

# The Dynamics of Corruption

## Artificial Society Approach

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### Abstract

Corruption has been an important priority to gain the better and more efficient economical governmental system. This proposition came from the statistical evidence of perception on corruption in Indonesia recently and the importance to exacerbate the governmental reform strategies in Indonesia. The paper defines corruption as state capture and administrative corruption to gain the quintessence of the corruption cases modeled in dynamical computational social system. The result of experiments through simulation is prepared to construct understanding of structural properties of the corruption. The result is understanding and conclusions seeing corruption as an interdisciplinary problem and should be handled in holistic perspectives.

**Keywords:** corruption, Indonesia, definitions of corruption, artificial society, agent-based model, bounded rationality, primitive model of corruption.

*....Now kings will rule and the poor will toil  
And tear their hands as they tear the soil  
But a day will come in this dawning age  
When an honest man sees an honest wage...*

Van Diemen's Land – U2

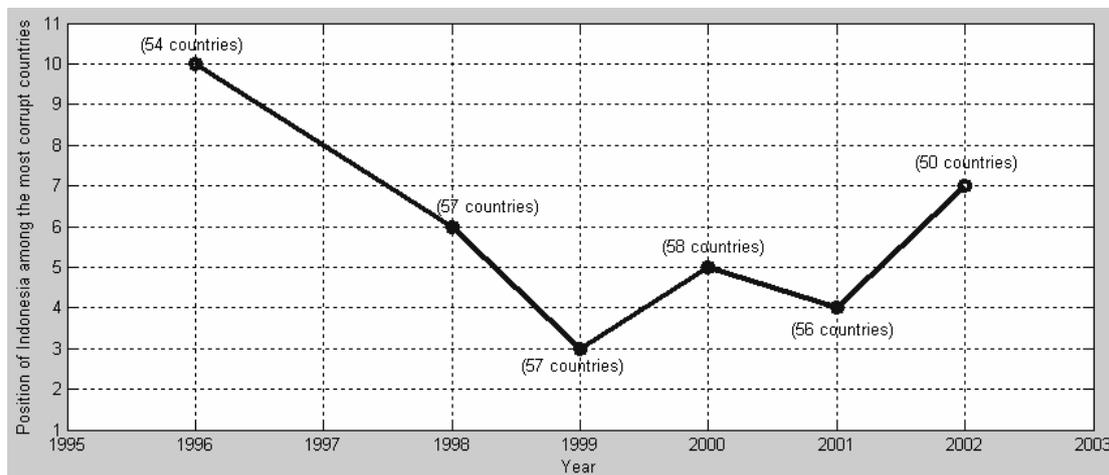
## 1. Introductory Elaboration

Indonesia is sentenced as one of the most corrupt countries. There have been many policies and governmental actions to overcome the problem, but still cases of corruption are felt in every sectors of the society. This is the fact that elaborated in some publications e.g.: Makarim (2001), Situngkir (2003b), and Holloway (2002). Corruption is ubiquitous, written Hornick (2001). According to Hornick, the ubiquity of corruption can be summarized as:

1. Grease payments: small bribes, gratuities and other benefits provided to low and middle-level bureaucrats to procure basic government services and protections, such as obtaining official documents, subscribing for telephone and electric services, registering land titles and mortgages,

- getting visas and exit permits, clearing customs, and collecting one's government salary.
- 2. Subverted legal system: the routine bribing of judges, prosecutors and court officials. In 1999, a senior litigator in Jakarta said that up to 90% of court cases were decided by bribes to judges, prosecutors and other court officials.
- 3. High-level executive branch payoffs: to procure licenses, contracts and the like.
- 4. Indispensability of good political connections: to improve one's chances of securing the plum deals, obtaining preferential regulatory treatment, and escaping inconvenient contractual obligations while deflecting the 'predatory' trading practices of those who are well connected.

In Indonesia, corruption has two sisters, i.e.: collusion and nepotism, which oftenly become one acronym: KKN (*Korupsi, Kolusi, Nepotisme*). Hornick (2001) defined 'collusion' as condition in which State employee wrongfully conspiring or cooperating with another State employee or private person to harm an individual, society or the State, and 'nepotism' as a State employee wrongfully placing the interests of his family or cronies above the interests of society, the people or the State<sup>1</sup>.



**Figure 1**

The position-rank of Indonesia among the most corrupt countries in the world in the period 1996-2002 according to surveys done by the Transparency International of the Corruption Perception Index (CPI).

According to Keefer (2002), the evidence suggests that corruption in Indonesia today is strongly related to some characteristics of Indonesian democracy that make it susceptible to corruption, i.e.:

- 1. The under-development of democratic institutions and the corresponding prevalence of 'clientelism' weaken electoral discipline on political decision makers. Indonesian democracy can be said to date only from the 1999 general elections, not enough time for the political process to mature and for clientelist motivations in politics to be displaced.
- 2. The time horizons of most politicians, particularly legislators, have shortened since the dictatorship era of the second president, Suharto. Until the end of this era, few key decision makers, beginning with Suharto himself, expected to lose power in the near future. With the advent of democracy and the still unsettled nature of electoral institutions,

<sup>1</sup> There are different terminologies on differing the cases of corruption, collusion, and nepotism in Indonesia contrasting with most international scientific papers on corruption that categorize the terms in only one terminology: corruption. These terms will be elaborated more in the rest of the paper.

legislators and even the highest party leaders confront a higher probability of losing power.

3. Decision making has not only splintered since *Reformasi* (the fall-down of Suharto regime), but responsibilities are diffuse and opaque from the point of view of voters. Voters are less able to hold individual parties or legislators responsible for outcomes, leaving parties and legislators with fewer incentives than similarly situated legislators in more developed democracies to rein in corrupt behavior by government officials.

Corruption has been a serious case in Indonesia regarding the economical growth and even the evolution of social contract (Situngkir & Hariadi, 2003), the international relations, *et cetera*. The ubiquity of the very systemic corruption should be approached in many analytical tools.

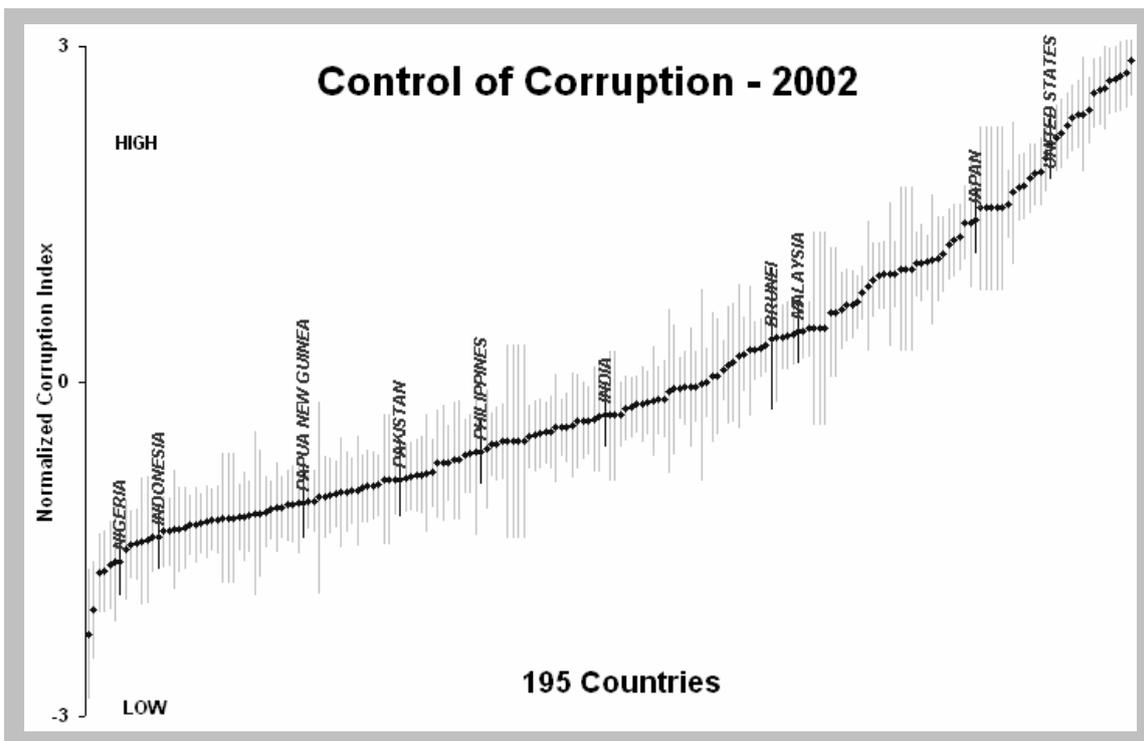


Figure 2

The Normalized Corruption Index of Governance on the ability among 195 countries to control the corruption (2002) done by the World Bank (Kaufmann, et.al, 2003). Indonesia is one of the lowest countries having ability to control corruption even in the Southeast countries.

The rest of the paper will capture the structural dynamics of corruptions in Indonesia by growing the structural corruptions *in silico* to demonstrate that corruption as individually micro-specification is sufficient to generate macro-phenomena in a country (Epstein & Axtell, 1996). We will try to outline some generalizations on the meaning of terminologies and relate them to the structures of cases in Indonesia perceived in everyday life. Some general propositions will then become the material on constructing the model for the simulations. The simulations then test some 'solutions on combating' corruption proposed by some policies in Indonesia and concluding some theoretical aspects on corruption locally in Indonesia.

## 2. Corruption as Floated Signifier

Corruption, however, is a little difficult term to define. Gambetta (2000):

Can we identify a specific social practice that we can justifiably call 'corruption', and, if so, what are its distinct analytical properties? Given the multiplicity of definitions found in the literature and the considerable confusion over what exactly we should understand corruption to mean, this question, which forms the object of this essay, does neither have a straightforward or a formalistic answer.

It is obvious that corruption is not an exclusively economic phenomenon. As described by Abed & Davoodi (2000), corruption manifests itself in many political processes, law and judicial system, and many less visible spheres. The minimum amount of literatures on clear and careful theoretical explorations about corruption in Indonesia has become a major obstacle of the paper. However, we will compare some definitions of corruption in many circumstances to the definition used in the local law-enforcement.

In Indonesia, according to the law issued by the government (1999: section 2(1) & 3), corruption is defined as "*self-enrichment behavior of someone or a corporation to inflict the state's financial and economical loss by abusing authority or opportunity*". But the most popular and probably simplest definition was coming from Tanzi (1998) that defined corruption as "*the abuse of public power for private benefit*".

In many cases, corruption is a signifier referring to many phenomena. Most of literatures on corruption referring corruption to many phenomena i.e.: bribery, collusion, nepotism, and so on. According to Berg (2001), corruption is the abuse of public power for private benefit, and that private benefit is most often in the form of illicit money or in-kind from a client to the agent; we call this as bribery. Conclusively, the evaluation of the definition on corruption from many literatures brings us to realize that the terminology of corruption is a floated signifier whose many terminologies should have point in.

In advance, we can say that corruption is a symptom of the weakness in political, social, legal and economic systems. Even where corruption is widespread, the actor will strive to keep it hidden from public view. Corruption is not new, nor is it confined to any particular part of the world. On the contrary, corruption is a global phenomenon, although its severity varies from country to country. Nevertheless, the mode and typology of corruption in Indonesia will somehow different with in other countries in the world.

One important thing to note is that the different definitions on corruption eventually impact the way we measure and analyze a corrupt phenomena. Berg (2001) analyzed some different methods on measurement on corruption. To day, corruption is measured by using the survey and polling of random sample of locals or businesspeople; this is what can be called the method of subjective measures, and how the figure 1 and figure 2 made up, although each of the subjective measurement employ distinguishable methodologies: the first based on the perceptions and the other based on experience. However, the paper will not discuss the methodologies of the measurement since the purpose of the paper is to find some general structural outline of corruption in Indonesia.

The rest of the paper will construct analytical tools from the definition of corruption directing to the practical cases found in Indonesia. We will use analytical map of corruption (Gambetta, 2000) and the game-theoretic model of corruption in bureaucracies (Norris, 2000). Eventually, we will try to construct the dynamical model based on the definitions and the classifications described in the next section.

### 3. What can we call corruption?

To define what corruption is, we must analyze the social agent that involved in the process. According to Gambetta (2000), there are at least three agents involved in the corruption: agent (can be individual, such as an employer, or a collective body) relying on the expectation that people in certain positions

are bound to follow given rules, one who agrees to act on behalf of the first agent, and the one whose interests are affected by the second agent's actions. There are rules to be done by the second agent as trusted by the first agent. However, the third agent wants the second agent to do improperly: to abuse the second agent's trust from the first in order to gain benefit for her. For the easier linguistic environment we will give three set of agents, the first agent is member of the set  $T$ , to give trust to the second agent. The second agent is member of the set  $G$  receiving obligation to play as the rule that tied  $G$  and  $T$ . However, in the walking process there will be the third agent, the member of the set  $P$ , try to attract member of  $G$  to violate the rule specified. Once member of  $G$  agrees to do it, the corruption on abusing the authority occurs. We should note that a corruption can only be occurred if and only if a certain relationship between members of  $T$  and members of  $G$  pre-exists.

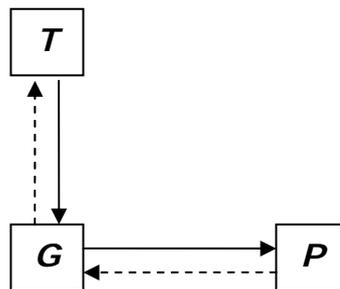


Figure 3

The primitive model of corruption.

The solid arrows represent things should be done according to rule of the game and the other represent situation when corruption occurs.

In our case members of  $T$  agree to entrust some resources or objects to members of  $G$  if the members of  $T$  expects the members of  $G$  to serve their interests. The members of  $T$  trust the members of  $G$  to do things whose outcome  $x$  for  $T$ . The wrong doing abusing the trust by members of  $G$  denoted by  $y$  will reduce what should be gotten by members of  $T$  since  $y > x$ . But it is obvious by abusing the trust, members of  $G$  gain more benefit. An act of corruption is then defined by the amount of some currency, say  $b^*$ , received by members of  $G$  which persuaded by the members of  $P$  in order to make members of  $G$  abusing the trust they received. We can say that the value of  $b^*$  to fulfill

$$y + b^* > x$$

This is the value motivating members of  $G$  to abuse the trust. Members of  $P$  can vary the value of  $b^*$  in return the members of  $G$  obviously can reject the offer because it is too small relative to the cost they incur by doing by the rule, or probably because their integrity: a moral keep them not to abuse the trust. It is important to note that there should be an exchange between members of  $P$  and  $G$  then the corrupt action occurs<sup>2</sup>.

By the above notions, we can say that bribe (use of rewards to pervert the judgment of a person in a position of trust), nepotism (patronage by reason of certain types of primordialism rather than capability), and misappropriation (illegal appropriation of public resources for private regarding use) are aspects of corruption. A bribe to the police officer, the judge, or anything can be classified as corruption since the members of  $P$  offer some currency to the members of  $G$  to

<sup>2</sup> What I use here is some modified and adjusted definition of corruption expanded more details, e.g.: on special cases where the members of  $G$  and  $P$  are the same subject, etc. in Gambetta (2000).

break the law trusted by the supreme power (can be the government, the representatives of the whole people, etc.). However, we should consider also that sometimes members of *P* offer bribe to *G* in order to have their own rights as citizens. For example, we should offer bribe to a trash-collector then he will take our trash, if we don't pay the bribe he will not serve us well. In the developing countries including Indonesia, some cases like these are often.

Such works like Hellman, et. al. (2000), Berg (2001), up to the works of the Transparency International (2003) and The Gallup Institute (1999) practically gave us the structured perspectives of common people or citizens on corruption in countries; and at the special case of Indonesia (Holloway, 2002). The method used is statistics to measure how the citizens perceived corruption in their society. In Indonesia, research by the Partnership for Governance Reform in Indonesia (2002) showed that corruption can be classified in two terms:

- ✓ *the Administrative Corruption*, defined as intentional imposition by state or non-state actors of distortions in existing laws, policies, regulations for their own advantages. In our basic model, this case can be drawn as in figure 4a. There are some rights should be given to the citizens but the officials abusing their authorities to gain as much advantages as they can.
- ✓ *the state capture*, defined as illegal actions by firms or individuals to influence the formulation of laws, policies, regulations to their own advantage. In many post-communist countries this kind of corruption can be differ in two other classifiers (Hellman, et.al., 2000), i.e.: *state capture* (influence with illicit payment) and the *influence* (without illicit or non-transparent payment). In Indonesia, there is no completed literatures like this to differ this classifier, thus we will use term *state capture* to see the rule of the game.

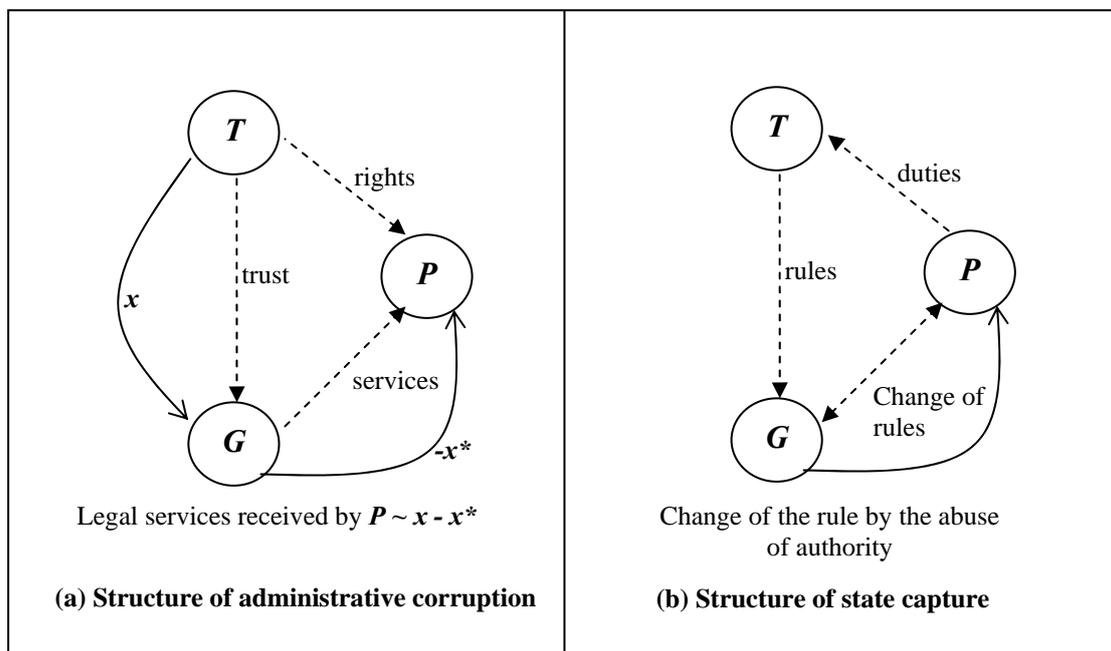


Figure 4

The general structures of corruption occur in Indonesian society

Seeing the figure 4, we find that corruption in many cases should be approached in the perspectives of the interactions between the members of *G* and *P*: there will always be two sides exchanging benefit and abusing the trust and authority pre-gained by one of them. In the cases of administration corruption we can see

that bribe as the generic model. They are dealing with someone's right (the members of **P**) by having connection with **T** but must be actualized by interacting with **G**. In this type, the members of **G** abusing their positions and authority to gain benefit from the members of **P**'s offer. As explained above, the offer can be actualized for breaking the rule of service of members of **P** by members of **G** reducing the right to have service of members of **P** or even to achieve the full service for them.

The second type found most in the unclear political system where members of **P** can influence the rule of the game contracted by the members of **G** and the members of **T**. The cases usually happen on the duties should be fulfilled by members of **P** for the members of **T**, but to accomplish the duties members of **P** should interact with the members of **G**. By actualizing this corruption mode the members of **P** will reduce the duties they should accomplish according to the rule since they will influence the members of **G** to use their authority on changing the rule to give the most benefit they can get.

Somehow, we can find the terminologies on collusion and nepotism inherently in the two types of corruption. It is not an exaggeration to say that in Indonesia, they are the generic models of the practical corruptions in every day life. In the next section, we approach the dynamics and evolutionary corruptions in Indonesia by the two generic types. The static game-theoretic model of bureaucratic corruptions (Norris, 2000) can be seen as the more technical views of the two types of corruptions.

#### 4. The Dynamics of Corruption: Model Construction

From the two types of corruption explained in the previous sections we understand that corruption can be seen as general form described in figure 3. Practically, we can classify corruptions as seen in figure 4; how the abuse of power misappropriates the rights or the duties contracted by the rule of the game. We construct a dynamical model to see some transitions or some changes in the social system regarding the corruption cases within. We build model based on the general model described on the figure 3 on varying parameters of social system by realizing that the figure 4 will only give us some details that can be seen succinctly in the general model.

There are three groups of agents we will deal with. We isolate two interacting set of constituent in the model (members of **G** and **P**) as corruption rises from these two sets of agents. The two set of agents interact each other in random order and sequences while there will be exchange of benefit between the two of them corrupting the rule of the game. We build subjectivity in every agent, i.e.: the memory to remember what has happened with her friends in the previous iterations, the preferences based on her morality, subjectivity on the system, whether or not she asks her partner to corrupt or do honestly.

We use the simple pay-off matrix presented by Hammond (2000) and have some modifications in the playing games. The modifications lead us to adaptation of the model to general outline of corruption in Indonesia.

In our model, we construct two sets of agents, representing members of **G** and the members of **P**. Each agent from each set interacts in the trust game based on the pay-off matrix pre-defined. Their neighbors and partners with whom she interact with is selected randomly as figured in figure 5. Each will get pay-off as the consequence of the choice or decision. Corruption will only occur when the two partners agree to do so. We should note that the agents are bounded rational on their expectations of the next turn choice.

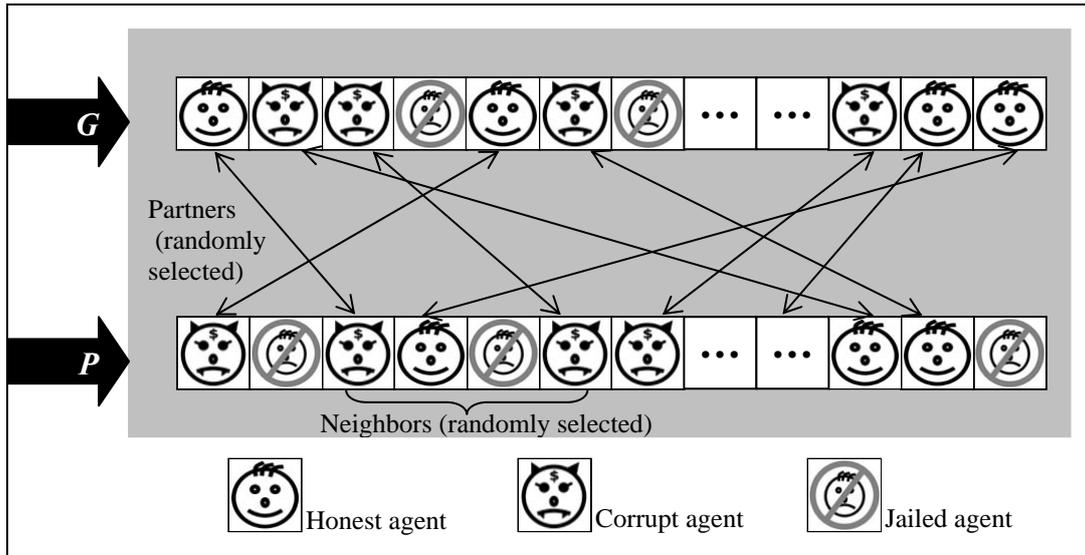


Figure 5

The way the game roles.

There are two subjective considerations on every agent to choose whether to corrupt or not, i.e.:

- ✓ subjective thought whether or not her partner in the next round will agree to corrupt or not, denoted by  $F$ , based on the number of the matched corrupt partner that agreed to corrupt (e.g.: to accept or offer bribe) per the length of memory of each.

$$F = \frac{\text{Matched corrupt Partners}}{\text{Memory}}$$

- ✓ subjective thought whether or not she will be caught by the members of  $T$  that can sentence her to the jail for some certain rounds,  $C$ , assumed by the jailed friends ( $m$ ), in her social network per corrupt friends in the last round ( $M$ ).

$$C = \frac{\text{Friends in Jail}}{\text{Corrupt Friends}}$$

As figured in table 1, the biggest payoff value will be gained if both players choose to corrupt. Every agents in our system will be pre-given the honesty index, the index shows how corrupt one to be. Practically, we give the index by [0, 1] randomly among agents; the more un-honest an agent to be corrupt the index will closer to the unity.

Table 1  
The Pay-off Matrix of the Game

	<b>Corrupt</b>	<b>Not-Corrupt</b>
<b>Corrupt</b>	$\alpha$	$\beta$
<b>Not-Corrupt</b>	$\beta$	$\beta$

Honesty index determines the expectation of each agent on every round's pay-off. The closer the index to the unity the bigger expectation of the agent, the greedier the agent that follows:

$$\alpha^* = (1 - i)\alpha$$

where the  $\alpha^*I$  is the expectation of the corruption and  $i$  as the honesty index.

By glancing at the pay-off matrix we can see that the game seems to be very simple, since  $\alpha > \beta$ . By assuming the game as static, we can solve it and find the equilibrium, but under dynamical system, the game will show the complexity of the game, since there will be emergence in the collective state of all agents. In other words, the complexity of the game comes out from the uncertainty of each agent to choose whether corrupt or not.

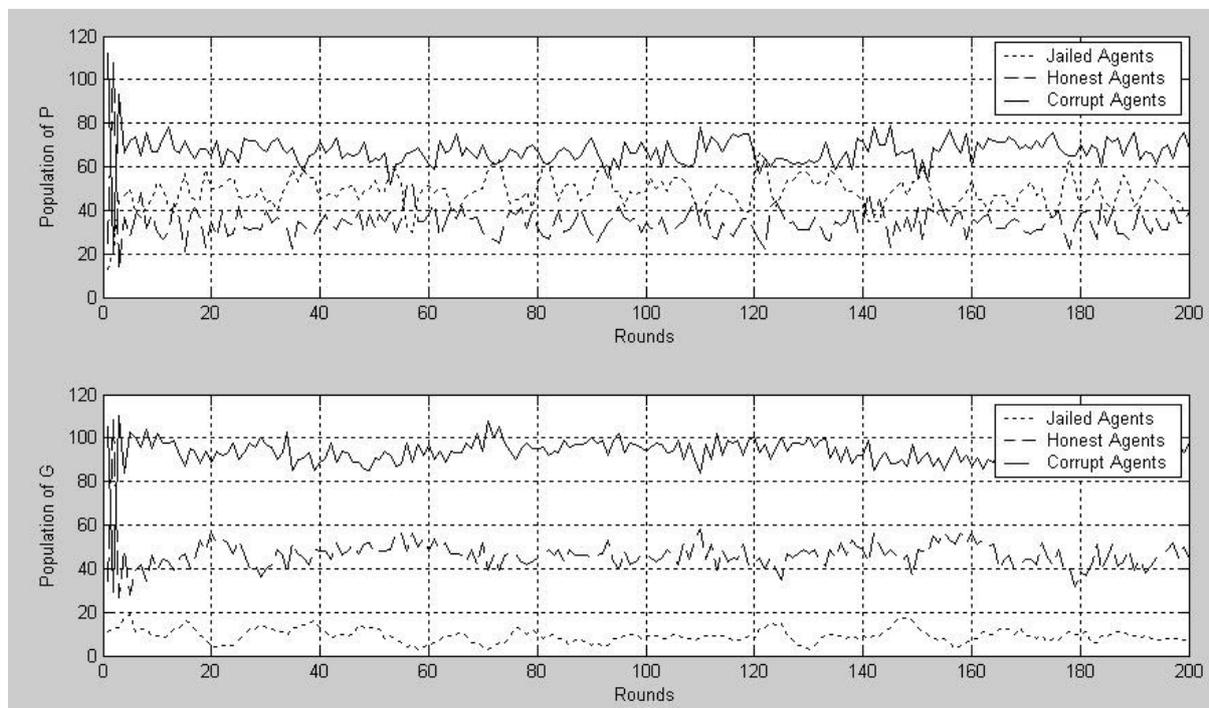
Eventually, the agent uses the limited information (the agent never knows and calculates the macro-state of the system) to choose that follows:

$$E(x) = (1 - C)|F\alpha^* + (1 - F)\beta| + C|\beta - k\beta|$$

where  $k$  is the length of the jail term. If the expectation  $E(x) > \beta$  then the agent has been greedy enough to do corruption. It is obvious that the agent build up subjective perspectives on her environment then choose to corrupt or to be honest. The simulations of this model will bring us to the ability to answer some general points on corruption cases in Indonesian society analytically.

## 5. Results of Simulations

We do several experiments on the artificial corrupt society. The list of basic numerical variables is available in the appendix of the paper. We do some experiments based on the structures and some structural alternative solutions oftenly proposed to handle corruption cases in Indonesia. Our first experiment wants to test how the social system gets its evolutionary stable in which the variables used are at the basic values.

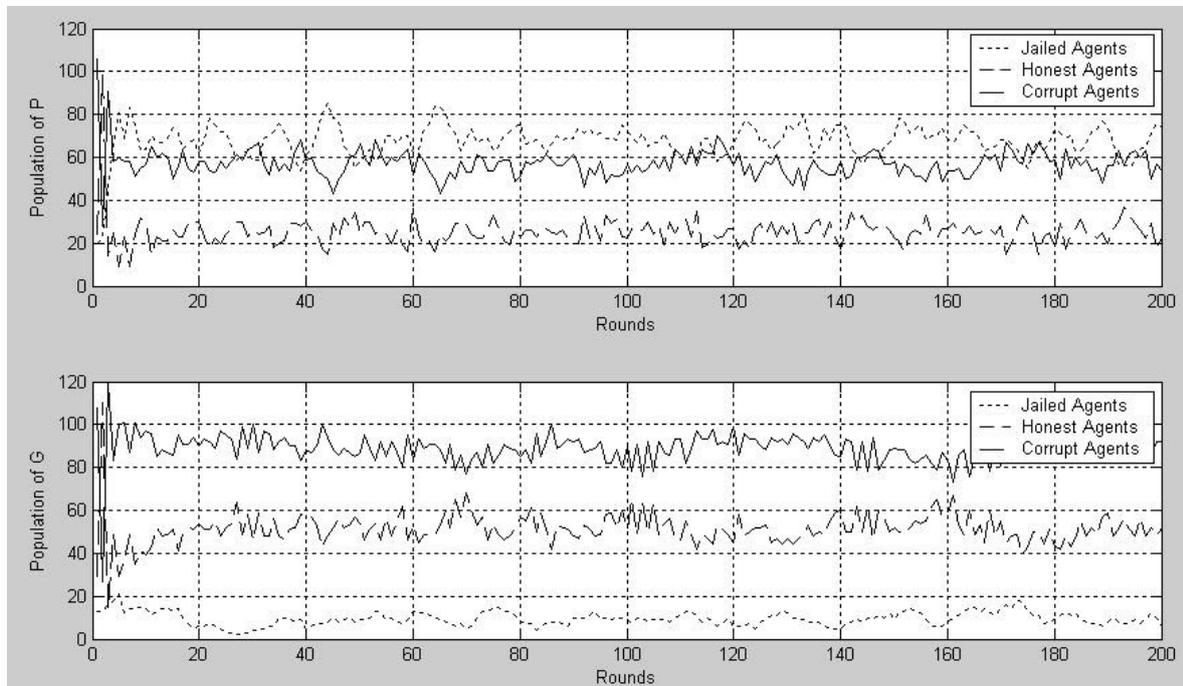


**Figure 6**

The first simulation result when we use the basic parameters on the artificial society

In figure 6, we can see that the population of  $P$  jailed more than the members of  $G$ , since in most cases of corruption in Indonesia the ordinary people

is much easier to get captured doing corruption than them who is part of the bureaucrats. The evolutionary stable conditions seem to remain the corruptors to corrupt still while the honest one remains honest or stimulated to corrupt. The simulation result reflects the algorithm employed here that the jailed corruptors will perform honest right after she leave the jail while then she can be corruptor again in the next round. That is why the population of corruptor is seemingly more stable than others in both graphs.

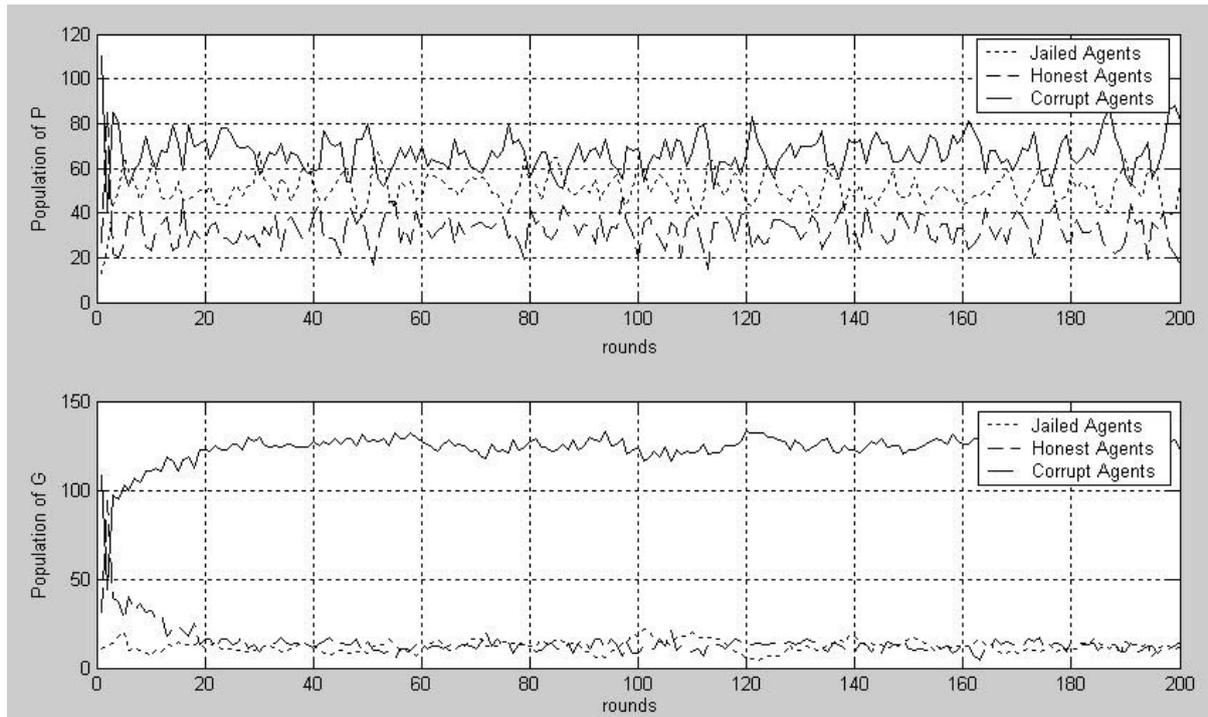


**Figure 7**

The performance of the system on the same jail period. There is a fast transition on the domination of honest agents and the corrupt one in the populations since the populations of  $P$  learn and fear of corruption the many of their friends jailed on corruption relative to the bureaucrats.

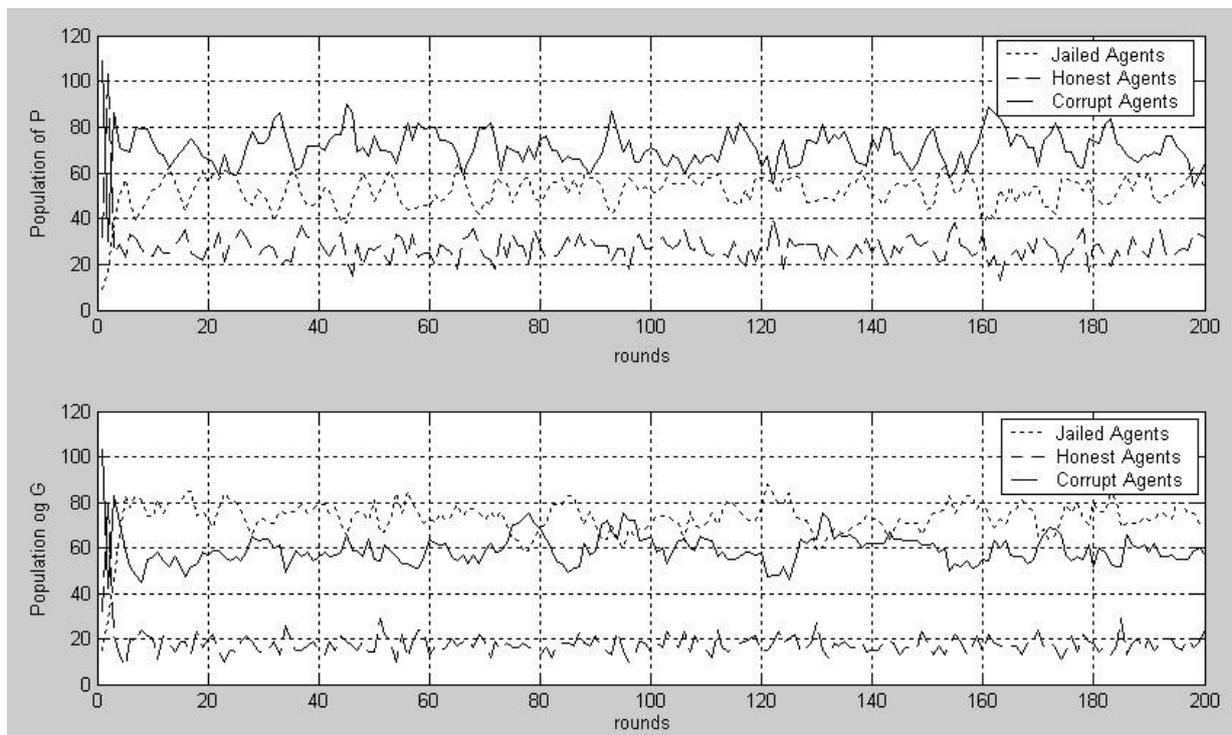
When we give the members of  $G$  longer length of jail period than the members of  $P$ , as described in figure 8 the members of  $G$  become very corrupt bureaucracies with minimum jailed agents. This fact is followed by the dominant corrupt agents among the population of the jailed agents of  $P$ . This result concludes a common propositions saying that corrupt government will induced corrupt citizens. We should note also, that as has been proved by the previous work (Situngkir, 2003a), agent's morality can not become a major solutions to combat corruption. In our simulation experiments we do not change and analyze the honesty index. As it has been introduced before, the honesty index is pre-defined parameters that will never be changed in the running simulations.

In our simulations the corrupt culture in the members of  $G$  induces the corrupt behavior among the members of  $P$ ; do not care how honest the populations of  $P$ . By this result we can say that the combat of corruptions somehow should begin from the law enforcement first regarding all the populations of bureaucracies and then regarding the citizens. The endeavor combating corruption by campaigning to the people without the law-enforcement (as described in the next experiments) will nevertheless fail. This is persuaded by the next simulations figured in figure 9, where the length of the jail period on members of  $P$  is longer than among the members of  $G$ . In other words combating corruption should be done holistically.



**Figure 8**

The dominations of corruption in members of  $G$  on the bigger length of jail period than the agents of  $P$ . The honest agents in  $P$  will be induced to be corrupted populations on the corruptions in the bureaucracies (members of  $G$ ).

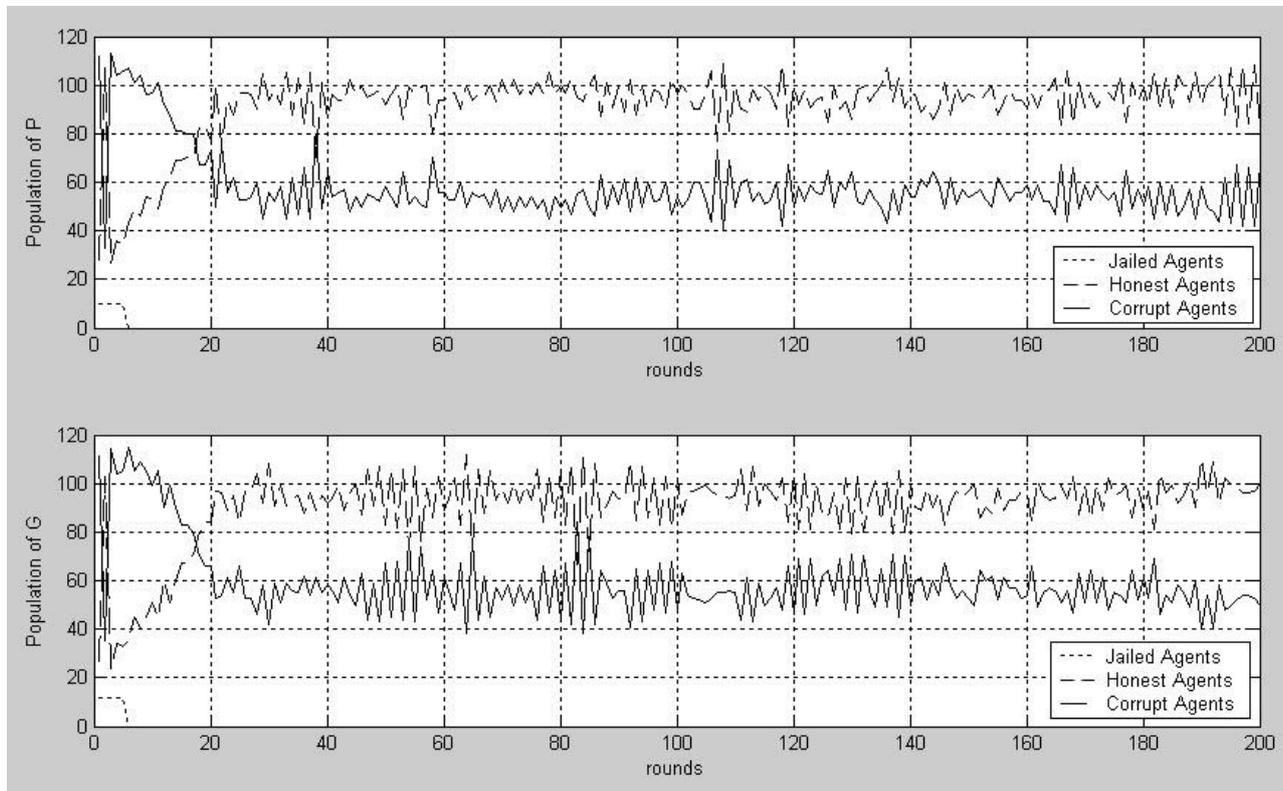


**Figure 9**

The length jail period among the members of  $P$  is longer than among  $G$ . Following the previous simulation result, the corrupt citizens reflected by the dominance of jailed agents among bureaucracies.

There is an alternative solutions proposed by the common sense that if we give any chance to giant corruptors then they will be followed by the spreading of corruption among the whole people. Our simulation shows that this is

experimentally correct. When the highest authority (represented in our general model as members of the  $T$ ) jails the giant corruptors (represented by the most often corruptors) there will be fast transitions from the corrupt regimes to the dominations of the honest and the lowest level of corrupted agents. This fact shows us that it is important to jail the big corruptors as will be followed by other agents who corrupt rarely turn out to be honest.



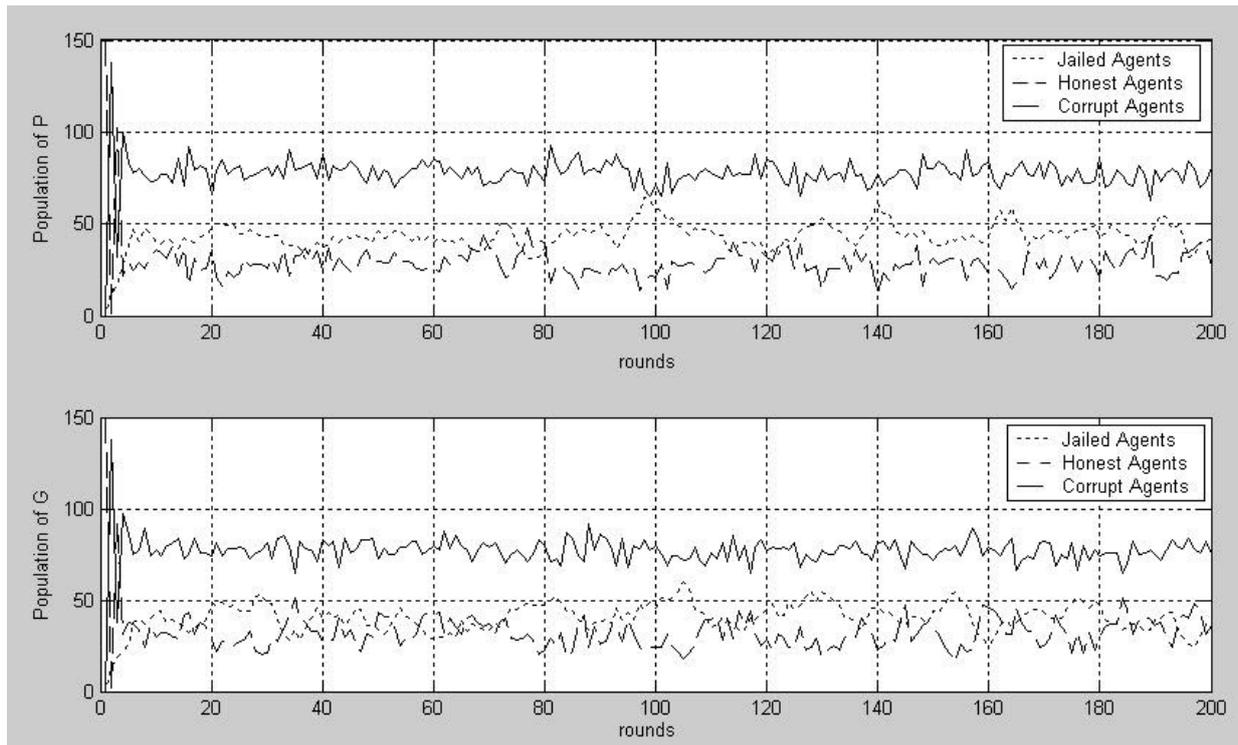
**Figure 10**

The transitions among the two interacting populations when there is law-enforcement to jail most often corrupting agents from the corrupt regime to the honest one.

Eventually, we check computationally in our model whether a corruption regime will fail on the better pay-off for the honest. Practically, this is very popular in Indonesia to say that an important way to reduce corruption is to higher the wages. However, as described in the beginning of the paper, we must understand that corruption is not merely economical problem. Corruption is linked to many aspects of the life of a society, including political, culture, and sociological aspects<sup>3</sup>. On this paradigm, the solutions to higher the wage comes from the assumption that corruption is merely an economical problem. A nice statistical analysis proving this proposition practically can be seen on the works by Rijkeghem & Weder (1997).

As pictured in figure 11, we can see that at the high pay-off for an honest agent relative to the corrupt one will remain no solution at all. The corrupt agents will still dominate among the member of  $G$  and  $P$ . This fact however demands the more holistic view on corruption and constructing alternatives to combat it. When we solve problem of corruption in only economical aspects it will remain nothing since corruption has root not only in economical properties of social system but also in many other aspects.

<sup>3</sup> A more comprehensive agent based computational economics on corruption to interplay the dynamics of corruption and the macro-economical aspects can be seen in Chakrabarti (2001).



**Figure 11**

The merely higher pay-off (or wage) to do honest relative to the corrupt one is not a good solution to combat corruption. Corruption should be seen holistically on constructing the strategy to eliminate corruption.

## 6. Further Works & Concluding Remarks

The high perceptions on corruption in Indonesia are revisited to show that corruption has been an important priority to gain the better and more efficient economical and governmental system. There is no excuse to delay Indonesian to combat corruption.

The corruption is defined as the abuse of authority and or power trusted to someone to gain self-benefit offered by the third side finding benefits from the abusing of the trust game. By this analysis we defined the administrative corruption and the state capture as the two basic types of corruption happens in Indonesia. We obtain general model of corruption then by seeing the vested of interests in the two models on abusing the legal proportions on duties and rights of citizens.

The computational simulation experiments done shows that the dynamics of corruption touch the two interacting agents, i.e.: the trusted agents and the agents proposing the abuse of the trust. Henceforth, the way to cope with corruption should also touch these two agents simultaneously. Forgetting one agent in the basic model will remain nothing on the elimination strategies of corruption. Thus, to see corruption correctly is to see it as a complex dynamical system in the complexity of social system.

It is understood that the rule-mechanism of each agents seemingly simple since the model presented here is on the purpose of clarifying the general structural dynamics of corruption in Indonesia. To make the attributes of the agents to be more complicated in order to find more emergent phenomena is a challenged further work to be considered, i.e.: the use of some macroeconomic variables e.g.: inflation, economic growth, etc. This further works will enrich any policies made for reducing corruption practically.

In general, we have shown that corruption should not also be seen in mono-dimensional spectacles. The corruption is not merely economical phenomena but the root of corruption lies upon many aspect of social dynamics, politically and economically cultures among the whole people in all level of social hierarchies. Therefore, to eliminate corruption is to construct holistic strategies including as wide as possible field of discourse. Corruption, however, is an interdisciplinary field of discussions.

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## **Appendix**

The basic values used in the simulations of the Artificial Corrupt Societies:

Pay-off to the corruption ( $\alpha$ )	20
Pay-off to being honest ( $\beta$ )	1
Distribution of Honesty Index	Randomly Distributed (Gaussian Distribution) among agents
Number of Agents	75 members of <b>P</b> and 75 members of <b>G</b>
Honesty Index	[0..1]
Length of jail period	5 rounds
Social Network	5 agents
Memory	3
Probability to be caught	0.2
Iterations	200 rounds

Some of the basic values are changed to see the effect to the evolutionary stable conditions in the whole artificial social system.