LOBBYING, BRIBING, OR COMPLIANCE: THREE ESSAYS ON FIRMS' CHOICE

by

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پیشکش به خانواده مهربانم

To my dear family

Preface:

"Corruption is as deadly as the HIV/Aids virus – it's a cancer, whether it is the official signatures needed on a license, the policeman taking bribes at the border or the tractor that is paid for but not delivered."

Bono, The Guardian, 23 May 2006

Hardly one can overstate about negative consequences of corruption. A huge part of literatures in Economics, Sociology, Management, and Political Science is devoted to the causes and consequences of corruption, but unsuccessfulness of anti-corruption programs in many countries raises doubts about sufficiency of related studies. This need brought me to reserve my last 5-year academic works to the study of corruption or other kin issues. For master thesis, I studied, in a Neo-Classical point of view, the impact of government interventions on firms' behaviour and the evolution of some part of economy known as Informal, or unobservable Economy. But for the doctoral dissertation which is the subject of this document, I decided to concentrate on specific acts like lobbying and bribing. This book investigates the rent-seeking behaviour of firms in three papers each represented in one chapter preceded by an introduction. The first chapter using an evolutionary game tries to explain countrywide disparity in prevalence of lobbying and bribing. Having shown the significant effect of some social parameters like cooperation, the second chapter studies the possibility of coalitional lobbying and the main obstacles on the way of firms' coalition formation. The third chapter unfold how large groups despite various problems of collective action have succeeded in many cases to reach Pareto superior outcomes.

At the end I wish to express deep sense of gratitude to Stefano Vannucci for his valuable supervision and helpful suggestion in the completion of this thesis. My sincere thanks also go to the faculty of economics at University of Siena and many friends of mine who provided me the excellent atmosphere to work and live in lovely city of Siena.

Abbas Khandan
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Introduction:

"These contemporary versions wrap corruption in a cloud of ambiguity." (Kaufmann 1997: 1) Some part of ambiguity is, of course, due to hidden nature of corruption, but previous studies are also blameworthy. Deficiency of literature is caused not by insufficiency in number of studies which in fact the literature is huge, but because of its extra focus such that until now a great mass of researches is dedicated only to the demand side of bribes "*while fewer studies examine the issue from the firm's or the bribe giver's perspective."* (Li and Ouyang 2007: 1) This unidimensional view can be found, even more evidently, in analysis of firms' behaviour. While gaining complete understanding of rent-seekers' decision making warrants consideration of all strategies at their hand, lobbying and bribing as the *"two means of influencing the regulatory environment have either been studied separately or viewed as basically being the same thing."* (Harstad and Svensson 2011: 1)

Damania et al. (2004) considered lobbying and bribing at the same time. In his model, firms facing an environmental tax had three strategies to bribe inspectors, to lobby government for a lower tax, or to persuade government to underinvest in judiciary system and as a result enjoy from a permissive regulatory system. The first strategy i.e. lobbying to set a favorable rule was ruled out after introduction of political instability into model together with the assumption that *"at some time in the future the firm will eventually confront a new regime that will adopt policies that are less favorable to it than those of the existing government."* (2004: 10) What he obtained as conclusion was a positive relationship between corruption and an especial form of lobbying or, in other words, between bribing inspectors and lobbying government to reduce its entailed risk. One year later, in 2005, Harstad & Svensson were the firsts who tried to fill up this gap. They claim that lobbying and bribing are independent but substitute strategies; firms lobby to replace the current rule with a favourable one while by proposing bribe, as passive reaction to the current rule, firms try to gain exemption. Substitutability of lobbying and corruption at firm level is confirmed by Campos and Giovannoni (2007) and Bennedsen et.al (2009).

Lobbying and bribing as two substitute strategies available for rent-seeking firms to influence government are different in five aspects. The first is the difference in goals which lobbying or bribing are used for; while by lobbying firms proactively try to change the rules, bribery is

usually used to bypass or avoid the required costs of executing current rules. They are also different in time horizon of decision. Success in lobby means that firms can enjoy the benefit of a new favourable rule for ever or at least until the rules has not changed again. Benefits of bribery, on the other hand, are not long-lasting. The exemption firms get by bribery has to be renewed for the next periods by proposing bribe again to the same or different inspectors. The third difference is that lobbying is not illegal wile bribing is a crime with risk of being detected and punished.

The fourth difference is that lobbying success, a change in the rule, is in fact a success for all firms regardless of their participation in negotiation with government. This is because the benefits of lobbying are not excludable. The possibility of free-riding by other firms is an important factor affects firm decision for lobbying, but for sure this is not the case in bribery. The last difference is that lobbying benefits, a new favourable rule, in contrast with what firms obtain from bribery, a temporary exemption, is non-rival. In other words, the economic rent firms get by bribing inspector, the value of the exemption, may decrease as it becomes common and widespread. As an example consider firms which are waiting in a queue. Firms by bribing bureaucrats can benefit from saving time but the rent would be vanished soon as more firms propose bribe.

There are a few studies investigating factors deriving firms to choose one strategy over the other. In this study I try to elucidate firm's behaviour and bring out factors explaining the choice over lobbying, bribing, and compliance as three strategies facing government. Each of the following three chapters adds to the literature by considering a different aspect of the issue. Chapter one models the evolutionary dynamics of these three strategies and their determining parameters. Some preliminary statistical analyses highlight the importance of social factors including social punishment of bribery and cooperation for lobbying. Chapter two ponders over cooperative behaviour of firms. This chapter taking bribery as fallback position of lobbying investigates factors encouraging firms to form a coalition. Chapter three tries to explain how large group despite numerous and difficult obstacles may succeed in provision of collective goods like lobbying. The important implication of the last chapter is that bribery at industry level may have a positive effect on productivity of lobbying efforts. Considering lobbying as an effort to demonstrate genuineness of new favourable rule, it would be more productive if the legitimacy of the current rule were destroyed before by corruption.

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Chapter one:

Lobbying, bribery, or compliance:
An evolutionary model of social factors' impacts

Abstract:

Connecting to rule-makers to set favourable rules, lobbying, or paying government executives to bend the current rule, bribing, are two main strategies for influencing government. This study in an evolutionary game model elucidates why bribing is widespread whereas other states like compliance and cooperative lobbying are Pareto superior. Although the underlying assuming model emphasizes bribery dominance, the model was capable to explain the reason other strategies are also commonly used. In contrast with the literature, social and cultural parameters are the key determinant factors which this study concentrate on. Some statistical analyses were used to clarify the effects of social factors on firm's choice and justifies the necessary modifications to improve the underlying assuming model. As it was expected legal and social punishments of bribery recede its basin of attraction and encourage firms toward lobbying or compliance. The impact of punishments, however, depends on the history of countries. Social punishments is not significant in countries with corrupt history. Cooperation was the second social factor to be investigated. Descriptive data show that, in contrast with what previously was thought, lobbying is used in developing countries as much as in developed economies. The effect of cooperation on lobbying depends on the costs of establishing a link to the government. Results show that in countries with high level of cooperation between firms linkage cost is not a significant retarding factor of lobbying.

JEL classification: D72, D73, C73, O57, Z13

Key words: Lobbying, Bribery, Evolutionary games, Replicator dynamics, Punishment, Cooperation

I. Introduction:

All governmental decisions, policies, laws and regulations produce distributional effects. Economic agents have preferences for the outcome of these decisions and, therefore, willing try to influence them. This willingness can be fulfilled by lobbying government or bribing bureaucrats as two primary rent-seeking methods. Bribery includes rent-seeking activities directed at rule enforcers while lobbying is rent-seeking activities directed at rule makers[1]. Hardly one can overstate about negative consequences of these corrupt activities. Each year over US$ 1 trillion is paid in bribes worldwide (World Bank, 2002); fifteen per cent of all companies in industrialized countries have to pay bribes to win or retain business, this figure stood at 40% and 60% for Asia and former Soviet Union countries, respectively (World Development Report 1997: 36). Lobbying is also widespread. Politically active organizations [in United States] in 2009 reported $3.47 billion on direct lobbying expenses, controlling for inflation, almost seven times lobbying expenses in 1983 (Drutman 2010: 1).

Unfortunately till now "*these two means of influencing the regulatory environment have either been studied separately or viewed as basically being the same thing*" (Harstad and Svensson 2011: 1). The few studies which have considered both principally point on the size of the firms as the main determinant factor of rent-seeking behaviour. The main conclusion which is also supported by some empirical evidences[2] is that lobbying is observed in rich developed countries while bribing is commonly used in developing economies. These empirical works are restricted on OECD countries though "*if one includes developing countries, though, one might obtain a slightly different picture"* (Beckmann and Gerrits 2009: 18). Figure (1) shows the lobbying prevalence throughout the world. Vertical axis is the percent of companies which see themselves influential on legislation process[3]. Data are collected from World Business Environment Survey (2000) reported by the World Bank.

[1] Harstad and Sevenson (2011).
[2] Campos and Giovannoni (2007)
[3] Companies which marked their influence on government legislature above 3 in a range from 1=not applicable to 6=very influential.

In contrast with the picture proposed by previous literature, lobbying is also common in developing countries like Philippines, Indonesia, Malaysia, Pakistan, Panama, and Uzbekistan. Moreover there are some rich countries like United Kingdom, Germany, and Sweden in which lobbying is very rare. This shortcoming comes from the attempt to explain countrywide in lobbying and bribery prevalence using only firms' characteristics overlooking effects of social and cultural factors.

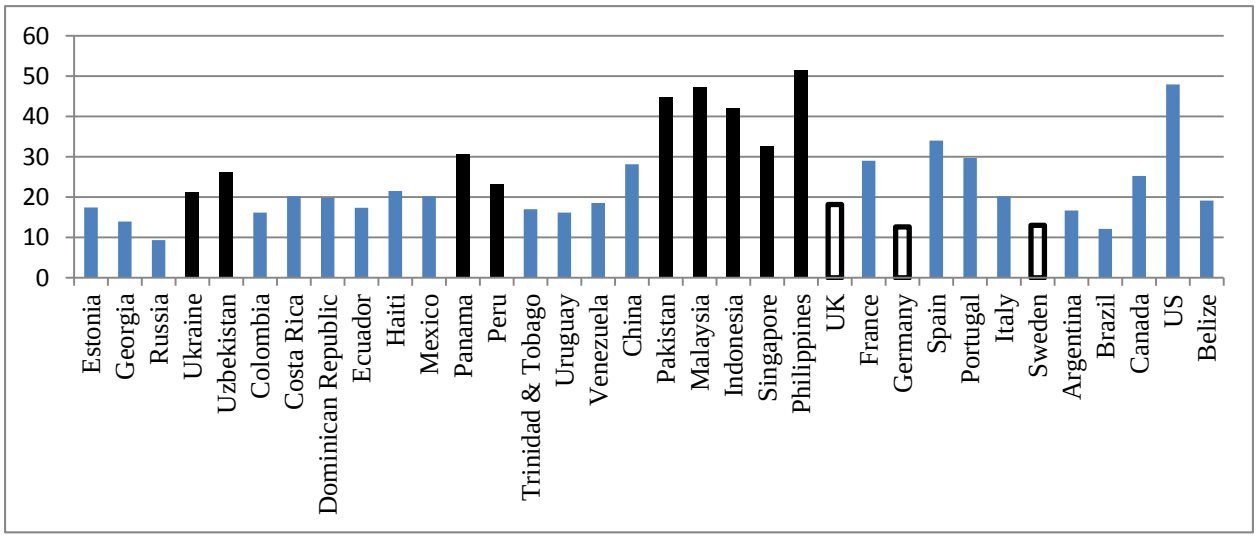

Figure (1): prevalence of lobbying in different countries

Firms lobby to replace the current rule with a favourable one. On their decision for lobbying government has an important role. However, since the main focus of this study is on firm's free-riding or cooperative behaviour, government is assumed as a neutral player indifferent between the current and the alternative rules. Using this assumption, government's role can be reduced to and be modelled as a probability function[4] over the possible set of rules. Moreover, since there are only two rules available, the current rule and the alternative one which is in favour of firms, the assigned probability may be perceived as winning chance or the probability of lobbying success. But to lobby firms first need to build some links to the government. The linkage cost is in fact the cost of being politically active.

[4] In general lobbyists to influence government have to compete with other rival industries. This competition in the literature usually is modeled as lobbying contest. The probability of winning depends on the power, the effort and the contributions of different competing industries.

High linkage cost and the fact that lobbying benefits are non-excludable make firms to pursue it mainly in group. Individual factors like size of the firm are not enough to explain cooperative lobbying; in fact many other social and cultural parameters must be noticed. The same is for bribery which is illegal and culturally unacceptable. Aside from individual factors, there are many social parameters of importance for understanding firms' illegal acts. However, unfortunately, these social and cultural determinants are neglected mostly in the literature. The main purpose of this study is to theoretically model firms' strategy choice, and at the same time by presenting some statistical analyses explain the potential effects of social factors on firms' rent-seeking behaviour.

The three main strategies are cooperation with others to produce a permanent rent through changing the current rule (lobbying), passively obeying the current rule (compliance), or bribing government executives to obtain an exemption (bribing). To understand firm's choice and the impact of social parameters on it, a population game framework is applied. Evolutionary dynamics helps to explain how these strategies spread and, as result, why countries are different in the prevalence of lobbying and bribing[5]. Strategies with high payoffs become more popular as they spread within the population through learning, copying or inheriting. Since the payoffs themselves depend on the popularity of strategies this mechanism in a loop reinforces successful strategies. The population structure, the underlying game and the way strategies spread are crucial in an evolutionary dynamics.

In our model there is only one industry with a population of N firms. To concentrate on the impacts of social parameters which is the main objective of this study, it is assumed that all the firms are similar. Firms face a rule which imposes some additional costs on them. Replacing the current costly rule with a new favourable one through lobbying is in the interest of all firms. There are no conflicting benefits between firms in case of lobbying. Supply of lobbying like other collective acts is limited with free-riding problem. Free-riders have two alternative strategies namely to passively obey the rule or to bypass the rule by bribing rule-enforcers. Rent obtained through bribing is assumed to be rival and prone to congestion. This means that as more firms bribe the

[5] Myopic decision making and anonymity are tacit assumptions of evolutionary dynamics. For firms decision to lobby or to bribe beside the corresponding payoffs the state of population also matters. Since bribery is illegal or lobbying needs cooperation, the population's state and the prevalence of these strategies are important. This justifies the objective of this study to understand the impact of social factors on firm's behavior. Anonymity also helps to overlook firm-level characteristics and differences and instead focus on social factors common among firms.

rent diminishes. Therefore, in case of bribing firms are competing with conflicting benefits. As an example assume the people who are waiting in a queue. If they cooperate to lobby and set a new rule by which there is no need to stay in the queue anymore, all firms will commonly benefit from a non-excludable non-rival ease. But if each firm tries to get a better position by proposing bribe the rent soon would be vanished as number of bribers increase. Thus, firms have to decide whether to follow their common interest through cooperation for lobbying or to seek their individualistic benefits through competing with other firms in proposing bribes.

The rest of the paper is organized as follow. Section II expand on the underlying game with more details. Section III reviews different families of evolutionary protocols in order to find a suitable dynamics according to criteria which will be discussed. Section IV talks about the role of social factors on dynamics and final states of population. Section V concludes.

II. Structure of the game:

Lobbying, bribing and compliance are the three strategies available to firms for influencing government. Lobbying is the direct contact of firms with rule makers as mean to persuade them for a change in the current rule. If the alternative rule is enforced no matter which firms were participated in the process of negotiation, all the firms benefit from a non-excludable non-rival durable rent. But this rent will not be obtained with certainty; there is the possibility of failure in the negotiation. Because the underlying game of this study is not dynamic, the probability of winning p^w is fixed. The lobbying rent firms might expect to get is:

$$\mathcal{R}_L = (p^w \times 1) + \delta(p^w \times 1) + \delta^2(p^w \times 1) + \cdots + \delta^n(p^w \times 1) = \frac{p^w}{1-\delta}$$

The benefits corresponding to the current and new rule are valued as 0 and one respectively, and δ is the weight of future benefits. To obtain this rent firms need to contact with the government. The cost of setting links is fixed and shown by C. The cost of being politically active usually is high so that lobbying individually would not be profitable.

Assumption (1): In case of cooperation lobbying is profitable but high linkage cost prevent firms from individual lobbying; $\mathcal{R}_L < C < \mathcal{R}_L + \mathcal{H}$.

Where $\mathcal{H}$ is the marginal contribution of second cooperator. Sharing the fixed cost of lobbying is not the only incentive for cooperation. United lobbyists are more powerful in negotiations with government. The probability of winning in case of cooperation is multiplied by a parameter ψ indicating synergy or necessity of cooperation. Marginal contribution[6] of the second cooperator is equal to $\mathcal{H} = \frac{(\psi-1)p^w}{1-\delta} + \frac{C}{2}$. Firms have more incentive to cooperate for lobbying when either linkage cost or synergy is high. Table (1) represents the payoff structure of the game for the row player.

Table (1): Payoff structure of the game

	Lobby	Comply	Bribe
Lobby	$\mathcal{R}_L - C + \mathcal{H} = \frac{\psi\, p^w}{1-\delta} - \frac{C}{2}$	$\mathcal{R}_L - C = \frac{p^w}{1-\delta} - C$	$\mathcal{R}_L - C - \mathfrak{D}_b = \frac{p^w - 1}{1-\delta} - C$
Comply	$\mathcal{R}_L - \mathfrak{D}_l = \frac{p^w - d}{1-\delta}$	0	$-\mathfrak{D}_b = \frac{-1}{1-\delta}$
Bribe	$\mathcal{R}_L + \mathcal{R}_B - \mathfrak{D}_l = \frac{1}{1-\delta}(1 - [B + d + p^d f])$	$\mathcal{R}_B = \frac{1}{1-\delta}(1 - [B + p^d f])$	$\mathcal{R}_B - \mathcal{L} = \frac{1}{1-\delta}(\gamma - [B + p^d \tau f])$

Although there is much to get from cooperation, since the benefits of lobbying are non-excludable there are always some firms which decide to free-ride. Non-cooperators evade from sharing the fixed lobbying cost but they will benefit from lobbyists' attempts for changing the current rule. Free-riders have two alternative options, to passively comply with the current rule or to bypass it through bribing. Bribers are more harmful than compliers to lobbyists because while lobbyists are trying to change the rule bribers may steal their projects. The damage received from bribers is $\mathfrak{D}_b = \frac{1}{1-\delta}$. To clarify the discussion more, suppose according to the current rule firms need to stay in a queue and the cost imposed on firms by this rule is the time of waiting. A group of firms try to lobby with rule-makers to replace the current situation with an alternative rule which according to there is no need to wait in the queue anymore. This alternative rule is in common interest of all firms. On the other hand, firms by proposing bribe to rule-enforcers may get a better position in the queue. But bribers get the better position at cost of a worse position for non-bribers. This rent is rival and shows that firms have conflicting interests in case of bribery.

[6] This is only the marginal contribution of the second cooperator in the two-player game. In random matching there is no externality from other players.

Cooperators also punish free-riders including compliers and bribers. The punishment $\mathfrak{D}_l = \frac{d}{1-\delta}$ is either direct or indirect punishment known in the literature as selective incentive mechanism. The *"group action can be obtained only through an incentive that operates, not indiscriminately, like the collective good, upon the group as a whole, but rather selectively toward the individuals in the group. The incentive must be "selective" so that those who do not join the organization working for the group's interest,…, can be treated differently from those who do"* (Olson 2002, p.51). For example a trade union is able to create a selective incentive by providing some excludable goods like insurance to its members and punish non-cooperators by withholding these goods from them.

Compliers through passive obedience get nothing, but they benefit from a change in the rule while evading from lobbying costs. This means that in case of being matched with a cooperating lobbyist compliers can increase their payoff by refusing to contribute to linkage cost. This free-riding behavior also decreases winning chance of lobbying. The only cost a complier which is faced with a lobbyist must incur is the possibility of being punished due to its free-riding. The punishment by decreasing free-riders payoff acts as a stabilization mechanism for the lobbying coalition.

Assumption (2): Although free-riders have to carry a punishment imposed by lobbyists, evading the fixed linkage cost is still appealing. Free-riding incentive is the payoff compliers get by deviation i.e. $\mathcal{M}_f = (\pi^{CL} - \pi^{LL}) = \frac{C}{2} - \frac{(\psi-1)\,p^w + d}{1-\delta} > 0$.

By these two assumptions compliance dominates lobbying strategy. Although playing compliance although might be profitable against lobbyists, it is not advantageous against bribers. Compliers by sitting passively aside and obeying the rules are in danger of losing projects to bribers. Like the example of queue the better position bribers receive is the position compliers lose. Therefore when firms encounter bribers the compliance strategy gives a negative payoff equal to the value of the rent or position lost, $\mathfrak{D}_b$.

Bribery rent is temporary and should be renewed for the next periods by bribing again the same or different inspectors. Moreover, the exemption which bribers get is valuable only if the lobbyists fail in changing the rule. Bribers with probability p^w benefit from a success in lobbying and with probability $(1 - p^w)$, a failure in lobbying, they enjoy the rent which they get by bribing. In other

words, firms by bribing insurance themselves against lobbying failure, $\frac{(1-p^w)}{1-\delta}+\frac{p^w}{1-\delta}=\frac{1}{1-\delta}$. The positive rent of bribery incite firms to compete with each other in proposing bribes. This rent equals $\mathcal{R}_b=\frac{(1-p^w)-[B+p^d f]}{1-\delta}$, where B is the bribe payment and f is the punishment bribers incur in case of detection. The parameter p^d is the probability of detection.

Assumption (3): The exemption obtained from bribery is valuable i.e. $(1-p^w)>B+p^d f$.

Bribery also dominates compliance strategy. Therefore, firms compete with each other in proposing bribes to get this positive rent. The incentive for competition when other players comply is $\mathcal{M}_b=(\pi^{BC}-\pi^{CC})=\frac{1-[B+p^d f]}{1-\delta}>0$. Note that here there are no lobbyists, bribers are faced a complier, thus probability of winning is zero and this rent is all what bribers get from exemption. As the population of bribers increases their payoffs change. First because the social punishment like feeling shame would be less severe as number of bribers increase and corruption becomes more prevalent. The parameter τ indicates this effect. Second because the rent bribers get like a position in queue is rival. A firm might be able to get a better position by bribing rule-enforcers but if all firms try to bribe no one can be thoroughly successful. The parameter γ indicates the degree of congestion. The bribery rent decreases as more firms compete in proposing bribe; the amount of loss is $\mathcal{L}=\frac{1}{1-\delta}\big((1-\gamma)-(1-\tau)p^d f\big)$.

Assumption (4): Congestion is so high such that a big part of the rent would be lost as firms compete with each other in bribing i.e. $\gamma<B+p^d\tau f$.

The game in table (1) is a form of prisoner dilemma with three strategies. While everyone was benefited from cooperation for lobbying, free-riding incentive urges the population toward another state with lower payoff. Lobbying is strictly dominated by free-riding strategies, compliance and bribing. The worse situation happens when firms continue with competing for the rival bribery rent which is leading to bribery equilibrium with lowest payoff to all players. Bribing is the only Nash equilibrium of the game although cooperation for lobbying and compliance are Pareto superior. This game reflects a cooperation failure as firms fall in an endless competition for a rival bribery rent which soon would be vanished by an increase in number of bribers or the bribe payments.

To extend this two-player game to a population game some standard assumptions are made. A random matching symmetric game is considered which according to the individuals within population interchangeably play the game. Strictly speaking, firms are assumed to be similar with exactly the same strategy set. Stability is also a bit different concept here. Evolutionary Stable Strategy (ESS) is a Nash equilibrium which is immune to invasion of new traits or strategies. Invasion refers to the spread of new strategies through innovation, copying etc. among the population. Every ESS is Nash equilibrium but the converse is not true. The ESS is best response to itself (Nash equilibrium); however, if it is a weak best response then the other strategies should not be a best response to themselves.

Restricting the whole population to one, $x^C+x^B+x^L=1$, the payoffs of different strategies as a function of population state are listed in formula (1). Payoffs can be written as functions of only two of the subgroups because using the restriction above the rest subsumes the population of the third strategy. Fixing the population of one strategy, complier's population is set to $\bar{x}^C$, the payoff structure of the game is drawn in two-dimensional figure (2). Compliance was selected in order to show how the population lose as bribery grows in society. Notice that $\boldsymbol{\pi^{LL} > \pi^{BB}}$ although bribery is dominant and the unique Nash equilibrium.

$$(1) \qquad \Pi = \begin{Bmatrix} \pi^L = x^L\pi^{LL} + x^C\pi^{LC} + x^B\pi^{LB} = (\mathcal{R}_L - C) + \mathcal{H}x^L - \mathfrak{D}_b x^B \\ \pi^C = x^L\pi^{CL} + x^C\pi^{CC} + x^B\pi^{CB} = (\mathcal{R}_L - \mathfrak{D}_l)x^L - \mathfrak{D}_b x^B \\ \pi^B = x^L\pi^{BL} + x^C\pi^{BC} + x^B\pi^{BB} = \mathcal{M}_b - \mathcal{L}x^B - \mathfrak{D}_l x^L \end{Bmatrix}$$

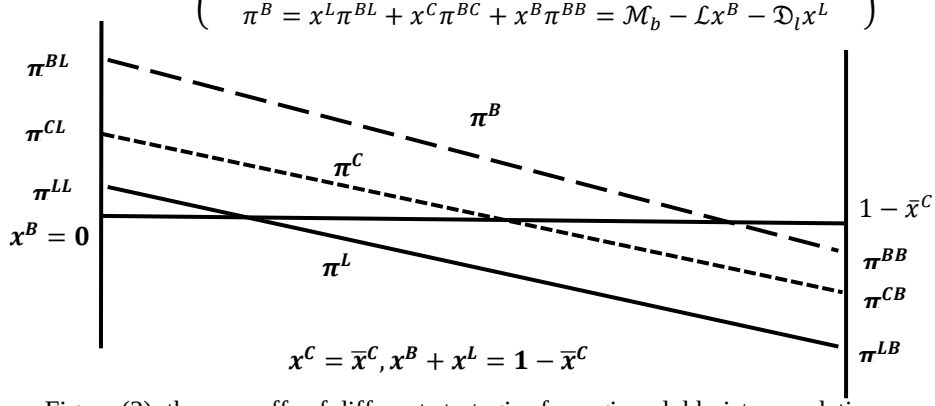

Figure (2): they payoffs of different strategies for a given lobbyists population

Lobbying is strictly dominated by compliance strategy because of the assumption (2) which according to free-riding is profitable even if there is risk of receiving punishment from cooperators. Bribing also dominates compliance because of assumption (3) saying that the rent of bribery is

always positive. Assumption (4) is crucial for determining the slope of the bribing payoff function. If the congestion was high the final rent is lower as numbers of bribers increase (number of lobbyists decrease). Bribery is the unique Nash equilibrium and thus unique evolutionary stable strategy. It is not only the best response to itself but also to other strategies for every state of population. Starting from every point inside the population simplex it is expected that bribing strategy spreads throughout the population. Bribing equilibrium is stable and immune to any invasion by other strategies. However, the figure above contains another important point regarding the problem of cooperation failure. As bribery spreads in the population, all players will be worse off. The negative slopes of payoff functions show that bribery although evolutionary stable, it is Pareto inferior to lobbying and compliance states.

III. Evolutionary dynamics of the game

Suppose there are N firms randomly drawn to play an evolutionary game with pure strategy set $h \in \{Lobbying, Compliance, Bribing\}$. The state of population is described by vector x = (x^L, x^C, x^B) where x^h is the proportion of the population adopting strategy h. Suppose that every player is pre-programmed to adopt a pure strategy, but when a player is drawn to play, she gets an opportunity to 'review' her strategy and switch to another type. A revision protocol ρ takes the current payoffs and the aggregate behaviour as inputs; its outputs are some conditional switch rates $\rho_{ij}(\pi, x)$. These rates describe how frequently agents playing strategy $i \in h$, who consider switching after getting a revision opportunity, switch to the strategy $j \in h$. The game and the revision protocol together define a stochastic evolutionary process.

The deterministic dynamics is $\dot{x}_i = \sum x_j \rho_{ji}(\pi, x) - x_i \sum \rho_{ij}(\pi, x)$ where the first term shows the inflow and the second term is the outflow of i-strategists. Inflow includes agents who currently play a different strategy but are ready and willing to switch to strategy i. On the other hand, outflow consists of i strategy players who are going to apply other strategies. There are many different protocols. In some protocols agents are very rational and their decision depends only on the payoff structure of the game. In others agents copy and follow each other such that their decision depends on the state of population. One criterion for choosing a protocol is that how information-

demanding it is since assuming an agent with high information about the payoffs of all strategies or state of population in each period of time is very unrealistic.

The other important criteria about protocols are positive correlation (incentive consistency) and Nash stationary. Positive correlation requires that whenever a population is not at rest system grows according to payoffs; $V_\pi(x) \neq 0 \implies V_\pi(x)\Pi(x) > 0$ where $V_\pi(x)$ is the growth rate and $\Pi(x)$ is the payoff matrix. Nash stationarity bridging between dynamic and traditional game theory says that every rest point is Nash, if not there would be some who benefits from switching; $V_\pi(x) = 0 \iff x \in NE(\Pi)$. The other important point is that the final result should not depend heavily on the formulation of protocols; in other words the results should be robust. For this purpose it can be proved that the final conclusions hold under any number of protocols sharing a certain family resemblance. Below a short review of various families of evolutionary dynamics is presented[7].

Best response dynamics is the closest protocol to Nash equilibrium. The players in this protocol are rational without myopic decision-making. They need only information about payoff matrix. The main weakness of best response dynamic is that it is not differentiable. Another family of dynamics is excess payoff protocols. Accordingly agents compare payoff of each strategy with the average payoff of society, and hence switch to strategy with the highest excess payoff. This protocol is the most information demanding protocol in that agents not only should know the payoff of each strategy but also need to know the exact state of population to calculate the average. This problem can be solved if the average payoff in protocol is replaced with a less information-demanding reference payoff. For example in the pairwise comparison protocol agents compare the payoffs of strategies together. These two protocols satisfy both Nash stationary and positive correlation properties. Projection dynamics is another class of protocols with a nice geometrical interpretation. Positive correlation requires that the growth vector form an acute angle with the payoff vector at every state where the population is not at rest. To minimize distortion, one can always take growth vector to be the closest point in vector plane to payoff vector, the orthogonal projection. This dynamic has a close relationship with replicator dynamic which is very famous and common in evolutionary games.

[7] To know better deterministic dynamics and their properties read chapter 5 of Sandhom (2010) book.

In fact replicator dynamic itself belong to a family of protocols known as imitative dynamics. The name indicates that in this family of protocols the probability of a change depends on the population of target strategy, $\rho_{ij}(\pi, x) = x_j\, r_{ij}(\pi, x)$. However depending on $r_{ij}(\pi, x)$ this protocol also may demand information about payoffs of particular strategies or the average payoff of the population. Bounded-rationality of agents is the base of evolutionary games. The diffusion speed depends not only on the payoffs but also on the popularity of strategies because the more popular a strategy is the more probable it is to be copied or to be imitated. Imitation of Success is one of the imitative family protocols. According to this protocol probability of a change depends on popularity and the payoff of the target strategy $\rho_{ij}(\pi, x) = x_j\, \pi_j$. This dynamics result in famous replicator dynamics.

$$\dot{x}_i = \sum x_j\, \rho_{ji}(\pi, x) - x_i \sum \rho_{ij}(\pi, x) \Rightarrow \dot{x}_i = \sum x_j x_i\, \pi_i - x_i \sum x_j\, \pi_j$$

$$\dot{x}_i = x_i \left(\pi_i \sum x_j - \sum x_j\, \pi_j\right) = x_i \left(\pi_i - \frac{\sum x_j\, \pi_j}{\sum x_j}\right) \Rightarrow \dot{x}_i = x_i\, (\pi_i - \bar{\pi})$$

The population's average payoff is presented below in formula (2). The rent which firms get from lobbying $\mathcal{R}_L$ increases the average payoff because a change in the rule benefits to all population regardless of their cooperative or free-riding behaviour. The population also benefits from cooperation $\mathcal{H}$ and loses as firms fight for the rival bribery rent. The punishment imposed on free-riders by lobbyists and the damage firms receive from bribers reduce the average payoff.

$$(2) \qquad \bar{\pi} = \big((1 + x^C)\mathcal{R}_L - C\big)x^L + \mathcal{M}_b x^B + \mathcal{H} x^{L^2} - \mathcal{L} x^{B^2} - \mathfrak{D}_l (1 - x^L) x^L - \mathfrak{D}_b (1 - x^B) x^B$$

In the formula above $x^L(\mathcal{R}_L - C), x^C x^L \mathcal{R}_L$, and $\mathcal{M}_b x^B$ are the rent received by lobbyists, compliers and bribers respectively. An increase in probability of winning add to the average payoff through increasing the benefits of lobbyists and compliers while it has no effect on bribers payoff because bribers by paying bribe have insured the whole rent against lobbying failure. Lobbyists with a population equal to x^L benefit from cooperation of other firms by $\mathcal{H} x^L$but on the other hand, bribers with a population x^B lose from the presence of other bribers by $\mathcal{L} x^B$. The punishment $\mathfrak{D}_l$ imposed by lobbyists x^L to free riders $(1 - x^L)$, and the damage $\mathfrak{D}_b$ which non-bribers $(1 - x^B)$ incur because of venal act of x^B bribers decrease the average payoff. Now having the average payoff and the

payoff of different strategies at hand, presented in formula (1) and (2) respectively, we can obtain and discuss more about the dynamics of the strategies.

First to analyse the dynamics of lobbyists' population. Higher marginal contribution of cooperators and the selective incentive mechanism created to punish free-rides work to the advantage of lobbyists' population growth. Higher lobbying rent resulted either from higher probability of winning or lower participation costs is in favour of lobbying firms' population. On the other hand, higher rent of bribery, lower costs of bribery, and the damage which bribers impose to others change the population dynamics against lobbyists. However, due to congestion, as number of bribers increases moving away from lobbying toward bribing slows down.

$$(3) \qquad \begin{aligned} \dot{x}^L &= x^L(\pi^L - \bar{\pi}) \\ &= -(\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L){x^L}^3 + (\mathcal{H} + C - (2 - x^B)\mathcal{R}_L + \mathfrak{D}_l){x^L}^2 \\ &\quad + \left((\mathcal{R}_L - C) - (\mathcal{R}_L + \mathcal{R}_b)x^B + (\mathcal{L} - \mathfrak{D}_b){x^B}^2\right)x^L \end{aligned}$$

$$\frac{\partial \dot{x}^L}{\partial \mathcal{H}} = \frac{\partial \dot{x}^L}{\partial \mathfrak{D}_l} = {x^L}^2(1 - x^L) \geq 0, \qquad \frac{\partial \dot{x}^L}{\partial \mathcal{R}_L} = x^L x^C(1 - x^L) \geq 0, \qquad \frac{\partial \dot{x}^L}{\partial C} = -x^L(1 - x^L) \leq 0$$

$$\frac{\partial \dot{x}^L}{\partial \mathcal{R}_b} = -x^L x^B \leq 0, \qquad \frac{\partial \dot{x}^L}{\partial \mathcal{L}} = -\frac{\partial \dot{x}^L}{\partial \mathfrak{D}_b} = x^L {x^B}^2 \geq 0$$

The dynamics of briber-population is shown in formula (4). Obviously higher the rent of bribery and lower the bribery costs have positive effects on bribers reproduction. Weakening non-bribers by taking their positions and imposing damage on them; $\mathfrak{D}_b$ also increases bribers offspring. As corruption becomes popular, however, the bribers' loss due to congestion decelerates dynamics of their population. On the other hand, all parameters in favour of other strategies like marginal contribution of cooperation, serious punishment of free-riders, and lower linkage cost make bribery less absorbing. The impact of lobbying rent on bribers population is positive because it benefits all players regardless of their behaviour.

$$(4) \qquad \begin{aligned} \dot{x}^B &= x^B(\pi^B - \bar{\pi}) \\ &= (\mathcal{L} - \mathfrak{D}_b){x^B}^3 - \left(\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_b + \mathcal{R}_L(1 - x^L)\right){x^B}^2 \\ &\quad + \left((\mathcal{R}_L + \mathcal{R}_b) - (2\mathcal{R}_L - C)x^L - (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L)\,{x^L}^2\right)x^B \end{aligned}$$

$$\frac{\partial \dot{x}^B}{\partial \mathcal{R}_b} = x^B(1 - x^B) \geq 0, \qquad \frac{\partial \dot{x}^B}{\partial \mathcal{L}} = -\frac{\partial \dot{x}^B}{\partial \mathfrak{D}_b} = -{x^B}^2(1 - x^B) \leq 0$$

$$\frac{\partial \dot{x}^B}{\partial \mathcal{H}} = \frac{\partial \dot{x}^B}{\partial \mathfrak{D}_l} = -{x^L}^2 x^B \leq 0, \qquad \frac{\partial \dot{x}^B}{\partial \mathcal{R}_L} = x^C(1 - x^L)x^B \geq 0, \qquad \frac{\partial \dot{x}^L}{\partial C} = x^L x^B \geq 0$$

The population dynamics of compliers is represented by formula (5). It is clear that all parameters in favour of lobbying and bribing make the passive strategy of compliance less appealing. Higher marginal contribution of cooperators, severe punishment of free riders, higher lobbying rent or probability of winning, and lower linkage cost encourage compliers to cooperate with other lobbyists and, thus, have negative effects on compliers population. Moreover, the dynamics becomes against compliers when the bribery rent is high, the damage imposed by bribers $\mathfrak{D}_b$ is more harmful, or the congestion in bribery rent is low.

(5)
$$\begin{aligned}\dot{x}^C &= -\dot{x}^B - \dot{x}^L \\ &= (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L){x^L}^3 - (\mathcal{L} - \mathfrak{D}_b){x^B}^3 - (\mathcal{H} + C - 2\mathcal{R}_L + \mathfrak{D}_l){x^L}^2 \\ &+ (\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_b + \mathcal{R}_L){x^B}^2 + (\mathcal{H} + \mathfrak{D}_l - 2\mathcal{R}_L)\, {x^L}^2 x^B - (\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_L){x^B}^2 x^L \\ &+ (3\mathcal{R}_L + \mathcal{R}_b - C)x^B x^L - (\mathcal{R}_L - C)x^L - (\mathcal{R}_L + \mathcal{R}_b)x^B\end{aligned}$$

$$\frac{\partial \dot{x}^C}{\partial \mathcal{H}} = \frac{\partial \dot{x}^C}{\partial \mathfrak{D}_l} = -{x^L}^2 x^C \leq 0, \qquad \frac{\partial \dot{x}^C}{\partial \mathcal{R}_L} = -(x^L x^C + x^B)x^C \leq 0, \qquad \frac{\partial \dot{x}^L}{\partial C} = x^L x^C \geq 0$$

$$\frac{\partial \dot{x}^B}{\partial \mathcal{R}_b} = -x^B x^C \leq 0, \qquad \frac{\partial \dot{x}^B}{\partial \mathcal{L}} = -\frac{\partial \dot{x}^B}{\partial \mathfrak{D}_b} = {x^B}^2 x^C \geq 0$$

As mentioned in the last section, lobbying and compliance are strictly dominated by bribing strategy and thus bribery is the only evolutionary stable strategy of the game. Therefore, no matter which protocol have been used, dynamics of the game started from every point in the strategies simplex ends in bribery equilibrium. A simple simulation of the population dynamics using exemplar amounts for the game parameters is presented in table (2) and figures (3) and (4). All trajectories started from every point in simplex end in bribery equilibrium because lobbying and compliance are strictly dominated by the bribing strategy. The trajectories close to lobbying-compliance boundary are a bit inclined toward compliance strategy because in this region the initial number of bribers is very low and since we are using a replicator dynamics their reproduction level is also low.

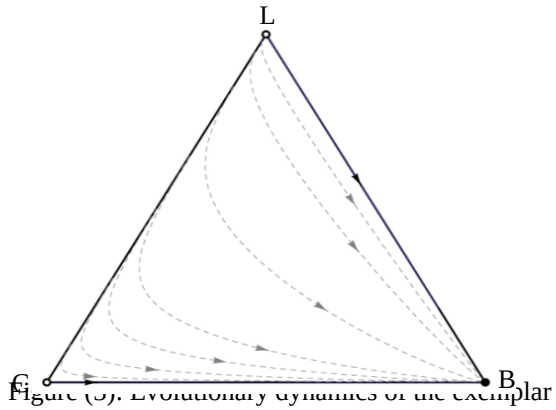

Figure (3): Evolutionary dynamics of the exemplar game with selected trajectories

Table (2): Payoff structure of the exemplar game

	Lobby	Comply	Bribe
Lobby	1.5	-1	-5
Comply	1.6	0	-4
Bribe	2	2.4	-0.2
$\boldsymbol{p^w = .5, \psi = 1.5, \delta = 0.75, C = 3, d = 0.1,}$ $\boldsymbol{p^d f = 0.2, B = 0.2, \tau = 0.75, \gamma = .3}$			

But as time goes on more and more firms will be absorbed by bribing strategy and finally the population rests at this evolutionary stable equilibrium. Figure (4) represents a traditional cooperation failure game. At the end, despite higher payoffs of compliance and cooperation equilibria, all players lose as they selfishly follow the bribing strategy which is individually profitable but gets them a congestible rival rent.

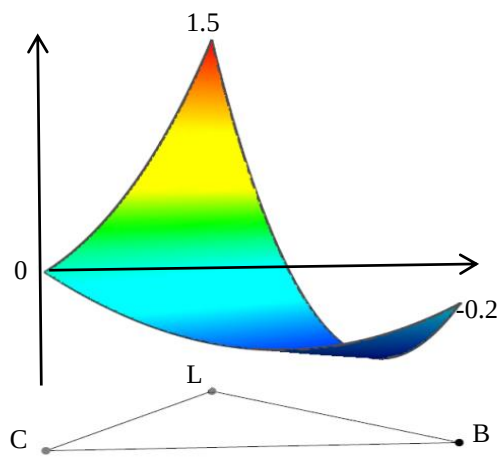

Figure (4): Potential function of exemplar game representing the payoff of population

IV. Impact of social parameters

What we observe in real world is different from the main conclusion of presented assuming model by which bribery as the unique dominant strategy spreads throughout the population. A quick look at Transparency Index in the last decade shows that some countries like Georgia, Lithuania,

Croatia, and Uruguay have overcome corruption; an increase about twenty scores in Corruption Perception Index. Moreover, as figure (5) shows, lobbying and compliance are commonly used as much as bribery in most of the countries. Vertical axis is the percentage of companies which are influential on legislation reported by World Business Environment Survey (2002). This index serves as a proxy for lobbying. Horizontal axis, on the other hand, represents Corruption Perception Index (2012) for different countries. Assuming fifteen percent influence rate and the score of fifty in CPI as the imaginary boundaries between free riders-lobbyists and corrupted-clean countries, the space is divided into four regions. Regions I and III are in line with previous studies which according to countries are specialized in one of the rent-seeking strategies; developed countries use lobbying and developing countries use bribing to influence government. United States as an example of countries located in region III is specialized in lobbying while, on the other hand, Azerbaijan in region I is corrupted. But the regions II and IV in contrast represent countries in which both or none of lobbying or bribing are used. In region II both lobbying and bribing strategies are common in countries like Philippine, Pakistan and Indonesia. Region IV represents countries like Sweden and Germania in which firms prefer to comply with the rules.

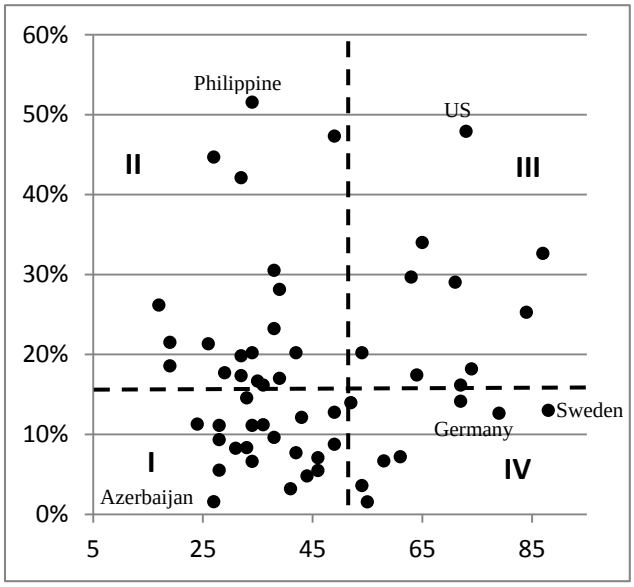

Figure (5): lobbying versus corruption in different countries

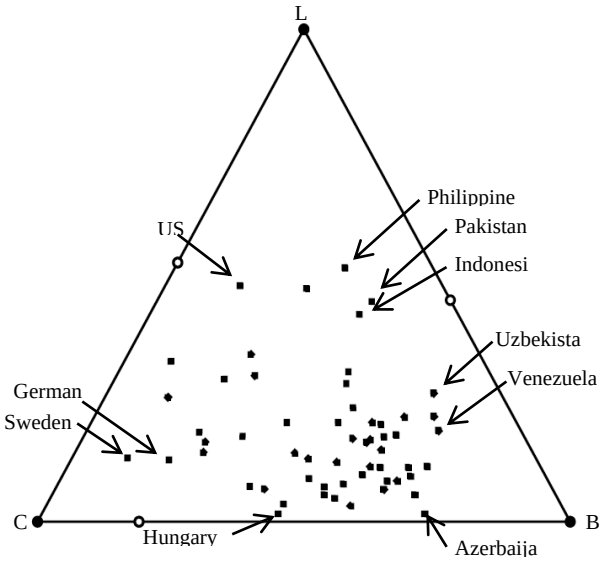

Figure (6): Prevalence of lobbying, bribing and compliance in the world

The main objective is to explain the prevalence of these rent-seeking activities in various countries by focusing on the effects of social parameters. For this purpose this section utilizes the previously presented assuming model as underlying game to see how changes in social parameters improve the model and explain compliance and lobbying usage. The data are also presented in the same simplex, shown in figure (6), in order to make the comparison easier between facts and assumptions. In this standard 2-simplex the coordinates in this new way of presentation is obtained accepting the fact that the three strategies are substitute and cannot be used simultaneously. From influence rate data the percentage of lobbyists is known; the rest is devoted to bribers or compliers. For example when 48 percent of companies in United States have influence on legislatures, this assumption means that the rest i.e. 52% consists of bribers and compliers. Now considering the CPI index as the frequency of non-corrupted companies, 73 for the US case, the compliers population can be computed by multiplying this probability to the percentage of remaining companies i.e. 52%, which brings 38 percent compliance. Since these numbers must sum up to one, the coordinates or the prevalence of different strategies of Unites states is (0.48, 0.38, 0.14).

Figure (6) shows that while in some countries like Germany and Sweden complying with the rules is the best strategy in some others which are mostly from developing countries both rent-seeking strategies, lobbying and bribing, are common. These points together with the fact that in developed countries lobbying is commonly used are in contrast with the conclusion of our default game in which bribery was the unique dominant strategy. In such prisoners' dilemma games "the undesirable outcome is the only Nash equilibrium, so the only way that any of the other outcomes can be supported is by a permanent intervention to change the payoffs or the rules of the game" (Bowles, 2004). At the following of this section the role of some social factors as permanent interventions changing the games and their significance on firm's behavior will be investigated.

- **Social and legal Punishments**

One of the permanent interventions is to enhance the risk and the costs of illegal acts. It is expected that as social and legal costs of bribery $p^d f$ increases, proposing bribes becomes less attractive and, as result, firms prefer to passively abide from the rules rather than to commit a crime. To

empirically test the significance of social and legal punishments on corruption, I used a simple OLS regression whose results are reported in Table (3) .

$$\text{Corruption} = \text{Constant} + a_1 * \text{Number of procedures} + a_2 * \text{Judiciary} + a_3 * \text{Social acceptance}$$

Corruption is measured by Corruption Perception Index (2012) reported by Transparency International. The first independent variable is the number of procedures needed to start a business reported by Doing Business data (2012) of The World Bank. This variable reflects the very common economists' statement that corruption is a direct result of bad regulation and government intervention in markets. High number of procedures means a greater number of direct contacts between firms and rule-enforcers and, thus, a higher probability of proposing bribe. According to the results, the positive relation between number of procedures and corruption is weakly significant; an extra procedure decreases the CPI by 0.9 score.

Table (3): Corruption and its main determinant factors

Source	SS	df	MS		
				Number of obs =	26
				F(3, 22) =	32.72
Model	7766.78143	3	2588.92714	Prob > F =	0.0000
Residual	1740.75703	22	79.1253194	R-squared =	0.8169
				Adj R-squared =	0.7919
Total	9507.53846	25	380.301538	Root MSE =	8.8952

CPI2012	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
NProcedures	-.9101788	.5595613	-1.63	0.118	-2.070638	.2502803
Judiciary	.5266686	.0730585	7.21	0.000	.3751546	.6781826
Socialacceptance	-2.350832	95.92854	-2.45	0.023	-434.0268	-36.13956
_cons	39.87449	7.149199	5.58	0.000	25.04796	54.70102

The second independent variable shows the effectiveness and integrity of the legal and judicial system against corruption. Data are reported by The World Bank in Corporate corruption/Ethics indices (2004). This variable indicates strictness of legal system in fight against corruption and, therefore, I take it as proxy for legal punishment. This variable as it is shown has a positive and significant impact on CPI index. The third variable is the social acceptance or justifiability of bribing which is reported by World Values Survey[8]. Lower acceptance or unjustifiability of bribery

[8] This index is the percentage of people who think bribing is justifiable; ranked greater than 8 in a range of 10. High ranks are used because lower ranks although show social disapproval of bribing might not be answered trustfully.

is interpreted as higher social punishment or social disapproval of bribing. This variable is also highly significant such that a 10 percent increase in acceptance of bribery decreases the CPI index by more than 23 scores. The highly significance of legal and social punishments highlights the importance of these two factors for explaining the prevalence of compliance in different countries. Therefore to incorporate these effects I have to modify the assuming model introduced in previous sections.

To make the necessary changes, now suppose that the legal and social punishments are high such that the assumption (3) does not hold; $\mathcal{R}_b \leq 0 \Rightarrow (1 - p^w) \leq B + p^d f$. In this new game bribery is not always profitable especially when number of bribers are very low and firm's action is visible to the public. Lobbying is dominated by other free-riding strategies but now there are two Nash equilibria. The first one is the compliance equilibrium and the second is the bribery. The compliance equilibrium is Pareto superior than bribery equilibrium. In fact permanent intervention in form of increasing costs of bribery has changed the game from a cooperation failure game with one unique Nash equilibrium to a coordination failure game with two Pareto ranked Nash equilibria. The two equilibria are evolutionary stable and the point x^{B*} is the boundary of their basins of attraction. Figure (7) shows this new payoff structure of the game.

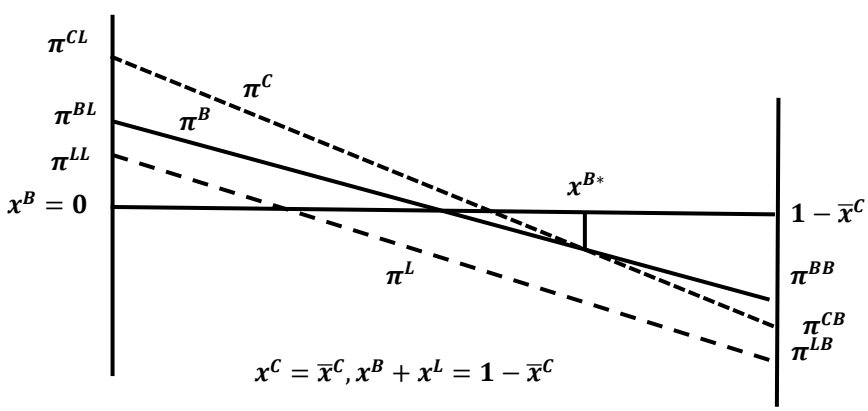

Figure (7): they payoffs of different strategies for a given compliers population

From dynamic equations (3), (4), (5), it is easy to conclude that a decrease in bribery rent decreases the number of bribers while has positive effects on lobbyists' and compliers' populations. Dynamics of the new exemplar game in which $p^d f$ is increased from 0.2 to 0.9 is depicted in figure (8). Comparing this with figure (9) shows how good this model and its exemplar game resemble

the actual data and how much social parameters are important to explain the prevalence of compliance among countries. Stable states are shown in black. Figure (9) represents the actual data. As it was expected countries with high social disapproval of bribing, shown as the grey points, are located mostly close to compliance strategy and countries in which social punishment is low and corruption is partially acceptable, the black points, are inclined toward bribing strategy.

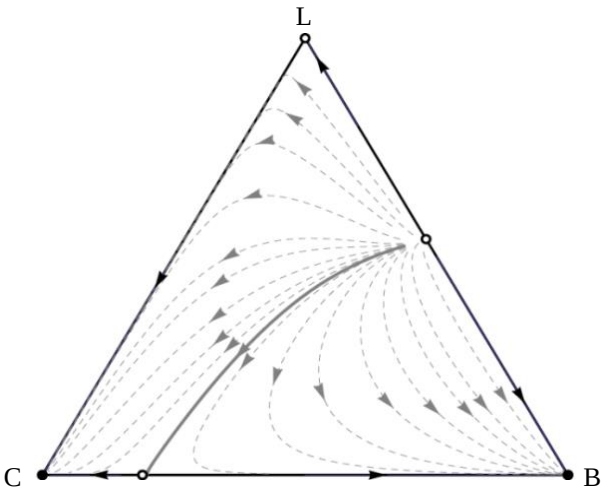

Figure (8): Evolutionary dynamics of the exemplar game

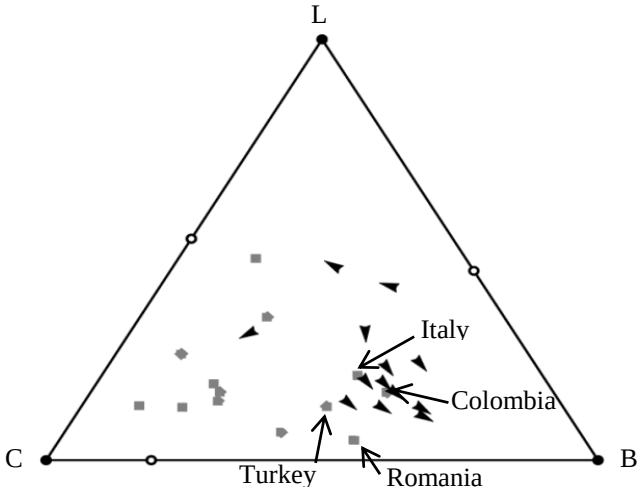

Figure (9): Evolutionary dynamics of the exemplar game

The legal and social punishments, however, are not the only factors important. The final conclusion, the point which the dynamics rests on, depends on the initial points or what is known as chance. This means that fighting with corruption through setting severe punishments on bribers is successful only in countries with initial points far away enough from bribing equilibrium. In figure (9) some of these countries like Italy, Romania, Colombia and Turkey in which bribing is unjustifiable but still popular are shown. To understand the importance of initial points for the final equilibrium, I divided the sample into two subsamples, countries with good and bad histories, an run the regression again. The results are reported in table (4) where CPI(1999) is used as proxy for countries' history.

Table (4): The effect of bribe's social approval and countries history on corruption

CPI2012=constant + a_1*NProdedures+a_2*Judiciary+a_3*Social acceptance			
		Judiciary	**Social acceptance**
All Countries	Coefficients	0.52	-235.08
	P-value (t-test)	0.00**	0.02**
Countries with bad history (CPI99<50)	Coefficients	0.43	-158.7
	P-value (t-test)	0.053*	0.20

To test that the coefficients in countries with bad history is less I run a two-sample mean test with the hypotheses which are represented below. In the first test the alternative hypothesis is accepted at 95% (p-value=0.016) showing that legal punishment although significant but is less effective in countries with bad histories comparing to the other countries. The second test also accepts the alternative strategy at 95% (p-value=0.013) saying that social punishment cannot prevent firms from proposing bribe in countries with bad histories. In countries with bad history it is not easy to fight against corruption and make firms to abide from the rules. This explains why anti-corruption programs are failed in many of corrupted countries.

$$\begin{cases} H_0: a_2 = a_2(CPI99 < 50) \\ H_1: a_2 > a_2(CPI99 < 50) \end{cases}, \qquad \begin{cases} H_0: |a_3| = |a_3|(CPI99 < 50) \\ H_1: |a_3| > |a_3|(CPI99 < 50) \end{cases}$$

- **Cooperation**

Another social parameter which helps countries to escape from bribery equilibrium is cooperation. Some of these countries are placed in regions II and III of figure (5). To determine how cooperation has helped firms in these countries to overcome the free riding problem, first we need to delineate the main determinants of firms' common interest which is lobbying for a favourable rule. The rent which firms may obtain through lobbying and the required cost of linking and negotiation are the main two factors of the model explaining firms lobbying behaviour. The regression below is designed to evaluate the importance of these two factors.

$$\text{Lobby} = \text{Constant} + a_1 * \text{Rent of lobbying} + a_2 * \text{linkage cost}$$

Lobbying can be considered as firm's attempt to protect itself against any potential loss or costs. A very popular form of these governmental protections is setting higher tariffs to limit international trade and restricting foreign competitors. A large part of lobbying literature known as "the protection for sale" is dedicated to this issue. I used the simple mean of import tariffs to measure the generosity of governmental protection. The expectation is a positive correlation between higher tariffs, as proxy for the rent lobbying, and lobbying activities. Lobbying, as before, is the percentage of companies known themselves influential on legislation reported by World Business environment survey (2000). But to get this rent lobbyists need to connect with the government. The linkage cost depends on the willingness of legislators to share their task of rule-making. One

determining factor is government's alacrity for listening to the voice of business. The percentage of companies which believe that government does not listen to the voice of business is reported by World Values Survey (2005). This index shows the accessibility of government and I will take it as proxy for the linkage cost. The expectation is that lobbying is used much less in countries with high linkage cost; countries where the government does not listen to the voice of business. The results are shown in table (5).

Table (5): Lobbying and its main determinant factors

Source	SS	df	MS		
				Number of obs =	42
				F(2, 39) =	19.66
Model	3104.67678	2	1552.33839	Prob > F =	0.0000
Residual	3079.27125	39	78.955673	R-squared =	0.5021
				Adj R-squared =	0.4765
Total	6183.94803	41	150.828001	Root MSE =	8.8857

lobby	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
rent	.711038	.3499836	2.03	0.049	.0031293	1.418947
linkage cost	-.5839784	.1046109	-5.58	0.000	-.7955738	-.3723829
_cons	62.25488	9.169267	6.79	0.000	43.70829	80.80147

As was expected countries with higher tariffs indicating greater protection from domestic industries are correspond with higher level of lobbying. The coefficient is positive and highly significant. The linkage cost is also significant. The negative coefficient shows that lobbying is used less in countries where their government does not listen to the voice of business and, as result, linking to the government is more difficult for the firms.

Cooperation between firms has important impacts on these two factors, the chance of winning the rent and the linkage cost. Cooperation helps firms to form stronger coalitions and thus to be more successful in lobbying. In case of cooperation, firms also benefit from cost sharing of lobbying. To test the significance of cooperation on lobbying, I take the percentage of companies which are an active member of some professional organization as proxy for cooperation among firms. Data are collected from World Values Survey (2005). I found a 60 percent correlation, statistically significant at 95 percent confidence interval, between cooperation and lobbying. However, adding cooperation into the regression above makes the other two variables insignificant showing that, in fact, the impact of cooperation on lobbying is indirect through the two aforementioned factors. To

empirically test this indirect relation the sample is divided to two subsamples, countries where cooperation is common among firms and countries with low level of cooperation. Running the previous regression on these two subsamples, the expectation is that linkage cost should be more significant in countries with low cooperation. The results are shown in table (6). The alternative hypothesis is accepted at 95% (p-value=0.002) indicating that linkage cost in countries with high level of cooperation is not impeding.

$$\begin{cases} H_0: |a_2| = |a_2|(Cooperation > 10) \\ H_1: |a_2| > |a_2|(Cooperation > 10) \end{cases}$$

Table (6): The effect of linkage cost in countries with low and high level of cooperation

Lobby=constant + a_1*rent+a_2*linkage cost		
		Linkage cost
All Countries	Coefficients	-0.58
	P-value (t-test)	0.000**
Countries with high cooperation (Cooperation>10%)	Coefficients	-0.41
	P-value (t-test)	0.23
Countries with low cooperation (Cooperation<10%)	Coefficients	-0.51
	P-value (t-test)	0.09*

These finding helps to explain the prevalence of lobbying in some countries. However, in order to incorporate these facts in theoretical model, some of the previous assumptions need to be modified. Previously I had assumed that lobbying is dominated by compliance due to free-riding behaviour of some players. Although free-riding is of great concern, many studies[9] have shown that either if the team work production is a non-excludable public good or if the marginal production is increasing, a larger group with cooperation of more players will be formed. In the next chapter, it will be shown that firms have positive incentive for cooperation as long as marginal benefits of cooperation is greater than its marginal cost; $\pi^{CL} < \pi^{LL}$. In countries with high cooperation, firms have no incentive to free-ride which means that the assumption (2), positive rent for free-riders, does not hold; $\mathcal{M}_f \leq 0 \Rightarrow (\pi^{CL} - \pi^{LL}) = \frac{(\psi-1)\, p^w + d}{1-\delta} \geq \frac{C}{2}$. These countries are correspond with high

[9] Esteban and Ray (2001); Marwell and Oliver (19888, 1993)

degree of synergy which increases the benefits of cooperation. This modification in assumption makes cooperation a stable equilibrium.

Figure (10) represents the payoff structure of this new game. Higher synergy or necessity of cooperation makes cooperation and, therefore, lobbying profitable. In this new game none of the strategies are dominated. In Figure (10), as before, compliers population is fixed to $\bar{x}^C$ but the payoffs are drawn as function of lobbyists' population. There are three Nash equilibria which all are evolutionary stable. The equilibria can be Pareto ranked from cooperation equilibrium with the highest payoff to compliance and then bribing equilibrium with the lowest payoff.

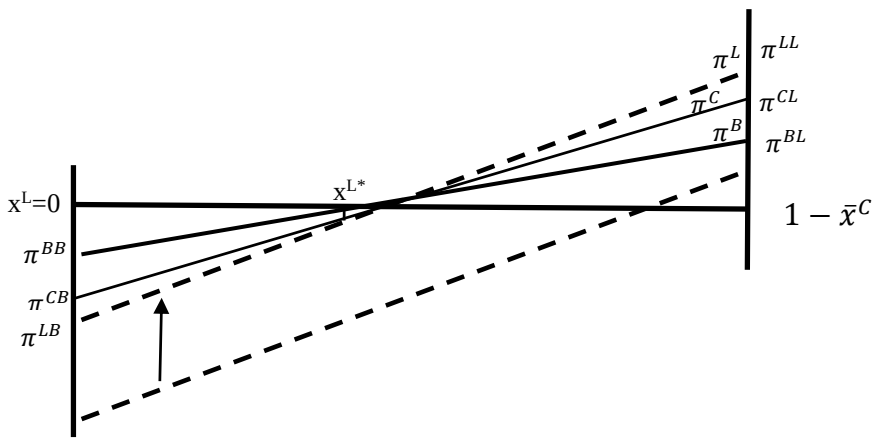

Figure (10): the payoffs of different strategies for a given compliers population

According to dynamics equations (3), (4), (5), an increase in synergy ψ or the marginal benefit of cooperation $\mathcal{H}$ while decreases the number of bribers and compliers, positively influence on lobbyists' population. Cooperation also decreases the significance of linkage cost. It was empirically shown that linkage cost can not prevent firms from lobbying in countries with high cooperation. The expected linkage cost is $EX(C) = \frac{C}{2}(x^L) + C(1 - x^L)$. The expected linkage cost depends on the likelihood of being matched with cooperators or non-cooperators. The expected linkage cost is lower when there are many cooperators; $EX(C) = C\left(1 - \frac{x^L}{2}\right)$. Using a numerical example, synergy has been increased from 1.5 to 2, the new dynamics of population is drawn and presented in figure (11). Synergy and high benefits for cooperation make lobbying a stable equilibrium however this does not mean that all the countries will approach toward lobbying; as it is shown other strategies are still stable and absorbent.

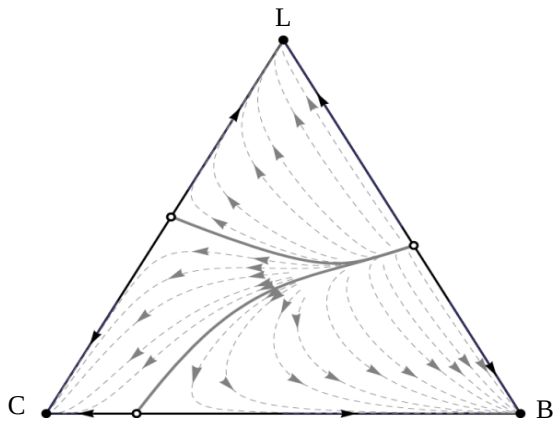

Figure (11): Evolutionary dynamics of the exemplar game

V. Conclusion

Economic agents have the incentive to influence government. Two rent-seeking strategies available are lobbying, connecting to the government to set favourable rules, or bribing, bending the current rule by paying rule-enforcers. Although there is a huge literature about each of these rent-seeking activities and their negative consequences separately, few have considered both at the same time to analyse firms' behaviour. These studies to explain firms' choice between lobbying and bribing mainly have focused on individual characteristics like the size, the capital endowment, or the firms' ownership. The main contribution of this study was to instead focus on the effects of social parameters which unfortunately are totally neglected in the literature. Incorporating social parameters in the model of firms' rent-seeking behaviour is crucial because each of these strategies have some important social and cultural aspects.

Using these social factors in an evolutionary game model, this study tried to correct the image made by previous studies about the prevalence of lobbying, bribing, and compliance in the world. The main conclusion of the literature is that lobbying is observed in developed economies while bribing is more common in developing countries. This seems to be faulty when more countries are entered in the analysis. The data show that lobbying in developing countries like Philippines, Indonesia, Malaysia, Pakistan, Panama, and Uzbekistan is commonly used to influence government as much as in developed economies. Moreover there are some rich countries like United Kingdom, Germany, and Sweden in which lobbying is very rare.

Afterwards a theoretical model is build up to explain firms' choice and dispersion of strategies among firms. Using the some assumptions it was shown that lobbying and compliance strategies are dominated by bribing. Bribers by free-riding on the effort of lobbyists and stealing their projects obtain a positive rent. Because of this rent bribery spreads throughout the population, however, as bribers population increases their corresponding rent recedes. This congestion effect make bribing equilibrium to be Pareto ranked lower than lobbying and compliance states. Using this theoretical model this study explains why corruption spreads in a population when it concludes to a bribery trap with the lowest payoff.

In the last section it was shown that how social parameters can be used to change this game so that other strategies are also used. Some empirical tests had been done to clarify the importance of these social factors. Social and legal punishments of bribing were the first parameters of interest. Since bribing is kind of illegal and socially unaccepted act it was expected that higher punishments decrease bribing basin of attraction and make it less frequent among countries. Theoretically, by modifying the preliminary assuming model, and empirically, using some proxies for legal and social punishments of bribing in various countries, this expected negative relation is confirmed. The results indicate that high punishments are not enough to eradicate corruption but the history of the countries is also very important. It was shown that in countries with bad histories, legal and social punishments are not very significant.

The second social and cultural parameter analysed was cooperation. Because lobbying entails non-excludable benefits and in most countries it is costly to link to the government, it was expected that cooperation have positive effects on lobbying. This was empirically shown and we found that the impact of cooperation is indirect such that linkage cost in countries with high cooperation becomes insignificant. The assuming model was modified to incorporate these facts. In the new version of the game with high degree of synergy, lobbying becomes the third Nash equilibria. High cooperation also decreases the expected linkage cost and, thus, expands the basin of attraction of lobbying.

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Attachment (1): Computational details

$$\Pi = \begin{Bmatrix} \pi^L = x^L\pi^{LL} + x^C\pi^{LC} + x^B\pi^{LB} = (\mathcal{R}_L - C) + \mathcal{H}x^L - \mathfrak{D}_b x^B \\ \pi^C = x^L\pi^{CL} + x^C\pi^{CC} + x^B\pi^{CB} = (\mathcal{R}_L - \mathfrak{D}_l)x^L - \mathfrak{D}_b x^B \\ \pi^B = x^L\pi^{BL} + x^C\pi^{BC} + x^B\pi^{BB} = (\mathcal{R}_L + \mathcal{R}_b) - \mathcal{L}x^B - \mathfrak{D}_l x^L \end{Bmatrix}$$

- Average Payoff

$$\bar{\pi} = x^L\big((\mathcal{R}_L - C) + \mathcal{H}x^L - \mathfrak{D}_b x^B\big) + (1 - x^L - x^B)\big((\mathcal{R}_L - \mathfrak{D}_l)x^L - \mathfrak{D}_b x^B\big) + x^B\big((\mathcal{R}_L + \mathcal{R}_b) - \mathcal{L}x^B - \mathfrak{D}_l x^L\big)$$

$$\bar{\pi} = \big((1 + x^C)\mathcal{R}_L - C - \mathfrak{D}_l(1 - x^L)\big)x^L + \big((\mathcal{R}_L + \mathcal{R}_b) - \mathfrak{D}_b(1 - x^B)\big)x^B + \mathcal{H}{x^L}^2 - \mathcal{L}{x^B}^2$$

- Dynamics of lobbying population

$$\dot{x}^L = x^L(\pi^L - \bar{\pi}) = x^L\Big((\mathcal{R}_L - C) + \mathcal{H}x^L - \mathfrak{D}_b x^B - \big((1 + x^C)\mathcal{R}_L - C - \mathfrak{D}_l(1 - x^L)\big)x^L - \big((\mathcal{R}_L + \mathcal{R}_b) - \mathfrak{D}_b(1 - x^B)\big)x^B - \mathcal{H}{x^L}^2 + \mathcal{L}{x^B}^2\Big)$$

$$\dot{x}^L = x^L(\pi^L - \bar{\pi}) = -(\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L){x^L}^3 + (\mathcal{H} + C - (2 - x^B)\mathcal{R}_L + \mathfrak{D}_l){x^L}^2 + \Big((\mathcal{R}_L - C) - (\mathcal{R}_L + \mathcal{R}_b)x^B + +(\mathcal{L} - \mathfrak{D}_b){x^B}^2\Big)x^L$$

$$\dot{x}^L = x^L(\pi^L - \bar{\pi}) = -\left(\frac{(\psi - 2)p^w + d}{1 - \delta} + \frac{C}{2}\right){x^L}^3 + \left(\frac{(\psi - 3 + x^B)p^w + d}{1 - \delta} + \frac{3C}{2}\right){x^L}^2 + \left(\left(\frac{p^w}{1 - \delta} - C\right) - \left[\frac{\gamma + (1 - \tau)p^d f}{1 - \delta}\right]{x^B}^2 - \left(\frac{1 - [B + p^d f]}{1 - \delta}\right)x^B\right)x^L$$

- Dynamics of bribers population

$$\dot{x}^B = x^B(\pi^B - \bar{\pi}) = x^B\Big((\mathcal{R}_L + \mathcal{R}_b) - \mathcal{L}x^B - \mathfrak{D}_l x^L - \big((1 + x^C)\mathcal{R}_L - C - \mathfrak{D}_l(1 - x^L)\big)x^L - \big((\mathcal{R}_L + \mathcal{R}_b) - \mathfrak{D}_b(1 - x^B)\big)x^B - \mathcal{H}{x^L}^2 + \mathcal{L}{x^B}^2\Big)$$

$$\dot{x}^B = x^B(\pi^B - \bar{\pi}) = (\mathcal{L} - \mathfrak{D}_b){x^B}^3 - \big(\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_b + \mathcal{R}_L(1 - x^L)\big){x^B}^2 + \Big((\mathcal{R}_L + \mathcal{R}_b) - (2\mathcal{R}_L - C)x^L - (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L)\,{x^L}^2\Big)x^B$$

$$\dot{x}^B = -\left[\frac{\gamma + (1-\tau)p^d f}{1-\delta}\right] x^{B^3} + \left[\frac{(B+\gamma-1) + (2-\tau)p^d f + p^w(1-x^L)}{1-\delta}\right] x^{B^2}$$
$$+ \left(\left(\frac{1-B-p^d f}{1-\delta}\right) - \left(\frac{(\psi-2)p^w + d}{1-\delta} + \frac{C}{2}\right) x^{L^2} - \left(\frac{2p^w}{1-\delta} - C\right) x^L\right) x^B$$

-Dynamics of compliers population

$$\dot{x}^C = -\dot{x}^B - \dot{x}^L = (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L)x^{L^3} - (\mathcal{H} + C - (2 - x^B)\mathcal{R}_L + \mathfrak{D}_l)x^{L^2} - \Big((\mathcal{R}_L - C) - (\mathcal{R}_L + \mathcal{R}_b)x^B + +(\mathcal{L} - \mathfrak{D}_b)x^{B^2}\Big) x^L - (\mathcal{L} - \mathfrak{D}_b)x^{B^3} + \big(\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_b + \mathcal{R}_L(1 - x^L)\big)x^{B^2} - \Big((\mathcal{R}_L + \mathcal{R}_b) - (2\mathcal{R}_L - C)x^L - (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L)\, x^{L^2}\Big) x^B$$

$$\dot{x}^C = -\dot{x}^B - \dot{x}^L = (\mathcal{H} + \mathfrak{D}_l - \mathcal{R}_L)x^{L^3} - (\mathcal{L} - \mathfrak{D}_b)x^{B^3} - (\mathcal{H} + C - 2\mathcal{R}_L + \mathfrak{D}_l)x^{L^2} + (\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_b + \mathcal{R}_L)x^{B^2}$$
$$+ (\mathcal{H} + \mathfrak{D}_l - 2\mathcal{R}_L)\, x^{L^2}x^B - (\mathcal{L} - \mathfrak{D}_b + \mathcal{R}_L)x^{B^2}x^L + (3\mathcal{R}_L + \mathcal{R}_b - C)x^B x^L - (\mathcal{R}_L - C)x^L$$
$$- (\mathcal{R}_L + \mathcal{R}_b)x^B$$

$$\dot{x}^C = -\dot{x}^B - \dot{x}^L = \left(\frac{(\psi-2)p^w + d}{1-\delta} + \frac{C}{2}\right) x^{L^3} + \left[\frac{\gamma + (1-\tau)p^d f}{1-\delta}\right] x^{B^3} - \left(\frac{(\psi-3)p^w + d}{1-\delta} + \frac{3C}{2}\right) x^{L^2}$$
$$- \left[\frac{(B+\gamma-1) + (2-\tau)p^d f}{1-\delta}\right] x^{B^2} + \left[\frac{\gamma + (1-\tau)p^d f - p^w}{1-\delta}\right] x^{B^2}x^L$$
$$+ \left(\frac{(\psi-3)p^w + d}{1-\delta} + \frac{C}{2}\right) x^{L^2}x^B - \left(\frac{p^w}{1-\delta} - C\right) x^L - \left(\frac{1-B-p^d f}{1-\delta}\right) x^B$$
$$- \left(\frac{-2p^w - 1 + B + p^d f}{1-\delta} + C\right) x^B x^L$$

Attachment (2): The data

Country	Influence rate	% member of professional organization	% government hears the voice of business	Simple mean of tariffs	CPI 1999	CPI 2012	% Bribe acceptance	Judiciary	Number of Procedures
Albania	8.33%	.	9.86		23	33	.	.	5
Argentina	16.67%	10.88	9.09	11.85	30	35	3.10	12.3	14
Armenia	6.61%	.	9.17		25	34	.	.	2
Azerbaijan	1.56%	.	36.97		17	27	.	.	3
Belarus	8.26%	.	6.50		34	31	.	.	5
Bolivia	11.11%	.	5.00	7.76	25	34	.	13.2	15
Brazil	12.12%	15.85	16.00	13.28	41	43	3.20	41.5	13
Bulgaria	3.20%	3.00	6.78	2.46	33	41	3.20	22.4	4
Canada	25.26%	27.15	38.14	4.29	92	84	1.70	81.6	1
Chile	14.14%	15.10	43.16	4.89	69	72	1.70	66.1	7
China	28.13%	8.10	40.86	9.80	34	39	2.60	42	13
Colombia	16.16%	4.70	15.84	11.44	29	36	1.70	30	9
Costa Rica	20.20%	.	31.31	5.83	51	54	.	47.2	9
Croatia	7.09%	.	4.84	2.52	27	46	.	18.2	6
Czech Rep	8.76%	.	15.60	2.46	46	49	.	37.4	9
Dominican Republic	19.82%	.	20.00	10.33	.	32	.	27	7
Ecuador	17.35%	.	9.09	11.60	24	32	.	15	13
El Salvador	9.62%	.	16.67	5.78	39	38	.	33.9	8
Estonia	17.42%	.	10.74	2.46	57	64	.	75.2	5
France	29.03%	10.40	30.85	2.46	66	71	4.20	76.4	5
Georgia	13.95%	1.00	12.70	7.49	23	52	.	12.6	2
Germany	12.63%	9.17	9.38	2.46	80	79	1.00	85.5	9
Guatemala	14.56%	.	14.29	5.20	32	33	6.00	14.6	6
Haiti	21.51%	.	2.91			19	.	.	12
Honduras	11.11%	.	16.30	5.61	18	28	5.90	17.6	13
Hungary	1.55%	.	8.33	2.46	52	55	.	47.1	4
Indonesia	42.11%	31.45	13.54	6.07	17	32	2.20	39.9	10
Italy	20.21%	17.90	19.15	2.46	47	42	0.30	40.7	6
Kazakhstan	5.51%	.	5.79	2.42	23	28	.	.	6
Kyrgyzstan	11.29%	.	3.64		22	24	.	.	2

Lithuania	3.60%	.	3.77	2.46	38	54	.	32.6	4
Malaysia	47.31%	9.34	29.03		51	49	4.70	77.5	3
Mexico	20.21%	18..95	15.79	10.21	34	34	8.10	29.8	6
Moldova	11.20%	12.52	6.72		26	36	3.80	.	6
Nicaragua	17.71%	.	6.25	5.29	31	29	.	16.3	7
Pakistan	44.68%	.	37.00	16.17	22	27	.	4.8	10
Panama	30.53%	.	22.45		.	38	.	25.9	5
Peru	23.23%	8.65	8.57	9.65	45	38	.	17.5	5
Philippines	51.55%	.	42.42	5.31	36	34	.	17.7	15
Poland	6.67%	9.31	11.11	2.46	42	58	0.60	18.3	4
Portugal	29.67%	.	15.56	2.46	67	63	.	65	3
Romania	4.80%	1.86	1.75	2.46	33	44	1.50	29.7	5
Russia	9.33%	7.30	3.00		24	28	2.60	15.8	7
Singapore	32.63%	.	58.16	0.00	91	87	.	89.9	3
Slovakia	5.47%	.	6.98	2.46	37	46	.	34.9	7
Slovenia	7.20%	12.44	14.40	2.46	60	61	.	51.1	2
Spain	34.00%	6.90	23.00	2.46	66	65	1.60	53	10
Sweden	13.00%	20.80	19.19	2.46	94	88	2.00	93.2	3
Trinidad & Tobago	17.00%	18.36	22.77		.	39	5.10	41	7
Turkey	12.75%	2.70	25.68		36	49	0.30	37.2	6
UK	18.18%	23.70	27.00		86	74	1.10	92.1	6
Ukraine	21.33%	6.94	2.75	2.46	26	26	4.10	9.6	6
Uruguay	16.16%	3.92	18.56	3.23	44	72	1.50	50.5	5
US	47.92%	26.70	43.75	11.15	75	73	1.60	83.7	6
Uzbekistan	26.17%	.	24.11		18	17	.	.	4
Venezuela	18.56%	.	18.37	12.27	26	19	.	12.8	17

Chapter Two:

Lobbying, Bribing, or compliance:
Firm's choice and the effect of industrial factors

Abstract:

Lobbying and bribery are the two main strategies to influence government. This work is one of the few which explains firm's choice between these strategies using both firm-level and industrial characteristics. Our results agree with previous findings in the literature that lobbying is more common among strong firms while bribery is mostly used by small firms. However, contributions of this study refer to two important points neglected in the literature. One is that firms with common interest lobby collectively. Using a two-stage game we found four coalitional equilibria. Firms form a coalition in two steps. At the first step simultaneous collective act of some firms is needed. Large firms play this leading role. The results show that firm's arrival into the coalition positively relates to its size. Then at the second step leaders try to enlarge the coalition. The expansion because of high organizational cost stops before the grand coalition, however, the exact size depends on coalition's membership rule. In an exclusive membership rule the leaders in order to prevent internal conflicts close the coalition to small firms sooner. The other point is the effect of industrial characteristics on prevalence of lobbying and bribery. The results indicate that bribery, compliance and lobbying are more common respectively in small sized, medium sized and large size industries. It is also showed that when a large mass of firms have above-average size, a less positively skewed distribution, the organizational cost is not impeding which leads to larger coalitions and higher prevalence of lobbying.

JEL Classification: D7; C7; L2

Key words: Lobbying; bribing; collective goods; coalition formation games; heterogeneous firms; industrial characteristics

I. Introduction:

All governmental decisions, policies, and regulations have some distributional effects. Economic agents have preferences about outcome of these decisions and thus try to influence them. This purpose may be fulfilled through lobbying or bribing; the two primary methods of rent-seeking. Bribery includes rent-seeking acts directed at rule enforcers while lobbying is directed at rule maker[1]. Hardly one can overstate about their negative consequences. Each year over US$ 1 trillion is paid in bribes worldwide (World Bank); fifteen per cent of all companies in industrialized countries have to pay bribes to win or retain business, this figure stood at 40% and 60% for Asia and former Soviet Union countries, respectively (World Development Report 1997: 36). Politically active organizations [in United States] in 2009 reported $3.47 billion on direct lobbying expenses, controlling for inflation, almost seven times lobbying expenses in 1983 (Drutman 2010: 1).

Unfortunately till now *"these two means of influencing the regulatory environment have either been studied separately or viewed as basically being the same thing"* (Harstad and Svensson 2011: 1). Harstad and Svensson tried to fill up this gap by considering lobbying and bribery as two substitute strategies to influence government. They noticed that while firms with higher level of capital are more powerful in lobbying politicians, they are more vulnerable encountering bureaucrats. Large firms have less bargaining power in bribery. As a result, lobbyists invest more which by giving them higher bargaining power reinforces their lobbying effort. On the other hand, small firms prefer to bribe and to be less defenseless invest less.

These different paths end in two extreme equilibria, in one, firms characterized by high level of capital lobby while, in the other equilibrium, firms fallen in bribery trap suffer from low capital. Harstad and Svensson apply this model to explain why we often observe corruption in poor and lobbying in rich countries; an empirical result confirmed by Campos Giovannoni (2007) using data from OECD countries. '*If one includes developing countries, though, one might obtain a slightly different picture'* (Beckmann & Gerrits 2009: 18). Figure(1) is a three-dimensional plot representing Transparency International's Corruption Perception Index (y-axis) and a lobbying variable (size of bubbles) versus real per capita income in PPP-adjusted US-$ (x-axis) for a larger

[1] Campos and Giovannoni (2007); Harstad and Sevenson (2011).

sample of countries. Lobbying has been measured as percentage of companies which see themselves influential on legislation reported by World Business Environment Survey (2000)[2].

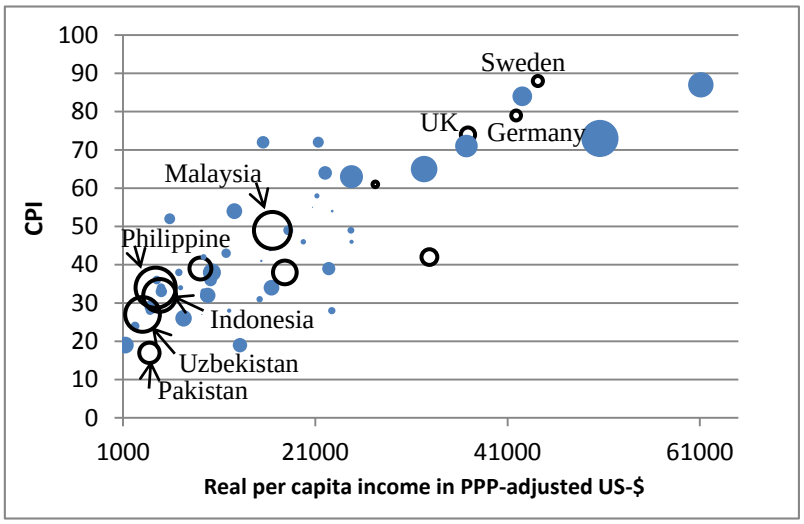

Figure (1): TI index for corruption and lobbying versus per capita income

Two groups of observations are highlighted in the figure. The first group depicted by filled circles is in accordance with the literature. There are some countries which only lobby, big blue circles at the top-right of the figure, and some which have decided to bribe, small circles at the bottom-left. But the second group which is shown by empty circles violates the previous results. This group itself includes two groups of countries. The first group consists of middle income and even some rich countries like Germany and Sweden which do not use any of the two rent-seeking strategies; small empty circles at the top-right. While by previous studies firms in these countries were expected to lobby to influence government, they prefer to obey the rules. The second group contains poor countries in which both lobbying and bribery are very popular, large empty circles at the bottom-left. This is against previous results by which countries were expected to be specialized only in one strategy because lobbying and bribery are substitute.

This shortcoming in the literature partly comes from using only firms' characteristics to explain countrywide differences in lobbying and bribery prevalence while overlooking effects of industrial factors. Industrial factors are very important linkages between firms' behaviour and countrywide

[2] Companies which marked their influence on government legislature above 3 in a range from 1=not applicable to 6=very influential.

differences. Moving one step forward from firms' characteristics to industrial factors, we raise the hypothesis that lobbying is more probable to be observed in sectors characterized by large, reputed, and capital intensive firms but bribery is more often used in industries containing small size firms. This helps to explain the paradoxical fact that the two substitute strategies are used at the same time. In fact since industries of both types exist in every country, it is possible to observe simultaneous application of both lobbying and bribery.

Empirical evidences, Ozer and Lee (2009) or Lenway and Rehbein (1991) for example, show that firms lobby individually when there are rival firm-specific advantages like governmental contracts. In this paper, however, lobbying is considered as collective action with non-excludable non-rival benefits. This restriction helps to focus on cooperative behaviour of firms with common interests. Lobbying is assumed as a contest where rival industries compete for their favourable rules. High contribution cost of participation in the contest and the fact that lobbying benefits are non-excludable make firms to pursue it generally in group. Studying industrial factors besides firm's characteristics elucidates firm's choice from different rent-seeking strategies and may even provide answers to mentioned shortcomings. To achieve this purpose a two-stage normal form game is presented in the following sections. At the first stage, firms simultaneously decide whether to cooperate with each other and make a lobbying coalition or to free-ride. This stage is modelled as a normal endogenous coalition formation game. In case of free riding, at the second stage, firms have two alternative strategies; compliance or bribing. Figure (2) represents the game structure.

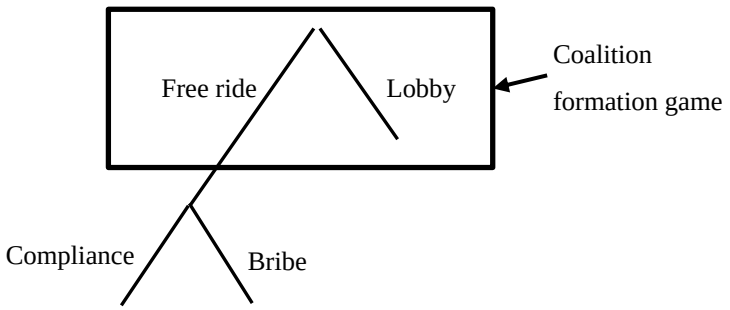

Figure (2): Structure of the game

Section II discusses the game in details. Section III uses this game to denunciate firm's incentive for cooperative. This section beside the firm's size incorporates many other factors of influence on firm's choice between lobbying, bribing, and compliance strategies. Section IV delineates final

coalitional size under different membership rules. The section V is devoted to important but missed in the literature role of industrial characteristics. Section VI concludes.

II. Structure of the game

Suppose there are N firms different in size. Other dissimilarities like capital endowment, employment, and reputation which all are necessary for understanding firms' behaviour are closely connected to firm's production. Thus assume that differences in size represent all other factors. Benefits are distributed in a continuum from zero to one, corresponding respectively to the current and desired rule. Three available strategies are to lobby with the rule-makers in order to replace the current rule with the desired one, to bribe rule-enforcers to be exempted from executing the current rule, or to comply with the current rule. Escaping from the current rule either by bribing or through lobbying brings one payoff for each unit of production, but by compliance firms gain nothing.

Firms through bribing get only a temporary exemption with a price determined in briber-executive bargain. For lobbying the case is different because its benefits, a change in the rule, are long-lasting. Firms to set a favourable rule must contact with the government. The linkage cost is assumed to be fixed. Lobbying may also be viewed as a contest between rival industries. However, since the only interest of this study is to model the cooperative behaviour of common interested firms within the industry, the cost of participation in the contest is also considered fixed. Therefore, linkage cost or participation cost are only different names which will be used interchangeably in this study. The corresponding probability of winning is a function of lobbying strength of the industry measured by the accumulated production of coalition's members[3,4]. Government is considered as a benign neutral player indifferent between rules. Chance of winning is a function of coalition's production which itself embodies all other factors which give firms higher convincing power like capital and labour employment, or reputation. The author is aware of the huge lobbying literature, pressure groups in political economy or "protection for sale" paradigm among trade economists. But this simplifications help to consciously pass by government

[3] This can be placed in Contest-Success-Function (CSF) theme introduced by Tullock (1980).
[4] Again there is no difference if we model lobbying as linking attempt, the accumulated production of the coalition may be considered as its strength in persuasion of the government.

incentives or the political means to influence and instead focus on the participation decision of firms and their cooperative behaviour.

> ***Assumption (1):*** *Bribery helps firms to temporary evade from the rule. The price of this exemption is determined in briber-executive bargain. On the other hand, firms to lobby need to participate in a contest with other rival industries. The corresponding chance of winning depends on the coalition's production.*

Firms at the first stage participate in an endogenous normal coalition formation game. They decide to cooperate for lobbying or to free-ride. In case of free-riding two other strategies are available. Solving the game by backward induction; this section studies firm's choice at the second stage between compliance and bribery. Then, taking the result as fall-back position, next sections model how firms at the first stage of the game cooperate to form lobbying coalition.

What firms get by bribing is a temporary exemption. By assumption, this exemption is valued at one for each unit of production. Firms larger in size benefit more from evasion of execution of the current rule. However, this objective entails some risk. The risk includes implicit costs like legal and social punishments that bribers have to incur in case of detection. Issuing bribes is a serious crime that may result in heavy fines or several years in prison. Beside legal penalties, people or other firms also punish bribers because of their anti-social behaviour. Social punishments are administered in forms of social sanctions or societal disrepute. "*There is every reason to believe that individuals differ appreciably in their perceptions of the severity of punishment."* (Erikson and Gibbs 1979: 4) Hans (1998) and Vidmar (1993) theory of deep pocket in legal penalties indicate that larger firms will be faced larger penalties. Empirical evidences[5] confirm deep pockets argument not only for legal penalties but also for reputation loss. Reputed companies and firms larger in size have much more at stake. Moreover, large firms are visible and thus are exposed to detection[6]. The greater likelihood of detection aggravates the risk of bribery. Therefore the risk of bribery is a positive function of firm's production. Effect of bribers population n^b is also important. The risk decreases as number of bribers nb increases because detection becomes more difficult

[5] Karpoff and Mahajan (2004); Murphy et al. (2009)
[6] "[L]ess visible firms, those better able to avoid public scrutiny, would be likely to face less external control" (Menzer and Nigh 1995: 5).

and, moreover, the perceived severity of informal sanctions or what Braithwaite (1989) referred to as "shame" is less.

> ***Assumption (2):*** *the risk of bribery is lower for small firms and when the society is corrupted.* $R_i(q_i)$; $R_i(0) = 0$, $\frac{\partial R_i}{\partial q_i} > 0$, $\frac{\partial^2 R_i}{\partial {q_i}^2} > 0$ $\frac{\partial R_i}{\partial n^b} < 0$.

Beside the implicit costs which must be incurred in case of detection, bribers have to pay bureaucrats. This bribe payment is the explicit cost of bribery. Public officials have discretionary power in extracting bribes. The bribe payment is the outcome of briber and rule-enforcer bargain. The same as briber, the executives are at risk in case of detection. The rent which executives get from the corrupt deal is equal to the received bribe taking away the costs which should be incurred in case of detection i.e. $(B_i - R_e)$. The risk consists of probability of detection and the punishment. Nash bargaining solution is the bribe payment maximizing the Nash product.

$$Max_{B_i} w = (q_i - R_i - B_i)^{1-\alpha}(B_i - R_e)^{\alpha}.$$

Where α is the bargaining power of executive. The fall-back positions are zero because the firm is assumed to get nothing in case of failure in bargaining which is compliance. Solving the above maximization, the Nash bargaining solution is $B_i = \alpha q_i + (1-\alpha)R_e - \alpha R_i$. Bribe payment increases as firms are larger. This is in accordance with queuing (Lui, 1985), and endogenous harassment (Myrdal, 1968) theories, and is confirmed empirically by Kaufmann and Wei (2000), Svensson (2003), and Bennedsen et al. (2009).

Putting these together, payoff of the bribing strategy, shown in formula (10), resembles a reverse U function of firm's production. The negative second derivative shows that as long as the risk of bribery is low bribers marginally benefit from larger size. This means that for small firms implicit costs are negligible, and therefore the exemption is valued more as firms produce more; $\frac{\partial \pi^B}{\partial q_i} > 0$. As the large size embodies in more probable and more severe punishment, very soon the bribing strategy becomes unprofitable. As shown in figure (3), the point q_m is the optimum level of production that maximizes the briber's payoff. Since lower production is not optimal, this point is taken as the minimum size of firms. The bribing strategy dominates the compliance up to the point q^*. At this point firms are indifferent to bribe executives or passively comply with the rules. As the firms become larger the bribe payment grows. The implicit costs of illegal acts also increase

when firms are larger in size, have higher level of capital, or are reputed. Thus, large firms decide to obey the rules.

$$(1)\ \ \pi^B = (1-\alpha)q_i - (1-\alpha)(R_e + R_i)$$

$$\frac{\partial \pi^B}{\partial q_i} = (1-\alpha)\left[1 - \frac{\partial R_i}{\partial q_i}\right], \qquad \frac{\partial^2 \pi^B}{\partial {q_i}^2} = -(1-\alpha)\frac{\partial^2 R_i}{\partial {q_i}^2} < 0$$

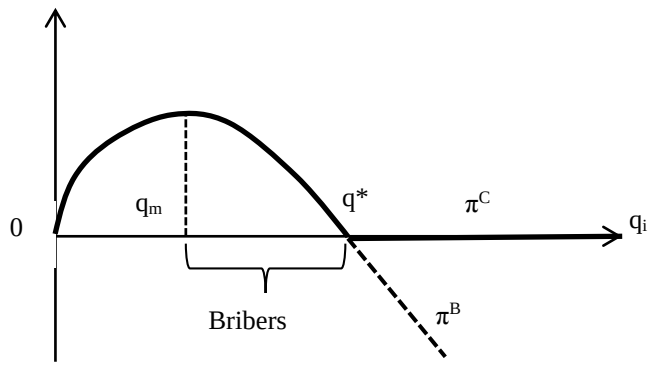

Figure (3): the expected payoff of bribing and compliance strategies

The main result is that weak and small firms use the bribing strategy to bend the current rule but as firms become larger the explicit and implicit costs of bribery increase such that for production levels higher than q^* the compliance strategy becomes dominant. Higher prevalence of corruption decreases the implicit costs of bribery thorough lower probability of detection, or making the punishments non-deterrent. This shifts the threshold to the right so that even larger firms with high reputation may be prone to commit the bribe.

Proposition (1): *small firms bribe to bend the rules but large firms comply with the rules.*

Notice that this proposition is driven from a simple bargaining model based on theoretical and empirical results of other studies embodied in the assumptions. Nevertheless this proposition very well models the fall-back position of firms in the macro game presented before. It is now clear that in case of refusing to cooperate with other firms at the first stage of coalition formation game, weak firms have a profitable alternative which is the bribing strategy but large firms have no other option except complying with the current rule. Figure (4) illustrates the reduced game after solving

the second stage by backward induction. The following paragraphs concentrate on the first stage of the game where firms decide about their collective action.

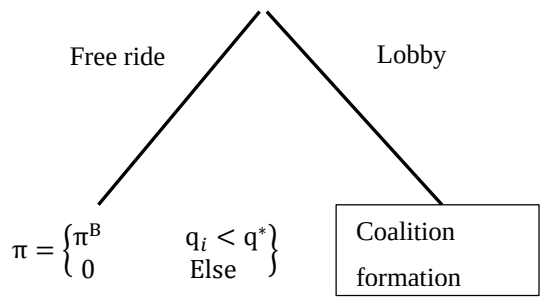

Figure (4): the reduced form of the macro-game

Cartels or lobbing coalitions are two of many examples of cooperation between firms. Cooperative Game Models (CGM) was previously used commonly to model cooperative behaviour. Cooperative games assume a certain coalition, usually the grand one including all players, then using Characteristic Function assign a value to the coalition and, finally, study solutions of the game i.e. distribution of value so that the coalition remains stable.

There are two main drawbacks in these models. The first problem refers to characteristic function *"which by its very construction assumes away the interesting strategic interactions"* (Ray and Vohra 1999: 2). The α-characteristic function is the highest payoff that a group of players can secure regardless of external players' reaction; a min-max optimization. The value of coalition depends only on acts of members inside the coalition. Other words, the "characteristic functions (in either the TU or NTU version) cannot adequately describe environments in which there are significant externalities across coalitions" (Bloch and Dutta 2010: 4)[7]. Games in partition function form can be used to resolve this problem and to introduce competition among coalitions. A partition of N players is a set $\varphi = \{C_1, C_2, \dots, C_m\}$ where m is the number of coalitions such that $C_i \cap C_j \neq 0$, $\cup_i^m C_i = N$. In this framework value of coalition not only depends on internal members, but also on structure of other coalitions. Denoting by Φ the set of all feasible coalition structures, a partition function $W: \Phi \rightarrow R$ maps a vector $\Re^{|\varphi|}$ of worth to all coalitions in φ.

[7] See Bloch (1997), and Finus & Rudshagen (2003a).

The second problem is that in CGM or even in partition function forms, coalitions are determined exogenously. To analyse emergence of coalitions a two stage endogenous coalition formation game is usually used where coalition is determined as the outcome of non-cooperative or strategic behaviour of players. At the first stage players non-cooperatively decide whether to join the coalition or not. After the coalition structure formed, the players inside coalition set their strategies so to maximize the coalition's payoff. Bloch (1997) and Yi (1997) showed that assuming a unique Nash equilibrium for the second stage, the game can be reduced to a partition function game. This way, to study formation and stability of coalition, it would be enough to focus only on the first stage where players decide whether or not to enter the coalition.

Uniqueness of Nash equilibrium at the second stage requires a payoff distribution among coalition members so that the coalition remains stable. In the literature the worth of the coalition usually is assumed to be distributed according to either Nash bargaining solution or Shapley value[8]. Since the benefits of lobbying are non-rival the cooperators only need to agree ex-ante on their cost-shares of lobbying. Three possible scenarios for costs division are paying larger, equal, or smaller share for higher levels of production. Small firms argue that according to a fair sharing rule large-size firms gain more from lobbying and thus they have to pay more. Large firms, on the other hand, reason that they contribute more in the coalition success i.e. probability of winning and thus, according to Shapley-Value, they must receive their marginal contribution. This means that large firms reject to pay larger shares. Since large firms have the upper hand[9], it seems reasonable to assume that an equal sharing rule would be applied[10]. Fixing the cost sharing rule helps to focus only on the first stage of the game which is a per-member partition function game $w: \Phi \rightarrow R^N$. Players inside the coalition act cooperatively while the coalitions and singletons play strategically. It is also assumed that only one coalition takes place and all non-members are singletons; an assumption which is true especially in lobbying.

[8] The examples from climate change literature are Botteon and Carraro (1997, 1998) for Nash bargaining and Barrett (1997), Botteon and Carraro (1997, 1998) for Shapley value.

[9] It is similar to a kind of oligarchic leadership by which the elites create and rule the coalition according to their own interest. See Ansell (2007: 499).

[10] Although the empirical and theoretical results have shown that firms' contributions on lobbying expenditures positively depend on their size, note that in those models lobbying expenses had a direct effect on the winning chance. But in the model proposed here the effect of firms' size on the lobbying success is separated from the fixed lobbying cost of connecting to government.

***Assumption (3)**: At the second stage of the game, the members of the coalition in a unique solution according to Shapley Value divide the costs equally i.e. $C_i = \frac{C}{n^I}$. The parameter C is the participation cost of lobbying contest and n^I is the number of cooperators.*

$$\begin{cases} Internal\ stability & \pi^I(n^I) \geq \pi^O(n^I - 1) \\ External\ stability & \pi^I(n^I + 1) \leq \pi^O(n^I) \end{cases}$$

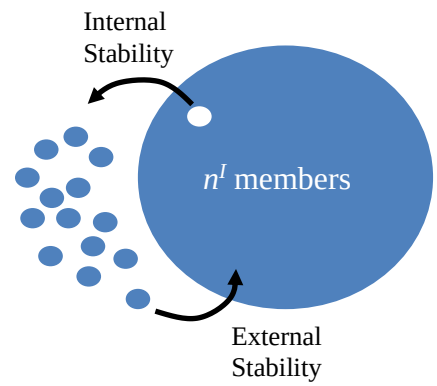

Figure (5): Internal and external stability concepts of coalitional equilibrium

The analysis of participation game contains discussions about the existence and stability of coalitional equilibria. Profitability is the necessary condition for coalition formation. It means that each member inside the coalition gets a higher payoff from a coalition of size $n^{I,min}$ than zero-coalition; $\pi^I(n^{I,min}) \geq \pi^O(0)$. The payoff of insiders and outsiders are represented by π^I and π^O respectively, and $n^{I,min}$ is the minimum coalitional size equality holds. Smaller coalitions do not form because no one benefits from. For a set of N players $\{1, 2, \ldots, n^I\text{-}1, n^I, n^I + 1, \ldots, N\}$, a coalition is internally stable when members inside the coalition have no incentive to deviate. In contrast external stability means there is no extra payoff for outsiders to join the coalition. A coalition satisfying these two conditions is stable. The *Stability Function* (Carraro and Siniscalco 1992) is useful to determine the Nash equilibrium size of the coalition.

$$L(n^I) = \pi^I(n^I) - \pi^O(n^I - 1)$$

When positive, singletons have incentives to join the coalition. When negative, there is an incentive to free-ride. The coalition is stable if and only if the stability function is zero. Using this function in the next section after writing down outsiders' and insiders' payoff, firms' incentives for cooperation and the controlling factor would be determined.

III. Coalition formation: firm's incentive to cooperate

First step to understand the process of coalition formation is to delineate benefits and motivations of cooperation. For two main reasons firms accumulate their efforts and pursue the lobbying in coalition. The first reason refers to group advantages. One of these advantages is what firms save on the lobbying costs by sharing them between group members. To influence government firms have to compete with other rival industries. The fix linkage cost which is usually high encourages the common interested firms to share it. A plausible cost-sharing mechanism is to divide the cost equally between cooperators. This cost-sharing rule which was discussed by the assumption (3).

Another advantage of group work is to avail from higher probability of winning in the lobbying contest. Probability of winning depends on the strength of the coalition relative to rival industries. Based on the assumption (2), the coalition's strength is the accumulation of firms' production multiplied by constant ψ indicating synergy or necessity of cooperation[11]. Assuming a concave probability function[12], the chance of winning is positively but in a marginally decreasing manner related to the coalition's production; $P = p(\psi Q),\ p' > 0\ , p'' < 0$. Greater chance of winning embodies in higher expected payoff for lobbying. Lobbying benefits are long lasting. The probability that after success the new rule changes again in next periods by other competing industries is $p(Competing\ industries) = 1 - p(\psi Q)$. Discounting future benefits by δ, lobbying benefits depend on the firm's individual production and the coalition's lobbying power.

$$A_i = p(\psi Q) \times q_i + \delta\, p(\psi Q) \times q_i + \cdots + \delta^t\, p(\psi Q) \times q_i \ \ => \ A_i = \frac{q_i p(\psi Q)}{1-\delta}$$

Second reason behind coalition formation attributes to particular characteristics of all collective goods i.e. non-exclusion and non-rivalry. All firms benefit from a change in the rule either they have cooperated or free-ridded. Firms pursue lobbying in group to protect themselves from exploitation. Coalition formation, however, is limited to the degree of similarity between interests. Intragroup conflicts make coalition idle and unstable. Therefore, at an important step of coalition

[11] The accumulation of individuals lobbying power might not be additive. A simple way of modeling is to separate the functional effects from individuals strength summation. Thus ψ represents the possible non-linearity existed in lobbying powers accumulation.

12 One example of increasing concave probability function is $P = \frac{Q}{Q+Q^C}$ where Q and QC are the lobbying power of the coalition and competent industries respectively.

formation, firms need to harmonize their interests. Interests' reconciliation entails some costs known in the literature as organizational or administrative costs of pact making. Suppose that organization requires linking between all group members and, in addition, assume that linkage cost is a function of conflicts or payoff differences inside the coalition. Organization is more difficult and more costly in case of conflicting interests. Conflicts originate from payoff differences. Thus measuring payoff distribution helps to estimate conflict within coalition. The payoff differences come from firms' differences in size because as it was assumed firms benefit from a change in the rule according to their production.

Assumption (4): *linkage cost between firms i and j is a function of their payoff differences caused by firms' dissimilarity in production. Firm i's administrative cost is the sum of costs of linking to other group mates.*

$$AC_i = \sum_{j=1, j\neq i}^{n^I} (q_i - q_j)^2 = \sum_{j=1, j\neq i}^{n^I} (q_i - \bar{q} + \bar{q} - q_j)^2 = n^I (q_i - \bar{q})^2 + n^I \sigma^2 = n^I \, \overline{AC}_i$$

Where parameters $\bar{q}$, and σ^2 represent the mean and the variance of size distribution inside the coalition. The difference between the two firms' production is squared because the linkage costs need to be positive. The organizational cost is a function of the coalition's size and the variance of production distribution. As the coalition is larger or the players are more heterogeneous, the organization is more costly. Putting these all together, the total payoff of lobbying is:

$$\pi^I = A_i - (AC_i + C_i) = \frac{q_i p(\psi Q)}{1-\delta} - \frac{C}{n^I} - n^I (q_i - \bar{q})^2 - n^I \sigma^2$$

Numerous parameters affect the lobbying payoff. The expected benefit depends positively on the group production. Stronger synergy and higher weight of future benefits also increase the payoff. Higher participation cost and internal conflicts, on the other hand, make lobbying less profitable. The effect of coalitional size on insiders' payoff, however, needs to be clarified.

$$\frac{\partial \pi^I}{\partial n^I} = \frac{\partial A_i}{\partial n^I} - \frac{\partial C_i}{\partial n^I} - \frac{\partial AC_i}{\partial n^I}, \qquad where \ \frac{\partial A_i}{\partial n^I} = \frac{\psi q_i p'}{1-\delta}\left(\frac{\partial Q}{\partial n^I}\right) > 0, \frac{\partial C_i}{\partial n^I} = -\frac{C}{{n^I}^2} < 0, \frac{\partial AC_i}{\partial n^I} > 0$$

An increase in size of the coalition affects insiders' payoff in three ways. At first, new members make the coalition stronger, increase the chance of winning and, as a result, bring more benefits.

Larger coalition also means that fixed cost of lobbying contest is shared among more firms and, thus, coalition members pay lower participation costs. The third effect which is negative comes from the administrative costs. Organization of larger coalitions is more costly. As long as the positive effect of the first two factors is greater than the negative effect of administrative cost, firms benefit from a larger coalitional size. In other words, the marginal payoff is the trade-off between the lobbying power of new members and consistency of their interests with coalitions'. Both effects are contingent upon the size of new members. This means that campaign members if possible may apply an exclusive membership rule[13] to dismiss small firms.

Next step is to identify what firms get by free-riding. Free-riders staying out of the coalition have two alternative strategies, bribing or compliance, which were discussed previously. Free riders, in addition to the payoff of these alternative strategies, enjoy from lobbying effort of the coalition. The reason is non-excludability of lobbying benefits. In case of success in lobbying not only coalition's members but also outsiders benefit. Free-riders' payoff is $\pi_i{}^O = Z_i + A_i$ where Z_i represents the payoff of alternative options. Using insiders and outsiders payoff, the stability function which was previously introduced becomes as follow. This function indicating the incentive for cooperation is the difference between payoffs of insiders and free-riders.

$$\begin{cases} \pi^I(n^I) = \dfrac{q_i p\left(\psi \sum_{j=1}^{n^I-1} q_j + \psi q_i\right)}{1-\delta} - AC_i - \dfrac{C}{n^I} \\ \pi^O(n^I - 1) = Z_i + \dfrac{q_i p\left(\psi \sum_{j=1}^{n^I-1} q_j\right)}{1-\delta} \end{cases}$$

$$(2) \qquad L(n^I)_i = \pi^I(n^I) - \pi^O(n^I - 1) \;\; => L(n^I)_i = \frac{p' \times \psi {q_i}^2}{(1-\delta)} - Z_i - AC_i - \frac{C}{n^I}$$

All the parameters which have a positive effect on lobbying payoff, consequentially, increase incentive for cooperation. Yet, two unexplored points exist. How does the incentive for cooperation changes by firms' characteristics or by the action of other firms? Answering this question needs a more detailed argument about the impacts of coalitional size and firm's characteristics i.e. production on the stability function.

[13] Different membership rules and their impact on the size of the coalition will be discussed in the next section

$$\frac{\partial L(n^I)_i}{\partial n^I} = \frac{\psi {q_i}^2}{(1-\delta)}\left(\frac{\partial^2 p}{\partial Q \times \partial n^I}\right) - \frac{\partial AC_i}{\partial n^I} + \frac{C}{{n^I}^2}$$

A larger size reinforces incentive for cooperation because individual shares of participation cost become smaller as the coalition enlarges. But there are other factors weakening this positive reinforcement. Marginal changes in the winning probability resulted from larger coalitional size is the first one. Since the probability is a concave function with negative second derivative, marginal increase in coalition's strength is less valuable for large groups; $\left(\frac{\partial p^2}{\partial Q \times \partial n^I}\right) = p'' \times \frac{\partial Q}{\partial n^I} < 0$. In other words, the firm marks cooperation of itself less useful when the coalition is already large and powerful. Joining the coalition is more effective when the coalition is weak and small. The second counterproductive factor is the increase in organizational cost as the coalition enlarges. Organization of large groups is more costly and more difficult because firms must align their interests with more firms. Figure (6) and proposition (2) abstract the final effect.

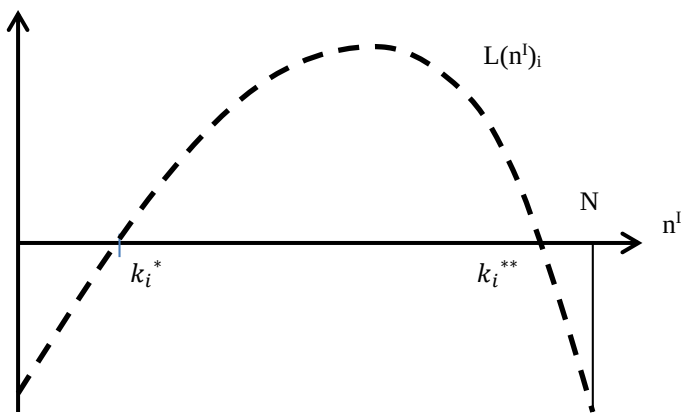

Figure (6): Stability function and four coalitional equilibria

Proposition (2): *Contingent to firms' characteristics, there might be two, three or four possible equilibria for the size of the coalition.*

Proof: *The second derivative of stability function is negative. Therefore, depending on firms' characteristics this function may not cut the horizontal axis or have one or, at most, two intersection points. Including the "Zero-Coalition" and the "Grand-Coalition", number of equilibria ranges from two to four. Details are presented in attachment (1).*

As stated in the attachment (1), the cases with two or three equilibria correspond to firms with extreme size which either never or always at every coalitional size benefit from cooperative lobbying. For a general discussion, however, let's focus on the usual case where firms' incentive for cooperation depends on other firms' willingness to cooperate. This general case consists of four equilibria. The first equilibrium is the "zero-coalition". High participation cost especially if other firms do not contribute to share, makes this equilibrium stable. Higher payoff of alternative options z_i, higher participation cost C_i and finally lower benefits of lobbying make basin of attraction of zero-coalition larger. This means that coalition is less profitable and its formation depends on the cooperation of more firms as the leaders. Other factors like lower weight of future payoffs δ, and lower synergy ψ also stabilize the zero-coalition.

Since Zero-coalition is not profitable, any lobbying effort without the cooperation of other firms will fail. As more firms decide to cooperate, the incentive for cooperation increases because individual shares of costs become smaller while, on the other hand, the negative effects of coalitional size are tiny. A jump in the winning probability is still possible and the organization is not a problem yet. Only coalitions larger than k_i^*, the minimum size of the coalition, are possible to form. At lower coalitional sizes the cooperation incentive is negative.

Notice that the minimum size is subjective and depends on firms' characteristics. Cooperation of firm is contingent to the presence of a certain number of other firms in the coalition. The minimum size for some firms is very high. These firms join the coalition only if it is large enough. The pioneers or the leaders of coalition formation are the firms with lowest k_i^*. When the incentive for cooperation is negative, only a simultaneous collective act of these firms helps the industry to leave the zero-coalition. The incentive for cooperation function at Zero-Coalition neighbourhood reveals that these leaders are indeed large-size firms which highly benefit from lobbying. Large firms with high lobbying power consider themselves crucial for lobbying success and capable of changing the rule. Moreover, they lose the most in case of cooperation failure because they are prone and vulnerable to alternative strategies like bribing. They do not wait for cooperation of small and medium-size firms for two reasons. First, smaller firms have severe constraints for joining the coalition i.e. higher minimum size of the coalition k_i^*. And secondly, even in case of cooperation, contributions of small and medium-size firms in lobbying success are negligible.

Proposition (3): *Large-size firms which are constrained with lower minimum size are the leaders of coalition formation.*

Proof: *The incentive for cooperation at Zero-Coalition neighborhood is positively related to firms' production.*

$$L(n^I)_i = \frac{p'\psi {q_i}^2}{(1-\delta)} - Z_i - \frac{C}{n^I} \quad => \quad \frac{\partial L(0)_i}{\partial q_i} = \frac{2p'q_i}{(1-\delta)} - \frac{\partial Z_i}{\partial q_i} > 0$$

How many leaders are required so that a coalition with the smallest size forms? If individual lobbying is not profitable, when the participation cost is very high for example, k_i^* is greater than one even for the large firms. Firms have to cooperate with each other and share the costs. At this stage free-riding is not very problematic for two reasons. Firstly because the range is limited to cooperation of only large firms which are few in each industry. Secondly, the large or leading firms know that without their cooperation the coalition will not form and by their deviation it will be taken apart. In other words, the first step of coalition formation should be taken unanimously. The unique condition is that coalitional members, the leaders, get a positive benefit from cooperation.

Suppose firms are ordered from the largest q_N to the smallest q_1 according to their size. In the formula below, constraints grouped in bracket require positive payoffs for all leaders. The coalition must be profitable. Indicating the set of profitable coalitions by $\Omega = \left\{ n^I \middle| \frac{Qp(\psi Q)}{(1-\delta)} - C \geq 0 \right\}$, the coalition $n^{I,Min}$ is the smallest profitable coalition which only consists of leaders. The firm standing at the threshold, shown by q**, is indifferent.

$$\begin{Bmatrix} {\pi_N}^I \geq 0 \;\; => \; \frac{q_N p(\psi Q_{min})}{(1-\delta)} - \frac{C}{n^{I,Min}} \geq 0 \\ {\pi_{N-1}}^I \geq 0 \;\; => \; \frac{q_{N-1} p(\psi Q_{min})}{(1-\delta)} - \frac{C}{n^{I,Min}} \geq 0 \end{Bmatrix} => \frac{Q_{min} p(\psi Q_{min})}{(1-\delta)} - C \geq 0$$

$$\cdots$$

$$\pi^{**I} = 0 \;\; => \; \frac{q^{**} p(\psi Q_{min})}{(1-\delta)} - \frac{C}{n^{I,Min}} = 0 \quad => \quad q^{**} = \frac{C(1-\delta)}{n^{I,Min} p(\psi Q_{min})}$$

Higher lobbying participation cost, lower probability of winning, and smaller synergy increase q** and thus limit the range of leaders to very large and strong firm as it is shown in figure (7).

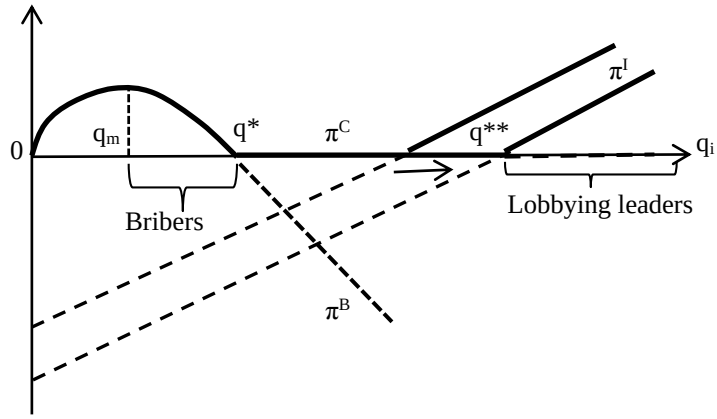

Figure (7): characteristics of lobbying leaders, followers, compliers and bribers

The process of coalition formation is easier when individual lobbying is possible either because there is an extremely large firm with positive incentive for cooperation at every coalitional size or because participation cost is not impeding. The unique leader lobby and other firms sequentially join the group. The second coalitional equilibrium including only leaders, as shown in the figure (6), is not stable because they can benefit from lower individual shares of lobbying costs as coalition enlarges. This intensifies the incentive for cooperation and encourages leaders to attract new members. However, it does not take much time that organization becomes a problem. The two negative effects of coalitional size, concavity of winning probability function and organizational costs, stop the coalition from expansion. At point k_i^{**} the benefit of attracting new members will be totally traded off by high organizational costs. Again this threshold is subjective. Firms with lower k_i^{**} exit the coalition sooner. Proposition (4) by looking at the incentive for cooperation function around the Grand-Coalition, concludes that medium-size firms have the largest k_i^{**}. Medium-size firms are able to coordinate with others easily.

Proposition (4): *large- and small firms exit the coalition earlier than medium-size firms.*

Proof: *Around the Grand-Coalition, the first derivative of incentive for cooperation relative to production is negative for large but positive for small firms. Large and small firms at this neighbourhood have lower cooperation incentives and thus smaller* k_i^{**}.

$$L(N)_i = \frac{p'\psi {q_i}^2}{(1-\delta)} - Z_i - N(q_i - \bar{q})^2 - N\sigma^2 - \frac{C}{N}$$

$$\begin{cases} q_i > \bar{q} \;\; => \;\; \dfrac{\partial L(N)_i}{\partial q_i} = \dfrac{2p'\psi q_i}{(1-\delta)} - \dfrac{\partial Z_i}{\partial q_i} - 2N(q_i - \bar{q}) < 0 \\ q_i < \bar{q} \;\; => \;\; \dfrac{\partial L(N)_i}{\partial q_i} = \dfrac{2p'\psi q_i}{(1-\delta)} - \dfrac{\partial Z_i}{\partial q_i} - 2N(q_i - \bar{q}) > 0 \end{cases}$$

The reason is that at the Grand-Coalition neighbourhood, the administrative costs of pact making are prominent. Organization is more costly for firms with extreme sizes, large or small, because they have major conflicting interests. In other words, the maximum coalitional size, k_i^{**}, shows the maximum number of group mates that firms tolerate.

IV. Size of the coalition

In the last section, the analysis of firm's incentive for cooperation revealed that coalitions form in two steps. At the first step, since zero-coalition is stable, a unanimous collective action of large firms known as leaders is required. Then, at the second step, the coalition grows as the potential benefits of cost sharing intensify firms' incentive for cooperation. Corollary (1) represented below summarizes the previous results of propositions (3) and (4).

Corollary (1):

- *Large firms enter and exit the coalition sooner than others*
- *Medium-size firms enter the coalition late but they stay inside and cooperate when coalition enlarges.*
- *Small firms enter the coalition very late and exit quite soon. The range of coalitional sizes which include these small firms is narrow.*

The final size of the coalition depends, aside from firms' cooperation incentive, on membership rules of the coalition. According to Finus and Rundshagen (2003b) the three main membership rules are the unanimous, the open and the exclusive membership. According to unanimous membership rule, coalition will form if and only if all members unanimously agree to cooperate. In other words, deviation of one player makes other members to deviate after and the whole coalition will collapse. The zero-coalition and the grand-coalition are the two equilibria which can be contemplated based on unanimous membership rule. The zero-coalition, however, is more probable if the players are numerous and heterogeneous. Unanimous membership is plausible

when the cooperation candidates are few and approximately similar; just like the first step of coalition formation where a unanimous collective action of large firms was required.

In open membership players are free to enter and deviate from the coalition. After coalition has been formed more firms are willing to cooperate. The leaders welcome these new arrivals because participation of them means lower individual share of costs. As the coalition keeps growing, however, organizational problem appears. The potential benefits of large coalition will be vanished soon especially for large firms which are less lenient in tolerating within group conflicts. The threshold $k_N{}^{**}$ which belongs to the largest firm is the lowest $k_i{}^{**}$ and the largest coalitional size based on open membership rule. No new arrival will happen after this threshold because neither insiders nor outsiders benefit from replacing the largest firm with a weak one.

> ***Proposition (5):*** *the maximum number of firms which the largest firm may tolerate inside the coalition i.e.* $k_N{}^{**}$ *is the maximum coalitional size in open membership.*
>
> ***Proof:*** *no firm has the incentive to cooperate if its arrival ends in deviation of the largest firm;* $L(n^I)_i = \frac{q_i\, p' \times \psi(q_i - q_N)}{(1-\delta)} - Z_i - AC_i - \frac{C}{n^I} \leq 0$

The maximum size of the coalition derived from the incentive for cooperation function of the largest firm is reported below, and, as it was expected the most influential factor is the organizational cost. Higher the administrative cost, lower the maximum coalitional size. Other factors in favour of lobbying like higher synergy or lower participation cost, enlarge the coalition.

$$L(k_N{}^{**})_N = \frac{p'\psi q_N{}^2}{(1-\delta)} - Z_N - AC_N - \frac{C}{k_N{}^{**}} = [-\overline{AC}_N]\, k_N{}^{**2} + \left[\frac{p'\psi q_N{}^2}{(1-\delta)}\right] k_N{}^{**} - C = 0$$

$$\Delta = \left(\frac{p'\psi q_N{}^2}{1-\delta}\right)^2 - 4C\overline{AC}_N \;, \qquad k_N{}^{**} = \frac{\left(\frac{p'\psi q_N{}^2}{1-\delta}\right) + \sqrt{\Delta}}{2\overline{AC}_N}$$

Large firms deviate from any coalition larger than this maximum size. At this point the benefit of cooperation will be lost such that the leaders become indifferent between staying inside or outside of the coalition. If the leaders had some power in group, however, it would be plausible to assume that restricted membership rule be set. Max Weber (1918, 1925) by the theory of bureaucracy, Michels (1911) by his famous idea of “iron law of oligarchy”, and empirical evidences reported in

Barnett (2013) verify the existence of such power. Oligarchic leadership eventually distorts group aims because the elites soon create a paid bureaucracy to sustain their leadership. The leaders will not let small firms to idle the coalition by aggravating internal conflicts. Leaders using an exclusive membership rule select the best cooperators. Leaders after forming the coalition will not send invitation to all firms. They restrict the coalition's membership as a mean to maximize their payoff. Targeting the desired level of strength Q_{max}, the leaders by minimizing the coalitional size avoid the cost of building extra links. In fact, by permutation of members, various coalitions may exist with strength equal to the desired level but the smallest coalition is preferable. This means that the leaders select larger firms. Leaders accept new memberships only if the firms were large enough to make the coalition stronger and, moreover, their arrivals do not lead to bitter conflict or radical differences within the group. Function $L^{\circ}(C)_i$ represents the desire of leaders to enlarge the coalition.

$$L^{\circ}(n^I)_i = \pi_i{}^I(n^I+1) - \pi_i{}^I(n^I) \ = \frac{q_i p' \psi q_{new}}{(1-\delta)} + \frac{C}{n^I(n^I+1)} - (q_i - q_{new})^2$$

$$\frac{\partial L^{\circ}(n^I)_i}{\partial n^I} = \frac{q_i p' \psi}{(1-\delta)} \frac{\partial q_{new}}{\partial n^I} - \frac{C(2n^I+1)}{n^I{}^2(n^I+1)^2} + 2(q_i - q_{new}) \frac{\partial q_{new}}{\partial n^I} < 0$$

According to exclusive membership rule the coalition grows as long as the leaders gain from new members. New members affect leaders' payoff through making the coalition stronger, reducing cost shares, and raising organizational problems. Since by proposition (3) firms entering the coalition with a delay are smaller in size i.e. $\frac{\partial q_{new}}{\partial n^I} < 0$ and, in addition, the probability function is concave, the first effect recedes as coalition grows. In other words, cooperation of outsiders is not useful when coalition is large and strong. For large coalition the second effect also is negligible because when cooperators are numerous, new members' contributions in lobbying costs are trifle and less alluring. Adding to these the organizational problem rising after small firms arrival, it can be concluded that leaders desire to enlarge the coalition diminishes gradually. At some point the leaders start rejecting new members.

Again this point is subjective and depends on the size of the leading firms. Since sealing the coalition off from small firms is the purpose of exclusive membership, larger firms are considered as the first ones which stand against new firms. This implies that again the desire for coalition

expansion of the largest firm N determines the maximum size $n^{I,max}$of the coalition. Proposition (6) shows that the maximum coalitional size is smaller when the leaders apply an exclusive membership rather than an open membership rule.

> ***Proposition (6):*** *the maximum coalitional size is equal or smaller by exclusive membership than open membership rule.*
>
> ***Proof:*** *At maximum coalitional size corresponding to exclusive membership rule, the largest firm q_N though has no desire to enlarge the coalition is far from deviation from the coalition because of overcrowding. Since at $n^{I,max}$ the largest firm has a positive incentive for cooperation, it is concluded that $n^{I,max} < k_N^{**}$. Attachment (2) provides some details.*

According to both membership rules, at the second step of coalition formation, only few firms which are of medium-size join the coalition. This new members are not big enough to proactively form and lead a coalition and are not very small to benefit from alternative strategies. These followers are the firms which passively comply from the rules in case of lobbying failure. They wait for leaders to form the coalition simply because they have a higher minimum size of coalition warranted to cooperate. Figure (8) provides an adequate explanation for firms' cooperative behaviour and their choice between lobbying, bribing, and compliance. Size of the firm q_i is one of the crucial factors for determining firm's behaviour. Proposition (3) showed that large firms have more incentive to lobby. These beneficiary firms which see themselves capable of changing the rule proactively cooperate with other large firms to form and lead a coalition. The benefits of cooperation, having stronger coalition or enjoying from lower cost shares, accelerates the coalition growth. The main difference between leaders and followers is that the coalition breaks apart by deviation of leaders but hold out against followers' defect. As the coalition becomes larger internal conflicts annihilate these benefits. Cautious and powerful leaders may exclude small firms through a bureaucratic mechanism. The small firms remained out of the coalition beside free-riding on lobbying effort of coalition, have two alternative strategies. Some of them passively comply with the rules but the smaller ones bribe inspectors to insure themselves against lobbying failure.

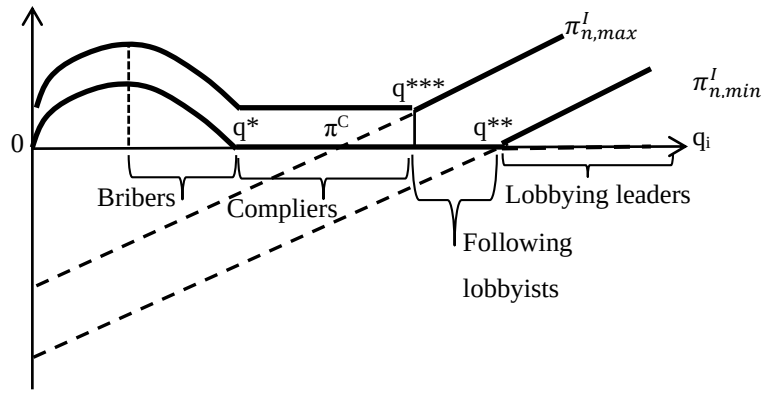

Figure (8): characteristics of lobbying leaders, followers, compliers and bribers

This research, which can be placed among the few studies examining this subject, presents a unique model focusing on firms' incentive to cooperate and endogenous coalition formation process. This model incorporating many social factors besides firm's size yield a better understanding of firm's behaviour. Organizational problem was another distinctive feature of this section. It was shown that leaders if have the warranted power will restrict coalition's membership in order to prevent internal conflicts. Some degree of conflict between common interest firms is veritable but missed in literature. Next section moves forward from analysis of firm level to industrial characteristics. It deliberates about the effect of industrial characteristics on the prevalence of lobbying, bribery, and compliance strategies.

V. Industrial characteristics and firm's optimal strategy

Previous section was devoted to investigate impacts of firms' characteristics on their rent-seeking behaviour. Cultural and social parameters were used to incorporate social aspects of the lobbying and the bribing strategies but, yet, this one-dimensional focus does not help to fully understand firms' decisions. This section analysing the impact of industrial factors takes another step which is important but, unfortunately, overlooked in the literature. Industrial characteristics describe consistency between firm's interests and their expectations about other firms' cooperation. According to Axtell (2001) and Helpman et al. (2004) distribution of firm size conforms approximately to a Pareto distribution, $q_i \sim Pareto(q_{min}, \alpha)$ where q_{min} is the minimum size of the firms, and α is the exponential part. By definition Pareto distribution represents probability that $q_i \in [q_{min}, \infty]$ is greater than the minimum size. It is also known as survival or tail function. The

prevalence of the bribing, the compliance, and the lobbying strategies is shown in figure (9). Density function shows that how probable is to observe a firm with a certain size. Bribers are the small firms $q_i \leq q^*$. Lobbyists, the extremely large leading firms and the followers, are larger than the crucial threshold q^{***}. Compliance is more common among medium-size firms. To conjecture about the significance of industrial characteristics, this section studies the effects of the minimum production, q_{min}, and the tail index, α, on firm's behaviour.

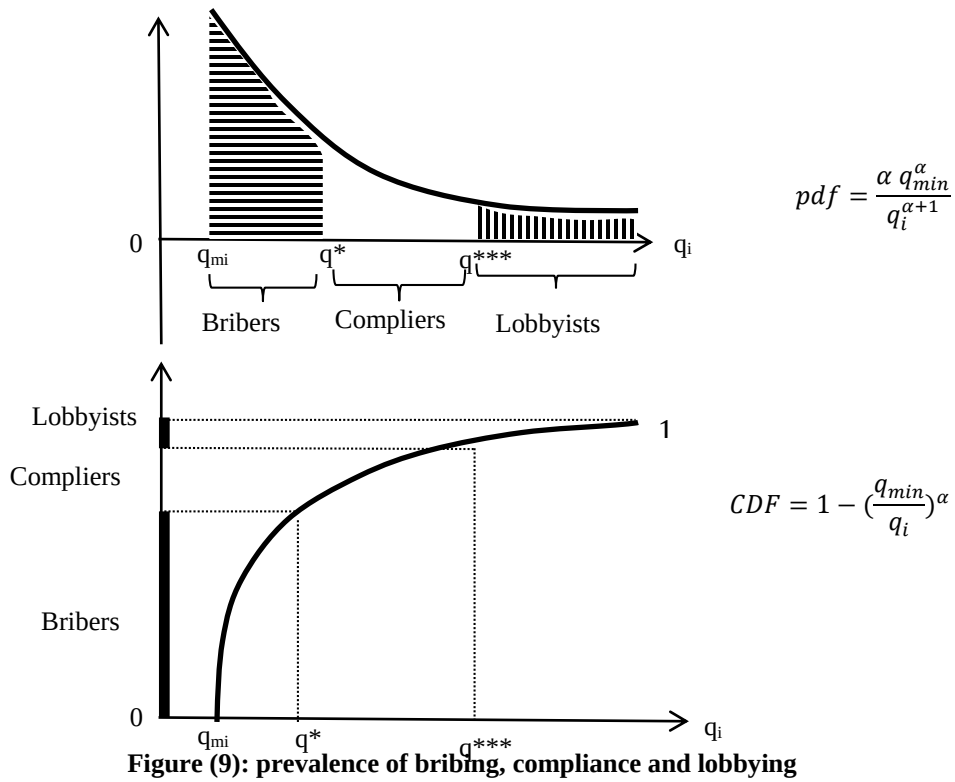

Figure (9): prevalence of bribing, compliance and lobbying

There are two mechanisms of effect. Distributional factors change the likelihood of observing firms with certain size and, then, have an impact on prevalence of different strategies. For example lobbying is more prevalent in industries with a thick tail simply because it is more probable to see firms with large size. This mechanism is in fact an extension of results from firms' level to the industry. The second mechanism takes place through movements of the critical thresholds. Industrial characteristics have an effect on firms' decision by changing their expectations about other firms' behaviour and interests.

A comparison between two industries with different lower bounds clarifies the effect of the first parameter i.e. the minimum production. We already know that small firms lower than q^* bribe inspectors to avoid costly rules. But its commonness depends on the probability to observe such small firms in different industries. The direct result is that when size distribution has smaller minimum production, lower bound of distribution, bribery is more common because there are more firms which are small and less vulnerable against bureaucrats. The second mechanism of effect happens through the firm's expectations about other firms' bribing behaviour. The risk of bribery is negatively related to the number of bribers. Shame or the implicit costs of bribery decrease when firms observe more bribe commitments. Higher acceptability may induce even medium-size firms to switch from the compliance to the bribing strategy.

Proposition (7): *bribery is more common in industries characterized by small sized firms.*

Proof: *consider two industries i and j with size distributions equal in exponential part but different lower bounds. For industry i which is characterized with smaller firms,* $q_{min}{}^{i} < q_{min}{}^{j}$. *Therefore, bribers' population* $CDF = 1 - (\frac{q_{min}}{q^*})^{\alpha}$ *is greater:*

$$CDF^{i}(q^*) = 1 - \left(\frac{q_{min}{}^{i}}{q^*}\right)^{\alpha} > 1 - \left(\frac{q_{min}{}^{j}}{q^*}\right)^{\alpha} = CDF^{j}(q^*)$$

Industrial factors, however, are more influential on firms' participation in lobbying because of its collective nature. In collective lobbying not the individual power, but rather the strength of other firms and probability of coalition formation are important. In small size industries, popularity of lobbying changes through the same two mechanisms. It was shown that in case of high participation cost the zero-coalition is stable and, therefore, coalition formation needs a simultaneous collective act of large firms known as leaders. These leaders after forming the coalition try to enlarge it by attracting new cooperators. Industries characterized with low level of production suffer from the lack of such large leading firms.

Changes in firm's expectation about cooperation of other firms and the perceived likelihood of coalition formation raise the second mechanism of impact. If firms were pessimistic about the cooperation of others, before and after forming the coalition, they do not see lobbying profitable, especially in case of high participation cost. To show this effect the model is modified such that

the benefits of lobbying becomes as $A_i = \frac{q_i\,\mu\left(1-CDF(q^{***})\right)p(\psi Q)}{1-\delta}$. The parameter μ represents firms' expectation about others cooperation. This expectation depends on numbers of potential lobbyists. In a dynamic model this expectation may be created based on number of cooperators in the last periods. In sectors with low minimum production, industries with great density of small firms, the range of potential lobbyists is low and thus the firms are more pessimistic about the cooperation of other firms. A decrease in the expected payoff makes lobbying less profitable by shifting the point q^{***} to the right.

Proposition (8): *lobbying is used less in industries characterized by small sized firms.*

Proof: *consider the same two industries i and j with different lower bounds. Since the minimum production in industry i is lower,* $q_{min}^{i} < q_{min}^{j}$*, lobbying is less frequent because:*

$$1 - CDF^{i}(q^{***}) = \left(\frac{q_{min}{}^{i}}{q^{***}}\right)^{\alpha} < \left(\frac{q_{min}{}^{j}}{q^{***}}\right)^{\alpha} = 1 - CDF^{j}(q^{***})$$

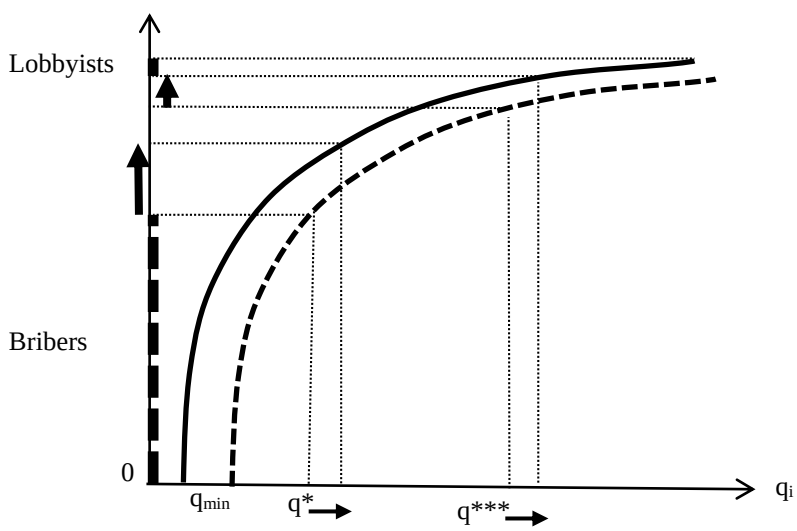

Figure (10): the effect of lower average strength on prevalence of bribing, compliance, and lobbying

Corollary (2) rewrites the result. This conclusion is confirmed by Bombardini (2008) where she found a positive and significant correlation of 0.39 between the average size of firms and PAC contributions made by lobbyists in that sector. In Pareto distribution the mean is directly related to the minimum production; $mean = \frac{\alpha\, q_{min}}{\alpha-1}$.

Corollary (2): *Bribery is more common in small size industries while the compliance and the lobbying strategy are used more frequently in medium-size and large size industries respectively.*

Another interesting question about industrial characteristics is the effect of skewness of size-distribution[14]. The distribution is positively (right) skewed if the mean is greater than the median or, in other words, if a greater mass were smaller than the mean. Figure (11) compares two size distributions with another artificial distribution with zero skewness or alpha equal to one. As it is shown a low α indicates a thicker tail at the right and, therefore, a less skewed distribution.

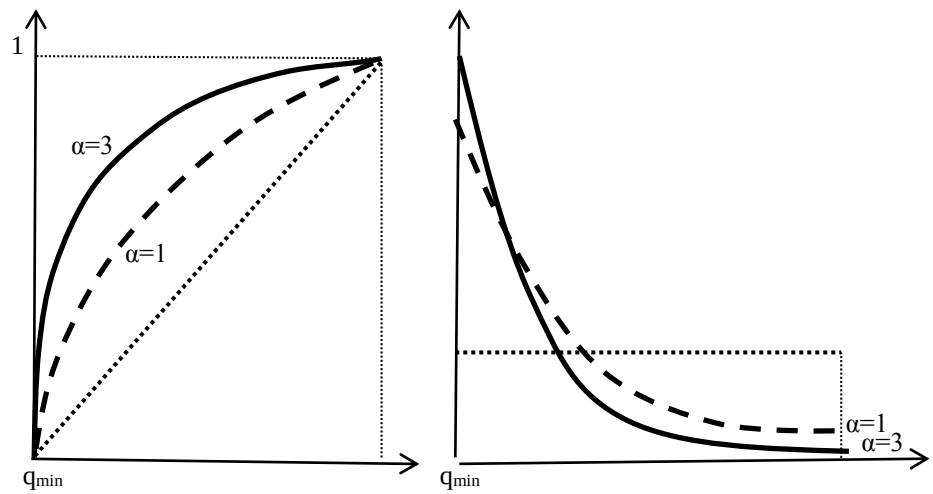

Figure (11): The skewness of the distribution α and diversity between the firms

Observing large size firms is more probable in distributions with lower α or thicker right tail. This means that lobbying is more popular in sectors with low positive skewness (high left skewness). This is in complete agreement with theory of critical mass which according to *"if an interest group is heterogeneous, there may be some highly interested or highly resourceful people available for a critical mass even when the mean interest or resource level is rather low. Greater variance and positive skew are the statistical properties of distributions that favor the presence of such persons."* (Oliver et al. 1985: 529) Bombardini's empirical results although show a positive and significant correlation between participation and contribution on lobbying and the variance of size

[14] Pareto distribution is positively skewed, therefore what we investigate is in fact the impact of a high or low positive skewness

distribution, confirm the above argument. The intuition she provides for the effect of variance relies on thick tail of distribution or lower positive skewness. *"The likelihood that in a sector where, holding the average constant, the size distribution of firms has a larger standard deviation, we can find a greater number of firms that are large enough to overcome the initial fixed cost of lobbying and find it profitable to participate in the political game."* (2008: 18)

But profitability is only a necessary condition. Despite profitability, firms may remain inactive to free-ride on others' lobbying effort. In order to form a coalition, firms must harmonize their interests and efforts. The administrative cost is a function of coalitional size and the intragroup conflicts. Organization is less problematic when firms inside coalition are more similar. Therefore, in sectors with a thick tail distribution of size, where a great mass of firms are larger than mean, leaders encounter fewer obstacles in their attempt to form and expand the coalition. In these sectors the stable coalition size is larger.

> ***Proposition (9):*** *the coalition is larger in industries with thick tail or lower positive skewness of size distributions*
>
> ***Proof:*** *consider two industries i and j with equal lower bounds but different exponential parts* $\alpha_i > \alpha_j$. *Suppose leaders have decided to invite a certain number of firms* n^I *to the coalition. Since the density function in industry j has a thicker tail, the firms which join the coalition in industry j are larger in size; figure (12).*

$$CDF^i(q^{***i}) = CDF^j(q^{***j}) \;\; => \left(\frac{q_{min}}{q^{***i}}\right)^{\alpha_i} = \left(\frac{q_{min}}{q^{***j}}\right)^{\alpha_j} => \frac{q_{min}}{q^{***j}} < \frac{q_{min}}{q^{***i}} => \; q^{***j} > q^{***i}$$

In the calculation above $\alpha_i > \alpha_j$ and $\frac{q_{min}}{q^{***}} < 1$. The leaders in industry j realize that it is easy to find large firms similar to them. This increases the incentive for cooperation and makes the leaders to restrict coalition membership at a larger maximum size; figures (13). Lobbying is more prevalent in less positively skewed distributions (left skewed distributions) for three reasons. First because these industries have a thick right tail and therefore firms with larger size are more probable to exist. This means that lobbying is profitable for a larger range of size distribution. Secondly, in these industries there are more firms capable of leading the coalition formation. The third reason

is that when the mass of above-average firms is great, organizational costs does not stop the coalition from growing. This helps leaders to form larger and more uniform coalition.

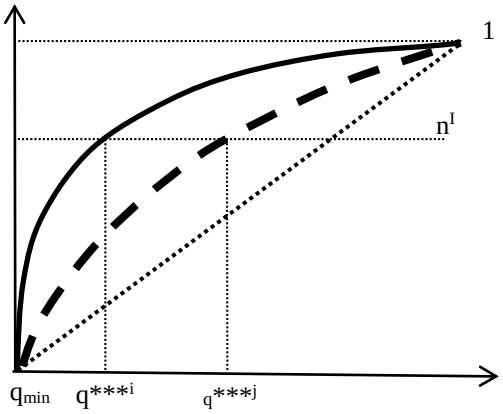

Figure (12): comparing the size of followers in two industries

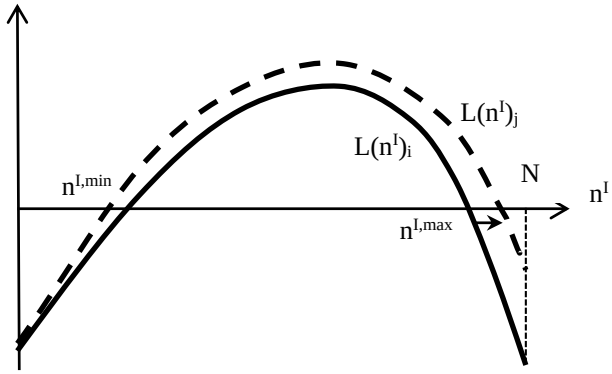

Figure (13): the incentive for cooperation when diversity is low

The two latter reasons show themselves only in case of collective lobbying. Although individual lobbying is also frequent but "firms may prefer individual action to collective action when they seek firm-specific advantages such as government contracts." (Ozer and Lee 2009: 15) Conflicting interests in lobbying may even push firms into an arms race[15] but, when the subject is in their common interest, collective lobbying is more plausible. As a matter of fact, industrial factors are more important and more influential in case of collective lobbying rather than individual actions.

The effect of thick right tail on bribing prevalence is negative. This is because fewer small-size firms exist comparing to a highly positive skewed distribution and, in addition, many medium size firms are invited to the coalition and it is less probable to pursue alternative strategies. These make bribery more risky and, consequentially, less popular. The argument is summarized and illustrated in Corollary (3) and figure (14).

> ***Corollary (3):*** *in industries with highly positive skewed distribution, bribery is popular. On the other hand, lobbying is more frequently used in industries with thick right tail.*

[15] See Gray and Lowery (1997)

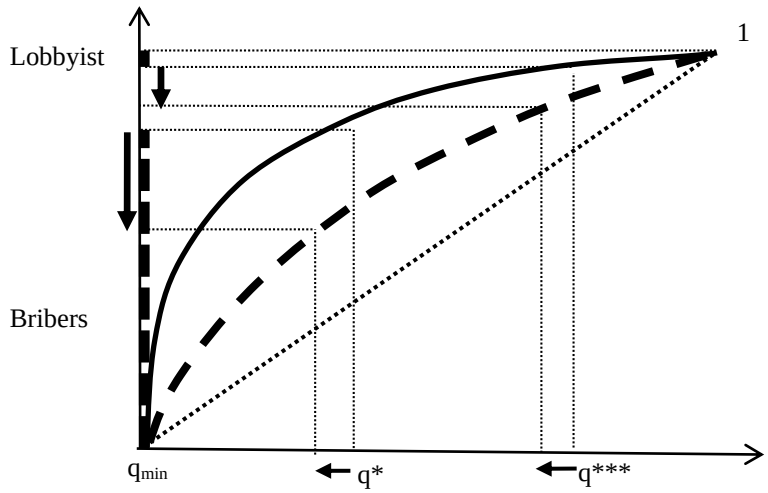

Figure (14): positive skewed distribution and proportion of bribing, compliance and lobbying

VI. Conclusion

Economic agents always have the incentive to influence rules or other public policies through lobbying or bribery. Although there is huge literature for each of these activities separately, studying lobbying and bribery together is very rare while necessary for a better knowledge of firm's strategic behavior. This comprehensiveness is conducive to perceive inter-sectors or countrywide dissimilarities regarding the popularity of these activities. Reviewing previous results highlighted the main deficiencies of the literature. This study in a greater scope, incorporating social and economic parameters, confirms the previous findings and, in addition, discusses some new and interesting issues raised by an attempt to rectify previous shortcomings.

This study put its main focus on two important points neglected in the literature. One is that lobbying for a group of common interested firms is a non-excludable collective good. Firms would be better-off if they cooperate and pursue their common interest in coalition with others. We found two stable and two instable coalitional equilibria. The zero-coalition is stable because of high costs of participation in lobbying contest. To form a coalition simultaneous collective action of some firms is necessary. Large firms which benefit the most from lobbying take this first step of coalition formation process. Higher synergy, higher chance of winning, higher future weights of lobbying payoffs, lower participation costs, and finally lower costs of organization increase firm's incentive to cooperate. The second equilibrium is not stable because of leaders desire to enlarge the coalition by inviting other firms to join. But as the coalition becomes larger organizational cost increases and, consequently, incentives for cooperation recedes. The process settles before reaching the

grand coalition, however, the size depends on coalition's membership rule. In case that distribution of power inside the group is biased toward the large firms, leaders by applying exclusive membership select the best cooperators to minimize the organizational costs. Coalition in this case is smaller than open membership.

In determination of firm's collective behaviour industrial factors are as important as firm's characteristics like size. Exploring the effects of industrial characteristics on firm's decision is another point in dispute which this study tried to contribute on. Results show that bribery is more common in industries whose size distribution has lower minimum bound and a thin right tail. On the other hand, lobbying is more prevalent for industries characterized by large size firms with a less positively skewed distribution. Industries with lower positive skewness have thicker right tail which makes formation and enlargement of coalition easier. Compliance is also expected to be observed mostly in medium-size industries.

The results while providing better knowledge about firm's cooperative behaviour may, moreover, be used to infer about facts reported in the introduction. The two groups of observations in contrast with literature were, first, developing countries where lobbying was as prevalent as corruption and, second, compliance in some rich countries. Based on previous discussion, type of industries active in each group of countries and the probability of success in lobbying, are the two reasons at hand to speculate. Compliance among middle income and some of rich countries is popular because medium-sized industries for which complying the rules is more profitable are prevalent in such countries. The reason might be sever competition or anti-cartel laws. In these countries bribery entails huge risk and lobbying efforts may face persistent rules. Fixed rules decrease the winning chance of lobbying. On other hand, the economies and governments of developing countries are weak and dependent to some principal industries characterized by large size firms. These large firms with high lobbying power see themselves capable of lobbying.

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Attachment (1):

The second derivative is negative:

$$\frac{\partial L(n^I)_i}{\partial n^I} = \frac{p''\psi {q_i}^2}{(1-\delta)}\left(\frac{\partial Q}{\partial n^I}\right) - \frac{\partial AC_i}{\partial n^I} + \frac{C}{{n^I}^2} => \frac{\partial^2 L(n^I)_i}{\partial {n^I}^2} = \frac{p''\psi {q_i}^2}{(1-\delta)}\left(\frac{\partial^2 Q}{\partial {n^I}^2}\right) - \frac{\partial^2 AC_i}{\partial {n^I}^2} - \frac{2C}{{n^I}^3} < 0$$

$$\frac{\partial AC_i}{\partial n^I} = (q_i - q_{new})^2 \;=> \frac{\partial^2 AC_i}{\partial {n^I}^2} = 0, \qquad \frac{\partial Q}{\partial n^I} = q_{new} \;=> \frac{\partial^2 Q}{\partial {n^I}^2} = 0$$

Number of the intersection points depends on the firm's characteristics like production.

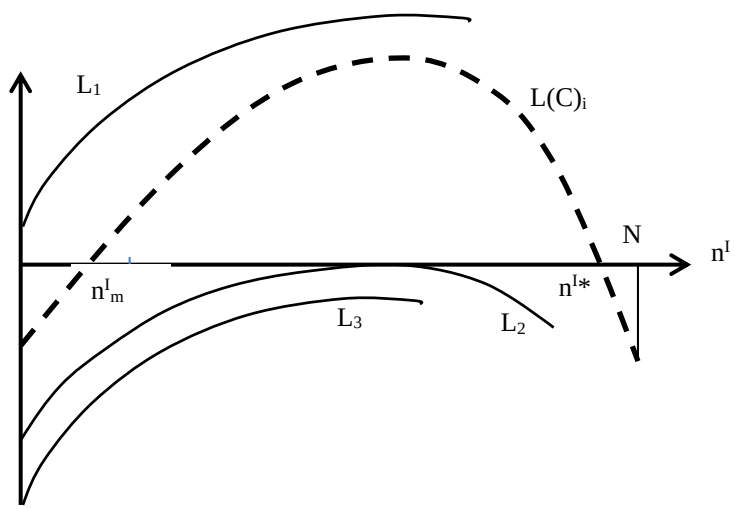

Figure (A.1): Firms characteristics and number of equilibria

As it is shown, the stability function may be tangent to horizontal axis, L_2, or may never cut it L_1 and L_3 lines. These are the extreme cases. The firms corresponding to these lines are either so large that benefits from lobbying at every coalitional size or so weak for which cooperation never going to be attractive. For a general case, this study focuses on the dashed-line stability function with four equilibria.

Attachment (2):

$$\left\{\begin{array}{l} L(C)_N = \dfrac{p'\psi {q_N}^2}{(1-\delta)} - Z_N - AC_N - \dfrac{C}{n} \\ L^{\circ}(C)_N = \dfrac{q_N p'\psi q_{new}}{(1-\delta)} + \dfrac{C}{n(n+1)} - (q_N - q_{new})^2 \end{array}\right\}$$

In the following it will be shown that incentive for cooperation is larger than marginal desire of coalition expansion.

$$L(C)_N = \frac{p'\psi {q_N}^2}{(1-\delta)} - Z_N - \frac{C}{n} - AC_N = \frac{p'\psi {q_N}^2}{(1-\delta)} - Z_N - \frac{C}{n} - \sum_{j=1}^{n-1}\left(q_N - q_j\right)^2 - (q_N - q_{new})^2$$

$$L(C)_N = \frac{p'\psi {q_N}^2}{(1-\delta)} - Z_N - \frac{C}{n} - \sum_{j=1}^{n-1}\left(q_N - q_j\right)^2 - (q_N - q_{new})^2 + \frac{C}{n(n-1)} - \frac{C}{n(n-1)} + \frac{p'\psi q_N q_{new}}{(1-\delta)} - \frac{p'\psi q_N q_{new}}{(1-\delta)}$$

$$L(C)_N = \frac{p'\psi q_N q_{new}}{(1-\delta)} + \frac{C}{n(n-1)} - (q_N - q_{new})^2 + \frac{p'\psi q_N (q_N - q_{new})}{(1-\delta)} - Z_N - \sum_{j=1}^{n-1}\left(q_N - q_j\right)^2 - \frac{C}{(n-1)}$$

$$L(C)_N = L^{\circ}(C)_N + \frac{p'\psi q_N (q_N - q_{new})}{(1-\delta)} - \frac{C}{(n-1)} - Z_N - \sum_{j=1}^{n-1}\left(q_N - q_j\right)^2$$

$$L(C)_N = L^{\circ}(C)_N + L(C-1)_N - \frac{p'\psi q_N q_{new}}{(1-\delta)}$$

First notice that:

$$\Delta L(C)_N = L^{\circ}(C)_N - \frac{p'\psi q_N q_{new}}{(1-\delta)} \quad => if \;\; L^{\circ}(C)_N = 0, \Delta L(C)_N < 0$$

This means that leaders close the entrance of coalition when their incentive is marginally decreasing. In other words, the leaders try to close the coalition only when they notice that new arrivals increase the organizational problem. Let $L^{\circ}(C)_N = 0$, we are facing with the following two situations. But before that notice the point that $L(C-1)_N$ must be positive because the leader must be inside the coalition when it is going to implement an exclusive membership rule regarding to either reject or accept the new arrivals.

- $L(C-1)_N \geq \frac{p'\psi q_N q_{new}}{(1-\delta)} > 0 \quad => \; L(C)_N > 0$

  This means that the leader stop small firms from entering the coalition sooner than the open membership.

- $0 < L(C-1)_N \leq \frac{p'\psi q_N q_{new}}{(1-\delta)} \quad => \; L(C)_N < 0$

  When $L(C-1)_N > 0$, and $L(C)_N < 0$, that means that open membership and exclusive membership lead to an unique and equal size of coalition. This happens when the leader incentive for cooperation was not high enough to endure the presence of another new arrival with dissimilar interests.

Therefore, size of the coalition in exclusive membership is equal or less then open membership.

Chapter Three:

Collective action in large groups: Jumping the higher hurdles

Abstract:

The literature has been very pessimistic about collective action. It has been told that free-riding or organizational problems make individuals to fail in pursuing their common interests. This study initially discusses that not all the players outside of the group are free-riders. It will be explained and analytically shown that group leaders in order to avoid intragroup conflicts may exclude some players. Exclusive membership increases the group's stability, integrity, and quickness in reaction to potential threats. From the outsiders view there is a positive externality in the collective effort of group members. On the other hand there is an agency problem; outsiders' preferences will not be considered by insiders. There is a lens of untouched benefits which can be negotiated by the two sides. It will be shown that if there is a way for insiders to compensate the collective effort of the group a Pareto superior solution may be reached. Cooperation in different but complete and compatible forms is the key of success especially for large groups. At the end some examples make clear how a "continuum of collective action" assists individuals in provision of collective good.

JEL Classification: D7; D2; C7

Key words: Collective action; Free-riding; Oligarchic leadership; Organizational cost; Bargaining

I. Introduction:

Collective work is a great part of our life. Every day we engage in some kind of group works and cooperate with people with whom we have something in common. Common interest is the motivational prerequisite of group formation. There are two main reasons to accumulate efforts and pursue the commons as a group. First reason refers to advantages of group work. One advantage is what individuals save on costs by sharing them with their group mates. Another advantage is a result of the fact that groups are stronger than individuals in realization of wills. Success is more achievable if people with common interest accumulate their efforts, especially in cases when they have to compete with rivals. The second reason is related to particular characteristics of collective goods i.e. non-exclusion and non-rivalry. To wit, access to benefits of collective goods cannot be limited to certain people and their consumption by some agent does not exclude its usage by others. These two distinguishing qualities make individual and voluntary provision of collective goods economically irrational, especially when there is a huge fixed production cost. In other words, group work is needed to provide collective goods.

Despite necessity and the great advantages of group work, however, there are factors preventing cooperation. “Free-riding” and “iron law of oligarchy” have been denounced by the literature as two main impediments of collective work. Free-riding problem first introduced by Olson (1965). According to him, fragmented individuals hardly can organize themselves to advance their collective interest. He stressed that because of non-exclusion feature of public goods rational individuals will have incentives to free-ride on the efforts of others. Therefore, in a pessimistic manner, it would be anticipated that while everyone is waiting for others to act, no one putts effort to provide the collective good. This conjecture has been studied extensively by the literature afterward. Its celebrity overshadowed an older idea about the role of leaders in provision of collective goods. Max Weber (1918, 1925) with his theory of bureaucracy, and Michels (1911) with his famous “iron law of oligarchy” were the firsts to notice the need for leaders to organize groups whose members would otherwise be unable to coordinate. Their main idea is that this kind of oligarchic leadership eventually distorts group aims.

Neither benefits of collective work could sufficiently guarantee its success, nor were the potential obstacles able to dissuade human beings completely from cooperation. The history is replete with successes and failures of groups. Many studies have tried to understand reasons behind these different experiences. The size of the group is one of determinant factors. The aforementioned obstacles make higher hurdles for large groups to jump.

Next section of this study searches in the literature to bring out factors inducing large groups to break up and, as result, divide into insiders and outsiders[1]. In order to overcome potential obstacles to collective work several remedies have been discussed in the literature including social norms and punishment or providing by-product private goods. These all are in fact different ways of encouraging outsiders to join the group. Pushing outsiders into the group is based on two implicit assumptions. One is that the grand coalition _ a group consists of all common interested individuals _ is the most efficient outcome. Another is that all outsiders are uninterested people who cooperate only if they are forced socially or economically. But these assumptions are not consistent with "Organizational Costs", the key word which can be found in almost all relevant studies. High costs of organization account for collective work shortcomings, especially if individuals are diffuse and large in number. According to Olson, smaller groups are more successful because they could organize themselves more efficiently. Organizational costs bring to the conclusion that there is an optimal size for groups. To reach the optimal size some of the potential members need to be excluded. This implies that not all the outsiders are reluctant to join the group.[2] This study taking as given the boundary between insiders-outsiders determined by organizational costs, goes instead in quest of a middle ground where they can compromise on.

Section II closes the literary discussion by describing the externalities and the agency problem existing in insiders-outsiders relationships. Section III brings the whole debate into a theoretical model. After finding a lens over which the two sides can bargain, the Coase theorem has been

[1] The term Insiders-Outsiders has been selected to incorporate all other expressions extant in previous works like leaders-slackers or cooperators-free-riders.

[2] The "free-riding" problem is independent of the "organizational problem". Any attempt to reduce free-riding incentives like punishment or selective incentive mechanisms may help to form the grand coalition but notice that organizational costs would not be zero even in case of zero free-riding. Full participation especially using punishment or other similar mechanism may raise severe conflicts, increase organizational costs, destabilize or even break down the group.

deployed to show that a Pareto improvement is possible. The result is that if a mechanism there exists through which outsiders compensate insiders' effort, a great part of problems mentioned i.e. free-riding problem, organization problem, oligarchic leadership problem, and finally agency problem could be partly resolved. Section IV argues that this is not an innovative idea but a commonly used solution for large groups to succeed in provision of collective good. The compensation may be perceived as financial contributions or other forms of cooperation on the "Continuum of Collective Action[3]". Section V concludes.

II. Collective action: reviewing the two sides of the issue

> *"... [U]nless the number of individuals in a group is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interests"* (Olson 1965: 2).

Generally it is accepted that individuals may fail in furthering their common interest due to their simultaneous self-interest behavior known as "free-riding". This problem arises because *"[t]hough all of the members of the group therefore have a common interest in obtaining this collective benefit, they have no common interest in paying the cost of providing that collective good. Each would prefer that the others pay the entire cost, and ordinarily would get any benefit provided whether he had borne part of the cost or not"* (Olson 1965: 21). As it is stated in the last line this problem results from non-excludability characteristic of collective goods. Olson believes that free-riding problem is inevitable but it can be partially resolved when the group is small or there exists coercion or other special devices to control a large group. In what follows four sources of efficiency for small groups will be discussed. It is argued that forming groups smaller than the grand group is unavoidable. Coercion or other similar devices are not applicable in many cases, even if they were, would not result in zero free-riding outcome.

Experimental studies have shown that the relationship between people eventually leads to creation of social norms which any deviation from it may result in informal sanctions by players who are

[3] This term is used by Brook (2001).

conditional cooperators. But *"in general, social pressures and social incentives operate only in groups of smaller size, in the groups so small that the members can have face-to-face contact with one another"* (Olson 1965: 62). In large groups recognizing defectors is very difficult and therefore it is very unlikely to maintain a cooperative equilibrium by punishment. *"In a realistic setting, as group size rises, so does the likelihood that there is an agent who actually prefers the non-cooperative equilibrium .... If such an individual exists, a 'revenge' strategy of withholding cooperation would not be effective and would destroy the cooperative equilibrium"* (Azfar 2001: 69).

Designing a selective incentives mechanism *"that operates, not indiscriminately, like the collective good, upon the group as a whole, but rather selectively"* (Olson 1965: 51) is another way to treat free-riders differently. Excludable goods like insurance or any other kind of supports which have been provided by groups to punish non-cooperators by withholding these goods from them is an example. However, punishments, fines or sanctions face the same free-riding problem since they are costly to administer; they are not, moreover, applicable in every situation. For example sanctioning single workers is not costly for unions, but for sure it would not be the best strategy for firms or governments to go into a war only in order to punish non-cooperators[4]. Existence of a power is also helpful for resolving free-riding problem, especially in large groups. People obligation to pay taxes is an example in national level. However this super power hardly exists in many cases. For example existence of a power would not be accepted in the world by other nations, or in the market by other firms which although may follow a common interest, they are rivals with many other conflicting interests. Limited application of aforementioned tools in large groups is the first source of small groups' efficiency.

The second source of small groups' efficiency is that *"they may very well be able to provide themselves with a collective good simply because of the attraction of collective good to the individual members"* (Olson 1965: 36). Olson believes that larger group's size makes collective good less attractive because the larger the group the smaller is the individual prize. His assumption

[4] For example governments are unwilling to use trade sanctions in order to punish defectors in global warming problem; or in case of lobbying it is usually observed that firms prefer to lobby individually rather than to use punishment as mean to get the cooperation of others.

is that the collective good must be divided between cooperators. A considerable number of studies[5] have shown that Olson's result would be reversed if one considers a non-rival collective good. However, efficiency of small groups still holds when individuals are different. In large groups the perceived effect of an individual defection is negligible. As it will be shown in the next section, firms with less lobbying power have less incentive for cooperation. These firms in large groups will free-ride and at the end only powerful firms will remain.

In case of dissimilar individuals the assumption of pure common interest becomes clearly unrealistic. Perfect consensus is *"... both about the desire for the collective good and the most efficient means of getting it ..."* (Olson 1965: 59). In real world while people may share a desire for certain collective goods, their strategies or tactics are not ex ante compatible. The truth is that both common and conflicting interests are present in most social interactions. *"... while there are mutual gains to all people's speaking the same language, people are far from indifferent about which language they speak"* (Bowles 2004: 38). *"... [W]hile the collective action result is not excludable the competing collective options for dealing with the collective problem are at least partially excludable"* (Atiram 2009: 9). Minimizing intragroup conflicts is the third source of efficiency for groups smaller in size.

Collective work warrants some sort of agreement, coordination, or organization among individuals. *"... [T]he larger a group is, the more agreement and organization it will need. The larger the group, the greater the number that will usually have to be included in the group agreement or organization"* (Olson 1965: 46). Organization is more problematic when there are within group conflicts. The fourth source of efficiency is laid behind Olson's words when writes:

> *"... [T]he larger the number of members in the group the greater the organization costs, and thus the higher the hurdle that must be jumped before any of the collective good at all can be obtained"* (1965, 48)

Smaller groups are more agile in responding to issues facing them. Time and urgency in provision of goods could be as important as the goods themselves. This is while *"... as the membership of a society increases it becomes ... increasingly unlikely that unanimity will be a viable rule"* (Azfar

[5] See for example Esteban and Ray (2001).

2001: 69). For example Guosheng and Kennedy by comparing the lobbying action of individual firms and trade associations conclude that *"it would be unfair to call associations passive, but there appears to be less urgency in their work"* (2009: 18).

For all these reasons the group leaders, the powerful individuals who proactively have created the group, have the incentive to call into existence kind of paid bureaucracy with the corresponding incentives to stabilize the group. Elites control power over the group is theoretically modeled by Michels (1911) theory of "iron law of oligarchy" and Max Weber (1918, 1925) theory of bureaucracy[6] and, moreover, empirically confirmed by Barnett (2013). Leaders know that new members by complicating members' relationship reduce the effectiveness of punishment or selective incentives mechanism, intensify free-riding problem, escalate within group conflicts, and make the group slow in decision making and reaction toward common problems. These all sources of efficiency prompt group leaders to apply an exclusive membership rule[7] in order to reach the optimal size[8,9].

Which firms enter the coalition or what is this optimal coalitional size are two interesting questions, however, this study is going to concentrate instead on the firms remained outside and their interaction with insiders. What have been understood from the previous paragraphs is that elites' priority to stabilize the group and reduce within group conflicts may stop some individuals from entering the group. Thus, being out of the group is not always voluntary. Outsiders are not all free-riders or slackers. In real world staying out of group may be in fact very costly. These costs refer to individuals' obliviousness of what is happening around and their inability to bargain over favourable final outcomes.

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[6] See Colomer (1995), Esteban and Hauk (2009) as more recent studies.

[7] Three main membership rules in the literature are open, exclusive and unanimous. In open membership players are free to enter and deviate from the coalition while in exclusive membership the coalition can reject new members. For more information see Finus and Rundshagen (2003).

[8] Khandan (2014) compares the optimal size of the coalition according to the three open, exclusive, and unanimous membership rules.

9 This point should be noted that the efficiency of different membership rules depends on the subject of the collective work. Of course when there is little conflict and the issue can be easily and unanimously agreed on, large group is more viable in pursuing the collective work. In a lobbying example Ozer and Lee (2009) show that *"... firms may prefer individual action [smaller group through exclusive membership rule] to collective action [trade association with an open membership rule] when they seek firm-specific advantages [there is more severe intragroup conflicts] such as government contracts"*. See also Hansen et al (2005).

"In shaping their living environment active participators cannot fully represent the wide spectrum of interests possessed by non-participating parties. Idiosyncratic interests of those who are commonly cast as freeloaders cannot be anticipated … [while] participating parties' interests will take the lead. … Since not all interests can be protected, and some compromises have to be made this conflict of interests, presents a unique agency problem, which is yet to be fully comprehended" (Atiram 2009: 8).

Outsiders not only miss the opportunity to bargain over their specific interests, but also lose from under-provision of collective good. Insiders also would be better off if there were more collective goods but, of course, they will not produce more when they are alone. Olson apportions blame on free-riders for this loss. Max Weber and Michels, on the other hand, censure the elites for their oligarchic leadership and selective bureaucracy. What is for certain, however, is that individuals' specific interests, intragroup conflicts when they are different or free-riding incentive if they were identical, have prevented them from reaching their common interest. But is there a middle ground for the two sides to compromise on?

As Coase asserts, *"the traditional approach has tended to obscure the nature of the choice that has to be made. The question is commonly thought of as one in which [free-riders] inflicts harm on [cooperators] and what has to be decided is: how should we restrain [free-riders]? But this is wrong. We are dealing with a problem of a reciprocal nature. To avoid the harm to [insiders] would inflict harm on [outsiders]".*

The Coase theorem indicates that in the absence of transaction costs i.e. when the market exists and the pricing system operates without cost, negotiation between the two parties lead to a Pareto superior outcome regardless of initial assignment of rights. In other words, the possibility of bargaining between outsiders and insiders will help them in the provision of collective goods. This will be the subject of the next section. At first, an analytical model will be created in order to highlight outsiders-insiders common and conflicting interests. It will be shown that collective work of insiders has a positive externality on outsiders' benefit. The next section will direct attention on a lens of untouched benefits which could be used if there were a mechanism through which outsiders could compensate insiders' effort.

III. In quest of a middle ground to compromise on[10]

Suppose there are N firms different in size. Other dissimilarities like capital endowment, employment, and public stature are closely connected to firms' levels of production and thus can be represented by it. Suppose for each unit of production the benefits are distributed in a continuum from zero to one, corresponding respectively to the current and the desired rules. In order to set favourable rule in their common interest, firms must compete with other rivals. The government is considered as a benign neutral player indifferent between rules. The cost of participation in this contest is fixed. It may be thought as cost of linking to the government as a mean to send information about the favourable rules. The potential benefit of a change in the current situation is non-excludable and non-rival. Chance of winning is a function of firms' collective lobbying effort and the coalition's lobbying power measured by its total production.

The process of coalition formation happens in two steps. Firms at first participate in an endogenous normal coalition formation game. They decide to cooperate for lobbying or to free-ride. After the coalition structure formed the inside players set their strategies to maximize their payoffs. Bloch (1997) and Yi (1997) showed that assuming a unique Nash equilibrium for the second stage, the game can be reduced to a partition function game. This means that to study formation and stability of coalition it would be enough to focus only on the first stage, where players decide whether to enter the coalition or free-ride. Uniqueness of Nash equilibrium at the second stage requires a payoff distribution over coalition's members which guarantee its stability. Since the benefits of lobbying are non-rival, insiders only need to agree ex-ante on their cost-shares. Here we assume that the insiders divide the costs equally i.e. $C_i = \frac{C}{n}$. The parameter C refers to the participation cost of lobbying contest and n is the number of cooperators. Players inside the coalition act cooperatively while the coalitions and outsiders play strategically. It is also assumed that only one coalition takes place and all outsiders are singletons. The payoff of lobbyists is presented below, where q_i indicates the size of the representative firm, and Q stands for the group production level

[10] The first part of this section presents just an outline of coalition formation process. For a thorough analysis see Khandan (2014)

as a measure of its strength. The terms E, and e_i also represent the accumulated and individual exerted level of lobbying effort.

$$(1) \qquad \pi^I{}_i = \frac{q_i\, p(\psi Q, E)}{(1-\delta)} - e_i^2 - \frac{C}{n} - AC_i(n,\sigma)$$

The first term represents benefits of lobbying. Since lobbyists obtain one unit of payoff for each produced unit of good, corresponding to the favourable rule, the expected benefit equals to production level of the firm multiplied by the probability of lobbying success. Benefits are permanent and discounted by δ. Assuming a concave probability function, the likelihood of winning is a function of firms collective effort $E = \sum_{i=1}^{n} e_i$ and the campaign's production as a proxy for its lobbying power $S = \psi \sum_{i=1}^{n} q_i$. The term ψ indicates synergy or necessity of cooperation. Lobbying entails some costs. The disutility resulted from lobbying effort is represented as e_i^2. Another cost which lobbyists have to endure is the fixed cost of participation in the lobbying contest. This cost is shared among campaign members equally.

The fourth term describes cost of organization. Organizational cost increase as coalition grows or becomes or more heterogeneous. The parameter σ which is the variance of insiders' production represents this heterogeneity. Organization is more difficult and more costly when the members have conflicting interests. Conflicts arise from differences in payoffs. Therefore, a measurement of payoff distribution can be used to estimate degree of conflicts between insiders. Suppose organization is created by building links among all members of the group and, in addition, assume that the linkage cost is a function of conflicts or payoff differences between firms. Payoff inequality resulted from firms' differences in size because it was assumed at the beginning that a change in the rule benefits all firms according to their level of production. As it is shown below, the aggregate administrative cost is a function of the coalition's size and the variance of production distribution among insiders. The larger the coalition is, or the more heterogeneous the insiders are, the higher organizational costs.

$$AC_i = \sum_{j=1, j\neq i}^{n} (q_i - q_j)^2 = \sum_{j=1, j\neq i}^{n} (q_i - \bar{q} + \bar{q} - q_j)^2 = (n+1)\,(q_i - \bar{q})^2 + n\sigma^2$$

$$AC = \sum_{i=1}^{n} AC_i = (2n+1)n\sigma^2$$

Insiders do lobby collectively to displace the current rule with a favourable one. The optimal level of effort is based on maximization of their own payoff although its benefit cannot be deprived from outsiders. This optimal lobbying effort presented below is obtained by getting the first derivative of insiders' payoff function, formula (1), relative to level of effort.

$$\frac{\partial \pi^L{}_i}{\partial e_i} = 0 \Rightarrow \quad e_i{}^* = \frac{q_i\,(\partial p/\partial E)}{2(1-\delta)}$$

Firms' optimal level of lobbying effort is a positive function of their production, change in winning probability relative to total group's effort, and the weight of future benefits. Moving backward, prior to this decision, firms at the first stage compare inside and outside payoffs to decide whether to join or stay out of the coalition. They already know that if they decide to cooperate they must exert certain amount of lobbying effort. Incentive for cooperation is the difference between payoff of cooperation and free-riding. This is also known as coalition's stability function introduced by Carraro and Siniscalco (1992).

$$I(n) = \pi_i^I(n) - \pi_i^O(n-1) > 0 \quad \Rightarrow \left[\frac{q_i\,p(S,E)}{1-\delta} - e_i^{*2} - \frac{C}{n} - AC_i(n,\sigma)\right] - \left[Z_i + \frac{q_i\,\acute{p}(S,E)}{1-\delta}\right] > 0$$

$$(2) \qquad I(n) = \frac{q_i}{1-\delta}\left(\frac{\partial p}{\partial S} \times \psi q_i\right) + e_i^* - \frac{C}{n} - AC_i(n,\sigma) - Z_i$$

Where *I(n)* is the incentive for cooperation of the representative firm when the group consists of *n* members. The superscripts *I* and *O* written above payoffs stand for insiders and outsiders. Outsiders' payoff includes the payoff of alternative strategies Z_i, plus what they get from non-excludable collective good provided by insiders. The only difference is that $\acute{p}(S,E)$ is the group's probability of winning with one less member, $p(S,E) = \acute{p}(S,E) + \left(\frac{\partial p}{\partial S} \times \psi q_i\right) + \left(\frac{\partial p}{\partial E} \times e_i^*\right)$.

Large-size firms, the ones with higher q_i, have the greatest incentive to cooperate and form lobbying coalition. Their presence is crucial at the first steps of coalition formation. Large firms act as leaders to create a coalition. As stated in the last section, there are two potential obstacles on the way of group success. The first one is the free-riding problem. Since the benefit is non-excludable, small firms have no incentive to cooperate. What they gain in case of success is not as much as large firms. They know that their deviation will not result in a probable lobbying failure.

Small firms, moreover, are prone to lower risk of alternative strategies like bribing or hiding from the government. Thus, it is anticipated that small firms stay out of the group and free-ride on insiders lobbying effort.

The second problem is regarded to the role of leaders in provision of collective goods. The creation of group is contingent to existence of large firms which have higher incentive to cooperate. The oligarchic leadership eventually distorts group aims. As more members enter organization and stabilization becomes more difficult and more costly for the leaders although at the first stage of group formation they were avid for cooperation with other firms and sharing the lobbying costs. Size of the group has two effects on the incentive for cooperation function.

$$\frac{\partial I(n)}{\partial n} = \frac{C}{n^2} - \frac{\partial AC_i(n,\sigma)}{\partial n}$$

The first effect shows the leaders enthusiasm for sharing the costs among more firms. The second factor indicates insiders' wariness of intragroup conflicts and organizational problem as result of incorporating a large number of firms. As group enlarges the second effect dominates and, therefore, it is expected to reject some of the firms by applying an exclusive membership rule. This oligarchic bureaucracy is the second reason for public goods' sub-provision. Insiders to decide about the optimal level of effort $e_i{}^* = \frac{q_i\,(\partial p/\partial E)}{2(1-\delta)}$ consider only their own production. They do not take into account the payoff of outsiders. In other words, there is an agency problem. The payoff function of outsiders discloses the positive externality which exists in lobbying effort.

$$\pi_i^O = \frac{q_i{}^O p(S,E)}{1-\delta} + \mathrm{Z}_i \ , \qquad \frac{\partial \pi_i^O}{\partial \mathrm{E}^*} = \frac{q_i{}^O}{1-\delta}(\partial p/\partial E) \geq 0$$

Outsiders will benefit from higher level of effort provided by insiders. A higher lobbying effort exerted by insiders increases the probability of winning which benefits all firms no matter they are a member of coalition or not. This positive externality does not enter in lobbyists' maximization and therefore the level of lobbying effort is lower than what is socially optimal.

$$\pi = \sum_{j=1}^{N-n} \pi^O{}_j + \sum_{i=1}^{n} \pi^I{}_i = \sum_{j=1}^{N-n} \mathrm{Z}_j + \frac{p(S,E)\ \sum_{j=1}^{N-n} q_j{}^O}{1-\delta} + \frac{p(S,E)\sum_{i=1}^{n} q_i{}^I}{1-\delta} - \sum_{i=1}^{n} e_i^{*2} - C - AC$$

$$\frac{\partial \pi}{\partial \mathrm{E}} = \frac{\sum_{j=1}^{N-n} q_j{}^O + \sum_{i=1}^{n} q_i{}^I}{1-\delta}(\partial p/\partial E) - 2\mathrm{E} = 0 \quad => \quad \mathrm{E}^{**} = \frac{\sum_{j=1}^{N-n} q_j{}^O + \sum_{i=1}^{n} q_i{}^I}{2(1-\delta)}(\partial p/\partial E) \geq \mathrm{E}^*$$

Regardless of who are responsible for society's loss, this section searches for possible ways leading to higher provision of collective good. Different methods like punishment or selective incentives have been used by groups. The question is whether all the successful groups have solely applied these tools or there is still other ways of overcoming the problem. What is already known by Coase theorem is that in a zero transaction cost world, the two sides through negotiation are able to internalize externalities and to reach a Pareto superior outcome. In case that insiders' effort has a positive externality on outsiders' payoff, the people out of the group can induce and encourage insiders to exert higher effort. The only necessary condition is the existence of a market or any way available to outsiders to compensate insiders.

The incentive to compensate insiders seems doubtful when outsiders could participate in group work but have decided to free-ride. But note that free-riding was not the only reason for staying out of the group. It was shown that leaders may reject some of the membership requests as a mean to stabilize and organize the group. These outsiders have the incentive to compensate insiders and encourage them to produce more of collective good. In case that some individuals have remained outside because of some conflicting interest, this compensation mechanism is, moreover, a way to reconcile the interests. They may be able to persuade insiders to apply a moderate option in the common interest of the whole society.

The next section presents a complete discussion about real world examples of such compensation mechanism, but for now, suppose such a market exists and small firms which have been remained outside act as a principal and pay the campaign members, the agents, to compensate their disutility from higher exerted lobbying effort. Outsiders' contribution, indicated by t, is assumed to be a function of excess lobbying effort. This level of effort higher than what was optimal exclusively for insiders is signified by e. There is no reason to compensate insiders for what they will do with or without any contribution. The new payoff functions are as below.

$$\left\{\begin{array}{l} \pi^I = \dfrac{Q\, p(S, E^* + e)}{1-\delta} - (\mathrm{E}^* + \mathrm{e})^2 - \mathrm{C} - \mathrm{AC} + te \\ \pi_i^O = \dfrac{q_i{}^O\, p(S, E^* + e)}{1-\delta} - te \end{array}\right\}$$

Although the coalition in the bargaining process is considered as one united player, since the sharing mechanism of lobbying efforts and costs between its members is known the model can also be written with individual payoffs. Knowing the optimal lobbying effort, outsiders pay the price t for excess levels of effort as a mean to compensate insiders' disutility. The formula presented below show the indifference curves of both insiders and outsiders.

$$\partial\pi^I = \left(\frac{Q(\partial p/\partial \mathrm{E})}{1-\delta} - 2(\mathrm{E}^* + \mathrm{e}) + \mathrm{t}\right)\partial \mathrm{e} + e\partial t = 0$$

$$\frac{\partial t}{\partial \mathrm{e}} = 2 - \frac{t}{e}, \qquad \frac{\partial^2 t}{\partial \mathrm{e}^2} = \frac{t}{e^2} \geq 0$$

$$\partial\pi_i^O = \left(\frac{{q_i}^O(\partial p/\partial \mathrm{E})}{1-\delta} - t\right)\partial \mathrm{e} - e\partial t = 0$$

$$\frac{\partial t}{\partial \mathrm{e}} = \left(\frac{{q_i}^D(\partial p/\partial \mathrm{E})}{e(1-\delta)}\right) - \frac{t}{e}, \qquad \frac{\partial^2 t}{\partial \mathrm{e}^2} = -\left(\frac{{q_i}^D(\partial p/\partial \mathrm{E})}{e^2(1-\delta)}\right) + \frac{t}{e^2}$$

The analysis of insiders' indifference curves comes first. The line $t = 2e$ is crucial for understanding insiders' behavior. At points above this line, higher excess effort has positive effect on insiders' payoff i.e. $\frac{\partial\pi^I}{\partial e} > 0 \; if \; t > 2e$. If the marginal contribution t was greater than marginal disutility of effort 2e, excess effort becomes a good rather than a bad for insiders. Above this line the insiders' indifference curves have negative slopes. But for the points below the line since the price is not enough to compensate marginal disutility, $t < 2e$, excess effort becomes a bad commodity whose consumption decreases the payoffs. Therefore below the line, insiders exert higher effort contingent to higher proposed price and thus the indifference curves have positive slopes.

The line $t = \frac{{q_i}^D(\partial p/\partial E)}{1-\delta}$, on the other hand, plays the same important role for outsiders' indifference curves. This is the maximum price which outsiders pay and is equal to the marginal benefits of excess effort. It seems irrational for outsiders to pay prices higher than what they benefit. But they may willingly pay lower prices. Below this line t becomes a good commodity for outsiders because it brings more payoffs to them through inducement of insiders to put forth higher level of effort. The positive slope means that outsiders are ready to pay higher prices for higher levels of effort. The positive second derivative of insiders' indifference curve and the negative second derivative

of outsiders' both have resulted from the exponential form of disutility corresponding to effort. Since disutility grows exponentially, insiders ask higher and higher prices. Outsiders' indifference curves become smoother for higher level of excess effort because as the gap between the group's and social optimal levels of effort recedes, excess effort becomes marginally less fruitful and more expensive for them.

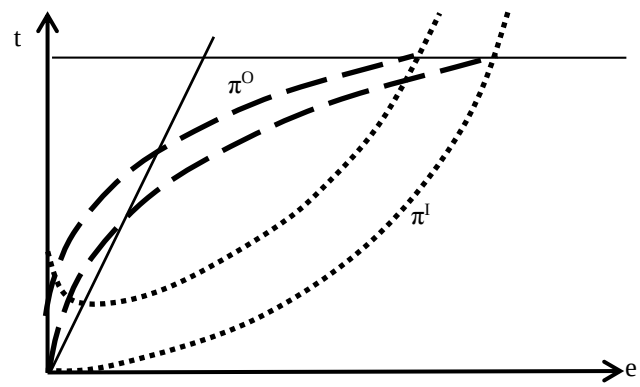

Figure (1): The bargaining lens between lobbyists' and free-riders indifference curves

At point $(e, t) = (0,0)$, where insiders do not exert effort greater than the optimal level and outsiders pay nothing to compensate them, there is a lens between the two indifference curves which shows the possibility of bargaining between the two sides. Though every point inside this lens is Pareto superior, the final outcome depends on the bargaining power of negotiation parties and their willingness to cooperate. Insiders' bargaining power roots in the famous principal agent problem which is the invisibility of effort. Outsiders' payoff maximization is constrained by insiders best response function. Outsiders cannot propose a price lower than what insiders ask because the effort exerted is not observable or verifiable from outside the group. The requested price is equal to the marginal disutility of excess effort.

$$\frac{\partial \pi^I}{\partial \mathrm{e}} = -2\mathrm{e} + t = 0 \quad => \mathrm{b}^I\colon\ \mathrm{t} = 2\mathrm{e}$$

Where b^I is the best response function of insiders and represents the supply of excess effort. Outsiders will propose a positive price t which is advantageous to both sides if and only if they internalize the benefits of excess effort in their maximization.

$$\frac{\partial \pi_i^O}{\partial t} = -e + \left(\frac{q_i{}^O(\partial p/\partial E)}{1-\delta} - t\right) \partial \mathrm{e}/\partial t = 0 \ => \quad t = \left(\frac{q_i{}^O(\partial p/\partial E)}{1-\delta} - 2e\right)$$

In the calculation above $\left(\frac{q_i{}^O(\partial p/\partial E)}{1-\delta} - t\right)$ is outsiders' benefit from excess effort and $\partial e/\partial t$ is the response they anticipate based on insiders best response function. Outsiders' contribution is higher if firms were larger in size, or if the excess effort had a marginally great effect on the winning probability. The proposed price decreases eventually because as the excess effort grows the gap between social and group's optimal level of effort is filling up. The intersection of this line, the demand function, with insiders' best response function, the supply function, leads to the cooperative win-win solution.

$$t^C = \frac{q_i{}^O(\partial p/\partial E)}{2(1-\delta)}, \qquad e^C = \frac{q_i{}^O(\partial p/\partial E)}{4(1-\delta)}$$

The insiders' and outsiders' payoffs at the win-win solution verify that this cooperative point is placed inside the lens. The second term in the formula below is the benefit the two sides obtain.

$$\begin{cases} \pi^I = \left(\frac{Q\, p(S,E^*)}{1-\delta} - \mathrm{C} - \mathrm{AC} - \mathrm{E}^{*2}\right) + \left(\frac{q_i{}^{O\,2}(\partial p/\partial E)^2}{16(1-\delta)^2}\right) \\ \pi_i^O = \left(\frac{q_i{}^O\, p(S,E^*)}{1-\delta}\right) + \left(\frac{q_i{}^{O\,2}(\partial p/\partial E)^2}{8(1-\delta)^2}\right) \end{cases}$$

This point although a Pareto improvement but still is far from the socially optimal point (e^{**}, t^{**}). The cooperative solution and the socially optimal points are illustrated in figure (2) below.

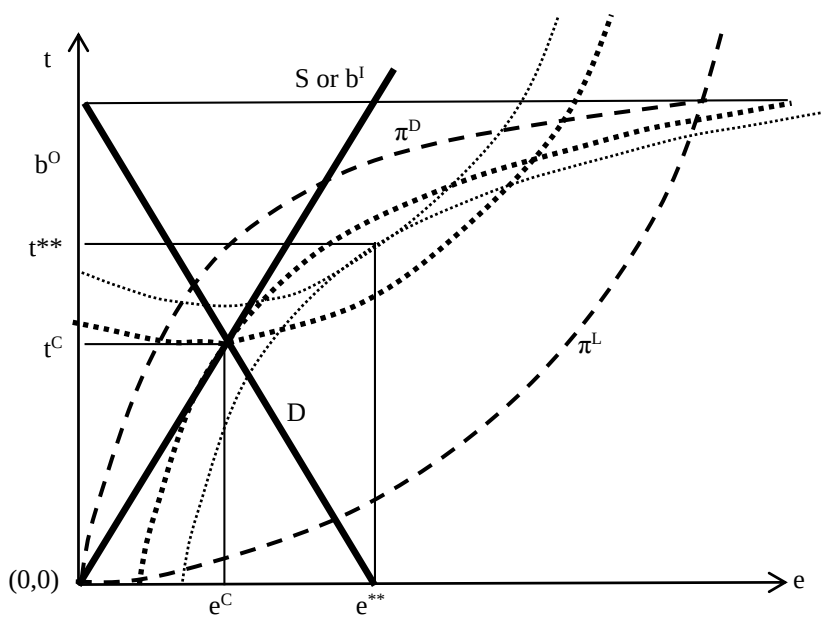

Figure (2): The zero equilibrium, cooperative and socially optimal solutions

At the cooperative solution the outsider's indifference curve instead of being tangent to the insiders' indifference curve, it is tangent to the group's best response function. This means that although higher level of excess effort is still appealing to the outsiders, further steps are not possible because the lobbying effort is not observable and insiders' best response function is extremely binding. Invisibility of effort restrains outsiders to bargain only for points located on the best response function of insiders and thus some space remained still untouchable, however it was shown that there exists a middle ground on which the two sides can compromise. The theoretical results show that the leaders instead of enlarging the coalition which increases intergroup conflicts and makes the campaign less organized and less stable have the possibility to bargain with outsiders and reach a win-win solution. This shows that although there are many problems on the way of collective action, both sides, insiders and outsiders, are able to reach a Pareto superior solution. Notice that the two sides through bargaining have partly overcome some of the problems existed before. The free-riding problem has been moderated because insiders while preventing organizational problems and intragroup conflicts could get a positive contribution from outsiders. The agency problem also has been partly solved. The group members which previously were paying attention solely to their own payoff to decide about the optimal level of collective good, after bargaining provide a higher level in the interest of outsiders. Outsiders through their contributions are able to influence the decisions of the group.

In sum, this section using a simple theoretical model first showed the problems on the way of collective work namely the free-riding problem, within group conflicts and organizational problem, and the agency problem resulting from oligarchic leadership of the group. Then it was showed that if it was possible for outsiders to compensate the effort exerted by group, there will be a middle ground for the two sides to compromise on. The main conclusion of this section is that the two sides, insiders and outsiders, through bargaining could partially resolve many of the problems existed before and by producing higher level of collective good could reach a Pareto superior solution. Having shown this possibility, the next section examines the application of this theory in real world example. If a lens of potential benefits exists, then it should not be remained untouched.

IV. Discussion:

Various obstacles on the way of collective goods' provision, especially for large groups, bring many of economists to accept that large groups are not able to align themselves for a collective work. The many successful examples of large groups' collective action, however, stop us to aver it explicitly. For example, we see that large number of firms and individuals with common interests proactively participate in political actions. Provision of political goods whose benefits are non-excludable is more than the level which was anticipated by theories. Individuals active in politics have overcome free-riding problem while because of legal limitations[11] they were unable to use tools like punishments or other forms of pressure. The secret lies behind organizations known as Political Action Committees (PAC) that pools contributions from individuals or corporations and donate those funds to campaign for or against candidates or legislation.

The three forms of PACs namely connected[12], non-connected[13], and super PACs[14] base on United States' Federal law are different in rules regarding their expenditures and fundraising. While non-connected and connected PACs are controlled and limited extensively[15], super PACs may engage in unlimited political spending as long as they are independent of campaigns. A huge number of PACs are small, *"95 percent of PACs averaged just $40,000 in contributions to candidates … [while] the remaining 5 percent … together accounted for over half of all money donated to candidates"* (Janda et al. 2011: 334), and pursue similar purposes, according to Gray and Lowrey (1997) 32 percent of associations and 41 percent of membership groups sponsoring PACs have positively responded to the presence of organizations with similar purposes. The point that PACs prefer to be small rather than to join with other similar PACs introduces some level of conflict

[11] For example Separate Segregated funds (SSF) or other forms of PACs are strongly prohibited from using threats of physical force, job discrimination or financial reprisal when soliciting contributions. (11 Code of Federal Election 114.5)

[12] Connected PACs can be established by businesses, unions, and trade or other forms of associations. They are allowed to receive money from a restricted group consisting of their stakeholders or members.

[13] Non-connected PACs are formed by grand ideological groups or political leaders. They can accept fund from any individual, connected PACs, or other organizations.

[14] Super PACs unlike other forms can raise money without any legal limitation, but they have to remain independent of campaigns without any direct contribution.

[15] They cannot contribute more than $15,000 to a political party per year; or they are allowed to solicit contributions only from a certain group of individuals and up to a certain amount.

which may even raise an “arms race among similar or related organized interests” (Gray and Lowrey 1997: 20).

Within group conflicts, as discussed in previous sections, result in insiders-outsiders division. Mediating political participation of a large number of individuals with common interests (outsiders) is the role of all forms of PACs. Despite a large mass of studies about PACs in economics, political science, and management literatures, nevertheless, no distinction has been made between PAC founders and its contributors. The main difference is in the way they participate in collective work. Contributors (outsiders) which are large in number pursue their common interest indirectly while committee members (insiders) have direct control on decisions made about detailed political disbursements. This oligarchic leadership problem, however, has been mitigated when outsiders try to participate indirectly through their financial compensation. Outsiders are able to align committee decision with their preferences insomuch as they contribute. Committee members also need to harmonize their decisions to common interests in order to succeed in fundraising. The solution key is to find a middle ground to compromise on. Settlement will be achieved if there is a compensation scheme for outsiders. Large groups succeed in collective work only if they define a miscellany of cooperation.

As result of delineating different forms of cooperation, higher level of collective work will be achieved not only by alleviating agency problem but also through weakening free-riding incentives. When a “continuum of collective action” exists, individuals regarding their constraints decide how and how much to participate. Individuals for example based on time, financial assets or other resources available to them decide whether to establish a PAC with cooperation of a small homogenous group or financially contribute to a currently existed PAC with more or less compatible purposes. Cooperation through choosing a point on the “continuum of collective action” is cheaper; and in this wise, fewer will free-ride.

Resistance and rebellion is another example of how variety of cooperation forms helps large groups to provide themselves with collective good. According to Brook (2001) the periodic eruption of insurrection is only the visible face or “public transcript” of collective action. The “hidden transcript” consists of various different forms of resistance like dissimulation, false compliance, desertion, pilfering, and sabotage which in an unorganized manner take place every

day. These two faces of collective work in rebellion are not equally available to all individuals. Although focusing only on the visible face comes into conclusion that others are free-riding, the hidden transcript has a consequential role in fulfilling the common desire.

Notice that as there is a continuum of collective action, individuals are not restricted to choose only one form of cooperation; they may participate in various forms, direct and indirect or visible and hidden. An example is lobbying tactics used by firms to influence government. Classifying lobbying tactics in direct lobbying and grassroots lobbying, firms may apply none, only one or both to fulfil their aims. Firms which do not participate in direct negotiations with government have the possibility to compensate lobbyists by constituency building efforts and public affairs. The reason is that firms involved in direct lobbying in order to succeed have to make the issue salient and legitimate to governors. Considering public pessimism over intentions of large lobbying firms, small firms' effort on constituency building and grassroots lobbying may be even more valuable than direct lobbying participation for the group.

One important corollary of discussion above is the need for reconsidering free-riding. Outsiders may become co-operators after extending the set of actions which can be perceived as different forms of cooperation. For example, in the last paragraph it was mentioned that lobbyists' need for a great public support warrants grassroots lobbying. As a mean to guarantee their success, in parallel to their effort to legitimate their favourite rule, they should undermine the genuineness of the current one. In other words, lobbyists must raise doubts on the functioning and effectiveness of the current rule. This work can be done in no way better than corruption. This whole brings in mind the idea that lobbying and corruption although substitute at firm-level, may be complement strategies at industry level.

V. Conclusion:

Although the advantages of group work are vast and great, collective action may fail due to free-riding, oligarchic leadership or intragroup conflicts. Large groups face higher hurdles, however. Unfortunately remedies studied in the literature like punishment and selective incentives are economically inefficient and, moreover, applicable only in restricted issues. In addition, these tactics have ignored organizational problems and within group conflicts. It is assumed that if

outsiders join the group all the problems will be solved and agreement will be reached as simple as before. Individuals although have some interests in common, they may have private benefits or specific preferences on various strategies which are fulfilling their common purpose. Organizational problem and within group conflicts are damaging as much as free-riding problem. Exercising an exclusive membership rule may be the result of oligarchic power of group's elites who concern for stability and integrity of the group as well as its size. Taking organizational costs into consideration, not all the outsiders are free-riders.

This study taking as given the size of the group derived from organizational costs, instead, searches for a middle ground where insiders and outsiders can compromise on. It was shown that if it is possible for the outsiders to compensate insiders' collective effort a win-win cooperative solution will appear. At this solution provision of collective good is higher because previous problems like free-riding and agency problem are partly resolved. It was also discussed that this is not an innovative solution. The thesis is illustrated by some examples verifying that large groups' success in provision of collective good depends on how much they could extend the set of shapes on which cooperation may be conceived. If individuals can choose among compatible and complement actions on a "continuum of collective action" cooperation is cheaper.

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