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Abstract

This paper provides an overview of economic developments and the conduct of monetary policy in interwar Japan, while considering the relationships of these fluctuations and policies to changes in the monetary regime. To this end, monetary policies under the respective monetary regimes are discussed by using the Taylor Rule, which has recently been widely applied to evaluations of monetary policy. The analyses in this paper reveal that Japan's monetary policy from the gold standard era through the interwar period generally worked in a pro-cyclical manner in relation to inflation rates, though influenced by the choice of monetary regimes. Domestic economic stability was sacrificed in the conduct of monetary policy to attain exchange rate targets under the gold standard system before the First World War (WWI) and under the managed floating system in the 1920s. Although more effective monetary policy designed to stabilize the domestic economy might have been enabled after the departure from the gold standard, such policies were not actually carried out.

Key words: monetary policy, monetary regime, gold standard system, interwar economy, Taylor Rule

JEL classification: E52, N15

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Contents

1. Introduction

Some observers compare the stagnant economic conditions of Japan since the 1990s to the economic situation in the 1920s, where Japan experienced cycles of short-term business recovery and turbulence in the financial system. Also, some argue that an economic stimulus package promoted in the early 1930s at the initiative of Korekiyo Takahashi, the then-Finance Minister (the so-called "Takahashi Economic Policy") led the Japanese economy to relatively early recovery, and suggest that similar policies may be effectively applied to present-day Japan. However, in order to properly review the economic conditions and policy responses in the interwar period (from the 1920s through the 1930s), one should examine them from a multidimensional point of view, taking into account influences of the drastic changes in domestic and overseas economic conditions triggered by the First World War (WWI), and changes in the monetary regime such as turbulence in the gold standard system and the departure from the gold standard.

This study attempts to provide an overview of interwar economic developments and conduct of monetary policy in Japan, while devoting proper attention to the relationships of these fluctuations and operations to changes in the monetary regime. The conducts of monetary policy under the respective monetary regimes are discussed by using the Taylor Rule, which has recently been widely applied to the evaluation of monetary policies.

This paper is comprised of the following sections. Section 2 discusses economic developments during the interwar period (from the 1920s through the 1930s) in Japan, with due consideration given to past studies. Section 3 reviews Japan's monetary policy from the period of the gold standard system through the interwar period in connection with changing monetary regimes. Section 4 investigates changes in monetary policy rules in the long run based on the Taylor Rule. Finally, Section 5 presents and discusses implications of the results. In the appendices, the behavior of monetary indicators is

reviewed mainly for the interwar period, followed by a preliminary study of the characteristics of the interwar economy from the viewpoint of price fluctuations and economic growth, in connection with the interactions between structural adjustments in industries and monetary policy.

2. Economic Developments from the First World War through the Interwar Period in Japan

This section reviews basic data on long-term economic developments in Japan, mainly during the interwar period. Chart 1 indicates changes in real GNP and prices (GNP deflator) from 1886 to 1940, based on data from Ohkawa, Takamatsu, and Yamamoto [1974]. Throughout the period, real GNP grew at an average of 3.3%, and the GNP deflator increased at the average of 3.8%. In the second half of the 1910s (that is, roughly corresponding to the duration of WWI), real GNP grew by as much as 6% annually, while GNP deflator showed high inflation with an average annual rate of 19%. During this period, the standard deviation for the percentage change in the GNP deflator also showed high values (above nine), indicating drastic fluctuations in prices. In contrast, throughout the 1920s, real GNP grew modestly, at an average of 2% annually, and on average the GNP deflator change was negative. During this period, the standard deviations of the percentage changes both in real GNP and in the GNP deflator fell toward the late 1920s.[1] In the first half of the 1930s (a period characterized by the lifting of the gold embargo from 1930-1931, followed by the so-called Takahashi Economic Policy), real GNP again rose at 6%, yet the deflator remained slightly negative. In the latter half of the 1930s, growth slowed to 4%, but the deflator turned upward at an

1 Some observers emphasize the deflationary characteristics of the Japanese economy in the 1920s with a downward trend of prices; others, however, regard this period as a stabilizing process, while bearing low growth. We raise this point later in this section.

annual rate of 10%. During the 1930s, the standard deviations of the percentage changes both in real GNP and in the GNP deflator remained relatively small.

The boom experienced in and after WWI and the subsequent recurring short-term economic recoveries and depressions could be regarded as one of the greatest economic upheavals of the modern Japanese economy, in terms of both business cycles and structural changes. The Japanese economy during the interwar period has already been extensively studied.[2] In the following subsections, basic facts about the Japanese economy from WWI through the interwar period will be summarized for four periods: (1) the WWI Boom, (2) the 1920s, (3) the lifting of the gold embargo, and (4) the reinstatement of the gold embargo (departure from the gold standard), following Nakamura and Odaka [1989] and Nakamura [1989].[3]

(1) The First World War boom

WWI promoted rapid industrialization associated with the export-driven economic expansion, and also witnessed improvements in the industrial infrastructure such as electricity, railroad, marine transportation, and so on. Exports to Asia and North America increased significantly, especially of light industrial items with relatively high export competitiveness (e.g. textiles). In addition, import substitutions in heavy industry

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2 For past surveys in Japanese, refer, for example, to Nakamura and Odaka [1989] and Nakamura [1989]. There are few English-language documents on the interwar Japanese economy; Patrick [1971] has commented that the economic policy in the 1920s, preparing for the lifting of the gold embargo at the old parity, had an excessively deflationary effect on the domestic economy. On the other hand, Nakamura [1983] has stressed the growth led by domestic demand, achieving heavy industrialization, chemical industrialization, and urbanization throughout the interwar period, though he does not flatly deny deflationary pressures in this period. In terms of the economic recovery during the period of the Takahashi Economic Policy, Nanto and Takagi [1985], and Okura and Teranishi [1994] stress the effects of the increase of exports accompanying the depreciation of the yen.

3 Nakamura [1989] divides the Japanese economy from 1914 to 1936, or from the outbreak of WWI to the eve of the Sino-Japanese War, into the four phases of the WWI Boom, the deflationary period in the 1920s, the period of the worldwide Great Depression in the early 1930s, and the period of recovery and growth after 1932 or the era of the Takahashi Economic Policy.

(e.g. metals and machinery) proceeded, and some items in these areas even became export products. The industrialization process was accompanied by improvements in the industrial infrastructure such as electricity, railroad, and communication equipment. The marine transportation industry grew to support overseas trade, and the shipbuilding industry also developed to support marine transportation. During the War, world prices for both agricultural products and industrial items rose sharply, leading to a 3.5-fold increase in domestic wholesale prices from the end of 1914 through March 1920. These conditions led to prolonged economic expansion in rural areas as well as in cities. On the other hand, severe inflation depressed the real wages of laborers, triggering rice riots in August 1918, and posing a major social problem. Following a temporary business setback occurring after the end of WWI, the lifting of the gold embargo in the U.S. (June 1919) prompted a massive inflow of funds from the middle of 1919, which funds had been accumulated by current-account surplus and were converted into gold in the U.S. after June 1919. These funds supported brisk business investment including speculative inventory investments and private consumption, fueling domestic demand. Further, the economic restoration in Europe added external demand. These conditions contributed to overheating the economy. Junnosuke Inoue, then the BOJ Governor, referred to it as the "false boom."[4]

(2) The 1920s

In 1920, exports abruptly turned downward, triggering the so-called repercussive depression in March, and prices began declining after a peak in March. Clear indications of recession became noticeable, particularly in rural areas. Tsuchiya [1968]

4 Inoue referred to it as a groundless economic fever brought about by large-scale speculations centering on stock and commodity markets, using the metaphor of "burning a field in early winter by igniting a small fire that spreads rapidly in the wind." Refer to Inoue [1925] p. 28; Tanaka [1980] p. 6; and the Committee for Compiling the One-Hundred Year History of the Bank of Japan [1983a] pp. 504-510.

characterized the Japanese economy in the 1920s as in "chronic recession." Further, the Great Kanto Earthquake in September 1923 and the financial crisis from March to May 1927, among other events, triggered recurring turmoil in the financial system, to which the Bank of Japan (BOJ) responded with a series of relief loans. On the other hand, business restructurings through mergers were briskly pursued in various industries such as the electricity, railroad, spinning and fertilizer sectors. Both new establishment/capital increases and dissolution/capital reductions were at high levels in this period.[5] Growth continued in such specified fields as the machinery, metal, and chemical fields, accelerating the impetus toward heavy and chemical industrialization. As a result, changes in real GNP were positive in many years during this period and real GNP in 1930 exceeded the level in 1920 by 22%, while prices showed a declining trend in the 1920s. Urbanization accelerated along with drastic changes in the industrial structure. Based on these findings, Nakamura [1989] concluded that the Japanese economy in the 1920s should not be regarded as suffering across-the-board recession, but that it should instead be characterized by "unbalanced growth" led by domestic demand centering on investments on business capital and infrastructures. In other words, while the Japanese economy was subject to repeated short-term recoveries and recessions in the 1920s, the overall picture indicated mild economic growth, in which the growth rates in urban and rural areas differed.

On the international scene, U.S. and European countries returned to the gold standard one after another. However, as current-account deficits persisted, many observers at that time viewed the lifting of the gold embargo as premature in Japan. The Japanese government thus did not dare to do so.

Within these economic conditions, there were heated discussions on the lifting of the gold embargo among policymakers (including politicians), economists, business people,

[5] Refer to Nakamura [1989] p. 296.

academics, and the general public. The causes of economic fluctuations and proposed countermeasures drew the attention not only of policymakers and researchers, but also of the public as a whole. The wide range of economic policy debates were partly attributable to changing political and social conditions (the so-called Taisho Democracy) with the establishment of party politics, and to the emergence of new forms of media such as economic newspapers and magazines. While policy discussions in the 1920s were quite diversified, they had converged into the "debate over the lifting of the gold embargo" by the end of the 1920s, when the gold embargo was finally lifted.[6]

While a dualistic simplification may not be appropriate as the arguments changed along with economic conditions, policy arguments during this period can be roughly divided into two categories. One was the pillar of the argument which emphasizing structural reforms to maintain external competitiveness under the gold standard system, and another was emphasizing the stability of the domestic economy.[7] Those in the

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6 Concerning the debate over the lifting of the gold embargo, the Research Department, Bank of Japan [1968a], [1968c], and [1969] have prepared comprehensive lists of contemporary documents. Also refer to Tanaka [1980] pp. 104-129, Cho [1983], the Committee for Compiling the One-Hundred Year History of the Bank of Japan [1983b] pp. 126-168 and pp. 380-392, Nakamura [1978] pp. 39-46, and [1989] pp. 290-305, and Ito [1989] pp. 133-146.

7 Nakamura [1978] classifies the arguments on the lifting of the gold embargo into three types: "lifting at the old parity," "lifting at the new parity," and "opposing lifting," and comments that the argument of "lifting at the old parity" versus "opposing the lifting" in the early stages was transformed to that of "lifting at the old parity" versus "lifting at the new parity." Cho [1983] utilizes internal Finance Ministry documents to contrast "lifting at the old parity" with opposition to it in around 1924, and with "lifting at the new parity" in around 1929. Tanaka [1980] discusses "lifting at the old parity" from the standpoint of international cooperation. Ito [1989] also argues that "lifting at the old parity" policy was consistent with the interests of Western investors, as well as of the Japanese government. He pointed out that the Western investors wanted to secure stable investment sites in Japan, and that the Japanese government had strong concerns about the confidence of overseas investors for the smooth refunding of existing foreign debts in the near future. Ito [1989] also comments that "it was the depletion of specie money, which had been kept abroad, that finally paved the way toward the lifting of the gold embargo." He then emphasizes the government's concerns about external finance that is to say, specie reserve requirements, as the background of Japan's formulation of a policy of lifting the gold embargo. Refer to Tanaka [1980] p. 107, Ito [1989] pp. 134-137, pp. 147-151, and p. 213.

former position favored “the lifting of the gold embargo at the old parity” with confidence in the gold standard as an international monetary regime. They intended “to reorganize the business community” by selecting competitive companies and deflating domestic prices to the same levels as in the U.K. and the U.S. Among them, Sanji Muto, president of the Kanebo Textile Company, advocated the immediate lifting of the gold embargo as early as 1922.[8] Most of his peers in business, bureaucracy, and financial circles preferred only to prepare for the lifting of the gold embargo, to be implemented as soon as conditions were favorable. Others in the latter position argued that the lifting of the gold embargo at the old parity would have a significant deflationary impact on the domestic economy. They emphasized the stability of the domestic economy, contending that the gold embargo should not be lifted immediately, or that the embargo should be lifted at a new gold parity (i.e., a new exchange rate) with a depreciated yen reflecting price differences between the domestic and the overseas markets. Naokichi Kaneko, the head clerk of Suzuki Shoten, which went bankrupt in the financial crisis of 1927, had strongly opposed the lifting of the embargo in 1922. Tanzan Ishibashi, Kamekichi Takahashi and others, affiliated with Toyo Keizai Inc. (a prominent economic journal), began advocating the lifting of the embargo at a new parity in around 1924.

The *History of the Lifting of the Gold Embargo (1)*, reprinted by the Research Department, Bank of Japan [1968a], is regarded as originally compiled by the BOJ staff around 1932-1933. It suggests that although BOJ consistently aimed at a policy of “reorganization of the business community” geared toward lifting of the gold embargo, BOJ was, in fact, forced to adopt relief loans as its central policy instrument in order to respond to turmoil in the financial system. Under these circumstances, Junnosuke Inoue was appointed as the Governor of BOJ from 1919 to 1923 and from 1927 to 1928, and

8 Refer to Nakamura [1978] pp. 39-46.

as Finance Minister in 1923 (immediately after the Great Kanto Earthquake) and from 1929 to 1931, leading to his significant influence on financial and monetary policies. Inoue intended to develop Japan to be the hub of the international financial market in Asia, or the "London of the East." With an eye to returning to the gold standard system after sufficient preparation, he was reported to have strongly advocated the enhancement of competitiveness of domestic industries through "reorganization of the business community" as a prerequisite. And, in the end, he played a central role in lifting the gold embargo in the early 1930s.[9]

Eigo Fukai was appointed as BOJ Executive Director in the 1920s, and served as Deputy Governor and Governor during the period of the Takahashi Economic Policy. His views on monetary regimes were rather different from those expressed by Inoue. In a series of works including *A Thesis on Monetary Management* (1928) and *Recollections on Seventy Years* (1941), he expressed the belief that the gold standard system was merely one of various replaceable monetary regimes (including a controlled monetary system), its merits notwithstanding. Further, he contended that a monetary regime should be adopted flexibly in accordance with economic conditions.[10] His view of placing the gold standard system in a relative context was consistent with his evaluation of the Takahashi Economic Policy. One of his books, published in 1938 (*Monetary Policy after the Departure from the Gold Standard System*) basically supported an expansionary fiscal policy accompanied by a departure from the gold

9 In this context, the Committee for Compiling the One-Hundred Year History of the Bank of Japan [1983b] points out that Inoue was regarded as advocating prudence in lifting the gold embargo when he was appointed Finance Minister for the Hamaguchi cabinet in 1929, and states that "viewing Inoue before that as opposing the lifting of the gold embargo does not necessarily do him justice." Refer to Tanaka [1980] pp. 52-55 and pp. 114-119, and to the Committee for Compiling the One-Hundred Year History of the Bank of Japan [1983b] p. 148 and p. 381. However, Eigo Fukai points out that relief loans for the private sector, implemented by Inoue as Governor of the BOJ, delayed the structural reforms required for the lifting of the gold embargo, despite Inoue's ideal. Refer to Fukai [1941] pp. 197-199 and Nakamura [1978] pp. 67-69.

10 For example, refer to Eigo Fukai [1928] pp. 194-200 and Eigo Fukai [1941] p. 240.

standard system and underwriting of government bonds by BOJ, although he expressed fears of future inflation.[11]

(3) The period during which the gold embargo was lifted

Junnosuke Inoue took office as Finance Minister for the Hamaguchi Cabinet of the Minsei Party, which had presented a formal pledge to lift the gold embargo. He implemented an austere fiscal policy (the so-called "Inoue Economic Policy"), and finally lifted the gold embargo as of January 11, 1930. Prior to this point, stock prices at the New York Stock Exchange had plummeted in October 1929 ("Black Thursday"), triggering the Great Depression around the globe.[12] The lifting of the gold embargo amid this confusion further deteriorated the deflationary situation of the Japanese economy, with domestic wholesale prices falling by more than 30% over less than two years (from December 1929 to October 1931). Although the U.S. maintained the gold standard system until April 1933, the U.K. stopped its conversion to gold in September 1931, followed by gold embargos in Denmark, Norway, Sweden, and Switzerland, and by the introduction of foreign-exchange control in Italy and other countries. Under these circumstances, sales of yen increased in anticipation of the reinstatement of the gold embargo in Japan, accelerating the outflow of specie.

(4) After the reinstatement of the gold embargo (the departure from the gold standard system)

Korekiyo Takahashi was appointed Finance Minister for the Inukai Cabinet of the Seiyu Kai Party in December 1931, and implemented the gold embargo on the day of his appointment. The policy adopted by Takahashi early in his tenure, usually referred to as the "Takahashi Economic Policy," exceeded the normal narrow scope of fiscal policy,

11 Refer to Eigo Fukai [1938] pp. 359-364 and Cho [1983].

12 Many studies are available on the Great Depression. Refer to Friedman and Schwartz [1963], C.P. Kindleberger [1982], M.A. Bernstein [1991], P. Temin [1994], and Bernanke [2001].

and was comprised of three pillars. Those are an exchange-rate policy featuring the free depreciation of the yen, expansion of fiscal expenditures funded by government bonds underwritten by the BOJ, and lowering of interest rates. As a result, the economy recovered, accelerating the heavy and chemical industrialization that was already underway in the 1920s. Along with these measures, regulation of financial and industrial activities reinforced, gradually strengthening the aspects of a command economy.

At the first stage of the Takahashi Economic Policy, the BOJ absorbed the funds from the domestic financial market by selling underwritten government bonds to financial institutions. However, as allowances for production capacity were diminishing following the latter half of 1935, the private sector's demand for funds at the financial institutions increased, in its desire to build up capital. In this context the BOJ's operation of government bond sales for financial institutions became more and more difficult. On the advice of Fukai, Takahashi insisted on reductions in defense spending and in deficit-covering bonds during compilation of the fiscal 1936 budget, sharply opposing the wishes of the military. Takahashi was thus assassinated in the attempted coup d'état on February 26, 1936. Subsequent to this incident, government bond issues became out of control, a phenomenon regarded as a cause of the hyperinflation occurring after the Second World War.[13]

3. Monetary Policy in the Interwar Period of Japan

In this section, monetary policy in Japan during the interwar period is reviewed in connection with changing monetary regimes, which are closely linked to the issues addressed in Section 4. The policies are then discussed in relation to the so-called "rules

13 For more information on the historical background, refer to Shizume [2001] and Ide [2001].

of the game" of the gold standard, which had continued from 1897 (immediately following the Sino-Japanese War) until 1917 (the middle of WWI) and had been readopted in 1930-31. Finally, a survey is presented of the external economic conditions in which these policies were conducted.

(1) Relationship to the monetary regime

In the relationship between the choice of the monetary regime of a country and its macroeconomic policy, there exists the so-called "macroeconomic policy trilemma of an open economy."[14] The idea is that one cannot simultaneously achieve all three conditions among exchange rate stabilization, stability of the domestic economy (or monetary policy autonomy), and free flow of capital. To summarize the monetary policy in Japan during the interwar period in terms of the monetary regime, the gold standard system was in place that, prior to WWI, consisted of a fixed-rate system based on the free flow of capital. It gave priority to the stabilization of exchange rates and free flow of capital at the cost of the stability of the domestic economy. From wartime through the immediate postwar period (when the gold embargo was implemented), it had been desirable to adopt a tight monetary policy in order to stabilize the domestic economy. But in reality, a large increase in the money supply led to inflation amid significant international price increases, in accordance with the "rules of the game" of the gold standard.

In the 1920s, the government set a target of restoring the pre-war exchange rate with an eye toward lifting the gold embargo at the old parity. However, as exchange rates fluctuated in a *de facto* gold embargo, the monetary policy operated with some consideration for the stabilization of the domestic economy. In other words, although the policymakers set the target of realizing stabilization of exchange rates and free flow of capital in the long run, they sacrificed exchange rate stability in the short-term in

14 For more discussion on the trilemma of an open economy, refer to Obstfeld and Taylor [1997].

favor of stability of the domestic economy. This policy stance may be regarded as a sort of managed floating-rate system. In this regard, one observer has commented that "the BOJ was able to become a relief organization because it had effectively continued to halt the conversion of bank notes to gold since the gold embargo was introduced in 1917. Moreover, this was because the government prevented the exchange rate from falling by selling specie money despite the fact that imports continued to exceed exports while gold conversion had been halted. "[15] A number of previous studies observed that the economy was supported to some extent by monetary relaxation in the 1920s, especially in the latter half of the decade. It was also said that "while the business community spent gloomy days under threatening skies, the government and the BOJ tried to prevent major bankruptcies with loans from the Deposit Bureau and with the BOJ's Special Loans. These efforts kept overall economic conditions from suffering major setbacks, while some individual banks or companies could have faced crises."[16]

In 1930-31, Japan lifted the gold embargo and returned to the gold standard. However, Japan faced a harsh outflow of specie money due to the abandonment of the gold standard by the U.K., and implemented the gold embargo again in the end of 1931, marking the eventual departure from the gold standard to the fiat money system. In the first half of 1932, the yen was depreciated in order to give priority to stability of the domestic economy, sacrificing stabilization of exchange rates, while maintaining the free flow of capital. Later, new controls over currency and capital flow were implemented through the enforcement of the Capital Flight Prevention Law in July 1932, the Foreign Exchange Control Law in May 1933, and the Import-Exchange Bill

15 Tanaka [1980] p. 37.

16 Nakamura [1989] pp. 296-297. This view leads to the conclusion that the BOJ had become a relief organization. Ito [1989 and 2001] points out that due to disintermediation of funds, the effects of the relaxation did not necessarily spread throughout the entire economy; Ito applies the expression "abnormal financial slack" to the relaxation phase following the financial crisis of 1927. Refer to Fukai [1941] pp. 194-200, Tanaka [1980] pp. 24-37, Teranishi [1989] pp. 205-208, Ito [1989] pp. 197-215.

Control Ordinance in January 1937. In relation to the monetary regime, Japan thus entered a controlled economy phase, aiming at the stability of exchange rates and the domestic economy at the cost of free flow of capital.[17]

(2) Relationship to the "rules of the game" of the gold standard

Many studies have been conducted on the so-called "rules of the game" of the gold standard; i.e., the formulation and implementation of monetary policy under the gold standard system. For example, Amano [1980] cites two conditions for the establishment of an international gold standard system. These conditions are that the monetary authorities of each country are ready to accept unlimited sales and purchases of gold at a certain price expressed in the country's currency (gold parity), and that domestic and international gold trades can be conducted freely. If these conditions are met, he points out, exchange rates fluctuate only within a narrow range (with the lower limit at gold parity minus the import cost of gold and the upper limit at gold parity plus the export cost of gold), thus achieving a fixed exchange-rate system without governmental intervention in foreign exchange markets. Furthermore, the actual international gold standard system was managed under the "rules of the game" of the gold standard, or more specifically, under the condition that the "monetary authorities of each country increase or decrease money supply in accordance with increases or decreases in that country's gold reserve."[18]

The classical theory on the quantity of money assumes that automatic adjustment of trade balance works if each country implements the "rules of the game" of the gold standard, maintaining a commitment to a fixed exchange rate for longer periods.[19] In other words, if prices go up in Country A due to a domestic shock, gold will flow out of

17 For more information on these circumstances, refer to Ito [1989] pp. 261-278.

18 Refer to Amano [1980] p. 240.

19 This mechanism was first explained in a comprehensive manner by D. Hume and elaborated and completed in the form of a classical international trade theory by D. Ricardo. Refer to Harui [1991]

the country, with an increase in imports and a decrease in exports. This reduces the gold reserves held by the monetary authorities of the country. In response, the monetary authorities reduce currency circulation, pushing prices down, and conversely, if prices go down, the authorities increase currency, pushing prices up. From the point of view of another country (Country B), the domestic shock in Country A will affect the currency circulation of Country B through international transfers of specie money, triggered by a temporary imbalance in trade. This leads to worldwide price equality for identical commodities in the long run. If each country operates monetary policy in accordance with these "rules of the game" of the gold standard, prices in all countries around the world would remain stable, and temporary current-account imbalances would be solved easily, except in the case of major fluctuations in gold output, which would affect the worldwide currency circulation.[20]

The international gold standard system was predominant from the latter half of the 19th century to the early 20th century. But whether or not each country implemented its policy in accordance with the "rules of the game" of the gold standard has been questioned.[21] A number of studies suggest that the monetary authorities of countries did

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pp. 28-38.

20 In terms of the automatic adjustment mechanism in the gold standard system, the British Committee on Currency and Foreign Exchanges after the War (Cunliffe Committee) compiled an interim report in 1918 and a final report in 1919. They insisted that international capital movements prompted by the interest-rate policy of central banks provided automatic-adjustment functions as an alternative to the current account balance, and that the U.K. should immediately return to the gold standard system after WWI. On the other hand, the Committee on Finance and Industry (MacMillan Committee) issued its own report in 1931. Keynes and others participated in this report, stating that the automatic adjustment mechanism of the gold standard did not function in the U.K. at that time with the presence of downward rigidity of wages.

21 Refer to Bloomfield [1975] pp. 56-61, McKinnon [1994] pp. 54-57, and Harui [1991] pp. 128-134. Teranishi and Uchino [1986] undertake a positive analysis of monetary policy in Japan from 1898-1914, when the gold standard system was in effect. They pointed out that the BOJ does not seem to follow the "rules of the game" of the gold standard when one looks at numerical data. But they also indicate the need for further analyses, including analysis of the rules of implementation of monetary policy as well as of the transmission mechanisms of these policies through the markets of tangible goods, services, and assets.

not mechanically adjust currency circulation passively to respond to gold-reserve fluctuations. Rather, they might have conducted somewhat discretionary policies, changing discount rates and intervening in the gold market, as long as the gold reserve fluctuated within a certain range.

The comments of the parties concerned and official documents indicate that the BOJ actually operated on official discount rates in order to stabilize the domestic economy even under the constraints of gold reserves required under the gold standard system.[22] However, as explained later, the BOJ policy under the gold standard system did not seem to work to alleviate domestic economic fluctuations (i.e., it did not appear to be counter-cyclical). Chart 2 indicates monthly timing correlations between wholesale prices (percentage change over the previous year) and the discount-rate levels. For the period between 1899 and 1914, roughly corresponding to the period of the gold standard, the correlation coefficient was negative where the time difference was zero. Although the correlation coefficient does not suggest any cause-and-effect relationship between the variables, it is natural to assume that monetary policies during this period were conducted in consideration of targets other than price levels (e.g., the stabilization of exchange rates). Sub-section (3) in Section 3 discusses in detail the ways in which operations were focused on how to respond effectively to overseas economic conditions. Furthermore, from WWI to the post-war period (1915-1920), a negative correlation is indicated where the time difference is zero, which means that interest rates were lowered amid rising inflation rates.

In contrast, in 1922-1928, the correlation coefficient with no time difference is positive, and the discount rate marked the highest correlation five months prior to the

22 Refer to the Committee for Compiling One-Hundred Year History of the Bank of Japan [1983a] pp. 240-249 and pp. 260-276. It is also reported that the BOJ utilized not only discount-rate operations but also such means as changing screening criteria for eligible bills and changeover of bills to be subject to market operations. For more details on this issue, refer to Tanaka [1980] pp. 15-39.

inflation rate. This may suggest that the BOJ had adopted a counter-cyclical policy under the gold embargo. Further, stabilization of the domestic economy may be regarded as a policy objective, while the monetary regime was transformed from a fixed exchange-rate system into a managed floating-rate system. However, after 1932, the correlation coefficient with a zero time difference was slightly negative. In this period, the gold standard system was transformed into a controlled monetary system. In terms of the monetary regime, it may have been possible to implement a monetary policy in order to stabilize the domestic economy. However, as far as interest rates are concerned, such a policy does not seem to have been adopted.

(3) External economic environment (international correlation in prices and the state of the balance of payments)

Next, we will examine the international correlation in prices and the BOP from the gold standard period through the interwar period. We will compare wholesale prices in Japan, the U.S., and the U.K. These latter countries comprised Japan's major trade partners and also employed the gold standard system (Chart 3). Price movements in these countries did not significantly diverge from 1897 (when Japan introduced the gold standard system) to 1913 partly because of relative stability of prices in these countries. Real exchange rates—calculated by the nominal exchange rates (dollar/yen and sterling/yen) and the wholesale price figures (Chart 4)—were relatively stable during this period, compared with other periods. However, it may be noted that it was merely the fortuitous absence of any major turbulence that prevented significant divergence in price fluctuations between countries.

In 1915, the year after the outbreak of WWI, U.K. prices jumped by more than 20%, followed by accelerated price hikes in Japan and in the U.S. Prices peaked in 1920 in all three countries, then plummeted in 1921-1922. The price index (with the reference level in 1913 set as “100”), stood at 259 in Japan, at 221 in the U.S., and at 317 in the U.K. at the peak in 1920; in 1922, at 196 in Japan, at 164 in the U.K., and at 139 in the U.S.

Price fluctuations followed the same directions for the different countries; however, the magnitudes of fluctuation were different. In the first half of the 1920s, prices in Japan remained resolutely high compared to those in the U.K. and the U.S. In the meantime, the nominal exchange rate of the yen barely fluctuated against the dollar. As a result, in 1922 the yen had appreciated in real terms by about 40% to the U.S. dollar, and by 20% to the British pound compared to the level in 1913.

Toward the latter half of the 1920s, the yen depreciated slightly in nominal terms and wholesale prices declined further in Japan than in the U.K. or in the U.S., leading to real exchange rate depreciation. As of 1930, when Japan returned to the gold standard system at the old par value, the yen had appreciated by about 10% over the 1913 level against the U.S. dollar and the British pound in real terms.

After the departure from the gold standard system at the end of 1932, the yen depreciated against the U.S. dollar and the British pound by more than 40% relative to the 1913 level in nominal terms, while import prices increased. In real terms, the yen decreased by about 20% relative to the 1913 level up until 1935-36. Subsequently, the nominal exchange rate remained relatively stable, but Japanese wholesale prices rose at a higher pace than in the U.K. and the U.S., bringing the real exchange rates near levels seen in 1913.

Chart 5 indicates the developments of Japanese international accounts as fractions of GNP, showing the movements of the current, capital, and financial accounts. The financial account refers to the movements in foreign currency and gold reserves held by the monetary authorities. Until the 1920s, the current account and the capital account tended to move in opposite directions, and fluctuations in the current account were largely offset by the movements of the capital account. Thus, the short-term fluctuations of foreign currency/gold reserves remained small compared to the current-account fluctuations. Still, current-account fluctuations were not entirely offset by the capital account, and both the current account and the foreign currency/gold reserves tended to

move in the same direction[23] (with foreign currency/gold reserves increasing in periods of current-account surplus).

More specifically, in 1916-17 (during WWI), a current-account surplus of over 10% (as a fraction of GNP) was recorded. The accumulated surplus during 1915-19 amounted to ¥3 billion (or $1.5 billion). Japan, as a newly industrialized country, had expanded its production capacity to respond to rapid increases in demand during WWI. Deficits then persisted from 1920 to 1928[24]. Japan was now faced with diminishing international competitiveness due to the decline in international prices after the boom. The government compensated for the losses by applying a policy of supporting its economy by enhancing domestic demand. However, in the latter half of the 1920s, domestic prices fell at a greater pace than in the U.K. or the U.S., and the current-account deficit virtually disappeared. In 1930-1931, when the gold embargo was lifted, the capital account, which had previously served to stabilize the BOP, was driven into a significant outflow and paved the way to Japan's departure from the gold standard system, while the current account was roughly balanced.

Under these economic conditions, there appeared fervent arguments for lifting the gold embargo in the 1920s. As the real exchange rates against U.K. and U.S. currencies were returning to the levels noted prior to WWI, the lifting of the gold embargo became a viable option in the 1920s. In fact, prior to the actual lifting of the gold embargo in January 1930, the government was reported to have studied the possibility of lifting the gold embargo on three different occasions: in 1919, 1923, and 1926. However, lifting the gold embargo in the midst of continued current-account deficits would have had a deflationary effect on the domestic economy through shrinkage of the currency,

23 The exception was in 1905, when a large capital-account surplus was recorded due to foreign-bond issues by the government to finance the Russo-Japanese War, and accordingly the specie reserves (particularly those held abroad) were increased.

24 The current account deficit in 1924 was 4% (as a fraction of GNP), and the accumulated deficits until 1928 totaled ¥2.4 billion. These figures indicate that most of the current-account surplus

necessitating the enforcement of “painful reforms.” In light of the domestic economic disturbances following the repercussive depression (March 1920), the Great Kanto Earthquake (September 1923), and the financial crisis (March 1927), the government was reported to have passed up opportunities for lifting the gold embargo on each occasion.[25]

In 1932, following the lifting and reinstatement of the gold embargo in the immediately prior years, external economic conditions changed drastically. The nominal exchange rate against U.K. and U.S. currencies fell by 40-50%, exceeding the gap in inflation rates and reducing the real exchange rate, contributing greatly to Japan's economic recovery in the early stages of the Takahashi Economic Policy. Still, international trade was affected not only by exchange rates, but by numerous other factors, such as the effects of Japan's invasion of Asia, the existence of tariff/non-tariff barriers, and non-price competitiveness in various industries. In addition, increased Japanese exports, especially to Asia, provoked political backlashes abroad, partly because of the intensifying international aversion to Japan's military invasions, which paved the way for Japan's increasing isolation.

4. Analysis Based on the Taylor Rule

(1) Significance of applying the Taylor Rule to historical analyses

Studies of monetary policies from extended historical perspectives, covering the period in which the gold standard system was applied, were conducted as early as 1963, when Friedman and Schwartz discussed the relationship between money supply and economic fluctuations in the U.S. In Japan, Asakura and Nishiyama [1974], Fujino [1994], and

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accumulated during WWI dissipated into the subsequent current-account deficit.

25 Refer to Tanaka [1980] pp. 64-81 and pp. 96-103.

others have also analyzed the effects of monetary policies on the real economy based on fluctuations in the money supply. More recently, Taylor [1998] argued that past evaluations of monetary policies could be re-interpreted within the framework of the Taylor Rule. Taylor compares monetary policy rules[26] and the economic conditions in the U.S. of the following periods: (1) 1880-1914 (under the gold standard system), (2) the 1960s-70s, and (3) after 1987, (the beginning of Greenspan's tenure as chairman of the FRB). Taylor indicates that under the gold standard system during period (1), interest rates seem to have barely responded to changes in inflation rates or GDP gaps with respect to the Taylor Rule, and that price levels remained stable on average but were still quite volatile. He also notes that during period (2), interest rates became more responsive to inflation rates or GDP gaps than in the gold standard days; still, the reactions to inflation rates were smaller than predicted by the normative Taylor Rule; under these circumstances, inflation was accelerated. he then argues that compared with past policies, monetary policy in period (3) has been more responsive to increases in the inflation rate, which has contributed to stabilizing the economy. He concludes that the Federal Reserve System has drawn policy lessons from past experience.

Originally, the Taylor Rule was advocated as a normative rule to be used to derive a desirable interest rate in the implementation of monetary policy, with an eye toward stabilizing the economy.[27] Taylor [1998] further applies the rule as a means of comparing different monetary policies adopted under different monetary regimes. This analytical framework may be considered as a useful tool for analyzing monetary policies in the interwar period in terms of the transition from the gold standard to a

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26 No Federal Reserve System existed when the gold standard system was implemented in the U.S. Thus, strictly speaking, it could be doubted whether any monetary policy was implemented. On this issue, Taylor argues that interest rates fluctuate regardless of the existence of a central bank, that the Treasury Department served the function of a central bank to some extent during the period of the gold standard, and that a similar framework could be applicable to this period. Refer to Taylor [1998] pp. 324-325.

27 Refer to Taylor [1993].

controlled monetary regime.[28] Regarding Japanese monetary policy, Jinushi, Kuroki, and Miyao [2001] analyzed policy reactions in Japan based on the Taylor Rule for the period after 1975, and concluded that monetary policy became more responsive to inflation from the latter half of the 1980s to the first half of the 1990s.[29] However, there have been no studies analyzing previous periods with this framework.

(2) Formulation of the Taylor Rule

Based on Taylor [1998], this study estimates policy reactions based on the Taylor Rule, as calculated by the following formula, using data from 1886, the year after the BOJ started issuing convertible bank notes, to 1940, the year before the outbreak of the Second World War.

$$i = \pi + \alpha y + \beta (\pi - \pi^{t}) + r^{f}. \quad (1)$$

Here, "i" is the short-term money market rate (bill discount rate <average of the Tokyo Bank Assembly member banks>), "α" the inflation rate[30] (GNP deflator), and "y" the output gap (divergence rate from the GNP trend), all representing annual data.

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28 Eigo Fukai raised two instruments for monetary policy in *A Thesis on Monetary Management* (1928). They are, "expansion and contraction of bank notes with fiduciary issue" through loans and government bond operations, and interest rate policy. Further, he cites three possible monetary policy objectives: maintaining specie reserves, monetary management to stabilize prices, and alleviation of the severity of business cycles. Fukai's argument proves that a policymaker of interwar Japan regarded interest-rate operations as a viable policy instrument and saw the stability of domestic economy (in terms of prices and business conditions) as an objective of interest rate policies. Thus, it is appropriate to apply the Taylor Rule to the analysis of the implementation of policies. Refer to Fukai [1928] pp. 349-386.

29 However, Jinushi, Kuroki, and Miyao suggest that this may have destabilized the real economy. Refer to Jinushi, Kuroki, and Miyao [2001] pp. 142-150

30 While "π" should be the expected rate of inflation (implying that the expected rate of inflation should be equal to the target rate of inflation), Taylor [1993, 1998] uses realized inflation rates, the method followed here. This assumes that the expected rate of inflation equals the currently realized inflation rate.

Of these, "π" and "y" are derived from Ohkawa, Takamatsu, and Yamamoto [1974], and the Hodrick-Prescott Filter is used to calculate the GNP trend, as Taylor [1998] has done. Furthermore, "π^*" is the target inflation rate and "r^f" the equilibrium real interest rate. Formula (1) represents the following policy targets: in the long term, to make the short-term market rate equivalent to the sum of the target inflation rate and the equilibrium real interest rate; and in the short term, to bring it above long-term levels when GNP exceeds the trend or the inflation rate exceeds the target inflation rate temporarily, and conversely, to bring it below long-term levels when GNP falls below the trend or the inflation rate falls below the target inflation rate. If economic activities are more inflationary than policymakers deem desirable, interest rates should be raised above long-term target levels; if they are more deflationary, interest rates should be lowered below the target level. Here, "α" and "β" stand for the sensitivity of policy reactions in the event of divergence from the targets.

Specifically, formula (1) is transformed into

$$i = (r^f - \beta \pi^*) + (1 - \beta) + \alpha y, \quad (2)$$

to calculate the constant term of the estimate formula, ($r^f - \beta \pi^*$), as well as β and α, the parameters that indicate policy reactions to inflation rates and output gaps. Here, in the case of β>-1, it is implied that the interest rate moves in the same direction as the inflation rate; in the case of β<0, the real interest rate moves in the direction opposite of inflation rates. In the case of β>0, the interest rate moves more than is required to offset the fluctuation of the inflation rate. That is, the policy reaction is to raise the real interest rate when the inflation rate rises, and conversely, to lower the real interest rate when the inflation rate falls. In this case, a counter-cyclical policy is adopted as long as the inflation rate is regarded as a yardstick. "α" indicates the policy response to GNP gaps. As "α" approaches zero, interest rates react almost exclusively to inflation rates.

Chart 6 indicates the historical development of the output gap and the GNP deflator used in this study. output gaps show a series of swings. Most evident among these are a downturn in the first half of the 1910s (the repercussive depression after the Russo-Japanese War), an upturn in the latter half of the 1910s through the early 1920s (WWI boom), and a decline in the early 1930s (the lifting of the gold embargo). The inflation in GNP deflators indicate conspicuous increases in the latter half of the 1910s through the early 1920s (WWI boom).

(3) Results of empirical analyses and their interpretations

The estimated results are summarized in Chart 7.[31] "β" indicates a negative reaction to inflation rates and is statistically significant in all periods, indicating that policy responses had been pro-cyclical in relation to the inflation rate throughout the period covered by the estimate. Further, "α" indicates that the reaction to the output gap is positive but not significant, except for the period of the Takahashi Economic Policy and the following period (1932-1940), during which "α" is negative and significant.

To examine this point more closely, this study has conducted a rolling estimate for a selected 10-year sub-sample period,[32] to observe changes in the coefficients and statistical significance. The results are summarized in Chart 8; the shaded areas indicate significant results (10% level). The results show that "β," the inflation rate coefficient, was negative and significant for most of the sub-sample periods. But they also show that there are periods in which the coefficient is consistently not significant (where it is not possible statistically to reject the possibility that "β" equals zero) from the latter half of the 1890s to the 1900s, roughly corresponding to the period during which the gold standard system was adopted. "α," the output gap coefficient, is not significant for most

31 The estimate is made by the two-stage least-squares method, with the one-period lag of the explanatory variable as the operating variable.

32 To be more specific, estimates are iterated in one-year increments for successive ten years periods, starting with the period 1887-1896 and ending with the period 1931-1940.

of the sub-sample periods, while it is positive and significant for the periods 1912-1921, 1913-1922, and 1914-1923, and negative and significant for the periods 1930-1939 and 1931-1940.

Chart 9 summarizes the relationship between the rolling estimate results and the real GNP/GNP deflator for the corresponding 10-year sub-sample period. First, the values of the constant term ($r^f - \beta \pi^t$) vacillate between five and ten.[33] If one assumes that the real GNP trend (10-year average of annual percentage change) equals the equilibrium real interest rate (represented as "r^f"), we can derive "π^t," the target inflation rate. In this study, "π^t" is estimated to go up toward the 1900s (cir. 1898-1907) and down toward the 1910s (cir. 1910-1919), with some outlying data. Then it is flat until the first half of the 1920s (cir. 1917-1926), goes up with some fluctuations around 1930 (cir. 1925-1934), and goes down from 1931-1940.[34] On the other hand, there are no clear relationships between inflation rate and GNP-gap coefficients (β, α) with the standard deviation for the inflation rate, while the standard deviation for the inflation rate increases for the period encompassing WWI.

To examine whether policy rules were affected by monetary regime changes, dummy variables corresponding to three different periods are applied. These consist of dummies for the gold standard system (1898-1917), for the managed floating-rate system (1918-1929), and for the controlled monetary system (1932-1940) to be applied to the constant

33 Figures exceed 10 or fall short of 5 in some periods, but are statistically insignificant.

34 ($r^f - \beta \pi^t$), the constant term of the Taylor Rule, changes in accordance with fluctuations in equilibrium real interest (r^f), inflation rate coefficient (β), and the target inflation rate (π^t). From WWI to the post-war period, it is possible that target inflation rates fluctuated greatly due to significant price fluctuations worldwide. More specifically, in the 1920s, to lower domestic prices was recognized as a policy objective in preparation for a return to the gold standard system at the old par value (entailing an appreciation in exchange rates), and the target inflation rate may have been negative. On the other hand, after 1932, the target inflation rate may have risen due to the departure from the gold standard system. However, estimates obtained in this study are not necessarily consistent with these hypotheses.

term and the two coefficients of formula (2) (there are nine dummies in total) (Fig. 10)[35]. The results indicate that none of the dummy variables is significant for the constant term ($r^f - \beta \pi^t$), the inflation rate coefficient (β), or the GNP gap coefficient (α).

For reference, formula (2) was applied for the period from 1970 to 2000, using the uncollateralized overnight call rate as the interest rate variable (Chart 7 cited above). "β," representing the reaction to the inflation rate, is negative and significant (5% level). Setting aside the period of high inflation after the first oil crisis, this period is divided into a first stage (1975-1985) and a second stage (1986-2000). "β" is negative but not significant in the first stage, while it is positive and significant (at the 5% level) in the latter stage. Additionally, "α," the output gap coefficient, was not significant for the entire period.[36]

Taylor [1998] argues that in terms of stabilizing the economy policy should stipulate that the real interest rate move up as the inflation rate increases; i.e., "β>0."[37] This study indicates that "β" was consistently negative for the entire period prior to 1940. According to Taylor's argument, our study reveals that monetary policy in Japan prior to 1940 can be interpreted to be pro-cyclical in terms of its relationship to the inflation rate.

This study has also examined whether monetary policies changed over different periods by utilizing rolling estimates and dummy variables. The results of rolling estimates suggest that the value of the constant term changed over different sample

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35 Dummies cover periods other than those before 1897 (i.e., the pre-gold-standard era) and from 1930 to 1931 (when the gold embargo was lifted). In addition to the dummies above, the dummies for WWI (1914-1918) and for the lifting of the gold embargo (1930-1931) are examined, but the results are insignificant.

36 These results are consistent with the conclusions of Jinushi, Kuroki, and Miyao [2001]. They argue that monetary policies approaching pure inflation targeting were implemented in Japan from the latter half of the 1980s to the first half of the 1990s. In any event, we should not evaluate contemporary monetary policy in terms of flexibility of policy operation only with the analyses on annual data. Annual data are utilized here only to compare present and past monetary policies. For recent studies on the Taylor Rule as a policy target, refer to Kimura and Tanemura [2000].

periods; however, dummy variables for different monetary regimes were insignificant. These findings indicate that no major differences have been detected in monetary policies in terms of inflation rates and GNP gaps, despite changes in monetary regimes from the gold standard system through the managed floating rate system to the controlled monetary system.

(4) Expansion of the Taylor Rule

From WWI to the interwar period, Japan's policy operations were subject to the maintenance of gold and foreign currency reserves. Thus, policymakers may have actually considered external factors such as BOP, which have not yet been explored as explanatory variables in this study, as policy variables.[38] The expansion of the formulation of the Taylor Rule will be attempted here by adding explanatory variables accounting for external factors--namely, stock or flow BOP and overseas interest rates.

$$i = (r^f - \beta \pi^t) + (1 - \beta) + \alpha y + \delta z + \gamma i^*. \quad (3)$$

Here, "z" represents gold and foreign currency reserves (as fractions of GNP) and "i^*" represents the short-term interest rate in the U.K. (the bill discount rate in the London market). Based on the issue of the "macroeconomic policy trilemma for an open economy" discussed in Section 3. (1), the relationship between these variables and interest rates may vary between different monetary regimes. For example, under the gold standard system, which is a fixed-rate system based on free internal and external capital flows, domestic interest rates are considered to move in accordance with overseas interest rates. It is thus assumed that "γ," representing a coefficient of "i^*," is positive. If the policymakers in Japan paid proper attention to gold and foreign currency

37 Refer to Taylor [1998] pp. 325-326.

38 A discussion of optimal monetary policies in an open economy within the framework of the

reserves while conducting policies, the sign of "δ," which indicates the coefficient of the gold and foreign currency reserve changes, *z*, would be negative.

Chart 11 summarizes the estimates. The sign conditions proved to be as previously assumed for both "δ" (negative), the coefficient of gold and foreign currency reserves, and "γ" (positive), the coefficient of overseas interest rates. However, neither is statistically significant. Estimates adding dummy variables to the respective explanatory variables have demonstrated that no coefficient of the dummy variables proved significant.

Next, as indicated in the following formula, in addition to overseas interest rates, instead of gold and foreign currency reserves (representing stock data), the flow BOP (current and capital accounts) will be added to the explanatory variables.

$$i = (r^f - \beta \pi^f) + (1 - \beta) + \alpha y + \lambda x + \theta w + \gamma i^*. \quad (4)$$

Here, "*x*" represents the current account as a fraction of GNP; and "*w*" is the capital account as a fraction of GNP. The signs for "λ" [the coefficient of the current account (*x*)] and "θ" [the coefficient of the capital account (*w*)] are assumed to be negative. The results (in the previously cited Fig. 11) indicate that the sign conditions have proven to be as assumed for "λ," "θ, " and "γ, " though none was statistically significant. In addition, estimates were made for the respective explanatory variables by adding dummy variables; none of the dummy variable coefficients proved significant. These results fail to show conclusively whether external factors, such as BOP and overseas interest rates, influenced Japan's implementation of monetary policy from the period of the gold standard system through the interwar period.

Next, estimates are made by adding the one-period self-lag of explained variable (i_{-1}) to each of the above estimates.

Taylor Rule can be found, for example, in Clarida, Gali, and Gertler [2001].

$$i = (r^f - \beta \pi^t) + (1 - \beta) + \alpha y + \omega i_{-1}, \quad (5)$$

$$i = (r^f - \beta \pi^t) + (1 - \beta) + \alpha y + \delta z + \gamma i^* + \omega i_{-1}, \quad (6)$$

$$i = (r^f - \beta \pi^t) + (1 - \beta) + \alpha y + \lambda x + \theta w + \gamma i^* + \omega i_{-1}. \quad (7)$$

When policymakers attempt to maintain stability in interest rates, "ω" (the coefficient of "i_{-1}") is assumed to be positive. The results (in the previously cited Chart 11) indicate that, for all estimates, the sign conditions for the self-lag of explained variables (i_{-1}) turned out to be positive and significant, as assumed. Another estimate, made by adding a dummy variable to each explanatory variable, indicates that no coefficient of the dummy variable was significant.

More extensive investigation is required from various perspectives on the monetary policies for the periods in question. For example, while analyses in this study are based on annual data, using quarterly or monthly data may allow for more detailed analyses of policies and the mechanisms by which the effects of these policies were spread. It is also necessary to consider the effects of the transformation in monetary regimes and other economic conditions on the behavior of private-sector economic entities. In addition, analyses performed by Taylor indicate that "β<0" for the period of the gold standard system (1897-1914) as well as for the preceding period in the U.S. Although the analysis by Taylor does not cover the interwar period, new findings are expected from a comparison of the results of this study with the results of other studies on the interwar situation in the U.S., specifically during the Great Depression. Furthermore, while the Taylor Rule focuses on interest rates as a policy instrument, various policy means other than interest rates (such as special loans) were actually implemented during the interwar period covered by this study. In order to evaluate the overall effects of the

monetary policies of the time, the effects of these policies on the economy and their relationship to interest rate fluctuations should also be analyzed.

5. Concluding Remarks

Observations made in this study indicate that Japan's implementation of monetary policy from the days of the gold standard to the interwar period were generally pro-cyclical in relation to the inflation rate, though influenced by the choice of monetary regimes. With respect to latter point, this study suggests that Japanese monetary policy under the gold standard system before WWI sought to maintain exchange rate stability at the cost of the stability of the domestic economy. Then, during the 1920s, under a kind of managed floating rate system, policy operations were basically the same as those under the gold standard system, judging from the perspective of the Taylor Rule. Further, during and after the period of the Takahashi Economic Policy (following the departure from the gold standard system), monetary policy was not necessarily conducted to stabilize the domestic economy (i.e., in counter-cyclical manners), which should have been possible under the fiat money system.

The question is why the policies for stabilizing domestic economy weren't carried out, while monetary policy could have been geared to that objective after the departure from the gold standard system. More research is required to answer this question, but we may raise the issue of the difficulty of discretionary policy due to the lack of discipline or nominal anchor. Shizume [2001] has raised the point that "market discipline for fiscal policy," which had worked effectively under the gold standard system, was lost by the departure from the gold standard system. Further, no effective disciplinary mechanism was introduced in its place during the period of the Takahashi Economic Policy, which may have resulted in the subsequent hyperinflation. Since the gold standard system as a disciplinary mechanism had more direct influence on monetary policies than on fiscal policies, the above argument seems of greater

significance for the implementation of monetary policy. In Fukai [1928], Eigo Fukai has commented on the difficulty in the conduct of monetary policy under the fiat money system during a time of fervent arguments for the lifting of the gold embargo, as follows.[39]

> Proponents of the fiat money system would argue that if human intelligence enables us to conduct an effective monetary management even under the gold standard system, it should certainly be possible to rely on the same capacity to perform more discretionary monetary management under the fiat money system. However, it is generally difficult to establish adequate standards for monetary management; and even if established, it is difficult to maintain them.
>
> (…) In particular, the conduct of monetary policies under the present conditions often requires not only the discretion of the parties involved, but also the consent of the general public. From the perspective of immediate benefits, an abundant money supply seems to be the best bet both fiscally and economically; nonetheless, the supply needs to be properly controlled to avoid future setbacks. It is, however, difficult to obtain the consent of the general public simply by explaining monetary theories or standards for monetary management. An explanation that money should not be issued extravagantly because it must be backed by a certain amount of gold would immediately convince people for common-sense reasons. Because of the restrictions derived from the gold standard, money could be controlled relatively properly and safely.

Subsequent turns of events seem to have followed the course that Eigo Fukai feared; that is, monetary policies were carried out merely in response to fiscal policy

39 Fukai [1928] pp. 249-250. For a discussion of arguments on the lifting of the gold embargo, refer to 2. (2) above.

requirements, and were not "properly controlled," making "future setbacks" a reality.[40] Still, the analyses conducted in this study are not sufficient to evaluate the overall policy operations after the days of the Takahashi Economic Policy. The author thus suggests that researchers pursue deeper analyses of this matter, with due attention to cases overseas.

Future research should also include analyses of the market structures and economic systems of Japan behind the conduct of monetary policy from the period of the gold standard system to the interwar period.[41]

Appendix 1: Behavior of Monetary Indicators

This Appendix 1 surveys movements of monetary indicators from the days of the gold standard system through the interwar period. Movements of the credit multiplier (various money quantity indices/high-powered money)[42] and Marshallian *k* (inverse of velocity; M2 / nominal GNP) indicate that the M2[43] credit multiplier was on the rise from the 1890s to WWI, but that the rising trend was moderated from 1918 to 1923. After 1924, the increase accelerated. Although it temporarily subsided in the financial crisis of 1927, it resumed its upward trend by 1932. Subsequently, the trend leveled off after 1933 (Chart A-1). Factors affecting the credit multiplier may include (1) deepening financial intermediary functions (enhancing the upward trend of the credit multiplier), (2) interest rate behavior (with low interest rates, the credit multiplier will be lower if all

40 Particularly in terms of monetary policy after the days of the Takahashi Economic Policy, the policy objective of facilitating the smooth issuance of government bonds may make it difficult to raise interest rates flexibly.

41 Some preliminary observations are introduced in Appendix 2.

42 Estimated from Fujino and Teranishi [2000] and the Committee for Compiling One-Hundred Year History of the Bank of Japan [1986].

43 Total of cash currency, deposit currency, and quasi-money. Estimated from Fujino and Teranishi

other conditions remain constant, as the opportunity costs of holding cash are lower), (3) changing portfolio structures in financial institutions (e.g., a shift from lending toward holding of government bonds will lower the credit multiplier), and (4) lowered credit-creating functions of financial institutions due to credit insecurity (that is, a lowered credit multiplier), and the like. When the behavior of credit multipliers in the first half of the 1920s and the latter half of the 1930s are compared, the former indicates a slowdown of the upward trend of the credit multiplier in an environment of rising interest rates, while the latter suggests a change from upward movement to a leveling-off of the credit multiplier in an environment of falling interest rates. This point should be further analyzed, but may at least suggest that certain malfunctions in the credit-creating processes of financial institutions in the first half of the 1920s were moving toward resolution in the latter half of the 1920s. Further, the halt of the upward trend of the credit multiplier after 1933 may have resulted from behavioral changes among financial institutions, from increased holdings of government bonds, and from low interest rates.

Meanwhile, Marshallian *k* accelerated its upward trend from the 1920s to the early 1930s, relative to the 1910s.[44] but declined from 1932 to 1935. While these developments might also reflect a variety of factors, including the effects of interest rate fluctuations, it can be surmised that financial intermediary functions changed qualitatively after 1932.[45]

[2000].

44 Toward the latter half of the 1920s, the reduced opportunity costs of holding money due to lowered interest rates might have had a certain influence on Marshallian *k* (i.e., this may have been a factor pushing Marshallian *k* upward).

45 In this period, interest rates sank significantly below levels in the 1920s. While interest rates seem to have pushed Marshallian *k* up, changes in asset-management behavior at financial institutions (e.g., an intensified preference for government bonds) may have had some influence on the downturn in Marshallian *k*. For more information on these developments, refer to Shizume [2001].

Chart A-2 indicates the historical development of monthly wholesale prices and the quantity of notes issued (nominal figures). Chart A-3 indicates the timing correlation of monthly wholesale prices and the quantity of notes issued over the previous year. In order to ascertain the relationship between prices and quantity of money, it is appropriate to observe the numerical data including deposit currency. However, as no monthly data are available on deposit currency, only the relationship between quantity of notes and prices is noted here. Findings include the following: (1) there exists a high correlation between the fluctuations in wholesale prices and in quantity of notes issued for the entire period, (2) neither of the fluctuations appears to precede the other (both take place almost simultaneously) for the entire period, and (3) nevertheless, in the period before WWI, fluctuations in the quantity of notes issued preceded corresponding changes in wholesale prices by two months; from WWI to the 1920s (when Japan was hit by severe price fluctuations) both fluctuations took place almost simultaneously; and following the period of the Takahashi Economic Policy, wholesale price fluctuations preceded fluctuations in the quantity of notes by nine months. While there are many more points to be considered concerning the relationship between currency-related indices and prices, the fact that prices moved before the quantity of notes issued following the period of the Takahashi Economic Policy at least suggests the possibility that certain changes took place in the transmission mechanism of monetary policies.[46]

Appendix 2: Characteristics of the Interwar Economy in Terms of Price Fluctuations and Economic Growth

46 It should be noted that correlation coefficients explain statistical relationships between numerical data, and do not indicate any cause-and-effect relationship. Furthermore, in order to observe behavior of economic agents and changes in market structures behind these behavior, it is necessary to conduct more detailed analyses, including analyses of interest rate movements.

This Appendix 2 makes some preliminary observations, based on preceding studies, on the relationship between industrial structural adjustments[47] and monetary policies, with the goal of suggesting future directions for research.

The possibility that relief loans provided by the BOJ in the 1920s accelerated the "moral hazard" problems of banks and companies and hindered the weeding out of weaker companies has been pointed out by many researchers, including those affiliated with the BOJ at the time.[48] "As a result of efforts to suppress the advance of depression and to prevent companies from going bankrupt, the business community in the 1920s remained shrouded by weak and 'risky' banks and companies."[49] Thus, many observers have commented that monetary relaxation deserves some blame for delaying necessary industrial structural adjustments. In this regard, from a microeconomic perspective (in terms of industrial competitiveness and industrial structural changes, for example), the crucial question should be whether adjustments in resource allocation can be performed smoothly in response to changing economic environments. Okazaki and Okuno [1993] contend that the basic framework of the economic system in Japan after the Second World War was formulated in the period between the 1930s and the 1940s. Behind this view lies the observation that Japan before the 1920s had featured an Anglo-Saxon price-flexible economy.[50]

Following is a brief review of the relationship between GDP (GNP in the prewar era) gaps and inflation rates for both the interwar period and for the present, in accordance with Kitamura [2001]. Kitamura [2001] presented a framework for dynamic analyses of price fluctuations and economic growth, and classified economic development into four

47 The term "structural adjustment" often has different meanings when used by different researchers; here, it refers primarily to the enhancement of industrial competitiveness prompted by major upheavals in the external economic environment, in addition to corporate departmental adjustments, as indicated by changes in industrial structures and the like.
48 Refer to Tanaka [1980] pp. 33-37 and pp. 78-79.
49 Nakamura [1989] p.292.

phases: (1) an inflationary state characterized by the coexistence of price hikes and high growth; (2) a stagflationary state characterized by the coexistence of price hikes and an economic downturn; (3) a deflationary state characterized by the coexistence of decreasing prices and an economic downturn; and (4) a new-economy state characterized by the coexistence of decreasing prices and high growth. The results of the application of these phases to pre-war Japan (Chart A-4) reveal that in the 1920s, Japan followed the four phases from (1)to (2) to (3) to (4); in 1930-1931 (when Japan lifted the gold embargo) phase (3) appeared; and from the period of the Takahashi Economic Policy to the following Baba Economic Policy, the economy moved into phase (1).[51]

When a similar graph is drawn to compare post-war conditions in Japan with pre-war conditions, it is apparent that fluctuations along the vertical axis (prices) are extremely limited, except for the inflationary period after the first oil crisis.[52] On this issue, Yoshikawa [1992] states that "regarding the coefficients of variation for real and nominal wages, these were three to four times more flexible in the pre-war days (1905-38) than in the post-war period (1966-85). Comparing the autocorrelation coefficients reveals that the persistence of real wages was significantly enhanced after the Second World War."[53]

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50 Refer to Sato [1981].

51 While Kitamura [2001] conducts analyses in the two-dimensional framework of price fluctuation rates (vertical axis) and economic growth (horizontal axis), this study draws two-dimensional graphs of price fluctuation rates (vertical axis) and output gaps (horizontal axis) used in the Taylor Rule analyses. Still, in either case, the basic arguments are the same. The only noticeable difference may be that the use of output gaps in place of economic growth rates will make it easier to grasp the situation graphically because the horizontal axis indicates cyclical changes.

52 Behind these differences, a relationship exists between economic growth rates and labor markets, as represented by the Phillips curve, as well as between labor market and prices, as observed by Okun's law. Other factors, such as differences in employment practices and social security systems, as well as differences in the behavior of enterprises and workers, are also involved. However, these issues are beyond the scope of this study.

53 Yoshikawa [1992] pp. 156-157. Yoshikawa continues, writing as follows: "However, the

coefficients of variation for production indices are almost identical, which raises a significant question about the commonly held belief that price rigidity is the most important factor leading to quantity fluctuations." Still, in order to compare the interwar economy and the postwar economy, it is necessary to consider the differences in conditions as follows. (1) Under the international gold standard system before WWI and in the interwar period, Japan was a "small open economy" in terms of its international standing, while under the Bretton Woods System after the Second World War, Japan was allowed to restrict capital movements and was somewhat capable of protecting itself against overseas shocks and the repercussions of the international economy. (2) There are differences of scale between the shocks experienced by Japan in each period (where the major shocks included WWI and the Great Depression before the Second World War). However price-flexible an economy may be, it will not be capable of avoiding major fluctuations in production quantity, if the shocks it faces are extremely large in terms of the size of its economy.

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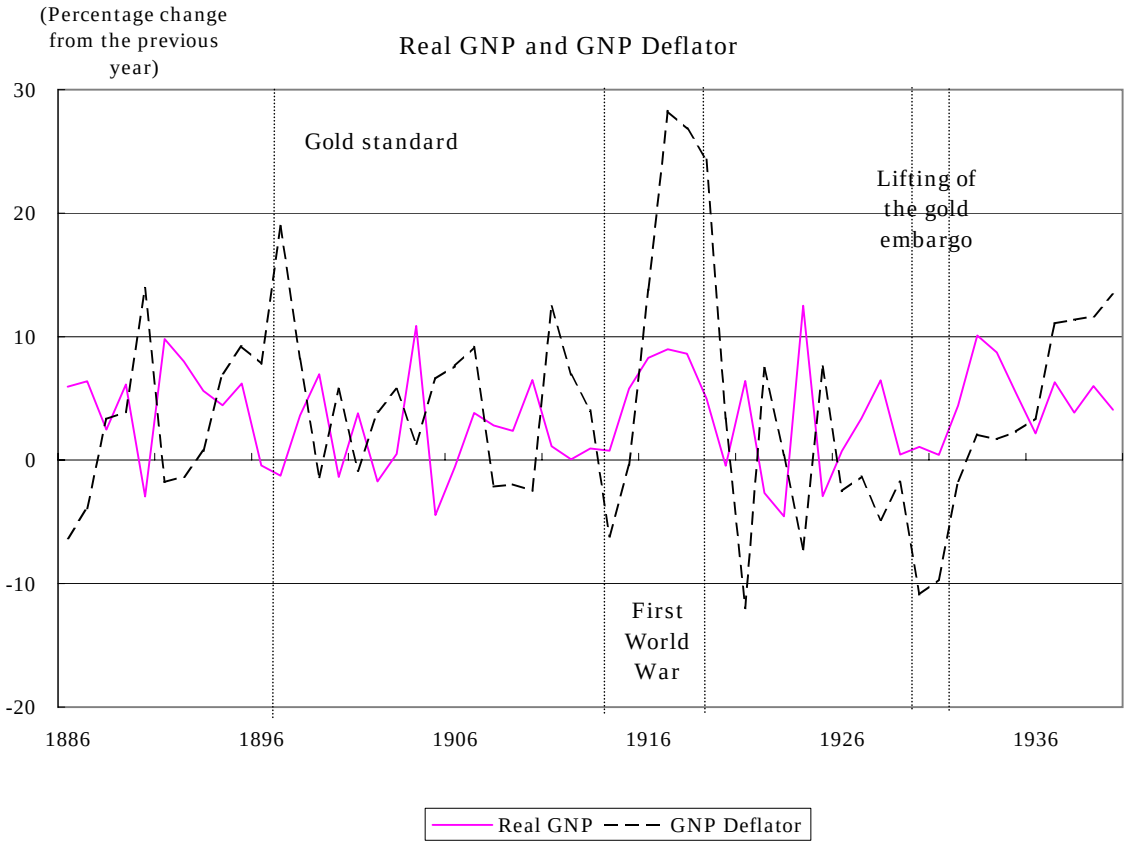
Chart 1 Nominal and Real GNP and GNP Deflator

Percentage Change over Five Years

(1 million yen; annual rate %)

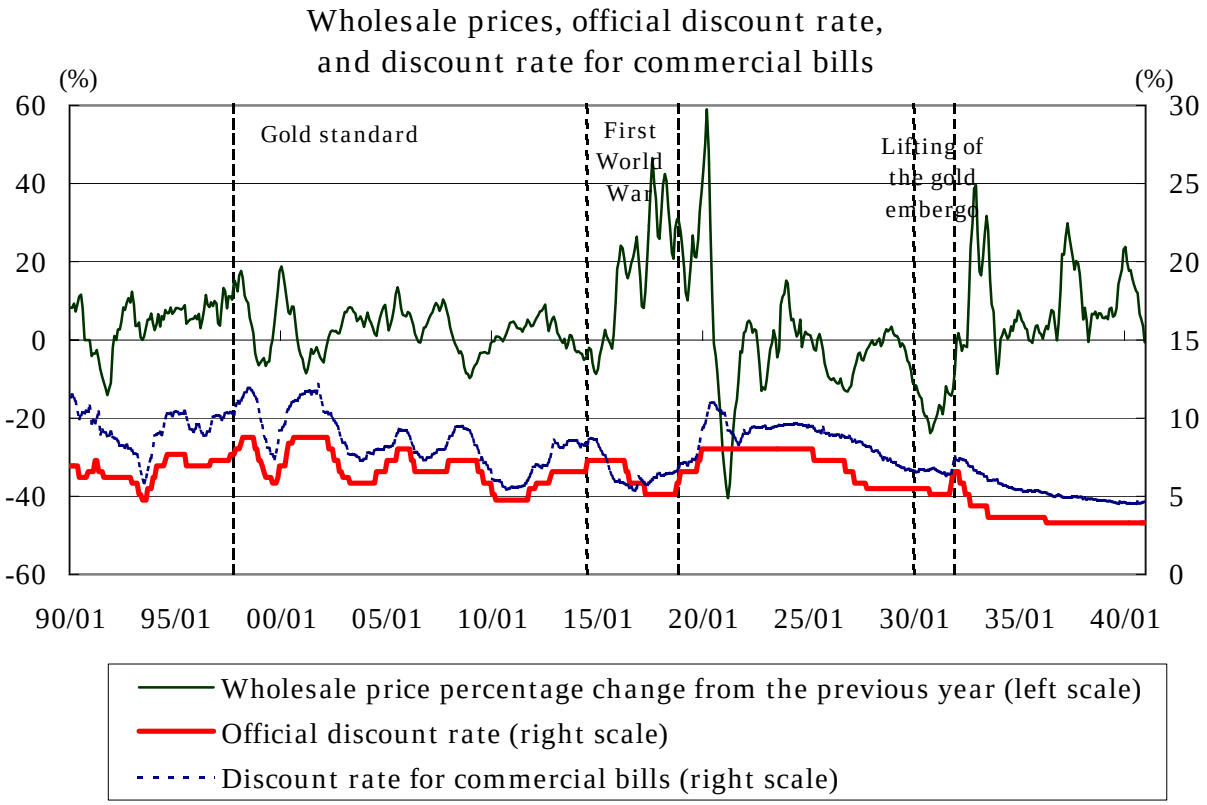
Year	Nominal GNP	Average percentage change	Standard deviation of percentage change	Real GNP	Average percentage change	Standard deviation of percentage change	GNP deflator	Average percentage change	Standard deviation of percentage change
1885	806	—	—	3,852	—	—	20.9	—	—
1886～1890	1,056	5.6	4.43	4,583	3.5	3.57	23.0	1.9	7.09
1891～1895	1,552	8.0	5.76	5,798	4.8	3.74	26.8	3.1	4.22
1896～1900	2,414	9.2	4.86	6,232	1.5	3.28	38.7	7.6	6.53
1901～1905	3,084	5.0	3.94	6,769	1.7	5.28	45.6	3.3	2.77
1906～1910	3,925	4.9	4.82	7,834	3.0	2.27	50.1	1.9	5.22
1911～1915	4,991	4.9	6.16	8,527	1.7	2.06	58.5	3.1	6.34
1916～1920	15,896	26.1	13.33	11,422	6.0	3.57	139.2	18.9	9.46
1921～1925	16,265	0.5	4.82	12,332	1.5	6.61	131.9	-1.1	7.83
1926～1930	14,671	-2.0	4.24	13,882	2.4	2.27	105.7	-4.3	3.52
1931～1935	18,298	4.5	7.78	18,366	5.8	3.40	99.6	-1.2	4.54
1936～1940	36,851	15.0	4.86	22,848	4.5	1.52	161.3	10.1	3.49
Total average		7.2	9.80		3.3	4.04		3.8	8.50

Note: The real GNP is standardized according to the 1934-36 level; the average for the 1934-36 GNP deflator is set at 100.



Source: Ohkawa, Takamatsu, and Yamamoto (1974)

Chart 2 Relationship between Prices and Intererest Rates



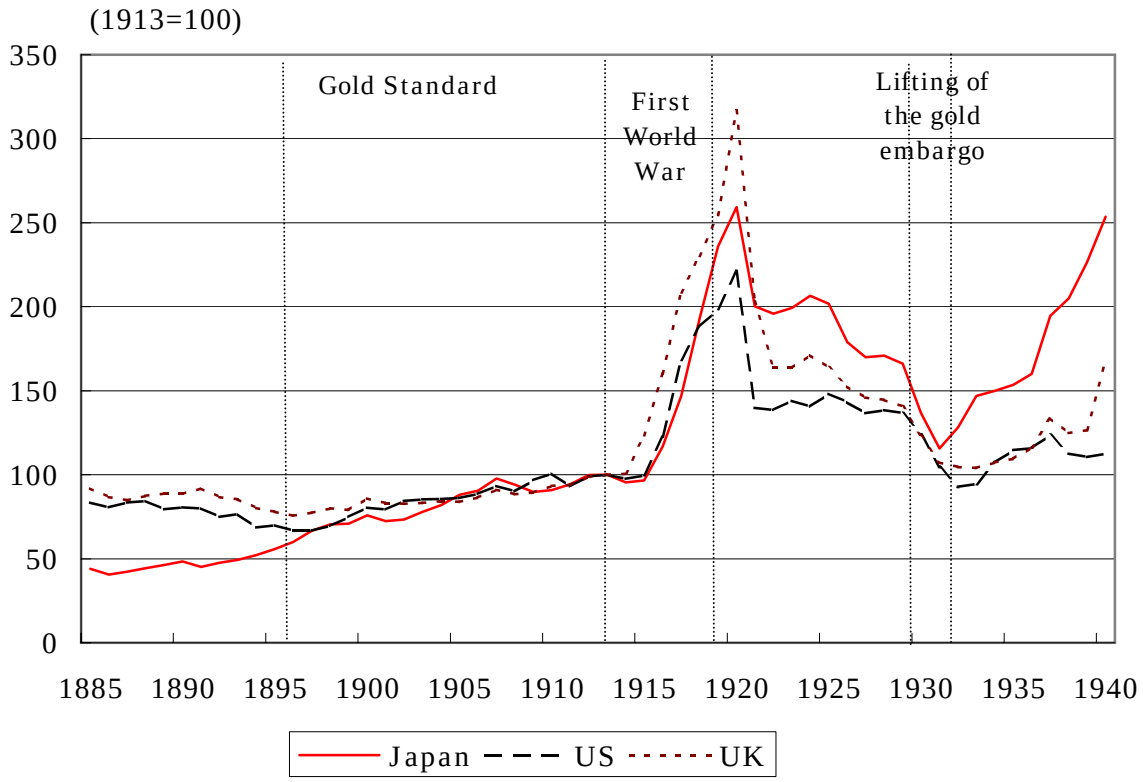
Timing correlation of wholesale-price percentage change from the previous year and official discount rate

Year	1893-1938	1893-1896	1899-1914	1916-1920	1922-1928	1930-1931	1932-1939
Preceding price							
-12	-0.055	-0.111	0.249	-0.022	0.108	-0.171	-0.593
-11	-0.065	-0.219	0.242	-0.014	0.133	-0.073	-0.583
-10	-0.076	-0.292	0.230	0.004	0.167	0.018	-0.561
-9	-0.087	-0.355	0.212	0.035	0.210	0.112	-0.536
-8	-0.094	-0.341	0.185	0.047	0.253	0.182	-0.499
-7	-0.102	-0.297	0.149	0.032	0.291	0.187	-0.437
-6	-0.109	-0.124	0.109	0.000	0.310	0.217	-0.375
-5	-0.117	0.076	0.064	-0.042	0.317	0.371	-0.333
-4	-0.126	0.202	0.010	-0.073	0.312	0.510	-0.291
-3	-0.136	0.355	-0.049	-0.107	0.289	0.513	-0.246
-2	-0.148	0.469	-0.107	-0.161	0.255	0.449	-0.191
-1	-0.160	0.553	-0.161	-0.230	0.219	0.445	-0.131
0	-0.172	0.663	-0.211	-0.315	0.173	0.531	-0.067
1	-0.185	0.655	-0.259	-0.398	0.134	0.649	-0.026
2	-0.199	0.569	-0.300	-0.473	0.095	0.693	-0.002
3	-0.210	0.506	-0.339	-0.538	0.063	0.608	0.051
4	-0.220	0.443	-0.369	-0.590	0.038	0.425	0.128
5	-0.228	0.450	-0.386	-0.626	0.021	0.285	0.185
6	-0.233	0.435	-0.391	-0.658	-0.002	0.216	0.248
7	-0.234	0.384	-0.384	-0.680	-0.022	0.163	0.329
8	-0.234	0.346	-0.365	-0.703	-0.028	0.250	0.361
9	-0.232	0.260	-0.342	-0.718	-0.021	0.436	0.358
10	-0.227	0.228	-0.309	-0.724	-0.004	0.565	0.346
11	-0.223	0.188	-0.266	-0.722	0.021	0.588	0.288
12	-0.218	0.197	-0.214	-0.704	0.058	0.549	0.205
Preceding interest rate							

Sources: Research and Statistics Department, Bank of Japan, *Statistics on Wholesale Price Indices in and after the Meiji Era*; Committee for Compiling One-Hundred Year History of the Bank of Japan, *One-Hundred Year History of the Bank of Japan* (1986); Financial Bureau, Ministry of Finance, *Finacial Item Reference, Annual Editions.*

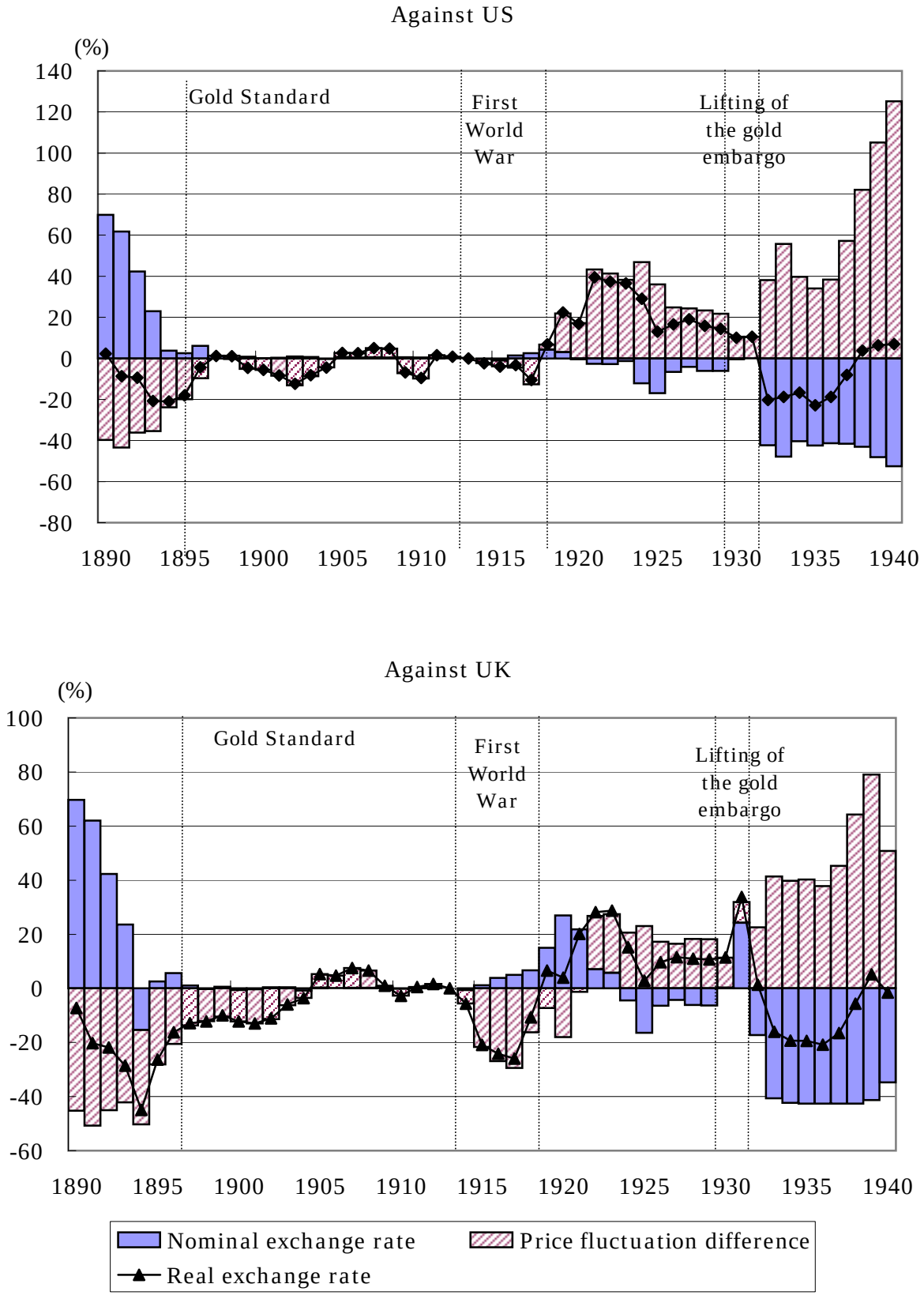
Note: Shaded area represents the highest points of correlation.

Chart 3 Wholesale-Price Indices



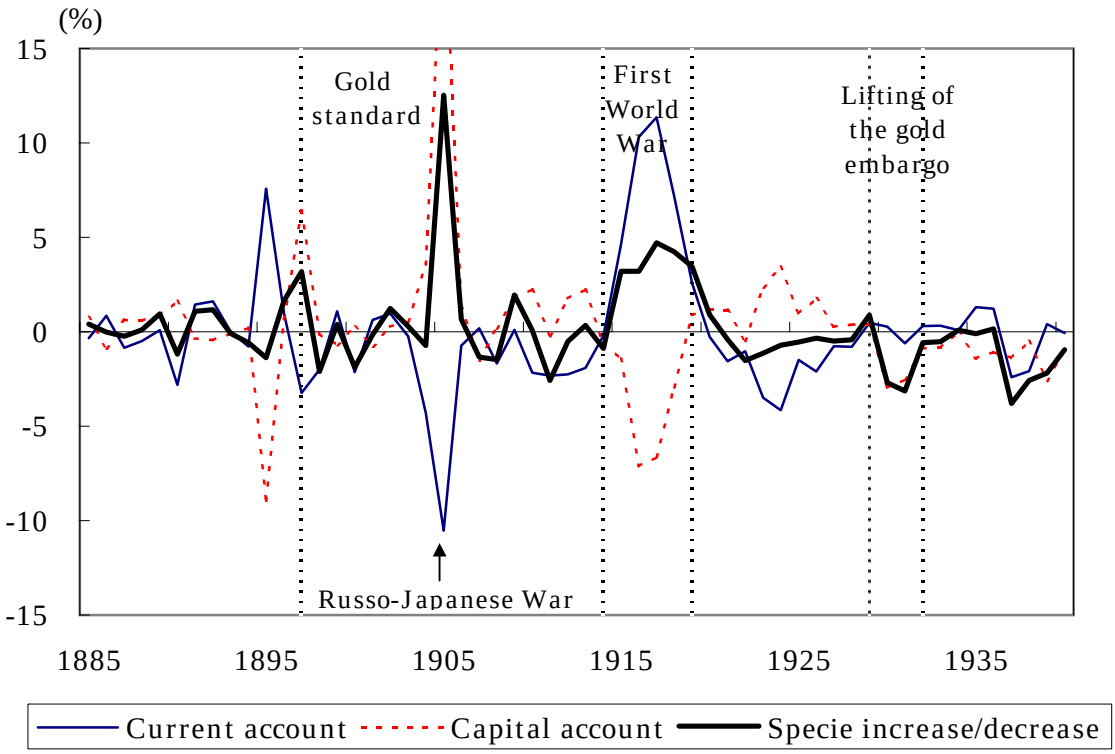
Sources: Research and Statistics Department, Bank of Japan, *Statistics on Wholesale-Price Indices in and after the Meiji Era*; U.S. Department of Commerce, Bureau of the Census, *Historical Statistics of the United States*; B. R. Mitchell, *British Historical Statistics.*

Chart 4 Real Exchange Rate (percentage change from 1913 level)



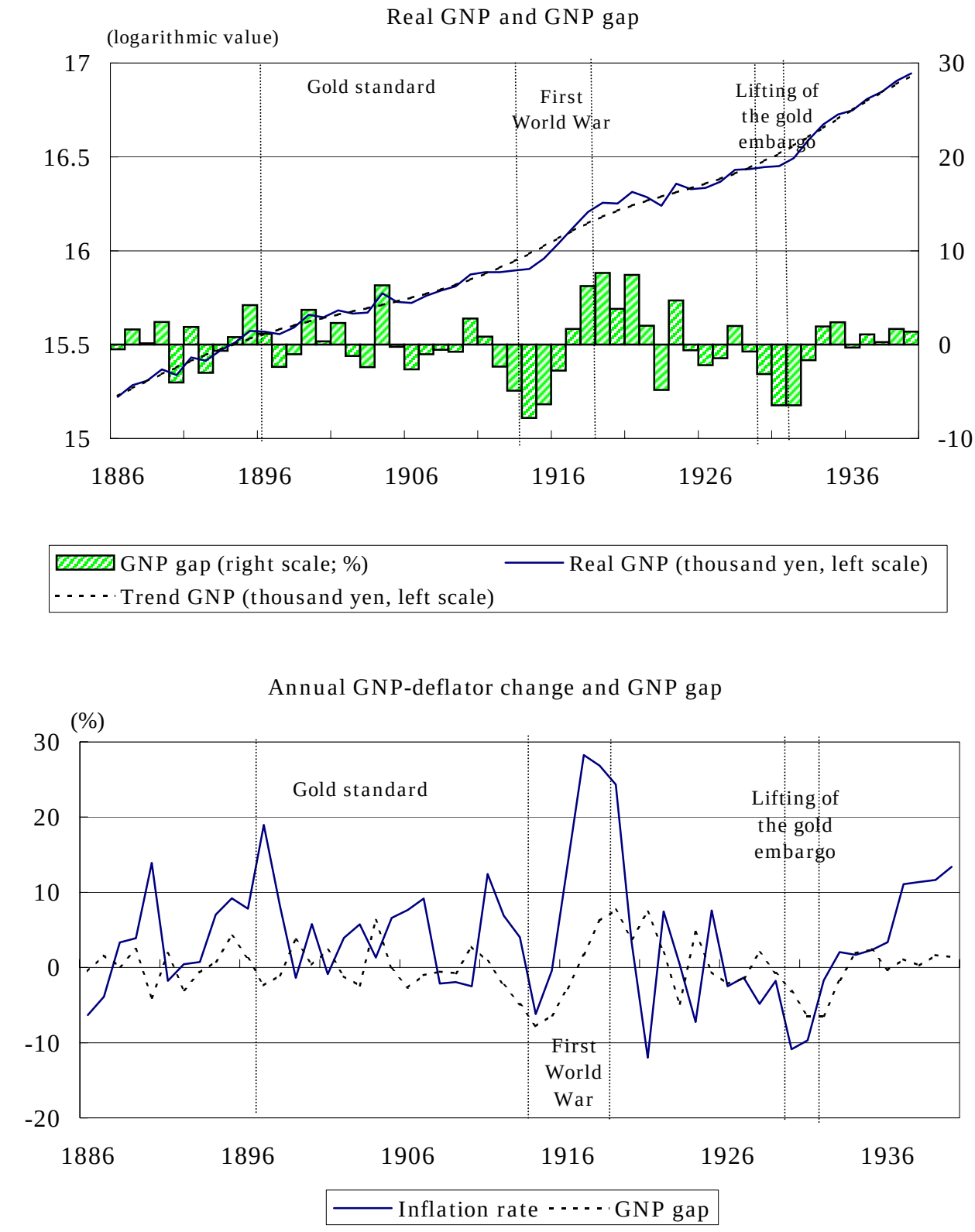
Sources: Research and Statistics Department, Bank of Japan, *Statistics on Wholesale-Price Indices in and after the Meiji Era*; U.S. Department of Commerce, *Bureau of the Census, Historical Statistics of the United States*; B. R. Mitchell, *British Historical Statistics; Asahi Shimbun, Statistical Abstract of the Japanese Ecoomy;* Financial Bureau, Ministry of Finance, *Financial Item Reference, Annual Editions.*

Chart 5 Balance of Payments (Relative to GNP)



Sources: Ohkawa, Takamatsu, and Yamamoto (1974); Ippei Yamasawa and Yuzo Yamamoto, *Long-term Economic Statistics 14: International Trade and BOP.*

Chart 6 Real GNP and GNP Deflator



Source: Ohkawa, Takamatsu, and Yamamoto (1974)

Note: GNP gap represents a divergence from trend value calculated by applying the H-P filter (λ = 100) to the data from 1885 to 1940.

Chart 7 Results of Regression Analyses

Estimate Formula: $i = (r^f - \beta\pi^t) + (1 + \beta)\pi + \alpha y$

	$r^f - \beta\pi^t$	β	α	R^2
1887-1940	8.598 <9.26>***	-1.142 <-5.68>***	0.532 <1.01>	-0.947
1887-1931	9.017 <9.18>***	-1.128 <-4.88>***	0.586 <0.92>	-1.841
1932-1940	5.598 <13.37>***	-1.037 <-16.15>***	-0.293 <-1.97>**	0.689
(Reference) 1970-2000	2.891 <4.77>***	-0.281 <-2.01>**	-0.456 <-1.51>	0.456
1975-1985	6.549 <2.00>*	-0.549 <-0.91>	1.483 <1.22>	-0.974
1986-2000	1.892 <3.76>***	1.193 <2.32>**	-0.567 <-1.54>	0.533

Sources: Ohkawa, Takamatsu, and Yamamoto (1974)
Cabinet Office, *National Accounts*

Note: 1. < > represents t-value. * represents 10 % significance; ** represents 5% significance; and *** represents 1% significance.
2. R^2 values represent figures after adjustments for degrees of freedom.
3. Estimates are made with the two-stage least-squares method, which utili the one-period lag of explanatory variables as its operating variables.
4. For the period after the Second World War, y represents the GDP gap.

Chart 8 Results of Rolling Estimates

Start year/end year for the sub-sample period		$r^f - \beta\pi^t$	β	α
1887	1896	8.718 (17.91)	-0.855 (-10.45)	0.065 (0.20)
1888	1897	8.407 (14.14)	-0.836 (-10.29)	0.152 (0.51)
1889	1898	8.031 (3.95)	-0.757 (-2.76)	1.015 (0.66)
1890	1899	7.879 (4.71)	-0.758 (-3.30)	0.823 (0.84)
1891	1899	7.914 (5.07)	-0.798 (-3.43)	0.850 (0.58)
1892	1899	8.063 (5.49)	-0.775 (-1.94)	0.639 (0.21)
1893	1899	7.206 (0.41)	-0.812 (-0.44)	2.052 (0.05)
1894	1899	8.063 (0.30)	-0.287 (-0.01)	-5.028 (-0.02)
1895	1899	8.081 (1.76)	-0.734 (-1.52)	0.064 (0.04)
1896	1899	7.409 (1.78)	-0.664 (-1.19)	0.465 (0.28)
1897	1899	7.140 (1.35)	-0.603 (-0.72)	0.308 (0.15)
1898	1899	6.801 (0.60)	-0.441 (-0.20)	-0.423 (-0.13)
1899	1899	9.517 (1.99)	-1.028 (-0.99)	-0.933 (-0.36)
1900	1899	7.516 (1.40)	-0.602 (-0.41)	-0.598 (-0.15)
1901	1899	7.374 (2.16)	-0.586 (-0.59)	-0.254 (-0.09)
1902	1899	10.136 (0.76)	-1.506 (-0.49)	-2.184 (-0.27)
1903	1899	8.487 (2.85)	-1.204 (-1.81)	-0.848 (-0.62)
1904	1899	7.807 (5.16)	-1.067 (-2.98)	-0.590 (-0.84)
1905	1899	6.613 (5.81)	-0.857 (-4.94)	-0.378 (-1.11)
1906	1899	5.131 (1.53)	-0.639 (-1.09)	-0.636 (-0.83)
1907	1899	1.165 (0.04)	0.372 (0.05)	-0.710 (-0.22)
1908	1899	6.502 (4.48)	-0.896 (-4.85)	-0.054 (-0.16)
1909	1899	6.528 (8.25)	-0.972 (-15.05)	-0.092 (-0.54)
1910	1899	6.159 (5.17)	-0.938 (-9.86)	-0.099 (-0.49)
1911	1899	7.811 (4.21)	-1.036 (-6.85)	0.172 (0.79)
1912	1899	8.190 (15.56)	-1.066 (-28.32)	0.196 (2.10)
1913	1899	8.706 (11.64)	-1.114 (-15.83)	0.245 (2.18)
1914	1899	8.869 (10.62)	-1.129 (-14.03)	0.279 (1.99)
1915	1899	8.558 (8.65)	-1.145 (-10.82)	0.380 (1.40)
1916	1899	8.873 (4.85)	-1.216 (-5.40)	0.560 (0.75)
1917	1899	8.229 (1.83)	-1.315 (-1.42)	1.074 (0.27)
1918	1899	10.730 (0.91)	-0.623 (-0.22)	-1.608 (-0.15)
1919	1899	9.217 (6.94)	-0.925 (-4.54)	-0.211 (-0.26)
1920	1899	7.587 (1.83)	-1.058 (-2.04)	1.198 (0.35)
1921	1899	9.133 (2.75)	-0.878 (-1.39)	-1.040 (-0.22)
1922	1899	6.501 (0.61)	-0.870 (-1.56)	-1.920 (-0.19)
1923	1899	9.607 (4.38)	-0.971 (-3.30)	0.773 (0.77)
1924	1899	8.538 (10.08)	-0.885 (-3.87)	0.301 (1.33)
1925	1899	8.235 (4.97)	-0.534 (-0.52)	-0.041 (-0.05)
1926	1899	7.220 (8.78)	-0.877 (-2.89)	-0.023 (-0.09)
1927	1899	6.333 (12.58)	-0.958 (-3.11)	-0.219 (-0.68)
1928	1899	5.974 (18.31)	-1.026 (-6.39)	-0.183 (-0.76)
1929	1899	5.743 (20.29)	-1.058 (-16.78)	-0.173 (-1.24)
1930	1899	5.330 (13.39)	-0.987 (-13.21)	-0.322 (-1.78)
1931	1899	5.163 (8.16)	-0.977 (-9.88)	-0.361 (-1.49)

Source: Ohkawa, Takamatsu, and Yamamoto (1974)

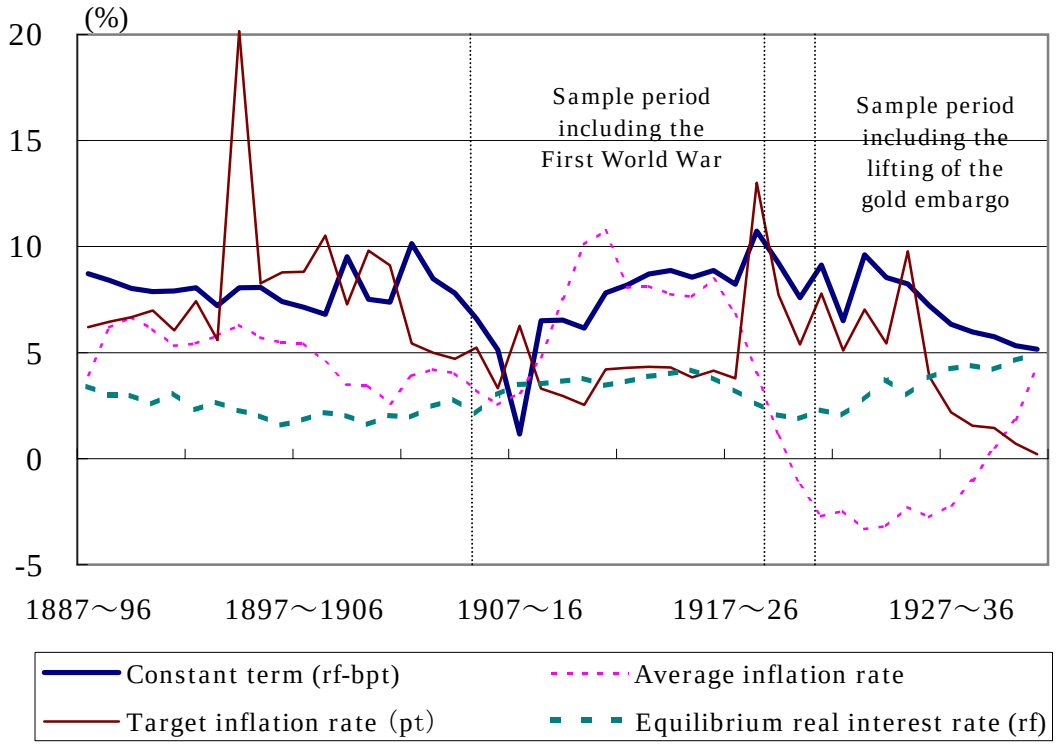
Note: 1. ( ) represents *t*-value.

2. Shaded area represents 10 % significance.

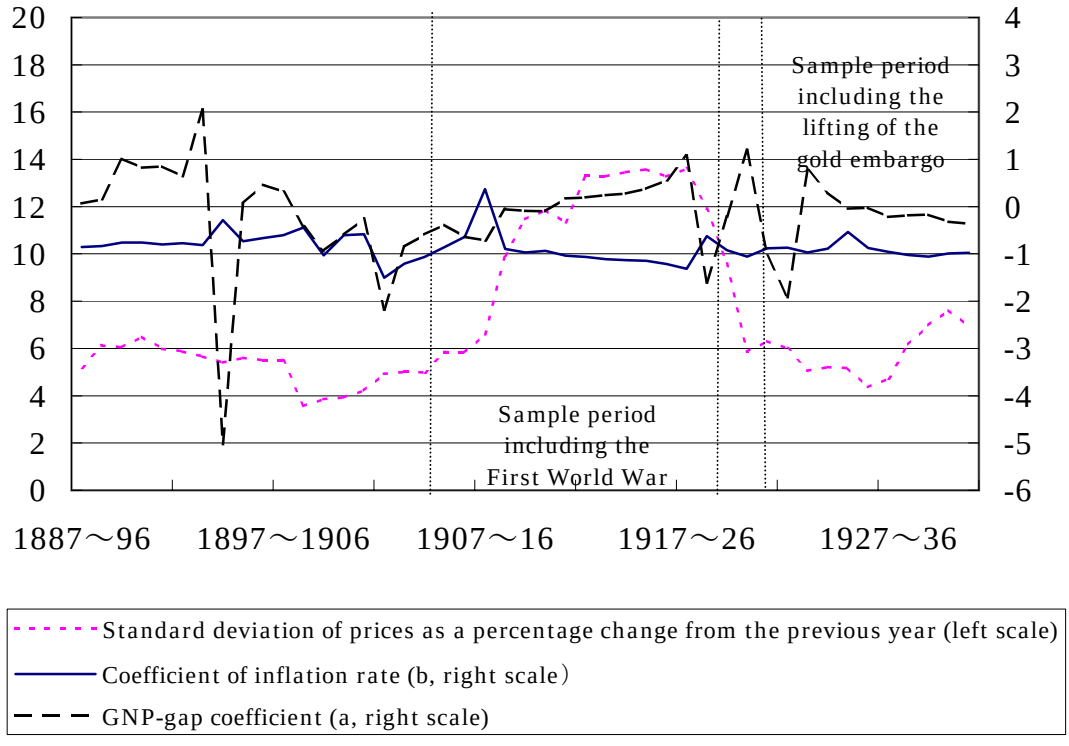
3. Estimates are made with the two-stage least-squares method that utilizes the one-period lag of explanatory variables as its operating variables.

Chart 9 Interpretation of the Taylor Rule

Constant term, target inflation rate, and avarage inflation rate, as analyzed according to the Taylor Rule



Taylor Rule coefficient and standard deviation of prices as a percentage change from the previous year



Source: Ohkawa, Takamatsu, and Yamamoto (1974)

Chart 10 Estimates, including estimates with Dummy Variables

Estimate Formula: $i = (r^f - \beta\pi^t + dummy1) + (1 + \beta + dummy2)\pi + (\alpha + dummy3)y$
(Estimate period: 1887-1940)

	$r^f - \beta\pi^t$ (dummy1)	β (dummy2)	α (dummy3)	R^2
Without dummy	8.598 <9.26>***	-1.142 <-5.68>***	0.532 <1.01>	-0.947
With dummy	9.422 <2.41>**	-0.898 <-1.49>*	1.078 <0.81>	-1.000
Dummy variable				
Gold standard system	0.490 <0.13>	-0.454 <-0.68>	-0.596 <-0.44>	
Controlled floating-rate system	-0.540 <-0.11>	-0.088 <-0.11>	-1.071 <-0.58>	
Controlled currency system	-3.448 <-0.71>	-0.169 <-0.29>	-1.493 <-1.08>	

Source: Ohkawa, Takamatsu, and Yamamoto (1974)

Note: 1. < > represents *t*-value.

2. Estimates are made with the two-stage least-squares method, which utilizes the one-period lag of explanatory variables as its operating variables.

3. Values of dummy coefficients are as follows.

   1) Gold standard system: 1 for 1898-1917, and 0 for other years.

   2) Controlled floating-rate system: 1 for 1918-1929, and 0 for other years.

   3) Controlled currency system: 1 for 1932-1940, and 0 for other years.

4. *** represents 1% significanse, ** represents 5% significance; and * represents 10 % significance. R^2 values represent figures after adjustments for degrees of freedom.

Chart 11 Expansion of the Taylor Rule

(Addition of gold/foreign currency reserves, and overseas interest rates)

Estimate Formula: $i = (r^f - \beta\pi^t) + (1+\beta)\pi + \alpha y + \delta z + \gamma i^*$

(Estimate period: 1887-1940)

$r^f - \beta\pi^t$	β	α	δ	γ	R^2
7.939 <5.03>**	-1.165 <-5.37>**	0.620 <1.03>	-0.100 <-0.48>	0.505 <1.24>	-1.313

(Addition of current account, capital account, and overseas interest rates)

Estimate Formula: $i = (r^f - \beta\pi^t) + (1+\beta)\pi + \alpha y + \lambda x + \theta w + \gamma i^*$

(Estimate period: 1887-1940)

$r^f - \beta\pi^t$	β	α	λ	θ	γ	R^2
6.294 <3.49>**	-0.965 <-5.12>**	0.061 <0.14>	-0.359 <-0.37>	-0.094 <-0.09>	0.533 <1.18>	0.016

(Addition of the lagged dependent variables)

stimate Formula: 1) $i = (r^f - \beta\pi^t) + (1+\beta)\pi + \alpha y + \omega i_{-1}$

2) $i = (r^f - \beta\pi^t) + (1+\beta)\pi + \alpha y + \delta z + \gamma i^* + \omega i_{-1}$

3) $i = (r^f - \beta\pi^t) + (1+\beta)\pi + \alpha y + \lambda x + \theta w + \gamma i^* + \omega i_{-1}$

（Estimate period: 1887-1940）

	$r^f - \beta\pi^t$	β	α	δ	λ	θ	γ	ω	R^2
1)	1.663 <0.59>	-1.019 <-6.60>**	0.291 <0.77>	—	—	—	—	0.791 <2.89>**	0.341
2)	2.080 <0.61>	-1.039 <-5.70>**	0.356 <0.77>	-0.050 <-0.39>	—	—	0.199 <0.72>	0.722 <2.13>*	0.167
3)	0.094 <0.02>	-0.966 <-5.29>**	0.284 <0.74>	—	-0.522 <-0.52>	-0.480 <-0.43>	0.292 <0.79>	0.862 <2.31>*	0.073

Sources: Ohkawa, Takamatsu, and Yamamoto (1974); Ippei Yamasawa and Yuzo Yamamoto, *Long-term Economic Statistics 14: International Trade and BOP*; B. R. Mitchell, *British Historical Statistics,* Cambridge University Press, 1988.

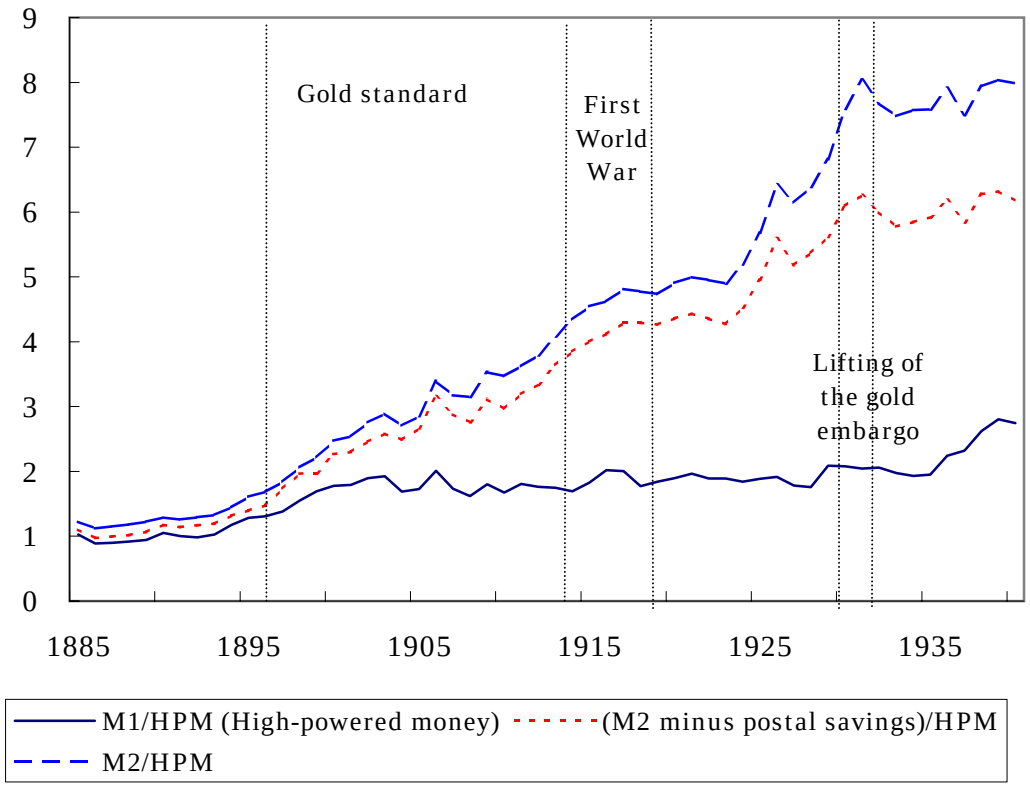
Note: 1. < > represents *t*-value. *** represents 1% significance, ** represents 5% significance.

2. R^2 values represent figures after adjustments for degrees of freedom.

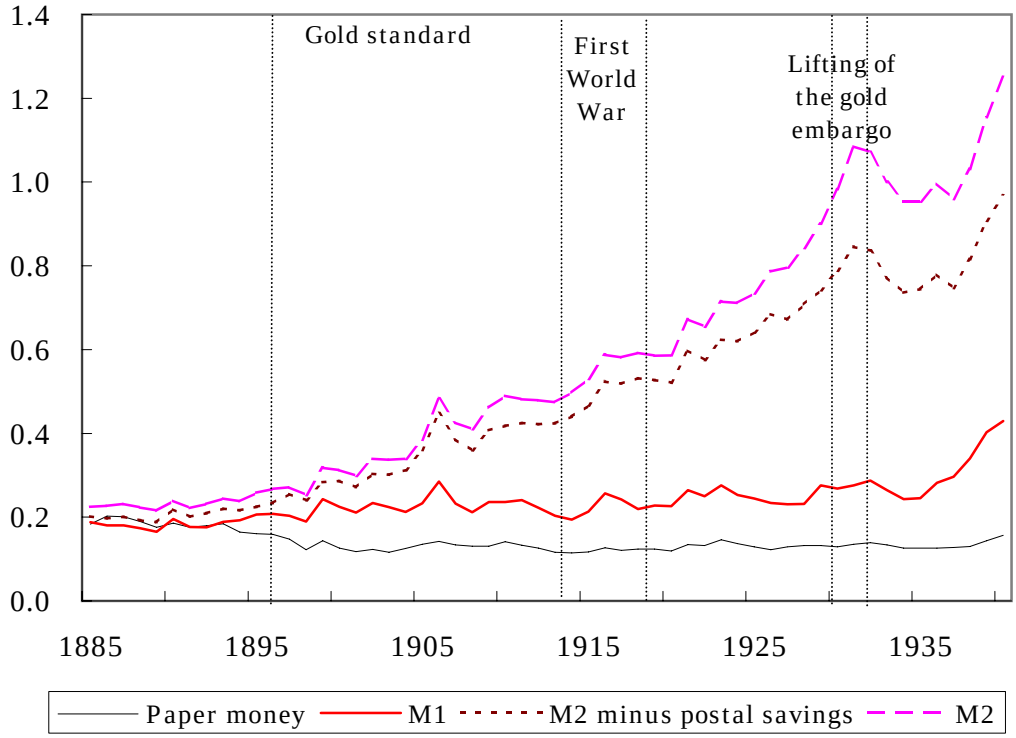
3. Estimates are made with the two-stage least-squares method, which utilizes the one-period lags of π, *y, x, w, z* among other explanatory variables, *i** (without lag), and the one-period lag of dependent variables (i), as its operating variables.

Chart A-1 Credit multiplier and Marshallian *k*

Credit multiplier



Marshallian *k*



Sources: Fujino and Teranishi (2000); Ohkawa, Takamatsu, and Yamamoto (1974)

Chart A-2 Wholesale Prices and Notes Issued

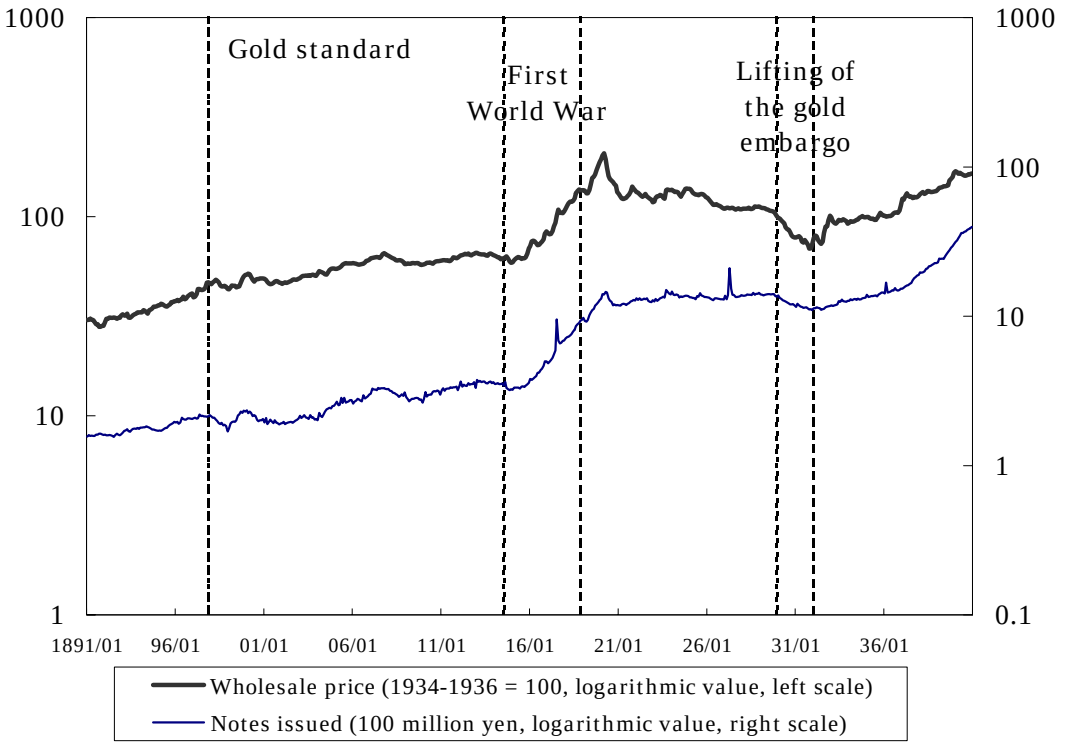


Chart A-3 Timing correlation of price and notes issued

(percentage change from the previous year)

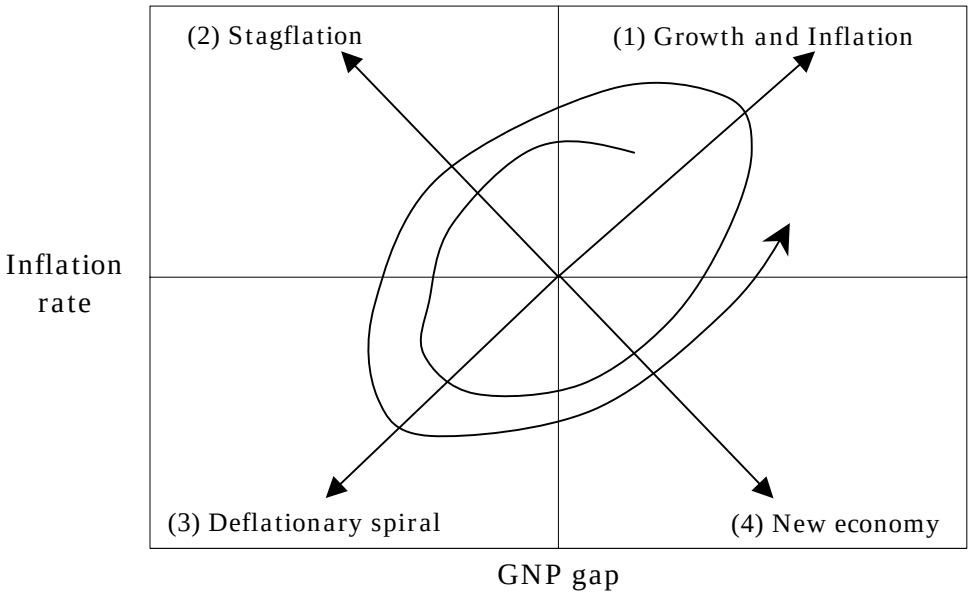
Year	1893-1938	1893-1896	1899-1914	1916-1920	1922-1928	1930-1931	1932-1939
Preceding price							
-12	0.278	0.357	-0.229	0.120	-0.396	-0.047	0.460
-11	0.301	0.328	-0.219	-0.174	-0.404	-0.022	0.483
-10	0.345	0.256	-0.182	-0.156	-0.373	0.035	0.518
-9	0.391	0.219	-0.124	-0.149	-0.340	0.110	0.541
-8	0.434	0.138	-0.056	-0.116	-0.284	0.166	0.516
-7	0.462	0.045	0.034	-0.124	-0.226	0.269	0.457
-6	0.482	-0.146	0.144	-0.125	-0.165	0.358	0.379
-5	0.509	-0.253	0.268	-0.080	-0.101	0.430	0.314
-4	0.549	-0.281	0.386	0.039	-0.008	0.500	0.264
-3	0.595	-0.269	0.492	0.216	0.060	0.632	0.228
-2	0.646	-0.316	0.597	0.431	0.147	0.750	0.191
-1	0.689	-0.284	0.693	0.594	0.247	0.824	0.148
0	0.715	-0.178	0.768	0.696	0.314	0.813	0.109
1	0.707	-0.107	0.814	0.684	0.313	0.662	0.052
2	0.661	-0.062	0.827	0.564	0.283	0.507	-0.030
3	0.612	-0.045	0.808	0.473	0.216	0.433	-0.098
4	0.563	0.075	0.760	0.394	0.135	0.419	-0.135
5	0.529	0.119	0.691	0.368	0.094	0.330	-0.150
6	0.503	0.205	0.623	0.367	0.075	0.203	-0.165
7	0.473	0.251	0.532	0.361	0.066	0.129	-0.184
8	0.437	0.276	0.431	0.341	0.042	0.088	-0.181
9	0.394	0.331	0.326	0.285	0.062	0.084	-0.168
10	0.340	0.389	0.218	0.193	0.067	0.122	-0.141
11	0.289	0.387	0.099	0.113	0.076	0.159	-0.101
12	0.243	0.361	-0.003	0.037	0.099	0.180	-0.087
Preceding notes							

Sources: Research and Statistics Department, Bank of Japan, *Statistics on Wholesale-Price Indices in and after the Meiji Era*; Financial Bureau, Ministry of Finance, *Financial Item Reference, Annual Editions.*

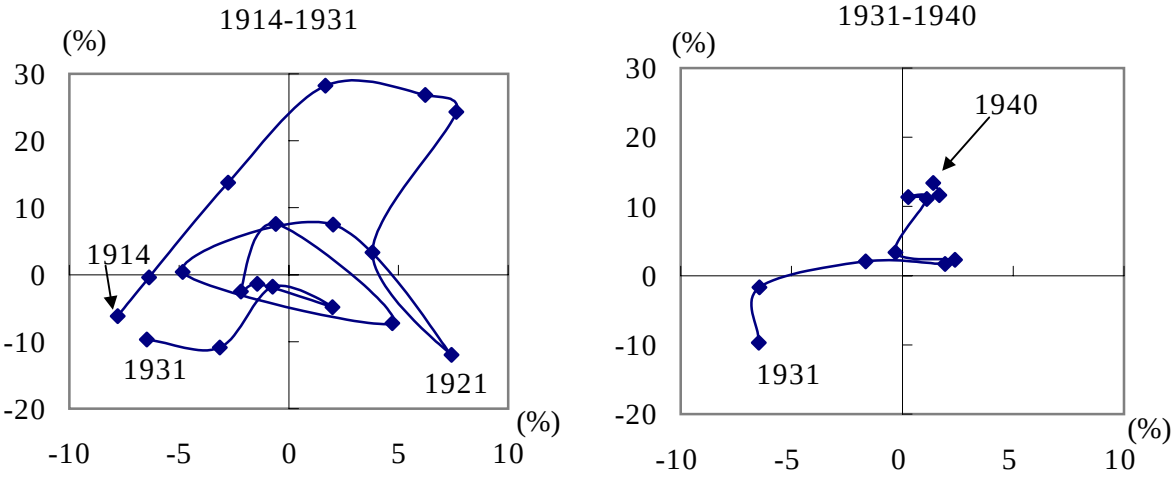
Note: Shaded area represents the highest points of correlation.

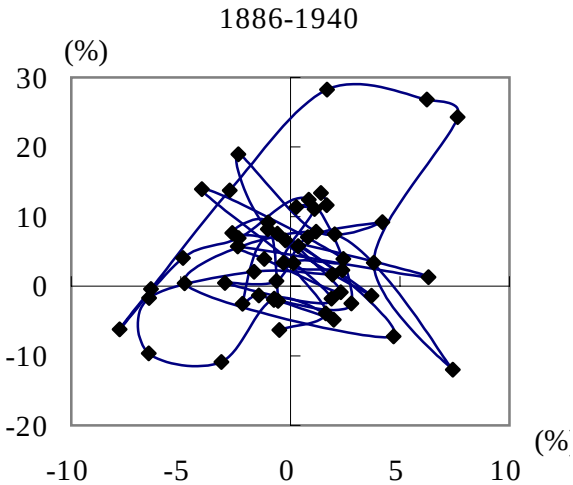
Chart A-4 Relationship between GNP and Prices

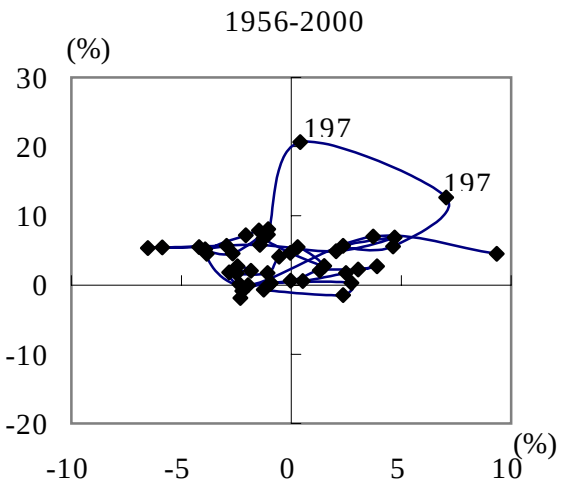
Conceptual chart of dynamism between GNP and prices



Source: Kitamura (2001)







Source: Ohkawa, Takamatsu, and Yamamoto (1974)