

## Economic and Political Reforms in a Planned Economy

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*This paper investigates the economic and political reforms in a planned economy as the equilibrium responses to revolutionary threats. Which reform will be chosen depends on the initial degree of resource inequality between the elite and the mass. The probability of a successful revolution plays a role in implementing either economic or political reforms only when the resource disparity is not too severe. In this case political reform is more likely when the probability of revolution is lower and revolution is not costly and the introduction of market oriented system greatly improves the efficiency of the economy. It is also found that, when the introduction of market oriented system is enough for the prevention of revolution, the elite extract more from the mass with a higher tax rate as the probability of revolution becomes higher. With severe inequality in resource distribution, the elite give up their political power and democratic market oriented economic system is the only equilibrium outcome. We also consider conditions under which either economic or political reform is not enough to prevent revolution.*

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### I. Introduction

In their theory of democracy, Acemoglu and Robinson (2000) propose that it is the threat of revolution that is the major reason for the extension of the franchise in the West. Since the revolution is the worst outcome, the elite in the West might have realized that, to prevent the revolution, it is better for the elite either to redistribute the economic resources to the poor or to transfer the political power including the power to tax to the mass.

Revolutionary threats seem to be as relevant today as they were in the past as a driving force for the institutional changes in countries where the ruling class

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exercises authoritarian power and the economic system is characterized as a planned economy. In North Korea, the elite, besides keeping political control, did not even consider introducing full-scale market oriented system including privatization and opening the borders to outside world. However, the institutional changes that were made in China in recent period are different. In China the elite have introduced the market oriented economic system while retaining their political power. This paper tries to explain the different institutional paths these countries follow as a result of different equilibrium responses to the potential existence of revolution.

With slight modifications of the model of Acemoglu and Robinson (2000), this paper investigates theoretically how and under what conditions revolutionary threats in a planned economy give rise to institutional changes that include economic or political reform or revolution.

Faced with the exogenously given probability of a successful revolution, an economic reform or a political reform is assumed to be available to the incumbent elite to prevent the occurrence of revolution. In the economic reform, a more productive system as represented by market oriented economic system replaces a less productive planned economy but the elite retain the political power including the power to extract rents by taxing the marketable output of the mass. With the political reform, however, we suppose that political power is peacefully transferred to the mass such that both democratic political system and market oriented economic system are introduced and the mass implement a redistributive tax policy to enhance their welfare.

The analysis in the paper shows that the threat of revolutions results in several distinct equilibrium institutional changes in a planned economy and the realized change depends on the degree of resource inequality between the elite and the mass. This resource inequality is assumed to be determined by the legacy of the technology that is used in the planned economy. If the initial resource inequality is severe, either political reform or revolution is the only equilibrium outcome. In the political reform the elite give up their political power to the mass and democratic market oriented economic system is established. In some cases, the political reform is not enough for the prevention of revolution.

When the initial resource disparity is moderate, the probability of a successful revolution plays an important role in determining whether economic or political reform is the equilibrium outcome. It is found that political reform rather than economic reform is more likely with a stable political system represented by a small probability of revolution and with a less costly revolution in the sense of not destroying too much of the productive capacity of the economy. Political reform is also more likely when the introduction of market oriented system greatly improves the efficiency of the economy.

If the resource disparity is small, economic reform is enough for the prevention of

revolution. The elite, interestingly, in this case, extract more from the mass by setting a higher tax rate when the probability of revolution becomes higher. If the resource disparity is very small, the economy continues as a planned economy despite the revolutionary threats.

This paper considers institutional changes including revolution in a planned economy. But, the initial planned economy may be the result of the past revolution. In this sense, the model developed in this paper is not complete. In an interesting paper, Usher (1989) considers dynastic cycle alternating between anarchy and despotism as a result of the interactions of economic variables including mortality rate which depends on the violent encounters among rulers, bandits, and farmers.

To model a conflict situation like revolution, in addition to considering the productive utilization of resources, we may want to consider explicitly how the appropriative activities like repressions by the elite or the revolutionary efforts of the mass use the limited resources and influence the probability of successful revolution as in Grossman (1991, 1995) or Noh (2002). However, since the objective of this paper is mostly concerned with economic and political reforms rather than revolution itself, this paper assumes that the probability of revolution is given exogenously.

The analysis on the transition of former communist countries has mostly focused on whether big bang approach or gradualism is better in implementing reforms that are conducive to market economy. See, for example Dewatripont and Roland (1995). But, the analysis in this literature seems to take market economy as an end itself and takes democracy for granted without explicitly considering the incentives of the incumbent elite.

## II. The Model

### 2.1. Planned Economy

Following the model in Acemoglu and Robinson (2000), we consider an infinite-time horizon planned economy where the population consists of the elite and the governed. The governed who are poor account for  $\lambda$  fraction of the population.  $\lambda$  is assumed to be greater than  $\frac{1}{2}$ . The exogenously given total capital stock in the economy, denoted by  $H$ , is commonly owned but the allocation of which for the production purposes is controlled by the elite.

Suppose that the production is conducted in a large number of identical communes where each elite supervises  $\frac{\lambda}{1-\lambda}$  number of poor agents in a commune. We assume that the production technology in a planned economy is such that each elite requires  $h^E$  amount of capital stock and each poor agent needs  $h^P$  amount of capital stock and  $h^E > h^P$ .

We assume that the amount of output produced in each commune is proportional to the total capital stock in the commune and is given by  $C[h^r + \frac{\lambda}{1-\lambda}h^p]$ , where  $C$  represents productivity in the planned economy and is assumed to be quite low. Since  $H = \lambda h^p + (1-\lambda)h^r$ , the total output in the planned economy is simply  $CH$ .

Without modelling explicitly how the elite set the income for the poor in the planned economy, we assume that the elite, after extracting their share of output, they evenly divide the remaining output among the poor. For the facility of calculations in later sections, we assume that the income of a poor person in the planned economy is some fraction of the output from the capital stock that is assigned to him in the commune,  $Bh^p$ .<sup>1</sup> Obviously,  $B$  is much smaller than  $C$ .

In this planned economy there always exists a potential for revolution from the poor. To represent the threat of revolution in a simple way, we assume that, in each period, one of the two states,  $s^N$  or  $s^R$ , occurs. Each state indicates differing incentives for the poor to make revolution by differently affecting the productivity and the consequences of the revolution.

In the normal state,  $s^N$ , which occurs with probability  $1-q$ , the productivity  $C$  takes the normal value and the income of the poor is  $Bh^p$ . In addition, we assume that when the poor revolt, in the normal state, the struggle with the elite is so severe that the entire capital stock of the economy is destroyed so that revolution never pays off to the poor. We could assume that, in the normal state, part of the capital stock remains intact after the revolution so that the poor can utilize it for the production after the revolution. But this only adds another inequality for the derivation of the condition when revolution occurs.

With probability  $q$ , a revolutionary state,  $s^R$ , occurs. This state is propitious for revolution. First, the productivity becomes lower than the normal value. Hence, the income of the poor becomes lower than the level in the normal state. We assume that the income of the poor in this state is  $\alpha Bh^p$ , where  $\alpha < 1$ .  $\alpha Bh^p$  can be thought as income level which is near subsistence income. Additionally, this state is relatively attractive for the poor because even though part of the capital stock in the economy is destroyed during the revolution, still  $\mu$  fraction of the total capital stock remains for the post revolution production purposes.

The revolutionary state may be caused by international political situations as well as natural disasters. For example, suppose that the planned economy is supported by allies with key economic resources as well as military assistance. If the circumstances make the allies change their mind, productivity will fall with the shortage of key resources and revolution may be made easier with the assistance of outside world.

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<sup>1</sup> We could assume that the income of a poor person is a very small fraction of total output in the commune or total output in the economy.

We make a very simple assumption that whenever the poor wage a revolution against the elite, it succeeds and the remaining capital stock in the economy after the revolution including the capital stock that was used by the elite in the planned economy is evenly distributed among the poor. We assume that after the revolution the mass adopt market oriented economic system so that the evenly distributed capital stock becomes the private property of each poor person. The productivity of the economy increases from  $C$  to  $A$ . The amount of output is also assumed to be linear in the amount of capital stock.

The sequence of events within each period is 1) state of the world is realized 2) the elite decide whether to implement economic or political reform 3) the mass decide whether to revolt.

Due to the recursive nature of the model, we will make use of Bellman equation and we focus on the Markov Perfect equilibrium where the strategies of the elite and the mass depend only on the current state of the world.

Suppose the normal state occurs. Since there is no threat of revolution in this state, the elite do not implement any reform and the economy continues as a planned economy. Denoting discount rate by  $\beta$ , the Bellman equation of life-time utility or income of a poor person in a normal state in the planned economy becomes

$$V^p(s^N, PL) = Bh^p + \beta[(1-q)V^p(s^N, PL) + qV^p(s^R, PL)], \quad (1)$$

where  $PL$  in the equation represents planned economy. The first term on the right hand side is the current income of the poor in the normal state. In the next period, there is  $q$  probability of having  $s^R$  and  $1-q$  probability of having  $s^N$ .

Suppose that revolutionary state occurs and the revolution actually breaks out. Then, revolution succeeds and the total post revolution capital stock in the economy,  $\mu H$ , is evenly distributed among the poor so that post revolution per capita capital stock of the poor is  $\frac{\mu H}{\lambda}$ . Per period income of the poor will be  $A$  times the individual capital stock. The life-time utilities of the poor and rich person after revolution become

$$V^p(R) = \frac{A\mu H}{\lambda(1-\beta)}, \quad V^r(R) = 0.$$

$R$  in these expressions indicates revolution and recall that the elite lose everything with revolution.

Suppose that the revolutionary state occurs and the elite do not implement any reform and manage the economy as a planned economy. Suppose that the poor do not take revolutionary action. In this case, the Bellman equation of the income of

the poor becomes

$$V^p(s^R, PL) = \alpha B h^p + \beta[(1-q)V^p(s^N, PL) + qV^p(s^R, PL)]. \quad (2)$$

Solving equations (1) and (2) simultaneously, we obtain

$$V^p(s^R, PL) = \frac{Z(\alpha)}{1-\beta} B h^p,$$

where  $Z(\alpha) = \alpha(1-\beta(1-q)) + \beta(1-q)$  and has the maximum value of 1 when  $\alpha = 1$ .

The condition that revolution is a better option for the poor than living continually under the planned economy regime is given by  $\frac{A\mu H}{\lambda(1-\beta)} > V^p(s^R, PL)$ . By rearranging this inequality, we obtain the following condition.

$$V^p(R) > V^p(s^R, PL) \Leftrightarrow \frac{h^r}{h^p} > \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} \frac{B}{A} Z(\alpha) - 1 \right]. \quad (C1)$$

(C1) shows that revolution makes sense only when the ratio of capital stock assigned to the elite in the planned economy to the capital stock assigned to the poor exceeds a certain amount. This amount can be negative and, in this case, revolution is better than planned economy for all assignment of capital stock between the elite and the poor in the planned economy. When  $\alpha = 1$ , (C1) can be rearranged to become  $\frac{\mu A}{B} > \frac{\lambda h^r}{H}$ . This condition indicates that the productivity increase after the revolution even after we account for the destruction of the capital stock during the revolution is greater than the portion of the capital stock that was assigned to the poor in the planned economy.

Therefore, given that (C1) is satisfied, whenever revolutionary state occurs, unless the elite take any actions to make the life of the poor better, revolution occurs.

## 2.2. Economic and Political Reform

Since the elite lose everything with the successful revolution, we assume that the elite try to prevent the revolution by introducing changes in institutions in the economy. We consider two different types of reforms. One is the introduction of market oriented system. Market oriented institutions take a variety of forms like establishment of special economic zones or increased foreign trade. They are all supposed to contribute to the increase in the productivity. In this paper, economic reform takes the form of establishment of private property rights over the capital stock, which gives more incentives to produce more because the output from the

private property belongs to the owners. With the introduction of market oriented system the productivity in the economy increases from  $C$  to  $A$ .

In establishing the institution of private property rights system, the elite are faced with the problem of allocating capital stock between the elite and the poor. With regard to this problem, we assume that the legacy of production technology in the planned economy determines this allocation problem.<sup>2</sup> That is,  $h^r$  and  $h^p$  which were the needed amount of capital stock for the elite and the poor in the production process of the planned economy become the private capital stock of each member of the elite and the poor. We may think of the introduction of household responsibility system in the collective farms as an element of economic reforms in China. Therefore, with the economic reform, the gross income of a poor person becomes  $Ah^p$ .

With the introduction of economic reform, however, we assume that the elite retain the political power including the power to tax on output of the poor. We also assume that there is a limit in taxing the poor because, if tax rate is too high, the mass allocate their resources to the informal sector which cannot be taxed.

As an alternative to the economic reform, the elite can implement the political reform whereby the elite transfer the political power to the mass. In this case, in addition to adopting market oriented system as described in economic reform, the economy becomes democratic. Since  $\lambda$  is greater than  $\frac{1}{2}$  and assuming majority voting, the poor will choose the tax rate for the determination of the transfer of income from the elite to the poor. The political reform considered in the paper is a comprehensive reform package where both economic reform and franchise extension are included.

The event that the elite introduce a market oriented system is represented by  $\varphi = 0$ . And the event where the elite implement a political reform is represented by  $\varphi = 1$ . Since, if either of the reforms does not produce a better outcome than what the poor can expect by revolution, the poor has the option of revolting, it follows that

$$V^p(s^R, E) = \max[V^p(R), \varphi V^p(D) + (1 - \varphi)V^p(s^R, E, M)],$$

where  $E$  indicates that political power is in the hands of the elite.  $D$  and  $M$  denote democratic regime and market oriented system respectively. With the market oriented economic reform, the elite collect tax revenue and keep it by imposing the tax rate of  $\tau$  on the output of the poor. Therefore, the utility level of the poor

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<sup>2</sup> Whereas this paper takes the distribution of resources between the elite and the poor as given from the legacy of the planned economy, Usher and Engineer (1987) considered the distribution of income in a society as the equilibrium outcome from violence or revolution from the hierarchical structure of the economy. See also Roemer (1985).

when the elite introduce market oriented system becomes

$$V^p(s^R, E, M) = (1-\tau)Ah^p + \beta[(1-q)V^p(s^N, PL) + qV^p(s^R, E, M)]. \quad (3)$$

Note that, in equation (3), it is assumed that when the elite introduce a market oriented reform, they do it only reluctantly so that when situation permits, i.e., when  $s^N$  occurs in future periods, they reintroduce a planned economy. The elite can confiscate the property of the poor and revert to the planned economy. We can imagine that the elite may close the special economic zones temporarily or freeze foreign trade etc. That is to say, the economic reform as represented by the introduction of market economy is not permanent but reversible.<sup>3</sup>

To indicate that taxing power is limited in a market oriented system, we assume an existence of informal sector on which tax cannot be imposed. To simplify the calculation, we assume that the productivity of the informal sector in a market oriented system is the same as the productivity of the planned economy in a normal state,  $B$ .<sup>4</sup> Therefore, the maximum tax rate which ensures that people allocate their resources to the market rather than underground economy is  $\tau = \frac{A-B}{A}$ .

With the political reform, political power is transferred to the mass peacefully. Under the democratic regime, a tax rate, which is applied uniformly to the poor as well as to the rich, is chosen by the poor to redistribute the output from the rich to the poor. We assume that the tax revenue is evenly distributed among the population. Therefore, in each period, the after tax amount of production for the poor is  $(1-\tau)Ah^p$  but they receive as redistribution at the rate of  $\tau AH$ . Therefore, in a democratic regime, the poor will maximize the amount of redistribution of income by setting the tax rate at  $\frac{A-B}{A}$ .

With the implementation of political reform, therefore, the utility levels of the poor and the elite become

$$V^p(D) = \frac{1}{1-\beta}[Bh^p + (A-B)H], \quad V^r(D) = \frac{1}{1-\beta}[Bh^r + (A-B)H].$$

<sup>3</sup> There are many reasons why the elite may want to go back to the planned economy. If market economy is introduced, economic power may be shifted to the mass so that the probability of losing political power may increase. This mechanism is considered in Acemoglu and Robinson (2006). In this paper, however, the probability of having a revolutionary state,  $q$ , remains constant even when economic reform is implemented. Or simply, we can imagine that the elite enjoy a non-pecuniary benefit in the planned.

<sup>4</sup> In a market oriented system whether introduced with economic or political reform, we assume, there exist an informal sector. The productivity in this sector may be higher or lower than the productivity in the planned economic system. For simplicity of calculation, we assume that the productivity of informal sector in a market economy is the same as the productivity of the command economy after paying rents.

Since, with the revolution, the elite lose everything, implementing a political reform is a better strategy for the elite than letting revolution happen. But we cannot exclude the possibility that revolution is better for the poor than even the political reform. The condition that taking over political control by a peaceful method is better for the poor than by revolution is given by  $\frac{1}{1-\beta}[Bh^p + (A-B)H] > \frac{A\mu H}{\lambda(1-\beta)}$ .

In solving this inequality in terms of resource disparity, we consider two cases. If  $\frac{\mu A}{\lambda} < (A-B)$ , we find that  $V^p(D) > V^p(R)$  whenever  $\frac{h^r}{h^p} > 0$ . Roughly  $(A-B)$  can be interpreted as the extra gain per unit of capital stock the poor enjoy in a democratic regime compared to the planned economy.  $\frac{\mu A}{\lambda}$  is the income level of the poor per unit of capital stock after the revolution. Consequently, in this case, regardless of resource distribution between the elite and the poor, political reform is better to the poor than revolution. See section 3.3.

If  $\frac{\mu A}{\lambda} > (A-B)$ , however, the condition whether democracy is better than revolution becomes

$$V^p(D) > V^p(R) \leftrightarrow \frac{h^r}{h^p} < \frac{\lambda}{1-\lambda} \left[ \frac{\frac{1}{\mu} \frac{B}{A}}{1 - \frac{\lambda}{\mu} (1 - \frac{B}{A})} - 1 \right]. \tag{C2}$$

That is to say, since the extra gain from the democratic regime is smaller than the income level of the poor after the revolution, political reform is not always better than revolution. (C2) shows that the extra gain from the political reform exceeds the extra gain from the revolution when resource disparity is not too large. Otherwise, the poor would rather revolt rather than accept political reform. In the main text, we focus on this case.

To check whether the introduction of market oriented system is not enough for the prevention of revolution, we first consider the maximum utility the poor can expect in the market economy. Then by comparing this level to the level that can be achieved with the revolution, we will derive the condition under which the introduction of market oriented system suffices to prevent the revolution.

The maximum utility of the poor in the market oriented system is obtained when the elite impose the tax rate of 0. Then solving equations (1) and (3) simultaneously, and by setting  $\tau = 0$ , we obtain<sup>5</sup>

$$V^p(s^R, E, M, \tau = 0) = \frac{1}{1-\beta} [(1-\beta(1-q))A + \beta(1-q)B] h^p. \tag{4}$$

Note that the expression in equation (4) is an increasing function of  $q$ . Since

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<sup>5</sup> In deriving equation (4), we make use of the fact that  $V^p(s^R, PL)$  becomes  $V^p(s^R, E, M)$  in equation (1).

market oriented system will be in place whenever  $s^R$  occurs, the higher the probability of having  $s^R$ , the poor expect a higher utility. In particular, we have

$$V^p(s^R, E, M, \tau = 0 / q = 0) = \frac{1}{1-\beta} [(1-\beta)A + \beta B] h^p,$$

$$V^p(s^R, E, M, \tau = 0 / q = 1) = \frac{1}{1-\beta} [A] h^p.$$

To investigate the possibility that the maximum utility that the poor obtain in the market system for all values of  $q$ , which occurs when  $\tau = 0$  and  $q = 1$ , can be less than the level of utility that is obtained with revolution, we derive the condition

$$V^p(R) > V^p(s^R, E, M, \tau = 0 / q = 1) \Leftrightarrow \frac{h^r}{h^p} > \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} - 1 \right]. \quad (C3)$$

Similarly, to consider the case that, depending on the values of  $q$ , the market economy is better than revolution for the poor, we obtain

$$V^p(R) > V^p(s^R, E, M, \tau = 0 / q = 0) \Leftrightarrow \frac{h^r}{h^p} > \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} \left( 1 - \beta + \beta \frac{B}{A} \right) - 1 \right]. \quad (C4)$$

Up to this point, we obtained conditions (C1) through (C4) by considering whether the poor prefers revolution to the planned economy, market oriented reform, political reform. Comparing (C1), (C3), (C4), we easily find that

$$\frac{\lambda}{1-\lambda} \left( \frac{B}{A} \frac{1}{\mu} Z(\alpha) - 1 \right) < \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} \left( 1 - \beta + \beta \frac{B}{A} \right) - 1 \right] < \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} - 1 \right]. \quad (5)$$

We also find that, given that,  $\frac{\mu A}{\lambda} > (A - B)$ , if  $\lambda > \mu$ ,

$$\frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} - 1 \right] < \frac{\lambda}{1-\lambda} \left[ \frac{\frac{1}{\mu} B}{1 - \frac{\lambda}{\mu} \left( 1 - \frac{B}{A} \right)} - 1 \right]. \quad (6)$$

If  $\lambda < \mu$ , the above inequality is reversed. Even though the term on right hand side of (6) is larger than the term on the left most side of (5), it may be larger or smaller than the middle term in (5). In the next section, we first focus on the case when inequality in (6) holds. Then, we will discuss the implications when inequality in (6) does not hold.

### III. Equilibrium

#### 3.1. $\frac{\mu A}{\lambda} > (A - B)$ and $\lambda > \mu$ : Political Reform is Better than Economic Reform

This is the case when revolution is preferable to the political reform when the resource disparity exceeds a certain number. If  $\lambda > \mu$ , inequalities in (5) and (6) hold. Political reform is better for the poor than economic reform in the sense that the political reform requires more resource inequality than the economic reform. In this case, depending on the degree of resource inequality, we obtain five different equilibrium outcomes when the revolutionary state  $s^R$  occurs.

As a numerical example, suppose that  $\lambda = 0.6$  and  $\mu = \frac{4}{11}$ . We normalize the productivity of the planned economy to be 1,  $C = 1$ . Assume that half of the output that is produced with the use of the assigned capital stock by the poor is extracted by the elite in the planned economy,  $B = \frac{1}{2}$ . Suppose that the introduction of market oriented system improves efficiency from 1 to  $A = \frac{11}{10}$ . Assuming  $\beta = 0.04$ , the inequalities in (5) become  $0.375 < 0.535 < 2.625$ . And the inequality in (6) becomes  $2.625 < 17.25$ .

##### 3.1.1. Region I: Continuation of Planned Economy: $\frac{h'}{h^p} < \frac{\lambda}{1-\lambda} (\frac{B}{A} \frac{1}{\mu} Z(\alpha) - 1)$

In this region, according to (C1), we have  $V^p(R) < V^p(s^R, PL)$ . Consequently, the poor have no incentive to revolt. The economy goes as a planned economy regardless of the state of the world.

##### 3.1.2. Region II: Economic Reform: $\frac{\lambda}{1-\lambda} (\frac{B}{A} \frac{1}{\mu} Z(\alpha) - 1) < \frac{h'}{h^p} < \frac{\lambda}{1-\lambda} [1 - \beta + \beta \frac{B}{A} - 1]$

By (C1), the poor will revolt unless the elite introduce some changes in the economy. If the elite introduce market oriented system, in this region,  $V^p(R) < V^p(s^R, E, M, \tau = 0 / q = 0) < V^p(s^R, E, M, \tau = 0 / q = 1)$ . The level of utility that the poor obtain in the market economy when tax rate is 0, is higher than the level that is available with revolution for all values of  $q$ .

In this region, whenever  $s^R$  occurs, the elite can prevent the revolution by introducing a market economy. Even though the poor understand that the market economy is reversible so that the elite cannot commit the market economy forever in the future, they acquiesce in the economic reform because revolution produces a worse outcome to the poor.

To prevent the revolution, it is sufficient for the elite to introduce the market mechanism and, for each  $q$ , to choose an appropriate tax rate that produces a slightly higher utility than what the poor obtain from the revolution. By setting

$V^p(s^R, E, M, \tau = \tau^*)$  equal to  $V^p(R)$ , we obtain the tax rate that will be chosen by the elite in this region.

$$\tau^* = 1 - \frac{\frac{\mu}{\lambda}(\lambda + (1-\lambda)\frac{h^r}{h^p}) - \beta(1-q)\frac{B}{A}}{1 - \beta(1-q)}. \quad (7)$$

We note that  $\tau^*$  is increasing in  $q$ . That is, when the probability of having a situation where social unrest leads to a successful revolution becomes higher, the elite respond by imposing a higher tax rate. This seemingly odd result follows from the fact that, with higher  $q$ , there are more instances of market economy in the future so that the poor can expect to enjoy a higher level of utility. Since the elite, in this region, can prevent the revolution simply by letting the poor enjoy the same level of utility level that they can achieve with the revolution, the elite can afford to extract more from the poor with a higher value of  $q$ .<sup>6</sup>

Therefore, in this region,  $q$  does not play any role in inducing institutional change nor does it affect the utility level of the poor because the expected utility of the poor remains constant for all values of  $q$ . We only observe that with a higher  $q$ , the economy looks more repressive.

### 3.1.3. Region III: Economic or Political Reform: $\frac{\lambda}{1-\lambda}[\frac{1}{\mu}(1-\beta+\beta\frac{B}{A})-1] < \frac{h^r}{h^p} < \frac{\lambda}{1-\lambda}[\frac{1}{\mu}-1]$

In this region we have  $V^p(s^R, E, M, \tau = 0 / q = 0) < V^p(R) < V^p(s^R, E, M, \tau = 0 / q = 1)$ . When the probability of having  $s^R$  is 0 so that there is no prospect of experiencing a market economy then revolution is a better option for the poor. However, the poor prefer a situation of almost certain introduction and continuation of market oriented economy to revolution.

Since  $V^p(s^R, E, M)$  is an increasing function of  $q$ , there exists  $q^*$  such that  $V^p(s^R, E, M, \tau = 0 / q = q^*) = V^p(R)$ . Therefore, when  $q < q^*$ , the introduction of the market oriented system is not enough to prevent the revolution. Recall that this region satisfies (C2). Therefore, since the poor prefers political reform to revolution, the equilibrium outcome will be political reform instead of economic reform. However, when  $q > q^*$ , the elite can prevent the revolution by introducing market

<sup>6</sup> Notice that  $\tau^*$  takes on the highest value of  $\frac{A-B}{A}$  when  $\frac{h^r}{h^p} = \frac{\lambda}{1-\lambda}(\frac{B}{A}\frac{1}{\mu}-1)$ . It becomes lower as resource inequality widens and reaches the lowest value of  $\frac{\beta q(1-\frac{B}{A})}{1-\beta(1-q)}$  when resource distribution becomes the most unequal. This is because the poor expect a higher level of utility with revolution when resource distribution is more severe. Similarly, the poor expect a higher utility level after revolution with a higher  $A$ . To guarantee this higher level of utility, tax rate should be lower if the adopted market oriented system is more productive.

oriented economic reform while holding on to political power. In this case, the elite choose an appropriate tax rate that is given by (7).

This counterintuitive result that only the extreme form of political reform can prevent the revolution when  $q$  is low while a mild form of economic reform is enough to avert revolution when  $q$  is high is because the elite cannot convince the poor that the elite will maintain a market economy in the future in all circumstances. Therefore, when  $q$  is high, the introduction of market economy is enough to prevent revolution because the poor know that they will be better off by benefiting from the fruits of market economy more frequently in the future.<sup>7</sup>

We derive that

$$q^* = 1 + \frac{\mu(1 + \frac{1-\lambda}{\lambda} \frac{h'}{h^p}) - 1}{\beta(1 - \frac{B}{A})}. \tag{8}$$

We note that  $q^*$  is an increasing function of  $\frac{h'}{h^p}$  and takes the value of 0 when resource disparity is at the lower end of this region and value of 1 when the resource disparity is at the upper end of the region. This implies that as initial resource disparity becomes higher, political reform is more likely.

Similarly, with some calculations, we find that  $q^*$  is increasing in both  $A$  and  $\mu$ . Consequently, it follows that political reform instead of economic reform is more likely when political environment is stable (lower  $q$ ) and the revolution, when it happens, is not too costly in the sense of not destroying much of productive capacity of the economy (higher  $\mu$ ) and the introduction of market oriented system greatly improves the efficiency of the economy (higher  $A$ ). These implications shed some lights on the conditions under which countries like North Korea and China change into a genuine democracy with market oriented economic system.

**3.1.4. Region IV: Political Reform:**  $\frac{\lambda}{1-\lambda} [\frac{1}{\mu} - 1] < \frac{h'}{h^p} < \frac{\lambda}{1-\lambda} \left[ \frac{\frac{1B}{\mu A}}{1 - \frac{\lambda}{\mu}(1 - \frac{B}{A})} - 1 \right]$

In this region, the inequality of capital stock between the elite and the poor is substantial so that even taking into account the fact that the revolution destroys part of the capital stock in the economy, the revolution produces a better result for the poor than the best the poor can achieve in the market economy.  $q$  does not play any role in this region in inducing institutional change.

$$V^p(R) > V^p(s^R, E, M, \tau = 0 / q = 1) > V^p(s^R, E, M, \tau = 0 / q = 0)$$

<sup>7</sup> Acemoglu and Robinson (2000) identified the same forces that explain why in Germany where  $q$  is high could prevent revolution with the introduction of redistributive welfare reform while in England and France, where  $q$  is relatively low, franchise reform is implemented.

Also, in this region, by (C2), we know that the poor prefer peaceful reform of democratization to revolution. Since the rich lose everything with revolution, political reform, that is democratization, is the only equilibrium outcome.

### 3.1.5. Region V: Revolution: $\frac{h^r}{h^p} > \frac{\lambda}{1-\lambda} \left[ \frac{\frac{1B}{\mu A}}{1-\frac{\lambda}{\mu}(1-\frac{B}{A})} - 1 \right]$

In this region, by (C2), we have  $V^p(D) < V^p(R)$ . Even though the elite want to implement political reform, revolution is a better option for the poor. Hence, revolution is the only equilibrium outcome.

## 3.2. $\frac{\mu A}{\lambda} > (A - B)$ and $\lambda < \mu$ : Economic Reform can be Better than Political Reform

If revolution is preferable to the political reform when the resource disparity exceeds a certain number and if the fraction of the poor is smaller than the fraction of total capital stock of the economy that remains after the revolution, we will observe more frequently revolution than political reform when resource disparity is large.

In this case, inequalities in (5) hold but the inequality in (6) is reversed. We consider two cases. If  $\left[ \frac{\frac{1B}{\mu A}}{1-\frac{\lambda}{\mu}(1-\frac{B}{A})} - 1 \right] > \left[ \frac{1}{\mu}(1-\beta + \beta \frac{B}{A}) - 1 \right]$ , we have the same first two regions as in subsection 3.1. But, Region 3 is divided into two intervals  $\frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu}(1-\beta + \beta \frac{B}{A}) - 1 \right] < \frac{h^r}{h^p} < \frac{\lambda}{1-\lambda} \left[ \frac{\frac{1B}{\mu A}}{1-\frac{\lambda}{\mu}(1-\frac{B}{A})} - 1 \right]$  and  $\frac{\lambda}{1-\lambda} \left[ \frac{\frac{1B}{\mu A}}{1-\frac{\lambda}{\mu}(1-\frac{B}{A})} - 1 \right] < \frac{h^r}{h^p} < \frac{\lambda}{1-\lambda} \left[ \frac{1}{\mu} - 1 \right]$ . In the first interval, depending on the values of  $q$ , either economic or political reform is the equilibrium outcome. But in the second interval, the equilibrium outcome is either economic reform or revolution. In Regions IV and V, revolution is the equilibrium outcome.

If  $\left[ \frac{\frac{1B}{\mu A}}{1-\frac{\lambda}{\mu}(1-\frac{B}{A})} - 1 \right] < \left[ \frac{1}{\mu}(1-\beta + \beta \frac{B}{A}) - 1 \right]$ , we have the same first two Regions as in subsection 3.1. Now, in Region III, we have either economic reform or revolution depending on  $q$ . In Regions IV and V, we have revolution as equilibrium outcome.

## 3.3. $\frac{\mu A}{\lambda} < (A - B)$ : No Revolution

In this situation, we know that political reform is preferred to revolution by the poor for all values of resource disparity. Hence, revolution never occurs. We have the identical first three Regions as in subsection 3.1. However, in both Region IV and Region V, political reform is the equilibrium outcome.

## IV. Conclusion

This paper investigated the institutional changes in a planned economy as the equilibrium outcome from the interactions between the elite and the mass in the presence of revolutionary threats. Given that economic and political reforms are available to the elite, the particular reform that is implemented depends crucially on the initial resource inequality between the elite and the mass. The analysis shows that as the initial resource inequality becomes larger, the market oriented economic reform is not enough to prevent the revolution and only the full scale political reform whereby the elite transfer the political power to the mass can prevent the costly revolution. In some cases, either economic or political reform is not enough for the prevention of revolution so that revolution is the only equilibrium outcome when resource disparity is quite large.

It is found that when resource disparity is not too small nor too severe, political reform instead of economic reform is more likely when political environment is stable and the revolution, when it happens, is not too costly in the sense of not destroying much of productive capacity of the economy and the introduction of market oriented system greatly improves the efficiency of the economy.

It would be an interesting future research if we model the institutional change in a command economy within a dynamic setting where resource inequality widens over time and considering explicitly the probability of revolution that is influenced by the appropriative activities of the elite and the mass.

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