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Masahiko SHIBAMOTO
Masato SHIZUME

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Research Institute for Economics and Business Administration
Kobe University
2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

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Masahiko Shibamoto[a,*], Masato Shizume[b,†]

[a] Research Institute for Economics and Business Administration, Kobe University

[b] Institute for Monetary and Economic Studies, Bank of Japan

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*Corresponding author: Research Institute for Economics and Business Administration, Kobe University, 2–1, Rokkodai, Nada, Kobe, 657–8501, Japan. E–mail: shibamoto@rieb.kobe-u.ac.jp. Tel/Fax:+81-78-803-7008.

†Institute for Monetary and Ecoomic Studies, Bank of Japan, 2–1–1, Nihonbashi-Hongokucho, Chuo, Tokyo, 103–8660, Japan, E–mail: masato.shizume@boj.or.jp.

Abstract

A veteran finance minister, Takahashi Korekiyo, brought an early recovery for Japan from the Great Depression of the 1930s by prescribing a combination of expansionary fiscal, exchange rate, and monetary policies. To explore the comprehensive transmission mechanism of Takahashi's macroeconomic policy package, including the expectation channel, we construct a structural vector auto-regression (S-VAR) model with three state variables (output, price, and the inflation expectations) and three policy variables (fiscal balance, exchange rate, and money stock). Our analysis reveals that the exchange rate adjustment undertaken as an independent policy tool had the strongest effect, and that changes in people's expectations played a significant role for escaping from the Great Depression. During the second half of 1931, in particular, speculation on Japan's departure from the gold standard and the inflation that was likely to follow reversed the existing expectations: instead of expecting deflation, people began to expect inflation, months ahead of the actual departure from the gold standard. As a whole, the choice of the level of the exchange rate was crucial for changing people's expectations as well as promoting exports.
Keywords: Great depression; Japanese economy; Macroeconomic policy; Expectation; Vector auto-regressive model; Commodity futures

JEL Classification: E52, E63, N15.

1 Introduction

In the wake of the recent global economic turmoil, policymakers and economists around the world focus on the experiences during the Great Depression in the 1930s to learn lessons from them. In this respect, the Japanese economy in this period draws renewed attention as a canonical case of successful policy to bring an early recovery in the midst of the global depression. After two years of double-digit deflation in 1930 and 1931, Japan escaped from the deflationary trend in 1932. Over the next five years, it went on to experience robust economic growth and mild inflation, even as depression persisted in many other parts of the world.[1]

Korekiyo Takahashi, a veteran finance minister, brought about an early recovery for Japan, during his fifth, sixth and seventh terms as finance mininster, by prescribing a combination of expansionary exchange rate, fiscal, and monetary policies between December 1931 and February 1936. Right after his return as minister, Takahashi moved Japan off the gold standard to depreciate the yen. Over the next few years, he prescribed fiscal stimulus and an easy monetary policy.[2] Takahashi's policy has drawn attention from economic historians, economists, and policymakers from around the world. Ben Bernanke, among others, has spoken highly of Takahashi's accomplishments: "Finance Minister Korekiyo Takahashi brilliantly rescued Japan from the Great Depression through reflationary policies in the early 1930s."[3]

While most economic historians agree that Takahashi's policy package stimulated the Japanese economy as a whole, they do not agree on which parts of the package were more effective and which parts were less effective.[4] Some argue that Japan's early economic recovery can mainly be credited to the depreciation of the yen.[5] Others claim that the key was fiscal stimulus.[6] Others still are convinced that the easy monetary policy kick-started the recovery.

[1] Patrick, "Economic Muddle." For an international comparison of economic performance during the early 1930s, see Shizume, "Japanese Economy."

[2] Smethurst, *Takahashi Korekiyo*, pp.238–267; Nakamura, *Economic growth*, pp.232–262.

[3] Bernanke, Ben, "Some Thoughts on Monetary Policy in Japan," Remarks by Ben S. Bernanke, Member, Board of Governors of the Federal Reserve System, before the 60th Anniversary Meeting, Japan Society of Monetary Economics, Tokyo, Japan, May 31, 2003.

[4] Okura-Teranishi and Iwami et al. claim that various factors such as the depreciated yen, deficit spending, and expansionist policy in the Asian Continent contributed to the recovery. Okura and Teranishi, "exchange rate and economic recovery," and Iwami, Okazaki and Yoshikawa, "the Great Depression in Japan."

[5] Nanto and Takagi, "Korekiyo Takahashi and Japan's recovery,"; and Takagi, the "flexible exchange rate."

[6] Cha, "Did Takahashi Korekiyo Rescue Japan?"

Some emphasize the impact of the Keynesian path in creating effective demand, whereas others stress the central role of the expectations of price changes in the future.

Observing data in Japan's interwar period, we notice that Takahashi pursued a policy package of increasing fiscal deficit, depreciating the currency, and expanding the money stock during his term. We now know little, however, of the dynamics of the policy shifts. Which parts of the policy package were crucial for Japan's recovery from the Great Depression? What kind of policy shift brought about the changes in output? Which parts of the package were deliberate policy actions and which were reactions to changes in the economy or the influence of other policy changes?

To disentangle the various possible directions of causality, we need to identify and measure the exogenous and endogenous components of each macroeconomic variable in a systematic way. A structural vector autoregressive (S-VAR) methodology is useful for this purpose. Cha (2003) introduces a S-VAR analysis to capture the magnitude of respective policy effects in Japan during this period. He uses the S-VAR model with monthly data on world output, the real effective exchange rate, the real government deficit, high-powered money, the volume of railway freight (as a proxy for aggregate real output), and real wages for the period of January 1929 to September 1936 (93 months). He concludes that fiscal expansion stands out as the single most important cause of Japan's upswing in the early 1930s.

Recent macroeconomic policy debates shed new light on the role of expectations as the key element when escaping from a severe economic downturn. A number of studies explore the experience during the Great Depression to derive policy lessons. After the seminal works by Temin (1989) and Eichengreen (1992), the departure from the gold standard was regarded crucial for the economic recovery of the 1930s.[7] Temin and Wigmore (1990) argue that, in the United States, a "regime change" associated with the departure from the gold standard in 1933 was crucial in order to change people's expectations and behavioral patterns.[8] Romer (1992) states that the departure from the gold standard enabled monetary expansion which brought recovery.[9] Hsieh and Romer (2006) find that a large, but short-lived, monetary expansion in 1932 did not raise expectations for devaluation of the dollar because investors had

[7]Temin, *Lessons from the great depression*; Eichengreen, *Golden fetters*.
[8]Temin and Wigmore, "the end of one big deflation."
[9]Romer, "What ended the great depression?"

no doubt about the Fed's commitment to maintaining the gold standard. They argue that the Fed was not constrained by the gold standard, but that the Fed refrained from a decisive monetary expansion because it adhered to the gold standard philosophy.[10] Eggertsson (2008) suggests that the elimination of policy dogmas of the gold standard, a balanced budget, and a small government generated an endogenous shift in expectations about future macroeconomic policies such that, rather than expecting contractionary macroeconomic policies, people expected expansionary policies, which triggered the recovery from the Great Depression.[11] In Europe, Crafts (2011) claims that the British government changed people's inflation expectations by abandoning the fixed exchange rate, gaining control over its monetary policy, and making interest rate reduction possible.[12] Berg and Jonung (1999) argue that Sweden in the 1930s was the pioneering case of price level targeting by which the monetary authorities succeeded in turning people's expectations from deflation to inflation.[13] Straumann and Woitek (2009) challenge the view of Berg and Jonung.[14] Strauman and Woitek claim that Swedish monetary authorities intended to stabilize its exchange rate vis-a-vis the pound-sterling and followed British monetary policy both before and after the departure from the gold standard in 1931. In Japan, some economists argue that Takahashi's decisive monetary policy rescued Japan from the Great Depression by reversing people's expectations from deflation to inflation.[15] However, the transmission mechanism of macroeconomic policy tools including the "expectation channel" has been under-explored so far.

This paper is the first attempt to draw an overall picture of the transmission mechanism of macroeconomic policy tools of fiscal, exchange rate and monetary policies in a national economy during the Great Depression, incorporating the role of expectations as well as the policy tools. To do so, we construct a S-VAR model with three state variables (output, price, and inflation expectations) and three policy variables (fiscal balance, exchange rate,

[10] Hsieh and Romer, "Was the Federal Reserve constrained by the gold standard?"
[11] Eggertsson, "Great Expectations and the End of the Depression."
[12] Crafts, "delivering growth while reducing deficits."
[13] Berg and Jonung, "pioneering price-level targeting."
[14] Straumann and Woitek, "a pioneer of a new monetary policy?"
[15] Iida and Okada, "expected inflation." They estimate inflation expectations in the 1920s and 1930s in Japan using the interest rate model developed by Mishkin (1990) and Cecchetti (1992). With the result of the estimation, they argue that a "two-step regime change" caused shifts in inflation expectations and contributed to an early recovery during Takahashi's term. They attributed the two-step regime change to British departure from the gold standard in September 1931 and the announcement of BOJ's underwriting of government bonds in March 1932. However, they do not elucidate the dynamics behind the shifts in inflation expectations.

and money stock).

Several novel features of our analysis set this study apart from the existing litelature. Our VAR allows us to incorporate the variables underlying the explanations of Japan's recovery from the Great Depression into a single empirical model. In this regard, the only precedent for our analysis is Cha's S-VAR analysis of macroeconomic policy. We expand and deepen Cha's analysis by integrating an inflation expectation variable into the model, quantifying effects of each policy measures, and extending sample period.

First, we incorporate a direct measure of the public's inflation expectations extracted from commodity future prices into the VAR. This approach helps us identify exogenous movements in inflation expectaions, which in turn allows us to study the role of expectations in the business cycles during the interwar period.

Second, we quantify impacts of the policy measures. We express the impacts on output using the relevant impulse response functions, which Cha uses, too. In addition, we examine the historical role of each policy measure employing econometric methodologies such as the historical decomposition analysis of past movements in macroeconomic variables and the counter-factual simulation analysis.

Third, the sample in our analysis is relatively large compared with the samples in previous studies, which allows us to make more precise estimations.

Our analysis sheds new light on the conduct of macroeconomic policy not only in Japan during the Great Depression, but also in other parts of the world and/or during different periods. It demonstrates that exchange rate adjustment undertaken as an independent policy tool played the most important role in recovery from the depression and that expectations played a pivotal role in dynamics at work. During the second half of 1931, in particular, speculation on Japan's departure from the gold standard and the inflation likely to follow reversed expectations: instead of expecting deflation, people began to expect inflation, months ahead of the actual departure from the gold standard, which occurred in December of that year. Monetary policy was effective, but was not conducted as an independent policy device. Rather, it accommodated changes in economic conditions and other macroeconomic policy measures such as exchange rate settings. The effects of fiscal policy were limited. As a whole, the choice of the level of the exchange rate was crucial for changing people's expectations as

well as promoting exports and raising domestic prices.

The rest of this paper proceeds as follows. Section 2 describes the econometric methodology and our data. Section 3 presents the empirical results. Section 4 discusses our findings in relation to anecdotal evidence and previous studies. Section 5 concludes the paper.

2 Econometric Methodology and Data

This section describes our econometric methodology and our data to explore the transmission mechanism of Takahashi's fiscal, exchange rate, and monetary policies, including the expectation channel, and estimates the magnitude of the effects of these policies. To this end, we extract measures of the expected inflation from commodity futures prices and use the VAR model to distinguish between the causes and effects of the movements of the macroeconomic variables, including inflation expectations.

2.1 Inflation expectations for commodity futures prices

Regarding the public's expectations of inflation/deflation, we follow Hamilton's notion that commodity futures prices contain some information about people's expectations of inflation/deflation.[16] Let $f_{it}(j)$ denote the futures price of commodity i for the j-period-ahead. Following Hamilton (1987), we use the 1-month futures price $f_{it}(1)$ as the spot price and $f_{it}(j)$ as the $j-1$-month futures price of commodity i. The expected inflation for the $j-1$-period-ahead anticipated by futures market participants for commodity i at period t, π^e_{it}, is measured as follows:

$$\pi^e_{it} = 100(\log(f_{it}(j)) - \log(f_{it}(1))). \tag{1}$$

We collect data on the four commodity futures prices of cotton yarn (1-month futures, 7-month futures, January 1920–December 1936), raw cotton (1-month futures, 7-month futures, January 1927–December 1936), rice (1-month futures, 3-month futures, January 1920–December 1936), and silk (1-month futures, 5-month futures, December 1923–December 1936).

While the commodity futures data contain some idiosyncratic noise, commodity futures prices contain substantial elements of the general inflation expectations within the economy.

[16] Hamilton, "deflation during the Great Depression."

By using commodity futures prices as direct measures of inflation expectations, we gain independent information on inflation expectations that is helpful for identifying their exogenous shocks and examining the role of inflation expectations in the economy.

2.2 VAR specification

To analyze the dynamic relationship among macroeconomic variables, we construct the following 6-variable S-VAR model consisting of the following variables: output (y_t), price (p_t), expected inflation of the commodity i (π^e_{it}), a fiscal policy measure (g_t), the exchange rate (e_t), and money (m_t):

$$B(L)X_t = b_0 + \epsilon_t, \tag{2}$$

where $X_t = (y_t, p_t, \pi^e_{it}, g_t, e_t, m_t)'$, b_0 is a six-by-one constant vector, $B(L) = B_0 - B_1 L - \cdots - B_p L^p$ is a pth order lag polynomial of a six-by-six coefficient matrix B_j $(j = 1, \cdots, p)$ (the diagonal elements of B_0 are equal to 1), and $\epsilon_t = (\epsilon_{yt}, \epsilon_{pt}, \epsilon_{\pi^e_i t}, \epsilon_{gt}, \epsilon_{et}, \epsilon_{mt})'$ is a six-by-one vector of serially uncorrelated structural disturbances with a mean zero and a covariance matrix Σ_ϵ.

In our VAR model, we place macroeconomic variables before policy instrument variables. This ordering assumes that policymakers are aware of the current macroeconomic variables when they set the policy instruments, but that the macroeconomic variables will only respond to a policy shock with one lag. This ordering is essentially the same as that employed by Christiano et al. (1999). We put fiscal policy first, among the policy variables, as the government determined its fiscal policy independently from the other policies in the period in question. We put the exchange rate second and leave the money stock last, as monetary policy was thought to be conducted in a manner accommodating to the other policies during that period.[17]

The structural model above can be described in the following reduced-form VAR:

$$A(L)X_t = a_0 + u_t, \tag{3}$$

where a_0 is a six-by-one constant vector, $A(L) = I - A_1 L - \cdots - A_p L^p$ is a pth order lag polyno-

[17] Changes in the order of variables do not qualitatively alter the regression results.

mial of a six-by-six coefficient matrix A_j $(j = 1, \cdots, p)$, and $u_t = (u_{yt}, u_{pt}, u_{\pi_i^e t}, u_{gt}, u_{et}, u_{mt})'$ is a six-by-one vector of serially uncorrelated structural disturbances with a mean zero and a covariance matrix Σ_u. Here, a Cholesky decomposition of the reduced-form covariance matrix Σ_u is used to orthogonalize the reduced-form innovations.

2.3 Data

y_t is output measured by the volume of railway freight; p_t is the wholesale price index (WPI); π_{it}^e is inflation expectations derived from commodity futures prices; g_t is the real fiscal balance measured by changes in the financial assets and liabilities of the government, and deflated by the WPI; e_t is the effective exchange rate calculated from the export-weighted average value of the US dollar, British pound sterling, French franc, and Chinese (Shanghai) tael against the yen; and m_t is the money stock measured by cash in circulation.

The volume of railway freight is taken as the measure of output, as this is the most reliable data for the full-sample period from January 1920 through December 1936. Several other industrial production indexes (IIPs) are available for subsample periods, and we have confirmed that the railway freight data moves in tandem with them.

The real fiscal balance is calculated by taking the difference between the net balance of the central government at the end of a month and the net balance at the end of the previous month and then deflating it by the WPI.[18] On the liability side, we use the overall government liabilities, including long-term and short-term government securities and borrowings from the central bank. On the asset side, we use government deposits to the central bank. These steps, taken together, allow us to count all of the activities of the central government.

The effective exchange rate of the yen is used as a weighted average of exchange rates against the US dollar, the British pound-sterling, the French franc, and the Chinese (Shanghai) tael. The weight of Japanese exports to respective countries and their colonies is used (the 1917 weight).[19] Japanese exports to those regions account for 89 percent of the total Japanese

[18] Deflating the fiscal variables by the Consumer Price Index (CPI) does not alter the empirical results qualitatively though CPI series is available only from January 1922.

[19] We confirmed the robustness of the main empirical results reported below by using several alternative exchange rate measures: (i) the effective exchange rate of the yen calculated by the 1917 weight for the period from January 1920 to December 1931 and by the 1936 weight for the period from January 1932 to February 1936, (ii) yen-dollar exchange rate, and (iii) yen-pound-sterling exchange rate.

exports in 1917. The United States, Great Britain, and France returned to and departed from the gold standard at different times during sample period, while China stayed on the silver standard until its currency reform of November 1935.

We use the commodity price inflation expectations derived in eq. (1). Our VAR analysis employs cotton yarn, the commodity with the most readily available data, as the benchmark result. We also confirm the robustness of the main empirical results reported below by using other commodity futures data.[20]

The frequency of our data is monthly, and the sample period is from January 1920 to December 1936 (204 months). All of the variables are transformed into the logarithmic form and multiplied by 100, except for the real fiscal balance (which takes a negative value at times). We estimate the VAR in levels because it yields consistent estimates even if each variable is nonstationary.[21] The lag length is set to four in the reduced-form VAR estimation, which is sufficient to capture the system dynamics and ensure no serial correlation in the residuals.[22]

3 Empirical Results

This section presents the empirical results based on the VAR framework just described. We offer four sets of results: (i) a time series of identified structural shocks, namely, real output, price, expected inflation, fiscal, exchange rate, and monetary shocks, (ii) impulse responses, (iii) counterfactual simulations about the effects of the expected inflation shocks, and (iv) historical decompositions of macroeconomic variables that are explained by the structural shocks.

[20] Checking by the X-12-ARIMA method, we confirm that commodity futures data contain no seasonality.

[21] See Hamilton (1994) pp. 651–653.

[22] We perform a modified likelihood ratio test proposed by Sims (1980) to check whether taking four lags is sufficient. The null of four lags is tested against the alternative of six lags or eight lags. The chi-square statistics indicate that the null hypothesis is not rejected by conventional significance levels for any of the models considered. We also perform the multivariate Lagrange multiplier (LM) test for residual serial correlation for up to the $\{1, \cdots, 13\}$th order. See Johansen (1995), p. 22 for the formula for the LM statistic. The LM statistics for each order indicate that the null hypothesis of no serial correlation is not rejected by asymptotic significance levels.

3.1 Identified structural shocks

Figure 1 displays the six time series of structural shocks: output shocks, price shocks, expectation shocks, fiscal shocks, exchange rate shocks, and monetary shocks. The estimated time series of the structural shocks identified from the VAR model tend to be noisy, since all of them are by construction serially uncorrelated. Although we employ all the regressions with raw data, we report the moving average of the shock for the previous 11 months in Figure 1 for ease of visual interpretation. The eight vertical lines denote major events, namely, the Great Kanto Earthquake (September 1923), the outbreak of the Showa Financial Crisis (March 1927), the NY Stock Exchange crash (October 1929), the Japanese return to the gold standard (January 1930), the British departure from the gold standard (September 1931), the Japanese departure from the gold standard (December 1931), the start of government bond underwriting by the Bank of Japan (BOJ) (November 1932), and the US departure from the gold standard (April 1933). The shocks we have extracted from our VAR system are independent from the structural shocks on other variables. The shocks on fiscal, exchange rate, and monetary variables are independent policy shocks not induced as responses to fluctuations in other variables. Meanwhile, the shocks on output, price, and expected inflation are exogenous shocks that cannot be accounted for by contemporaneous fluctuations in other variables. As our model includes expected inflation components, we identify price shocks as unexpected shocks that can be treated independently from expected inflation shocks.

The shocks shown in the panel are largely consistent with the anecdotal evidence. In the upper left panel of Figure 1, we see two major troughs representing unexpected output shocks, one after the Great Kanto Earthquake in 1923 and one after the Japanese return to the gold standard in 1930. Each is followed by a recovery in output.

In the upper right panel, we see major troughs in unexpected price shocks during the post-world-war-I deflationary period of 1920 and during the *de-jure* gold standard period of 1930–31, each followed by an upward swing, and a third trough after the US departure from the gold standard in 1933.

In the middle left panel, we see growing deflation expectations before and during Japan's return to the gold standard in 1930–31, and an upswing in inflation expectations approxi-

mately when Japan departs from the gold standard at the end of 1931.

In the middle right panel, we see persistent contractionary fiscal policy shocks during the second half of the 1920s. Contrary to the conventional arguments, the fiscal policy shocks during the first half of Takahashi's term during 1931–36 shows no significant upswing independent from the shocks on other variables. We will come back to this point later in this paper.

In the lower left panel, we see major independent shocks leading to a weaker yen after the British return to the gold standard in April 1925, followed by an upswing in shocks towards a stronger yen after the British departure from the gold standard in September 1931. This is followed by a new round of shocks towards a dramatically weaker yen after the Japanese departure from the gold standard in December 1931.

In the lower right panel, we see major contractionary shocks in monetary aggregates before the outbreak of the Showa Financial Crisis in 1927, followed by sudden stimulative shocks just after the crisis. The monetary aggregates show small shocks as an independent policy variable during the *de-jure* gold standard period of 1930–31 and Takahashi's subsequent term.

3.2 Measuring the effects of structural shocks

Figure 2 displays all estimated impulse responses to a one-standard-deviation shock to each variable. The first to sixth rows represent the dynamic responses of the six variables to an output shock, a price shock, an expected inflation shock, a fiscal shock, an exchange rate shock, and a monetary shock, respectively. The solid lines in each plot indicate the estimated responses and the shade areas denote the 1.64 standard error band (90% confidence interval) calculated using 10000 bootstrap samples.

Here, we will first turn to the impulse responses to exchange rate shocks, shown in the fifth row of Figure 2. In the chart on the far left, the real output moves to the bottom 1 year after an exchange rate shock (appreciation in the exchange rate), with statistical significance, then rises back to a steady-state level. Goods prices also respond negatively to the exchange rate shock, though the standard error band appears to be relatively wide. These results suggest that exchange rate shocks independently had strong influences on the real economy during the interwar period. We also note that the rise in the exchange rate is followed by a decline in the

money stock. This indicates that the monetary authority endogenously responded to the yen appreciation by decreasing the money stock, a move that was tantamount to accommodating the money supply in response to the exchange rate change. We also note a downward trend in the fiscal deficit in response to the exchange rate appreciation. This implies that the government also considered the exchange rate when setting its fiscal policy. Overall, these responses to the exchange rate shock reflect the open nature of the Japanese economy during the interwar period.

The charts in the bottom row of Figure 2 plot the impulse responses to a monetary shock. A monetary shock (an exogenous increase in the money stock) is followed by a depreciation of the yen, indicating that an upward adjustment of the money stock by the monetary authority pushes the yen value down. The shock, in turn, raises real output and prices, which implies that the aggressive monetary expansions had substantial impacts on the real economy by stimulating the aggregate demand. On the other hand, as we observe in the fourth row of Figure 2, fiscal policy shocks have limited impacts on real output and prices, which is in contrast with Cha's finding.

The expectation shocks (exogenous changes in the expected inflation) have persistent and statistically significant impacts on the output and prices. The peak comes about one and a half years after the initial shocks, and is long-lived. This implies that the expectation shocks identified in our VAR model played an important role over the business cycle during the interwar period. We also note that the shock leads to a rise in the fiscal deficit, a depreciation in the exchange rate, and a rise in the money stock. This suggests that shocks contain forward-looking information reflective of market expectations or forecasts of future macroeconomic events such as fiscal expansion, depreciation of the yen, and monetary expansion.

Real output shocks, which are often interpreted as productivity/technology shocks in the literature, have significant impacts on real output but limited impacts on prices. Price shocks (unexpected changes in aggregate prices) have significant effects on prices. These shocks have large effects when they strike, and the effects are rapidly transmitted.

3.3 The "expectation channel" of macroeconomic policy effects

Here, we examine macroeconomic policy effects through inflation expectations. When people anticipate shifts in fiscal, exchange rate, and/or monetary policies, people alter their inflation expectations ahead of actual changes in the macroeconomic policies. Our VAR model identifies such changes in the inflation expectations as *exogenous* shocks, independent from other macroeconomic shocks, followed by *endogenous* shifts in fiscal, exchange rate, and monetary policy variables. We refer to the effects of the macroeconomic policies that occur through inflation expectations as occurring through the "expectation channel."

Then, to what extent does the expectation channel work on output? We test the significance of the expectation channel of three measures of macroeconomic policy; fiscal, exchange rate, and monetary policies in our VAR framework. Specifically, we employ a counter-factual simulation analysis introduced by Bernanke et al. (1997) and Sims and Zha (2006) in our VAR model. The analysis will enable us to disentangle the endogenous components of future macroeconomic policy actions from the total effects of expectation shocks on output.

Figure 3 compares impulse responses for output in the absence of endogenous reactions of macroeconomic policy measures with the baseline result. The solid line without symbols is the baseline result with the estimated fiscal, exchange rate, and monetary policy reactions in our benchmark model. The solid line with stars ($*$) is the result if the policymakers hold fiscal policy unresponsive to other variables, the solid line with pluses ($+$) is the one if the policymakers hold exchange rate policy unresponsive, the solid line with circles ($\circ$) is the one if the policymakers hold monetary policy unresponsive, and the solid line with squares ($\square$) is the one if the policymakers hold all the macroeconomic policies unresponsive. The difference between the baseline result and the result in absence of each policy response indicates a magnitude of the effect of the policy through the expectation channel.

As seen in Figure 3, the absence of exchange rate and monetary policy responses results in the limited rise in output compared to the benchmark, whereas the absence of a fiscal policy response yields almost the same result as the benchmark. These results imply that the expectation channel has significant impacts on output in the case of exchange rate and monetary policies, but has little effect in the case of fiscal policy. The absence of all policy responses

results in a quite small rise in output, which suggests that other expectation components unrelated to the macroeconomic policy actions have limited effects on output.

3.4 Source of the economic recovery

The next part of this study, the historical decomposition analysis, examines how our model interprets history. Figure 4 decomposes the real output series into six components that are respectively explained by six types of structural shock: the output shock, unexpected price shock, expected inflation shock, fiscal shock, exchange rate shock, and the monetary shock. All the series are displayed as deviations from the linear trend. The solid line shows the decomposed series and the dotted line indicates the estimated series before the decomposition.

In the upper-left chart in Figure 4, we find that, while real output shocks explain a large part of the fluctuations in output during the second half of the 1920s, in contrast, during the early 1930s, most of the fluctuations were due to factors other than the exogenous real output shocks. The lower-left chart shows that exchange rate shocks had significant impacts on real output throughout the sample period, especially on the upswing in real output in 1932–34. We also find that the changes in the expected and unexpected inflation explain a large part of the fall and rise in output in the early 1930s, which indicates that these shocks had some impact on real output. Monetary shocks had significant impacts on real output, but the effect differed on each occasion: the shocks contributed to a downturn in output before the Financial Crisis in 1927, followed by an upswing just afterwards, then they counteracted the sharp decline of output in 1931. Monetary shocks had limited impact during the recovery of 1932–33. Fiscal policy shocks had no effect on the real output, which suggests that changes in the fiscal balance played virtually no role as an independent policy tool during the recovery of the early 1930s.

From the trough in October 1931 to the peak in May 1934, output rises by 39 percentage points around the trend, of which exchange rate shocks contribute 17 percentage points, exogenous changes in expected inflation 9 percentage points, unexpected price shocks 5 percentage points, unexpected output shocks 4 percentage points, monetary shocks 2 percentage points, and fiscal policy shocks 2 percentage point. These results confirm the relative importance of the depreciation of the yen and the expectation channel.

Many studies argue that Takahashi rescued the Japanese economy from the Great Depression through a package of macroeconomic stimulus measures combining fiscal, exchange rate, and monetary policies. Our results reveal that the depreciation of the yen and changes in inflation expectations contributed to production growth after Japan departed from the gold standard in December 1931, whereas monetary and fiscal policies had very limited effects in the early stage of the recovery.

According to our analyses, policymakers shaped some of their policy measures in response to economic conditions and other policy shifts in a systematic fashion, while undertaking other policy actions independently. To elaborate this point, Figures 5, 6, and 7 plot historical decompositions of fluctuations in the fiscal balance, exchange rate, and money stock, respectively, into components attributed to structural shocks in output, price, inflation expectations, fiscal balance, the exchange rate, and money stock.

Figure 5 shows a historical decomposition of fluctuations in the fiscal balance. Fiscal policy shocks apparently accounted for most of the fiscal balance movements over time. Periodically, however, we observe deviations from the independent movements of the fiscal balance. These deviations can be largely explained by the expectation shocks and the exchange rate shocks. Later, we will look more deeply into the background of these deviations.

Figure 6 shows the historical decomposition of exchange rate fluctuations. The component explained by the exchange rate shocks rapidly fell in December 1931, indicating that the exchange rate shocks accounted for a large part of the exchange rate depreciation at that time. Inflation-expectation shocks and unexpected price shocks also turn out to be important factors in explaining the large hump in the exchange rate when Japan returned to and then departed from the gold standard. Specifically, the upward swing in inflation expectations from September 1931, when Britain departed from the gold standard, explains a substantial part of the yen depreciation over the ensuing months.

Figure 7 plots the historical decomposition of fluctuations in the money stock. The independent monetary shocks apparently explain a substantial part of the fluctuations in money stock throughout the sample period. As it turns out, these shocks are the sole factor explaining the upward spike in the money stock during the Showa Financial Crisis of 1927. Meanwhile, unexpected output and price shocks, the inflation-expectation shocks, and the exchange rate

shocks contributed to the large swings in money stock in the early 1930s. These results suggest that the policy actions by the BOJ during the Great Depression and the Takahashi period may be emblematic not of an active, exogenous monetary policy, but of an accommodative, endogenous series of policy responses to changes in economic conditions, such as the exchange rate and inflation expectations, as well as exogenous output and price movements.

Finally, we conduct the counterfactual simulations of our VAR model in which we explore what would have happened to output in the absence of the macroeconomic policy actions. Figure 8 shows the results, focusing on the behavior of real output from September 1931 to February 1936. The solid line without symbols shows the historical path of the output. We call it the baseline scenario. The solid line with stars ($*$) shows the fictitious path of the output assuming that the fiscal balance was fixed at the initial value through the entire sample period, that is, it assumes no exogenous fiscal policy shocks and no endogenous fiscal policy responses to fluctuations of other variables. The solid line with pluses ($+$) shows the scenario assuming that the exchange rate was fixed at the initial value through the entire sample period, that is, assuming no exogenous exchange rate shocks and no endogenous exchange rate responses to fluctuations of other variables. The solid line with circles ($\circ$) shows the scenario assuming that the money stock was fixed at the initial value through the entire sample period, that is, assuming no exogenous monetary policy shocks and no endogenous monetary policy responses to fluctuations of other variables. Each of the scenarios eliminates the exogenous policy component and the endogenous policy component of the effect of the other shocks. The solid line with squares ($\square$) shows the scenario assuming that all the policy variables were fixed at the initial value through the entire sample period, that is, it assumes there are no exogenous policy shocks and no endogenous policy responses to fluctuations of variables in the system. The last scenario leaves only the effects of the exogenous shocks in output, price and inflation expectations on output. The difference between the baseline scenario and the scenario without any policy shocks and responses implies the overall policy effects, including exogenous shocks and endogenous responses.

Exchange rate shocks and/or responses substantially explain the low level of output in 1932, the vigorous recovery in 1933, and the high output levels achieved during 1934 and afterwards. Apparently, this is the result of the delayed effects of the appreciation of the yen

in 1931 and the subsequent depreciation in 1932. Monetary policy shocks and/or responses explain a large part of the enduring high level of output in 1934 and 1935. During this period, exogenous monetary policy shocks had limited effects on output (Figure 4), and monetary policy accommodated the depreciation of the yen (Figure 7). This indicates that conducting easy monetary policy in accordance with the depreciation of the yen, not as an independent policy action, supported the high level of output. Fiscal policy played only a marginal role.

4 Discussion

Our results show that, on the one hand, the depreciation of the yen and the consequent changes in inflation expectations had dominant effects on the macroeconomy when Japan escaped from the Great Depression of the early 1930s. In the wake of Britain's departure from the gold standard, speculation on Japan's departure from the gold standard precipitated a drastic change in inflation expectations months ahead of its actual departure.

Our findings indicate that exchange rate movements played a pivotal role in the increases in output and prices during the economic recovery in the early 1930s. This is consistent with Nanto and Takagi (1985) and Takagi (1989). They characterize Japan at that time as a small open economy and emphasize the impact of price movements induced by overseas events and exchange rate fluctuations. In a sense, we explore the underlying mechanism of their argument, taking into account the role of expectations and the dynamics of policy formation. As the Japanese economy depended heavily on overseas markets, in terms of both trade and finance, Japanese market participants and policymakers took overseas events and exchange rate settings into account in making their decisions.

In the course of events, expectations related to the future exchange rate and monetary policy actions were the main channel resulting in the output increase in the early 1930s. In particular, the Japanese economic recovery in 1932-33 was initiated by changing the expectations of market participants from deflation to inflation. This occurred as a result of anticipations that Japanese policymakers would depart from the gold standard following the British departure and alter the exchange rate and monetary policies.

In the initial stage of recovery in 1932-33, monetary policy played a limited role, in con-

trast to the argument of Iida and Okada (2004). They state that the announcement of the BOJ's underwriting of government bonds in March 1932 changed people's expectations from deflation to inflation and gave a big push to the economic recovery, taking this as an indication of a drastic change in monetary policy. However, our historical decomposition analysis reveals that an upward swing in output in 1932 was not the result of monetary easing caused by underwriting of government bonds, but largely the consequence of the depreciation of the yen and changes in expectations associated with the depreciation (Figure 4). Monetary policy largely accommodated other policies such as exchange rate settings rather than being conducted as an independent policy tool (Figure 7).

In a small open economy, monetary autonomy was not available for stabilizing the domestic economy, and the choice of the exchange rate was crucial because a "regime change" was brought largely through depreciation of the currency. Shizume (2002) applies Taylor rule analysis to interwar Japan and finds that Japan's monetary policy was not conducted in a countercyclical manner not only before but also after the departure from the gold standard.[23] Fukai Eigo, Takahashi's primary policy advisor, recalled that the authorities welcomed an orderly depreciation of the yen, but that they conducted an accommodative monetary policy rather than a proactive one in fear of a spiral of excess inflation and currency devaluation.[24] This was also the case in Sweden, as reported by Straumann and Woitek (2009), who argue that Swedish monetary policy was devoted to exchange rate stability rather than domestic price stability in the 1930s.[25].

Our arguments are consistent with the anecdotal evidence. Market participants anticipated that Britain's departure from the gold standard would force Japan to follow. From September to November 1931, the Monthly Report from the Tokyo Stock Exchange (TSE) repeatedly stated that, in the wake of Britain's departure from the gold standard, market participants expected Japan to follow suit and once again place an embargo on gold exports.[26] In the same vein, the BOJ reported, in October 1931, that Britain's departure from the gold standard revived speculations on a Japanese departure among investors in London and

[23]Shizume, "Economic developments and monetary policy responses," pp. 104-105.

[24]Fukai, "Reflections on seventy years," pp.266-267; pp.274-275. Fukai was the Deputy Governor of the Bank of Japan (1928-35) and the Governor of the Bank (1935-37).

[25]Straumann and Woitek, "a pioneer of a new monetary policy?," pp. 276-277.

[26]TSE Monthly Report, September 1931, October 1931, and November 1931.

Continental Europe.[27]

The Japanese government considered the exchange rate when setting its fiscal policy, too. Japan suspended the yen from the gold standard in September 1917, 5 days after the United States had done so. Then, during the 1920s, Japan sought to return to the gold standard as a primary policy goal. Incidents such as the Great Kanto Earthquake of September 1923 and the Showa Financial Crisis in the spring of 1927 delayed the government's final decision. Finally, in July 1929, the Hamaguchi Cabinet of the Minseito Party published a manifesto, placing Japan's return to the gold standard at the very top. In the ensuing months, they let the yen appreciate to the level of the pre-war parity and pushed forward fiscal austerity measures. They succeeded in reinstating the yen to the gold standard in January 1930, but this lasted for only about two years. When the opposing Seiyu Kai Party came into power in December 1931, Takahashi declared that Japan would depart from the gold standard and embark on a phase of a fiscal expansion.[28] These episodes illustrate the nature of fiscal policy during the 1920s and early 1930s, a period deeply influenced by exchange rate policy.

The statistics on gross national product endorse the export-led nature of economic recovery in the early 1930s (Table 1). The Japanese economy grew by 35 percent during Takahashi's years in power during 1932–36. Exports contributed 15 percentage points to this growth, with personal consumption contributing 12 percentage points, private investments 7 percentage points, government expenditure 5 percentage points, with imports subtracting 5 percentage points. Exports were the only component that grew over the five consecutive years.

Our results are inconsistent with those of Cha, who concludes that fiscal expansion became the leading source of recovery during Takahashi's term. In a sense, we expand Cha's econometric analysis on the effect of Takahashi's policy package during the early 1930s by extending the sample period from 93 months to 204 months, and, more significantly, by including prices and inflation expectations in the analysis.

From what sources do the differences between our results and those of Cha (2003) emerge? If the differences stem from the inclusion of price dynamics and the role of inflation expectations, we will obtain the same results as Cha by running the S-VAR model without variables

[27]The Report to the Semiannual Meeting of Executives and Branch Managers, October 13, 1931, BOJ Archives No. 3942.

[28]Shizume, "Sustainability of Public Debt: Evidence from Japan before the Second World War".

Table 1: Growth rates of the components of real GNP during 1932–36.

Year	C	G	I	EX	IM	EX-IM	GNP
1932	-1.2	2.8	-1.0	3.1	0.7	3.8	4.4
1933	5.2	1.5	1.7	1.1	0.7	1.8	10.1
1934	4.7	-0.9	2.7	5.1	-2.7	2.3	8.7
1935	-0.1	0.7	1.8	3.6	-0.7	2.9	5.4
1936	1.8	0.4	0.9	0.6	-1.5	-0.9	2.2
1932-36	11.9	4.7	7.2	15.4	-4.6	10.8	34.6

Notes: The table shows the contributions to the percentage change in real gross national product in the previous year from consumption (C), government purchases (G), investment (I), the value of exports (EX), the value of imports (IM), net exports (EX−IM), and real GNP (GNP). All data are taken from Ohkawa et al. (1974).

representing price and inflation expectations.

Here, we employ a S-VAR model with four variables, namely, output, real fiscal balance, the effective exchange rate, and money stock, omitting wholesale price and inflation expectations. As the left upper and lower panel of Figure 9 shows, this formula provides a result qualitatively similar to Cha's, with a strong fiscal policy effect on output. In other words, the price and inflation expectations variables drastically alter Cha's interpretation. In contrast, our benchmark results show that fiscal policy had only a limited effect on the output throughout Takahashi's term in the early 1930s. This implies that the exclusion of price and/or inflation expectation variables led to an overestimation of the fiscal policy effect.

The most notable difference between the benchmark model and the model excluding price and inflation expectation variables is in the identification of fiscal shocks in 1932-33, the initial stage of Takahashi's term. As we see in the right upper panel of Figure 9, the benchmark model shows little upward swing in fiscal shocks during this period, while the model excluding price and inflation expectation variables shows a big spike in 'exogenous' fiscal shocks. The benchmark model tells us that, when Takahashi pushed up fiscal spending, depreciation of the yen boosted the Japanese economy through the "expectation channel" and a subsequent increase in real demand. Omission of price and inflation expectation variables in the model neglects the crucial channel in interpreting policy effects and misidentifies it as an effect of a discretionary fiscal policy.

Then, why was fiscal policy not effective in Japan during the early 1930s? One hypothesis is the changing nature of fiscal spending in this period. In the period of 1932-36, the ratio of

fiscal spending to gross national products (GNP) increased to 10.8 percent from 9.0 percent in the previous decade of 1922-31. However, military expenditures including overseas campaign in the Asian Continent increased by more than two percent points from 3.2 percent to 5.4 percent, while other expenditures decreased from 5.7 percent to 5.4 percent.[29] Smethurst (2007) shows that the military was the primary beneficiary while rural relief program got only a small portion of the pie.[30] As Japanese army and navy heavily depended on the overseas weapons and fuel, and as military expenditures for overseas campaigns leaked to the Asian Continent, the fiscal multiplier of the military spending was smaller than civil spending.[31]

5 Concluding Remarks

We draw an overall picture of the transmission mechanism of macroeconomic policy tools of fiscal, exchange rate and monetary policies in Japan during the Great Depression in the 1930s, incorporating the role of expectations as well as all the policy tools. Our S-VAR analysis reveals that exchange rate adjustment undertaken as an independent policy tool played the most important role in recovery from the depression, and that inflation expectations played a pivotal role in the dynamics at work. During the second half of 1931, in particular, speculation on Japan's departure from the gold standard and the inflation likely to follow reversed expectations: instead of expecting deflation, people began to expect inflation, months ahead of the actual departure from the gold standard, which occurred in December of that year. Monetary policy was effective, but was not conducted as an independent policy device. Rather, it accommodated changes in economic conditions and other macroeconomic policy measures such as exchange rate settings. The effects of fiscal policy were limited. As a whole, the choice of the level of the exchange rate was crucial for escaping from the Great Depression, by changing people's expectations as well as promoting exports and raising domestic prices. People already had expected a "regime change" and recovery months ahead of Takahashi's return to power; what Takahashi did was to realize the outcome in a prompt and orderly

[29] Shizume, "Sustainability of Public Debt," p. 1117.

[30] Smethurst, *Takahashi Korekiyo*, pp. 263–264.

[31] Crafts and Mills (2013) show that the fiscal multiplier in Britain during the 1930s was significantly less than one, that was much smaller than previously thought. They argue that British recovery in the initial phase was brought by leaving the gold standard and the following easy monetary policy rather than fiscal stimulus.

manner as people had expected.

Japan in the 1930s was a canonical case for a small open economy escaping from the severe global economic downturn. It brought a "regime change" by the departure from the gold standard. People expected the event well ahead of time and changed their behavior in advance, enhancing policy effects. Our story is consistent with Temin (1989) and Eichengreen (1992), who argue that the departure from the gold standard was crucial for the economic recovery of the 1930s. Our findings show new empirical evidence that inflation expectations played a pivotal role in the dynamics at work.

Appendix: Robustness

In this appendix, we reestimate the model under a number of alternative settings to examine the robustness of the VAR model. First, when we extended the lag length of the VAR from four lags to eight lags, the model produced qualitatively similar results with more complex impulse responses. Next, we reran the VAR using the alternative measures of the commodity futures price (raw cotton (1-month futures, 7-month futures, January 1927–December 1936), rice (1-month futures, 3-month futures, January 1920–December 1936), and silk (1-month futures, 5-month futures, December 1923–December 1936)) to examine whether the alternative inflation expectation shocks produced impacts on the macroeconomic variables similar to those observed in the benchmark results. We also included the US output in our regression to check whether this variable would alter the results. In addition, we reran the VAR using the consumption price index as a different proxy for aggregate prices, and using the index of industrial production as a proxy for real output. None of these experiments changed the qualitative nature of the results. Finally, we examined the structural stability of our reduced form dynamic models. Although a statistical test suggests the existence of a structural break within the sample period, we confirmed that our empirical results do not alter even with the break.[32] Following the example from Cha (2003), we set the starting point of the sample in

[32]We have applied a modified likelihood ratio test to determine whether the overall parameter values were unchanged between the two periods before and after a given possible break date. When we set possible break dates every month for the period from January 1928 to January 1932, the null hypothesis that all the model parameters are the same is rejected against the alternative of a structural shift. The results suggest that there was a break sometime between January 1928 and January 1932.

January 1929, excluding the period from January 1920 through December 1928, and obtained a qualitatively same results to the ones with the full sample.

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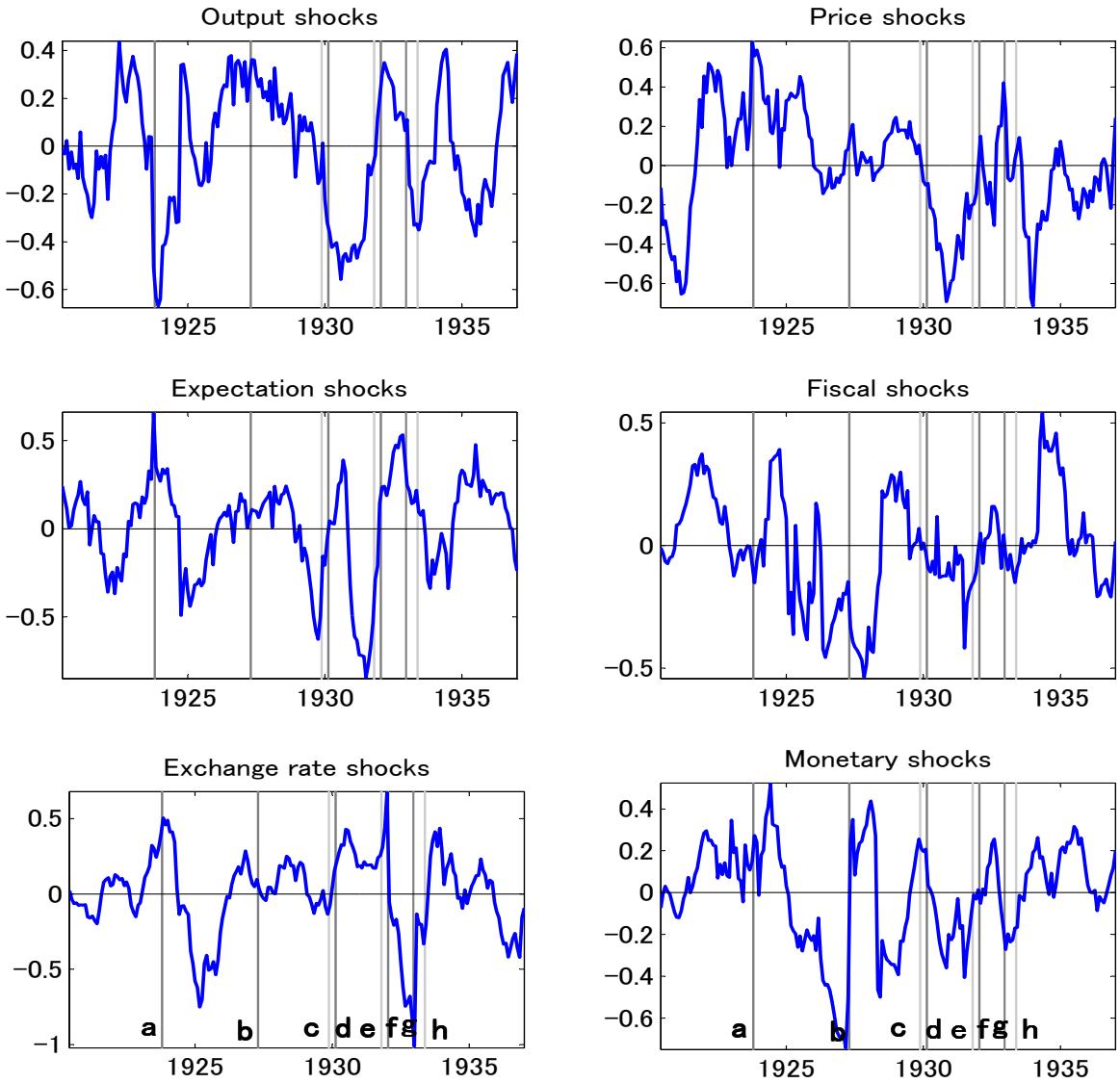

a: the Great Kanto Earthquake (September 1923)
b: the outbreak of the Showa Financial Crisis (March 1927)
c: the NY Stock Exchange crash (October 1929)
d: the Japanese return to the gold standard (January 1930)
e: the British departure from the gold standard (September 1931)
f: the Japanese departure from the gold standard (December 1931)
g: the start of government bond underwriting by the BOJ (November 1932)
h: the US departure from the gold standard (April 1933)

Figure 1: Identified structural shocks

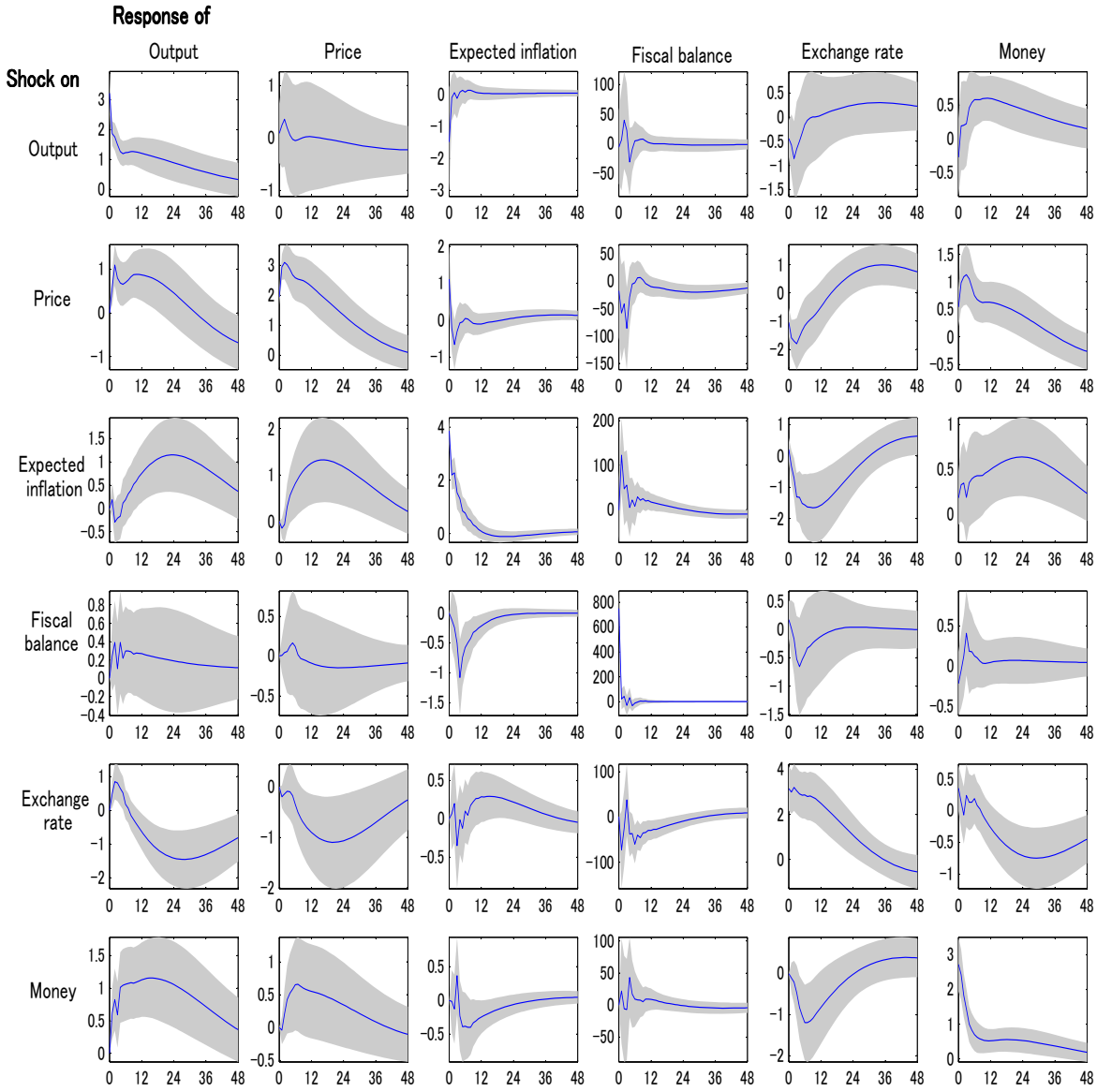

Figure 2: Impulse responses

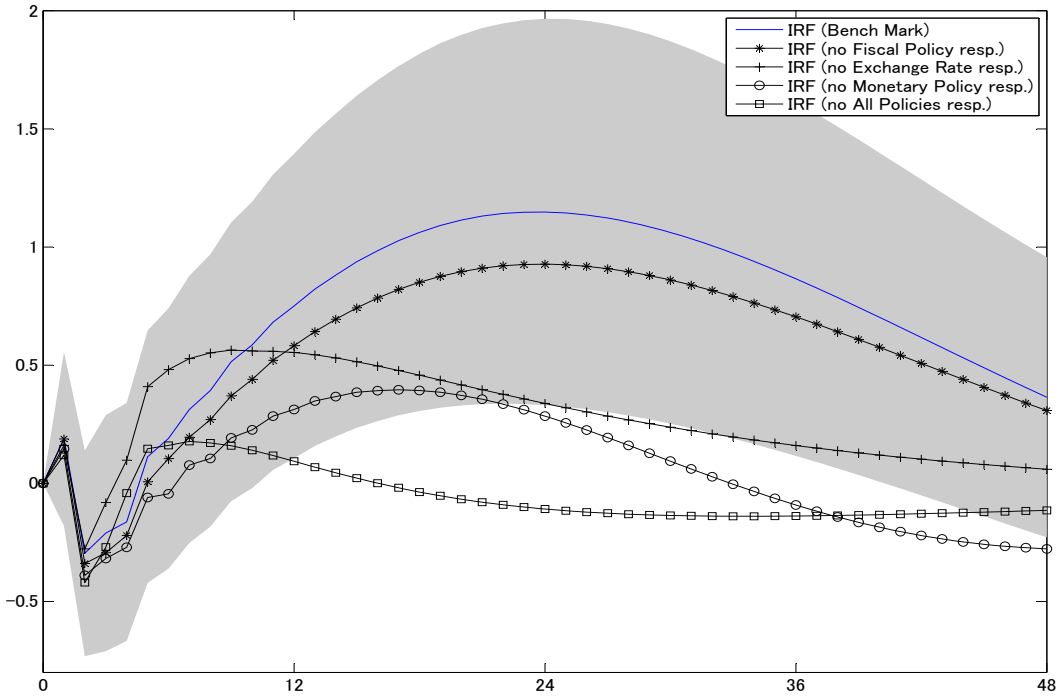

Figure 3: Comparison of output responses to an expected inflation shock

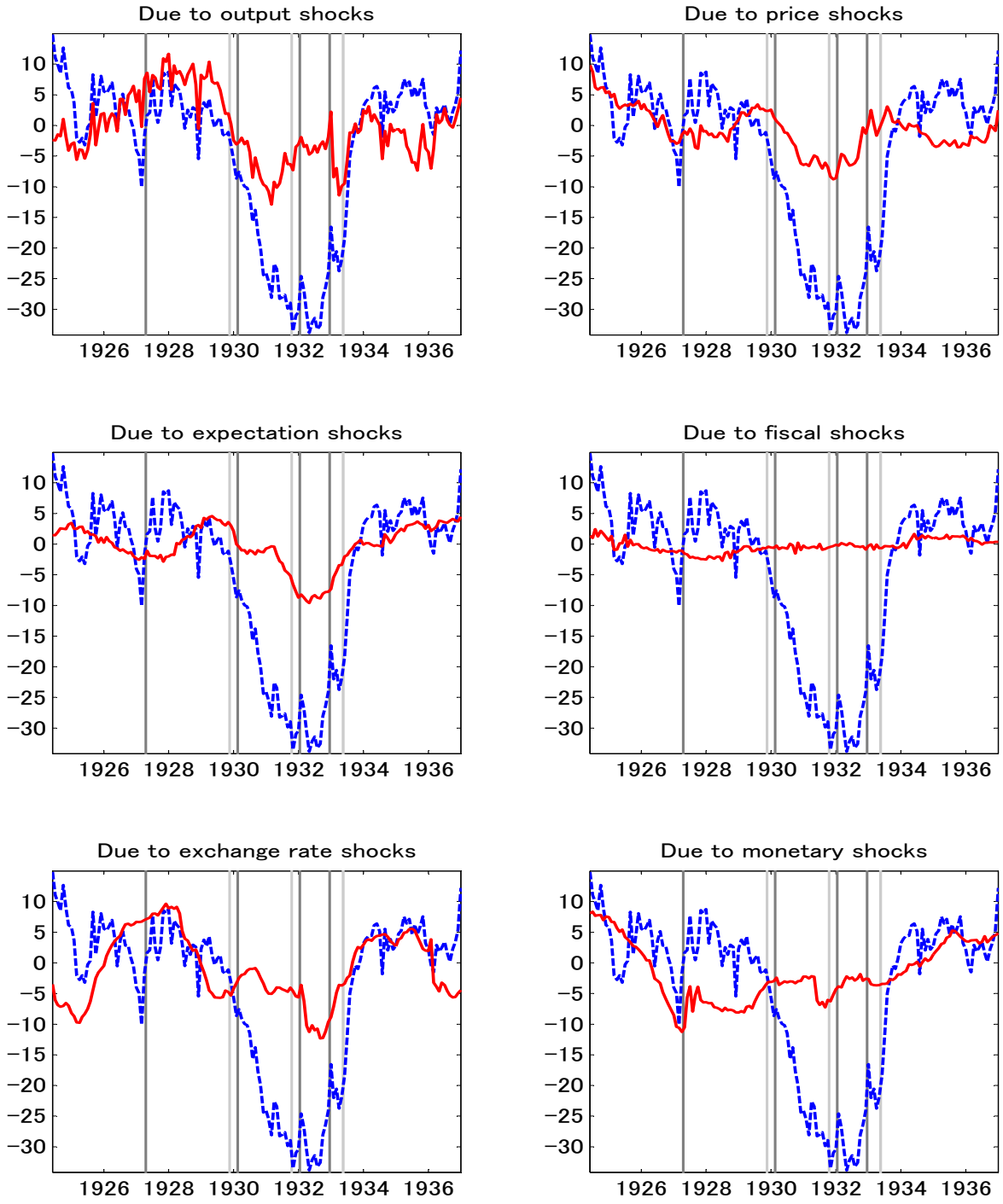

Figure 4: Historical decomposition of output

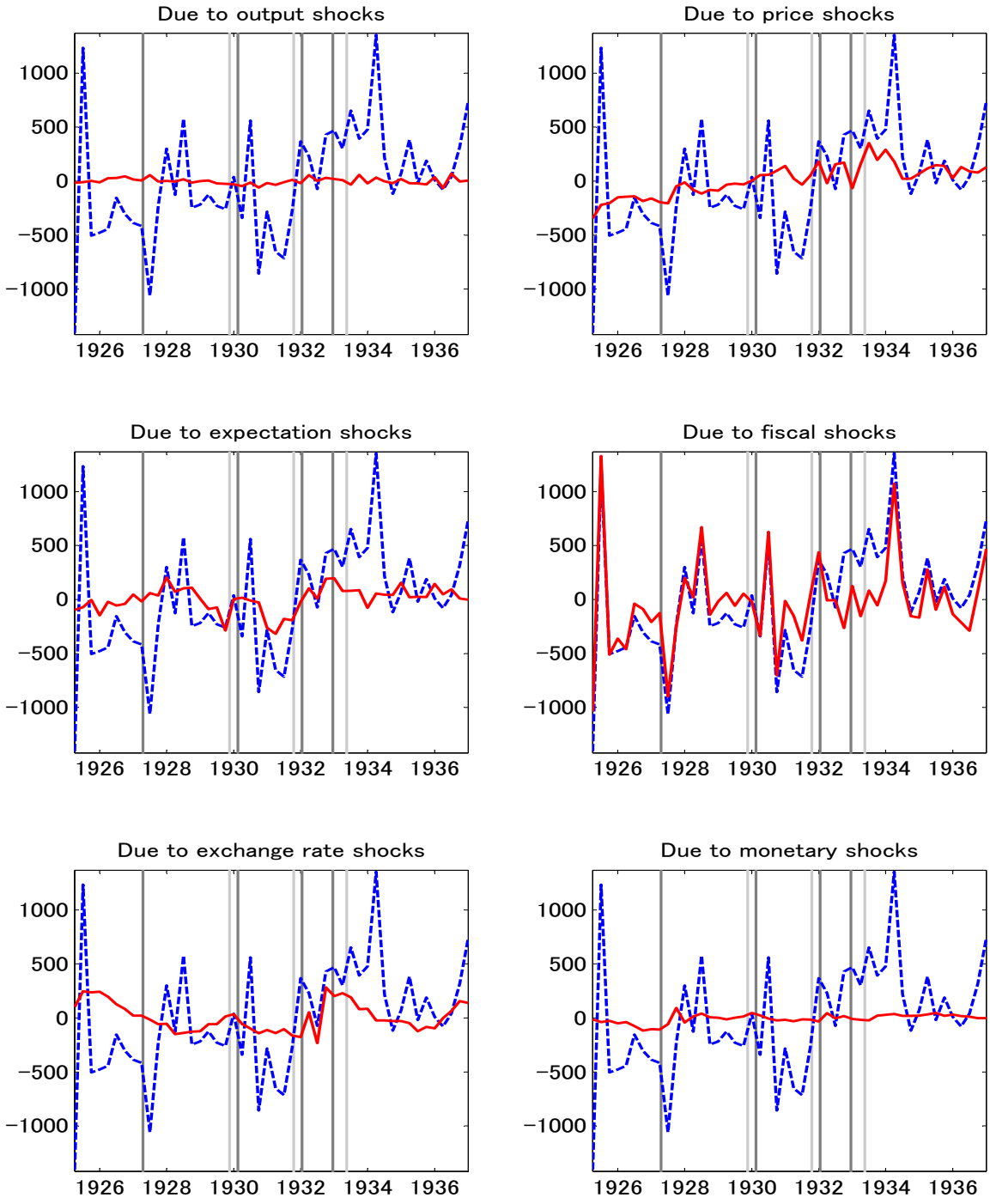

Figure 5: Historical decomposition of fiscal balance

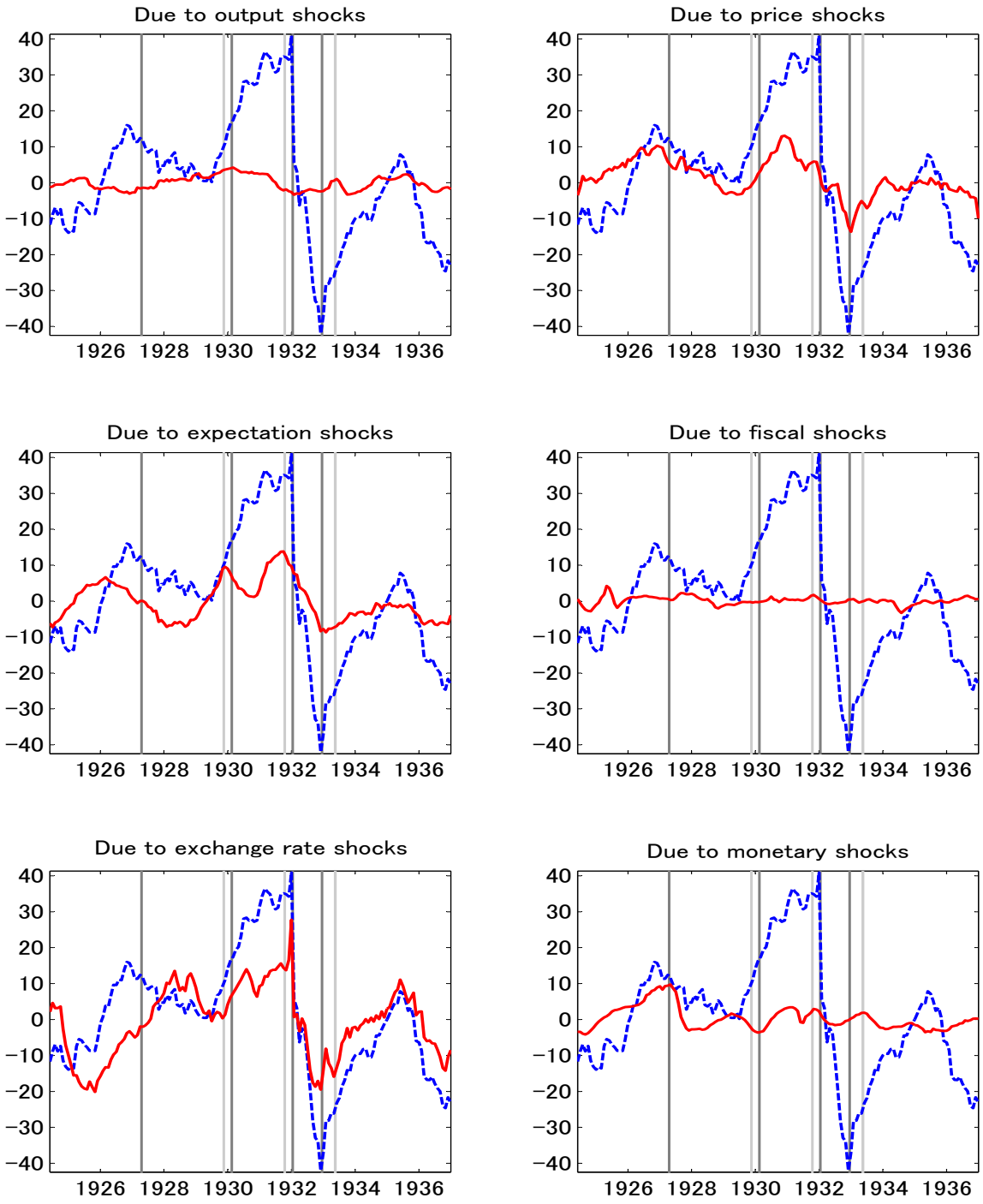

Figure 6: Historical decomposition of exchange rate

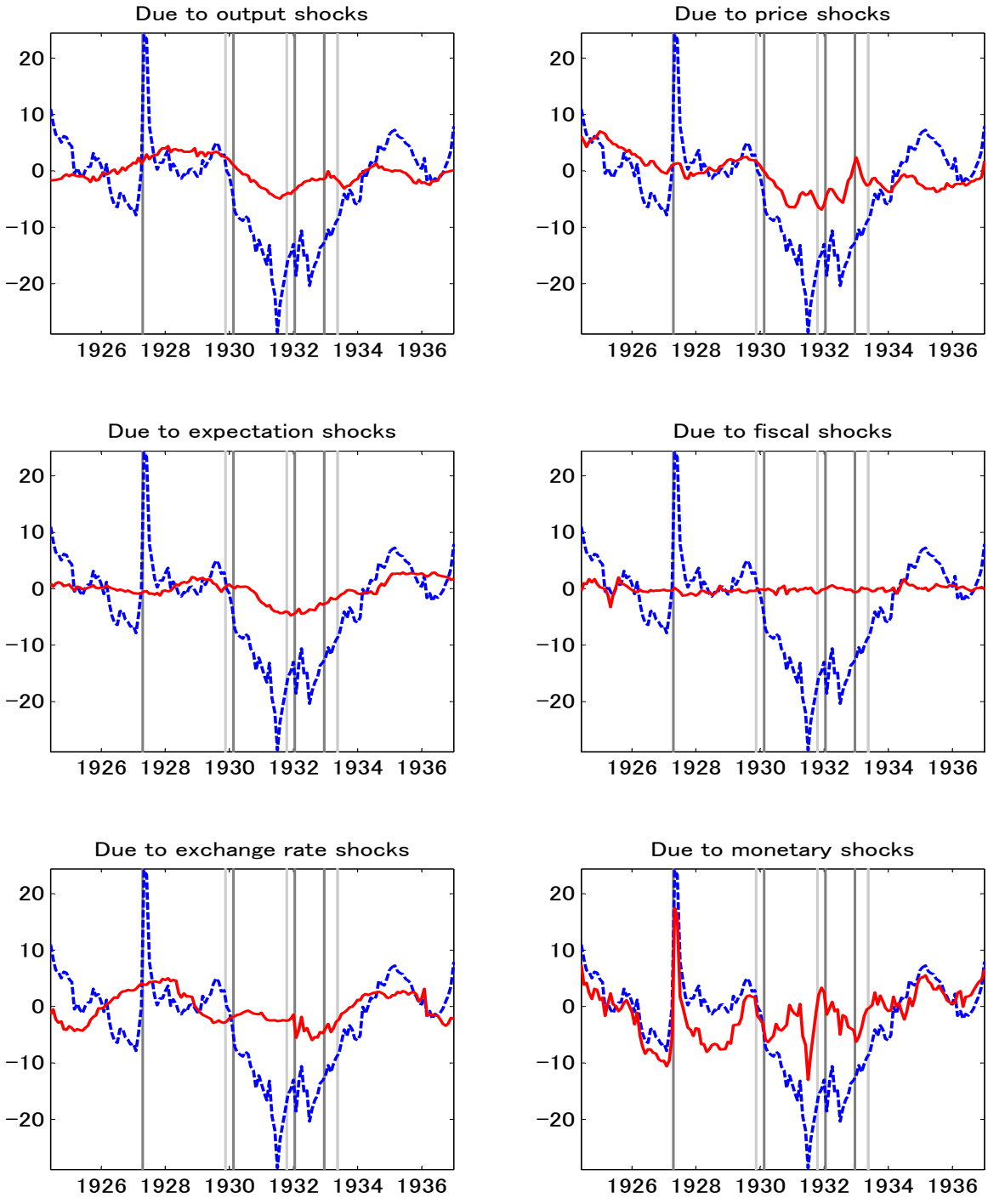

Figure 7: Historical decomposition of money

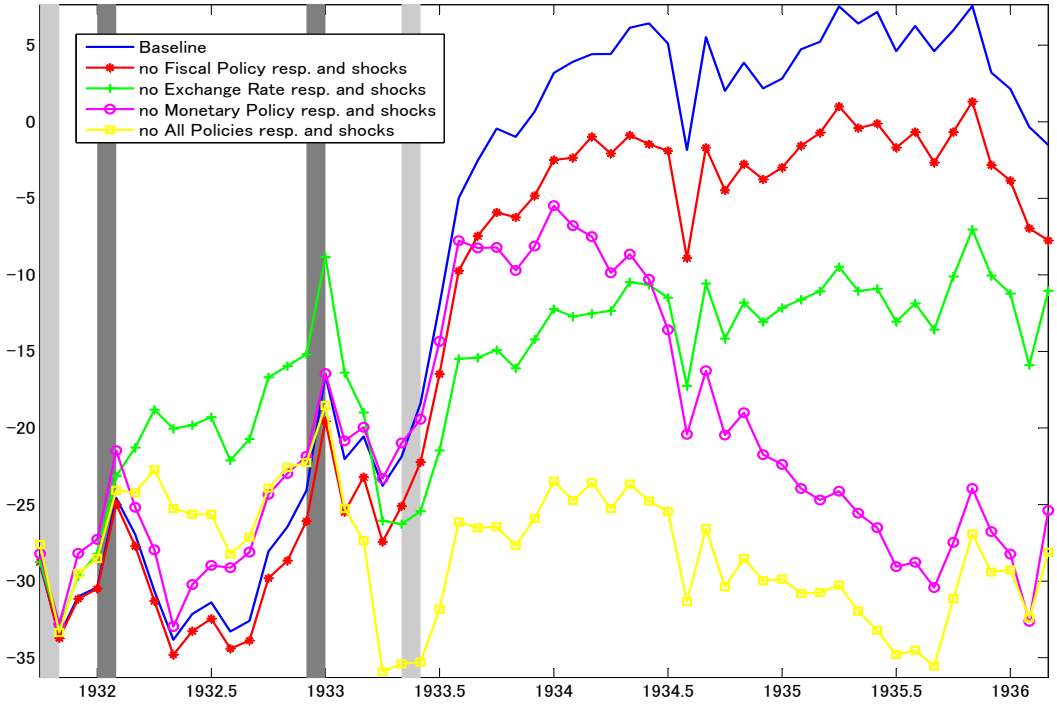

Figure 8: Counterfactual simulations for output, September 1931–February 1936

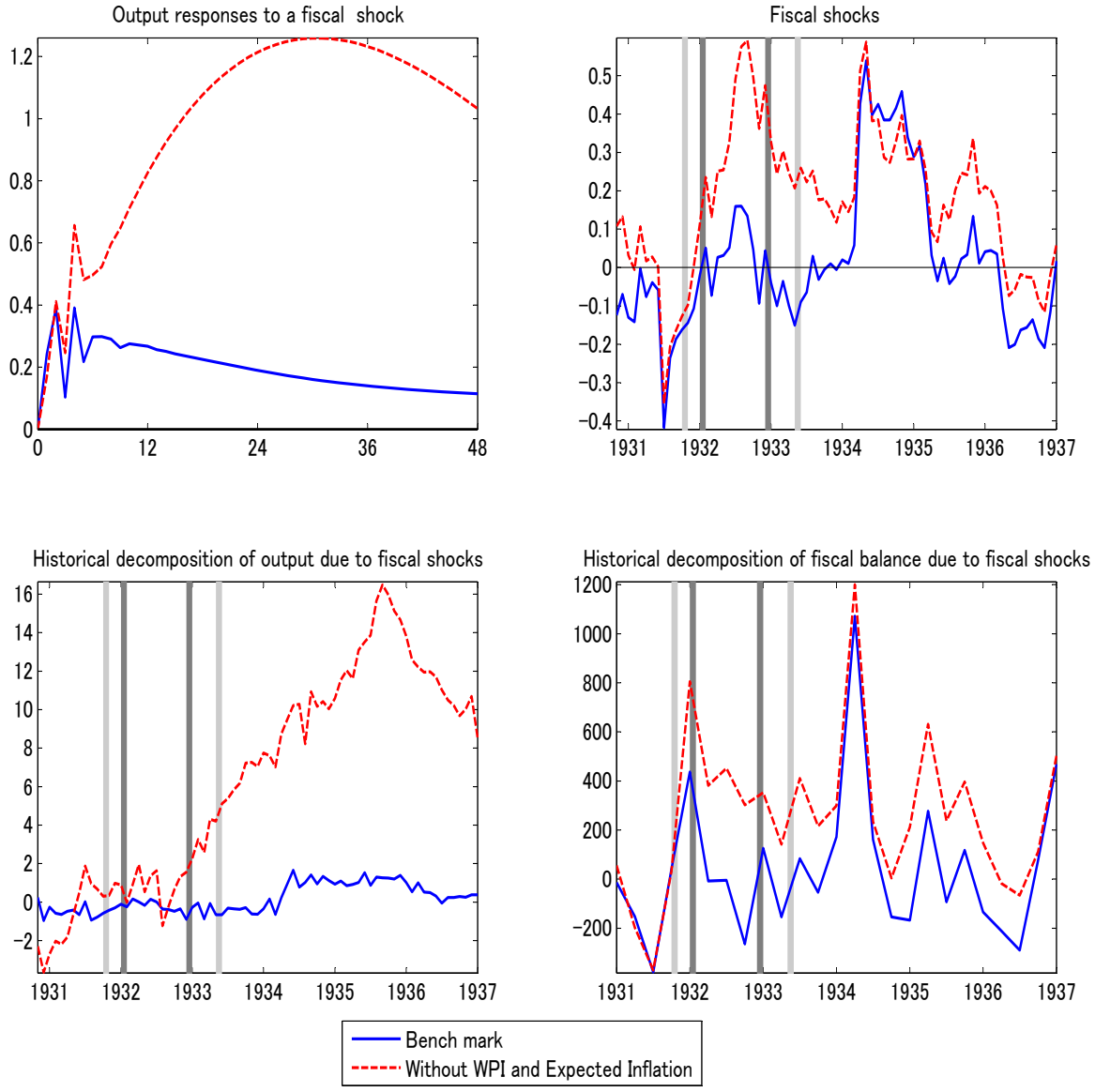

Figure 9: Benchmark model vs. VAR model without price and expected inflation