UAH **(5.88 to 14.71 USD)**	From 170 to 255 UAH **(29.41 to 44.12 USD)**	3 to 5
Speeding Art. 122 Code of administrative violations	20+ km/h over the speed limit: warning or fine from 8.5 to 17 UAH **(1.47 to 2.94 USD)**	20+ km/h over the speed limit: from 255 to 340 UAH **(44.12 to 58.82 USD)** 50+ km/h over the speed limit: from 510 to 680 UAH **(88.24 to 117.65 USD**	30 to 40
Violations involving an intersection, a red light, or overtaking Art. 122 Code of administrative violations	From 3.4 to 17 UAH **(0.58 to 2.94 USD)**	From 425 to 510 UAH **(73.53 to 88.24 USD)**	30 to 125
Using a mobile phone without a handsfree device Art. 122 Code of administrative violations	none	From 425 to 510 UAH **(73.53 to 88.24 USD)**	75 to 90
Creating an accident-prone situation, documented and proven, Art.122 Code of administrative violations	From 34 to 68 UAH **(5.88 to 11.75 USD)** or loss of driving license for 6-12 months	From 680 to 850 UAH **(88.24 to 147.06)** or loss of driving license for 6-12 months	13 to 20
Driving without a license or insurance Art. 126 Code of administrative violations	From 8.5 to 17 UAH **(1.47 to 2.94 USD)**	From 425 to 850 UAH **(73.53 to 147.06 USD)**	50
Driving while intoxicated Art. 130 Code of administrative violations	First violation: from 255 to 340 UAH **(44.12 to 58.82 USD)** or loss of a driving license for 12-24 months Second violation in the same year: from 340 to 680 UAH **(44.12 to 88.24 USD)** or loss of a driving license for 24-32 months	First violation: from 2550 to 3400 UAH **(441.18 to 588.24 USD)** or loss of a driving license for 12-24 months Second violation in the same year: loss of driving license for 24-48 months	10

According to all three models, based on the equilibrium bribe size obtained from the Nash bargaining, an increase in fines for traffic violations leads to an increase in the size of the equilibrium bribe. Furthermore, further theoretical investigation of this by Chang, Lai, and Yang (2000) shows that in the presence of widespread corruption, an increase in fines does not act as a deterrent of crime, and the level of corruption is likely to increase. The endogenous agreement model where traffic policeman has advantageous bargaining power and the possibility to inflate the fine while attempting to extort a bribe predicts that in case of Ukraine—a transition country with authoritarian police—higher fines and wide brackets of fines lead to an increase in extortive bribery.

As for increasing the salaries of traffic policemen, the measure was not nearly as drastic as in Georgia. In 2005, salary of entry-level officer was 500 UAH, in 2006 1,000 UAH. By 2008-2009, the entry-level salaries of DAI policemen have gradually been increased 1.5 times to 1,500 UAH. Starting from 1 September 2009, the average salaries of DAI policemen were also projected to increase, additional 34%: from 3,000 UAH monthly (circa 500 USD), varying from 1,500 UAH (250 USD) monthly salary to a first-year sergeant, to 4,500 UAH (circa 800 USD) monthly salary to an officer with 20 years of experience. The 2010 new average salary is 3,500-3,900 UAH monthly (600-700 USD). If one is to consider the overall increase in averages from 1,850 to 3,500 UAH, that is slightly less than a 2-fold increase; an increase in entry-level salaries from 500 to 1500 UAH is a 3-fold increase. (Anon, 2008)

Given that the increase in Georgian salaries was 8-fold, while the increase in Ukrainian salaries was 3-fold, this highlights not only the direction of change, but also the level of change required to successfully generate a shift from a corruption to no-corruption equilibrium. It is noteworthy that a 2-fold increase over several years, when local currency inflation annual inflation averaged around 15% and in December 2008 was as high as 22.3% (Anon, 2009a), is also much less than a 2-fold increase in salaries overnight. Hence, based on the case studies alone, it is possible to tentatively conclude that the increase in salaries implemented in Ukraine did not provide significant financial motivation to not to accept a bribe in the micro-level interaction of driver-traffic policeman, and on the macro-level did not generate a decrease in traffic police bribery.

According to the models, an increase in salaries should negatively influence the level of corruption. However, a 2- or a 3-fold increase is not substantial enough in the

presence of fines that have an opposing effect on the susceptibility of traffic police officer to the bribery. This can be seen in the calibration exercise in the following section.

The remaining aspects of DAI reform included a marginal technical upgrade and changes to the legal basis (Anon, 2006b). Technical upgrade in Georgia contribute to increased probability of detection; in Ukraine, on the other hand, the technical upgrade included speedometers with inaccurate measurements, which widened the possibility for fine-inflation by a traffic policeman with advantageous bargaining power.

Change in traffic police bribery

There have not been any drastic changes in the level of traffic police bribery in Ukraine. Following the reform, various sources reported on the similar or increased frequency of traffic police bribery, and on the increased bribe size. For instance, according to a parliament member Svyatoslav Oliynyk, an increase in fines led to an increase in bribes to traffic policemen, but the equilibrium bribe is still lower than the fine:

> "50 or 60 UAH is a typical amount of a bribe nowadays [December 2009], which is still 3-4 times less than the average traffic violation fine." (Lashchenko and Naboka, 2009)

Furthermore, the Lonely Planet guide book blog discussion from 2009 reached a consensus is that in Ukraine, drivers are not stopped unless they are violating a traffic law, but if they are stopped by traffic police, a bribe of up to $10 will often suffice for a minor violation (70 UAH), which is higher than it used to be, $5 (25 UAH) before the increased fines (Lonely Planet, 2009).

As for the overall level of corruption after reform, a USAID Ukraine report reveals that over 60% of survey respondents in Ukraine are ready to pay bribes to traffic police, among which 31% do it to save time and effort (Anon, 2009b). According to a pre-election poll conducted in January 2009, the majority of Ukrainians, regardless of their voting preference, consider that the level of traffic police bribery increased as a result of the fines (PACE, 2009).

Models Versus Case Studies

In order to further assess the quality of the model and the predictions, let us consider a calibration exercise, where all the variables are taken to roughly resemble an average case for an average violation. Let the driver's violation be exceeding the speed limit, up to 30%, which is usually not considered 'dangerous' and therefore additional fines are not imposed. First, let us consider, based on Equation 10 of the models, what the equilibrium will be in Georgia and in Ukraine, in an interaction of an imaginary driver and imaginary traffic policeman:

Table 11. Hypothetical interaction scenario in Georgia and in Ukraine

Variable	Code	In Georgia	In Ukraine
Fine for speeding	F	20 lari	17 UAH
Inflated fine for speeding	F^	-	-
Probability of detection	q	0.01	0.01
Penalty on bribe-giver	T	0	0
Driver's time spent if receves a ticket and pays for it	t1	1[56] hour	1[57] hour
Driver's time spent if pays a bribe	t2	5 minutes = 0.083 hour	5 minutes = 0.083 hour
Driver's hourly salary	m	2 lari	50 UAH
Entry-level policeman's monthly salary	N	100 lari	500 UAH
Policeman's monthly quota requirement	v	none	40 protocols
Penalty on policeman if caught	S	Fired = 1 monthly salary	Fired = 1 monthly salary
Policeman's psychological cost	ϵZ	0	0
Equations for a bribe, R,:			
Driver's max.: $\hat{F} - qF - qT + (\hat{t_1} - t_2 - qt_1)m$; Policeman's min.: $\frac{N}{v} + q(S + \epsilon Z)$			

Inserting these approximated values into the equations for an equilibrium bribe, both in Ukraine and in Georgia, this situation would result in a corrupt outcome, because the minimum bribe this policeman is willing to offer is less than the maximum bribe the drive is willing to give:

In Georgia: 1 lari < R < 20.707 lari

In Ukraine: 17.5 hryvnias < R < 62.15 hryvnias

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[56] 30 minutes to issue a protocol of violation, 30 minutes to pay the fine at the bank
[57] 30 minutes to issue a protocol of violation, 30 minutes to pay the fine at the bank

In Georgia, the maximum bribe the driver is willing to offer is 20.707 lari, while the minimum bribe the traffic policeman is willing to accept is 1 lari. Similarly, in Ukraine, policeman's minimum is 17.5 hryvnias, while driver's maximum is 62.15 hryvnias.

Now, let us consider the outcome of the game when a similar imaginary driver and imaginary traffic policeman interact again after the reforms take place in both countries. Using the reforms that took place as a numerical basis, In Georgia, policeman's monthly salary increased 8-fold from 100 lari to 800 lari; in Ukraine, the salary increased 3-fold from 500 hryvnias to 1500 hryvnias. In Georgia, the probability of detection increased from 0.01 to 0.2 and the penalty for traffic police bribery imposed on this officer would be 5 years in prison, i.e., loss of 60 monthly salaries[58]. In Ukraine, the fine rose 10-fold and the new fine for speeding is from 250 to 350 hryvnias, so 350 is the inflated fine and 250 is the real fine. In Georgia and Ukraine, the procedures for payment have been simplified, but more so in Georgia: to bribe still takes 5 minutes but total to receive a ticket and pay for it is takes 20 minutes; in Ukraine the new t_1 total is 45 minutes. The remaining variables remain the same.

In this case, after reforms in Georgia, the maximum this driver is willing to offer is 16 lari, but the minimum this traffic police officer is willing to take is 9600 lari. In Ukraine after reform, the minimum this police officer is willing to take is 42.5 hryvnias, while the driver is willing to pay as much as 380 hryvnias:

<div align="center">In Georgia: 9600 lari </ R </ 16.15</div>

<div align="center">In Ukraine: 42.5 hryvnias < R < 380.475 hryvnias</div>

Hence, in Georgia after reforms, this interaction would end up in a no-corruption equilibrium. The radical change in the Georgian case is coming primarily from the impact on the traffic policeman's side and from the increased detection probability and significantly higher punishment costs; in this calibration exercise. Reducing the time it takes to process and pay for a fine has a substantial impact on the driver's side, but not nearly as radical as the impact of changes on the traffic policeman's side. This is in line with findings from the Georgian case study, where bribery significantly decreased.

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[58] For the purposes of simplicity, I assume that every detected bribe leads to five years in prison and I assume that the loss of salary is the only punishment imposed on the traffic policeman; currently in Georgia, the maximum fine for traffic police bribery is nine years in prison. While both are a little unrealistic, I consider that the fact that a prison sentence is worth more than living without salary compensates the fact that not every detected bribe leads to a less-than-maximum penalty.

In Ukraine after reforms, the equilibrium bribe is in possible range and therefore bribery would still take place. In fact, as the interval for R increased in Ukraine in this calibration exercise, compared to the interval before reforms, bribery would be even more likely to take place on the national level, given different drivers with different salaries, different violations, etc. This also indicates that the average bribe would be higher in Ukraine after the reforms. The significant change in the Ukrainian case is coming from several sources: the increased fine, the increased possibilities for fine-inflation, and higher salaries for traffic policemen, which pushed the threshold for a minimum bribe upwards. In conclusion, this prediction is also in line with findings from the Ukrainian case, where the average bribe significantly increased and the overall level of traffic police bribery has increased.

The calibration exercise demonstrates that the model captures the difference in outcome of the Georgian and Ukrainian cases. Therefore, this is an acceptable model. As outlined in the beginning of this chapter, the shortcomings in the empirical applications of these models include the fact that macro-factors (replacement of old policemen with new policemen) are not taken into account because these models represents micro-interactions. For instance, dynamic modelling so as to include the role of past experience and cultural norms or pervasiveness of corruption beyond the psychological cost would be very useful and make the model even better. Further, a more critical test could be undertaken, outside the scope and time frame of this study, to determine whether this model explains the difference in outcome better than a simple cost-benefit crime model, where bribery is not taken into account.

POLICY RECOMMENDATIONS AND CONCLUSIONS

This chapter summarises the policy recommendations that are effective both theoretically and in practice and evaluates the contributions of this study in greater depth. Lastly, conclusions are drawn from the research with a special focus on support for traditional and new anti-corruption theories, types of human rationality, and applicability of game-theory. Several possibilities for future research on the subject are suggested.

Policy Recommendations

Policy literature on anti-corruption relevant to traffic police bribery primarily consists of two analytical camps. One camp focuses the argument on what individual factors need to be targeted—such as the bureaucrats' salaries, while the other camp approaches corruption dynamically, arguing that a drastic combination of changes needs to take place. On the question of wages and corruption, for instance, Svensson (2005) comes to a conclusion that higher wages lead to lower corruption, but only under certain circumstances. Theoretically, when the official's wages are above the opportunity wage, one can ensure that the official will behave honestly (Becker and Stigler, 1974); yet when the official and bribe-giver can bargain over a bribe, "higher wage strengthens the official's bargaining power as it raises the expected cost of being corrupt" (Mookherjee and Png, 2005, cited in Svensson, 2005). Cross-country studies find mixed evidence[59]. Di Tella and Schargrodsky's (2003) empirical study of a crackdown on public hospitals in Buenos Aires and its relationship to hospital procurement policies revealed that

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[59] Van Rijckeghem and Weder (2001) find evidence that higher wages deter corruption, but Rauch and Evans (2000) and Treisman (2000) find that the evidence is not robust

higher wages do have a negative effect, though only when audit intensity is of a medium or high level. Hence, in all the studies where the wage incentive led to lower corruption, the enforcement apparatus was well-functioning and independent. Without a third-party enforcement agency, raising wages alone is not effective, concludes Svensson (2005).

The big-bang camp focuses on the large amount of change that is necessary to induce in order to fight corruption when it is widespread, and the importance of combining several changes simultaneously, as opposed to one defining policy. For instance, Mookherjee and Png (1995) show that the increase in the rewards or penalties has to be sufficiently large and discrete. More radically, Rothstein (2007) criticises the idea of incremental change when it comes to anti-corruption, and dismisses the presence of "keys"—entry-point for anti-corruption work that will set in motion significant institutional changes—in favour of a 'big-bang' approach.

Policy recommendations resulting from this thesis focus on both—individual effective measures targeting each actor—as well as the magnitude and combination of measures. With the traffic police bribery, actors on both sides of the transaction need to be influenced, both the driver on the supply-side and the traffic policeman on the demand-side. The USAID survey and interview research on traffic police bribery in Ukraine highlights that currently, bribes are profitable to both drivers, policemen, and supervisors in the police structures, and argues that this is why anti-corruption measures in Ukraine thus far have been vastly ineffective (PACE, 2009). Besides affecting both sides in the bribe-transaction, the combination is best when both punishment and reward incentives are applied.

On the policeman's side, positive incentives include increasing the salaries as well as any other material positive incentives. Quotas have shown to be a questionable tool both theoretically and in the case of Ukraine; a better positive incentive is focus on accurate reporting without regard for the total number of officially-processed violations, similarly to the change of operation that took place in Georgia. As far as punishments, the theoretically and empirically proven measure is increasing the probability of detection. On the driver's side, an important positive incentive is decreasing ticket-processing time, time and effort required to pay for a fine, and decreasing the repercussions of a formal fine. Fines are also a strong measure, but in the presence of

widespread corruption, dramatically increasing the fines leads to higher corruption, not less violations. As much as this is counter-intuitive for road safety policy, decreasing formal fines and decreasing the repercussions of official fines is an effective anti-corruption tool because it makes bribery less profitable for drivers. The question of road safety is an important one and also needs to be take into account, but it beyond the purpose of this paper. In the presence of authoritarian police, an equally effective measure is increasing driver's bargaining power via reducing policeman's possibilities for fine-inflation.

How expensive and feasible is the set of measures suggested in the previous paragraph? Increasing the salaries of traffic policemen and increasing the probability of detection are the most costly elements. Substantially increasing wages is fiscally burdensome while increasing the probability of detection requires a technological upgrade in practice. On the other hand, simplifying rules of the road, instituting positive incentives based on recording of all cases as opposed to informal quotas, decreasing fines, repercussions, and possibilities for fine-inflation are the cheapest and most feasible measures. Nevertheless, all suggestions have to be seen as a whole set; trade-offs between them imply significantly harsher changes, which could be counter-productive. While increasing the salaries and probability of detection are both costly, both are also important. In fact, as past literature suggests, increasing the wages without an independent third-party agency that monitors corruption would not be effective.

Conclusions

Jain argued in 2001 that the focus of future corruption studies should be (1) to "build a comprehensive models of how corruption works at the micro as well as at the macro levels" (p.101) and (2) subject the models to empirical tests. Moreover, he noted,

> "research on effective mechanisms to solve corruption is even scarcer. Although we have a good idea of what approaches are possible, we do not have more than anecdotal information on which approaches work." (p.102).

This study of traffic police bribery does just that. Modelling of utility payoffs has been derived from specifically-designed qualitative study to present determinants behind strategy selection at the micro-level, building a more comprehensive model. The three theoretical model variations of traffic police bribery were subjected to two empirical tests of anti-corruption reforms in the case of Georgia and in the case of Ukraine. As a result, this provides non-anecdotal information on which approaches work—such as the case of Georgia—and which do not.

All in all, this thesis also accomplishes the original study aim—development of a game-theoretic framework for modelling of traffic police bribery—by building a model that produces results in line with the empirical cases. Besides filling the gap in research on the issues outlined by Jain (2001), this thesis also incorporates a regional dimension of transition countries to the above modelling.

Conceptually, this research generates additional support to both the wage theory of anti-corruption, as well as to the 'big bang' theory: affecting factors like wages, probability of detection, ticket-issuing procedures, simplifying rules and regulations are important components of anti-corruption programmes and need to be tackled simultaneously, so as to generate a rapid shift from a corruption to a no-corruption equilibrium. The insights from interviews revealed that respondents utilised all three types of rationalities—instrumental, bounded and expressive rationalities, suggesting that utility-maximising elements of the models have to be further augmented with incorporation of social norms and beliefs about behaviour of others.

Hence, this research can and needs to be taken further. The modelling analysis does not include role of past experience and perception about others, while the case studies suggest that past experience is an important determinant, and that replacement of old police officers with new police officers is an effective tool. Suggestions for future research include incorporating dynamics of evolutionary game theory, based on Young (1998), and Mishra (2006) analysis relating to persistence of corruption. Alternatively or concurrently, the aims of the state (that implements the anti-corruption measures) could also be incorporated into the game, taking it away from a micro-level interaction, similarly to the work of Yao (1997). Experimental research where players role-play drivers and traffic policemen, given set variables and objectives, could be considered for further testing of the theoretical framework. Lastly, current methodological

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shortcomings could be improved by including increasing the sample size beyond the forty-two cases of driver-traffic policeman interaction and incorporating additional empirical cases[60].

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[60] For instance, Azerbaijan's raise in salaries of traffic policemen that did not lead to a decrease in the level of corruption (Anon, 2005).

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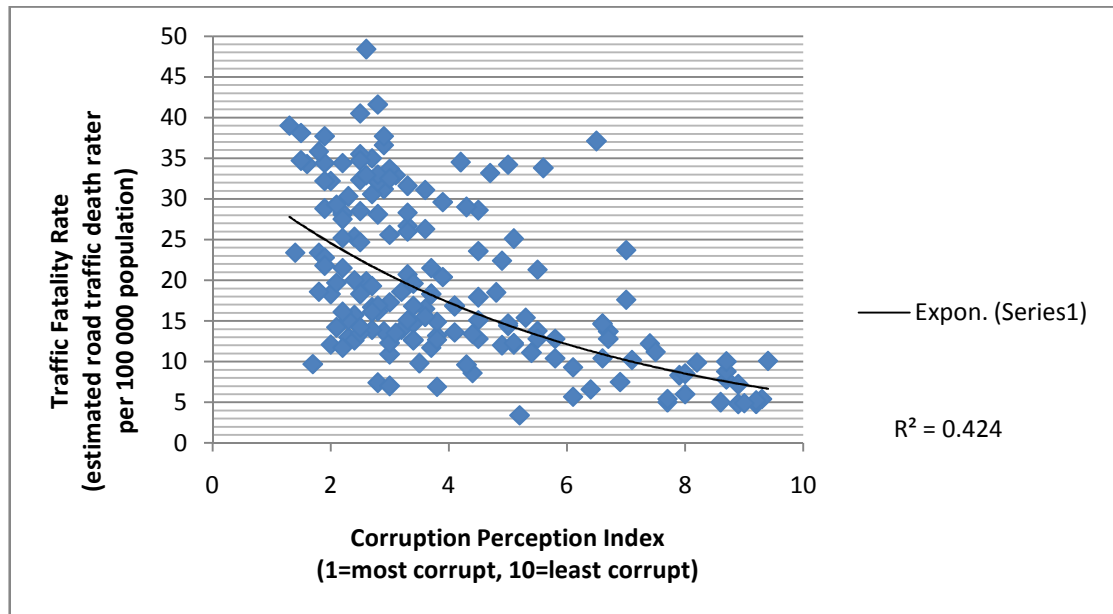Saar, J. 1999. Criminal Justice System and Process of Democratization in Estonia. *NATO Democratic Institutions Research Fellowship Final Report* [Online]. Available at: http://www.nato.int/acad/fellow/97-99/saar.pdf [Accessed 25 February 2010].

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APPENDICES

Appendix 1. Corruption and Traffic Fatalities

Figure 13. Corruption and Traffic Fatalities Worldwide in 2009

Appendix 2.A. Interview topic guide for the driver

"The aim of this research is to better understand the determinants of traffic police bribery in a country like Ukraine. In other words, what factors influence the decision of a driver to offer a bribe or to give a bribe. The interview is meant to be semi-structured, so besides answering the basic question, feel free to provide additional relevant information, explanations of the context, or your personal opinion. You may abstain from participation in the research and have the right to stop the interview at any point in time. Your replies will be kept confidential and neither your first nor your last name will not be used in the final version of the research."

Characteristics:
        Age:
        Level of education
        Region of Ukraine
        Reason for responding to survey
        Personal biases/ how is different from an average driver:

Capacity in which you are answering the question (how much do drive, how often stopped, in the past month, in the past year, for how many years driving)

Personal experience with bribery situations (how many? If 2-3 describe. If many – most exemplary ones)

Case 1:

Case 2:

Etc.

Influencing factors that guide behavior (ask which are most important in a typical scenario)
        Save time (value of own's time per hour)
        Complexity of procedures
        Low bribe cost
        Personal (past) experience
        Example from others
        Training/teaching by parents, internet
        Interaction with driver
        Interaction with others
        Punishment for bribery (legal, fine)
        Probability of detection
        Knowledge of law and rules of the road.

Additional questions for clarification:

Appendix 2.B. Interview topic guide for the policeman

"The aim of this research is to better understand the determinants of traffic police bribery in a country like Georgia. In other words, what factors influence the decision of a traffic policeman to ask for a bribe or to accept a bribe. The interview is meant to be semi-structured, so besides answering the basic question, feel free to provide additional relevant information, explanations of the context, or your personal opinion. You may abstain from participation in the research and have the right to stop the interview at any point in time. Your replies will be kept confidential and neither your first nor your last name will not be used in the final version of the research."

1. Characteristics:
   a. Age:
   b. Level of education
   c. Region of Ukraine
   d. Reason for responding to survey
   e. Personal biases/ how is different from an average driver:

2. Capacity in which you are answering the question (how long have you worked, in what positions, what rank, what duties, how many drivers stopped during a typical day)

3. Personal experience with bribery situations (how many? If 2-3 describe. If many – most exemplary ones)

Case 1:

Case 2:

Etc.

1. Influencing factors that guide behaviour
   a. Need for money (low salary)
   b. Organizational structure / kickbacks to bosses
   c. Personal (past) experience
   d. Example from others
   e. Training/teaching
   f. Interaction with driver
   g. Interaction with others
   h. Punishment for bribery (legal, fine)
   i. Probability of detection

Additional questions for clarification:

Appendix 3. Structured interview summaries

<u>D1. Driver respondent no.1 (8 cases)</u>
Age: 20-30. University education, medical. From Kiev. Works as a dentist, salary $10 per hour. Driving since 2006, not a careful driver.

Case 1.1. Year 2005 or 2006. Father was driving, exceeded speed limit. Traffic police officer stopped him, wrote out a protocol, but the protocol never reached their address. Driver used this example as a past experience before the new fines that writing a protocol does not definitely mean paying a fine.

Case 1.2. Year 2006. 2 months after receiving the driving license, the driver was speeding 20-30km/h over the speed limit. Traffic police officer stopped, said that was speeding, showed the speed on 'Fara' device, and first suggested, "Should we write out the protocol?", driver answered "OK". Driver remember that another time when father was speeding, the result was that the protocol somehow never reached Kiev. In this situation too, traffic policeman wrote out the protocol, but it never arrived by mail. The process took 20-25 minutes. A bribe for this violation would have been about 50 UAH.

Case 1.3. Year 2007. Driver exceeded the speed limit twice over; driver was in a hurry. Traffic policeman said, "let's do the protocol", to which the driver replied "why should you have to do the paperwork, I'm in a rush, let's solve this on the spot", took out a 50 UAH bill from the wallet and handed it to the traffic policeman, saying "is it enough?". Traffic policeman replied, "yes, this is enough, have a safe trip." In this case, the driver thought that the bribe was very close to the official fine, but the whole process took only 5 minutes and 'was worth it'.

Case 1.4. Year 2009, new fines. Driver overtook another car on a highway where it was not allowed. Another driver saw this and called the traffic police officer operating 10km ahead to signal to stop the yellow car. Traffic police officer called the original driver and another driver as two witnesses and insisted on writing out the protocol for a 500 UAH fine. The Driver-violator tried to convince the traffic police officer to take a bribe, as high as to the full amount of the fine. Traffic police officer categorically refused and the driver wondered if this was indeed a set-up because it looked like the policeman really needed this protocol. The situation resulted in a protocol of a violation, and took 40-45 minutes. The driver paid 500 UAH fine, at the bank; the whole process to pay a fine took 20 minutes, including waiting in line.

Case 1.5. Year 2009, new fines. Driver was driving with an unfastened seatbelt. Driver offered the traffic policeman 50 UAH, traffic policeman said "not enough, but if you double it, it would be ok to let you go". Driver gave 100 UAH and traffic policeman let driver go without a protocol of violation.

Case 1.6. Year 2010, new fines. Weather was bad, and the traffic policeman stopped the driver and told the driver "clean the plates or I will fine you for 350 UAH". Driver argued that it was understandable for the plates to have some dirt and said that would clean it at home without scratching the car. Traffic policeman said ok and let the driver

go. Driver felt that this was an occasion where traffic policeman was trying to make extra money, but didn't manage to extort it.

Case 1.7. Year 2008, summer, before the new fines. Driver crossed a solid line. Traffic police officer stopped the car, introduced, and insisted that the driver follow to the patrol car. In the car, traffic policeman showed driver an album with the photographs of all traffic deaths that took place in that area. After that, officer let the driver go. The driver forgot about it only 30 minutes later, since the driver works in the morgue and has seen much more disgusting corpses.

Case 1.8 Year 2008. Pedestrian cause a bumper-to-bumper where the driver was involved. Traffic police was called, wrote out a protocol properly; nobody was fines and nobody had to give a bribe. For the driver, insurance covered all the damages.

Statements:
1. "Time and laziness to have to go and pay for the fine somewhere else have always been the greatest motivating factors. Also, getting a fine ruins your mood for the day, whereas paying it on the spot helps to forget about it and not feel bad."
2. "I do not have a pre-determined strategy and usually decide whether to bribe or not spontaneously, although heavy past experience with bribe-giving sets a precedent of course."
3. "Knowing that I can pay the policeman off on the street possibly encourages me to drive less carefully, but I would never use that excuse to sit drunk behind a wheel, that would be dangerous in the first place."
4. "The first time it felt a little awkward to give a bribe, but now it comes very naturally to me."
5. "I have been stopped about 30 times, always because I violated traffic rules. I had to pay the fine once, I have been let go twice, and only once the fine did not reach my address. All other times (about 26 out of 30, i.e., 86% of the time), I solved the issue on the spot by paying a relatively small bribe of 50 UAH."

D2. Driver respondent no.2 (4 cases)

Age: 20-30. University education. Western Ukraine/Kiev. Has been driving officially for 7 years, is stopped 3 times per month on average. Works as a lawyer on the side. Hourly salary $5.

Case 2.1: Year 2009. Driver overtook traffic policeman's car. Inspector came up, introduced himself, asked to show documents. Driver turned on the camera, showed the documents, asked the inspector to show the documents. Read out the names and the information on the documents. Asked for the reason why was stopped. Inspector invited driver to come inside the car, but driver stayed in the car. Inspector wrote out the protocol of violation, the copies, showed the driver where to sign. Driver wrote in the protocol that he does not agree, that he did not violate anything, crossed out that there were no witnesses. Signed, takes a copy. The total processing time was 20-25 minutes. When the mailed notification came from the court, the driver went to the court. The charge was dropped based of the lack of evidence.

Case 2.2: Year 2008, before the fines in Ukraine were increased. Driver was driving drunk behind the wheel. Traffic policeman stopped the driver, stated what the driver was violating, and kept repeating "You know, this will cost at least 800 UAH". Driver understood this was a signal that a bribe was possible, and offered 50 UAH. Inspector said "too little", driver said that does not have any more. Inspector agreed to 50 UAH.

Case 2.3: Year 2009. Driver crossed a double yellow line. Traffic patrol car was turning the corner and stopped the driver. Driver knew that the fine would have been at least 450 UAH and the driver would have lost the driving license for 6 months. Driver understood that this was the beginning of the shift and traffic policeman could be flexible. Driver asked the traffic policeman whether something could be done, and mentioned that knows a colleague in the same traffic police department. Driver said that has very little money in the wallet tonight. Inspector replied "give whatever you have." Driver gave 20 UAH. The whole process took 10 minutes.

Case 2.4: Year 2005. Driving on an intercity highway at night, missed the post of traffic police and did not stop on the stop sign. Driver explained the extenuating circumstances of the situation, that was driving to begin university studies and was not very careful. Traffic police officer let the driver go without a fine.

Statements:
1. "Case 2.1 was a typical case, and whenever I physically went to court and disputed a fine, the charge was dropped 70% of the time."
2. "If I can see that there is no case for me to dispute in court and I would have to pay a fine anyway, I am ready to pay a bribe instead."
3. "If I don't have the 20 minutes to fill out the protocol of violation (which I would then dispute in court), I prefer to give a bribe instead."
4. "Every time I had a camera on me to record the situation, the traffic policeman always officially documented the situation with a protocol of violation."
5. "On average, I have been let go without a fine or a protocol 35-40% of the time."
6. "On average, only 5% of the time I ended up paying a bribe."
7. "Sometimes, when the traffic policeman has to fulfil the quota (for example, if for the inspector it has been a quiet night and the shift is coming to an end), will never take a bribe"

D3. Driver respondent no.3 (5 cases)

> Age: 20-30. University education, Kiev. Has been driving for 6 years, stopped 10-15 times total. Works in IT. Salary $10 per hour.

Case 3.1: Year 2006. Driver was stopped in the countryside for a minor violation. Fine was minimal, 17 UAH. Paid officially.

Case 3.2: Year 2005. Driver was driving to work in the morning, went the wrong way into a one-way street. "Kobra" department of police stopped the driver, asked to take the keys out and come to the police car. Driver asked why was stopped. Police officer

answered that a special operation is going on—checking all the cars of this make and model. Driver was not in a hurry, but had 25 UAH in the wallet. Driver knew that "Kobra" policemen are not supposed to be issuing tickets for traffic violations, and understood that wanted a bribe. Policemen signalled, "so what are we going to do, Mr so and so?", driver replied "let's write a protocol of traffic violation" since driver knew that "Kobra" policemen had no authority to write protocols of traffic violation. Policemen said "ok, you can go then, but don't violate again."

Case 3.3. Year 2009, after the fines were increased. Driver was approaching Kiev, on a business trip, in a hurry. Driver stopped at the stop sign, but the traffic policeman said that did not stop at the stop sign. Inspector said, "what will we be doing" and then named the price: 100 UAH. Driver was surprised that inspector named the price, but thought it was better not to bargain and paid. Did not want the fine to be known about at the job. The size of the bribe was small enough not to worry about it. Driver knew that the policeman would have taken whatever the driver gives him, no matter how small an amount, since the objective of a policeman was to maximise the number of cars stops, not to milk each individual driver. However, did not have time to bargain and financially 100 UAH at the salary of 10USD per hour was ok.

Case 3.4 Year 2005. Driver was crossing the border of Ukrainian regions, stopped to buy coffee, 50m in front of traffic police control post. Driver asked the policeman how to get to one town, got into the car, and same policeman stopped the driver. Policeman said, "where you stopped before, it was not allowed to stop". Driver argued that he didn't know, showed the documents. Policeman said "you are a good guy, I won't fine you. We'll put in the protocol that you were a pedestrian, crossed the road in the wrong place." For a 8.5 UAH fine. No protocol ever reached Kiev and the driver never paid anything.

Case 3.5. Year 2006. Driver's friend (another driver) was stopped when driving a motorcycle, left insurance at home. Friend paid the fine, 425 UAH, paid manually in the office of traffic police. Six months later, had to change the tech-passport, the fine came up as unpaid. Spent a whole day between the two offices, because originally the clerk at the office did not manually put a check mark that the fine was paid. Complications and is problematic when there are official fines on record.

Statements:
1. "In Ukraine, it is not possible to live without ever bribing anyone. This is the mentality, the way of thinking. Nobody trusts anyone else; you watch your own back."
2. "Past experience and commonplace pervasiveness of corruption makes a difference. To get a piece of paper, from passport to apartment registration, to car inspection, to medicines, need to pay up extra unofficially."
3. "Before the fines were increased, I never gave bribes. It was easier to pay the fine."
4. "Financial factor is very important. People (and I) are afraid to be left without money, should the formal fine have to be paid."
5. "I understand that the traffic policeman has to have at least one protocol during one day's work."

6. "Laws change very frequently, only 30-40% of drivers know up-to-date legislation and specific rules, rights."
7. "In Ukraine, as a driver, I never thought I could be punished for giving a bribe."

D4. Driver respondent no.4 (4 cases)

Age: over 60. Education: higher. Works as a professor in university. From Tbilisi. Does not like bribes – personal bias. Driver since 1957, every day during the period 1990-2009.

Case 4.1. Early 80s. Driver was driving to a city outside Tbilisi, 70 km/h, and was stopped by a traffic policeman. Inspector argued that violated a rule, driver argued that didn't (argument over interpretation of traffic sign). Inspector wrote down driver's personal details and made holes in the driving license. Driver complained to traffic police office that protocol of violation was incorrect, argued about the traffic sign, and threatened to complain to someone in higher command. Traffic police office issued the driver a fictitious certificate that driver was employed by traffic police. Driver has rarely been stopped since.

Case 4.2. 70s. Driver was driving from Gori and was stopped by a policeman. Policeman warned him that there will be ice on the road after the turn.

Case 4.3. 90s. Driver was driving in the village. Traffic policeman stopped the driver and asked why driver did not start driving differently when saw police car. Driver insisted to make protocol in case some traffic law was violated. Traffic policeman let the driver go.

Case 4.4. 2006. Received a parking ticket on a new parking spot. Has not been stopped since the reforms, has only received parking tickets.

Statements:
1. "The primary objective of the driver is to save most money possible. When stopped by a policeman, driver knows that has to pay something, so the idea is to pay the least. Bargaining over the size of the bribe definitely takes places, openly or not."
2. Traffic policeman's signal was "The fine is this much. You may give me the money and I can pay the fine for you."
3. "Georgians tend to violate traffic rules a lot; this is Georgian temper."
4. "Traffic police officers used to catch violators for money; now that they have to maximise the number of records, they just give out parking tickets."
5. "I have never personally experienced any examples with quotas, but I know they did exist."
6. "In Georgia, there are now very many places where one can pay the fine, so it is much easier, and this is less incentive to give bribes."

D5. Driver respondent no.5 (10 cases)

Age: 50-60. Education: higher technical. From Tbilisi. Has been driving for 22 years, very frequently. Works as an engineer.

Case 5.1. Year 1999. Forgot medication certificate at home. Traffic policeman stopped the driver on the charge that driver was drunk. Driver offered 5 lari, but the policeman said it was too little. Driver insisted to go to the clinic instead, so that doctor would determine his intoxication status. Doctor concluded that driver was not drunk. When driver was leaving the clinic, inspector asked for 5 lari and the driver gave it.

Case 5.2. Around 1993. Driver did give the turn signal and the traffic policeman stopped the driver. Traffic policeman wanted to write the protocol. Driver suggested to first solve it differently, but didn't have the money in the wallet. Traffic policeman let the driver go home pick up the money. Driver picked up the money and brought 5 lari for the traffic policeman. Driver and this traffic policeman became friends afterwards. Driver frequently passed this road, but traffic policeman never stopped him again. Salary at the time was 300 lari per month, i.e., 2 lari per hour. The official salary of traffic policeman was about 100 lari per month at the time.

Case 5.3. Year 2002. Traffic police was conducting 'raids' (stopping every car) for checks. Even though driver did not violate anything, traffic officer stopped and asked to see the first aid kit. Driver offered a bribe, but officer said no, because "they had to write protocols." Police officer wrote a protocol and driver had to pay it later.

Case 5.4. Year 1989. Driver was driving without a driving license, on an official car from work. Traffic policeman stopped the driver, and asked for 50 rubles for a bribe. Driver said that did not have any money on him, just 17 rubles, showed empty pockets. Traffic policeman took 17 rubles and let the driver go.

Case 5.5. Year 2000. At 6am, driver was driving and traffic policeman stopped driver for no reason. The inspector said said, "listen it's 6am and I have to stand here, can you please give me 5 lari?" the driver felt pity for the policeman and gave policeman the money.

Case 5.6. Year 2003. Driver was driving intoxicated and bumped the bumper of a bus from behind. Driver started bargaining with traffic policemen. In the end, traffic policemen agreed to take a bribe and let the driver arrange the rest with the bus driver. Bribe to policemen was 120 lari, and payment to the bus driver, to fix the bumper, was 40 lari.

Case 5.7. Year 2006, after reform. Driver parked in the wrong place. Traffic policeman asked, "do you like how you parked your car?", driver answered "no", policeman: "OK, I will give you a fine." The fine was 10 lari. At the time , driver had 800 lari salary per month, i.e., 5 lari per hour. The fine-issuing process took 7-8 minutes.

Case 5.8. Year 2008. Driver of the car was drunk. Traffic police stopped the car, checked that the driver was drunk. Traffic policeman wrote out the fine and suggested

to call for a sober driver. Because it was late at night and it was impolite to disturb anyone, traffic policeman drove the drunk driver and drunk passengers back home.

Case 5.9 Year 2009. Driver was an important person and drunk. Traffic policeman stopped the car, driver introduced who s/he was, and the traffic inspector immediately began compiling protocol.

Case 5.10. Year 2010. Driver was driving home from the sea. Was tired and stopped on the curb. Patrol came and asked whether the driver was ok or had nay problems.

Statements:
1. "Bargaining took place very often. With rubbles during the Soviet union times, and with lari after independence."
2. "Most often , policeman was correct about a violation, I haven't heard of cases where policeman stopped the driver and asked for a bribe even though the driver did not violate anything."
3. "Bribe size was always less than the actual fine. This was the greatest motivator to bribe."
4. "I never considered the possibility of being caught for giving a bribe and the potential punishment. Knew that there was a theoretical possibility for the traffic policeman to be punished, but never practically considered this possibility."
5. "In case 5.4., my boss knew that I was driving without a license, but still gave me the keys. If the boss knew that bribing was not an option, and that I would definitely be fined if caught, he would not have given me the keys to the car."
6. "Since the reform, I have been driving 5 years, but have been fined only 3 times, and because I actually parked in the wrong place."
7. "Before reforms, driver's licence would be taken away for driving drunk. Now, the first time the fine is 150 lari, second time 300 lari, third time 800 lari, etc."
8. "Paying for a fine in the bank is very easy now."
9. "My relatives talked about bad experiences with trying to bribe a traffic policeman after the reform. I would not dare to try and bribe because he knows by word of mouth that this is not possible any more, even if the fine was very high."

D6. Driver respondent no.6 (8 cases)
Age: 30-40. Higher education in sociology. From Kiev. Very careful driver. Driving since October 2007. Works as company manager, salary $10.

Case 6.1. Year 2008, before the fines were increased. Driver was turning from the wrong lane onto the bridge, then saw the traffic patrol car. Traffic police officer made an introduction, asked for documents. Driver passed the documents. Driver explained the situation, traffic policeman saw the child in the back of the car. Driver admitted that was turning from the wrong lane. Traffic policeman asked driver to go to the patrol car. Wrote out the protocol in the car. Driver did not know whether there was a signal for a bribe or not, so did not risk it. The whole process took 15 minutes.

Case 6.2. Year 2008, before the fines were increased. Driver made a turn on the wrong signal. Traffic policeman stopped the driver. Driver's child was on the back seat of the car, asking "why did we have to stop?" Driver asked the inspector "what did I violate?", traffic policeman explained that the light had not yet turned green. Driver disagreed and went with the traffic policeman to look at the light. Traffic policeman was correct and the fine would have been 17 UAH. Previously, driver talked to friends who advised to always keep some low-value bills in the passport just in case, and the driver had 10 UAH in the passport sleeve. Traffic policeman started asking for additional documents, which driver did not have and what carried a heavier fine. Driver perceived this as a tactic to inflate the potential fine and induce the driver to bribe. Driver suggested that the traffic policeman looks at the documents, including the page with the sleeve of the passport. Traffic policeman took the money and let the driver go. The whole process, including arguing and walking, took 15 minutes.

Case 6.3. Winter 2008, new fines. Driver parked by McDonald's illegally, with emergency lights on, passenger went to buy burgers. Traffic police patrol came up, explained the situation and left. Traffic police patrol car came up again. Policeman asked the driver to follow to the car. In the car, officer used the phrase "what are we going to do now?" but the driver did not perceive with certainty that this was a signal. Protocol took 25 minutes to write, fine was 300 UAH. Driver paid the fine within 7 days.

Case 6.4. Year 2007, end-of –the year. Picking up a passenger from the airport, parked for 30 seconds in the wrong place. Traffic policeman noticed and insisted on recording the violation, "if I don't record this, I won't get a Christmans premium." Also pointed to the cameras and insisted that cannot just let the driver and passenger go without a fine, or with a bribe. Passenger showed a diplomatic passport. Inspector let them go.

Case 6.5. Year 2010. Driver was coming back with family from a skiing trip, turned on the lights from the wrong lane, was a little lost. Traffic police s topped, asked for documents, insurance. Driver showed all the documents. Driver admitted that violated but explained that was lost and asked for directions. Child in the back of the car screamed "why were we stopped, I wanna go home!". Traffic policeman looked inside the car at the child, provided driving directions and let the driver and passengers go.

Case 6.6. Year 2009. Driver did not have full lights turned on, only half-way but it was still kind of light outside. Traffic police stopped, checked the documents, asked why driver was driving without the lights. Driver explained that when started driving it was still very light. Driver said, "are you really going to fine me for having the lights turned on half-way? On the street so and so there are many cars dangerously parked over the tram lines. It's more just to fine people there" Traffic policeman let the driver go.

Case 6.7. Year 2009. Another car next to driver's car turned incorrectly. Traffic police stopped driver's car. Driver asked why was stopped, and explained that the other car violated the rule but this car didn't. Showed that knew the rules very thoroughly. Traffic police said, "wow, you even know these rules?" and let the driver go.

Case 6.8. Year 2004. Driver had a driving license, but was driving another person's car, without paperwork from original driver that authorised another driver. Driver drove extremely slowly, traffic police stopped and asked why "driving so slowly, maybe you are drunk?" Driver answered that it is illegal to drive drunk, showed the documents, and explained that it was only the second time driving a car since getting the license. Traffic police asked how far had to go and whether needed help getting there. Driver said that can manage, and inspector let the car go without a fine.

Statements:
1. "If you do not argue with the traffic policeman and do not bargain, but admit the violation and ask for the protocol, then it is a lot quicker."

P1. Police respondent no.1

Age: 20-30. University education. From Western Ukraine. Worked with DPS (street patrol service) in a small Ukrainian town, side-by-side with traffic police service, while the two services were merged together, for 3 months. Salary $200, same for traffic police.

Statements:
1. "Probability of detection of bribery in traffic police is very low, 10%. This could only happen if VV investigates illegal activities of the police. Punishment would be imprisonment for several years, or losing a job, depending how well-connected the inspector is."
2. "Traffic policemen in Ukraine have an unofficial quota, to write protocols of 2 drunk drivers per night. During the holidays, the number is higher. Chiefs of police departments compete based on their numbers (the more traffic offenders fines, the better), and at the end of every month there is a meeting to see which regional department performed best, and which department performed worst."
3. "Before the fines were increased, for a lower-level traffic policeman who earns 1000 UAH per month, income from bribes could be 500 UAH, or even less. After the fines increased, income from bribes could be 1000-2000 UAH. From daily bribe income, majority went for lunches, coffee, to fuel the car; maximum 20% would be left over to split among the two traffic policemen."
4. "Policemen have to pay for their own fuel for the car, small amount for various awards and paperwork, which should officially be paid for by the government."
5. "Checking driver's documents and writing out the protocol cannot take less than 20 minutes, because driver has to show 4 things (car registration, technical passport, driving license, insurance)
6. "Signals used by the policemen include statements like "shall we think what to do about this?", "let's consider solving this issue differently", or calling the driver into the car. Approximately, if the bribe takes place, half the time driver hints first, another half the time policeman hints first.

P2. Police respondent no.2 (3 cases)

Age: 40-50. Police academy education. From Tbilisi. Worked for 10 years as police captain. On average took less bribes than colleagues. Salary 120 lari per month.

Case 2.1. Officer stopped a driver for violating rules like speeding, traffic signs, or driving on the red light. Officer told the driver the amount of official fine. Driver gave me relatively small amount of money and I did not fine him

Cse 2.2. Year 2002. Officer stopped a drunk driver who was speeding and dangerously. The official fine for this violation was 150 lari. Driver said that was at the wedding and it was ok to drink at the wedding. Officer told the driver to take the bus home and leave the car at the police patrol station. Next day, the driver came to pick up his car, dropped off 50 lari for the policeman and said that was grateful that did not receive a fine and police helped to get home safely.

Case 2.3. Year 2003. Driver drove on the red light and officer stopped the driver. Driver said that was in a rush, gave 10 lari and left. Officer shared the money with the partner.

Statements:
1. "As a policeman I could feel safe, and this is why I chose this job. Safe from other 'thief in laws', from other policemen, from criminals and from poverty. At first I liked being a policeman."
2. "In order to stop widespread corruption in Georgia, the government did not have the other choice but to fire everyone."
3. "I stopped about 20-30 cars per day on average, and significant majority resulted in bribes."
4. "I only stopped people who were violating traffic rules. The most frequent violations were speed, violations of street signs, racing, parking, driving on red light, driving drunk."
5. "Case 2.1. was a typical case."
6.

Violantion	Official fine	Average bribe
Driving drunk	150 lari	50-100 lari
Parking	5 lari	3 lari
Speeding	10 lari	5 lari
Dangerous speeding	25 lari	10-15 lari
Driving on red light	20 lari	5-10 lari
Street sign violation	5-10 lari	3-5 lari

7. "It was normal to let people go without warning, except when were driving drunk, then never."
8. "It was not very common to bargain. There was always the possibility that if you demanded too much, driver could file a claim with the general inspection and you would be punished by losing a job or having to pay as much as 1000 lari."
9. "In Georgia it was ok to offer a bribe, you wouldn't get in trouble even if someone refused. Because by offering a bribe, you offered a gift, and there is nothing wrong with a gift."
10. "Fuel and technology (radar detectors, etc.) were provided after 2000, before – not."

11. "Our supervisor was a good man, he cared about the employeed and about traffic safety. We tried our best to control the traffic safety, and the bribes and money came secondary. Money was not our primary objective. We just took the money because the system was like that."
12. "The quotas were very unofficial. Supervisors decided whether you worked hard enough; if not, your quotas would go up; if you didn't make any money that also meant you were not working hard enough."
13. Two greatest influencing factors: need for money/low salary, and the organisational structure.
14. "It was unimaginable to do otherwise."
15. "I was different from other policemen because I would only take money if someone really violated something, I would not take money from poor people. But there was no choice, the court and every system, involved unofficial payments."

P3. Police respondent no.3

Age: 40-50. Higher education. From Kiev. Works in the ministry of interior.

Statements
1. "Traffic police supervisors can give orders that officer needs to have more protocols, or less protocols. If traffic rate increases (holidays, summer), officers will need to write more protocols. There is no official quota, maybe just unofficial. If an officer was working all day, but did not write any protocols, means that was not working, so obviously has to have at least one protocol per work day."
2. "More traffic violations are not always better or worse. There is comparison with previous years, for the region, etc."
3. "For traffic policeman, the incentive to take a bribe is extra money. For driver, the incentive to bribe is to avoid or solving unnecessary problems that formal fine entails."
4. "Laws are set out so that the inspector always knows the laws better than the driver and can take advantage. Laws change very frequently, are very complex, average driver doesn't follow the changes and can be easily fined."
5. "Salary of entry-level policeman is 1500 UAH per month. Rent and minimum food costs 1200 UAH per month, thus not enough for minimum living conditions.
6. "Chance of getting caught may be 1 out of 100, or 1 out of 1000. Usually the focus of the anti-corruption department within police is on bigger issues, nobody bothers to chase individual traffic police bribery."
7. "Fuel for the car, repairs, technological equipment should theoretically be provided by the government."
8. Additional factors that influence the driver: "if violation was quite minor, without a significant impact on road safety, then there is more likelihood to take a bribe, as the driver does not deserve full punishment. Human factor also influences, for example, fining a pregnant woman is not appropriate."
9. "The general idea is that the officer's job is to have good 'pokazateli' (number of protocols) and the officer will be trying to do their job well by having good

number of protocols. There are no positive financial incentives like premiums of the amount of protocols, maybe for chiefs of departments."

Appendix 4. Traffic police reforms in comparative perspective

Country	Estonia	Georgia	Ukraine	Czech Republic	Poland	Russia
Reform year(s) and waves	1st wave: 1991-1992 2nd wave: 3rd wave:	1st wave: 2004-?	1st wave: 2005-2006 2nd wave: 2008-2009	2008	Continuous 1980s-1990s	
Change in: personnel	By end of 1992 about 50% of 5,504 police officers were inexperienced new hires, 37% younger than 25[61]; 1993-1997: 3,975 recruited and 1,386 fired[62]	100% of traffic police fired (15,000 officers); new officers recruited (15% were from old personnel), rest were young and inexperienced[63]	None, internal reorganization only	20% decrease in personnel (check: for ministry or for traffic police?)	? fired, ? hired new	
Change in: hiring and recruitment criteria	New requirement—good command of Estonian language[64]; Ideological loyalty[65]		No change, just more expensive (circa 10,000USD to get traffic policeman's position)		Fired if connected to the communist party apparatus; Higher education requirement, no experience in police, etc.	
Change in: compensation		8-fold increase in salaries ($50→$400)	2008 wave: 1.5-fold increase in salaries, circa 34% increase	7% increase in salaries (ministry vs. traffic police?)	At least 2-fold increase in salaries	
Change in: technology		New cars (Zhiguli→Volkswagen) new uniforms, new radios[66]	'Vizir's for speed detection			
Change in: fines			2008 wave: 5-fold times			

[61] Turunen (2001)
[62] Saar (1999)
[63] Di Puppo (2005)
[64] Saar (1999)
[65] Turunen (2001)
[66] Saakashvili (2005)

Country	Estonia	Georgia	Ukraine	Czech Republic	Poland	Russia
Change in: procedure of issuing the ticket			increase in fines (8.5-17UAH→240UAH-2500UAH)		Cash ticket procedure for traffic offences was abolished	
Change in: oversight structure, probability of getting caught			Marginally increased probability of getting caught.		Higher probability of getting caught, small increase in real prosecution numbers[67]	
Level of traffic police bribes prior to reform		Traffic police identified by a household survey in 2000 as among top 5 to take bribes[68], resulting from 'survival dynamics'[69]; stop checkpoints every 2km[70]	Ukraine's DAI traffic police chronically rate at or near the bottom of public trust in annual surveys; not as pervasive as in Georgia before reform		26% of people reported bribery cases in police situations[71,72]; use of on-the-spot discretionary cash fines and lack of supervision[73]	
Post-reform level of trafffic police bribes		"Car-drivers are no longer stopped and asked to pay bribes by policemen at improvised road check points"[74]	Bribes more widespread, bribe amount higher (proportionally to fine)			

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67 EU Report 2002
68 Corruption in Georgia: Survey Evidence report 2000
69 Saakashvili (2005)
70 Saakashvili (2005)
71 Batory Foundation survey *Corruption in Everyday Life* in EU Report 2002
72 EU Report 2002
73 EU Report 2002
74 Di Puppo (2005)