Corruption Traps and Economic Growth

Hyeongjun Bang*

April 2014

Abstract

Corruption is closely related to economic growth. This paper considers the prospects for constructing a model of growth in an economy with bureaucrats who collect bribe from entrepreneurs to pursue their bribe income maximization. The bureaucrats have an ability to set their effort level on receiving investment projects, and entrepreneurs must pay a bribe to operate their investment project if the bureaucrats observe them. Under progressive bribe rates along with project’s profitability, corruption can make entrepreneurs choose less productive investment projects to avoid high bribe rate, defined as a reversion of profitability. This reversion is possible to lead an economy to be captured in a corruption trap, where its unique steady states depends on its initial conditions, or a corruption collapse, in which a high steady state fails to exist and only a lower steady state survives. A major implication of the analysis is that corruption can explain part of income disparity among developed countries and poor corrupt countries.

1 Introduction

It will be admitted by most economists that economic growth and corruption heavily related and that highly corrupt social system hinders economic growth. During the last two decades, there have been a lot of studies about the effects of corruption on market, both theoretical and empirical, while it is still under dispute that how much corruption reduces social welfare or impedes economic development. Laffont and Guessan (1999) and Emerson (2006) concluded that competition and corruption relate negatively, while Bliss and Tella (1997) insisted that corruption does not necessarily reduce social welfare. Although a competition is one of the principal engines of economic growth, with most previous literature that focused on the relationship between competition and corruption, it is not clear how economic growth is affected by corruption.

*Department of Economics, Michigan State University, East Lansing, MI 48823 (e-mail: banghye1@msu.edu). The author is very grateful to Dr. Christian R. Ahlin for many valuable suggestions and comments. I also thank Dr. Todd E. Elder for helpful feedback and advice. All remaining errors are mine.
Some prevailing works tried to account for a more direct relation between economic growth and corruption. Ehrlich and Lui (1999) construct a model based on endogenous growth model with two investment schedules, while it focuses on trade-offs between political capital investment and human capital investment, not regarding corruption directly in the model. There are more empirical works on this topic. Mo (2001) estimated that 1% increase in corruption level reduces the growth rate by about 0.72%. Mauro (1995) analyzed a data set including corruption and concluded that corruption lowers investment, thereby lowering economic growth robustly. Monte and Papagni (2001) studied how corruption distorted public goods and services provision, and also found that corruption has a direct negative effect on growth rate.

The main contribution of the paper is to propose a simple macroeconomic model of corruption with heterogeneous investment projects. In this paper, economic growth has two meanings; one is a movement on a single trajectory from a state of low capital level to a state of high capital level under homogeneous investment project, and the other is a shift from a lower steady state to a higher steady state, which is accompanied with an increase in a portion of productive investment projects and a decrease in that of less productive projects under heterogeneity of investment projects. The basic framework of the model comes from Matsuyama (2007) which studied credit traps and business cycles, but this model differs from Matsuyama’s setting in consideration of corruption sector. Each entrepreneur must make a bribe payment to operate an investment plan when his operation is detected by bureaucrats. The bribe rates for investment projects are different each other progressively in profitability of the projects, that is, the bribe level is high for productive projects and low for less productive ones, while the bureaucrats determine how much efforts they make to detect a certain project type. With bribe maximization by the bureaucrats, because efforts play like a cost in the model, they put more efforts on more productive investment projects while less on less productive projects, in turns, a detection probability of a type of investment project increases so as the profitability of the project does.

In the model developed below, the homogenous entrepreneurs have access to a variety of heterogeneous investment projects. The projects differ in productivity and requirement, or in fixed investment size. A project produces its rate of return to an entrepreneur, but the profit to him is the rate of return minus bribe payment if his operation is detected, while the profit is the same to the rate of return if it is not detected, if the entrepreneur was a worker in the previous period. former bureaucrat entrepreneurs have political capital and the political capital allow them waived from bribe payment. The importance of the political capital is immense in some cases because each agent’s occupational choice depends on its value. Under the standard overlapping generation model, each agent cares life-time expected income in his occupational choice in the first period. In this model, the entrepreneurs carry out an investment projects that generate the highest profit to them. Along the equilibrium path, the high level of bribe payment for productive investment projects can cause an endogenous switch for the entrepreneurs from more productive projects to less productive.
ones. These interactions lead to a variety of non-linear phenomena, such as corruption traps, corruption collapse.

In this paper, the meaning of corruption trap is different from that used in previous studies. Prevailing works use 'corruption trap' as a phenomenon in which corruption is endemic and deeply embedded, so self-reinforcing mechanism that causes poverty persists, as like in Emerson (2006) and Hodge, et.al. (2011) and others. Here, corruption trap indicates a situation where an economy cannot escape from a low steady state trajectory if it has little initial capital accumulation, i.e., its growth trajectory heavily depends on initial conditions. Here, however, a corruption trap corresponds to a case in Banerjee and Newman (1993) where, it depends heavily on the economy’s initial conditions whether an economy converges into final steady state or whether an institutional transformation happens or not.

This model does not consider borrowing section in Matsuyama (2007) due to the simplicity of analysis. With borrowing section, the model has a borrowing constraint, which would generate more conditions on equilibrium interest rate that is expressed as a function of production technology and rate of returns, while the equilibrium path and other non-linear phenomena remain quite unchanged.

The model’s implications for economic growth might also be an interest. As the endogenous growth model prediction, the model we have constructed here says that convergence does not occur even if countries are identical in all respects except that there are differences in the progressive bribe rates. For economic growth, an economy needs to lower the bribe rates, as well to accumulate capital goods.

The rest of the paper is organized as follows. Section 2 introduces the model and derives the system of equations that governs the dynamics of equilibrium. Section 3 looks at a benchmark case, in which all the projects are homogeneous and the aggregate investment dynamics are characterized by monotone convergence, as in the standard neo-classical growth model. Section 4 investigates cases where there are trade-offs between productivity or profitability, defined as reversion of profitability, and bribe level that entrepreneurs face. These cases capture the situation where more productive projects are subject to bigger bribe level, and it gives rise to the possibility of corruption traps and corruption collapse. Section 5 looks at the case in which bribe rates are flat for all projects. Section 6 provides some discussion and concluding remarks.

2 The Model

The basic framework used is the Diamond over-lapping generations model with two-period lives. The economy has two types of goods, capital goods and final goods. The final good is produced with the constant returns to scale (CRS) technology, \( Y_t = F(K_t, L_t) \), where \( K_t \) is physical capital and \( L_t \) is labor. The final goods produced in period \( t \) may be consumed in period \( t \), may be paid as a bribe to and then consumed by bureaucrats in period \( t \), or may be allocated to
investment projects. Let \( y_t = Y_t / L_t = f(K_t / L_t, 1) = f(k_t), \) where \( k_t = K_t / L_t \) and \( f(k) \) satisfies \( f'(k) > 0 \) and \( f''(k) < 0 \). The capital good is physical capital, which is produced by savings, and is assumed to depreciate fully in one period. The markets are competitive, and the factor rewards for physical capital and for labor are respectively equal to \( \phi_t = f'(k_t) \) and \( w_t = f(k_t) - k_t f'(k_t) \equiv W(k_t) > 0 \), which are both paid in the final goods.

In each period, a new generation of potential entrepreneurs, a unit measure of homogeneous agents, arrives with one unit of labor endowment. They live for two periods. In the first period, they sell the endowment and earn \( w_t = W(k_t) \), and consume only in the second period. Thus, saving is inelastic, and at time \( t \), the total saving is equal to the wage, \( w_t \), which is converted into capital goods with multiplier of \( R_j \) in the next period. The new generation allocates it to maximize their second period consumption. In each period, a new generation of bureaucrats also arrives without any labor endowment. They collect bribe in each period, pursuing bribe income maximization, consume all their income in that period and do not make any saving. All the savings in the economy, therefore, comes from potential entrepreneurs. The gross return in the economy equals to \( r_{t+1} \) per unit, so entrepreneurs can consume \( r_{t+1} w_t \) in the second period if they choose to become lenders. The potential entrepreneurs may become entrepreneurs by using their earning, \( w_t \), to finance an investment project among \( J \)-types of projects. All projects come in discrete, indivisible units and each entrepreneur can run only one project. A type-\( j \) (\( j = 1, 2, \ldots, J \)) project transforms \( m_j \) units of the final good in period \( t \) into \( m_j R_j \) units of physical capital (capital goods) in period \( t+1 \). Because of the fixed investment size, \( m_j \), an entrepreneur needs to borrow by \( m_j - w_t \) at the rate equal to \( r_{t+1} \). If \( w_t > m_j \), they can entirely self-finance the project and lend \( w_t - m_j \).

Let \( X_{jt} \) denote the measure of type-\( j \) projects initiated in period \( t \). Then, the aggregate investment, the amount of the final goods allocated to all the projects, is \( I_t = \sum_j (m_j X_{jt}) \). Since the aggregate saving is \( S_t = W(k_t) \), the market equilibrium requires that \( W(k_t) = \sum_j (m_j X_{jt}) \). The capital stock adjusts according to

\[
k_{t+1} = \sum_j (m_j R_j X_{jt}) \tag{1}
\]

Each agent has two possible occupations in each period, a wage worker and a bureaucrat in the first period, and an entrepreneur and a lender in the second period. The wage for a worker is \( w_t \), that for a bureaucrat is \( w_o \), and \( w_t \) is bigger than \( w_o \). While a bureaucrat earns less than a worker does in the first period, bureaucrats receive political capital, which makes them pay less bribe payment in the second period than former worker entrepreneurs do. Let \( N \) denote the total number of population and \( n_t \) the number of bureaucrats in period \( t \). There is no population growth in this model, so \( N \) is the same in every period.

A new generation of bureaucrats also arrives in each period, and they live only for one period. Let \( b_j \) denote the fraction of a profit or factor rewards for physical capital, for project type \( j \) that is offered to a bureaucrat in terms of bribe, and \( p_j \) the probability with which bureaucrats detect each type \( j \).
project. \( p_j \) can be interpreted, therefore, to entrepreneurs as the probability of being detected by bureaucrats, and to bureaucrats as an actual bribe income. It is assumed that each bureaucrat is able to monitor only one entrepreneur, so \( p_j = n_j/X_j \) where \( n_j \) denotes the number of bureaucrats who monitor type \( j \) projects. The bureaucrats set \( b_j \) by determining their effort level for investigating project type \( j \), denoted \( c_j \), which plays like a cost in entrepreneurs’ detection activities. We can say, therefore, that, given \( p_j \) for each project type-\( j \), \( b_j \) is endogenously determined along by bureaucrats’ optimization problem as a function of \( c_j \). Let \( b_j \) be a function of \( c_j \), and \( b(c_j) \) satisfies
\[
\frac{\partial b_j}{\partial c_j} > 0 > \frac{\partial^2 b_j}{\partial c_j^2}.
\]
Also we assume that bureaucrats are centralized, so we do not consider a case of competition among bureaucrats and a case for dual or multi bribe payments by entrepreneurs.

Let us now look at the investment decisions. To invest in a project, the entrepreneurs must be both willing and able to borrow. By becoming the lenders, they can consume \( r_{t+1}w_t \). By running type-\( j \) projects, they can consume \( (1 - b_jp_j)m_jR_f(k_{t+1}) - r_{t+1}(m_j - w_j) \). Thus, the agents are willing to run a type-\( j \) project if and only if \( (1 - b_jp_j)m_jR_f(k_{t+1}) - r_{t+1}(m_j - w_j) \geq r_{t+1}w_t \), which can be simplified to
\[
(1 - b_jp_j)R_f(k_{t+1}) \geq r_{t+1}
\]
which is called as (PC-\( j \)), where PC stands for the profitability constraint.

Let us look at the bribe sector decisions. The bureaucrats’ optimization problem for project type-\( j \) is
\[
\max_{c_j} \{ p_jb(c_j)m_jR_f(k_{t+1}) - \kappa_j c_j \}
\]
where \( \kappa_j \) denotes the characteristics of type \( j \) project about corruption. When a project has high \( \kappa_j \), the industry is hard for bureaucrats to receive a bribe with a given level of effort. We can think, therefore, that \( \kappa_j \) represents the vulnerability of type \( j \) project against corruption. In the above optimization problem for bureaucrats, the only independent variable is \( c_j \). By solving the problem, applying \( p_{t+1} = f'(k_{t+1}) \), the first order condition is,
\[
p_j \frac{\partial b_j}{\partial c_j} = \frac{\kappa_j}{p_jm_jR_f(k_{t+1})}
\]
which is called as (EC-\( j \)) where EC stands for the exploitation constraint. For simplicity, in the rest of the paper, \( \kappa_j \) is assumed to be 1 for all project types.

The (EC-\( j \)) exhibits a relationship between the investment size and the detecting effort put on by bureaucrats. With a fixed investment size of \( m_j \), an investment project with higher \( m_j \) has low \( \partial p_j/\partial c_j \), in turns, with equation
(3), has a high level of detection effort, \(c_j\), since the second derivatives for \(b(c_j)\) always has a negative value.

In each period, an agent has to make an occupational choice, between a worker and a bureaucrat when he is young, and between an entrepreneur and a lender when he is old. At an equilibrium, each agent chooses his occupation in the first period so that the expected life-time income for a worker and that for a bureaucrat are the same. This is called the *life-time income constraint*, or LIC. For simplicity, we assume that the wage for bureaucrats in the first period is 0, that is \(w_0 = 0\), and they only get the political capital and bribe income in the first period, so the wage for a worker represents the wage gap between a worker and a bureaucrat. It is also assumed that an entrepreneur is totally free from bribe payment if he has a political capital to simplify the analysis.

For any initial value, \(k_0 > 0\), the sequence of \(r_{t+1}, k_t\) and \(c_j\) that solves (1), (3), and (5) are the equilibrium trajectory of the economy.

Let us consider the case where there are two types of investment projects, i.e., \(J = 2\), to simplify our analysis, and \(m_1 < m_2\) and \(R_1 < R_2\), the standard assumptions of development economics. Any cases of \(J > 2\) can be obtained by extension of the \(J = 2\) case. Since type-1 project is smaller in terms of investment size than type-2 project, the maximum number of the type-1 project that can be initiated in an economy is bigger than that of the type-2, if all capital is invested in a single project type. Now, we have three cases for the number of bureaucrats in an economy; it is bigger than the maximum number of type-1 project, it is between the maximum number of type-1 project and that of type-2 project, and it is even smaller than the maximum number of type-2 project.

### 3 The Case for \(n > X_1 > X_2\)

Suppose that the number of bureaucrats is bigger than the maximum number of type-1 project. In this case, all entrepreneurs were bureaucrats when they were young, and all workers have to be lenders. All former bureaucrats are free from bribe payment due to the political capital, so they can offer a higher interest rates to lenders than former workers can do. The following inequality holds, therefore, for this case.

\[
(1 - b^* \rho^*) m_j R_j f'(k_{t+1}) \leq r_{t+1} m_j \leq m_j R_j f'(k_{t+1})
\]  

(6)

By dividing \(m_j\),

\[
(1 - b^* \rho^*) R_j f'(k_{t+1}) \leq r_{t+1} \leq R_j f'(k_{t+1})
\]  

(7)

Let us look at the life-time income constraint. All entrepreneurs, in this case, have the political capital, so there is not any bribe income for bureaucrats when they are young. All agents who had an occupation as a worker when they were young become lenders. Now we have the following life-time income constraint.

\[
w_t + \beta r_{t+1} = \beta \left( \frac{X_t}{n} \right) (m_j R_j f'(k_{t+1}) - r_{t+1} m_j)
\]  

(8)
By applying $X_{jt} = (N - n)w_t/m_j$, it gives

$$1 + \beta r_{t+1} = \beta(N - n)\frac{1}{n}(R_jf'(k_{t+1}) - r_{t+1})$$

(9)

From (9), we can obtain the following equilibrium ratio of the bureaucrats for this case.

$$\frac{n}{N} = 1 + \frac{1 - \beta r_{t+1}}{1 + \beta Rf'(k_{t+1})}$$

(10)

By definition, $n$ should be greater than or equal to 0 and smaller than $N$, but (9) says that the equilibrium $n/N$ is greater than 1 if $\beta r_{t+1} < 1$. This is a contradiction, and we can conclude that there is no equilibrium if $n > X_1 > X_2$ when $\beta r_{t+1} < 1$. and the equilibrium exists only when $\beta r_{t+1} > 1$. The (9) shows that the number of bureaucrats rises as the rate of return of type-$j$ project or the factor rewards for physical capital goes up, this means that political capital becomes more valuable.

Now, we have to check which project entrepreneurs are willing to initiate. Entrepreneurs choose an investment plan that makes more profit, by comparing the pay-off of the two types. The pay-off of type-1 project is $(\frac{N-n}{n})w_t(R_1f'(k_{t+1}) - r_1)$ from (9), and that of type-2 is $(\frac{N-n}{n})w_t(R_2f'(k_{t+1}) - r_2)$. After simplifying, an entrepreneur’s problem is comparing $R_1f'(k_{t+1}) - r_1$ and $R_2f'(k_{t+1}) - r_2$. If $R_1f'(k_{t+1}) - r_1$ is greater than $R_2f'(k_{t+1}) - r_2$, then all entrepreneurs will choose to operate type-1 project, this phenomenon is called as the reversion of profitability. If the interest rates are flat for funding for both types, then there is no reversion.

4 The Case for $X_1 > n > X_2$

Suppose that the number of bureaucrats is smaller than the maximum number of type-1 project while it is still greater than the maximum number of type-2 project. In this case, all of the former bureaucrats can be entrepreneurs if all choose type-1 project, but only part of them are allowed to become entrepreneurs if they are willing to initiate type-2 project. The difference from the previous case is, former bureaucrats do not need to worry the winning probability to become an entrepreneur if they choose type-1 project, and they will also receive bribe income when they are young by allowing part of the former workers to initiate an investment.  

Let us look at the case where all bureaucrats operate type-2 project. The interest rate satisfies (9) the expected life-time earning for a bureaucrat is $(\frac{N-n}{n})w_t(R_2f'(k_{t+1}) - r_{2,t+1})$, that for a worker is $w_t(1 + \beta r_{2,t+1})$.

In the case where all of the bureaucrats initiate type-1 project, the interest rate is determined by (PC-1) from (3). The expected life-time income for a bureaucrat is $\sum_{i}(b_{1i}^{(1)*}p_{1i}) + \beta(m_1R_1f'(k_{t+1}) - r_{t+1}(m_1 - \sum_{i}(b_{1i}^{(1)*}p_{1i})))$, and that for a worker is $w_t(1 + \beta r_{t+1})$. By definition,
\[ p_{1i} = \begin{cases} 
\frac{n(N-n)w_t}{m_1} & \text{if } n < \frac{(N-n)w_t}{m_1}, \\
1 & \text{otherwise}.
\end{cases} \]

When \( n < \frac{(N-n)w_t}{m_1} \), each bureaucrat monitors an investment initiated by former workers, so the expected income for a bureaucrat in the first period is \( b_1 \). When \( n > \frac{(N-n)w_t}{m_1} \), the bureaucrat’s expected bribe income when he is young is \( b_1 \times \frac{n}{(N-n)w_t} \).

Each former bureaucrat is willing to initiate type-2 project if and only if the expected income from type-2 is greater than that from type-1. The optimal strategy for former-bureaucrat entrepreneurs, therefore, can be summarized as

\[
\text{type} = \begin{cases} 
1 & \text{if } \beta \left( \frac{N-n}{n} \right) w_t(R_2 f'(k_{t+1}) - r_{2,t+1}) - b_1 - \beta\{m_1 R_1 f'(k_{t+1}) + r_{1,t+1}(m_1 - b_1)\} < 0, \\
2 & \text{otherwise},
\end{cases}
\]

The deterministic equation is

\[
\beta \left( \frac{N-n}{n} \right) w_t(R_2 f'(k_{t+1}) - r_{2,t+1}) - b_1 - \beta\{m_1 R_1 f'(k_{t+1}) + r_{1,t+1}(m_1 - b_1)\} < 0 \quad (11)
\]

When \( R_2 \to \infty \), (11) approaches infinity, and all former bureaucrats will try to initiate type-2 project. If \( R_2 \to R_1 \), (11) becomes negative under some conditions, not all the time. If an economy has a negative (11), then all former bureaucrats would be willing to operate type-1 project. This is the case of the reversion of profitability. As the number of bureaucrats increases, here \( n \to N \), (11) also goes to negative, and more people want to become workers in the first period. High uncertainty in becoming entrepreneurs and small gap between the productive plan and less productive plan provide incentive for agents to shift from the occupation of bureaucrat to that of worker.

5 The Case for \( X_1 > X_2 > n \)

Now, let us consider the case in which the portion of bureaucrats in an economy is small so both project types are open to former workers. Regardless of former workers’ decision making, former bureaucrats will initiate more productive investment, here type-2 project, and the problem that is needed to be solved is former workers’ choice between type-1 and type-2. Since the number of feasible type-2 project that can be initiated by former workers is smaller than that of feasible type-1 due to the large initial investment requirement for type-2 project, the detection probability is higher for type-2 project. By (5), a bureaucrat would make more effort on type-2 project, of greater \( m_i \) and \( R_j \), to receive bribe income, so \( b_2 \) is higher than \( b_1 \). The real bribe rate is progressive such that the order of real rate of return, which is the rates of return after bribe payment, for the two investment projects become reversed compared to that of original projects’ rate of return. Without corruption, higher-indexed projects are more productive, so are more preferred by entrepreneurs over lower-indexed projects, but high bribe rate on profitable investments makes productive projects less attractive. Such reversion between productivity and profitability can be important when more profitable projects are easy to fall under a watch of bureaucrats.
As described in the section 2, bureaucrats try to maximize their bribe profit, \( b_jp_jm_jR_jf'(k_{t+1}) - c_j \), and from (EC-j), \( \frac{\partial b_j}{\partial c_j} = \frac{k_j}{p_jm_jR_jf'(k_{t+1})} \), there is a negative relationship between the rate of return, \( R_j \), and the real bribe rates, \( b_jp_j \). With equation (2), \( \frac{\partial^2 p_j}{\partial c_j^2} < 0 \), low marginal detection probability per cost exhibits high level of cost, i.e., detection efforts. In other words, bureaucrats pays more efforts to detect a type of project if the type is more profitable, and the order of efforts is the same with that of profitability. It is possible, therefore, that there is a case where the reversion of profitability takes place.

Let us turn to the Inada conditions for \( p_j \). From (EC-j),

\[
\lim_{k_{t+1} \to 0} \frac{\partial b_j}{\partial c_j} = \lim_{k_{t+1} \to 0} \frac{1}{p_jm_jR_jf'(k_{t+1})} \to 0 \quad (12)
\]

since \( \lim_{k_{t+1} \to 0} f'(k_{t+1}) \to \infty \) by the Inada conditions for the production function. \( \frac{\partial b_j}{\partial c_j} \) goes to 0 if and only if \( c_j \to \infty \) by (2), in turns, \( b_j \) approaches to 1. Analogously,

\[
\lim_{k_{t+1} \to \infty} \frac{\partial b_j}{\partial c_j} = \lim_{k_{t+1} \to \infty} \frac{1}{p_jm_jR_jf'(k_{t+1})} \to \infty \quad (13)
\]

since \( \lim_{k_{t+1} \to \infty} f'(k_{t+1}) \to 0 \), and we can say that as \( k_{t+1} \) goes to infinity, then \( b_j \) tends to go to 0. These can be expressed mathematically by

\[
\lim_{k_{t+1} \to 0} b_j^* \to 1, \quad \lim_{k_{t+1} \to \infty} b_j^* \to 0. \quad \text{(14)}
\]

The equation (14) and (15) shows the Inada conditions for \( b_j^* \), where * means that the value is an equilibrium value.

Under such Inada conditions, combining equation (??), (14), and (15), we can obtain two extreme values for real rate of return that is given by

\[
\lim_{k_{t+1} \to 0} (1 - b_jp_j)R_j \to (1 - p)R_j, \quad \text{(16)}
\]

\[
\lim_{k_{t+1} \to \infty} (1 - b_jp_j)R_j \to R_j. \quad \text{(17)}
\]

The two above equations, (16) and (17), exhibit two points. One is that as capital accumulation reduces towards 0, then the real rate of return converges to \((1 - p_j)R_j\), and the other that as capital accumulation goes to infinity, the real rate of return approaches to \( R_j \) itself, and the bribe rate effect becomes erased and gets ignored. With (16) and (17), the reversion of profitability between type-1 and type-2 project can be depicted in Figure (2). As shown, each profitability line for type-1 and type-2 increases in \( k_{t+1} \). With \( R_1 < R_2 \) and \((1 - b_1)R_1 > (1 - b_2)R_2\), the two lines intersect only once, at \( k^c \). In the region of capital level lower than \( k^c \), the type-1 project gives higher real rate of return to entrepreneurs than type-2 due to high bribe rate for type-2 projects until \( k_{t+1} = k^c \), while \( k_{t+1} > k^c \), then the corruption effects start to be slashed and finally is completely erased with infinity future capital goods.
Applying the equation (18) again, the optimal strategy for entrepreneurs, therefore, can be summarized as

\[ k_{t+1} = \begin{cases} \text{R}_1 W(k_t) & \text{if } k_t < k_c \\ \text{R}_2 W(k_t) & \text{if } k_t > k_c. \end{cases} \] (18)

The intuition behind equation (18) is that when the bribe rate has progressive features, then entrepreneurs choose less productive investment projects, type-1, to avoid excessive bribe rate on productive type-2 projects, and the reversion of profitability can be observed with high probability with a low level of capital in an economy, while if the economy is capital fluent, then the probability becomes relatively low, because the bribe rate does not matter much as in the economy with low capital level. The trajectory of \( k_t \), therefore, shows a jump at \( k^c \), as the equilibrium path moves from type-1 project’s path to type-2’s, a transition to more productive path. There are three cases for this jump, depending on whether \( k^c < k^* \) (Figure 3a), \( k^* < k^c < k^{**} \) (Figure 3b), or \( k^{**} < k^c \) (Figure 3c), where \( k^* \) and \( k^{**} \) are defined respectively by \( k^* \equiv R_1 W(k^*) \) and \( k^{**} \equiv R_2 W(k^{**}) \).

Each of them has its possibility for an existence. In the above three graphs, \( k^* \) and \( k^{**} \) are stable steady states. In Figure 3a, the low steady state fails to exist, because the equilibrium trajectory does not meet with 45° line at \( k^* \). In this case, regardless of the economy’s initial point, it will converge into \( k^{**} \), the high steady state, and all the capital goods are
Figure 2: Corruption Traps and Corruption Collapse
invested to finance type-2 projects. There is no corruption trap or corruption collapse here.

In Figure 3b, the economy has two steady states, both low and high states, at $k^*$ and $k^{**}$, which indicates that each of them is feasible. In this case, which steady state the economy will eventually have depends on its initial condition. If the initial capital stock is a point on a low trajectory, i.e., $k_0 < k^c$, then the economy will go to the low steady state, $k^*$. This is a corruption trap case. When an economy is captured in a corruption trap, then any type-2 projects will not be financed, and all physical capital would flow toward type-1 projects, less productive one. If, fortunately, the economy starts at an initial point larger than $k^c$, then it can escape from corruption trap and will converge to high steady state.

In Figure 3c, only the low steady state survives and the high one is not achievable. As a result, we can observe that the economy cannot avoid to converging into the low steady state, which is called corruption collapse. In a corruption collapse, the economy converges to low steady state, and all type-2 projects would vanish and the portion of less productive type-1 projects will be augmented up to 100%.

What is important for determining an economy's final state is the location of $k^c$ in the case of corruption traps and corruption collapse, and the initial condition, $k_0$ in the case of corruption traps. If $k^c$ is high, then the possibilities for existence of low steady state increases while that of high steady state decreases, and, in turns, the economy is easy to fall into corruption trap or corruption collapse. Also, if an economy starts its trajectory with a high level of initial capital goods, then it has more probability not to be captured in a low steady state in the case of corruption trap, while it cannot escape to converge to low steady state in a case of corruption collapse regardless of its initial capital accumulation. Then, to obtain the two conditions, more initial capital goods and low level of $k^c$, which features an economy must have? In general, an economy has more initial capital goods if it is industrialized deeply, but less industrialized economies have a low level of initial physical capital.

Regarding $k^c$, there are two respects to consider. First, if an economy is less corrupt, then $b_j$ would be low compared to other economies, so the starting points of investments' real rate of return go to upwards, while the final destinations remain unchanged, as depicted in Figure (4). Then the real rate of return graphs shift to left, and by these shifts, the critical value $k^c$ also moves to left, into $k^{cn}$, as a result, smaller room is allowed for reversion of profitability, the causes of corruption traps and corruption collapse. Second, if the gap between the two original rates of return becomes wider, then the economy can enjoy a leftwards shift in the critical value of $k_c$. Let denote $R'_2$ is a new rate of Returns for productive project type-2, and $R'_2 > R_2$ holds. Then, due to the reversion of profitability, the initial gap in the rates of return for type-1 project and new type-2 project would get wider, but the final gap between the two rate of returns also gets increased. This shift, shown in Figure 3, makes the critical value, $k^c$, moves to $k^{cn}$, and also reduces room for reversion of profitability. This productivity gap is, generally, witnessed in developed countries, while
Figure 3: Case of a Decrease in Bribe Rates

Figure 4: Case of Widening Gap in Rate of Return
in poor economies, productivity gaps between various industries is relatively small. Consequently, the model suggests that less developed or industrialized, and more corrupt countries are easy to be fallen into corruption trap or corruption collapse, but industrialized and democratic countries tend not to be fallen. The corruption trap and corruption collapse can partly explains income disparity among countries, which is consistent with the endogenous growth model. The implication of this model is, therefore, that if an economy pursues economic growth, then it has to accumulate more capital goods by industrialization, and also must reduce its corruption level, even without regarding human capital accumulation, that is neglected in this model but is a key factor in the endogenous growth model, as Lucas (1998) showed.

6 Conclusion

We have studies effect of corruption on economic growth. The model discussed in this paper suggests that corruption hinders economic growth not only because it reduces capital accumulation, but also disturbs entrepreneurs’ decision on which investment project they operate. A progressive bribe rate, which means bribe rate is high for more profitable projects and low for less productive projects, can instigate entrepreneurs to move from productive projects to less productive projects by making productive projects less attractive to entrepreneurs due to a large decrease in a real, or after-bribe, rate of return for productive projects. This is called a reversion of profitability. Under the reversion of profitability, it is possible for an economy to be captured in a corruption trap, in which an economy’s final steady state depends on its initial quantity of capital goods, or in a corruption collapse, where an economy monotonically converges to a low steady state and cannot achieve high steady state. The two phenomena, corruption trap and corruption collapse, have a common economic consequence, that is, all capital goods flow to less productive projects, and more productive projects are not financed. For an economy to grow, it must accumulate capital stocks as prevailed growth model suggested, also reduce its corruption level not to fall corruption traps or collapse. This model has a policy implication, that for poor countries to promote economic growth, governments should make more efforts to anti-corruption activities on more productive investments, not on less productive investments. According to the Figure 5, if a corruption level for less profitable projects decreases, then entrepreneurs tend to invest more capital for those projects with a lower corruption level, to avoid bribe payment and earn high after-bribe profit levels.

References


