The Impending Long March of the Chinese Economy

Harashima, Taiji

Kanazawa Seiryo University

26 August 2016

The Impending Long March of the Chinese Economy

Taiji HARASHIMA*

August 2016

Abstract

The Chinese economy is currently faced with the difficult problems of slowing economic growth and huge overcapacity. China is struggling to adapt to a “new normal.” Here, I examine the mechanism of why China is faced with these problems and some potential future paths of the Chinese economy. China does not have a socialist, socialist market, or market-oriented economy. Rather, it has a “state-driven economy” and that has deviated far from the saddle path to the steady state. The model of a state-driven economy constructed in this paper indicates that it is highly likely that China will proceed along a long-running transition path with low or no growth, but it is also very likely that China will excessively build up its military.

JEL Classification code: O40, O53, P20,
Keywords: The Chinese economy; Transition; Economic growth; Overcapacity; Pareto inefficiency

---

*Correspondence: Taiji HARASHIMA, Kanazawa Seiryo University, 10-1 Goshomachi-Ushi, Kanazawa-shi, Ishikawa, 920-8620, Japan.
Email: harashim@seiryo-u.ac.jp or t-harashima@mve.biglobe.ne.jp.

1 INTRODUCTION

The Chinese economy now appears to stand at a crossroads and be unsustainable anymore. China will not be able to keep its past strategy of pursuing the highest economic growth possible. Many researchers will agree with these views. Furthermore, the government of China itself is beginning to think this way as it struggles to stabilize its economy under the "new normal."

It is, however, unclear why China no longer can continue its long-standing high-growth strategy. Although some fundamental change appears to be happening, the mechanism for why it is happening has not been sufficiently presented (see, e.g., Huang and Wang, 2010; Dorrucci et al., 2013; Albert et al., 2015; Maliszewski and Zhang, 2015). Articles in newspapers and magazines frequently argue that a large-scale economic bubble in China either has or will soon burst, but it is unclear from a theoretical standpoint that the current state of the Chinese economy can be described as a bubble phenomenon.

In this paper, I examine the mechanism of the anomalies in the Chinese economy by introducing the concept of a "state-driven economy," which is different from either socialist, socialist market, or market-oriented economies. I show that China now faces an unsurmountable barrier to growth because its high economic growth in the past few decades was realized by its state-driven economy, but this type of economy is intrinsically unsustainable and is fated to eventually collapse.

Because China has been a state-driven economy, it has deviated far from the saddle path to the steady state. Therefore, a change from the current unsustainable state-driven economy to a sustainable economy will not be easy. If households greatly and suddenly increase consumption up to a point on the saddle path, a smooth and peaceful transition can be achieved, but Harashima (2009, 2013a, and 2016) showed that such a jump in consumption is very unlikely. As a result, the transition will require severe restructuring over a long period. I examine several potential options for this transition. One potential path could result in an excessively large and dangerous military buildup.

2 CHARACTERISTICS

2.1 The current state of the Chinese economy

The Chinese economy has grown at a high rate, i.e., its GDP has grown at about 10% annually since the 1980s.[1] However, the pace of growth has recently slowed down. In addition, some unusual phenomena have emerged; in particular, the ratio of investment to GDP has reached nearly 50%. This rate is extremely high compared with those of other economies. In contrast, the ratio of consumption to GDP is extremely low by historic standards (Dollar and Wei, 2007; Knight and Ding, 2010; Huang and Wang, 2010; Lee et al., 2012, 2013; Dorrucci et al., 2013; Albert et al., 2015; Maliszewski and Zhang, 2015). Another important anomaly is overcapacity. Many researchers have concluded and even the Chinese government has admitted that China currently has a great deal of overcapacity[2] (e.g., European Union Chamber of Commerce in China, 2009, 2016; OECD, 2015).

High growth rates in the early stages of development of an economy can be rationalized theoretically in most conventional economic growth models. However, the anomalies observed recently in China have rarely been observed. The existence of these rare phenomena implies that

---

[1] The World Bank, national accounts data.

[2] See *Report on the Work of the Government,* delivered at the Fourth Session of the 12th National People's Congress of the People's Republic of China on March 5, 2016. http://news.xinhuanet.com/english/china/2016-03/17/c_135198880.htm

something significantly different has been occurring in the Chinese economy than was the case for many other economies.

2.2 *The Chinese economy as a state-driven economy*

2.2.1 Socialist market economy

China calls its economy a socialist market economy. Although this name is somewhat ambiguous, it gives the impression that China has a simple mix of socialist and market-oriented economies, but how mixed is the economy actually? Superficially, China may look like a market-oriented economy with a small remaining legacy of socialism because there are many markets and privately owned enterprises. However, in reality, elements of its market-oriented economy are limited even now because state-owned enterprises (SOEs) dominate many fundamental industries. In addition, the state (both nationally and locally) wields a strong influence on various aspects of economic activities, financial markets are heavily regulated, most financial institutions are owned and governed by the state, and most investments are made by SOEs or enterprises that are at least partially under the influence of the state (Li et al., 2008; World Bank, 2013; IMF, 2015). The Chinese economy is therefore still largely driven by the state.

This could indicate that the Chinese economy is actually a socialist economy, but if it is, it is not the idealized socialist economy as theoretically described by Lange (1936, 1937, and 1938) and Lerner (1944). The idealized socialist economy is driven by the state, but it mimics a market-oriented economy. Therefore, consumption in a socialist economy is supposed to proceed on the saddle path and reach the steady state that is optimal for households. However, the anomalies discussed in Section 2.1 (e.g., the extremely low consumption ratio) indicate that it is highly likely that China is not on a path that is optimal for households,

Hence, the Chinese economy is neither a socialist nor a market-oriented economy. In addition, it is not even a simple mix of these two types of economy because both socialist and market-oriented economies commonly proceed on the path that is optimal for households. The anomalies shown in Section 2.1 indicate that the Chinese economy is driven not by households' optimization behaviors but rather by something else. The Chinese economy, therefore, seems to be fundamentally different from other industrialized economies (see Dorrucci et al., 2013).

2.2.2 State-driven economy

Here, I call an economy a "state-driven economy" if it is largely under the control of the state and managed by the state so as to achieve a target rate of growth that is also set by the state. In this sense, the Chinese economy appears to be a state-driven economy. The most important evidence supporting this conclusion is that, as noted in Section 2.1, the ratio of investment to GDP has gradually increased during the past few decades and is currently about 50%. If consumption proceeds on the saddle path that is optimal for households, this ratio would gradually decrease and eventually stabilize usually at about 20%. If the economy is state-driven, on the other hand, the ratio will theoretically continue to increase to 100%, as will be shown in Section 3. Therefore, the observed gradual and continuous increase in the investment ratio strongly suggests that China is a state-driven economy.

A state-driven economy is driven not by households' optimization behaviors but by the state's will, which is independent of that of households, particularly in its desire to achieve the highest economic growth possible. Similar to a socialist economy, the state largely controls the economy, but unlike the (idealized) socialist economy, the state does not care about households' optimality. History has shown that established socialist economies are strongly prone to be transformed to state-driven economies because many socialist economies were established in undemocratic countries where government policies generally ignored households' utilities. Furthermore, a socialist market economy, as China calls itself, also highly likely degenerates into a state-driven economy in an undemocratic country. China is undoubtedly undemocratic, so it is not surprising that its economy is state-driven and that households' optimization behaviors are largely ignored by the state.

3 A MODEL OF A STATE-DRIVEN ECONOMY

3.1 The model

Suppose that a state sets a constant target growth rate of production ρ (> 0), and it manages various policy instruments that it can control (e.g., nominal rates of interest, subsidies, and SOE activities) so as to achieve ρ. The production function is

$$y_t = f(k_t) = Ak_t^{1-\alpha} \ ,$$

where y_t and k_t are per capita production and capital in period t, respectively; A is technology; and α is a constant ($0 < \alpha < 1$). For simplicity, A is assumed to be constant; that is, technology neither progresses nor regresses, and there is no depreciation of capital. (In section 5, I will explore some of the consequences of relaxing this assumption.) The state therefore manages its economy so as to keep

$$\frac{\frac{dy_t}{dt}}{y_t} = \frac{\frac{dk_t^{1-\alpha}}{dt}}{k_t^{1-\alpha}} = \rho \quad . \tag{1}$$

By equation (1), per capita production grows exponentially such that

$$y_t = y_0 \exp(\rho t)$$

and thereby

$$k_t = k_0 \exp\left(\frac{\rho}{1-\alpha} t\right)$$

$$\frac{\frac{dk_t}{dt}}{k_t} = \frac{\rho}{1-\alpha} \quad .$$

Because $\frac{\rho}{1-\alpha} > \rho$, k_t grows faster than y_t. Per capita investment in period t is

$$\frac{dk_t}{dt} = k_0 \frac{\rho}{1-\alpha} \exp\left(\frac{\rho}{1-\alpha} t\right) \quad .$$

On the other hand, households' economic activities are largely under control of the state through, for example, strict regulations and SOEs that allow the state to squeeze households' incomes from both wages and returns on financial investments. Hence, the state can control households' consumption so as to follow

$$c_t = y_t - \frac{dk_t}{dt} = y_0 \exp(\rho t) - k_0 \frac{\rho}{1-\alpha} \exp\left(\frac{\rho}{1-\alpha} t\right) \quad , \tag{2}$$

where c_t is per capita consumption of households. Thereby,

$$\frac{dc_t}{dt} = y_0 \rho \exp(\rho t) - k_0 \left(\frac{\rho}{1-\alpha}\right)^2 \exp\left(\frac{\rho}{1-\alpha} t\right) \quad . \tag{3}$$

Because $\frac{dk_t}{dt}$ grows at a faster rate than y_t (i.e., $\frac{\rho}{1-\alpha} > \rho$), then in some future period,

$$y_0 \exp(\rho t) = k_0 \frac{\rho}{1-\alpha} \exp\left(\frac{\rho}{1-\alpha} t\right) \quad ;$$

that is, by equation (2), in some future period

$$c_t = 0 \quad .$$

Equations (2) and (3) indicate that c_t initially grows at a similar rate as y_t (i.e., ρ) because the value of $\left(\frac{\rho}{1-\alpha}\right)^2$ in equation (3) is very small, but the growth of c_t gradually slows down because the effect of a very small $\left(\frac{\rho}{1-\alpha}\right)^2$ is gradually overwhelmed by the effect of the increasing value of $\exp\left(\frac{\rho}{1-\alpha} t\right)$ in equation (3) as time passes. In some future period, the growth of c_t eventually stops and turns negative, and c_t continues to decrease and eventually reaches zero.

In sum, for the state to keep the target growth rate ρ, k_t must grow faster than y_t, but c_t has to grow slower than y_t. Eventually, the economy will collapse when it reaches the point $c_t = 0$.

3.2 Implications of the model for China

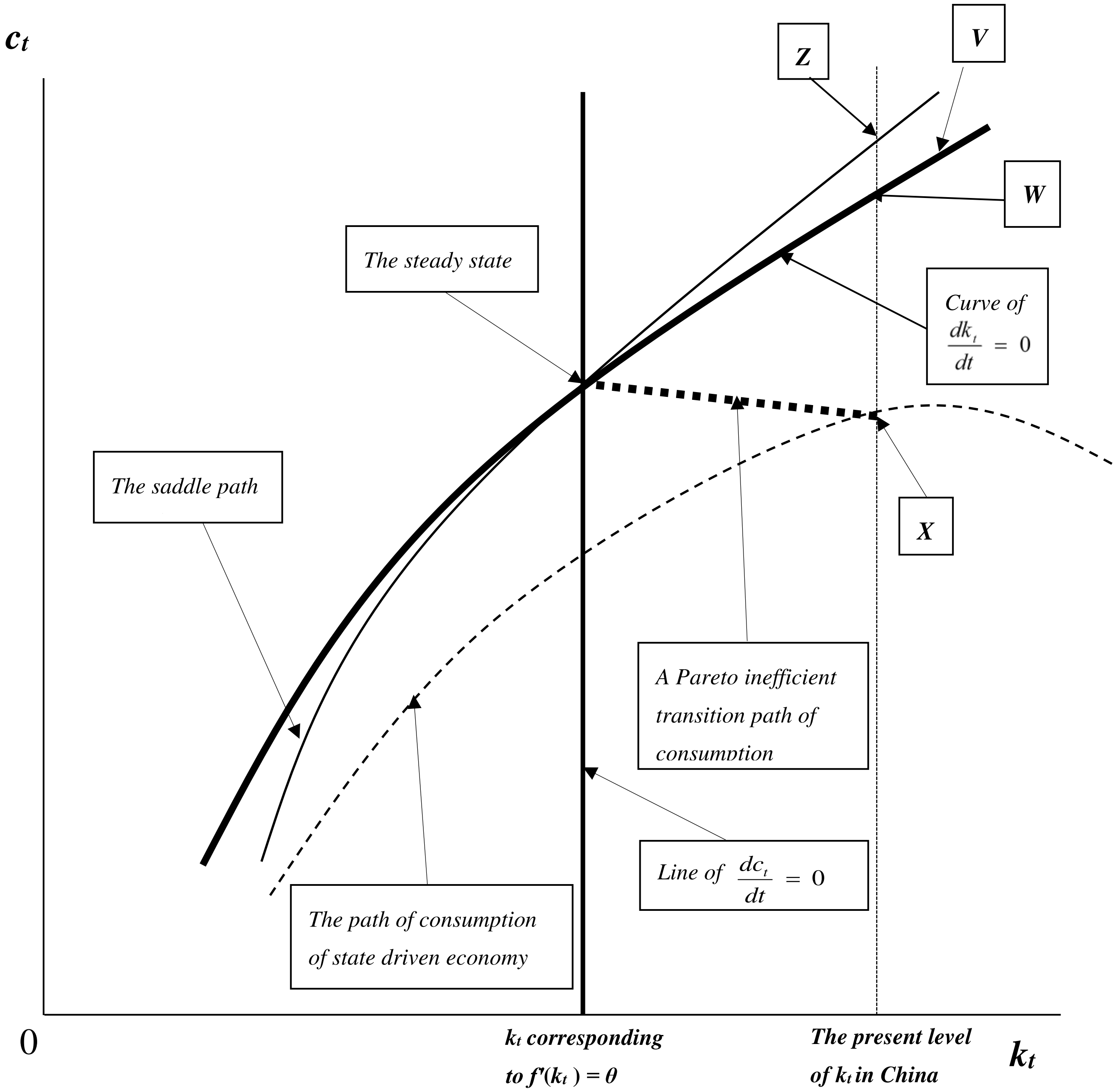
The consumption path of a state-driven economy is depicted by the thin dashed curve on a capital-consumption plane in Figure 1. The saddle path in a Ramsey-type growth model for a representative household is represented by the thin solid curve in Figure 1. In a Ramsey-type growth model, the economy is assumed to be decentralized and the representative household maximizes its expected utility

$$\int_0^\infty u(c_t) \exp(-\theta t) dt$$

subject to

$$\frac{dk_t}{dt} = f(k_t) - c_t \quad ,$$

Figure 1: The saddle path and a Pareto inefficient transition path



where θ is the rate of time preference of the representative household. There is no depreciation of capital.

Because a state-driven economy is not driven by households' optimization behaviors, its consumption path is different from the saddle path. Because the objective of the state is to continue a constant (high) growth rate, initial consumption will be set lower than it is on the saddle path. An important point is that consumption in the state-driven economy does not approach the steady state. As a result, the path of consumption of a state-driven economy will be situated below the saddle path, as shown in Figure 1, and particularly far below if the state pursues a very high growth rate. In addition, because households' optimization behaviors are irrelevant, capital will continue to accumulate even it exceeds the level of capital that corresponds to $f'(k_t) = \theta$ (indicated by the bold vertical line in Figure 1).

An important question is whether the Chinese economy is currently situated at the left or right side of the bold vertical line on the path of consumption (the thin dashed curve); that is, has the accumulated capital in China already exceeded the level that corresponds to $f'(k_t) = \theta$ (the bold vertical line). If we could correctly ascertain the rate of time preference of Chinese households and the current marginal product of capital, we could determine where China is on the curve but, in practice, these factors are quite difficult to determine. Therefore, we must infer where China is situated on the curve.

As discussed in Section 2, many researchers and even the Chinese government itself have concluded that China has a great deal of overcapacity at present. A huge amount of overcapacity means that China greatly lacks demand for its products. A lack of demand will be clearly perceived in a state-driven economy if the state restrains further investments. The model of a state-driven economy indicates that the economy will eventually collapse when $c_t = 0$, but the state will not allow the economy to collapse. In periods when capital is already hugely accumulated, the state may begin to doubt whether it continues the state-driven economy and to restrain investments. The current overcapacity in China seems to reflect such a change in the state's behavior, i.e., reluctance to invest further. Therefore, it is highly likely that China's consumption is situated to the right of the bold vertical line in Figure 1 (e.g., at point *X*).

4 OPTIONS AND CONSEQUENCES

4.1 Basic options

If China does not want its state-driven economy to inevitably collapse, it needs to change to an economy that will eventually stabilize at a steady state. There are several options for the transition to a steady state.

Option (1): The state lets the economy reach the steady state that is optimal for households.
Option (2): The state compulsorily makes point *W* in Figure 1 a steady state.
Option (3): The state compulsorily makes point *V* in Figure 1 a steady state (*V* corresponds to the k_t where consumption is highest on the path of the state-driven economy).

Option (1) means that the objective of the state has completely changed from maintaining high growth rates to stabilizing the economy at the steady state for households. If China is currently at point *X*, this change indicates that investment becomes negative ($\frac{dk_t}{dt} < 0$). That is, excessive capital is "consumed" or destroyed, and production shrinks until the economy reaches the steady state (remember that neither technological progress nor depreciation of capital is assumed in this model). In other words, negative growth rates continue for a long period. Nevertheless, if the representative household's consumption jumps from point *X* to *Z* in Figure 1, consumption proceeds on the saddle path, and Pareto efficiency is maintained during the transition to the steady state.

Option (2) means that no new investment is made ($\frac{dk_t}{dt} = 0$), but unlike Option (1), investment does not become negative. On the other hand, the state forces consumption to suddenly increase from point *X* to *W* and forces it to stay at point *W*. As a result, the levels of consumption, production and capital remain unchanged at the steady state described by point *W*. In Figure 1, the levels of production, consumption, and capital are larger at point *W* than at the original steady state. Judged only from this aspect, Option (2) may be viewed as preferable to Option (1).

Option (3) is basically the same as Option (2) in that the state chooses a steady state that is not optimal for households, but it differs in that investment is not stopped at the present level, but when capital reaches the level that corresponds to the highest consumption on the path of the state-driven economy. In this example, this level corresponds to the production indicated by point *V* in Figure 1. Until point *V* is reached, investments continue to be made and capital still accumulates. After arriving at point *V*, the state halts investments and the economy remains at point *V* indefinitely. The levels of consumption, production, and capital are larger at point *V* than those at point *W*. Judged only from this aspect, Option (3) may be preferable to Options (2) and (1).

4.2 *Option (1)*

Option (1) has several possible subordinate options on how to reach the steady state, including the following two basic subordinate options:

Option (1-1): The state stops directly controlling the economy.
Option (1-2): The state still directly controls the economy or it stops directly controlling the economy but still largely intervenes in the economy through fiscal policies.

Option (1-1) means that households and firms are released from the state's control and are allowed to reach their optimal steady state. Option (1-2) means that the state's goal changes from high growth rates to reaching the steady state, but the transition path to the steady state is still largely influenced by the state.

4.2.1 Option (1-1)

If the representative household's consumption jumps from point *X* to point *Z* on the saddle path, consumption will decrease along the saddle path and gradually approach the steady state while maintaining Pareto efficiency. Note that an increase in the representative household's consumption means the consumption of excess capital indicated by the gap between the saddle path and production for each k_t, which is initially the gap between point *Z* and *W*.[3] As a result, negative economic growth rates continue for a long period, but unemployment rates will not increase and resources will not be destroyed or left unused. This is the consequence of Option (1-1), which I call Consequence (1-1-1). (All subsequent consequences follow this numbering format.)

However, it is highly unlikely that the representative household will jump from point *X* to *Z*. The mechanism for why it is very unlikely to jump is explained in Harashima (2009, 2013a, and 2016) and also in the Appendix. Households are risk averse and intrinsically non-cooperative; therefore, they behave strategically in game theoretic situations. Because of these features, when

[3] If depreciation of capital is assumed to exist, the "consumption" of excess capital will be achieved by a reduction of investments that correspond to depreciated capital and an increase in consumer goods and services.

households strategically consider whether or not the jump is better for them (i.e., in a game theoretic situation), they will generally conclude that they obtain a higher expected utility if they do not jump. Hence, households will not actually choose this path and instead will choose a different transition path to the steady state (e.g., the bold dashed curve in Figure 1). Because this transition path is not on the saddle path, it is not Pareto efficient. Therefore, the excess resources indicated by the gap between the saddle path and the Pareto inefficient transition path for each k_t (initially, the gap between points Z and X) will be left idle or abandoned. Unemployment rates will increase sharply and stay at high levels for a long period (Consequence (1-1-2)).

4.2.2 Option (1-2)

To avoid Consequence (1-1-2), the state could suddenly increase its consumption.[4] Suppose for simplicity that the government consumption is zero at present. With this jump, the sum of the representative household's and the government's consumptions reaches point Z and then proceeds along the saddle path, as noted previously. Because the state consumes a large amount of the excess resources, unemployment rates do not rise and a huge amount of resources need not be left idle or destroyed, but negative economic growth will continue for a long period.

The question arises, however, how does the state consume such a large quantity of excess resources, most of which are capital inputs that have already been produced? In fact, there are several possible ways for the state to consume the resources, including the three subordinate options described below.

Conceptually, government consumption is the collective consumption of households through the expenditures of government (e.g., various kinds of administrative services that households receive), so a sudden increase in government consumption can be used as a substitute for that of households' consumption.

In addition, an increase in government consumption will generally be financed by government borrowing if the economy is changed to a market-oriented economy, but if the economy is still largely under the control of the state, it can also be financed by explicit and implicit taxes on households. An example of an implicit tax would be the state setting nominal interest rates artificially low and thereby transferring a part of households' savings into the state's hands, for example, through state-owned banks. Another example of an implicit tax is to restrain the wages of employees in SOEs and transfer the resulting profits to the state.

4.2.2.1 Option (1-2-1)

The easiest way for a state to consume excess resources is simply to buy them from firms and dispose of them (Option (1-2-1)). "Dispose of" in this case includes not only eliminating them but also leaving them unused forever and constructing useless infrastructure. It will also mean giving laborers busy work such as the classic example of "having workers dig holes and then fill them back up." These activities do not generate any utility for households, but they can be interpreted as a kind of "consumption" in the broad sense that the products purchased are intentionally made unusable. High unemployment rates can be avoided, but huge amounts of resources are systematically and continuously disposed of and negative growth rates continue for a long period.

However, many people, including high-ranking government officials, may not accept simply throwing away huge amounts of resources for no obvious reason.

4.2.2.2 Option (1-2-2)

Because Option (1-2-1) seems to be too absurd to be actually accepted, the government will search for alternative ways to consume the excess resources that cannot be used for investments because the economy would otherwise deviate from the saddle path. One of the alternative ways is to

[4] Government consumption, as used in this paper, indicates per capita government consumption.

export the excess resources to other countries at lower prices than the prevailing international prices (Option (1-2-2)). This is not "consumption" in the literal sense, but it can be interpreted as a sort of consumption in that exports are an element of demand. The state does not necessarily need to directly export the excess resources. Instead, it can indirectly support exports by directly subsidizing firms or through various kinds of regulations. High unemployment rates can be avoided with this option, but negative growth rates continue for a long period.

An important problem with Option (1-2-2) is that other countries may not accept the excessive exports. Option (1-2-2) clearly means setting prices that are far lower than the costs of production (i.e., dumping) on a large scale. For the option to work, export prices must be artificially set much lower than prevailing international prices. Because of this, export firms will lose money, but their losses will be compensated by the state using money obtained by borrowing or by extracting it from households through explicit or implicit taxes.

If the Chinese economy had a very small share of the world economy, such large-scale dumping would not have a significant impact on other countries, and the world might ignore or at least tolerate the dumping. However, China is currently the world's second-largest economy. Hence, if it engages in large-scale dumping, it will certainly distort international trade and have large negative impacts on the other countries. Other large countries would not be likely to stay silent on this issue and would likely take countermeasures, for example, by imposing high anti-dumping customs. Currently, many G7 countries suspect that China is already exporting steel at below-market prices (i.e., dumping steel), and they have implicitly warned China to stop doing so.[5] The scale of overcapacity in China in some important industrial materials (e.g., steel and cement) seems to greatly exceed the sum of demand in all other countries (European Union Chamber of Commerce in China, 2009, 2016). In essence, China's overcapacity is so large that it will be impossible for them to export it away peacefully.

In addition, under a floating exchange rate, dumping and the consequent trade surpluses may result in currency appreciation, which would cancel out the effect of imposing lower prices. As a result, excess resources still could not be exported to a sufficient extent. Therefore, Option (1-2-2) most likely won't succeed unless the exchange rate is fixed.

Another problem with Option (1-2-2) is the huge international imbalances that would accumulate as a consequence of the excessive exports. Because there is no excess demand by households in China, it will not import excess amounts of consumer goods or services using the money obtained by exporting the excessive resources. Huge trade imbalances will be generated. Such international imbalances may result in various anomalies, such as asset price hikes and falls and so-called "bubbles," both domestically and internationally. In sum, even though Option (1-2-2) may be somewhat adoptable in practice, there are many barriers to fully adopting this option as a way to suddenly increase government consumption.

4.2.2.3 Option (1-2-3)

Capital inputs are also able to produce arms and munitions with only small modifications. Hence, the necessary increase in government consumption can be easily achieved by a large military buildup (Option (1-2-3)). High unemployment rates can be avoided, but negative growth rates will continue for a long period as armaments are excessively accumulated (Consequence (1-2-3-a)).

An important problem of Option (1-2-3) is that a unilateral excessive military buildup will greatly worsen international relations and increase political and military tensions among countries. The probability of a country choosing Option (1-2-3) will be significantly higher in an undemocratic country than in a democratic country because the rulers in an undemocratic country typically rely on violence or the threat of violence as a basis for their power and will prefer a strong military far more than leaders in a democratic country. Furthermore, an excessive and

[5] See *G7 Ise-Shima Leaders' Declaration*, delivered at G7 Ise-Shima Summit on May 26–27, 2016.

unilateral buildup of military power in an undemocratic country is unquestionably dangerous for the rest of the world.

Another important problem is that the excessive military buildup needed to reach the steady state must diminish gradually to zero as the economy approaches the steady state. Initially, the necessary increase in military spending is the gap between point *X* and *W*, but gaps between the saddle path and the Pareto inefficient transition path then diminish gradually to zero. It is doubtful, however, that this pattern of military spending will be easily accepted by the military. Once military spending has been greatly increased, the military may strongly resist any reductions regardless of prevailing economic and social conditions, particularly the state's objective to reach the steady state. If the resistance is strong enough that the government cannot reduce military spending sufficiently, the objective of reaching the steady state will not be achieved. This means that Option (1-2-3) would not be fully implemented and the nature of the state-driven economy would remain largely the same. As a result, the economy will inevitably collapse as predicted by the model of the state-driven economy (Consequence (1-2-3-b)).

4.3 Option (2)

There are two basic subordinate options for Option (2):

Option (2-1): The state forces households to suddenly increase their consumption up to point *W* and then continues to force it to stay at point *W* indefinitely.
Option (2-2): The state suddenly increases government consumption to shift consumption (the sum of the representative household's and the government's consumptions) up to point *W* and then again forces it to stay at point *W* indefinitely.

Option (2-1) achieves the increased consumption (up to *W*) by shifting household consumption, whereas Option (2-2) shifts government consumption. Option (2-1) cannot be adopted if the economy changes to a market-oriented economy because households' optimality is achieved not at point *W*, and the state cannot force households to consume against their will. Option (2-2) can be implemented in either a market-oriented economy or an economy that is largely under the control of the state.

4.3.1 Option (2-1)

Option (2-1) is highly unlikely to be adopted because point *W* is not optimal for households. To make households maintain consumption at point *W*, the state must first allow households to consume freely up to point *W* but then prohibit them from consuming beyond point *W*. However, as argued for Option (1-1), if households are allowed to consume freely, they will choose a Pareto inefficient transition path (the bold dashed curve in Figure 1). The state therefore needs to force households to suddenly increase their consumption to point *W* against their wills. However, it is likely that such enforcement will eventually fail because of households' explicit and implicit resistance and hesitation. Furthermore, even if such forced consumption could be successfully implemented, the state quite likely would think that this type of forced consumption is absurd and it would be better to use Option (2-2).

4.3.2 Option (2-2)

Depending on how government consumption is suddenly increased, Option (2-2) has three subordinate options. Similar to the situation in Option (1-2), an increase in government consumption will be financed by government borrowing or explicit and implicit taxes on households in any of the three subordinate options. In addition, new investments cannot be substituted for increases in government consumption because the economy will otherwise deviate from point *W*.

4.3.2.1 Option (2-2-1)

The easiest way to suddenly increase government consumption is to simply dispose of the excess resources (Option (2-2-1)). The economy stays at point *W* and high unemployment rates can be avoided, and unlike Option (1-2-1), the rate of growth is zero, not negative. The problems associated with Option (2-2-1) are the same as those noted for Option (1-2-1).

4.3.2.2 Option (2-2-2)

A second option is to export the excess resources (Option (2-2-2)). High unemployment rates are avoided, and the rate of growth is zero, not negative. The problems associated with Option (2-2-2) are the same as those noted for Option (1-2-2). Hence, similar to Option (1-2-2), it will be difficult to fully adopt Option (2-2-2).

4.3.2.3 Option (2-2-3)

In the third option, the necessary increase in government consumption is achieved by a military buildup (Option (2-2-3)). High unemployment rates can be avoided, and the rate of growth is zero for a long period while armaments are excessively built up. Similar to Option (1-2-3), the probability of choosing Option (1-2-3) will be significantly higher in an undemocratic country than in a democratic country.

The problems associated with Option (2-2-3) are basically same as those noted for Option (1-2-3). A difference between the two options is that, unlike the case for Option (1-2-3), the excessive military spending need not be diminished as time passes. It can remain indefinitely at point *W*.

4.4 Option (3)

Option (3) has two basic subordinate options.

Option (3-1): When production reaches point *V*, the state forces households to suddenly increase their consumption up to point *V* and continues to force consumption to remain there indefinitely.
Option (3-2): When production reaches point *V*, the state suddenly increases government consumption to increase overall consumption (the sum of the representative household's and the government's consumptions) to point *V* and continues to force it to remain there indefinitely.

4.4.1 Option (3-1)

For the same reasons noted for Option (2-1), Option (3-1) will not be generally adopted.

4.4.2 Option (3-2)

After reaching point *V*, the characteristics of Option (3-2) are basically same as those of Option (2-2), and depending on how government consumption increases when production reaches point *V*, Option (3-2) also has three subordinate options.

4.4.2.1 Option (3-2-1)

In the first option, increases in government consumption are achieved simply by disposing of the excess resources and then the economy remains at point *V* (Option (3-2-1)). High unemployment rates can be avoided. Before reaching point *V*, the rate of growth is positive, but after that, it is zero. The problems associated with Option (3-2-1) are the same as those noted for Options (1-2-1) and (2-2-1).

4.4.2.2 Option (3-2-2)

In the second option, increases in government consumption are achieved by exporting the excess resources (Option (3-2-2)). High unemployment rates are avoided, and before reaching point *V*, the rate of growth is positive, and afterwards it is zero. Problems associated with Option (3-2-2) are the same as those noted for Options (1-2-1) and (2-2-1). Hence, it will also be difficult to fully adopt Option (3-2-2).

4.4.2.3 Option (3-2-3)

In the third option, increases in government consumption are achieved by a military buildup (Option (3-2-3)). High unemployment rates can be avoided, and before reaching point *V*, the rate of growth is positive, but after that, the rate of growth is zero for a long period as armaments are excessively accumulated (Consequence (3-2-3-a)). Similar to Options (1-2-3) and (2-2-3), the probability of Option (1-2-3) being chosen will be significantly higher in an undemocratic country than in a democratic country. The problems associated with Option (3-2-3) are basically the same as those with Options (1-2-3) and (2-2-3).

However, if a country is undemocratic, it seems doubtful that the military will be satisfied with the level of military buildup at point *V*, and much less at point *W*. The essential nature of Options (2) and (3) is that the state decides to stay at a particular point forever, but such a point need not necessarily be limited to points *W* and *V*. Point *W* will be chosen if the increase is implemented at the present time, and point *V* will be chosen if the highest consumption level on the path of a state-driven economy is regarded to be the most important factor. But other reasons could be used for choosing a point for a steady state. Because the military in an undemocratic country does not care about households' optimality, it may insist that investments be continued and that even more capital be accumulated past the levels corresponding with point *V* for the sake of a higher level of production. At the same time, the military may also insist that armaments continuously be built up even if the level of investments needs to be reduced to some extent and thereby the pace of capital accumulation will slow down (Option (3-2-3-b)).

If Option (3-2-3-b) is chosen, household consumption will be squeezed from the level at point *V* to a lower level by a similar mechanism as that shown in the model of a state-driven economy, possibly to a very low level. Nevertheless, it is also likely that the military knows not to squeeze household consumption too much, or households may rebel against the government and the military. Hence, it is likely the military will agree to stop additional investments and military buildup before the rebellion of households can no longer be sufficiently constrained. In this case, armaments are increased to a certain limit, and the consumption of households is squeezed to a limit, but the economy can remain at a steady state indefinitely, although the country becomes grotesquely militaristic (Consequence (3-2-3-b)).

Option (3-2-3-b) will be likely chosen if the country is seriously undemocratic because households' optimality will be generally ignored. Note that Consequence (3-2-3-b) is only sustainable if the assumption that a household rebellion can be constrained is satisfied, but this assumption may not always be satisfied if some exogenous disturbances unexpectedly occur.

4.5 Comparison and evaluation

None of the options can be recommended without hesitation or negative consequences. Option (1-1) will generally result in Consequence (1-1-2), and Options (2-1) and (3-1) will not generally be adopted. Options (1-2-1), (2-2-1), and (3-2-1) seem to be absurd because large quantities of resources are continuously disposed of. Options (1-2-2), (2-2-2), and (3-2-2) will face strong opposition and resistance by foreign countries. Options (1-2-3) and (3-2-3) will likely result in Consequences (1-2-3-b) and (3-2-3-b), respectively.

Options (1-1), (1-2-1), and (1-2-3) have the common feature of negative growth rates for a long period, and Options (2-2-1), (2-2-3), (3-2-1), and (3-2-3) have the common feature of zero growth rates for a long period. Nevertheless, China could take advantage of world technological progress (the model assumes no technological progress), so negative or zero rates may not be actually be observed. That said, the Chinese economy is going to have to experience negative, zero, or low positive growth rates for a long period whichever option it chooses.

Options			**Feasibility**	**Unemployment rates**	**Excessive military buildup**
Option (1)	Option (1-1)		Feasible	High	No
	Option (1-2)	Option (1-2-1)	Feasible	Low	No
		Option (1-2-2)	Basically unfeasible	Low	No
		Option (1-2-3)	Feasible	High / Low	Yes
Option (2)	Option (2-1)		Unfeasible	Low	No
	Option (2-2)	Option (2-2-1)	Feasible	Low	No
		Option (2-2-2)	Basically unfeasible	Low	No
		Option (2-2-3)	Feasible	Low	Yes
Option (3)	Option (3-1)		Unfeasible	Low	No
	Option (3-2)	Option (3-2-1)	Feasible	Low	No
		Option (3-2-2)	Basically unfeasible	Low	No
		Option (3-2-3)	Feasible	Low	Yes
		Option (3-2-3-b)	Feasible	Low	Yes

There are important differences among the feasible options on whether high unemployment rates can be avoided and whether an excessive military buildup is necessary. Option (1-1) will result in high unemployment rates, but Options (1-2-1), (2-2-1), (2-2-3), (3-2-1), (3-2-3), and (3-2-3b) will not. Option (1-2-3) will result in high unemployment rates if its consequence is Consequence (1-2-3-b), but not if Consequence (1-2-3-a). On the other hand, Options (1-1), (1-2-1), and (2-2-1) will not lead to an excessive military buildup, but Options (1-2-3), (2-2-3), (3-2-3), and (3-2-3b) will.

The option chosen is, of course, up to the rulers of the People's Republic of China (PRC). Among the feasible options, Options (1-2-1), (2-2-1), and (3-2-1) seem to be relatively better for the households of China because both high unemployment rates and an excessive military buildup can be avoided. These options, however, have the common drawback that a huge amount of resources are disposed of continuously in the name of government consumption, but this drawback seems to be relatively more acceptable for Chinese households than high unemployment rates or an excessive military buildup. Nevertheless, the rulers of the PRC may have different ideas and prefer Option (3-2-3-b)—military buildup—because China is currently undemocratic.

5 DÉJÀ VU: THE SOVIET UNION

5.1 The sequence of events and an interpretation

The path of the Chinese economy gives us a sense of déjà vu because China seems to have followed a similar path of another important state-driven economy, that of the Soviet Union. It is highly likely the Soviet Union had a state-driven economy. After World War II, the Soviet Union experienced high rates of economic growth for decades, as the model of a state-driven economy predicts. The Soviet Union's economy peaked during the era of Khrushchev and the early era of Brezhnev in the 1960s. However, as the model predicts, the problems of overcapacity and low economic growth were gradually aggravated in the 1970s. At the same time, the Soviet Union's military buildup continued. This military buildup may indicate that Option (1-2-3), (2-2-3), or (3-

2-3) was partially adopted because the government realized that its state-driven economy would eventually be difficult to sustain. Nevertheless, although some market modification were made, the state-driven economy was basically maintained.

In the era of Gorbachev in the 1980s, however, the aggravated problems of overcapacity and low economic growth could no longer be concealed. In addition, as the model predicts, household consumption was increasingly squeezed. In the end, the Soviet Union collapsed in 1991. After its collapse, Russian president Boris Yeltsin chose a sort of "hard-landing" scenario, that is, Option (1-1). As noted in Section 4, however, it resulted in Consequence (1-1-2): negative or low rates of economic growth, high unemployment rates, and a large amount of capital destruction. Hence, the popularity of Option (1-1) (and President Yeltsin) declined sharply among Russian people.

In 2000, new Russian president Vladimir Putin changed the economic policies of his predecessor. Putin replaced Option (1-1) with Option (1-2), (2-2), or (3-3), at least partially. Because of the economy had already experienced 10 years of Option (1-1), Putin's changes may have resulted in a mix of consequences from the several options chosen.

5.2 Differences between China and the Soviet Union

The situations of China and the Soviet Union are, of course, not completely the same. After an initial unsettled period when the Soviet Union was first established, its economy grew at high rates in the 1930s, but this high growth rate was interrupted during World War II. After World War II, the economy again began to grow rapidly. That is, with the exception of the war period, the Soviet Union basically grew at a fast rate from the beginning. On the other hand, the Chinese economy did not grow rapidly until the economic reforms led by Deng Xiaoping began to be implemented in the 1980s, even though China has been a state-driven economy since the PRC was founded in 1949. Unlike the Soviet Union, the PRC did not experience a large-scale war, and conditions for fast growth seem to have been met since its founding. The Chinese economy, however, did not grow rapidly for several decades.

The long stagnation before the economic reforms may have been caused by China's limited accesses to natural resources, technologies, and international markets resulting from its international isolation. In contrast, the territory of the Soviet Union consisted of about one-sixth of the world's land area, and there were sufficiently large amounts of raw materials, particularly oil and natural gas, to sustain its economy. Technologies in the Soviet Union were also more developed. Unlike the Soviet Union, the territory of China is not large enough to self-supply all of its raw materials, particularly energy, and it did not have good access to international markets. In addition, the level of technology was very low in China until relatively recently. Because of these restrictions and its policy of isolationism, economic growth in China was very likely severely hindered before the economic reforms of the 1980s.

After the economic reforms, the Chinese economy began to grow rapidly. An important reason for this high growth was unquestionably the opening up of China to outside markets. China joined in the free trade system that was constructed after World War II and has been protected internationally, mainly by U.S. diplomatic and military efforts. China was able to access almost all resources and technologies from throughout the world. The restrictions on natural resources, technologies, and international markets that restricted growth had been lifted. As a result, China's state-driven economy was able to operate without hindrances. Conversely, China's prosperity at present also can only be sustained under the current free trade system that is still protected internationally, mainly by the United States.

Technology is another important factor. In Sections 3 and 4, I assumed for simplicity that technology remains unchanged, but technological progress is important for sustaining steady economic growth. Because the Soviet Union was isolated from the western world, it had to generate innovations and new technologies by itself. However, Harashima (2011) showed that a socialist economy cannot sufficiently generate innovations except for some intrinsically nonmarket goods and services (e.g., military technologies) because such an economy cannot fully utilize human intelligence through competition in decentralized markets. This argument can be also applied to a state-driven economy because the state largely controls the economy in both socialist and state-driven economies. As a result, the level of technology in the Soviet Union gradually lagged behind that in the western world, and the growth of the Soviet Union's economy eventually almost stopped. A lack of growth will make an economy vulnerable to various exogenous shocks and raise the probability of households' uprising against the government and the military.

Unlike the Soviet Union, China can generally access the latest technologies except for key military technologies because it is a member of the free trade system. Hence, even if China itself cannot sufficiently generate innovations because of its nature as a state-driven economy, it can achieve technological progress by buying the latest technologies from the outside world. Unlike the Soviet Union, therefore, China may mitigate some of the pain of the transition by using new technologies purchased from foreign countries to help its economy grow. As a result, unlike the people of the Soviet Union, the Chinese people may not rebel against the government and the military, even under Consequence (3-2-3-b). This situation could become very dangerous for the rest of the world because the Chinese military could continue to grow excessively for an indefinite period.

6 CONCLUDING REMARKS

The growth of the Chinese economy has recently slowed down and overcapacity has become a serious problem. China will have to change its strategy for economic growth. In this paper, I showed that the difficulty that China now faces is an inevitable consequence of a state-driven economy, which is intrinsically unsustainable and will inevitably collapse at some point in time.

Although things may be perceived as difficult in China now, its future path will be much more difficult. Making the change to a sustainable economy will necessitate a long and painful transition period. Some options may mitigate the pain, but they also are accompanied some negative side effects, for example, an excessive military buildup. China seems to be following the path of the former Soviet Union, which also very likely had a state-driven economy. However, unlike the Soviet Union, China has been able to and most likely should continue to be able to utilize technologies developed in other countries. This advantage may mitigate some of the negative impacts of the transition in China, but it may also be worse for the rest of the world if China chooses an excessively large military buildup that will continue almost indefinitely.

The most frightening potential scenario for the world is that China chooses Option (3-2-3-b), and the probability of a large-scale war increases. China is not a democratic country and thus the probability that Option (3-2-3-b) is chosen is not necessarily low. Hence, the most urgent and difficult task facing the rest of the world is to prevent Option (3-2-3-b) from being chosen and to encourage China to choose Option (1-2-1), (2-2-1), or (3-2-1). These options are not without drawbacks, but they are better than the other options.

If Option (3-2-3-b) were to be chosen and the Chinese military were to be excessively and continuously built up, China would most likely become isolated from many other nations because political and military relations among them would become aggravated. China could even be ousted from the free trade system. The leaders of China need to keep in mind that, as noted in Section 5.2, China can only prosper and even build up its armaments under the existing international free trade system that is currently primarily protected by U.S. diplomatic and military efforts.

APPENDIX

The Nash Equilibrium of Pareto Inefficiency Path

A1 Model with non-cooperative households [6]

A1.1 The shock

The model describes the utility maximization of households after an upward time preference shock. This shock was chosen because it is one of the few shocks that result in a Nash equilibrium of a Pareto inefficient path. Another important reason for selecting an upward time preference shock is that it shifts the steady state to lower levels of production and consumption than before the shock, which is consistent with the phenomena actually observed in a recession.

Although the rate of time preference is a deep parameter, it has not been regarded as a source of shocks for economic fluctuations, possibly because the rate of time preference is thought to be constant and not to shift suddenly. There is also a practical reason, however. Models with a permanently constant rate of time preference exhibit excellent tractability (see Samuelson, 1937). However, the rate of time preference has been naturally assumed and actually observed to be time-variable. The concept of a time-varying rate of time preference has a long history (e.g., Böhm-Bawerk, 1889; Fisher, 1930). More recently, Lawrance (1991) and Becker and Mulligan (1997) showed that people do not inherit permanently constant rates of time preference by nature and that economic and social factors affect the formation of time preference rates. Their arguments indicate that many incidents can affect and change the rate of time preference throughout a person's life. For example, Parkin (1988) examined business cycles in the United States, explicitly considering the time-variability of the time preference rate, and showed that the rate of time preference was as volatile as technology and leisure preference.

A1.2 Households

Households are not intrinsically cooperative. Except in a strict communist economy, households do not coordinate themselves to behave as a single entity when consuming goods and services. The model in this paper assumes non-cooperative, identical, and infinitely long living households and that the number of households is sufficiently large. Each of them equally maximizes the expected utility

$$E_0 \int_0^\infty \exp(-\theta t) u(c_t) dt \quad ,$$

subject to

$$\frac{dk_t}{dt} = f(A, k_t) - \delta k_t - c_t \quad ,$$

where y_t, c_t, and k_t are production, consumption, and capital per capita in period t, respectively; A is technology and constant; u is the utility function; $y_t = f(A, k_t)$ is the production function; $\theta (> 0)$ is the rate of time preference; δ is the rate of depreciation; and E_0 is the expectations operator conditioned on the agents' period 0 information set. y_t, c_t, and k_t are monotonically continuous and differentiable in t, and u and f are monotonically continuous functions of c_t and k_t, respectively. All households initially have an identical amount of financial assets equal to k_t, and

[6] The model in Section 2 is based on the model by Harashima (2012). See also Harashima (2004, 2013b).

all households gain the identical amount of income $y_t = f(A, k_t)$ in each period. It is assumed that $\frac{du(c_t)}{dc_t} > 0$ and $\frac{d^2u(c_t)}{dc_t^2} < 0$; thus, households are risk averse. For simplicity, the utility function is specified to be the constant relative risk aversion utility function

$$u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma} \quad \text{if } \gamma \neq 1$$
$$u(c_t) = \ln(c_t) \quad \text{if } \gamma = 1 \ ,$$

where γ is a constant and $0 < \gamma < \infty$. In addition, $\frac{\partial f(A, k_t)}{\partial k_t} > 0$ and $\frac{\partial^2 f(k_t)}{\partial k_t^2} < 0$. Both technology ($A$) and labor supply are assumed to be constant.

The effects of an upward shift in time preference are shown in Figure A1. Suppose first that the economy is at steady state before the shock. After the upward time preference shock, the vertical line $\frac{dc_t}{dt} = 0$ moves to the left (from the solid vertical line to the dashed vertical line in Fig. 1). To keep Pareto efficiency, consumption needs to jump immediately from the steady state before the shock (the prior steady state) to point *Z*. After the jump, consumption proceeds on the Pareto efficient saddle path after the shock (the posterior Pareto efficient saddle path) from point *Z* to the lower steady state after the shock (the posterior steady state). Nevertheless, this discontinuous jump to *Z* may be uncomfortable for risk-averse households that wish to smooth consumption and not to experience substantial fluctuations. Households may instead take a shortcut and, for example, proceed on a path on which consumption is reduced continuously from the prior steady state to the posterior steady state (the bold dashed line in Fig. 1), but this shortcut is not Pareto efficient.

Choosing a Pareto inefficient consumption path must be consistent with each household's maximization of its expected utility. To examine the possibility of the rational choice of a Pareto inefficient path, the expected utilities between the two options need be compared. For this comparison, I assume that there are two options for each non-cooperative household with regard to consumption just after an upward shift in time preference. The first is a jump option, *J*, in which a household's consumption jumps to *Z* and then proceeds on the posterior Pareto efficient saddle path to the posterior steady state. The second is a non-jump option, *NJ*, in which a household's consumption does not jump but instead gradually decreases from the prior steady state to the posterior steady state, as shown by the bold dashed line in Figure A1. The household that chooses the *NJ* option reaches the posterior steady state in period $s(\geq 0)$. The difference in consumption between the two options in each period t is $b_t\,(\geq 0)$. Thus, b_0 indicates the difference between *Z* and the prior steady state. b_t diminishes continuously and becomes zero in period s. The *NJ* path of consumption (c_t) after the shock is monotonically continuous and differentiable in t and $\frac{dc_t}{dt} < 0$ if $0 \leq t < s$. In addition,

$$\bar{c} < c_t < \hat{c}_t \quad \text{if } 0 \leq t < s$$
$$c_t = \bar{c} \quad \text{if } 0 \leq s \leq t \ ,$$

where $\hat{c}_t$ is consumption when proceeding on the posterior Pareto efficient saddle path and $\bar{c}$ is consumption in the posterior steady state. Therefore,

$$b_t = \hat{c}_t - c_t > 0 \quad \text{if } 0 \le t < s$$
$$b_t = 0 \quad \text{if } 0 \le s \le t \quad .$$

It is also assumed that, when a household chooses a different option from the one the other households choose, the difference in the accumulation of financial assets resulting from the difference in consumption (b_t) before period s between that household and the other households is reflected in consumption after period s. That is, the difference in the return on financial assets is added to (or subtracted from) the household's consumption in each period after period s. The exact functional form of the addition (or subtraction) is shown in Section A1.4.

A1.3 Firms

Unutilized products because of b_t are eliminated quickly in each period by firms because holding them for a long period is a cost to firms. Elimination of unutilized products is accomplished by discarding the goods or preemptively suspending production, thereby leaving some capital and labor inputs idle. However, in the next period, unutilized products are generated again because the economy is not proceeding on the Pareto efficient saddle path. Unutilized products are therefore successively generated and eliminated. Faced with these unutilized products, firms dispose of the excess capital used to generate the unutilized products. Disposing of the excess capital is rational for firms because the excess capital is an unnecessary cost, but this means that parts of the firms are liquidated, which takes time and thus disposing of the excess capital will also take time. If the economy proceeds on the *NJ* path (that is, if all households choose the *NJ* option), firms dispose of all of the remaining excess capital that generates b_t and adjust their capital to the posterior steady-state level in period s, which also corresponds to households reaching the posterior steady state. Thus, if the economy proceeds on the *NJ* path, capital k_t is

$$\bar{k} < k_t \le \hat{k}_t \quad \text{if } 0 \le t < s$$
$$k_t = \bar{k} \quad \text{if } 0 \le s \le t \quad ,$$

where $\hat{k}_t$ is capital per capita when proceeding on the posterior Pareto efficient saddle path and $\bar{k}$ is capital per capita in the posterior steady state.

The real interest rate i_t is

$$i_t = \frac{\partial f(A, k_t)}{\partial k_t} \quad .$$

Because the real interest rate equals the rate of time preference at steady state, if the economy proceeds on the *NJ* path,

$$\tilde{\theta} \le i_t < \theta \quad \text{if } 0 \le t < s$$
$$i_t = \theta \quad \text{if } 0 \le s \le t \quad ,$$

where $\tilde{\theta}$ is the rate of time preference before the shock and θ is the rate of time preference after the shock. i_t is monotonically continuous and differentiable in t if $0 \le t < s$.

A1.4 Expected utility after the shock

The expected utility of a household after the shock depends on its choice of the *J* or *NJ* path. Let *Jalone* indicate that the household chooses option *J*, but the other households choose option *NJ*;

NJalone indicate that the household chooses option *NJ*, but the other households choose option *J*; *Jtogether* indicate that all households choose option *J*; and *NJtogether* indicate that all households choose option *NJ*. Let p ($0 \le p \le 1$) be the subjective probability of a household that the other households choose the *J* option (e.g., $p = 0$ indicates that all the other households choose option *NJ*). With p, the expected utility of a household when it chooses option *J* is

$$E_0(J) = pE_0(Jtogether) + (1-p)E_0(Jalone) \quad , \tag{A1}$$

and when it chooses option *NJ* is

$$E_0(NJ) = pE_0\,(NJalone) + (1-p)E_0(NJtogether) \quad , \tag{A2}$$

where $E_0(Jalone)$, $E_0(NJalone)$, $E_0(Jtogether)$, and $E_0(NJtogether)$ are the expected utilities of the household when choosing *Jalone*, *NJalone*, *Jtogether*, and *NJtogether*, respectively. Given the properties of *J* and *NJ* shown in Sections A1.2 and A1.3,

$$\begin{aligned} E_0(J) = {} & pE_0\left[\int_0^s \exp(-\theta t)u(c_t + b_t)dt + \int_s^\infty \exp(-\theta t)u(\hat{c}_t)dt\right] \\ & + (1-p)E_0\left[\int_0^s \exp(-\theta t)u(c_t + b_t)dt + \int_s^\infty \exp(-\theta t)u(\bar{c} - \bar{a})dt\right] \quad , \end{aligned} \tag{A3}$$

and

$$\begin{aligned} E_0(NJ) = {} & pE_0\left[\int_0^s \exp(-\theta t)u(c_t)dt + \int_s^\infty \exp(-\theta t)u(\hat{c}_t + a_t)dt\right] \\ & + (1-p)E_0\left[\int_0^s \exp(-\theta t)u(c_t)dt + \int_s^\infty \exp(-\theta t)u(\bar{c})dt\right] \quad , \end{aligned} \tag{A4}$$

where

$$\bar{a} = \theta \int_0^s b_r \exp \int_r^s i_q \, dq \, dr \quad , \tag{A5}$$

and

$$a_t = i_t \int_0^s b_r \exp \int_r^s i_q \, dq \, dr \quad , \tag{A6}$$

and the shock occurred in period $t = 0$. Figure A2 shows the paths of *Jalone* and *NJalone*. Because there is a sufficiently large number of households and the effect of an individual household on the whole economy is negligible, in the case of *Jalone*, the economy almost proceeds on the *NJ* path. Similarly, in the case of *NJalone*, it almost proceeds on the *J* path. If the other households choose the *NJ* option (*Jalone* or *NJtogether*), consumption after s is constant as $\bar{c}$ and capital is adjusted to $\bar{k}$ by firms in period s. In addition, a_t and i_t are constant after s such that a_t equals $\bar{a}$ and i_s equals θ, because the economy is at the posterior steady state. Nevertheless, during the transition period before s, the value of i_t changes from the value of the prior time preference rate to that of the posterior rate. If the other households choose option *J* (*NJalone* or *Jtogether*), however, consumption after s is $\hat{c}_t$ and capital is not adjusted to $\bar{k}$ by firms in period s and remains at $\hat{k}_t$.

As mentioned in Section A1.2, the difference in the returns on financial assets for the household from the returns for each of the other households is added to (or subtracted from) its consumption in each period after period *s*. This is described by a_t and $\overline{a}$ in equations (A3) and (A4), and equations (A5) and (A6) indicate that the accumulated difference in financial assets resulting from b_t increases by compound interest between the period *r* to *s*. That is, if the household takes the *NJalone* path, it accumulates more financial assets than each of the other *J* households, and instead of immediately consuming these extra accumulated financial assets after period *s*, the household consumes the returns on them in every subsequent period. If the household takes the *Jalone* path, however, its consumption after *s* is $\overline{c} - \overline{a}$, as shown in equation (A3). $\overline{a}$ is subtracted because the income of each household, $y_t = f(A, k_t)$, including the *Jalone* household, decreases equally by b_t. Each of the other *NJ* households decreases consumption by b_t at the same time, which compensates for the decrease in income; thus, its financial assets (i.e., capital per capita; k_t) are kept equal to $\hat{k}_t$. The *Jalone* household, however, does not decrease its consumption, and its financial assets become smaller than those of each of the other *NJ* households, which results in the subtraction of $\overline{a}$ after period *s*.

A2 Pareto inefficient transition path [7]

A2.1 Rational Pareto inefficient path

A2.1.1 Rational choice of a Pareto inefficient path

Before examining the economy with non-cooperative households, I first show that, if households are cooperative, only option *J* is chosen as the path after the shock because it gives a higher expected utility than option *NJ*. Because there is no possibility of *Jalone* and *NJalone* if households are cooperative, then $E_0(J) = E_0(Jtogether)$ and $E_0(NJ) = E_0(NJtogether)$. Therefore,

$$
\begin{aligned}
&E_0(J) - E_0(NJ) \\
&= E_0\left[\int_0^s \exp(-\theta t)u(c_t + b_t)dt + \int_s^\infty \exp(-\theta t)u(\hat{c}_t)dt\right] - E_0\left[\int_0^s \exp(-\theta t)u(c_t)dt + \int_s^\infty \exp(-\theta t)u(\overline{c})dt\right] \\
&= E_0\left\{\int_0^s \exp(-\theta t)[u(c_t + b_t) - u(c_t)]dt + \int_s^\infty \exp(-\theta t)[u(\hat{c}_t) - u(\overline{c})]dt\right\} > 0
\end{aligned}
$$

because $c_t < c_t + b_t$ and $\overline{c} < \hat{c}_t$.

Next, I examine the economy with non-cooperative households. First, the special case with a utility function with a sufficiently small γ is examined.

Lemma A1: If $\gamma (0 < \gamma < \infty)$ is sufficiently small, then $E_0(Jalone) - E_0(NJtogether) > 0$.

Proof: $\lim_{\gamma \to 0}[E_0(Jalone) - E_0(NJtogether)]$

$$
\begin{aligned}
&= E_0\int_0^s \exp(-\theta t) \lim_{\gamma \to 0}[u(c_t + b_t) - u(c_t)]dt + E_0\int_s^\infty \exp(-\theta t)\lim_{\gamma \to 0}[u(\overline{c} - \overline{a}) - u(\overline{c})]dt \\
&= E_0\int_0^s \exp(-\theta t)b_t\, dt - E_0\int_s^\infty \exp(-\theta t)\overline{a}\, dt \\
&= E_0\int_0^s \exp(-\theta t)b_t dt - E_0\theta\left[\int_0^s \left(b_r \exp\int_r^s i_q\, dq\right)dr\right]\int_s^\infty \exp(-\theta t)dt \\
&= E_0\int_0^s \exp(-\theta t)b_t dt - E_0 \exp(-\theta s)\int_0^s \left(b_r \exp\int_r^s i_q\, dq\right)dr
\end{aligned}
$$

[7] The idea of a rationally chosen Pareto inefficient path was originally presented by Harashima (2004).

$$= E_0 \exp(-\theta s)\int_0^s b_t \left\{\exp[\theta(s-t)] - \exp\int_t^s i_q\, dq\right\} dt \ > 0 \,,$$

because, if $0 \le t < s$, then $i_t < \theta$ and $\exp[\theta(s-t)] > \exp\int_t^s i_q\, dq$. Hence, because $\exp[\theta(s-t)]$ $> \exp\int_t^s i_q\, dq$, $E_0(Jalone) - E_0(NJtogether) > 0$ for sufficiently small *γ*. ■

Second, the opposite special case (i.e., a utility function with a sufficiently large *γ*) is examined.

Lemma A2: If $\gamma(0 < \gamma < \infty)$ is sufficiently large and if $0 < \lim_{\gamma\to\infty} \frac{\bar{a}}{\bar{c}} < 1$, then $E_0(Jalone) -$ $E_0(NJtogether) < 0$.

Proof: Because $0 < b_t$, then

$$\lim_{\gamma\to\infty} \frac{1-\gamma}{\bar{c}^{\,1-\gamma}}\left[u(c_t + b_t) - u(c_t)\right] = \lim_{\gamma\to\infty}\left[\left(\frac{c_t + b_t}{\bar{c}}\right)^{1-\gamma} - \left(\frac{c_t}{\bar{c}}\right)^{1-\gamma}\right] = 0$$

for any period $t(< s)$. On the other hand, because $0 < \bar{a}$, then for any period $t(< s)$, if $0 < \lim_{\gamma\to\infty} \frac{\bar{a}}{\bar{c}} < 1$,

$$\lim_{\gamma\to\infty} \frac{1-\gamma}{\bar{c}^{\,1-\gamma}}\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right] = \lim_{\gamma\to\infty}\left[\left(1 - \frac{\bar{a}}{\bar{c}}\right)^{1-\gamma} - 1\right] = \infty \ .$$

Thus,

$$\begin{aligned}
&\lim_{\gamma\to\infty} \frac{1-\gamma}{\bar{c}^{\,1-\gamma}} \ \left[E_0(Jalone) - E_0(NJtogether)\right] \\
&= \lim_{\gamma\to\infty} \frac{1-\gamma}{\bar{c}^{\,1-\gamma}} \int_0^s \exp(-\theta t)\lim_{\gamma\to\infty}\left[u(c_t + b_t) - u(c_t)\right] dt \\
&+ \lim_{\gamma\to\infty} \frac{1-\gamma}{\bar{c}^{\,1-\gamma}} \int_s^\infty \exp(-\theta t)\lim_{\gamma\to\infty}\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right] dt \\
&= 0 + \infty > 0 \ .
\end{aligned}$$

Because $\frac{1-\gamma}{\bar{c}^{\,1-\gamma}} < 0$ for any $\gamma(1 < \gamma < \infty)$, then if $0 < \lim_{\gamma\to\infty} \frac{\bar{a}}{\bar{c}} < 1$, $E_0(Jalone) - E_0(NJtogether)$ < 0 for sufficiently large $\gamma(< \infty)$. ■

The condition $0 < \lim_{\gamma\to\infty} \frac{\bar{a}}{\bar{c}} < 1$ indicates that path *NJ* from c_0 to $\bar{c}$ deviates sufficiently from the posterior Pareto efficient saddle path and reaches the posterior steady state $\bar{c}$ not taking much time. Because steady states are irrelevant to the degree of risk aversion (*γ*), both c_0 and $\bar{c}$ are irrelevant to *γ*.

By Lemmas A1 and A2, it can be proved that $E_0(Jalone) - E_0(NJtogether) < 0$ is possible.

Lemma A3: If $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$, then there is a $\gamma^*(0 < \gamma^* < \infty)$ such that if $\gamma^* < \gamma < \infty$, $E_0(Jalone) - E_0(NJtogether) < 0$.

Proof: If $\gamma(> 0)$ is sufficiently small, then $E_0(Jalone) - E_0(NJtogether) > 0$ by Lemma A1, and if $\gamma(< \infty)$ is sufficiently large and if $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$, then $E_0(Jalone) - E_0(NJtogether)$ < 0 by Lemma A2. Hence, if $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$, there is a certain $\gamma^*(0 < \gamma^* < \infty)$ such that, if $\gamma^* < \gamma < \infty$, then $E_0(Jalone) - E_0(NJtogether) < 0$. ■

However, $E_0(Jtogether) - E_0(NJalone) > 0$ because both *Jtogether* and *NJalone* indicate that all the other households choose option *J*; thus, the values of i_t and k_t are the same as those when all households proceed on the posterior Pareto efficient saddle path. Faced with these i_t and k_t, deviating alone from the Pareto efficient path (*NJalone*) gives a lower expected utility than *Jtogether* to the *NJ* household. Both *Jalone* and *NJtogether* indicate that all the other households choose option *NJ* and i_t and k_t are not those of the Pareto efficient path. Hence, the sign of $E_0(Jalone) - E_0(NJtogether)$ varies depending on the conditions, as Lemma A3 indicates.

By Lemma A3 and the property $E_0(Jtogether) - E_0(NJalone) > 0$, the possibility of the choice of a Pareto inefficient transition path, that is, $E_0(J) - E_0(NJ) < 0$, is shown.

Proposition A1: If $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$ and $\gamma^* < \gamma < \infty$, then there is a $p^*(0 \le p^* \le 1)$ such that if $p = p^*$, $E_0(J) - E_0(NJ) = 0$, and if $p < p^*$, $E_0(J) - E_0(NJ) < 0$.

Proof: By Lemma A3, if $\gamma^* < \gamma < \infty$, then $E_0(Jalone) - E_0(NJtogether) < 0$ and $E_0(Jtogether) - E_0(NJalone) > 0$. By equations (A1) and (A2),

$$E_0(J) - E_0(NJ) = p\left[E_0(Jtogether) - E_0(NJalone)\right] + (1 - p)\left[E_0(Jalone) - E_0(NJtogether)\right] .$$

Thus, if $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$ and $\gamma^* < \gamma < \infty$, $\lim_{p \to 0} \left[E_0(J) - E_0(NJ)\right] = E_0(Jalone) - E_0(NJtogether) < 0$ and $\lim_{p \to 1} \left[E_0(J) - E_0(NJ)\right] = E_0(Jtogether) - E_0(NJalone) > 0$. Hence, by the intermediate value theorem, there is $p^*(0 \le p^* \le 1)$ such that if $p = p^*$, $E_0(J) - E_0(NJ) = 0$ and if $p < p^*$, $E_0(J) - E_0(NJ) < 0$. ■

Proposition A1 indicates that, if $0 < \lim_{\gamma \to \infty} \frac{\bar{a}}{\bar{c}} < 1$, $\gamma^* < \gamma < \infty$, and $p < p^*$, then the choice of option *NJ* gives the higher expected utility than that of option *J* to a household; that is, a household may make the rational choice of taking a Pareto inefficient transition path. The lemmas and proposition require no friction, so a Pareto inefficient transition path can be chosen even in a frictionless economy. This result is very important because it offers counter-evidence against the conjecture that households never rationally choose a Pareto inefficient transition path in a frictionless economy.

A2.1.2 Conditions for a rational Pareto inefficient path

The proposition requires several conditions. Among them, $\gamma^* < \gamma < \infty$ may appear rather strict. If γ^* is very large, path *NJ* will rarely be chosen. However, if path *NJ* is such that consumption is reduced sharply after the shock, the *NJ* option yields a higher expected utility than the *J* option even though γ is very small. For example, for any $\gamma(0 < \gamma < \infty)$,

$$\lim_{s\to 0}\frac{1}{s}\left[E_0(Jalone) - E_0(NJtogether)\right]$$
$$= \lim_{s\to 0}\frac{1}{s}\int_0^s \exp(-\theta t)\left[u(c_t + b_t) - u(c_t)\right]dt + \lim_{s\to 0}\frac{1}{s}\int_s^\infty \exp(-\theta t)\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right]dt$$
$$= u(c_0 + b_0) - u(c_0) - \frac{1}{\theta}\lim_{s\to 0}\frac{u(\bar{c}) - u(\bar{c} - s\theta b_0)}{s} = u(c_0 + b_0) - u(c_0) - b_0\frac{du(\bar{c})}{d\bar{c}}$$
$$= \frac{(c_0 + b_0)^{1-\gamma} - c_0^{1-\gamma}}{1-\gamma} - b_0\bar{c}^{\,-\gamma} = \bar{c}^{\,-\gamma}\left\{\bar{c}^{\,\gamma}\left[\frac{(c_0 + b_0)^{1-\gamma}}{1-\gamma} - \frac{c_0^{1-\gamma}}{1-\gamma}\right] - b_0\right\} < 0 \quad ,$$

because $\lim_{\gamma\to 1}\bar{c}^{\,\gamma}\left[\frac{(c_0 + b_0)^{1-\gamma}}{1-\gamma} - \frac{c_0^{1-\gamma}}{1-\gamma}\right] = \bar{c}\left[\ln(c_0 + b_0) - \ln(c_0)\right] = \bar{c}\ln\left(1 + \frac{b_0}{c_0}\right) < b_0$ and $\lim_{\gamma\to\infty}\bar{c}^{\,\gamma}\left[\frac{(c_0 + b_0)^{1-\gamma}}{1-\gamma} - \frac{c_0^{1-\gamma}}{1-\gamma}\right] = \lim_{\gamma\to\infty}\bar{c}^{\,\gamma}c_0^{1-\gamma}\left[\frac{\left(1 + \frac{b_0}{c_0}\right)^{1-\gamma} - 1}{1-\gamma}\right] = 0$ because $\bar{c} < c_0$. That is, for each combination of path *NJ* and γ, there is $s^*(>0)$ such that, if $s < s^*$, then $E_0(Jalone) - E_0(NJtogether) < 0$.

Consider an example in which path *NJ* is such that b_t is constant and $b_t = \bar{b}$ before s (Figure A3); thus, $E_0\int_0^s b_t = s\bar{b}$. In this *NJ* path, consumption is reduced more sharply than it is in the case shown in Figure A2. In this case, because $\bar{a} > E_0\theta\int_0^s b_t = \theta s\bar{b}$, $0 < \gamma$, and $c_s < c_t$ for $t < s$, then $E_0\int_0^s \exp(-\theta t)\left[u(c_t + b_t) - u(c_t)\right]dt < E_0\int_0^s \exp(-\theta t)dt\left[u(c_s + \bar{b}) - u(c_s)\right] = E_0\frac{1 - \exp(-\theta s)}{\theta}\left[u(c_s + \bar{b}) - u(c_s)\right]$, and in addition, $E_0\int_s^\infty \exp(-\theta t)\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right]dt = E_0\int_s^\infty \exp(-\theta t)dt\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right] = E_0\frac{\exp(-\theta s)}{\theta}\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right] < E_0\frac{\exp(-\theta s)}{\theta}\left[u(\bar{c} - \theta s\bar{b}) - u(\bar{c})\right]$. Hence,

$$E_0(Jalone) - E_0(NJtogether)$$
$$= E_0\int_0^s \exp(-\theta t)\left[u(c_t + b_t) - u(c_t)\right]dt + E_0\int_s^\infty \exp(-\theta t)\left[u(\bar{c} - \bar{a}) - u(\bar{c})\right]dt$$
$$< E_0\frac{1 - \exp(-\theta s)}{\theta}\left[u(c_s + \bar{b}) - u(c_s)\right] + E_0\frac{\exp(-\theta s)}{\theta}\left[u(\bar{c} - \theta s\bar{b}) - u(\bar{c})\right]$$
$$= E_0\frac{1 - \exp(-\theta s)}{\theta}\left\{\left[u(c_s + \bar{b}) - u(c_s)\right] - \frac{\exp(-\theta s)}{1 - \exp(-\theta s)}\left[u(\bar{c}) - u(\bar{c} - \theta s\bar{b})\right]\right\} \quad .$$

As γ increases, the ratio $\dfrac{u(c_s + \bar{b}) - u(c_s)}{u(\bar{c}) - u(\bar{c} - \theta s \bar{b})}$ decreases; thus, larger values of s can satisfy $E_0(Jalone) - E_0(NJtogether) < 0$. For example, suppose that $\bar{c}$ = 10, c_s = 10.2, $\bar{b}$ = 0.3, and θ = 0.05. If $\gamma = 1$, then s^* = 1.5 at the minimum, and if $\gamma = 5$, then s^* = 6.8 at the minimum. This result implies that, if option *NJ* is such that consumption is reduced relatively sharply after the shock (e.g., $b_t = \bar{b}$) and $p < p^*$, option *NJ* will usually be chosen. Choosing option *NJ* is not a special case observed only if γ is very large, but option *NJ* can normally be chosen when the value of γ is within usually observed values. Conditions for generating a rational Pareto inefficient transition path therefore are not strict. In a recession, consumption usually declines sharply after the shock, which suggests that households have chosen the *NJ* option.

A3 Nash equilibrium

A3.1 A Nash equilibrium consisting of *NJ* strategies

A household strategically determines whether to choose the *J* or *NJ* option, considering other households' choices. All households know that each of them forms expectations about the future values of its utility and makes a decision in the same manner. Since all households are identical, the best response of each household is identical. Suppose that there are $H\ (\in N)$ identical households in the economy where H is sufficiently large (as assumed in Section A1). Let $q_\eta\ (0 \le q_\eta \le 1)$ be the probability that a household $\eta\ (\in H)$ chooses option *J*. The average utility of the other households almost equals that of all households because H is sufficiently large. Hence, the average expected utilities of the other households that choose the *J* and *NJ* options are E_0(*Jtogether*) and E_0(*NJtogether*), respectively. Hence, the payoff matrix of the H-dimensional symmetric mixed strategy game can be described as shown in Table A1. Each identical household determines its behavior on the basis of this payoff matrix.

In this mixed strategy game, the strategy profiles

$$(q_1,q_2,\ldots,q_H) = \{(1,1,\ldots,1), (p^*,p^*,\ldots,p^*), (0,0,\ldots,0)\}$$

are Nash equilibria for the following reason. By Proposition A1, the best response of household η is *J* (i.e., q_η = 1) if $p > p^*$, indifferent between *J* and *NJ* (i.e., any $q_\eta \in [0,1]$) if $p = p^*$, and *NJ* (i.e., q_η = 0) if $p < p^*$. Because all households are identical, the best-response correspondence of each household is identical such that q_η = 1 if $p > p^*$, [0,1] if $p = p^*$, and 0 if $p < p^*$ for any household $\eta \in H$. Hence, the mixed strategy profiles (1, 1,…,1), ($p^*,p^*,\ldots,p^*$), and (0,0,…,0) are the intersections of the graph of the best-response correspondences of all households. The Pareto efficient saddle path solution (1,1,…,1) (i.e., *Jtogether*) is a pure strategy Nash equilibrium, but a Pareto inefficient transition path (0,0,…,0) (i.e., *NJtogether*) is also a pure strategy Nash equilibrium. In addition, there is a mixed strategy Nash equilibrium ($p^*,p^*,\ldots,p^*$).

A3.2 Selection of equilibrium

Determining which Nash equilibrium, either *NJtogether* (0,0,…,0) or *Jtogether* (1,1,…,1), is dominant requires refinements of the Nash equilibrium, which necessitate additional criteria. Here, if households have a risk-averse preference in the sense that they avert the worst scenario when its probability is not known, households suppose a very low p and select the *NJtogether* (0,0,…,0) equilibrium. Because

$$
\begin{aligned}
&E_0(Jalone)\ \text{-}\ E_0(NJalone) \\
&= E_0\left\{\int_0^s \exp(-\theta t)[u(c_t+b_t)-u(c_t)]dt + \int_s^\infty \exp(-\theta t)[u(\bar{c}-\bar{a})-u(\hat{c}_t+a_t)]dt\right\} \\
&< E_0\left\{\int_0^s \exp(-\theta t)[u(c_t+b_t)-u(c_t)]dt + \int_s^\infty \exp(-\theta t)[u(\bar{c}-\bar{a})-u(\bar{c})]dt\right\} \\
&= E_0\,(Jalone) - E_0\,(NJtogether) < 0\ ,
\end{aligned}
\tag{A7}
$$

by Lemma A3, *Jalone* is the worst choice in terms of the amount of payoff, followed by *NJtogether*, and *NJalone*, and *Jtogether* is the best. The outcomes of choosing option *J* are more dispersed than those of option *NJ*. If households have a risk-averse preference in the above-mentioned sense and avert the worst scenario when they have no information on its probability, a household will prefer the less dispersed option (*NJ*), fearing the worst situation that the household alone substantially increases consumption while the other households substantially decrease consumption after the shock. This behavior is rational because it is consistent with preferences. Because all households are identical and know inequality (A7), all households will equally suppose that they all prefer the less dispersed *NJ* option; therefore, all of them will suppose a very low *p*, particularly $p = 0$, and select the *NJtogether* (0,0,…,0) equilibrium, which is the Nash equilibrium of a Pareto inefficient path. Thereby, unlike most multiple equilibria models, the problem of indeterminacy does not arise, and "animal spirits" (e.g., pessimism or optimism) are unnecessary to explain the selection.

A4 Amplified generation of unutilized resources

A Nash equilibrium of a Pareto inefficient path successively generates unutilized products because of b_t. They are left unused, discarded, or preemptively not produced during the path. Unused or discarded goods and services indicate a decline in sales and an increase in inventory for firms. Preemptively suspended production results in an increase in unemployment and idle capital. As a result, profits decline and some parts of firms need to be liquidated, which is unnecessary if the economy proceeds on the *J* path (i.e., the posterior Pareto efficient path). If the liquidation is implemented immediately after the shock, unutilized products because of b_t will no longer be generated, but such a liquidation would generate a tremendous shock. The process of the liquidation, however, will take time because of various frictions, and excess capital that generates unutilized products because of b_t will remain for a long period. During the period when capital is not reduced to the posterior steady-state level, unutilized products are successively generated. In a period, unutilized products are generated and eliminated, but in the next period, another, new, unutilized products are generated and eliminated. This cycle is repeated in every period throughout the transition path, and it implies that demand is lower than supply in every period. This phenomenon may be interpreted as a general glut or a persisting disequilibrium by some definitions of equilibrium.

References

Albert, Marie, Cristina Jude and Cyril Rebillard (2015) “The Long Landing Scenario: Rebalancing from Overinvestment and Excessive Credit Growth. Implications for Potential Growth in China,” *Banque de France, Working Paper*, No. 572.

Becker, Gary S. and Casey Mulligan (1997) “The Endogenous Determination of Time Preference,” *Quarterly Journal of Economics*, Vol. 112, No. 3, pp. 729–758.

Böhm-Bawerk, Eugen von (1889) *Capital and Interest*, Reprinted by Libertarian Press, South Holland, IL, 1970.

Dollar, David and Shang-Jin Wei (2007) “Das (Wasted) Capital: Firm Ownership and Investment Efficiency in China,” *NBER Working Papers*, No. 13103.

Dorrucci, Ettore, Gabor Pula and Daniel Santabárbara (2013) “China’s Economic Growth and Rebalancing,” *European Central Bank, Occasional Paper Series*, No. 142.

European Union Chamber of Commerce in China (2009) *Overcapacity in China - Causes, Impacts and Recommendations*.

European Union Chamber of Commerce in China (2016) *Overcapacity in China - An Impediment to the Party’s Reform Agenda*.

Fisher, Irving (1930) *The Theory of Interest*, Macmillan, New York

Harashima, Taiji (2004) “A More Realistic Endogenous Time Preference Model and the Slump in Japan,” *EconWPA Working Papers*, ewp-mac0402015.

Harashima, Taiji (2009) “Depression as a Nash Equilibrium Consisting of Strategies of Choosing a Pareto Inefficient Transition Path,” *MPRA* (*The Munich Personal RePEc Archive*) *Paper*, No. 18987.

Harashima, Taiji (2011) “A Model of Total Factor Productivity Built on Hayek’s View of Knowledge: What Really Went Wrong with Socialist Planned Economies?” *MPRA* (*The Munich Personal RePEc Archive*) *Paper*, No. 29107.

Harashima, Taiji (2013a) “Escaping a Liquidity Trap: Keynes’ Prescription Is Right But His Reasoning Is Wrong,” *MPRA* (*The Munich Personal RePEc Archive*) *Paper*, No. 69217.

Harashima, Taiji (2013b) *The Economics of Fiscal Deficits* (*Zaisei Akaji No Keizaigaku*), Buitsu-Soryushon, Nagoya, Japan (in Japanese).

Harashima, Taiji (2016) “The Cause of the Great Recession: What Caused the Downward Shift of the GDP Trend in the United States?” *MPRA* (*The Munich Personal RePEc Archive*) *Paper*, No. 69215.

Huang, Yiping and Bijun Wang (2010) “Cost Distortions and Structural Imbalances in China,” *China and World Economy*, Vol.18, pp.1–17.

IMF (2015) “2015 Article IV Consultation - People’s Republic of China,” *IMF Country Report*, No. 15/234.

Knight, John and Sai Ding (2010) “Why Does China Invest so Much?” *Asian Economic Papers*, Vol. 9, No. 3, pp. 87-117.

Lange, Oskar (1936) “On the Economic Theory of Socialism: Part One,” *Review of Economic Studies*, Vol. 4, No. 1, pp. 53-71.

Lange, Oskar (1937) “On the Economic Theory of Socialism: Part Two,” *Review of Economic Studies*, Vol. 4, No. 2, pp. 123-42.

Lange, Oskar (1938) *On the Economic Theory of Socialism*, University of Minnesota Press, Minneapolis.

Lawrance, Emily C. (1991) “Poverty and the Rate of Time Preference: Evidence from Panel Data,” *Journal of Political Economy*, Vol. 99, No. 1, pp. 54–77.

Lee, Il Houng, Mutase Syed and Liu Xueyan (2012) “Is China Over-Investing and Does it Matter?” *IMF Working Paper*, WP/12/277.

Lee, Il Houng, Murtaza Syed and Liu Xueyan (2013) “China’s Path to Consumer-Based Growth: Reorienting Investment and Enhancing Efficiency,” *IMF Working Paper*, WP/13/83.

Lerner, Abba Ptachya (1944) *The Economics of Control: Principles of Welfare Economics*, Macmillan, New York.

Li, Hongbin, Lingsheng Meng, Qian Wang and Li-An Zhou (2008)"Political Connections, Financing and Firm Performance: Evidence from Chinese Private Firms," *Journal of Development Economics*, Vol. 87, pp. 283–99.

Maliszewski, Wojciech and Longmei Zhang (2015) "China's Growth: Can Goldilocks Outgrow Bears?" *IMF Working Papers*, WP/15/113.

OECD (2015) *OECD Economic Surveys, China*.

Parkin, Michael (1988) "A Method for Determining Whether Parameters in Aggregative Models Are Structural," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 29, No. 1, pp. 215–252.

Samuelson, Paul (1937) "A Note on Measurement of Utility," *Review of Economic Studies*, Vol. 4, No. 2, pp. 155–161.

World Bank (2013) *China 2030 - Building a Modern, Harmonious, and Creative Society*.