

# Policy Swings of a Centralized Government: A Dynamic Optimizing Decision-Making Model and a Case of China

Fan Zhang<sup>1\*</sup>, Zeyu Xu<sup>2</sup>, Heqing Huang<sup>3</sup>

<sup>1</sup>National School of Development, Peking University, Beijing, China

<sup>2</sup>Columbia University, New York, USA

<sup>3</sup>Peking University, Beijing, China

Email: \*Zhangfan@nsd.pku.edu.cn

**How to cite this paper:** Zhang, F., Xu, Z. Y., & Huang, H. Q. (2022). Policy Swings of a Centralized Government: A Dynamic Optimizing Decision-Making Model and a Case of China. *Modern Economy*, 13, 566-579.

<https://doi.org/10.4236/me.2022.134030>

**Received:** March 5, 2022

**Accepted:** April 19, 2022

**Published:** April 22, 2022

Copyright © 2022 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

---

## Abstract

The Chinese government made dramatic changes in its policies concerning economic development and social stability several times in the past 70 years. This paper tries to explain the decision-making swings of a centralized government, by using a dynamic optimization model and the Chinese government as an example. The focus is on a government's contradictory decisions between economic development and social stability. Simulations are carried out to analyze the effects of different factors on the government's policy choice. The paper finds that the fluctuation of policies can lead to equilibrium with certain constraints, if the government is patient enough, if a feedback mechanism is effective, or if the government does not mandatorily change the policies periodically. Otherwise, the policy fluctuation cannot reach equilibrium and the policy will be out of control.

## Keywords

Contradictory Decisions between Economic Development and Social Stability, China, Policy Swings, Dynamic Optimization Model

---

## 1. Introduction

The modern Chinese government has experienced dramatic policy changes between emphasizing economic development and focusing on social stability. From the 1950s to the 1970s, the government focused on social stability and sacrificed economic development, especially when the Cultural Revolution from 1966 to 1976 resulted in the collapse of the Chinese economy. The reformists

subsequently readjusted the policy by emphasizing economic development and started the economic reform from 1978 to the first decade of the 21st century, by introducing a market economy into the bureaucratic system, at the expense of government control over certain areas. The leadership realized the possibility of losing control of the society and readjusted the policy toward social stabilities in the second decade of the 21st century. Major policy swings have occurred several times in the People's Republic of China's 70 years, some of which resulted in disasters. Similar policy swings also occurred in the former Soviet Union in the 1950s and 1960-70s<sup>1</sup>. The question we are trying to answer in this paper is: Can a centralized government perform an optimal decision-making process in the long run? If yes, can this process be rational or not? Is it possible that any irrational over-reactions in this process lead to situations that are out of leadership control? Answers to these questions can help policymakers and researchers understand the behavior of a centralized government and forecast potential future changes in their policies.

We define a centralized government or a centralized-decision-making government as a government form that has political authority to make important socio-economic decisions for the whole society through a centralized body of government. China is an example of a centralized-decision-making state. Although decision-making is in part based on opinions of ordinary citizens, most of its key socio-economic decisions are made by the centralized body of the government (Folsom et al., 1992; Naughton, 2007).

The objective of a centralized government can be described by a utility function with two basic components—stability of the society and economic growth—assuming complete information. Stability of the society means safety of the rule of the regime. Economic performance has been an important source of legitimacy of the government and the primary measure of political legitimacy in China since the end of the Cultural Revolution in the late 1970s. The government's reputation rises and falls with GDP, yet the stability of the society has been one of the main targets and the foundation of the existence of a centralized government. The two components are correlated with each other. Economic performance has been a critical condition for social stability, while social stability provides an environment for the growth of the economy. The government's utility function is a weighted sum of social stability and economic development.

There are two basic policy options—economic policy and social stability policy—from which the government may choose. Economic policy promotes economic growth and marketization, whereas social stability policy maintains the stability of society and the existence of the government itself. Economic policy promotes economic development through relaxing government's control on the market and the positive reaction of the market players, while stability policy enhances government's control of the society through tightening the control of its elites and ordinary residents. The government has to choose the correct combi-

<sup>1</sup>Nikita Khrushchev changed Joseph Stalin's policy and launched reform in the 1950s and Leonid Brezhnev returned to Stalin's policy to some extent in the late 1960s and 1970s.

nation of the two policy instruments. Even in a centralized society without rule of law, policymakers still face certain restrictions on policy implementations. Although favorable to economic growth, the economic policy may create political instability and inequality in the society, which may damage government control of the society. Meanwhile, social stability policy focuses on the control of society but could be unfavorable to economic development. The two policies are compatible with each other to some extent but competitive when the difference is large enough. The government makes choices regarding these two compatible/contradictory policies. The weight of the two policies changes over time and is determined by political and economic environments. These contradictions of policymaking result in swings between policy choices.

This paper first reviews the related literature; then lay out a dynamic optimal decision-making model for contradictory decisions between economic development and social stability; next, simulations are performed to analyze the effects of different variables on steady state equilibrium and the locus moving to equilibrium; finally, several conclusions are made at the end of the paper.

## 2. Literature Review

Much research has dealt with policy choice fluctuations in a democratic society. Nordhaus (1975) creates a model which shows how expansionary policy before an election can help incumbents get reelected in a democratic society. These political business cycles increase in economic activity in election years relative to non-election years in order to attract voters. Although some researches raised the question before Nordhaus (Akerman, 1947; Downs, 1957; Frey & Lau, 1968), Nordhaus's ground-breaking paper was the first to formalize the idea of political business cycles in an analytical framework. Dubois (2016) provides a detailed survey on the literature following Nordhaus's (1975) publication on political business cycles.

Many authors extended the Nordhaus model using different approaches, including Gonzales et al. (2006), Kaplan (2014), Golinelli and Momigliano (2006), Revelli (2019), Alesina and Stella (2010), Ferris et al. (2008), Konishi (2006), and Pham et al. (2018). Rogoff and Siber (1988) tried to reconcile Nordhaus's (1975) model with the rational expectations theory, which no longer envisages an inflation/unemployment trade-off but focuses on a state budget problem. Tufte (1978) first addresses the question of the means of action available to the government to generate economic expansion. The instruments must be easy to start-up and must yield clear and immediate benefits to a large number of voters. Empirical tests of the political business cycle in instruments were performed following Tufte's paper. Many researchers have emphasized that the context of an election has an influence on the political business cycle, including the level of popularity (Schultz, 1995), electoral competitiveness (Baker & Sen, 1986) and institutional context (Amacher & Boyes, 1978). Jindapon and Van Essen (2019) provide a micro-foundation for the existence of political business cycles genera-

lizing and extending the classic Nordhaus model. Using a differential games approach, they model the strategic interaction of legislators in an election period and show that cycles can exist in equilibrium. The existence and shape of cycles depend on the parameters of the model and the initial level of unemployment.

Other researches empirically test the political business cycle theories (Paso-vano, 2014; Brender & Drazen, 2005; Bostashvili & Gergely, 2019; Jong-A-Pin, 2009; Jens, 2017). Jong-A-Pin (2009) examines the multidimensionality of political instability using 25 political instability indicators in an Exploratory Factor Analysis. The paper finds that political instability has four dimensions, but only the instability of the political regime has a robust and significant negative effect on economic growth.

Some researches focus on decision-making in autocratic regimes. Guttman and Reuveny (2014) develop a game-theoretic model of endogenous economic policy for autocratic regimes facing a revolt or an insurgency. The paper finds that these autocratic regimes endogenously sort themselves into “tinpot” regimes that maximize their consumption at the cost of their survival or (weak and strong) “totalitarian” regimes that maximize their probability of survival at the expense of their consumption. Research shows that political business cycles occur in non-democratic systems: in Egypt (Blaydes, 2011) and Mexico (Gonzalez, 2002).

Some papers analyze China’s political-economic cycles, which are different from democratic countries. Tsai (2014) explores political budget cycles in China’s provinces. There exists a national, coordinated cycle associated with the timing of the National Congress of the Communist Party (NCCP). Two years prior to the NCCP, politicians are likely to shift public spending toward capital expenditures, such as innovation funds and capital construction, and away from current expenditures, such as agricultural subsidies, social expenditures and government administration. The opposite pattern occurs during the year of the NCCP, when politicians increase current expenditures and decrease capital expenditures. Xiao Gongqin’s *Beyond Left and Right Radicalism* (Xiao, 2012) argues that to promote the economic and political transition, China needs to fight against challenges from both left and right radicalism and follow a middle-of-the-road strategy. Zhang (2018) presents a theoretical framework to explain the target and the policies of an authoritarian government without a mathematical model. According to Zhang (2018), the target of the government is described by a benefit/utility function with two basic components—stability and economic growth. The government has to make choices regarding two basic policy options—economic policy and social stability policy. Guo (2009) examines the political business cycles in Chinese counties using panel data from 1997 through 2002.

No existing formal academic research focuses on the tradeoff of a centralized government between social stability and economic development, which is the question this paper tries to answer. The contradictory decisions between economic development and social stability have been the most important policy de-

cision for the Chinese government in recent years. It is also a key policy decision of many centralized decision-making countries. This decision has a dramatic influence on a large number of sub-level policies. For example, migration of rural labor into the urban area is favorable to the economic growth, but may cause social instability. The policymakers have to make the decision of how to control the rural migration based on their basic judgements on social stability and economic development. Researches on this topic have significant meaning, in theory and in practice, and can provide a way to understand the behavior of a centralized-decision-making government and to formulate guidelines for policymaking.

### 3. The Model

We assume the policymakers in the government are rational in general and occasionally behave irrationally. We assume that the government optimizes its intertemporal benefit or utility, which is a weighted sum of economic benefits and social stabilities, subject to the constraints of policy implementation costs, by choosing optimal policies. The government's utility is connected to but is not the same as the social welfare. The government is fundamentally driven by leaders' private interests. A feedback mechanism is built into the model, which is effective when the actual policy deviates from its target<sup>2</sup>. The optimal control problem for the government is:

Let

$$u(P_t) = \alpha\pi_t + (1 - \alpha)S_t - \left[ (P_t - \theta P)^2 + 1 \right] C(1 + c)^t$$

be the government's utility and consider the optimal control problem

$$\begin{aligned} \max_P \int_0^{\infty} u(P_t) e^{-\rho t} dt \\ \text{s.t. } \dot{\pi}_t &= P_t r_t \pi_t, \\ \dot{S}_t &= (1 - P_t) s_t S_t, \end{aligned}$$

where the initial values  $\pi_0$  and  $S_0$  are known. Economic benefit  $\pi$  and social stability  $S$  are state variables and policy  $P$  is the control variable. The larger the  $P$  is, the more favorable the policy is to economic development. We assume initial policy  $-1 < P_0 < 1$ , but as results of changes in other variables,  $P_t$  could be out of this range as time passes.  $u$  is the government's utility,  $\theta P$  is the target of government policy which is a function of actual policy,  $1 > \theta > 0$ ,  $C > 0$  is the cost of implementation of the policy (connected to but not the same as the cost to the whole society),  $c$  is the growth rate of  $C$ ,  $0 < \alpha < 1$  is the weight of economic revenue in the government's utility function, and  $\rho$  is the discount factor. The actual growth of economic benefits and social stabilities are affected by their natural growth rates (growth rates without the impacts of the policy),  $r$  and  $s$ , and the policy variable  $P$ , respectively. We assume  $r(t) \equiv r$ ,  $s(t) \equiv s$ ,  $r > 0$ ,  $s > 0$ , where  $r$  is the natural growth rate of economic revenue, and  $s$  is the natural

<sup>2</sup>Whether this mechanism guarantees the equilibrium depends on the value of feedback coefficient  $\theta$ .

growth rate of social stability. The government maximizes its multi-period utility, subject to the definition of utility, the natural growth rates of economic benefits and social stability, and the initial value of economic benefits and social stabilities. The utility of the government is the weighted sum of economic benefits and social stability subtracting the costs of implementation of policies when the policy deviates from the target.

The present value of the Hamilton function  $J$  is:

$$J = u(P_t) e^{-\rho t} + v_t P_t r \pi_t + w_t (1 - P_t) s S_t$$

The derivatives of  $J$  with respect to  $P$ ,  $\pi$  and  $S$  are, respectively:

$$\frac{\partial J}{\partial P} = -2[(1 - \theta)^2 P(t)] C(1 + c)^t e^{-\rho t} + v(t) r \pi(t) - w(t) s S(t) = 0 \quad (1)$$

$$\frac{\partial J}{\partial \pi} = \alpha e^{-\rho t} + v(t) r P(t) = -\dot{v}(t) \quad (2)$$

$$\frac{\partial J}{\partial S} = (1 - \alpha) e^{-\rho t} + w(t) s [1 - P(t)] = -\dot{w}(t) \quad (3)$$

where  $v$  and  $w$  are conjugate variables. Differentiate both side of (1) with respect to  $t$ :

$$2(1 - \theta)^2 C(1 + c)^t [-\dot{P}(t) - P(t) \ln(1 + c) + \rho P(t)] e^{-\rho t} + \dot{v}(t) r \pi(t) + v(t) r \dot{\pi}(t) - \dot{w}(t) s S(t) - w(t) s \dot{S}(t) = 0 \quad (4)$$

Insert (2) and (3) into (4), and use the growth function of  $\pi$  and  $S$ , resulted in:

$$2(1 - \theta)^2 C(1 + c)^t [-\dot{P}(t) - P(t) \ln(1 + c) + \rho P(t)] e^{-\rho t} + [-\alpha r \pi(t) + (1 - \alpha) s S(t)] e^{-\rho t} = 0$$

Rearrange to get  $\rho$  in terms of other variables:

$$\rho = \frac{\dot{P}(t)}{P(t)} + \frac{\alpha r \pi(t) - (1 - \alpha) s S(t)}{2C(1 + c)^t (1 - \theta)^2 P(t)} + \ln(1 + c)$$

Then the change of policy is determined by the following equation:

$$\dot{P}(t) = [\rho - \ln(1 + c)] P(t) - \frac{\alpha r \pi(t) - (1 - \alpha) s S(t)}{2C(1 + c)^t (1 - \theta)^2} \quad (5)$$

The first item on the right side of the equation shows the effects of patience on the changes of policy. The second item on the right shows the negative feedback mechanism built in the model, e.g., when the economy is in prosperity ( $\pi$  is relatively large), the government puts more weight on social stability; conversely, when the society is stable, the government is more concerned with the economy. Assuming economic benefit is larger than the returns of social stability, the right side is a double negative feedback to economy and policy when  $\rho < \ln(1 + c)$ ; while it is a sum of positive and negative feedback when  $\rho > \ln(1 + c)$ . If the condition  $[\rho - \ln(1 + c)] P(t) = \frac{\alpha r \pi(t) - (1 - \alpha) s S(t)}{2C(1 + c)^t (1 - \theta)^2}$  exists, a steady state of pol-

icy is reached at time  $t$ . This means that, to reach a steady state, discount factor  $\rho$  must make adjustments in order to be consistent with the changes in economic benefit, stability, and costs.

#### 4. Simulation

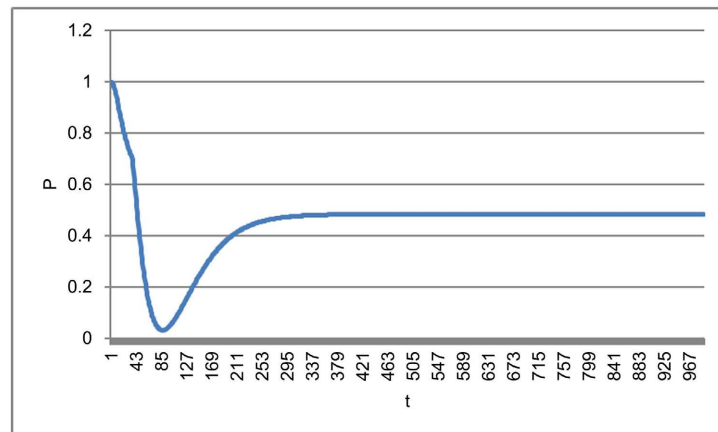
To analyze the effects of different variables on steady state equilibrium and the locus moving to equilibrium, we run simulations by choosing different coefficients of the variables, including the weight of economic revenue in government's utility function  $\alpha$ ; the policy target coefficient  $\theta$ ; the discount factor  $\rho$ ; the initial values of policy  $P_0$ ; the initial values of economic revenue  $\pi_0$ , social stability  $S_0$ , and cost  $C_0$ ; and the natural growth rates of economic revenue  $r$ , social stability  $s$ , and cost  $c$ . In our basic setting, the initial condition of economic benefit  $\pi_0$ , social stability  $S_0$ , and the initial costs of implementing policy  $C_0$  are assumed to be the same and equals 0.5; the natural growth rates of economic benefit  $r$ , social stability  $s$  and costs  $c$  are assumed to be 0.05; and the government is patient and the discount rate  $\rho = \ln(1 + c)$ .<sup>3</sup> From this basic setting, we will test the effects of policy on equilibrium by changing the discount rate  $\rho$ , the weight of economic benefit in government's utility function  $\alpha$ , the policy target coefficient  $\theta$ , and the natural growth rates of economic benefits  $r$  and social stability  $s$ . We will observe that in some cases the equilibrium can be reached through a process of fluctuations while in other cases the fluctuations of policies are out of control.

The first simulation (basic setting) finds that the equilibrium can be reached if the government is patient enough and the natural growth rates of economic benefit and social stability are the same. We assume that the patience level  $\rho$  equals  $\ln(1 + c)$ , the natural growth rates of economy  $r$  and social stability  $s$  are the same, and the initial condition of the economic benefit  $\pi_0$  and the initial condition of social stability  $S_0$  are the same. We find that the initial condition of policy  $P_0$  and whether  $P$  is consistent with the weight of utility function  $\alpha$  may affect the route to equilibrium, but do not affect the existence of the equilibrium to which the policy will ultimately reach. The difference between  $P_0$  and the policy target coefficient  $\theta$  does not affect the existence of equilibrium if the difference is in a reasonable range. **Figure 1** shows the results of the simulation in our basic setting:

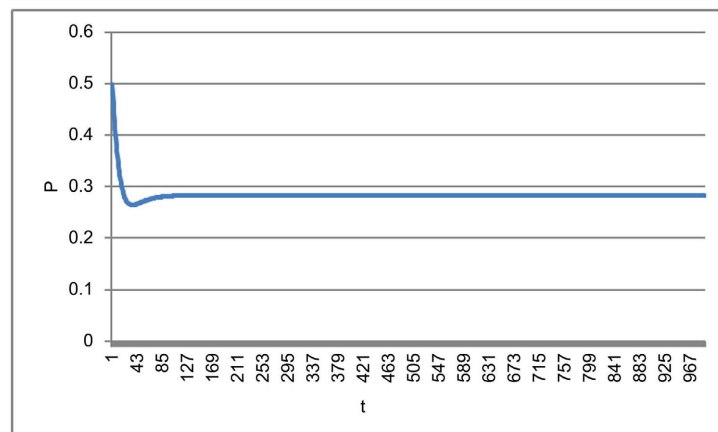
The difference in the natural growth rates of economic benefit and social stability,  $r$  and  $s$ , or the difference in the initial condition of economic benefit and social stability,  $\pi_0$  and  $S_0$ , given initial costs  $C_0$  and growth rate of costs  $c$ , may affect the route to equilibrium but do not affect the existence of equilibrium if the differences are small enough<sup>4</sup>. **Figure 2** shows the effects of small difference in natural growth rates when the natural growth rate of economic benefit is larger than that of social stability.

<sup>3</sup>While this is not a necessary condition for a steady state, it makes the analysis simple.

<sup>4</sup>To reach an equilibrium requires  $r \leq 0.8475$  when  $s = 0.05$ , given the value of other variables in this case.



**Figure 1.** Simulation Results, Basic Setting, the Locus of P (Assuming  $\rho = \ln(1 + c)$ ,  $P_0 = 1$ ,  $\alpha = 0.5$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. The larger the  $P$  is, the more favorable the policy is toward economic development. This Figure shows the locus of policy  $P$  in our basic setting. The policy variable  $P$  fluctuates initially, then moves quickly toward a steady state. Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).



**Figure 2.** Simulation Results, Effects of Small Difference in Natural Growth Rates (Assuming  $\rho = \ln(1 + c)$ ,  $P_0 = 0.5$ ,  $\alpha = 0.5$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = 0.07$ ,  $s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. The chart shows the locus of  $P$  when the natural growth rate of economic benefit is larger than that of social stability ( $r = 0.007$ ,  $s = 0.005$ ), but the difference is in a statistically reasonable range. The policy variable  $P$  fluctuates initially, then moves quickly toward a steady state. Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).

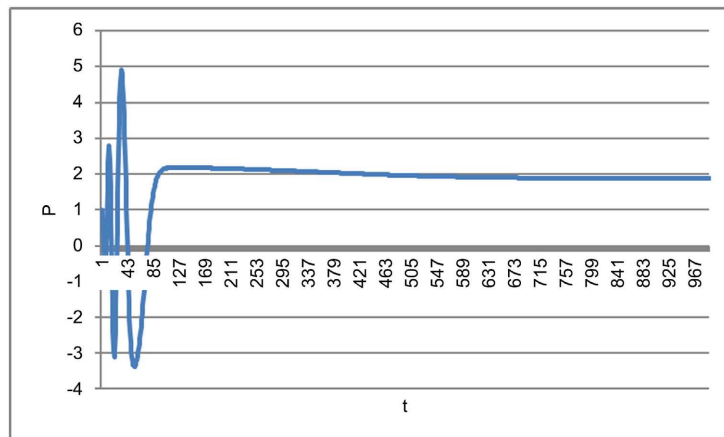
The policy target coefficient  $\theta$  represents the negative feedback mechanism which automatically corrects the policy decision to some degree. It does not affect the existence of equilibrium if  $|\theta - 1| > \gamma$ ,<sup>5</sup> and the initial economic, stability

<sup>5</sup>To reach the equilibrium requires  $\gamma = 0.04$  in this case, but this requirement may change if the values of other variables change. The condition means that the absolute value of the policy target coefficient needs to be large enough to create an enough range of a negative feedback.

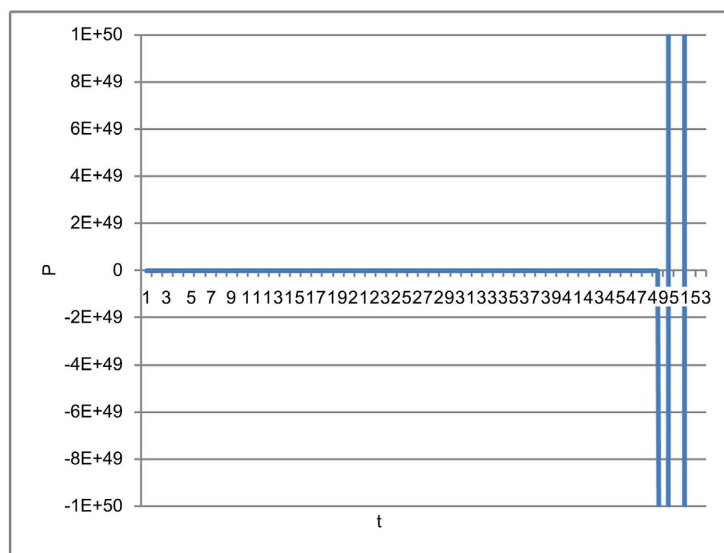
and cost conditions are equal and the natural growth rate  $r$ ,  $s$ , and  $c$  are equal. If the initial policy deviates from the target or the growth rates of economic benefit and social stability are different,  $\theta$  needs to be in a reasonable range to fully correct the biases and move the system back to equilibrium (Figure 3).

If the government is not patient enough, the equilibrium cannot be reached. Figure 4 shows the case when the value of patience level  $\rho$  is large (means impatient).

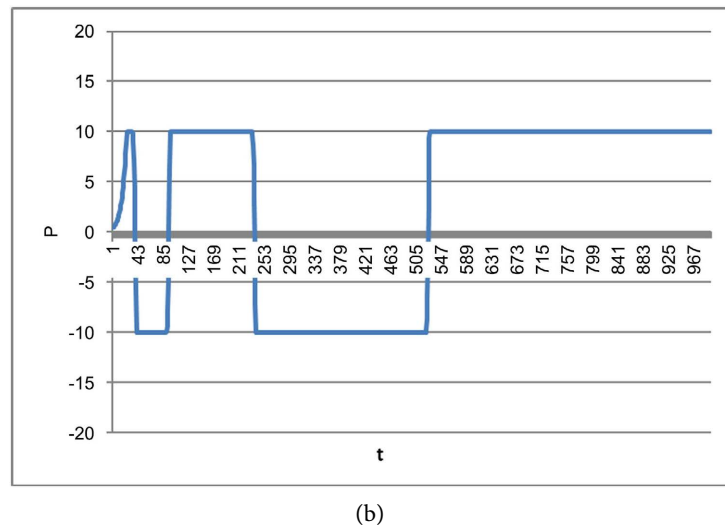
If restrictions on policy changes are set, reflecting the lack of ability of government to enforce the policy, after initial fluctuations, the policy will move toward the boundaries of the restriction.



**Figure 3.** Simulation Results, the Effects of Policy Target (Assuming  $\rho = \ln(1 + c)$ ,  $P_0 = 1$ ,  $\alpha = 0.5$ ,  $\theta = 0.95$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. This chart shows a negative feedback of the policy target coefficient that leads the system back to equilibrium after initial fluctuations, assuming  $|\theta - 1| > \gamma$ . Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).



(a)



**Figure 4.** (a) Simulation Results, the Effects of Patience Level (Assuming  $\rho = 0.2$ ,  $P_0 = 0.5$ ,  $\alpha = 0.5$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. This chart shows a case of the process of moving away from the equilibrium as a result of an impatient government. Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5). (b) Simulation Results, the Effects of Patience Level When a Restriction of the Policy Variable  $-10 < P < 10$  is set (Assuming  $\rho = 0.2$ ,  $P_0 = 0.5$ ,  $\alpha = 0.5$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. When the government is not patient enough, the policy experiences fluctuations initially, and then moves toward one of the boundaries of the restriction. Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).

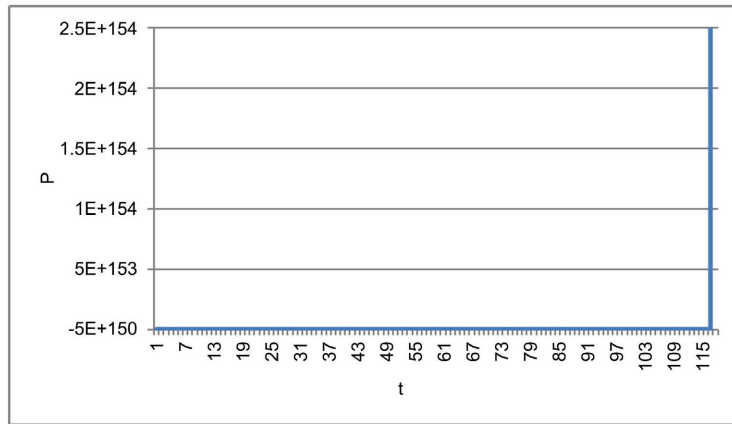
Even if the government is patient and  $\rho = \ln(1 + c)$ , if the difference in natural growth rates of economy and social stability,  $r$  and  $s$ , or the difference in initial conditions of economy and social stability,  $\pi_0$  and  $S_0$ , are large enough<sup>6</sup>, the equilibrium cannot be reached. **Figure 5** shows the case in which the difference between  $r$  and  $s$  is large<sup>7</sup>.

If the government makes mandatory changes to policy and the weights in the utility function periodically, keeps the new policy coefficients and the weights in the utility function for a period of time and then changes them again, the policy will move away from original locus immediately, but then gradually goes back toward the equilibrium if other variables satisfy the conditions required by an equilibrium. **Figure 6** shows the case in which the government makes mandatory changes in policy and the weights in utility function several times, which interrupts the process move toward equilibrium.

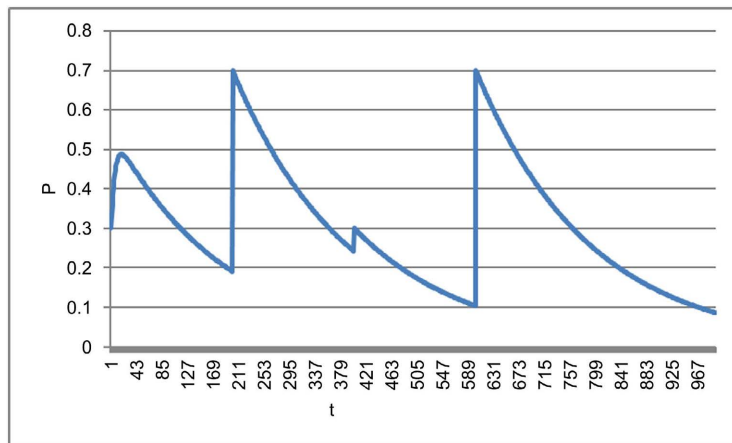
The existence and shape of policy swings depend on the parameters of the model and the initial level of variables. Given the initial conditions of economic

<sup>6</sup>In this case non-equilibrium requires  $r > 0.69$  given the value of other variables.

<sup>7</sup>If a restriction is set for policy variable  $P$ ,  $P$  is moving toward the equilibrium in the long run after initial fluctuations.



**Figure 5.** Simulation Results, Large Difference in Natural Growth Rates (Assuming  $\rho = \ln(1 + c)$ ,  $P_0 = 1$ ,  $\alpha = 0.5$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = 0.69$ ,  $s = c = 0.05$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. This chart shows the move away from the equilibrium as a result of a large difference between the natural growth rates of economy and stability. Data Source: The original values of the variables are set by the authors. The following values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).



**Figure 6.** Simulation Results, Government Makes Mandatory Changes to Policies Periodically (Assuming  $\rho = 0.09$ ,  $P = 0.3$  for  $t = 0$  and  $t = 401$ ;  $P = 0.7$  for  $t = 201$  and  $t = 601$ ,  $\alpha = 0.3$  for  $t = 0 - 200$  and  $t = 401 - 600$ ,  $\alpha = 0.7$  for  $t = 201 - 400$  and  $t = 601 - 1000$ ,  $\rho = 0.09$ ,  $\theta = 0.5$ ,  $\pi_0 = S_0 = C_0 = 0.5$ ,  $r = s = 0.05$ ,  $c = 0.1$ ). Note: The X-coordinate shows the policy variable  $P$ , while the Y-coordinate represents time. This chart shows the results of the government’s mandatory changes to policy when  $t = 201$ ,  $401$ , and  $601$ . The policy moves away from original locus immediately after a change in policy, but then gradually goes back toward the equilibrium before the next change. The process will repeat when a new change is made. Data Source: The original values of the variables are set by the authors. The value of  $P$  when  $t = 0$ ,  $201$ ,  $401$ , and  $601$  are set by the authors. The other values of policy  $P$  are the results of changes in all other variables, calculated by using Equation (5).

benefits, social stability, and costs,  $\pi_0$ ,  $S_0$ , and  $C_0$ , and the natural growth rates of them  $r$ ,  $s$ , and  $c$ , the government can choose the weight of economic revenue  $\alpha$  in its utility function, the policy  $P_t$  at time  $t > 0$ , the policy target coefficient  $\theta$  which is part of the feedback mechanism, and the patience level  $\rho$ . The weight of eco-

economic revenue  $\alpha$  in the utility function and the initial policy  $P_0$  do not affect the existence of equilibrium but will change the path to equilibrium. The equilibrium can be reached through controllable fluctuations of policies if the government is patient enough, if the feedback mechanism is fully effective, and if the differences in natural growth rates of economic benefits and social stability are small enough. The equilibrium cannot be reached and the fluctuation is out of control in four cases: 1) The feedback mechanism is not fully effective. The policy target coefficient  $\theta$  affects the existence of equilibrium if the condition  $|\theta - 1| > \gamma$  cannot be fulfilled, which means if the feedback is not enough an equilibrium cannot be reached. 2) The government is not patient enough. Patience level needs to be large enough and government needs to adjust its patience level according to the changes of other variables to reach the equilibrium. 3) If the government irrationally makes mandatory changes to policy and the weights in the utility function periodically (not following the policy rule defined by the model), the policy will change temporarily but gradually moves toward equilibrium if other variables satisfy the conditions required. 4) If the difference between the natural growth rates of economic benefits and social stabilities are large enough, which is not controlled by the government, the equilibrium cannot be reached. Whether a fluctuation of policies can reach the equilibrium or not depends on a group of controllable variables and uncontrollable variables.

This model provides one explanation of the dramatic policy changes in China in the past 70 years. The mandatory changes in policies in the 1950s and 1960s, e.g., the Great Leap Forward and the Cultural Revolution sacrificed the economy, and changes during reform years, e.g., the overemphasis of market and ignorance of social equality, resulted in deviations from the long-run equilibrium and increased the costs of policy implementation. The Chinese leadership realized the possibilities of losing control of the society and re-emphasized the importance of social stabilities and control of the society in the second decade of the 21st century (the 2010s), which also needs some degree of fine-tuning. These changes were also partially the result of impatience and short-sightedness of the policymakers due to the term limits or age of the leaders. To reach an equilibrium in the future, the policymakers need to be more patient with a view of the longer term, avoid mandatory policy changes, and encourage fine tuning through setting up a feedback mechanism in the policy-making process.

## 5. Conclusion

This paper builds an optimal control model to analyze the behavior of a centralized government such as the government in China. The government has to make decisions on economic growth and social stability. The model includes some negative feedback mechanisms which may lead to the equilibrium in the long run under certain conditions. The model shows that an equilibrium can be reached through a process of fluctuations under restricted constraints, e.g. if the government is patient enough, if the feedback mechanism is followed and fully

effective, or if the differences in natural growth rates of economic benefits and social stability are small enough. However, if the government is not patient enough, if the feedback mechanism is not fully effective, if the government makes mandatory changes to policies, or if the difference in natural growth rates of economy and social stability is large enough, the equilibrium cannot be reached and the policy fluctuations will be in turmoil and out of control. This happened in China in the 1960s and might happen again in the future in any centralized society. A centralized government cannot adjust its policies arbitrarily without considering concealed restrictions that are controllable or uncontrollable.

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

### References

- Akerman, J. (1947). Political Economic Cycle. *Kyklos*, 1, 107-117. <https://doi.org/10.1111/j.1467-6435.1947.tb00420.x>
- Alesina, A., & Stella, A. (2010). *The Politics of Monetary Policy*. Working Paper No. 15856, National Bureau of Economic Research. <https://doi.org/10.3386/w15856>
- Amacher, R. C., & Boyes, W. J. (1978). Cycles in Senatorial Voting Behavior: Implications for the Optimal Frequency of Elections. *Public Choice*, 33, 5-13. <https://doi.org/10.1007/BF00154680>
- Baker, W. R., & Sen, P. K. (1986). The Political Process and the Use of Debt Financing by State Governments. *Public Choice*, 48, 201-215. <https://doi.org/10.1007/BF00051618>
- Blaydes, L. (2011). *Elections and Distributive Politics in Mubarak's Egypt*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511976469>
- Bostashvili, D., & Gergely U. (2019). Political Budget Cycles and the Civil Service: Evidence from Highway Spending in US States. *Journal of Public Economics*, 175, 17-28. <https://doi.org/10.1016/j.jpubeco.2019.04.004>
- Brender, A., & Drazen A. (2005). Political Budget Cycles in New versus Established Democracies. *Journal of Monetary Economics*, 52, 1271-1295. <https://doi.org/10.1016/j.jmoneco.2005.04.004>
- Downs, A. (1957). *An Economic Theory of Democracy*. Harper & Row.
- Dubois, E. (2016). Political Business Cycles: 40 Years after Nordhaus. *Public Choice*, 166, 235-259. <https://doi.org/10.1007/s11127-016-0313-z>
- Ferris, J., Park, S.-B., & Winer, S. (2008). Studying the Role of Political Competition in the Evolution of Government Size over Long Horizons. *Public Choice*, 137, 369-401. <https://doi.org/10.1007/s11127-008-9334-6>
- Folsom, R. H., Minan, J. H., & Otto, L. A. (1992). *Law and Politics in the People's Republic of China*. West Publishing.
- Frey, B. S., & Lau, L. J. (1968). Towards a Mathematical Model of Government Behaviour. *Zeitschrift Für Nationalökonomie*, 28, 355-380. <https://doi.org/10.1007/BF01322891>
- Golinelli, R., & Momigliano, S. (2006). Real-Time Determinants of Fiscal Policies in the Euro Area. *Journal of Policy Modeling*, 28, 943-964. <https://doi.org/10.1016/j.jpolmod.2006.08.001>
- Gonzales, P., Hindriks, J., Lockwood, B., & Porteiro, N. (2006). *Political Budget Cycles*

- and Fiscal Decentralization*. The Warwick Economics Research Paper Series (TWERPS) No. 742, University of Warwick, Department of Economics.
- Gonzalez, M. (2002). Do Changes in Democracy Affect the Political Budget Cycle? Evidence from Mexico. *Review of Development Economics*, 6, 204-224. <https://doi.org/10.1111/1467-9361.00150>
- Guo, G. (2009). China's Local Political Budget Cycles. *American Journal of Political Science*, 53, 621-632. <https://doi.org/10.1111/j.1540-5907.2009.00390.x>
- Guttman, J., & Reuveny, R. (2014). On Revolt and Endogenous Economic Policy in Autocratic Regimes. *Public Choice*, 159, 27-52. <https://doi.org/10.1007/s11127-012-0012-3>
- Jens, C. E. (2017). Political Uncertainty and Investment: Causal Evidence from U.S. Gubernatorial Elections. *Journal of Financial Economics*, 124, 563-579. <https://doi.org/10.1016/j.jfineco.2016.01.034>
- Jindapon, P., & Van Essen M. (2019). Political Business Cycles in a Dynamic Bipartisan Voting Model. *Mathematical Social Sciences*, 102, 15-23. <https://doi.org/10.1016/j.mathsocsci.2019.08.004>
- Jong-A-Pin, R. (2009). On the Measurement of Political Instability and Its Impact on Economic Growth. *European Journal of Political Economy*, 25, 15-29. <https://doi.org/10.1016/j.ejpoleco.2008.09.010>
- Kaplan, S. B. (2014). *The Political Economy of Sovereign Debt: Global Finance and Electoral Cycles*. Working Papers, 2015-1. The George Washington University, Institute for International Economic Policy.
- Konishi, H. (2006). Spending Cuts or Tax Increases? The Composition of Fiscal Adjustments as a Signal. *European Economic Review*, 50, 1441-1469. <https://doi.org/10.1016/j.euroecorev.2005.06.002>
- Naughton, B. (2007). *The Chinese Economy: Transitions and Growth*. Massachusetts Institute of Technology Press.
- Nordhaus, W. D. (1975). The Political Business Cycle. *Review of Economic Studies*, 42, 169-190. <https://doi.org/10.2307/2296528>
- Pasovano, F. (2014). Distribution of Transfers and Soft Budget Spending Behaviors: Evidence from Italian Regions. *Public Choice*, 161, 11-29. <https://doi.org/10.1007/s11127-013-0119-1>
- Pham, H. T., Carmignani F., & Kler, P. (2018). Thrift Culture and the Size of Government. *Economic Modelling*, 70, 571-578. <https://doi.org/10.1016/j.econmod.2017.11.015>
- Revelli, F. (2019). The Electoral Migration Cycle. *European Journal of Political Economy*, 59, 461-482. <https://doi.org/10.1016/j.ejpoleco.2019.05.007>
- Rogoff, K., & Sibert, A. (1988). Elections and Macro-Economic Policy Cycle. *Review of Economic Studies*, 55, 1-16. <https://doi.org/10.2307/2297526>
- Schultz, K. A. (1995). The Politics of Political Business Cycle. *British Journal of Political Science*, 25, 79-99. <https://doi.org/10.1017/S0007123400007079>
- Tsai, P.-H. (2014). State Fiscal Rules and Composition Changes in Public Spending before the Election. *Public Finance Review*, 42, 58-91.
- Tufte, E. R. (1978). *Political Control of the Economy*. Princeton University Press. <https://doi.org/10.1515/9780691219417>
- Xiao, G. (2012). *Beyond Left and Right Radicalism: Out of China's Dilemma*. Zhejiang University Press.
- Zhang, F. (2018). *The Institutional Evolution of China: Government vs Market*. Edward Elgar. <https://doi.org/10.4337/9781784716912>