THE TOKYO FOUNDATION
FOR POLICY RESEARCH

TKFD Working Paper Series No.20-04

Political Economic Transition and Output Loss: Evidence from Japanese Political Economy 1990-2005

Sota Kato

December 2020

106-6234 東京都港区六本木3-2-1 六本木グランドタワー34階
The Roppongi Grand Tower 34th Floor
3-2-1 Roppongi, Minato-ku, Tokyo 1066234 Japan
政策研究 Policy Research | Tel: 03-5797-8401 Fax: 03-5570-6031

Political Economic Transition and Output Loss: Evidence from Japanese Political Economy 1990-2005

Sota Kato[1]

Abstract

This paper theoretically and empirically examines why an extensive reform of a political-economic system, including a reform toward a more efficient system, invites a temporal, and often substantial, loss of economic output. A political economic system is composed of a set of institutions that complement each other. During an extensive reform, such a complementary relation between institutions gets lost because different types of institutions change in different speeds. The loss of institutional complementarities, in turn, leads to an output loss. I formally show conditions under which even a reform toward more efficient system invites an output loss. The theoretical model was empirically verified by the Japanese panel data of 57 industries thru 1990 to 2005. Empirical analyses show that an extensive neoliberal reform during the era loosened complementary relations among key institutions of post-WWII Japanese political economy; the loosened complementary relations, in turn, led to loss of industrial outputs.

[1] Professor, International University of Japan and Research Director, Tokyo Foundation for Policy Research

Introduction

This paper investigates why an extensive reform of a political-economic system invites a temporal, and often substantial, loss of economic output. The question was initially raised in relation to transition between capitalism and socialism/communism. Adam Przeworski (1985) showed that, even if assuming that socialism is economically superior to capitalism, "valley of transition," a temporal drop of workers' welfare during transition from capitalism to socialism exists. Such a "valley of transition," according to Przeworski, served as an obstacle for transition from capitalism to socialism. The topic became a highly debated issue when the opposite transition from communism to capitalism occurred after fall of the Berlin wall. The question was especially puzzling because, when ex-communist states initiated their transition toward capitalism in the early 1990s, the consensus among scholars and reformers was that the capitalist system was superior to the communist system in producing better economic outcomes. Why a transition to a more efficient system has to suffer an output loss? Studies of transition economics proposed several theoretical accounts that explain why ex-communist states suffered severe output fall during transition (Calvo & Coricelli 1992; Roland & Verdier 1999; Blanchard 1997; Blanchard & Kremer 1997). Transition economists' analyses as well as Przeworski's earlier analysis on this topic were, however, mostly dependent on peculiarities of socialism and/or communism. The range of applicability of their analyses was thus often limited to transitions between capitalism and socialism and/or communism.

Although the transitions from communism to capitalism have currently ceased, the opening question still holds contemporary significance. For instance, Avinash Dixit, a former President of the American Economic Association (AEA), noted the following in his presidential address to AEA in 2009. "(W)hen making institutional reforms that are expected to lead to eventual improvements, it may be necessary to accept some transitional worsening of performance" (Dixit 2009). Social scientists and policy makers now need to focus their attentions on negative effects of institutional transitions within the capitalist system.

After the fall of the Berlin Wall, social scientists including a group of political scientists who initiated the study of "Varieties of Capitalism (VoC)" (Hall and Soskice 2001) came to recognize divergent patterns of political-economic system *within* capitalism. When neoliberal reforms swept across the world in the 1990s, many wondered whether the different patterns of capitalism would converge to the so-called "Anglo-Saxon Model." In contrast to the rich accumulation of theoretical research on transition economies, however, few researchers have theoretically examined consequences of transition from one type of capitalism to another. On the empirical side, large-n empirical analyses that examine transitions between different types of capitalism are lacking.

This paper argues that, under specified conditions, an extensive institutional change of a political economic system, including a change from an economically inefficient system to a more efficient one, invites a temporal output fall. I call such an output loss during the transition "valley of institutional change." The theoretical model of this paper does not, in contrast to existing literature on this topic, rely on the peculiarities of capitalism or socialism or communism. Instead, the model bases itself on theories of institution and institutional change which are rapidly developing in social science.[2] By taking this approach, this paper provides a parsimonious theoretical framework that has a broader applicability than previous models. It not only adds new insights to previous research on transitional economies but also can explain an output loss during a transition between different types of capitalist system.

The main argument of this paper is theoretically derived from the following two premises: (1) institutional complementarities exist among institutions that compose a political economic system, and (2) speeds of institutional change differ across institutions. Both premises are generally accepted by researchers of institution and institutional change. A set of institutions is said to be *complementary* to the other when its presence raises returns available from the other (Aoki 2001; Hall & Soskice 2001). Institutional economists have attempted to classify different types of

[2] As for recent developments on these topics, see, for example, Dixit (2009), Aoki (2010), and Mahoney & Thelen eds. (2010).

institutions that change in different speeds (e.g., Williamson 1996; Roland 2004).[3] Under these two premises, the basic logic behind this paper's argument is as follows. When a national political economic system composed of mutually complementary institutions undergoes an extensive reform, different types of institutions change with different speeds. Such gap of speeds of institutional changes invites a loss or loosening of institutional complementarities during the transition. The loss of institutional complementarities, in turn, leads to a temporal loss of economic output which I call "valley of institutional change." This paper formally proves such a mechanism of an output loss during system transitions.

Hypotheses derived from our theoretical model were empirically tested against Japanese panel data of 57 industries thru 1990-2005. During the period, Japan experienced a radical turn of events. As shown in Figure 1, the growth rate of Japanese economy outpaced all the other G5 countries before 1990; it was outpaced by all the others after 1990.[4] Responding to growing frustration of voters who faced the unprecedented economic downturn, the Japanese government underwent extensive neoliberal reforms in the 1990s (Rosenbluth & Thies 2010). The government dismantled once renowned the "Japan model,"[5] a distinctive set of institutions that characterized Japan's political economic system since the 1940s (Noguchi 1995; Ikeo 2006), and imported various institutional and legal frameworks from the United States (Ohmori 2007; Nakatani 2008; Dore 2000, 2011).[6] Japan also underwent a fundamental electoral system reform in 1993 that led to various political and economic changes. The Japanese neoliberal reform experience since the 1990s along with vertically divided structure of Japanese political economy provide social

---

[3] Williamson (1996) distinguishes four levels of institutions by how quickly they change. Roland (2004) classifies institutions into "slow-moving" and "fast-moving" institutions.

[4] Average real economic growth rate of 1980-1989

[5] The "Japan model" of this paper is named differently by different scholars: the "J-model" (Aoki 1994: 2001), "the Japanese system" (Katz 1998), "the Japanese model" (Vogel 2006), and "*koudo keizai seichouki model* [the high-economic-growth-era model]" (Teranishi 2003; Ikeo 2006), to name a few. Although each term has different tones, overall, they define a set of distinctive institutions that governed post WWII Japanese political economy.

[6] Ohmori (2007), one of the senior bureaucrats who drafted various financial reform plans since the 1990s, describes the "Japanese financial big bang" which was undertaken during 1996-2001 as a typical Japanese reform plan during the era that imitated the US systems.

scientists,[7] by taking industry as a basic unit of analysis, a favorable large-n sample to test effects of an extensive political economic reform.

Figure 1.

To test empirical validness of the theoretical model by using the Japanese case, I then constructed empirical models that fit to the Japanese situation by carefully examining the institutional structure and its trajectory of Japanese political economy. The Japan model was characterized by intimate, long-term, and informal government-industry and finance-industry relationships (Aoki 1995/2000; Dore 2000; Hoshi & Kashyap 2001; Ikeo et al. 2001; Teranishi 2003; Nakatani 2010). As scholars have pointed out, both government-industry and finance-industry relationships were mutually complementary. Empirical analyses of this paper examined how institutions that govern the two relationships changed during 1990-2005 and how such a change affected industrial outputs.

The main testing variable for the industry-level analysis of this paper represents the strength of complementary relations between institutions that govern (1) government-industry coordination and (2) finance-industry coordination.[8] I first constructed two indices that measure how strong the government-industry and the finance-industry coordination mechanisms affected each industry. Next, by taking the difference between the two indices, I constructed the main testing variable that shows the strength of complementary relation between institutions that govern government-

[7] As I will later describe in detail, the post-WWII Japanese political economic system was vertically divided by industrial sectors which functioned as a basic unit of political economic coordination (Teranishi 2003; Murakami 1994; Aoki 1995/2000).

[8] VoC school often emphasizes complementary relations between institutions that coordinate corporate governance and labor relations (e.g., Hall & Soskice 2001; Hall & Gingerich 2009). In the case of Japan, however, as Pempel and Tsunekawa (1979) characterized Japanese political process as "corporatism without labor," labor was mostly absent from political economic coordination. Instead, political economic coordination under the "Japan model" was led by organizations such as economic ministries (Johnson 1982; Samuels 1987; Okimoto 1989), the Liberal Democratic Party (LDP) which held the office for the best part of post WWII era (Rosenbluth and Thies 2010), and trade associations (Yonekura 1993; Sasada 2011). The government and its agencies played a crucial role in realizing coordination among firms and financial institutions in the Japan model. Martin and Thelen (2007) also emphasize the importance of the role of the state in sustaining varieties of coordination within each country.

industry and finance-industry coordination mechanisms. The dependent variable for empirical tests is an economic output of each industry. Control variables such as capital and labor inputs were added to regression models. [9]Economic data was mainly gathered from the Japan Industry Productivity Database 2006 (JIP 2006).[10] Political data was mainly gathered from governmental sources and was converted to an industry-base dataset.[11]

The results of empirical analyses supported arguments of this paper. Main findings of our empirical analyses were as follows. (1) During 1990-2005, due to neoliberal reforms that removed or undermined institutions that consisted the "Japan model," both government-industry and finance-industry coordination mechanisms were substantially weakened. (2) Institutions that govern government-industry coordination changed faster than those that govern finance-industry coordination at the earlier stages of neoliberal reforms, resulting in loss/loosening of institutional complementarities between the two. (3) The loss/loosening of institutional complementarities among institutions significantly and substantially lessened economic output of each industry. Several alternative panel data regression analyses confirmed these results. Signs of the coefficients of main control variables as well as key control variables were as expected.

The rest of this paper is organized as follows. First, I discuss previous research related to an output loss during an extensive institutional reform and show what this paper adds to. Second, I construct a formal model and prove that, under certain conditions, an extensive institutional change of a political economic system inevitably invites economic downturn. I also conduct simple simulations to demonstrate theoretical implications of the model and show the shape of "valley of institutional change." Third, by using Japanese panel data of 57 industries during 1990-2005, I test hypotheses derived from our theoretical model and check robustness of the results by conducting several panel data regression analyses from different standpoints. Finally,

[9] See Appendix B for the detail of empirical model specification.
[10] The JIP database was compiled in a collaborative effort between the Research Institute of Economy, Trade and Industry (RIETI), a subsidiary institute of Ministry of Economy, Trade, and Industry (METI), and Hitotsubashi University.
[11] See the supplement material for the conversion method.

I sum up results of my analyses and discuss policy implications of this topic.

Political -Economic Transition and its Consequence

Transition between Capitalism and Socialism/Communism

Adam Przeworski (1985) was one of the first to initiate analyses of an output fall during political-economic system transition. He argued that workers' material interests in capitalist societies do not automatically lead to transition toward socialism even if socialism was superior to capitalism. When capitalists face imminent nationalization, Przeworski argued, they would disinvest and might even seek for using armed forces to prevent the transition, leading to "valley of transition" for workers' welfare. Such a "valley" blocked the transition to perhaps the better economic system. His insightful argument has not garnered enough attention it deserves possibly because its applicability is confined to transition from capitalism to socialism that rarely happened.

In the 1990s, a massive transition toward the opposite direction of Przeworski's analysis occurred. Western economists who served as economic consultants for the government of transition economies led "big bang" structural reforms, aiming to implant capitalist systems into post-communist states. The results were, however, devastating (Roland 2000). Observing the debacle, transition economists questioned why transition toward a supposedly more efficient system (i.e., capitalism) incurred a serious output loss. Blanchard and Kremer (1997) introduced an well-known disorganization theory in which they argued that a transition from a state-led central planning system to a decentralized market-based system induced sharp output fall due to inefficient bargaining between suppliers and buyers under the underdeveloped new capitalist system. Roland and Verdier (1999) argued that firms' temporal disinvestment caused by increased search time for new business partners after liberalization led to an output fall during transition. Several researchers attributed the temporal output fall during transition to policy failures of governments (Calvo and Coricelli 1992; Kornai 1994; Berend 2009). Overall, transition economists' theoretical arguments on this topic are mostly dependent on (1) peculiarities of

capitalism and socialism/communism, (2) transitional contexts between them, and (3) transitional policies that the governments adapted during the 1990s. The range of applicability of their analysis is thus, in contrast to Przeworski's argument, limited to transition from communism to capitalism. In addition, their analyses often focus mostly on economic aspects of transition and downplay political economic and institutional aspects.[12]

Transition between Different Varieties of Capitalism

After the collapse of communism in 1989, social scientists` interest turned from comparing capitalism and socialism/communism to comparing different types of capitalism (Aoki & Kato 2007).[13] Hall and Soskice (2001) presented "varieties of capitalism (VOC)" perspective that classifies two types of capitalism by how firms coordinate with other actors. Capitalist economies in which firms mostly rely on market mode of coordination are classified as Liberalized Market Economies (LMEs) whereas those in which firms rely on strategic mode of coordination are classified as Coordinated Market Economies (CMEs). Typical examples of the former, in VOC's view, are the US and UK, and of the latter, Germany, France and Japan. While VOC perspective has become a major platform for analyses of post cold war comparative political economy, it has received various criticisms as well. One is that VOC over-emphasizes stableness and path-dependence of economies and fails to explain dynamic elements of economic change (Hancke et al. 2007; Streeck and Thelen 2005). In fact, when the neoliberal movement spread across the world after 1980s, some of the CMEs including Japan implemented neoliberal reform plans to transform

[12] Although earlier studies of transitional economies tended to downplay institutional factors (Turley & Luke 2011), recent empirical studies often include institutional factors in their analyses and find significant explanatory power in accounting for post-transition growth difference among transitional economies (E.g., Beck & Laeven 2006; Godoy & Stiglitz 2006). Most of them, however, attempted to analyze effects of institution on performance of post-transition economies rather than effects of institutional change during transitions.

[13] Several political scientists had proceeded economists in investigating this topic. Johnson (1982), for example, conceptualized "developmental state model" and pointed out that the developmental state such as Japan employs economic strategies quite distinct from Western economies. Main-stream economists, on the other hand, were reluctant to admit significant differences among advanced economies. Aoki (1990; 2001) was one of the few exceptions who explained rationales of Japanese and East Asian corporate system by using standard economic and game theoretic frameworks.

their political economic system to the Anglo Saxon model, or the LMEs. VOC perspective, however, is often ineffective in theoretically explaining causes and consequences of such transition efforts.[14] While it successfully shows distinct patterns of capitalism today, it does not predict or analyze divergence or convergence of such patterns in the future. On the empirical side, although both quantity and quality of case studies that analyze transitions between different types of capitalism are increasing, large-n statistical studies that test theories of transition between different types of capitalism are lacking.

This Paper's Approach

Why an extensive change of political-economic system invites output fall? In answering this question, this paper overcomes several limitations of past research. First, the theoretical model of this paper does not rely on, in contrast to Prezeworski and transition economists' analyses, peculiarities of capitalism or socialism/communism. The theoretical model is deduced from two simple assumptions that are widely accepted by institutional analysts across disciplines. As a result, it has much broader applicability than transition economists' theoretical arguments: the analyses of this paper are applicable to transitions between different varieties of capitalism as well as transitions between capitalism and socialism/communism. Second, on the empirical side, by analyzing the Japanese case, this paper realizes a rare large-n empirical analysis on political economic transition.

Model and Hypothesis

In this section, I first introduce two key assumptions from which I deduce theoretical claims of this paper. Second, I describe main theoretical ideas of this paper by using an illustrative example. Third, I deduce a theoretical model and prove that, under specified conditions, there exists "valley of institutional change," an output fall during an extensive institutional change of political economic systems, including a

[14] Hall and Soskice (2001) do touch upon dynamics of institutional change. Instead of identifying causes and consequences of change, however, they point toward explaining why different patterns of capitalism do not converge.

change from an economically inefficient system to a more efficient one. Finally, I run simple simulations to show theoretical implications of the model.

Assumptions

Two key assumptions for deducing theoretical models are as follows.

Assumption 1: Institutional complementarities exist.

Assumption 2: The time necessary for institutions to change varies from one institution to another.[15]

Social scientists who carry out institutional analyses generally accept both of the assumptions. As for assumption 1, Hall and Soskice (2001) define institutional complementarities as, "two institutions can be said to be complementary if the presence (or efficiency) of one increases the returns from (or efficiency of) the other." This paper follows their definition.[16] The idea of institutional complementarities has been widely endorsed by social scientists across different disciplines (e.g., Aoki 2001: Hall & Soskice 2001; Hoff and Stiglitz 2001; Teranishi 2003; Roland 2004; Hall & Gingerich. 2009; Acemoglu et al. 2012). Based on Assumption 1, "system" is defined as follows,

Definition: System is a set of institutions that are mutually complementary.

Assumption 2 is probably less well acknowledged but no less important. Williamson (1996) distinguishes four levels of institutions by how quickly they change. Roland

---

[15] Or stated differently, the speeds of institutional change differ across different types of institutions.

[16] More formerly, institutional complementarities among *n* institutions can be defined as follow. If let an institution $I_i \in \mathbf{I_n}$, $\mathbf{I_n}$ can be re-written as $\mathbf{I_n} = \{I_i, I_{-i}\}$, whereas $I_{-i} \in \mathbf{I_n}$ represents a set of all other institutions except I_i. Let $\Gamma(.)$ equals the economic output of a certain institutional arrangement while controlling for other relevant variables, and let an alternative set of institutions $\mathbf{I_n}' = \{I_1', I_2',,, I_N'\}$, $I_j' \neq I_j \ \forall j$ that does not complement each other. In such a case, institutional complementarities among $\{I_1, I_2,,, I_n\}$ can be formally represented as:
$\Gamma(I_i, I_{-i}) - \Gamma(I_i', I_{-i}) \geqq \Gamma(I_i, I_{-i}') - \Gamma(I_i', I_{-i}')$.

(2004) classifies institutions into "slow-moving" and "fast-moving" institutions.[17]

Illustrative Example

Figure 2 shows an illustrative example of the basic ideas of this paper. Suppose that in Country U, Institution I_U and Institution i_U are complementary. Suppose that in Country J, Institution I_J and Institution i_J are complementary. The combination of I_U and i_U generates H (high) economic performance in Country U; the combination of I_J and i_J generates M (mediocre) economic performance in Country J; and the combinations of institutions without complementarities ($\{I_U, i_J\}$,$\{I_J, i_U\}$) generate L (low) economic performances.

Figure 2.

Assume that policymakers and the public in Country J, after observing Country U outperforms their country's economic performance, seek a systemic transformation of Country J's institutions to those of Country U's. In doing so, they would prefer to transform Institution I and Institution i *simultaneously* because if Institution I and Institution i are transformed separately, Country J would temporarily experience combinations of $\{I_U, i_J\}$ or $\{I_J, i_U\}$ that result in performance L which is lower than Country J's current performance M. Thus, policymakers of Country J would want to jump to the system of Country U through the "big bang" approach, changing Institutions I and i simultaneously.

Suppose, however, that the speed of transformation for Institution I is faster than that for Institution i. In that event, even when policymakers intend to make a linear jump from the system of Country J to the system of Country U, the actual transformation path would *curve* as shown in Figure 12, and temporarily go through the domains of I_U and i_J, resulting in decline of economic performance of Country J. This is an intuitive description of the "valley of institutional change" which I will formally show in the next section.

[17] Typical examples of the former, according to Roland, are informal institutions, such as beliefs and values; political institutions are the examples of the latter.

One can substitute the US to Country U and Japan to Country J. As I will describe later in the empirical section, Figure 2 was the view that was held by Japanese policymakers who initiated arrays of neoliberal reforms aiming to be more like the US in the early 1990s.

Model

In this section, I deduce a theoretical model from the Assumptions 1 and 2 and show that, under specified conditions, a loss of institutional complementarities among institutions during a system transformation results in an output fall. Let assume that the performance of a political economic system T_t is dependent on the effectiveness of two complementary institutions T_{1t} and T_{2t}. Let $S_t \in [0,1]$ and $R_t \in [0,1]$ denote the performance of institutions T_{1t} and T_{2t}. The performance of T_t can be shown as P_t in the following simplified model;

$$P_t = P(S_t, R_t) = \alpha S_t \cdot R_t - \beta(S_t - R_t)^2 + \gamma, \quad (1)$$
$$\alpha > 0, \beta > 0, \gamma > 0.$$

The second term, derived from Assumption 1, shows strong complementarities between T_{1t} and T_{2t}. If T_{1t} and T_{2t} deviate from their complementary relation, the performance of system T_t, which is P_t, decreases substantially. The first term shows T_t is changing toward a more efficient system: that is, as $\{S_t, R_t\}$ changes from $\{0, 0\}$ to $\{1, 1\}$, P_t increases by $\alpha\ (> 0)$ as long as T_{1t} and T_{2t} manage to maintain their complementary relation. The first term also shows another complementary relation between T_{1t} and T_{2t}.

Next, we model dynamics of institutional change. Assume that, as institutions T_{1t} and T_{2t} continuously change ($t \in [0, \infty)$), the performance of each institution S_t and R_t linearly change as the following:

$$S_t = \begin{cases} a_s t, & \text{if } 0 \leq \mathrm{t} < \frac{1}{a_s} \\ 1, & \text{if } \frac{1}{a_s} \leq \mathrm{t} \end{cases} \quad (2)$$

$$R_t = \begin{cases} a_r t, & \text{if } 0 \leq \mathrm{t} < \frac{1}{a_r} \\ 1, & \text{if } \frac{1}{a_r} \leq \mathrm{t} \end{cases} \qquad (3)$$

where a_s and a_r are the parameters that denote the speeds of institutional change of T_{1t} and T_{2t}, respectively. From assumption 2, let $a_s > a_r$; that is, S_t changes faster than R_t. Figure 3 shows transitional paths of performances of institutions T_{1t} and T_{2t}. As S_t reaches 1, the transitional processes of T_{1t} ends: likewise, as R_t reaches 1, the transitional processes of T_{2t} ends.

Figure 3.

Next, we model an economic output of a representative firm of a certain industry during the system transition. From a standard economics view based on the Cobb-Douglas production function, one can reasonably assume that the performance of T_t affects each industry's productivity. Then t his situation can be expressed as follows. There is a representative firm of a certain industry whose production technology is,

$$Y_t = A_t N_t^{1-\delta} K_t^{\delta}, \quad (4)$$

where Y_t, A_t, N_t, and K_t denote output, productivity, labor input, and capital input, respectively. Assuming A_t consists of institutional factor P_t and non-institutional factor Q_t, A_t can be expressed as

$$A_t = b_P P_t + b_Q Q_t, \quad (5)$$

where b_P and b_Q are parameters.

The following proposition that demonstrates an output loss during transition can be derived from the models we developed.

Proposition: *Under assumptions 1 and 2 modeled in equations (1) (2) (3), a*

transition from an economically inefficient system to a more efficient system invites a temporal output loss if the following conditions hold,

$$\frac{\alpha}{\beta} < \frac{\left(\frac{a_s}{a_r}\right)^2 - 2\left(\frac{a_s}{a_r}\right) + 1}{\frac{a_s}{a_r}}, when\ 0 \leq t < \frac{1}{a_s}. \quad (6)$$

See Appendix A for the proof.

The shaded area in Figure 4 graphically displays when the inequality (6) holds; or put differently, when an output loss during system transition occurs. Several theoretical insights can be derived from the inequality (6) and Figure 4. First, when α takes larger values, a temporal output loss during system transition becomes less likely. Since α represents increased performance after the system transition, this means that the output loss during transition becomes less likely as the performance gap between the initial system and the destined system widens. Second, when β takes larger values, a temporal output loss during system transition becomes more likely. Since β denotes how institutional complementarity affects the performance of political economic system T_t, Figure 4 shows that a system under stronger influence of institutional complementary is more likely to suffer an output loss during transitions. Finally, as the difference between transition speeds of complementary institutions T_{1t} and T_{2t} widens (i.e., when $\frac{a_s}{a_r}$ takes larger values), an output loss during system transition becomes more likely.

Figure 4.

Since our proposition is derived from assumptions 1 and 2 that are widely accepted by social scientists, our theoretical model has a wider applicability than Przeworski's "valley of transition" as well as transition economists' theoretical models. Przeworski and transition economists focused their analyses on the context under which transitions between capitalism and socialism/communism occur. Our model can explain, in addition to transitions between capitalism and socialism/communism, an output loss during transitions between different types of capitalism. Our model is also more

parsimonious. We thus call the output loss described in our proposition "valley of institutional change," emphasizing that it has wider applicability than previous models.

Simulation

To earn theoretical insights of how loss of institutional complementarities affects economic output, actual values for each parameter that fulfill the inequality (6) are inserted to conduct simple simulations. The following three cases are observed: (1) when both $\frac{\alpha}{\beta}$ and $\frac{a_s}{a_r}$ take small values, (2) when $\frac{\alpha}{\beta}$ is small and $\frac{a_s}{a_r}$ is large, and (3) when both $\frac{\alpha}{\beta}$ and $\frac{a_s}{a_r}$ take large values. First, let $\alpha = 1$ and $a_r = 1$ for all the cases to make them comparable to each other. Then, in case (1), let $\beta = 10$ and $a_s = 1.5$. In case (2), let $\beta = 10$ and $a_s = 10$. In case (3), let $\beta = 1$ and $a_s = 10$. Figure 5 shows different patterns of economic output change. As is expected, case (2) shows the most drastic ups and downs of outputs. Case (1) and (3) show more moderate moves. In case (3), when the difference between transition speeds of complementary institutions is large, output falls more speedily at the earlier stage of transition. Overall, these cases confirm the proposition and show that under certain conditions, a temporal output fall during political economic transition occurs even when the transition is aiming toward a more efficient political economic system.

Figure 5.

Empirical Test

I empirically test implications of the theoretical model using Japanese panel data of 57 industries during 1990-2005. The collapse of so-called "bubble economy" at the beginning of 1990s induced a drastic change of political economic landscape in Japan. Before 1990, Japan outpaced virtually all the advanced industrial societies in economic growth; after 1990, the situation became totally the opposite. The Liberal Democratic Party (LDP), which ruled Japan since 1955, became the opposition party in 1993 for the first time in its history. Japan implemented a comprehensive electoral reform in 1994 that was its first after democratization. The public anger toward the

government and the bureaucracy led the Japanese government to pursue arrays of neoliberal reform plans aiming to dismantle the "Japan model," a set of political and economic institutions that governed Japanese economy since 1940s (Noguchi 1995; Ikeo 2006). To substitute traditional institutions, the Japanese government imported various institutional settings from the US (Ohmori 2007; Nakatani 2007; Dore 2000, 2001). In terms of VOC perspective, Japan sought for a transition from CMEs to LMEs. The Japanese experience since the 1990s thus provides social scientists a valuable opportunity to analyze the effect of a comprehensive political economic system reform.

Unit of Analysis

The primary unit of analysis of this paper is industry. Business economists have argued that industry does matter significantly for economic performance of firms even in countries such as the US where the market is well-developed (e.g., Porter & McGahan 1997).[18] There are further rationales for this empirical research in choosing industry as the primary unit of analysis. Industry played a special role in the post-WWII Japanese political economy by inheriting the legacy of wartime economy. Teranishi (2003) pointed out that in Japan, industry worked as a political platform for interest coordination; a role played by social classes in some Western countries. Other scholars similarly indicated that the Japanese political economy was vertically segmented by industry, and industry functioned as a basic unit of political economic coordination (Noguchi 1995; Ikeo et al. 2001). The organization of LDP, the party that held onto power in Japan for most of the post WWII era, was divided vertically by industrial sectors: so were government ministries and their departments. Whereas Sato and Matsuzaki (1986) and Aoki (1995/2000) called the Japanese version of iron triangle "s*hikirareta tagenshugi"* (bureau-pluralism) partitioned by industry, Murakami (1994) named it "compartmentalized competition" within each industrial sector. As a consequence, patterns of political economic institutions varied across industries resulting in the "dual economy" (Katz 1998), high performance variance

[18] Porter (1980) points out features of industries that define competitive structure of each industry and firms within the industry.

across Japanese industries. We thus use industry as a unit of analysis for analyzing political economic transition of Japan.[19]

Dataset

I gathered and compiled a political economic dataset covering 57 industries during 1990–2005.[20] 1990 is often regarded as the year when the bubble economy burst.[21] 2005 was the last full year of Koizumi Administration that led series of neo-liberal reforms called "*koizumi kaikaku* (Koizumi-reform plans)."[22] Economic data were mainly gathered from the Japan Industry Productivity Database 2006 (JIP 2006),[23] a relatively new industry database. Corporate financial data were gathered from the NEEDS Financial QUEST database and converted to industry-level data using Mitsubishi Research Institute (MRI) categorization. Political data was gathered from governmental sources and converted to JIP categorization.[24] To make different types of institutional variables comparable, I normalized each variable before using it in statistical analyses.[25]

Post-WWII Government-Industry and Bank-Industry Relationships

Since careful historical assessments are necessary to better specify empirical models, in this section, I briefly overview how the "Japan model" emerged and functioned

---

[19] One of the reasons why JIP database, a major government-funded initiative to build political economic database, was organized by industry was this very structure of Japanese political economy. (Interview with an official of Ministry of Economy, Trade, and Industry (METI), March 22nd, 2010.)

[20] Industries such as financial industries that are irrelevant for empirical testing of the theoretical model were eliminated. Those with substantial missing values were also eliminated.

[21] Nikkei 225 touched a historically all high in December 29th 1989, the last opening day of 1989, and lost 35% of value in 1990.

[22] After the resignation of the Prime Minister Koizumi in 2006, political backlash against Koizumi reform took place. (e.g., October 17th, 2007. Financial Times.)

[23] The JIP database was compiled in a collaborative effort between the Research Institute of Economy, Trade and Industry (RIETI), a subsidiary institute of Ministry of Economy, Trade, and Industry (METI), and Hitotsubashi University. The JIP database and its detailed description are available from the RIETI website (http://www.rieti.go.jp/jp/database/JIP2006/index.html).

[24] For the detail of conversion methods, see the supplement material.

[25] I used the following formula for normalization:

$$Z_{it} = \frac{X_{it} - \overline{X}}{\sigma}$$

where X_{it} is the original value before normalization, $\overline{X}$ is the mean of X_{it}, and σ is the standard deviation of X_{it}.

during post-WWII era by reviewing past research. I show how complementary relations between institutions that govern (1) government-industry coordination and (2) finance-industry coordination emerged and functioned during the era. I then create "coordination indices" that measure how strong each industry is embedded in (1) government-industry and (2) bank-industry relations of post-WWII Japan political economic system. Two indices are used as bases for the key testing variable of this paper.

The Japan model, a unique set of political economic institutions, was initially formed to allocate scarce capital and physical resources to strategic industries during the second Sino-Japan war and WWII (Okazaki & Okuno-Fujiwara 1993). Noguchi (1995) who re-named the Japan model as the "1940 system [1940-nen taisei]]" pointed out that the 1940 system was fully established around 1940, a year before Japan declared war upon the US. The 1940 system was still firmly in place in the 1990s. For instance, the Japanese main bank system and trade unions that linked the government and industries were institutionalized around 1940 and still served as key institutions of the Japanese political economy in the 1990s. Under the 1940 system, the government and the Japanese main bank system become to play crucial roles in mediating information and coordinating non-market resource allocations.[26]

One of the main features of post-WWII Japanese political economy is cooperative business-government relationship (Ikeo et al. 2001; Teranishi 2003). Among government agencies, Ministry of International Trade and Industry (MITI) acted as a primary coordinator and information intermediary positioned at the center of dense, long-term, and informal business-government networks (Okimoto 1989).[27] Each industry was linked to MITI and LDP's corresponding departments through industry-based trade unions (Yonekura 1993) and industry functioned as a platform for political economic coordination and adjustment (Teranishi 2003). Although MITI did

[26] In contrast, the pre-war Japanese economic system was more market-oriented and thus was more like the "Anglo-Saxon" system (Noguchi 1998; Naito 2004).

[27] Johnson (1983) advocated the view of "development state model" claiming that powerful and smart MITI bureaucrats led firms to realize Japan's post WWII high growth era. Later studies are generally more skeptical of MITI bureaucrats' power and ability. They point out that the relation between MITI and firms were reciprocal and MITI more often followed firms' initiatives (e.g., Samuels 1987; Gutman 2000).

not have regulatory power over banks, it attempted to coordinate its industrial policy with banks' lending policies by issuing future visions and investment guidelines and by daily interaction with Ministry of Finance (MOF) and banks.

Post-WWII Japanese political economy is also characterized as "bank-centered economy" (Tsuru 2006; Yamori & Asai 2006). Banks under strict supervision of the Japanese government played a decisive role in Japanese capital flow system. Flow of capital from households to firms was highly regulated by MOF who intentionally kept capital market underdeveloped (Ikeo 2006: Ogawa 2009). Deposit rate was strictly regulated and was suppressed at a very low level. Because of the underdevelopment of capital market, household had, despite suppressed saving rate, little choice other than depositing their savings in banks; firms had little choice other than borrowing loans from banks to finance their investments. Banks who maintained long-term relations with firms were thus positioned at the core of Japanese political economic networks. Under the Japan model, main banks not only functioned as a primary provider of capital but also as a primary source of corporate governance of firms (Aoki et al. 1994; Rosenbluth and Theis 2012).

Overall, government-industry and bank-industry relationships jointly functioned to allocate capital and physical resources, to mediate information flow among key players of post-WWII Japanese political economy, and to provide monitoring and governance mechanisms.[28] Institutions that governed each relationship were mutually complementary (Aoki 2001; Ikeo et al. 2001; Teranishi 2003; Kato 2011).[29] For

[28] These relational systems of post WWII Japanese political economy did not, in contrast to Johnson's (1983) bold assessment of the "Japanese miracle," necessarily realize efficient resource allocation. It often became a hotbed of rent-seeking activities and corruptions. Nevertheless, even some economists admit that there are some rationales for relational political economic mechanisms when a nation is at a developmental stage and its market is still underdeveloped (Aoki et al. 1994; Hoshi & Kashyap 2001; Tsuru 2006).

[29] VOC perspective often regards institutions that coordinate corporate governance and labor relations as mutually complementary institutions (e.g., Hall & Gingerich 2009). In the case of Japan, however, as Pempel and Tsunekawa (1979) pointed out, labor was mostly absent from political economic coordination. Instead, political economic coordination under the "Japan model" was achieved by economic ministries, the LDP, and trade associations, all of them being included in analyses of this paper. Another popular criticism of VOC perspective is that it downgrades the role of the state (Hancke et al. 2007; Martin & Thelen 2007). Many of the past research of comparative political economy see the state as a nucleus of informal networks of economic players, facilitating government-firm and firm-firm coordination (e.g., Okimoto 1989; Martin & Thelen 2007).

instance, banks, under the supervision and protection of MOF were able to provide ample amount of cheap and long-term loans to firms of industries that were strategically identified by MITI and other governmental agencies.

The Japan model was once praised by many as a key driving force of the "Japanese Miracle." However, the burst of bubble economy coupled with bureaucratic and corporate scandals that broke out in the early 1990s drastically changed its reputation. It was suddenly publicly criticized as the culprit of "crony capitalism." Facing unprecedented economic downturn, Japanese reformers in the 1990s were determined to abandon the Japan model and import various institutional settings from Anglo-Saxon countries. Entangling government-industry and finance-industry relationships thus became one of the major targets for the neoliberal reforms. For instance, "*kisei kanwa*," the Japanese term for deregulation, won the golden award for the popular words of the year in 1993.[30] Japanese financial big bang that started in 1996 and concluded in 2001 was a nucleus of neoliberal reforms during the era and aimed for a "free, fair, and global" financial system (Ohmori 2007). Such reform initiatives and subsequent institutional changes in Japan provide a valuable opportunity to test hypotheses derived from this paper's theories of institutional change. I empirically examine the validness of the theories by utilizing this opportunity.

Coordination Indices

To test hypotheses, I construct (1) *government-industry coordination index (G_{it})* and (2) *finance-industry coordination index (F_{it})* that measure how strong a certain industry is embedded in each institutional setting within the Japan model. The content of each index is shown in Table 2. The government-industry coordination index G_{it} for industry *i* in year *t* combines four proxy variables for how strong each industry is embedded to institutions that govern government-industry coordination. The higher the value of each variable, the higher the level of government-industry relationship. Since each variable is normalized, I simply took an average of four variables for the value of government-

[30] "*Shingo ryukogo taisho* [The new and trendy words of the year]," accessed in August 11th 2014, http://singo.jiyu.co.jp/nendo/1993.html

industry coordination (G_{it}). The first of four proxy variables is *retired bureaucrat (Exb_{it})* representing the number of retired bureaucrats customarily taking executive positions in firms of each industry. Such a custom is called "*amakudari,*" which means "fall from heaven" in Japanese. *Amakudari* has long been a symbol of collaborative government-firm relations. As Ramseyer and Rosenbluth (1994) pointed out, retaining executive positions in private firms after retirement (i.e., *amakudari*) had been a top priority of Japanese bureaucrats, thus making this variable a strong proxy of the closeness of government-industry relationship. The second proxy variable *trade association budget (Tab_{it})* accounts for the budget size of trade associations of each industry. As trade associations functioned as a point of contact between industry and the bureaucracy in the Japan model (Yonekura 1993; Teranishi 2003; Sasada 2011), the budget size of trade association should represent strength of collaborative government-industry relations as well. The third proxy variable is *governmental regulation (Reg_{it})*. Since regulation is one of the primary political tools for the government to affect industrial behavior, the number of firms under control of governmental regulations should also represent strength of government-industry coordination. The fourth proxy variable *political donation (Pdn_{it})* shows the amount of political donation by each industry. This is another indicator that should approximate the strength of government-industry relationship.

Table 2.

The finance-industry coordination index (F_{it}) also consists of four proxy variables for post WWII Japanese bank-industry relationships, which are often characterized as relational, long-term, and informal. The first proxy variable is *debt to equity ratio (Pde_{it})*. Aggressive borrowing of firms from banks was regarded as a distinctive feature of the Japan Model (Hoshi & Kashyap 2001; Ikeo 2006: Ogawa 2009). Based on long-term bank-firm relationship and implicit government guarantee provided by MOF, banks were able to lend an ample amount of capital to firms. On the flip side, typical postwar Japanese firms relied heavily on debts to finance their investments. The high debt to equity ratio thus shows how strong each industry is embedded in

post WWII Japanese bank-industry coordination mechanism. The second proxy variable *non-capital market finance* (Ncm_{it}) shows the ratio of each industry's finance through bank loans relative to equity and corporate bonds issued in capital market.[31] Under the Japan model, MOF intentionally kept Japanese capital market underdeveloped (Ogawa 2009). Firms had to rely predominantly on non-capital market finance, particularly bank loans for their investments. The third proxy variable is *cross-shareholding* (Csh_{it}), which is Japan's postwar unique ownership structure where firms and financial institutions held minority shares of each other. Cross-sharing was regarded as one of the main features of relational banking of the Japan model (Miyajima & Kuroki 2006). It functioned to strengthen relational banking and lessen pressures from equity market (Tsuru 2006). The fourth proxy variable is *keiretsu-ratio* (Krt_{it}) showing the ratio of firms included in the top six major *keiretsu* (Keizaichosakai 2000)[32] a unique corporate group system developed in postwar Japan. Firms in a *keiretsu* formed an intimate and informal inter-firm network. Banks served as a leader of each *keiretsu* and provided financial resources to member firms as their main bank (Hoshi & Kashyap 2001). Industry with higher value of keiretsu-ratio thus is more highly embedded to the post-WWII Japanese bank-industry relationship.

Figure 5 shows how government-industry coordination index (G_{it}) and bank-industry coordination index (F_{it}) changed during 1990-2005.[33] Both lessened their values substantially during the era, meaning that the Japan model was considerably dismantled. This goes against a popular Western view (e.g., Lincoln 2001; Katz 1998) that criticizes the Japanese government's inability to change itself during Japan's prolonged economic downturn since the 1990s. Between the two indices, government-industry coordination index (G_{it}) initially changed faster than bank-industry coordination index (F_{it}) when the extensive system reform of Japan started in the early 1990s. The change of bank-financial coordination index (F_{it}) eventually took

[31] The key difference between proxy variables debt to equity ratio (Pde_{it}) and non-capital market finance (Ncm_{it}) is that whereas the former accounts for corporate bonds, the latter only accounts for bank loans.

[32] The top six *keiretsu* consists of Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and Ichi-kan (Keizai-chosakai 2004 XX).

[33] Git and Fit that appear in Figure 4 are aggregated across industries.

over that of government-financial coordination index (G_{it}) when the latter seemingly completed its change. This is in line with Kato's (2013) argument that, once an institution starts to change, "government-centered institution" changes faster than "private-centered institution."[34] One can intuitively grasp from Figure 4 that the speed gap between institutions governing government-industry and finance-industry relationships led to loosening of institutional complementarities between the two sets of institutions during 1990-2005. In the next section, I empirically assess how such loosening of institutional complementarities during the period affected economic outputs of industries.

Figure 5.

Regression Analyses

I conducted several linear regression analyses to test theoretical implications. I first constructed *change of institutional complementarities* (ΔIC_{it}) variable which is,

$$\Delta IC_{it} = |(F_{it} - G_{it}) - (F_{i199} - G_{i1990})| \qquad (18).$$

It shows how institutional complementarities between institutions that govern finance-government coordination (F_{it}) and institutions that govern government-industry coordination (G_{it}) have changed for industry i in year t since 1990. The higher value of ΔIC_{it} shows weakened institutional complementarities and vice versa. I use *change of institutional complementarities* (ΔIC_{it}) as the main testing variable for the following specification:

$$\Delta Y_{it} = \beta_0 + \beta_1 \Delta IC_{it} + \beta_2 \Delta L_{it} + \beta_3 \Delta K_{it} + \beta_4 DS_{it} + \beta_5 LE_{it} + u_{it} \qquad (19).$$

[34] Kato (2013) argues that between government-centered institution and private-centered institution, since the capability of changing an institution is more concentrated for the former, the former changes faster and radically than the latter once it starts to change.

Appendix B more formally shows rationales for using equation (19) as a main empirical model to test the theories of this paper. The model examines how the loosening of institutional complementarities affected the change of output. The dependent variable is *change of output* $\Delta Y_{it}(= Y_{it} - Y_{i1990})$.[35] Other variables are controls. As is clear from the earlier theoretical models (see equations (1)(4)(5) and appendix A), *change of labor input* ΔL_{it} $(=\Delta L_{it} - \Delta L_{i199}$ $)$ and *change of capital input* $\Delta K_{it}(=\Delta K_{it} - \Delta K_{i1990})$ should be controlled for. Both are expected to be positively correlated to the output. Lagged variables account for changes that occurred since 1990, the year that is generally regarded as the last year of Japan's bubble economy (Noguchi 2008). Japan's extensive neoliberal reform started after 1990, absorbing dissatisfactions of Japanese who were not used to economic downturn. Other controls are as follows. *Domestic sales ratio* (DS_{it}) controls for each industry's dependence to the Japanese market. Since large enterprises and small and medium enterprises of Japan are said to have a distinctive pattern of financial structure (XX), I also controlled for *large enterprises ratio* (LE_{it}) of each industry. All the variables are normalized.

Theoretical prediction is that β_1, which is the coefficient of *Loss of Institutional Complementarities* ($IC_{i,t}$), is negative. It suggests that the gap of speeds of institutional change lead to loosening of institutional complementarities and decline of output since 1990. If β_1 is negative as expected, it verifies the theoretical implication of this paper and the existence of "valley of institutional change." Table 3 shows the results of regression analyses based on equation (19). Since the model and data we used are not rejected by the Hausman test, I used random effects model for estimation (see Wooldridge 2010). The parameter estimates of β_1 were negative and significant in all the regressions. Our prediction is thus confirmed. Considering that all the variables are standardized, the degree of the negative effect from loss/loosening of institutional complementarities is substantial. The estimated signs of coefficients (β_2, β_3) of main control variables, Capital Input (K_{it}) and Labor Input (L_{it}) from 1990, were both positive as expected and were both significant. In sum, as displayed in Table 3, the results confirmed theoretical predictions of this paper.

[35] I used nominal added value of each industry for the value of Y_{it}.

Table 3.

In the following, I conducted additional regression analyses from different standpoints and checked the validity of our theoretical predictions. The second linear regression model takes into account the initial situation of each industry before the system transition in the 1990s. The theoretical model of this paper predicts that if a typical industry initially operates under complementary institutions (e.g., "Japan model"), speed gap of institutional change during system transition loosen the initial institutional complementarities and cause an output loss of the industry. However, if a certain industry initially does not operate under complementary institutions before transition, the speed gap of institutional change may have no effect or even in some cases, improve the output of the industry. In this section, I first divide industries into those with strong institutional complementarities and those without them in 1990. Then I test whether the effect of speed gap of institutional change affect differently for the two groups of industries. For this purpose, I first define a new variable, *institutional complementarities dummy* D_i as;

$D_i = 1$ if industry i operates under complementary institutions in 1990 and $D_i = 0$ otherwise.

I define that an industry i operates under complementary institutions in 1990 (i.e., $D_i = 1$) if both $\mathrm{F_{i1990}}$ and $\mathrm{G_{i1990}}$ take above the median values or both $\mathrm{F_{i1990}}$ and $\mathrm{G_{i1990}}$ take below the median values. I run the following regression.

$$\Delta Y_{it} = \beta_0 + \beta_1^A \Delta IC_{it} + \beta_1^S D_i * \Delta IC_{it} + \beta_2 \Delta L_{it} + \beta_3 \Delta K_{it} + \beta_4 DS_{it} + \beta_5 LE_{it} + u_{it} \quad (20).$$

Theoretical prediction is that β_1^A is zero and β_1^S is negative. It suggests that speed gap of institutional change cause decline of output only for the industries that had strong institutional complementarities in1990. No decisive prediction can be derived for the second group. The estimation results are shown in Table 4. As a result of Hausman

tests, random effect model was not rejected. The estimates of β_1^A are not significant and the degree is small. The estimates of β_1^S are all negative and significant. They also take more substantial values than results of the regression (19) shown in table 3. These results are all in line with my theoretical prediction and further verify empirical validness of the theoretical model of this paper.

Table 4.

For the third empirical examination, I conducted a regression analysis using an alternative specification of institutional complementarities. So far, the empirical models of this paper analyzed institutional complementarities between institutions for government-industry coordination (G_{it}) and institutions for finance-industry coordination (F_{it}). This approach is in line with past studies of post WWII Japanese political economy that identify government-industry and finance-industry relationships as key components of the Japan model that are complementing each other. However, among various institutions of a national economy, it is sometimes difficult to identify which institution is complementing which. Through long history, institutions usually develop complex complementary relations with one another. I thus constructed an alternative testing variable by simply taking a standard deviation of all the eight institutional variables shown in Table 2 that comprise the coordination indices G_{it} and F_{it} in terms of their change from 1990. By taking a standard deviation of changes of the eight institutional variables, this testing variable measures whether complementary relations among all the eight variables have strengthened or weakened since 1990. The testing variable IC_{it}^{all} can thus be shown as,

$$\Delta IC_{it}^{all} \equiv std(\Delta krt_{it}, \Delta csh_{it}, \Delta pde_{it}, \Delta ncm_{it}, \Delta pdn_{it}, \Delta exb_{it}, \Delta tab_{it}, \Delta reg_{it}).^{36}$$

Using this testing variable, I ran the regression below.

[36] Each lagged institutional variable shows change from 1990. For example, $\Delta krt_{it} = krt_{it} - krt_{i1990}$.

$$\Delta Y_{it} = \beta_0 + \beta_1 \Delta IC_{it}^{all} + \beta_2 \Delta L_{it} + \beta_3 \Delta K_{it} + \beta_4 DS_{it} + \beta_5 LE_{it} + u_{it} \quad (21)$$

Theoretical prediction is that β_1 negative. It suggests speed gap of institutional change lead to loss of complementary relations among eight institutional variables that constitute the Japan model and negatively affect economic output. As shown in Table 5, the results of the regression again confirm our theoretical predictions. The estimated degree of effect is smaller than β_1 of the former two regressions (19) and (20), possibly implying that the former two regression models are better specified than this third regression. As the estimates of β_1 implies, speed gaps of institutional change negatively affect economic outputs across different models. Consistent results throughout Table 3, Table 4, and Table 5 demonstrate empirical validness and its robustness of the theoretical model of this paper.

Table 5.

Simulation

Finally, I conduct a simple simulation to capture the economic effect of loosening or loss of institutional complementarities, caused by speed gaps of institutional change. Specifically, I use regression model (19) and its parameter estimates to obtain predicted values of the nominal value added ($\hat{Y}_{it}$) as,

$$\hat{Y}_{it} = Y_{i199} \ + \hat{\beta}_0 + \hat{\beta}_1 \Delta IC_{it} + \hat{\beta}_2 \overline{\Delta L_{\imath t}} + \hat{\beta}_3 \overline{\Delta K_{\imath t}} + \hat{\beta}_4 \overline{DS_{\imath t}} + \hat{\beta}_5 \ \overline{LE_{\imath t}} \qquad (22)$$

where $\hat{\beta}_k$ represents the estimate of parameters, and variables with upper bars represent the sample averages.[37] Then, I calculate the sample average of $\hat{Y}_{it}$ in each year, i.e.,

[37] More precisely, $\widehat{Y_{\imath,t} - Y_{\imath,1990}} = \hat{\beta}_0 + \hat{\beta}_1 |(F_{it} - G_{it}) - (F_{i1990} - G_{i1990})| + \hat{\beta}_2 \frac{1}{n}\sum_{i=1}^{n}\frac{1}{T}\sum_{t=1}^{T}(L_{it} - L_{i1990}) + \hat{\beta}_3 \frac{1}{n}\sum_{i=1}^{n}\frac{1}{T}\sum_{t=1}^{T}(K_{it} - K_{i19}\ ) + \hat{\beta}_4 \frac{1}{n}\sum_{i=1}^{n}\frac{1}{T}\sum_{t=1}^{T} DS_{it} + \hat{\beta}_5 \frac{1}{n}\sum_{i=1}^{n}\frac{1}{T}\sum_{t=1}^{T} LE_{it}$

$$\frac{1}{n}\sum \hat{Y}_{it}.$$

Figure 6 shows the result of simulation. The economic output of industries initially drops due to the loss of institutional complementarities between the two sets of institutions. It eventually recovers implying the existence of the "valley of institutional change."

Figure 6.

V. Conclusion

Based on two generally accepted assumptions, this paper theoretically showed that an extensive institutional change, including a change toward more efficient political economic system, invites an output loss. In contrast to past research on transition economy as well as Przeworski's pioneering work of "valley of transition," the theoretical framework of this paper does not rely on peculiarity of capitalism or communism and is more parsimonious. It can explain not only an output loss during transitions between communism and capitalism but also between different types of capitalism. I thus call the mechanism of an output loss during system transitions shown in this paper, "valley of institutional change." The theoretical claims of this paper were empirically verified by the Japanese case in which Japan attempted to dismantle the Japan model and executed arrays of neoliberal reform plans.

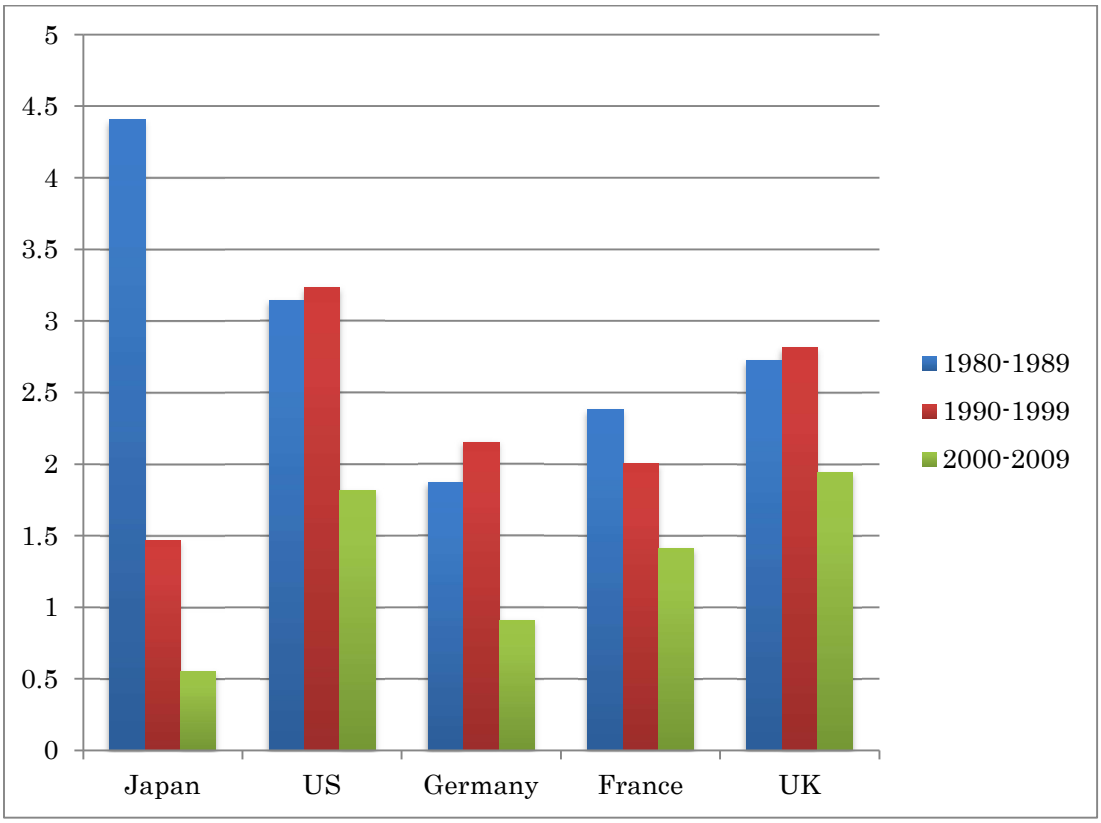
This paper also provides a possible alternative explanation for the question, "Why do different types of political economic system coexist?" Political scientists' VOC perspective and economists' analyses on comparative financial systems (La Porta et al. 1997; Allen & Gale 2000) successfully showed that there exist divergent patterns of national institutional arrangements among capitalist states. These analyses are, however, often criticized as being overly static and deterministic. They do not theoretically show consequences of possible transitions between different types of political economic system. As was the case of Japan in the early 1990s, however, if a certain pattern of national political economic system was outperformed by the other, why does not the former attempt to change itself to the latter? What are the

consequences of such reform initiatives? The theory and empirical evidence of this paper show that, when some countries implement a drastic system reform, they will likely to suffer a severe output loss during the transition. Reformers thus need the guts and patience to cross "valley of institutional change" if they are to execute the transition. As Przeworski argued that "valley of transition" might prevent capitalist states from making transitions to socialist states, "valley of institutional change" may serve as a major obstacle for the convergence of different types of capitalism.

I conclude with several policy implications that can be derived from this paper. First, successful institutional reforms in a certain country might cause a devastating result, at least in the short run, in another country. If a reformer wants to minimize such a severe downturn during system transition, he has to implement reform plans that better fit pre-reform institutional structure of the state. He also has to consider not only the overall contents of the reform plans but also the sequence and the pace of each institutional reform that consists the reform plans. If the reformer takes such a deliberate attitude to minimize an output loss during transition, institutional development of each country will likely to be path dependent. These policy implications of this paper are, despite taking rational choice institutional approach, surprisingly similar to those of historical institutionalists' (e.g., Pierson 2004; Ertman 1996). Second, the empirical results of this paper add new insights to Japan's "lost decade" policy debate that discusses causes of Japan's prolonged economic downturn in the 1990s. So-called supply-siders of the debate often criticized Japanese policymakers for acting "too little, too late." This paper's analyses indicate that what was crucial for Japanese policymakers was not just to accelerate the pace or magnify the degree of change but to maintain balanced pace of change among different spheres of political economy. They even imply that the Japanese reform in the 1990s might have been sometimes "too much, too fast." Overall, this paper suggests that a comprehensive political economic system reform requires the leaders and the public both patience to endure an output loss during system transition and sensitivity to carefully harmonize institutional changes across different spheres of a national political economy. If they are to mitigate the pain of transition, they need in depth knowledge of how their political economic system is functioning, how their system

historically evolved, and how political economic institutions are complementing each other.

Figure 1: G5 Average Annual Real GDP Growth Rate 1980-2009



(Source: IMF World Economic Outlook)

Figure 2: Institutional Transition (Curve)

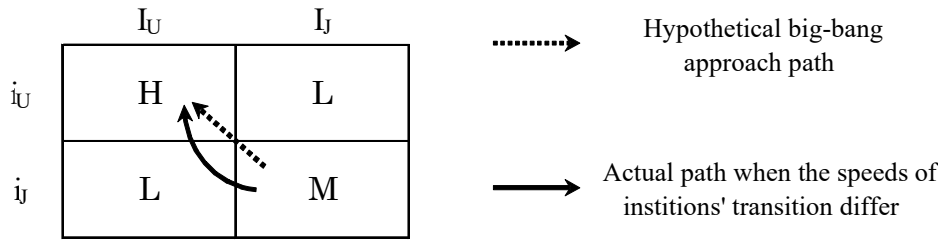


Figure 3: Transitional Path of S_t and R_t

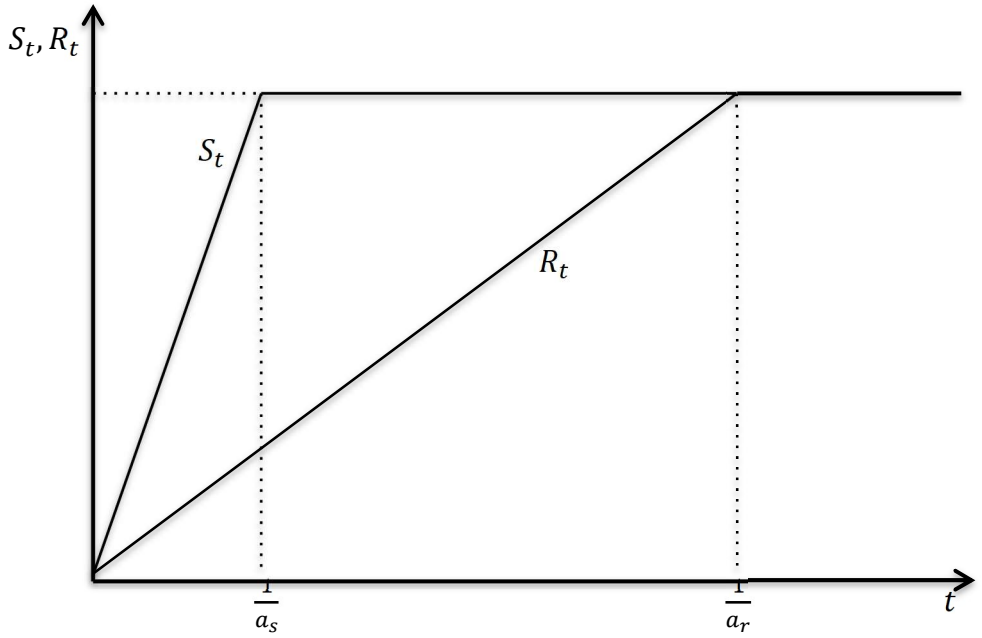


Figure 4: Conditions for Output Fall During Transition

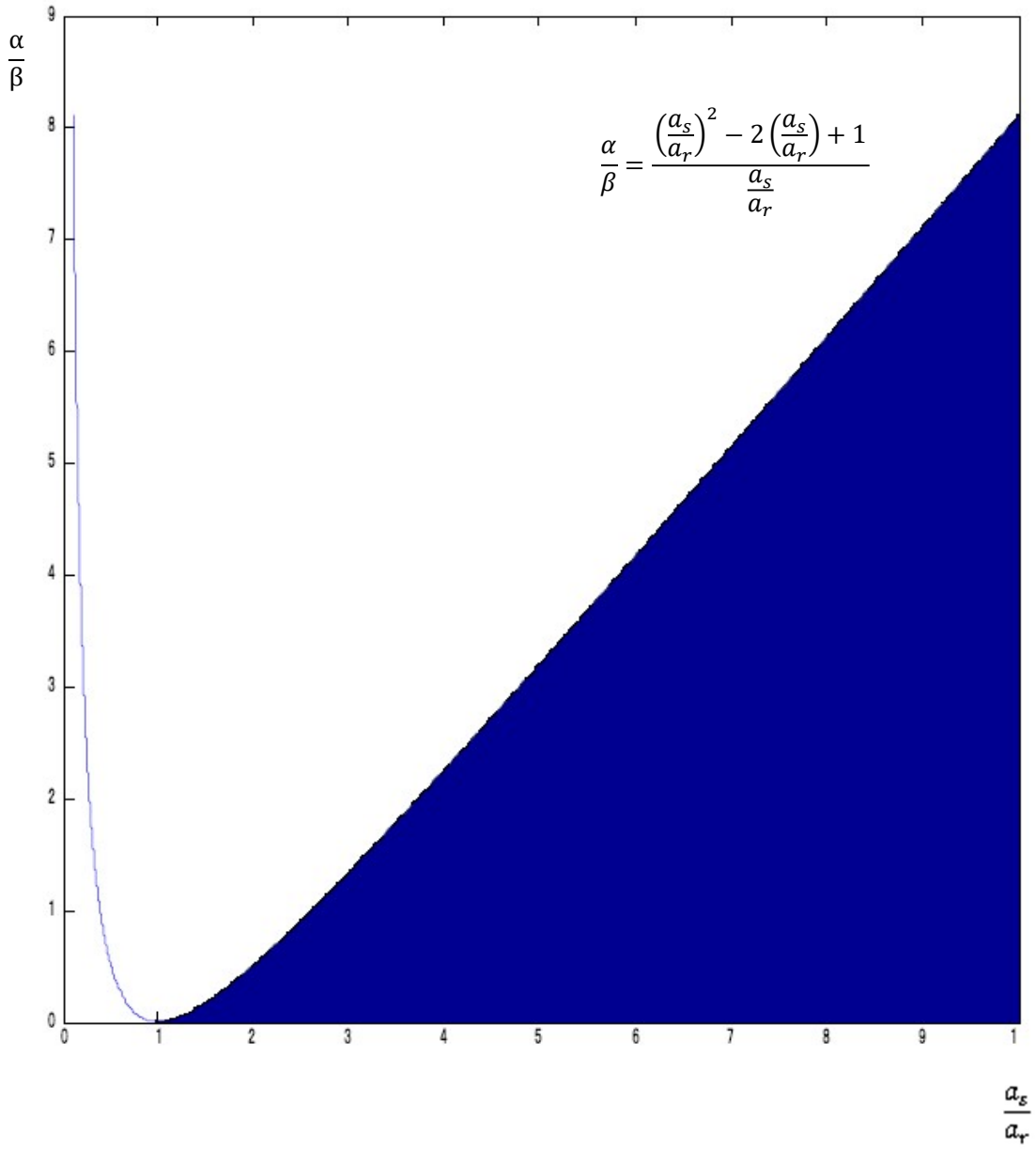
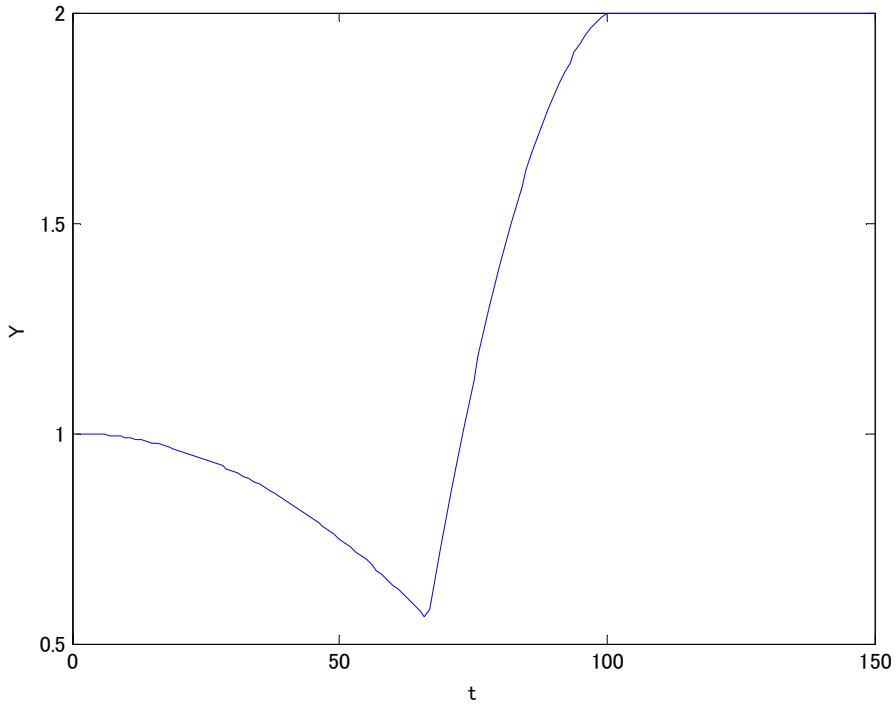
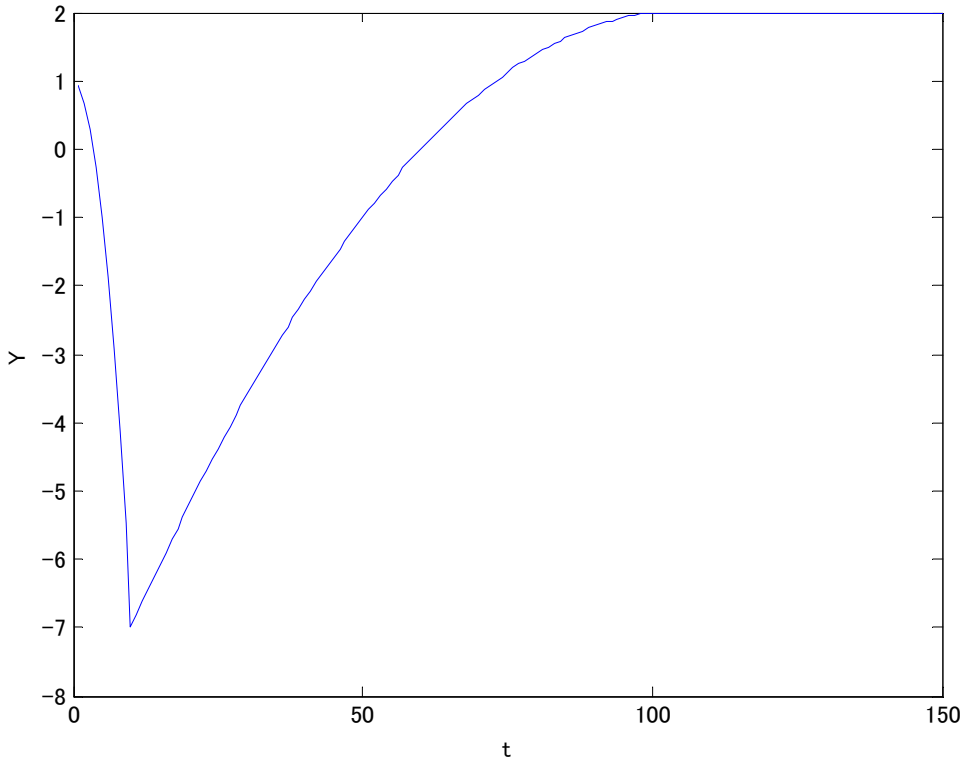


Figure 5: Simulation Results

Case 1:



Case 2:



Case 3:

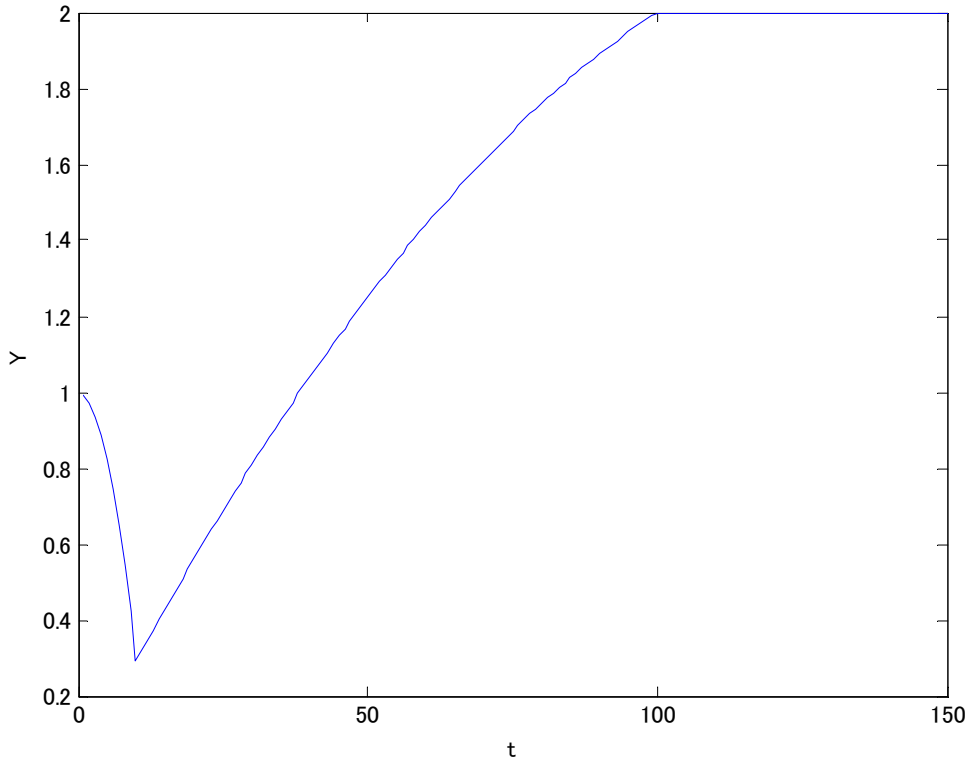


Figure 6: Transition of Coordination Indices

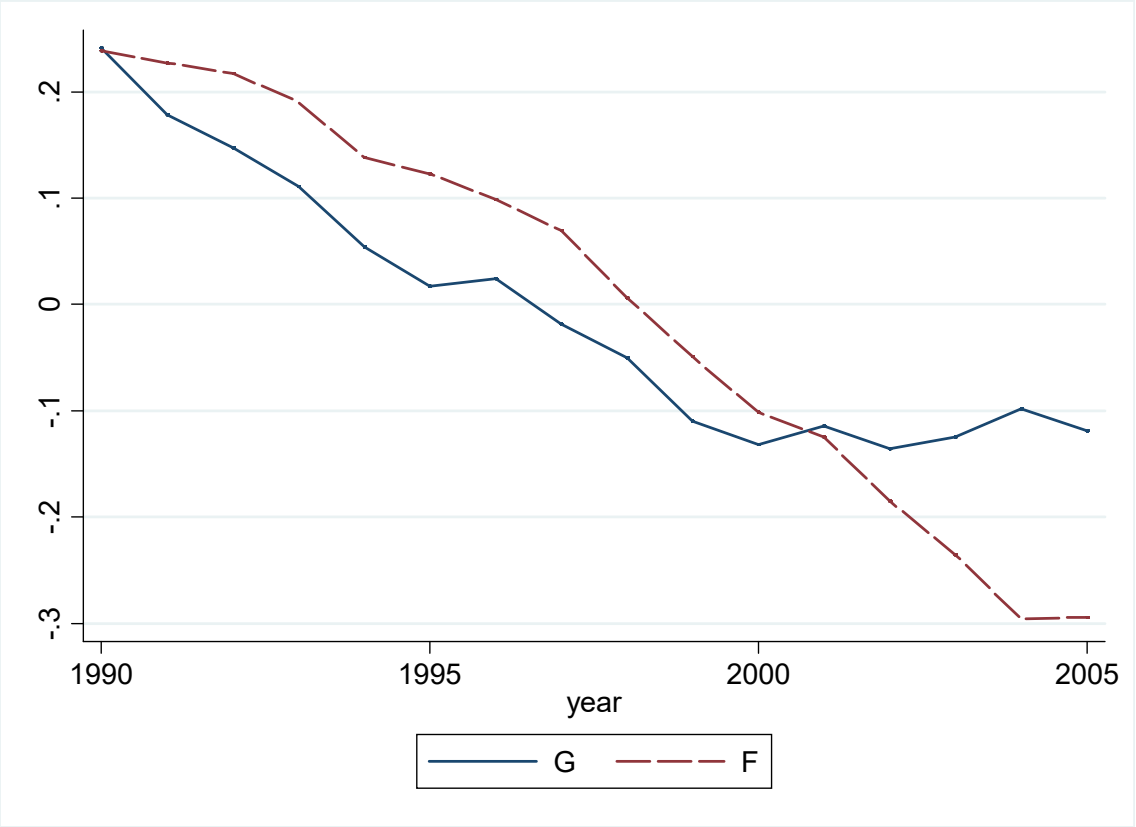


Figure 7: Simulation results

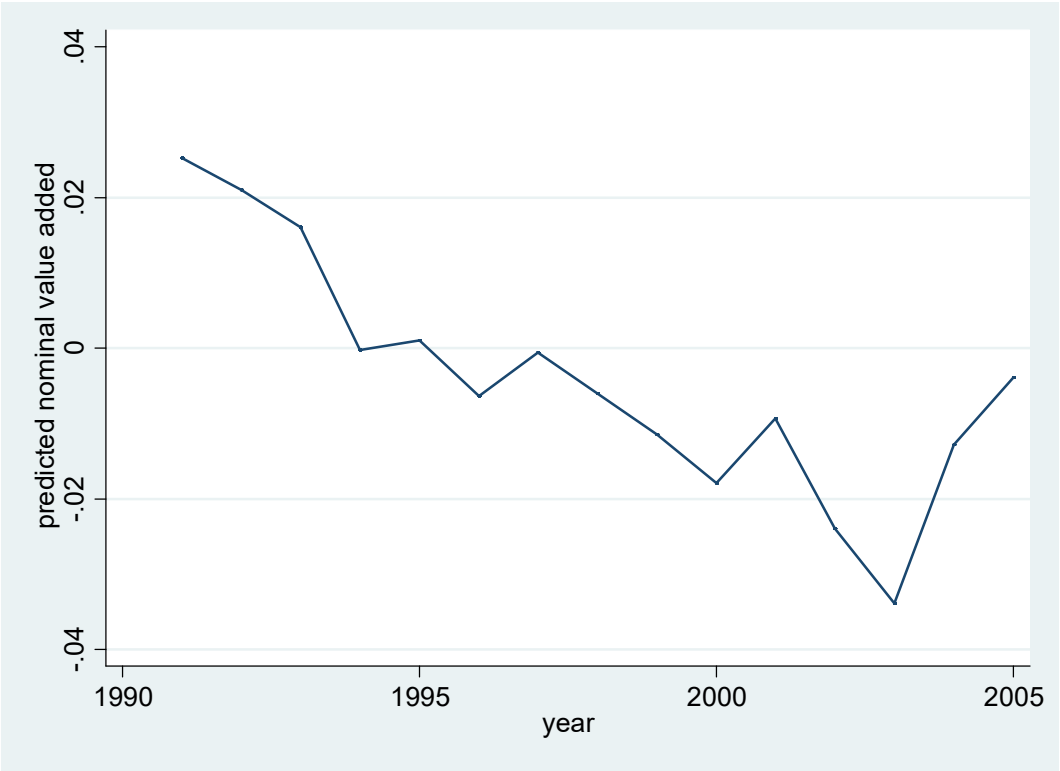


Table 1. Coordination Indices

Index		Variables
$F_{i,t}$	$\mathrm{Krt}_{i,t}$	*Keiretsu* ratio (the ratio of firms affiliated in major *keiretsu*)
	$\mathrm{Pde}_{i,t}$	Private debt to equity ratio
	$\mathrm{Csh}_{i,t}$	Cross shareholding ratio (the ratio of mutually held shares by two firms)
	$\mathrm{Ncm}_{i,t}$	Non-capital market finance ratio
$G_{i,t}$	$\mathrm{Exb}_{i,t}$	Number of ex-bureaucrats ("*amakudari*" bureaucrats)
	$\mathrm{Pdn}_{i,t}$	Amount of political donation
	$\mathrm{Tab}_{i,t}$	Budget size of trade association
	$\mathrm{Reg}_{i,t}$	Ratio of firms under government regulation

Table 2 : Estimation results for Regression (19)

VARIABLES	(1)	(2)	(3)	(4)
Loss of Institutional Complementarities (IC_{it})	-0.196***	-0.196***	-0.199***	-0.199***
	(0.0243)	(0.0243)	(0.0251)	(0.0251)
Labor ($L_{it} - L_{i1990}$)	0.0554***	0.0552***	0.0552***	0.0550***
	(0.00712)	(0.00717)	(0.00726)	(0.00732)
Capital ($K_{it} - K_{i1990}$)	0.0327***	0.0329***	0.0320***	0.0322***
	(0.00747)	(0.00753)	(0.00773)	(0.00778)
Large enterprise (LE_{it})		-0.00391		-0.00452
		(0.0199)		(0.0206)
Domestic sale (DS_{it})			-0.00285	-0.00300
			(0.00891)	(0.00895)
Constant	0.0619**	0.0616**	0.0611**	0.0609**
	(0.0280)	(0.0282)	(0.0292)	(0.0294)
Observations	838	838	808	808
Number of industry	57	57	55	55
R-squared	0.201	0.200	0.196	0.195

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 3: Estimation results for Regression (20)

VARIABLES	(1)	(2)	(3)	(4)
Loss of Institutional Complementarities (IC_{it})	-0.000485	0.00173	0.00793	0.0107
All Industries	(0.0377)	(0.0378)	(0.0400)	(0.0401)
Loss of Institutional Complementarities (D_1*IC_{it})	-0.300***	-0.304***	-0.308***	-0.313***
Strong Institutional Complementarities	(0.0450)	(0.0453)	(0.0471)	(0.0475)
Labor ($L_{it} - L_{i1990}$)	0.0597***	0.0591***	0.0599***	0.0592***
	(0.00697)	(0.00701)	(0.00712)	(0.00716)
Capital ($K_{it} - K_{i1990}$)	0.0400***	0.0409***	0.0395***	0.0404***
	(0.00737)	(0.00744)	(0.00763)	(0.00768)
Large enterprise (LE_{it})		-0.0175		-0.0191
		(0.0194)		(0.0202)
Domestic sale (DS_{it})			-0.000243	-0.000882
			(0.00870)	(0.00873)
Constant	0.0437	0.0423	0.0432	0.0420
	(0.0273)	(0.0276)	(0.0285)	(0.0288)
Observations	838	838	808	808
Number of industry	57	57	55	55
R-squared	0.247	0.248	0.242	0.244

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 4 : Estimation results for Regression (21)

VARIABLES	(1)	(2)	(3)	(4)
Loss of Institutional Complementarities (IC_{it}^{all})	-0.0714***	-0.0713***	-0.0716***	-0.0715***
Standard Error of All Institutional Vars.	(0.0205)	(0.0205)	(0.0210)	(0.0210)
Labor ($L_{it} - L_{i1990}$)	0.0630***	0.0630***	0.0629***	0.0628***
	(0.00751)	(0.00757)	(0.00766)	(0.00772)
Capital ($K_{it} - K_{i1990}$)	0.0312***	0.0312***	0.0301***	0.0302***
	(0.00786)	(0.00793)	(0.00813)	(0.00818)
Large enterprise (LE_{it})		-0.000640		-0.00188
		(0.0207)		(0.0215)
Domestic sale (DS_{it})			-0.00360	-0.00366
			(0.00920)	(0.00924)
Constant	0.0439	0.0438	0.0431	0.0430
	(0.0302)	(0.0305)	(0.0316)	(0.0318)
Observations	838	838	808	808
Number of industry	57	57	55	55
R-squared	0.125	0.125	0.121	0.121

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Reference

Acemoglu, D., J. Robinson, and T. Verdier. 2012. "Can't We All Be More Like Scandinavians? Asymmetric Growth and Institutions in an Interdependent World." *NBER Working Paper.* No. 28441.

Aoki, M. 1990. "Towards an economic model of the Japanese firm." *Journal of Economic Literature*. 28:1-27.

_____. 1995/2000. *Keizai Sisutemu no Shinka to Tagensei.* Tokyo: Toyokeizai Shinposha. Translated into English by S. Gehrig as *Information*, *Corporate Governance and Institutional Diversity: Competitiveness in Japan, US and Transition Economies*. Oxford: Oxford University Press.

_____. 2001. *Toward Comparative Institutional Analysis.* Cambridge: MIT Press.

_____. 2010. *Corporations in Evolving Diversity: Cognition, Governance and Institutions* Oxford: Oxford University Press.

_____. and S. Kato. 2007. "Syakai Kagaku ha Tougou sarete-iku. [Integrating Social Science.]" *Ronza. July.* Tokyo: Asahi Shimbunsya.

Beck, T. and L. Laeven. 2006. "Institution Building and Growth in Transition Economies." *Journal of Economic Growth.* 11-2.

Berend, I. T. 2009. *From the Soviet Bloc to the European Union: The economic and social transformation of Central and Eastern Europe since 1973.* Cambridge: Cambridge University Press.

Blanchard, O. 1997. *The Economics of Transition in Eastern Europe*. Oxford: Oxford University Press.

_____. and M. Kremer. 1997. "Disorganization." *Quarterly Journal of Economics.* 112(4): pp 1091-1126.

Calvo, C. and F. Coricelli. 1992. "Stabilizing a Previously Centrally-Planned Economy: Poland 1990." *Economic Policy*. April.

Dore, R. 2000. *Stock Market Capitalism: Welfare Capitalism: Japan and Germany versus the Anglo-Saxons.* Oxford: Oxford University Press.

_____. 2011. *Kinyu ga Nottoru Sekai Keizai.*[The World Economy Seized by Finance.]. Tokyo: Chuokoron Shinsya.

Godoy, S. and J. E. Stiglitz. 2006. "Growth, Initial Conditions, Law and Speed of Privatization in Transition Countries: 11 years later." *NBER Working Paper 11992.* NBER.

Gutman. J.R. 2000. "Industrial Policy without Carrots or Sticks: Non-Coercive Administrative Guidance in Japan." PhD dissertation. University of Michigan.

Hall, P. and D. Gingerich. 2009. "Varieties of Capitalism and Institutional Complementarities in the Political Economy: An Empirical Analysis." *British Journal of Political Science*. 39:449-482.

_____, and D. Soskice. 2001. "An Introduction to Varieties of Capitalism." In P.A. Hall and D. Soskice eds, *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage.* New York: Oxford University Press.

Hancke, B., M. Rhodes. and M. Thatcher. 2007. "Introduction: Beyond Varieties of

Capitalism." In Hancke, B., M. Rhodes, and M. Thatcher eds. *Beyond Varieties of Capitalism: Conflict, Contradictions and Complementarities in the European Economy.* Oxford: Oxford University Press.
Harada, Y. 1998. *Nihon no Ushinawareta Junen* [Japan's Lost Decade]. Tokyo: Nihonkeizai Shimbunsha.
Hoff, K. and J.S. Stiglitz. 2001. "Modern Economic Theory and Development." In Gerald M. Meier and Joseph E. Stiglitz eds. *Frontier of Development Economics*. New York: Oxford University Press.
Hoshi, T. and A. Kashyap. 2001. *Corporate Financing and Governance in Japan: The Road to the Future*. Cambridge: MIT Press.
Ikeo, K. 2006. *Kaihatsu-syugi no Bousou to Hoshin.* [Runaway Developmental State and its Self-protection.
_____., K. Hwang., and T. Iijima. 2001. *Nikkan Keizai-sisutemu no Hikaku Keizai Bunseki.* [Comparative Institutional Analysis of Japanese and Korean Economic System]. Tokyo: Nihon Keizai Shimbunsya.
Iwata, K. 2001. *Defure no Keizaigaku* [Economics of Deflation] Tokyo: Toyo Keizai Shimposha.
Jackson, G. and H. Miyajima. 2008. "Introduction: The Diversity and Change of Corporate Governance in Japan." In M. Aoki, G. Jackson, and H. Miyajima eds. *Corporate Governance in Japan.* Oxford: Oxford University Press.
Johnson, C. 1982. *MITI and the Japanese Miracle.* Stanford: Stanford University Press.
Kato, S. 2009. "Caught between Two Worlds: Political Change in Japan." *Global Asia*. Vol.4-1.
_____. 2011. "Institutional Complementarities, Institutional Changes, and Economic Outputs: Japanese Political Economy 1990-2005." Ph.D. dissertation. University of Michigan. *Proquest*.
_____ 2012. "Bifurcated Process of Institutional Change: An Empirical Investigation." *Mimeo*. International University of Japan.
Katz, R. 1998. *Japan: The System that Soured—The Rise and Fall of the Japanese Economic Miracle*. Armonk: M.E. Sharpe.
_____, 2010. "Japan's Fake Economic Reforms: Why Tokyo Could Use a Little More Creative Destruction?" *Foreign Policy*. From http://www.foreignpolicy.com/articles/2010/01/08/japans_economic_reforms.
Keizaichosakai eds. 2000. *Nempo Keiretsu no Kenkyu [Annual Study of Keiretsu].* Tokyo: Keizaichosakai.
Kenworthy, L. 2006. "Institutional coherence and macroeconomic performance." Socio-economic Review. 4(1): Pp. 69-91.
Kobayashi, K. and S. Kato. 2001. *Nihon Keizai no Wana: Naze Nihon ha Chouki Teimei o Nukedase naino ka.* [Trapped Economy: Why Japanese Economy Cannot Recover from Prolonged Stagnation]. Tokyo: Nihon Keizai Shimbunsha.
Kornai, J. 1994. "Transformational Recession: The main causes." *Journal of Comparative Economics.* 19(1).
Krugman, P. 1999. *The Return of Depression Economics.* New York: The Penguin Press.

Kushida, E. K. and K. Shimizu 2014. “Introduction: Syncretism in Japan’s Political Economy since the 1990.” In Kushida E. K., K. Shimizu, and J. C. Oi eds. *Syncretism: The Politics of Economic Restructuring and System Reform in Japan.* Stanford: Stanford University Press.

Lechevalier, S. 2012. “The Great Transformation of Japanese Capitalism (1980-2010).” *Japan Spotlight*. Pp. 51-53. Vol.183-3-31.

Lincoln, E.J. 2001. *Arthritic Japan: The Slow Pace of Economic Reform*. Washington DC: Brookings Institution Press.

Mahoney, J. and K. Thelen. Eds. 2010. *Explaining Institutional Change: Ambiguity, Agency, and Power.* Cambridge: Cambridge University Press.

Martin, C. J. and K. Thelen. 2007. “The State and Coordinated Capitalism: Contributions of the Public Sector to Social Solidarity in Postindustrial Societies.” *World Politics* 60: Pp. 1-36.

Miyajima, H. and F. Kuroki. 2006. “The Unwinding of Cross-Shareholding in Japan: Causes, Effects, and Implications.” In Aoki, M., G. Jackson, and H. Miyajima eds. *Corporate Governance in Japan. Institutional Change and Organizational Diversity.* Oxford: Oxford University Press.

Murakami, M. 2012. *Dokusen Kinshi Ho. 5th eds.* [Anti-monopoly Law. 5th eds.] Tokyo: Kobun-do.

Murakami, Y. 1996. *An Anticlassical Political-Economic Analysis: A Vision for the Next Century.* Stanford: Stanford University Press.

Naito, J. 2004. *Sennryakuteki Kinyu System no Sozo [The Foundation of Strategic Financial System]*. Tokyo: Chuo-koron-sya.

Nakatani, I. 1996. *Nihon Keizai no Rekishi teki Tenkan* [The Historical Transformation of the Japanese Economy]. Tokyo Toyo Keizai Shinposha.

_____. 2008. *Shihon syugi ha Naze Jikai Shitanoka.*[Why did Capitalism Self-destruted?]. Tokyo: Syuueisya

Noguchi, Y. 2008. *Sengo Nihon Keizaishi [Post WWII Japanese Economic History]*. Tokyo: Shinchosya.

_____. 1998. “The 1940 System: Japan under the Wartime Economy.” *American Economic Review, Papers and Proceedings.* 88-2: Pp. 404-407.

_____. 1995. *1940-nen Taisei: Saraba “Senji Keizai”* [The 1940 System: Farewell to the “War Economy”]. Tokyo: Toyo Keizai Shinposha.

Ogawa, K. 2009. *Ushinawareta 10-nen no Shinjitsu.* [The Reality of the Lost Decade.] Tokyo: Nihonkeizai Shimbunsya.

Ohmori. 2007. *Kinnyu System wo Kangaeru* [Thinking about the Financial System]. Tokyo: Kinnyu Zaisei Jijou Kenkyukai.

Okazaki, T., and M. Okuno-Fujiwara. 1993. “*Gendai Nihon no Keizai-system to sono Genryu*. [Japan’s Present-day Economic System and Its Historical Origins.]” In Okazaki T. and M. Okuno eds. *Gendai Nihon Keizai System no Genryu* [The Historical Origin of Contemporary Japanese Economic System.

Okimoto, D. I. 1989. *Between MITI and the Market: Japanese Industrial Policy for High Technology.* Stanford: Stanford University Press.

Ono, Y. 1998. *Keiki to Keizaiseisaku* [Business Cycle and Economic Policy]. Tokyo: Iwanami Shoten.
Pempel, T.J. 1998/2000. *Regime Shift: Comparative Dynamics of the Japanese Political Economy*. Ithaca: Cornell University Press.
_____. and K. Tsunekawa 1979. "Corporatism without Labor? The Japanese Anomary." In *Trends Towards Corporatist Intermidiation.* P. Shmitter and G. Lehmbruch eds. Pp.231-270. Beverly Hills: Sage.
Porter, M. E. 1980. "Industry Structure and Competitive Strategy: Keys to Profitability." *Financial Analysts Journal.* July-August.
_____. and A. McGahan. 1997. "How Much Does Industry Matter, Really?" *Strategic Management Journal.* 18:Pp. 15-30.
Posen, A.S. 1998. *Restoring Japan's Economic Growth*. Washington DC: Institute for International Economics.
Przeworski, A. 1985. *Capitalism and Social Democracy*. Cambridge: Cambridge University Press.
Roland, G. 2000. *Transition and Economics: Politics, Markets, and Firms.* Cambridge: MIT Press.
_____. 2004. "Understanding Institutional Change: Fast-Moving and Slow-Moving Institutions. *Studies in Comparative International Development.*
_____. and T. Verdier. 1999. "Transition and the Output Fall." *Economics of Transition.* 7(1): 1-28.
Rosenbluth, F. M. and M. F. Thies. 2010. *Japan Transformed: Political Change and Economic Restructuring.* Princeton: Princeton University Press.
Samuels, R. J. 1987. *The Business of the Japanese State: Energy Markets in Comparative and Historical Perspective*. Ithaca: Cornell University Press.
Sasada, H. 2011. *Seido Hatten to Seisaku Idea [Institutional Evolution and Policy Ideas]*. Tokyo: Bokutakusya.
Sato, S. and T. Matsuzaki. 1986. *Jiminto Seiken* [LDP Administration]. Tokyo: Chuo Koronsha.
Streeck, W. and K. Thelen. 2005. "Introduction: Institutional Change in Advanced Political Economies." In *Beyond Continuity: Institutional Change in Advanced Political Economies*. Eds. W. Streeck and K. Thelen. 1-39. Oxford: Oxford University Press.
Teranishi, J. 2003. *Nihon no Keizai System [Japanese Economic System].* Tokyo: Iwanami Shoten.
Toya, T. 2000. *The Political Economy of the Japanese Financial Big Bang: Institutional Change in Finance and Public Policy Making.* PhD book, Stanford University.
Tsuru, K. 2006. *Nihon Keizai System no Kaikaku [Reforming Japanese Economic System]*. Tokyo: Nihon Keizai Shimbunsya.
Turley, G. and P. J. Luke. 2011. *Transition Economics: Two Decades on.* London and New York: Routledge.
Vogel, S. K. 2006. *Japan Remodeled. How Government and Industry are Reforming Japanese Capitalism.* New York: Cornell University Press.
Williamson, O. E. 1996. *The Mechanism of Governance.* New York: Oxford University

Press.
Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data 2nd Edition.* Cambridge: MIT Press.
Yamori, N. and Y. Asai. 2006. "The Demise of Bank-centered Economy and Increasing Roles of Credit Rating in Japan." *Osaka University Discussion Paper* No.656.
Yanaga, M. 2012. *Legal Mind Kaisha-ho. 13th eds.* [Legal Mind.: Corporate Law 13th eds.]. Tokyo: Yuhi-kaku.
Yonekura, S. 1993. "Keizaidantai no Kinou [Functions of Trade Associations]." In Okazaki, T. and M. Okuno eds. *Gendai Nihon Keizai System no Genryu* [The Historical Origin of Contemporary Japanese Economic System]. Tokyo: Toyo Keizai Shimposya.
Yoshikawa, H. 1999. *Tenkanki no Nihon Keizai* [Japanese Economy under Transition]. Tokyo: Iwanami Shoten.

Appendix A: Proof of Proposition

1. When $0 \leq t < \frac{1}{a_s}$

By combining the above equations (1) (4) (5),

$$Y_t = \left[b_p(\{\alpha a_s a_r - \beta(a_s - a_r)^2\}t^2 + \gamma) + b_Q Q_t\right] N_t^{1-\delta} K_t^{\delta} \qquad (6).$$

Fixing N_t, K_t, and Q_t, and taking the partial derivative,

$$\frac{\partial Y_t}{\partial t} = 2\{\alpha b_p a_s a_r - \beta b_p (a_S - a_r)^2\} t \bar{N}^{1-\delta} \bar{K}^{\delta}.$$

Therefore,

$$\frac{\partial Y_t}{\partial t} < 0 \Leftrightarrow \alpha a_s a_r - \beta(a_s - a_r)^2 < 0 \qquad (7).$$

If let k= $\frac{\alpha}{\beta}$ and $t = \frac{a_s}{a_r}$, the inequality (7) can be re-written as follows:

$$\frac{\partial Y_t}{\partial t} < 0 \Leftrightarrow k\beta t {a_r}^2 - \beta(t-1)^2 {a_r}^2 < 0$$

$$\Leftrightarrow \beta {a_r}^2 \{kt - (t-1)^2\} < 0$$

$$\Leftrightarrow k < \frac{(t-1)^2}{t} \quad (\text{since } \beta {a_r}^2 > 0).$$

Therefore,

$$\frac{\partial Y_t}{\partial t} < 0 \Leftrightarrow \frac{\alpha}{\beta} < \frac{\left(\frac{a_s}{a_r}\right)^2 - 2\left(\frac{a_s}{a_r}\right) + 1}{\frac{a_s}{a_r}} \qquad (8).$$

Thus, Y_t decreases when the inequality (8) holds.

2. When $\frac{1}{a_s} \leq \mathrm{t} < \frac{1}{a_r}$

Since $S_t = 1$,

$$Y_t = \{b_P(\alpha a_R t - \beta(1 - a_R t)^2 + \gamma) + b_Q Q_t\} N_t^{1-\delta} K_t^{\delta}.$$

Fixing $\mathrm{N_t}$, $\mathrm{K_t}$, and $\mathrm{Q_t}$, and taking the partial derivative,

$$\frac{\partial Y_t}{\partial t} = a_r b_p \{\alpha + 2\beta(1 - a_r t)\} \bar{N}^{1-\delta} \bar{K}^{\delta}.$$

Therefore,

$$\frac{\partial Y_t}{\partial t} > 0 \Leftrightarrow \alpha + 2\beta(1 - a_r t) > 0$$

$$\Leftrightarrow \frac{\alpha}{\beta} - 2a_r t + 2 > 0 \qquad (9).$$

Since $\frac{1}{a_s} \leq \mathrm{t} < \frac{1}{a_r}$,

$$\frac{\alpha}{\beta} - 2a_r t + 2 > \frac{\alpha}{\beta} - 2a_r \frac{1}{a_r} + 2 = \frac{\alpha}{\beta} > 0$$

Therefore, the inequality (9) always holds and Y_t is always increasing.

3. When $\frac{1}{a_r} \leq \mathrm{t}$,

Since $S_t = 1$ and $R_t = 1$,

$$Y_t = \alpha + \gamma$$

Thus, Y_t takes a constant value of $\alpha + \gamma$.

From 1., 2., and 3., the proposition is true. ■

Appendix B: Empirical Model Specification

This appendix shows rational for using equation (19) as the main empirical model to test theoretical implications of this paper. Equation (19) can be re-written as,

$$Y_{it} - Y_{i1990} = \beta_0 + \beta_1 |(F_{it} - F_{i1990}) - (G_{it} - G_{i199}\ )| + \beta_2(K_{it} - K_{i199}\ ) + \beta_3(L_{it} - L_{i199}\ ) + \gamma X_{it} + u_{it} \quad \text{(B1)}$$

where X_{it} is controls. From equation (4), production function of a representative firm of a certain industry is specified using Cobb-Douglas function as,

$$\mathrm{Y_{it}} = A_{it}K_{it}^{\alpha}L_{it}^{\gamma}.$$

By taking the logarithm of both sides,

$$\log\ \mathrm{Y_{it}} = \log A_{it} + \alpha \log K_{it}\ + \beta \log L_{it}. \quad \text{(B2)}$$

I show in the following that through a linear approximation that one can derive equation (B1) from equation (B2). First, (B2) can be linearly approximated by taking first-order Taylor expansion, which is,

$$\log \mathrm{Y} + \frac{1}{\mathrm{Y}}(Y_{it} - Y) = \log \mathrm{A} + \frac{1}{\mathrm{A}}(A_{it} - A) + \alpha\left[\log \mathrm{K} + \frac{1}{\mathrm{K}}(K_{it} - K)\right] + \gamma\left[\log \mathrm{L} + \frac{1}{\mathrm{L}}(L_{it} - L)\right].$$

By taking the difference between the values of 1990,

$$\frac{1}{\mathrm{Y}}(Y_{it}-Y)-\frac{1}{Y}(Y_{i1990}-Y)=\left[\frac{1}{\mathrm{A}}(A_{it}-A)-\frac{1}{A}(A_{i1990}-A)\right]+\alpha\left[\frac{1}{\mathrm{K}}(K_{it}-K)-\frac{1}{K}(K_{i1990}-K)\right]+\gamma\left[\frac{1}{\mathrm{L}}(L_{it}-L)-\frac{1}{L}(L_{i1990}-L)\right].$$

It can be simplified into

$$\mathrm{Y_{it}}-Y_{i1990}=\frac{Y}{A}(A_{it}-A_{i199\ })+\frac{\alpha Y}{K}(K_{it}-K_{i1990})+\frac{\gamma Y}{L}(L_{it}-L_{i199\ }).$$

Since productivity variable A_{it} consists of institutional and non-institutional factors as shown in equation (5), to empirically test the Japanese case, one can specify $\frac{Y}{A}(A_{it}-A_{i19\ \ })$ as follows;

$$\frac{Y}{A}(A_{it}-A_{i1990})=\beta_0+\ \beta_1\ |(F_{it}-F_{i1990})-(G_{it}-G_{i1990})|+\gamma\mathrm{X_{it}}+u_{it}.$$

Let $\frac{\alpha Y}{K}=\beta_2,\frac{\beta Y}{L}=\beta_3$ and we can derive equation (B1). Thus, from Cobb-Douglas production function (B2), equation (B1) can be specified by a linear approximation.