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The Role of Corruption”

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# Inequality and Economic Development: The Role of Corruption\*

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## Abstract

This paper presents a model where income inequality negatively affects economic growth through corruption by politicians. While politicians pursue corruption rents that reduce the provision of public goods and sacrifice citizen's welfare, they are also concerned about the political support of citizens to maintain their political power. When inequality among citizens is large, political support is less sensitive to corruption. Therefore, large inequality increases corruption and impedes economic growth. Since corruption is more prevalent in poor countries than rich ones, our argument is consistent with the evidence that shows a negative relationship between inequality and growth in poor countries.

*JEL classification:* O11, K42, D31

*Keywords:* Corruption, Income Inequality, Economic Growth

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# 1 Introduction

The relationship between inequality and economic growth has attracted the interest of many economists; it has been investigated both empirically and theoretically. Regarding empirical literature, although some studies demonstrate that inequality has a positive impact on economic growth (e.g., Forbes 2000), overall, many studies show that inequality has a negative impact on economic growth (e.g., Alesina and Rodrik 1994, Persson and Tabellini 1994, and Perotti 1996).<sup>1</sup> Among empirical studies, the evidence presented by Deininger and Squire (1998) and Barro (2000) is very meaningful. Deininger and Squire (1998) reveal that inequality in assets has a negative impact on economic growth and that this negative relationship is observed only in nondemocratic countries. Moreover, Barro (2000) divides countries into rich and poor ones and finds that the effect of inequality on growth is negative in poor countries but positive in rich ones.<sup>2</sup>

As mentioned below, however, there is no consensus about the underlying mechanism that relates inequality to economic growth. The purpose of this paper is to explain the above negative relationship, particularly in poor and nondemocratic countries, by another mechanism that is not considered in previous studies. This paper focuses on the role of corruption by politicians as a channel through which inequality hinders economic growth. When inequality among citizens is large, their political preferences are largely dispersed. The dispersed political preferences render public support for an incumbent politician less responsive to corruption, and the incumbent politician's benefit from decreasing corruption rent reduces. Hence, when inequality is large, the incumbent politician extracts a large corruption rent, which harms investment and growth.

Corruption is more prevalent in poor countries than rich ones, and many studies point out that it would be one of important factors that prevent many less developed countries from achieving steady economic growth. In his seminal paper, Mauro (1995) finds that corruption hinders investment and economic growth and that its negative effects are substantial.<sup>3</sup> These findings imply that the determinants of corruption should be largely related to economic growth. Evidences found by recent empirical studies show that inequality is one of the important determinants of corruption. Jong-Sung and Khagram (2005) demonstrate that income inequality has a positive and substantial impact on corruption. In their study, they argue that "corruption is likely to be an important

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<sup>1</sup>See Benabou (1996) for a survey of this literature.

<sup>2</sup>In poor countries, the positive impact of inequality on economic growth found by Forbes (2000) is not applicable since his analysis excludes very poor countries owing to data limitations.

<sup>3</sup>Similar results are obtained by many studies. For instance, see Knack and Keefer (1995), Mauro (1997), and Tanzi and Davoodi (1997).

channel through which inequality adversely affects economic growth” (p. 154). Keefer and Knack (2002) confirm the importance of this channel in a more rigorous way. They find that inequality decreases the level of property rights protection and that the coefficient of income inequality in growth regression largely declines when adding the term of property rights protection. This evidence suggests that the deterioration of property rights protection is the primary channel of the effect of inequality on growth. Since property rights protection is closely connected to corruption, their findings support the hypothesis that inequality decreases economic growth through increase in corruption.<sup>4</sup>

Although the above studies suggest that inequality affects economic growth through corruption, these studies do not provide any formal models explaining why inequality promotes corruption.<sup>5</sup> Motivated by these studies, the present paper builds a theoretical model providing a new explanation that connects inequality, corruption, and growth. The basic mechanism of our results is explained as follows. We consider an economy where citizens and politicians exist. The citizens invest in education, work as economic agents, and decide whether or not to approve an incumbent politician as a political leader. The return of investment is heterogeneous among the citizens and depends on the level of public goods provided by the politician. Therefore, political preferences are also heterogeneous among the citizens. Although the politician can extract corruption rent, which reduces public goods provision and decreases the welfare of citizens, the citizens can restrict corruption to some degree by not supporting the politician. When a large share of the citizens disapprove him/her, the politician is likely to lose political power and obtain nothing. Therefore, he/she faces a trade-off between extracting corruption rent and maintaining political power.

When inequality among the citizens is large, their political preferences are largely dispersed. In such a situation, a marginal decrease in corruption does not considerably increase the number of citizens who change their political attitude from disapproval to approval. Therefore, when inequality is large, political support is less responsive to a decrease in corruption (i.e., the return of reducing corruption is small for the politician). Consequently, the politician engages in substantial corruption. Furthermore, since the return of educational investment depends negatively on the level of corruption (or positively on the level of public

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<sup>4</sup>Corrupted politicians would not prefer the protection of property rights because it reduces the scope for extraction of corruption rent. Therefore, when the level of corruption is large, property rights would not be protected well. Keefer and Knack (2002) use the index of property right that includes a measure of corruption in the government.

<sup>5</sup>Jong-Sung and Khagram (2005) argue that, in a society where inequality is large, rich people have a large incentive and resources for corruption to protect their wealth. Furthermore, they argue that inequality leads to decadence of social norms that restrain corruption. In contrast, Keefer and Knack (2002) argue that inequality makes the government attitude toward property rights unsteady. However, they do not provide any formal theoretical models to support these claims.

goods provision), an increase in corruption decreases the level of investment. Through this mechanism, inequality impedes economic growth.

The basic mechanism is similar to the probabilistic voting model (Lindbeck and Weibull 1987; Persson and Tabellini 2000).<sup>6</sup> As in the probabilistic voting model, the less dispersed the distribution of citizens' political preferences, the more politicians must be concerned about their welfare since the share of supporters is more responsive to the policy choice. This paper is also closely related to studies on political agency models that explore how citizens can control incumbent politicians who have some political power and enjoy the advantage of incumbency (Barro 1973; Ferejohn 1986; Persson and Tabellini 2000, Chapter 4). The most important difference between the above studies and ours is that, in this paper, the equilibrium level of corruption depends on heterogeneity among citizens. Furthermore, unlike the standard models, when citizens disapprove an incumbent politician, political disorder occurs. This set up enables the incumbent politician to extract rents in this paper.

The rest of this paper is organized as follows. Section 2 surveys previous work on inequality and growth. Section 3 builds the model and discusses some important assumptions. Section 4 defines equilibrium, solves the model, and shows how inequality increases equilibrium corruption. Section 5 analyzes the effect of inequality on equilibrium growth and discusses the prediction of the model. Finally, Section 6 concludes the paper.

## 2 Previous Work on Inequality and Growth

Many theoretical studies have attempted to explain how inequality affects growth. Roughly speaking, theoretical studies on the relationship between inequality and growth can be divided into two main streams: the credit market imperfections approach and the political redistribution approach. Galor and Zeira (1993), emphasizing credit market imperfections, analyze the effects of inequality on economic growth. Credit market imperfections make poor individuals unable to invest in human capital even if the return to education is sufficiently high. Since a large inequality makes the credit constraint binding for many agents, it decreases the aggregate level of human capital investment and impedes economic growth.

In contrast, Alesina and Rodrik (1994) and Persson and Tabellini (1994) focus on the political economic mechanism that connects inequality to growth.

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<sup>6</sup>Persson and Tabellini (2000) also provide a model that applies the probabilistic voting model to study the corruption by politicians. While they analyze how electoral competition before a politician holds office affects his/her corruption rent, this paper focuses on how citizens can control a politician who is already in power and does not assume the existence of electoral competition. In the former model, the equilibrium corruption rent is independent of heterogeneity among citizens. This is the most important difference.

In their models, individuals vote on redistributive policies that are financed by distortionary taxes as in Meltzer and Richard (1981). They argue that a large inequality increases the demand of the median voter for redistribution. Since large redistribution discourages the incentive for investment, a large inequality is related to lower economic growth.<sup>7</sup>

However, the existing explanations mentioned above are not supported by empirical studies. If credit market imperfections are crucial for the relationship between inequality and growth, the extent of credit market development would have critical effects on it. For instance, in countries with immature credit markets, inequality would impede economic growth strongly. However, Barro (2000) finds that the extent of credit market development does not significantly influence the relationship between inequality and growth.<sup>8</sup>

Some empirical studies are not consistent with the redistribution approach. Although the theory implies a positive relationship between inequality and redistribution and a negative relationship between redistribution and economic growth, Perotti (1996) argues that both of these relationships are not supported empirically. Moreover, evidences that focus on the political system do not support the redistribution approach. The redistribution approach is based on democratic electoral systems. Therefore, if the redistribution channel is crucial in the relationship between inequality and growth, the negative effect of inequality on growth would be larger in democratic countries. However, this is against the evidences found by Knack and Keefer (1997) and Deininger and Squire (1998).<sup>9</sup>

As for previous studies on inequality and growth, Helpman (2004) states that “although we can argue with limited confidence that inequality within a country slows its growth, we cannot say much about the channels through which this influence plays out” (pp. 93-94). This paper contributes to the literature by providing an alternative model to explain the relationship between inequality and growth.

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<sup>7</sup>Similar models are presented by Perotti (1993), Bertola (1993), and Benabou (1996).

<sup>8</sup>Deininger and Squire (1998) find that inequality harms educational investment and that a negative relationship between inequality and growth is found in nondemocratic countries, which tend to have immature credit markets. They argue that these evidences are consistent with the credit market imperfections approach. However, the model of this paper also predicts that inequality harms educational investment and growth in nondemocratic countries.

<sup>9</sup>Knack and Keefer (1997) investigate the relationship between inequality and economic growth in democracies and nondemocracies and conclude that the impact of inequality in nondemocracies is not significantly lower than that in democracies.

### 3 The Model

#### 3.1 Basic Environment

We consider an overlapping generations economy where agents live for two periods. They have same preferences and production technology, but they differ in their human capital within each generation. There is no population growth, and the population of each generation is normalized to one. In the first period (childhood), agents invest in education. In the second period (adulthood), they produce consumption goods and consume them. The agents are risk neutral, and they derive utility from their consumption when they become adults.

The level of human capital of each agent depends on his or her own educational expenditure and parental human capital. We assume a Cobb-Douglas-type human capital production function

$$h_{it+1} = \frac{1}{\phi} e_{it}^{\phi} h_{it}^{1-\phi}, \quad \phi \in (0, 1), \quad (1)$$

where  $h_{it+1}$  denotes the level of human capital of the agent born at period  $t$  and belongs to the dynasty  $i$ , and  $e_{it}$  is his or her educational expenditure. The difference in human capital is the only source of income inequality in the economy. While the externality of parental human capital enables the economy to attain long-run growth, it also causes the inequality of the proceeding generation to be taken over to the succeeding generation.

We suppose that the distribution of human capital in the initial generation is uniform with support

$$\left[ 1 - \frac{\xi}{2}, 1 + \frac{\xi}{2} \right], \quad \xi \in (0, 2).$$

The mean of the distribution is normalized to one, and the density is given by  $1/\xi$ . As we will see later, in equilibrium, the level of the human capital of each dynasty is proportional to the parental human capital. Thus, the distribution of the human capital of each generation is uniform, where the density depends negatively on  $\xi$ . Therefore, parameter  $\xi$  captures the degree of inequality in the economy.

As an adult, each agent produces consumption goods. The output level depends not only on his or her human capital but also on public goods. By providing productive public goods, the government can enhance the productivity of citizens. Public goods may include public services such as maintenance of law and order or protection of property rights. The production technology of each citizen is represented by the following production function

$$y_{it} = (1 + \alpha g_t) h_{it}, \quad g_t = \frac{G_t}{h_t}, \quad (2)$$

where  $G_t$  denotes total government expenditure on public good provision and  $\bar{h}_t \equiv \int h_{it} di$  denotes the average (or aggregate) level of human capital at period  $t$ . Parameter  $\alpha$  captures the efficiency of the public good. We assume that the production depends on the ratio of the amount of public goods to the average level of human capital. We can interpret the average level of human capital as the scale of economic activity. This formulation reflects a type of congestion effect. The larger the scale of economic activity, the larger is the required amount of public goods to produce one unit of consumption good. As the economy develops, more people use infrastructure, and the resulting congestion decreases the efficiency of public goods. Furthermore, the administrative procedure becomes more complicated, which decreases the efficiency of legal infrastructure. Therefore, the government must increase public expenditure to maintain the productive efficiency of citizens as the economy develops.

Equation (2) implies that public goods have complementarity with human capital, and thus, the return of educational investment is increasing in the level of public goods at the next period. Therefore, the provision of public goods by the government influences not only the level of output but also the growth of output through educational investment. We will return to this point later in the paper.

## 3.2 Political Events

Public policy is endogenously determined by the following political process. There are a large number of homogeneous politicians. In each period, one of them randomly gains political power; we call this politician the “incumbent.” One interpretation of this setup is the lack of a commitment device to enforce politicians to stand by their campaign promise. If politicians cannot commit their promised policies *ex ante*, the politician who acquires political power would be randomly determined since all politicians are homogeneous. Electoral competition based on promised policies requires mature democratic institutions and customs. However, in most of the developing countries, democratic institutions are immature. Thus, assuming that politicians cannot commit their promised policies seems to be realistic.

The incumbent levies lump-sum tax on adult citizens and allocates tax revenue between public good provision and corruption rent.<sup>10</sup> We assume that the incumbent cannot issue public debt. The budget constraint in each period is

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<sup>10</sup>In our model, the government cannot set a different policy for each citizen. That is, the government cannot increase the support of citizens by offering a policy that is favorable to a specific group in the economy. To provide such a policy, the government needs a mature bureaucracy. However, in many developing countries, such a mature bureaucracy does not exist.



given by

$$\pi_t + G_t = T_t, \quad (3)$$

where  $\pi_t$  and  $T_t$  denote corruption rent and lump-sum tax at period  $t$  respectively. Reflecting the incapacity of taxation in developing countries, we assume that there is an upper limit of tax level  $\bar{T}_t$ .<sup>11</sup> Furthermore, we assume that the limit grows proportionally to the scale of the economy; that is,

$$\bar{T}_t = \tau \bar{h}_t, \quad \tau > 0. \quad (4)$$

As mentioned above, since the selection of the incumbent is an entirely random event, there is no room for political control in determining who gets political power. However, citizens can control the behavior of the incumbent to some degree by *ex post* political control. After observing the policy package that the incumbent chooses, each citizen decides whether or not to support the incumbent. If many citizens choose not to support the incumbent, political disorder may occur. In this case, the incumbent loses political power and does not obtain any corruption rent. In addition, political disorder breaks down the function of the public sector, and thus,  $G = T = 0$  is implemented.<sup>12</sup> In many developing countries, a change of the government usually occurs in a violent manner, for example, a coup, civil war, and revolution. In these countries, political disorder may be very severe and may eliminate the function of the public sector.

In order to sustain political power, the incumbent must consider the welfare of citizens; that is, the *ex post* judgment of citizens pressurizes the incumbent to restrict the corruption rent. The probability of whether political disorder occurs or not depends on the share of the supporters. For simplicity, we assume that the probability of the incumbent retaining power is equal to the share of the supporters.

In each period, political events occur according to the following timing.

1. Among many identical politicians, one politician is randomly assigned to the ruling position.
2. The incumbent determines the policy plan  $(G, T)$  and citizens observe the plan.
3. All adult citizens declare whether or not to support the incumbent.

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<sup>11</sup>Acemoglu (2005) makes a similar assumption and argues that the limitation is due to “citizens’ exit options.” As the factor creating the exit options, he lists the citizens’ “ability to shift to informal production, to hide their revenues, or simply to disobey tax laws” (p. 1203).

<sup>12</sup>This assumption may seem to be quite extreme, but it is merely for simplicity. It is sufficient to derive similar results assuming that political disorder decreases both the levels of public goods and tax.

4. If the incumbent retains political power, he/she implements the planned policy. If not, the incumbent loses political power and political disorder occurs.

Note that, at the political stage, investment in education is already sunk since only adult citizens participate in the political process. Therefore, the incumbent cannot increase the current level of human capital by increasing the provision of public goods. For the incumbent, the objective of increasing this provision is not to stimulate investment and enlarge the tax base but to increase the probability of retaining political power. Further, note that the probability of holding political power in the next period is zero even if the incumbent retains political power in the current period. This is because the number of politicians is large, and political power in the next period is again randomly assigned. Therefore, the problem of the incumbent is static; that is, the incumbent maximizes the current period profit, as we will see later.

## 4 Equilibrium

We briefly define the equilibrium of this model. The politico-economic equilibrium must satisfy the following conditions. (i) *Optimal educational investment*: Given the expected policy, each child must invest in education in order to maximize his or her income. (ii) *Sincere support of citizens*: Comparing the payoff in a politically stable situation and that in political disorder, each citizen sincerely chooses whether to support the incumbent. (iii) *Optimal policy making by the incumbent*: Taking into account the political action of citizens, the incumbent determines the policy plan in order to maximize the expected corruption rent.

Before describing the formal definition of the equilibrium, we investigate each problem separately.

### 4.1 Educational choice

First, we consider the optimal educational choice of each agent. Since the political stage follows educational choice, the return of education depends on the political results in the next period. Hence, each agent expects the policy in the next period and makes an educational choice according to the expectation. Suppose that, at period  $t$ , each agent expects that the incumbent in the next period will win political confidence with probability  $\hat{p}_{t+1}$  (that is, political disorder will occur with probability  $1 - \hat{p}_{t+1}$ ) and that the incumbent will announce the policy package  $(\hat{G}_{t+1}, \hat{T}_{t+1})$ . Then, the production of citizen  $i$  at period  $t + 1$  is

$$y_{it+1} = \begin{cases} (1 + \alpha \hat{g}_{t+1}) h_{it+1} & \text{with probability } \hat{p}_{t+1}, \\ h_{it+1} & \text{with probability } 1 - \hat{p}_{t+1}, \end{cases}$$

where  $\hat{g}_{t+1}$  denotes the ratio of expected government expenditure  $\hat{G}_{t+1}$  to the expected level of average human capital in period  $t + 1$ . The expected income of the citizen is given by

$$E[y_{it+1}] = \hat{p}_{t+1}[(1 + \alpha\hat{g}_{t+1})h_{it+1} - \hat{T}_{t+1}] + (1 - \hat{p}_{t+1})h_{it+1}. \quad (5)$$

Each agent chooses the amount of educational expenditure in order to maximize his or her expected consumption:

$$\max_{e_{it}} (1 + \alpha\hat{p}_{t+1}\hat{g}_{t+1})\frac{e_{it}^\phi h_{it}^{1-\phi}}{\phi} - \hat{p}_{t+1}\hat{T}_{t+1} - e_{it}. \quad (6)$$

The first order condition is

$$(1 + \alpha\hat{p}_{t+1}\hat{g}_{t+1})e_{it}^{\phi-1}h_{it}^{1-\phi} = 1. \quad (7)$$

Arranging the terms, we obtain

$$e_{it} = (1 + \alpha\hat{p}_{t+1}\hat{g}_{t+1})^{\frac{1}{1-\phi}} h_{it}, \quad (8)$$

$$h_{it+1} = (1 + \alpha\hat{p}_{t+1}\hat{g}_{t+1})^{\frac{\phi}{1-\phi}} h_{it}. \quad (9)$$

Equation (8) shows that the optimal educational investment has the following properties. First, educational investment is increasing in the level of parental human capital  $h_{it}$  since the intergenerational externality of parental human capital makes the expected return of education increasing in  $h_{it}$ . Second, each agent makes a large educational investment when he or she expects that the incumbent in the next period will choose a large amount of provision of public goods. Because of the complementarity between human capital and provision of public goods in production technology, a larger amount of provision raises the expected return of educational investment. In contrast, if citizens expect the incumbent to extract a large corruption rent (or provide fewer public goods), the expected return becomes low and citizens make a small investment. In other words, the expectation of substantial corruption hinders economic growth. Educational investment is also increasing in the expected probability of political stability  $\hat{p}_{t+1}$ . When the economy is politically unstable, the provision of public goods is discontinued, which lowers the return of education.<sup>13</sup> Therefore, citizens choose a low level of investment if they expect that the incumbent will lose political power with high probability.

Equation (9) implies a positive linear relationship between a parent's and a child's human capital; this makes the evolution of income distribution quite simple. If the distribution of human capital of the preceding generation is

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<sup>13</sup>Many studies analyze the relationship between political instability and investment. For instance, see Alesina and Perotti (1996).

uniform, that of the current generation also becomes uniform. Since we suppose that human capital in the initial generation follows uniform distribution, the distribution of human capital is always uniform in equilibrium. In addition, the linearity of the human capital accumulation of each dynasty implies that the relative human capital between any two dynasties is constant; that is, we have

$$\forall t, t' \quad \forall i, j \quad \frac{h_{it}}{h_{jt}} = \frac{h_{it'}}{h_{jt'}}. \quad (10)$$

Therefore, the relative human capital of dynasty  $i$  to the average  $\tilde{h}_{it} \equiv h_{it}/\bar{h}_t$  is constant in all periods. The following lemma summarizes these results.

**Lemma 1.** *The optimal educational choice of each agent is represented by (8) and (9). Educational expenditure  $e_{it}$  is increasing in expected probability  $\hat{p}_{t+1}$  and expected public spending ratio  $\hat{g}_{t+1}$ .*

*In equilibrium, the distribution of relative human capital  $\tilde{h}_{it}$  is always uniform and the same as that of the initial generation*

$$U \left[ \left( 1 - \frac{\xi}{2} \right), \left( 1 + \frac{\xi}{2} \right) \right]. \quad (11)$$

## 4.2 Political Choices of Citizens

Next, we consider the political action of citizens. We assume that each citizen sincerely chooses whether or not to support the incumbent.<sup>14</sup>

Suppose that the incumbent chooses a policy  $(G_t, T_t)$  at period  $t$ . If the policy is implemented, citizens can use public goods to produce consumption good but must incur tax. Therefore, the income of a citizen with human capital  $h_t$  would be

$$V_I(h_t) = (1 + \alpha g_t)h_t - T_t. \quad (12)$$

In contrast, if the policy is rejected, there is no public good and tax, and the income of the citizen is simply given by

$$V_A(h_t) = h_t. \quad (13)$$

We assume that the citizen supports the incumbent if  $V_I(h_t) \geq V_A(h_t)$ , and rejects the incumbent otherwise. By comparing (12) with (13), we have the following lemma.

**Lemma 2.** *The political action of citizens can be characterized by the threshold*

$$\psi(\theta_t) \equiv \frac{1}{\alpha \theta_t}, \quad (14)$$

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<sup>14</sup>The assumption that citizens choose their political action sincerely is standard in the literature of political economics. For instance, see Persson and Tabellini (2000).

where  $\theta_t \equiv \frac{G_t}{T_t} \in [0, 1]$  is the ratio of public spending to tax revenue. If  $\tilde{h}_{it} \geq (<)$   $\psi(\theta_t)$ , citizen  $i$  supports (rejects) the incumbent.

The threshold  $\psi$  is decreasing in  $\theta_t$ ; that is, a higher public spending ratio increases the number of citizens who support the incumbent.

The interpretation of Lemma 2 is quite simple. Since there exists complementarity between public good and human capital, richer citizens receive more benefit from political stability where some public good would be provided. In contrast, all citizens have to incur the same lump-sum tax. Therefore, rich citizens tend to support the incumbent but poor ones do not. The number of supporters is increasing in the amount of public goods and decreasing in lump-sum tax. In particular, it depends only on the ratio of public spending to tax revenue.

In equilibrium, the distribution of relative human capital is always given by (11). From (11) and (14), we can derive the number of citizens who support the incumbent. In order to make the analysis more meaningful, we make the following assumption.

**Assumption 1.** *We impose the following condition:*

$$1 - \frac{\xi}{2} < \frac{1}{\alpha} < 1 + \frac{\xi}{2}. \quad (15)$$

The first inequality implies that there are citizens who do not support the incumbent even if the incumbent does not engage in any corruption. The second inequality implies that there are some citizens who support the incumbent if the incumbent does not engage in any corruption.

Under Assumption 1, a risk of political disorder always exists, but the incumbent can retain political power with positive probability if corruption is sufficiently small. As mentioned below, by imposing Assumption 1, the problem of the incumbent has a unique inner solution.

The probability that the incumbent retains political power, which coincides with the share of citizens who support the incumbent, is equal to the size of the population whose relative human capital exceeds threshold  $\psi(\theta)$  and given by

$$\begin{aligned} p(\theta_t; \xi) &= \int_{\psi(\theta_t)}^{\max\{1+\frac{\xi}{2}, \psi(\theta_t)\}} \frac{1}{\xi} d\tilde{h} \\ &= \begin{cases} 0 & \text{if } 0 \leq \theta_t \leq \frac{1}{\alpha(1+\frac{\xi}{2})}, \\ \frac{1}{2} + \frac{1}{\xi} \left(1 - \frac{1}{\alpha\theta_t}\right) & \text{if } \frac{1}{\alpha(1+\frac{\xi}{2})} < \theta_t \leq 1. \end{cases} \end{aligned} \quad (16)$$

Note that this probability is independent of the average level of human capital since only the relative human capital is important for the supporting behavior of citizens. Probability  $p$  is increasing and concave with respect to the ratio of

public spending to tax revenue  $\theta$ ; that is, an increase in the public spending ratio raises the probability of winning political confidence, but the marginal increase is decreasing in  $\theta$ . Furthermore, an increase in the efficiency of public good  $\alpha$  increases the cost of political disorder, thereby increasing the share of supporters.

The property of the derivative of function  $p(\theta; \xi)$  is notable. By differentiating  $p$  with respect to  $\theta$ , we obtain

$$\frac{\partial p}{\partial \theta}(\theta; \xi) = \begin{cases} 0 & \text{if } 0 \leq \theta \leq \frac{1}{\alpha(1+\frac{\xi}{2})}, \\ \frac{1}{\xi\alpha\theta^2} & \text{if } \frac{1}{\alpha(1+\frac{\xi}{2})} < \theta \leq 1. \end{cases} \quad (17)$$

Note that the derivative  $\frac{\partial p}{\partial \theta}(\theta; \xi)$  is decreasing in  $\xi$ . This means that, when inequality is large, marginal decrease in corruption does not increase considerably the probability of the incumbent retaining power. This interpretation is explained as follows. Suppose that there are two economies: an equal economy and an unequal one. The density of human capital distribution  $1/\xi$  is large in the equal economy and small in the unequal one. In the unequal economy, the political preferences of citizens are dispersed because the distribution of human capital is dispersed. Note that threshold  $\psi$  is independent of the distribution of human capital. Thus, the threshold that divides the political behavior of citizens is the same in both of the economies. However, a change of policies has a different impact on the two economies. Suppose that there is a decrease in corruption and the ratio of public good to tax revenue changes from  $\theta$  to  $\theta'$ . This policy change increases the population that supports the incumbent politician, but the size of the population that changes the political attitude is different from the two economies (see Figure 1). The increase of supporters due to the decrease in corruption is lower in the unequal economy than the equal one. This is because the density of human capital distribution is low in the unequal economy. Therefore, when inequality is large, a marginal decrease in corruption has a small impact on the probability of the incumbent retaining power.<sup>15</sup>

### 4.3 Political Choice of the Incumbent

Finally, we proceed to investigating the problem of the incumbent. The incumbent realizes that the probability that he or she retains political power is given by (16). Since the incumbent can extract a political rent only if it retains political power, the expected corruption rent of the incumbent is

$$\pi_t = p(\theta_t; \xi)(1 - \theta_t)T_t. \quad (18)$$

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<sup>15</sup>This mechanism is similar to the probabilistic voting model. See Lindbeck and Weibull (1987) and Persson and Tabellini (2000).

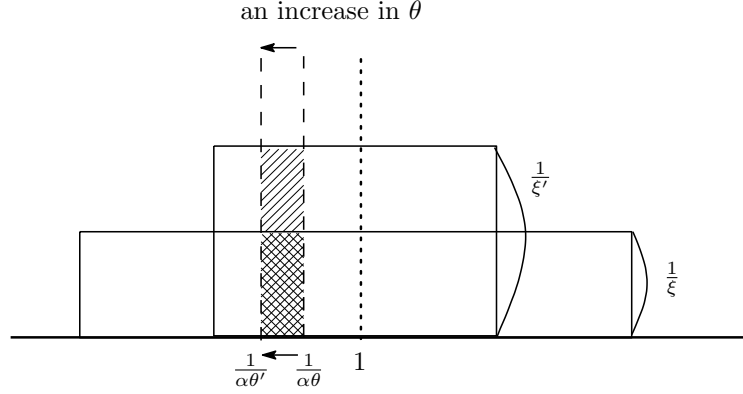


Figure 1: Marginal Effect of Policy Changes

The incumbent chooses policy  $(\theta_t, T_t)$  in order to maximize the expected corruption rent. However, since an upper limit of tax is assumed, it must hold  $T_t \leq \tau \bar{h}_t$ . Then, the problem of the incumbent is given by

$$\max_{(\theta_t, T_t) \in [0, 1] \times [0, \tau \bar{h}_t]} p(\theta_t; \xi)(1 - \theta_t)T_t. \quad (19)$$

It is obvious that the upper limit of taxation is binding; therefore the rent-maximizing tax level is

$$T_t = \tau \bar{h}_t. \quad (20)$$

The public spending ratio is determined by comparing the cost and benefit of the provision of public goods. From (16), the incumbent certainly loses political power if  $\theta_t \leq \frac{1}{\alpha(1+\xi/2)}$ . Therefore, the incumbent must choose  $\theta_t > \frac{1}{\alpha(1+\xi/2)}$  to extract the positive expected rent.

From the first-order condition, the rent-maximizing public spending ratio satisfies

$$\frac{\partial p}{\partial \theta_t}(\theta_t; \xi)(1 - \theta_t) = p(\theta_t; \xi). \quad (21)$$

The left-hand side of (21) represents the marginal benefit of increasing  $\theta_t$ , which is from the increase in the probability of winning political confidence. The right-hand side represents the marginal cost of increasing  $\theta_t$ , which arises from the reduction of the corruption rent. By arranging the terms, we obtain

$$\epsilon_p(\theta_t; \xi) = \epsilon_r(\theta_t), \quad (22)$$

where

$$\epsilon_p(\theta; \xi) \equiv \frac{\partial p(\theta; \xi)}{\partial \theta} \frac{\theta}{p(\theta; \xi)} = \frac{1}{\alpha \theta \left(1 + \frac{\xi}{2}\right) - 1}, \quad \epsilon_r(\theta) \equiv \frac{\theta}{1 - \theta}.$$

$\epsilon_p$  is the elasticity of the probability of winning political confidence with respect to  $\theta$ , and  $\epsilon_r$  is the elasticity of the corruption rent with respect to  $\theta$ . The maximization of the expected rent requires these two rates to be equal.

**Lemma 3.** *Under Assumption 1, the rent-maximization problem of the incumbent, which is represented by (19), has a unique solution.*

*Proof.* See Appendix. □

Now, we proceed to the main concern of this paper: how does inequality affect the provision of public goods and corruption? The elasticity of the probability of winning political confidence to  $\theta$  is shown to be decreasing in  $\xi$ , i.e.,  $\frac{\partial \epsilon_p}{\partial \xi}(\theta; \xi) \leq 0$ . As explained above, when inequality is large, a decrease in corruption does not increase considerably the probability of winning political confidence; that is, large inequality weakens the response of probability  $p$  to an increase in  $\theta$ . Thus, it reduces the elasticity of the probability. In contrast, the elasticity of the corruption rent to  $\theta$  does not depend on the degree of inequality  $\xi$ . Since an increase in  $\xi$  shifts  $\epsilon_p$  downward but keeps  $\epsilon_r$  constant, in equilibrium, the rent-maximizing public spending ratio is decreasing in  $\xi$  (see Figure 2). In fact, we can analytically solve the first-order condition with respect to  $\theta$  and obtain

$$\theta_t = \left[ \alpha \left( 1 + \frac{\xi}{2} \right) \right]^{-\frac{1}{2}} \equiv \theta(\xi). \quad (23)$$

Clearly, the rent-maximizing public spending ratio is time-independent and decreasing in  $\xi$ .

**Proposition 1.** *The ratio of the provision of public goods to tax revenue that the incumbent chooses is decreasing in the degree of inequality  $\xi$ . That is, corruption by the incumbent is large (small) in an unequal (equal) economy.*

Taking the above argument in account, the politico-economic equilibrium can be defined as follows.

**Definition 1.** *The politico-economic equilibrium is defined by  $\{(h_{it}^*)_{i \in [0,1]}, \theta_t^*, T_t^*, p_t^*\}_{t=0}^\infty$  that satisfies the following conditions:*

1. *Citizens invest in human capital so as to maximize their expected utility and predict the future policy correctly. That is, (8) and (9) must hold for all  $t \geq 0$  and the expected policy satisfies*

$$\forall t \quad \hat{g}_t = \frac{\theta_t^* T_t^*}{h_t^*}, \quad \hat{p}_t = p_t^*.$$

2. *Citizens sincerely determine whether or not to support the incumbent. As a result, the probability of political stability is given by*

$$\forall t \quad p_t^* = p(\theta_t^*; \xi).$$



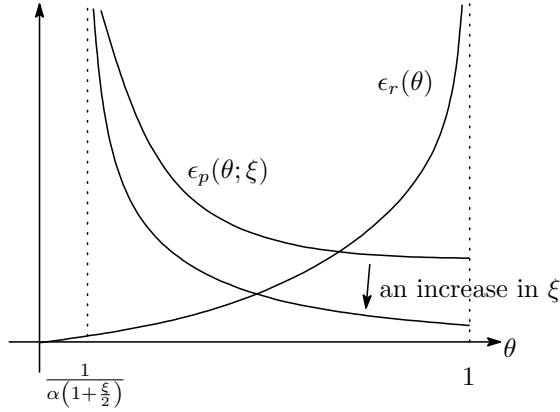


Figure 2: Equilibrium Corruption

3. In each period  $t$ , the incumbent sets policy  $g_t$  so as to maximize the expected corruption rent. That is, we obtain

$$\forall t \quad \theta_t^* = \theta(\xi), \quad T_t^* = \tau \bar{h}_t^*.$$

## 5 Equilibrium Growth Rate and Inequality

In the previous section, we have shown that inequality encourages corruption by the incumbent. Now, we confirm that inequality impedes economic growth through corruption.

In the equilibrium, the growth rate of the average human capital is given by

$$\frac{\bar{h}_{t+1}}{\bar{h}_t} = [1 + \alpha \tau p(\theta(\xi); \xi) \theta(\xi)]^{\frac{\phi}{1-\phi}} \equiv \gamma_h(\xi). \quad (24)$$

Equation (24) shows that inequality affects human capital accumulation through two channels. First, as mentioned above, an increase in the degree of inequality  $\xi$  reduces the equilibrium public spending ratio  $\theta^*$ , which directly reduces human capital investment. Second, an increase in  $\xi$  changes the probability of political stability  $p^*$ . The impact of inequality on the probability is not very obvious. By differentiating function  $p^*$ , we obtain

$$\frac{dp^*}{d\xi} = \frac{\partial p}{\partial \theta} [\theta(\xi), \xi] \theta'(\xi) + \frac{\partial p}{\partial \xi} [\theta(\xi), \xi]. \quad (25)$$

Keeping the distribution of human capital fixed, a decrease in the public spending ratio  $\theta^*$  caused by an increase in  $\xi$  reduces the probability of political stability (*corruption effect*). The first term of the right-hand side of (25) captures

this effect. In addition, a change of  $\xi$  transforms the distribution of human capital itself (*distribution effect*). The second term of the right-hand side of (25) captures this effect, whose sign is ambiguous. In general, whether inequality reduces the probability of political stability depends on the exogenous parameters. In this paper, we focus on the role of corruption; therefore we impose the following assumption, which assures that the corruption effect dominates the distribution effect in the equilibrium.<sup>16</sup>

**Assumption 2.** *We assume that the following relationship holds:*

$$\alpha > \frac{\left(1 + \frac{\xi}{4}\right)^2}{\left(1 + \frac{\xi}{2}\right)}.$$

**Lemma 4.** *Under Assumptions 1 and 2, the equilibrium probability of political stability  $p^*$  is decreasing in  $\xi$ .*

*Proof.* See Appendix. □

Finally, we investigate the effect of inequality on the growth of output. Note that under Assumptions 1 and 2, both  $\theta(\xi)$  and  $p(\theta(\xi); \xi)$  are decreasing in  $\xi$ , and therefore, inequality reduces the growth rate of the average human capital. However, whether or not the provision of public goods will be maintained in the next period is stochastic; therefore, the output also follows a stochastic process. The equilibrium output at period  $t$ ,  $y_t^*$ , is given by

$$y_t^* = \begin{cases} [1 + \alpha\tau\theta(\xi)]\bar{h}_t^* & \text{with probability } p(\theta(\xi); \xi), \\ \bar{h}_t^* & \text{with probability } 1 - p(\theta(\xi); \xi). \end{cases}$$

Therefore, the expected level of equilibrium output is given by

$$E(y_t^*) = [1 + \alpha\tau p(\theta(\xi); \xi)\theta(\xi)]\bar{h}_t^*.$$

Let us define the average growth rate of the output between period  $t$  to period  $t + 1$  such that

$$\gamma_y(\xi) \equiv \frac{E(y_{t+1}^*)}{E(y_t^*)}.$$

It immediately follows that

$$\gamma_y(\xi) = \frac{\bar{h}_{t+1}^*}{\bar{h}_t^*} = \gamma_h(\xi).$$

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<sup>16</sup>This is consistent with the evidence found by Alesina and Perotti (1996) that inequality increases political instability. However, the main focus of this paper is the impact of inequality on growth through corruption rather than political stability. With regard to this point, Keefer and Knack (2002) show that there is little change in the negative impact of inequality on growth through the weakening of property right protection even if political instability is controlled.

Therefore, on average, the growth rate of output coincides with that of the average human capital, which is decreasing in  $\xi$ .

**Proposition 2.** *Under Assumptions 1 and 2, an expansion of inequality depresses educational investment and impedes the growth of output.*

## 6 Conclusion

This paper investigates the negative effect of inequality on economic growth in developing countries — a topic that previous theoretical studies have not explained clearly. As a new mechanism, we focus on the role of corruption by politicians. Corruption seems to be more prevalent in developing countries, and it impedes investment and economic growth. In the model presented in this paper, the politician can extract corruption rent, which reduces the provision of public goods and sacrifices the welfare of citizens. However, citizens can control the behavior of the politician to some degree by not supporting him or her. If a large share of citizens do not support the politician, he or she loses political power with high probability. In such a situation, the politician must be concerned about citizens' political support in order to maintain political power. When inequality among citizens is large, political support is less sensitive to a decrease in corruption rents. Therefore, large inequality increases corruption and impedes investment and economic growth. Our results are consistent with empirical studies on the relationship between inequality and corruption and that between corruption and growth.

## Appendix

### Proof of Lemma 3

By simple calculation,  $\epsilon_p$  is shown to be decreasing in  $\theta$ , and  $\epsilon_r$  is shown to be increasing in  $\theta$ . Furthermore, we obtain

$$\lim_{\theta \rightarrow \frac{1}{\alpha(1+\frac{\xi}{2})}} \epsilon_p(\theta; \xi) = \infty, \quad \lim_{\theta \rightarrow 1} \epsilon_p(\theta; \xi) = \frac{1}{\alpha \left(1 + \frac{\xi}{2}\right) - 1} < \infty$$

$$\epsilon_r(0) = 0, \quad \lim_{\theta \rightarrow 1} \epsilon_r(\theta) = \infty.$$

Assumption 1 implies that  $0 < \frac{1}{\alpha(1+\frac{\xi}{2})} < 1$ . Thus, as shown in Figure 2, the ratio of public spending that satisfies (22) is shown to be uniquely existing.

## Proof of Lemma 4

Under Assumption 1, the equilibrium ratio of public good provision  $\theta(\xi)$  satisfies

$$\frac{1}{\alpha(1 + \frac{\xi}{2})} < \theta(\xi) = \left[ \alpha \left( 1 + \frac{\xi}{2} \right) \right]^{-\frac{1}{2}} < 1,$$

and the equilibrium probability of political stability is given by

$$p(\theta; \xi) = \frac{1}{2} + \frac{1}{\xi} \left[ 1 - \frac{1}{\alpha\theta(\xi)} \right].$$

Therefore, we have

$$\begin{aligned} \frac{dp}{d\xi} &= -\frac{1}{\xi^2} \left[ 1 - \frac{1}{\alpha\theta(\xi)} \right] + \frac{1}{\alpha\xi[\theta(\xi)]^2} \theta'(\xi) \\ &= \frac{1}{\alpha\xi^2\theta(\xi)} \left\{ 1 - \alpha\theta(\xi) - \frac{\alpha\xi}{4} [\theta(\xi)]^2 \right\}, \end{aligned}$$

where we use  $\theta'(\xi) = -\frac{\alpha}{4}[\theta(\xi)]^3$ .

By substituting  $\theta(\xi) = \left[ \alpha \left( 1 + \frac{\xi}{2} \right) \right]^{-\frac{1}{2}}$ , we have

$$\begin{aligned} 1 - \alpha\theta(\xi) - \frac{\alpha\xi}{4} [\theta(\xi)]^2 &= 1 - \left( \frac{\alpha}{1 + \frac{\xi}{2}} \right)^{\frac{1}{2}} - \frac{\xi}{4 \left( 1 + \frac{\xi}{2} \right)} \\ &< 1 - \frac{1 + \frac{\xi}{4}}{1 + \frac{\xi}{2}} - \frac{\xi}{4 \left( 1 + \frac{\xi}{2} \right)} = 0, \end{aligned}$$

where inequality arises from Assumption 2. Since the sign of  $\frac{dp}{d\xi}$  coincides with that of  $[1 - \alpha\theta(\xi) - \frac{\alpha\xi}{4}[\theta(\xi)]^2]$ , we have  $\frac{dp}{d\xi} < 0$ .

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