Did Takahashi Korekiyo Rescue Japan from the Great Depression?

MYUNG SOO CHA

Takahashi Korekiyo is remembered as a wise finance minister saving Japan from the Great Depression. The contribution of his policy measures however remains to be rigorously measured, with proper control of other forces also driving the recovery. Structural vector autoregression analysis of previously unexploited monthly data confirms the pivotal role of Takahashi’s debt-financed fiscal expansion. Monetizing the public debts, the Bank of Japan maintained a neutral stance. The recovery was aided by exchange-rate shocks generated during the transition from the gold standard to the floating-exchange-rate regime and, to a smaller extent, by the world recovery.

After half a century of rapid growth and industrialization following the Meiji Restoration, the boom ended and Japan entered a decade of stagnation following World War One. A series of supply and demand shocks contributed to the recession of the 1920s, including, among others, a devastating earthquake in 1923, the interwar agricultural depression, the financial crisis of 1927, and deflationary expectations resulting from the anticipated return to the gold standard.\(^1\) Finally came the Great Depression, in the wake of which Japan returned to the gold standard in January 1930, a policy decision likened by a contemporary industrialist as “opening a window in the middle of a typhoon.” The depression was of shorter duration in Japan than in other industrial countries, and the subsequent growth of the Japanese economy was unusually rapid.

Given that Japan left the gold standard relatively early (December 1931), its superior macroeconomic performance after 1929 can be seen as an additional piece of evidence corroborating the gold-standard theory of the Great Depression as proposed by Barry Eichengreen and Peter Temin.\(^2\) I show, however, that the early departure from the gold standard accounts for only

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1 See Nakamura, “Keiki hendo.” Faini and Toniolo (“Reconsidering Japan’s Deflation”) stressed the impact of deflation expectations. For a detailed account of the 1927 financial crisis, see Takahashi and Morigaki, Shōwa kin’yi kōto shi.

2 See Eichengreen, Golden Fetters; Temin, Lessons; and Eichengreen and Temin, “Gold Standard.”
part of the Japanese recovery. Most previous studies attribute the early and rapid recovery to the expansionary policy measures following the decision to take Japan off gold by Takahashi Korekiyo, the Finance Minister of Japan from December 1931 to February 1936. Much of this literature consists of narrative accounts, and quantitative studies have not been entirely convincing. Most importantly, in highlighting the policy shocks after December 1931, previous studies have failed properly to take into consideration other influences that might also have driven the Japanese recovery. Also, different studies emphasize different elements of Takahashi’s policy shocks: fiscal, monetary, or exchange-rate. Finally, there is a minority view that the recovery forces really came from the private sector.

Therefore, the causes of Japan’s recovery are an unsettled issue, and the impact of the policy measures remains to be rigorously measured, properly controlling for other shocks that also contributed to the recovery, including the world recovery and the political regime shift. The demise of Japan’s nascent democracy (known as the Taishō democracy) and the rise of fascism in the wake of the depression may have aided the Japanese recovery by exerting downward pressure upon wages, as in Nazi Germany.3 The political change was accompanied by the rise of government interventionism: in particular, industrial policy in the form of a “heavy and chemical industrialization” drive was launched in the 1930s, possibly generating investment demand stimuli. As compared with the influence of the world recovery and the economic consequences of the political regime shift, how important was the policy intervention associated with the departure from the gold standard for Japan’s recovery from the Great Depression? Which of the policy measures mattered most?

THE GREAT DEPRESSION AND RECOVERY IN JAPAN

According to the gold-standard theory of the Great Depression, both the severity of the depression and the vigor of the subsequent recovery depended upon how early a country abandoned the gold standard. As long as the gold convertibility of currency remained the predominant policy goal, the room for bold reflationary measures was severely limited, as such policies would create large balance-of-payments deficits and lead to rapid depletions of the gold stock. Removal of the external constraint being a necessary precondition for implementing expansionary policies, the earlier the departure from the gold standard, the faster was the recovery likely to be, and vice versa.

Figure 1 bears out this story: the ranking in the level of each country’s industrial-production index in 1937 matches the sequence of going off gold in the wake of the Depression: Britain, Germany, and Japan in 1931; the United States in 1933; and finally France in 1936. Figure 1 also shows that

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3 See Temin, “Socialism.”
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Japan (which abandoned the gold standard several months after Germany and Britain) revived earlier and grew faster than either of these countries. Using a richer panel data set, Ben Bernanke and Harold James showed that the rate of the Japanese contraction in 1930/31 (8 percent) was smaller than the average rate of contraction for those countries leaving the gold standard in 1931 (16 percent). Whereas most of the countries leaving the gold standard in 1931 had to wait until 1933 to see industrial production rebound, Japan’s industrial-production index resumed growth in 1932. Finally, Japan’s growth rate from 1932 to 1936 (62 percent) was substantially above not only the world average, but also the average for those countries leaving gold in the same year as Japan (45 percent).4

Different studies attributed Japan’s early and rapid recovery repeatedly to fiscal expansion, easy money, or the yen depreciation or to some combination of the three, following the decision by the Finance Minister Takahashi to take Japan off gold. However, the relative importance of different macroeconomic shocks in bringing about the expansion has never been properly evaluated. More importantly, it has been neither unanimously agreed upon nor rigorously established that the reflation measures were indeed crucial in generating the vigorous upswing of the 1930s, controlling for the influence of other shocks also driving the recovery.5

4 Bernanke and James, “Gold Standard,” p. 45, table 2.4.
5 Introducing Takahashi Korekiyo to English-speaking economists, Dick Nanto and Shinji Takagi used Granger-causality tests to show that both the yen/dollar exchange rate and real central government spending had significant impacts upon the level of activity, whereas real private investment had little
Although a majority of existing studies emphasize Japan’s effective policy response to deflationary shocks transmitted from abroad, there are others that contend that the recovery was initiated by the private sector. Using an input-output table for Japan for 1935, Norio Tominaga found that the impact of public consumption upon output was significantly weaker than that of exports and investment demand. Based on evidence of reviving private investment in the early 1930s, Kinzo Shima argued that Japan’s recovery was led by the private sector. Finally, the mildness of Japan’s depression was attributed by various scholars to wage flexibility, which was in turn related to the presence of a sizable traditional sector in a “dual structured” labor market.

Even if one accepts the crucial role of the macroeconomic policy-regime shift in reversing the downturn, it seems unlikely that the one-time shocks alone propelled rapid growth right up to the outbreak of the Sino-Japanese war in July 1937. The conventional story has it that when the worst seemed over, Takahashi began to be concerned about inflation and tried to revert to stabilization. Reducing expenditures, he attempted to put an end to debt financing, while at the same time urging the Bank of Japan to absorb money it had supplied in the course of debt monetization. This account is consistent with the fact that most of the devaluation occurred in 1932 and 1933, and that the value of the yen then began to stabilize. These studies suggest that causes other than the Keynesian policy measures may have been important in sustaining the economic growth after the early 1930s and that other unidentified factors could have mattered in reversing the downswing in the early 1930s as well.

Besides the policy-regime shift of 1931/32, there were also at least three important shocks, which are mentioned but not adequately taken into account in the previous studies. One was the recovery in the rest of the world, which, along with the yen depreciation, stimulated demand for Japanese exports. Second, as in many other countries, a consequence of the Great

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8 Nakamura, “Keiki hendō,” p. 307. In the standard historical account, the policy reversal eventually prompted the military to decide to kill Takahashi in February 1936.
Depression was that the liberal policy regime of the 1920s became discredited and state interventionism gained momentum in Japan. The shift in policy regime was pioneered by the “new bureaucrats (shinkanryo).” Disillusioned with corrupt party politics and the instability of the market economy as seen during the 1920s, these reform-minded technocrats implemented different types of market intervention.9 One was the legislation of the Important Industries Control Law (Jūyō sangyō tōseiho) in 1931. Although the law was not intended to impose direct state control over, but to encourage “cooperation” among, firms in designated “important industries” by forming depression cartels, the Ministry of Commerce and Industry remained in a position to influence investment decisions and output- and price-fixing agreements.10 Perhaps more importantly, various laws were introduced during the 1930s to promote specific (mostly “heavy and chemical”) industries, notably the Petroleum Industry Law of 1934 and the Automobile Manufacturing Law of 1936. Under these laws, the government imposed limits on market shares obtained by foreign companies (including Standard Oil, Ford, and General Motors) and used tax incentives to promote import substitution by heavy and chemical industries.11 As a consequence, transportation, chemical, and electricity emerged as the three sectors accounting for the largest parts of the increase in manufacturing investment from 1929 to 1936.12 The “heavy and chemical industrialization” drive seems likely to have contributed to the recovery by stimulating investment activity.13

The third and final factor concerns the labor market. Peter Temin explained the difference between the U.S. and German speeds of recovery in the 1930s in terms of contrasting policies towards the labor market. In the United States, labor unions were encouraged under the New Deal, and other labor protection laws were introduced, raising real wages. Exogenous wage rises shifted the aggregate supply curve to the left, reducing employment and output. In Germany, the opposite occurred. The Nazis destroyed labor unions quickly after taking power, and the government intervened in the process of wage bargaining, exerting downward pressures on the level of wages.14

Japan in the 1930s resembled Germany more than it did the United States. The Great Depression killed not only the classical liberalism in the sphere of economic policy, but also the Taishō democracy. As the unemployment

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9 Chalmers Johnson termed this shift in policy regime the “rise of industrial policy.” See his MITI, chapter 3.
10 See Hirasawa, Taikyo koki, chapters 1 and 2, for details on the Important Industries Control Law.
11 Hashimoto, Gendai Nihon, pp. 54–55.
13 Nakamura, Senzenki nihon, p. 208; and Suzuki, Shōwa kyōkōshi, p. 186.
14 See Temin, “Socialism.” Weinstein argued that the rise in nominal wages under the New Deal impeded the recovery of the U.S. economy from the depression. See Weinstein, “Some Macroeconomic Impacts.”
rate rose, the campaign against Prime Minister Hamaguchi’s deflationary policy of keeping Japan on gold turned into a movement against party politics. A right-wing terrorist shot Hamaguchi in November 1930, causing his eventual death in August 1931. In September, the Manchurian Incident made it clear that civilian control of the military was weakening. With the collapse of the rule of Hamaguchi’s Minseito party in December, Takahashi Korekiyo was appointed as the Finance Minister of the new Seiyukai party cabinet. Two fatal attacks were carried out in 1932, killing Inoue Junnosuke (the Finance Minister in Hamaguchi’s cabinet) in February and Inukai Tsuyoshi (the Prime Minister of the Seiyukai cabinet) in May. Thus ended Japan’s brief experiment with party politics. Thereafter, the military began to exercise an increasingly strong influence. In this changed political environment, both independent unions and proletarian parties suffered a setback. The Home Ministry abandoned its liberal labor policy of the 1920s and (together with the military) began to promote right-wing (“Japanist”) forces, which surfaced at the grass roots from the mid-1920s. Destroying mainstream unions, the Japanist groups expanded to the point of organizing the National Defense Fund Labor Association in early 1933. “At factories throughout the nation in the winter of 1933, an estimated 80,000 union workers and 20,000 non-union employees agreed to work on a Sunday or holiday and donate that day’s wages to the army’s National Defense Fund Drive.” The unionization rate declined from a peak in 1931 until 1934, as seen in Table 1, and the share of participants in labor disputes out of the total number of gainfully employed in the manufacturing sector also fell. Those scholars who identified downward wage flexibility may in fact have been observing the operation of the wage shocks.

To summarize, at least six different types of structural shocks need to be reckoned with to establish the causes of Japan’s early and rapid recovery from the Great Depression in a convincing way. One comes from the supply side, and the other five are demand shocks. The supply shock refers to the compression of wages during the 1930s, which possibly occurred in the transition from democracy to fascism. In the course of this transition, state interventionism emerged in Japan: in particular, “new bureaucrats” launched an industrial policy in the form of a “heavy and chemical industrialization”

15 For details, see Berger, “Politics,” pp. 105–17. The coup in 1936 (known as the February 26 Incident), during which Takahashi was murdered, finalized the transition to a de facto military rule.
16 See Gordon, Labor, chapters 9 and 10. The quote is from page 277.
17 For declining incidences of labor disputes, see Nakamura and Odaka, “Gaisetsu,” p. 35, figure 1-8.
18 After suffering a significant setback in the few years following the Manchurian invasion, the labor movement revived somewhat in the mid-1930s (see Table 1) as the labor market became tighter with the progress of the upswing, and also as the political impact of the invasion faded, only to be crushed again by the outbreak of the Sino-Japanese war in 1937. See Gordon, Labor, chapter 11. Japan’s military government banned labor unions altogether in 1940.
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<table>
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<th>UNIONIZATION RATE, 1929–1937 (percentage)</th>
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<td>1929</td>
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Source: Rōdō Undō Shiryō linkai, Nihon, p. 424.

drive, possibly generating domestic investment-demand shocks. Three of the remaining four demand shocks were related to the shift from a fixed to a floating exchange-rate regime in December 1931: public-spending, money-supply, and exchange-rate shocks. Finally, there were world-output shocks, affecting Japan’s export demand.

OUTPUT DECOMPOSITION RESULTS

To measure the role of these factors in the Japanese recovery from the Great Depression, I apply structural vector autoregression (VAR) analysis to previously unexploited monthly macroeconomic time series data. Using the analysis, one may first estimate the six structural shocks and the pattern of output response to each of the shocks and then decompose output fluctuations into different components attributable to each of the shocks. The analysis uses six variables: world output; the real effective exchange rate for Japan; real deficits of the Japanese government; high-powered money supplied by the Bank of Japan; the volume of railway freight (as an index of the aggregate activity); and real wages in Japan. The Appendices discuss the data sources and the estimation procedure.

Figure 2 shows the fluctuations of the six components from October 1930 to September 1936. To facilitate comparison, the six components are divided into two panels, and fiscal and domestic-demand components—the two lines defining the upper and lower bounds of the figure, respectively—are displayed in both panels. Fiscal shocks turn out to be the most consistent and potent source of recovery: the fiscal component rises to a plateau in 1935 and then falls, confirming the conventional story about the important role played by Takahashi’s fiscal expansion in reversing the downturn, and the subsequent shift to fiscal rectitude.19 In contrast, the domestic private-demand component declines until 1934 and then recovers. The upturn appeared to be driven by investment, as 1934 was the year when laws began to be introduced to encourage investment in heavy and chemical industries. Despite the capital accumulation in the new industries, domestic private demand shocks remained deflationary on the whole, over the sample period.

FIGURE 2A
OUTPUT DECOMPOSITION: WORLD, WAGE, FISCAL, AND DOMESTIC COMPONENTS

Note: All of the data series are log-transformed indices of rail-traffic volume.
In the early phase of the downswing, one finds the negative impact of the assassinations and aggression upon private demand—most probably consumer demand: notice the blips marked with asterisks in October 1931, and February and June 1932. Also the upswing after 1934 was interrupted by a sharp drop in February 1936, when the military coup occurred.

Figure 2A shows that the world output shock also accounted for a large part of the Japanese output fluctuations in the 1930s. Deflationary shocks continued to be transmitted to Japan from the rest of the world until early 1932, when the world as a whole entered upon a recovery path. The recovery was not steady, but interrupted by stagnation in 1934. The key causes of the setback could be found in the United States: the introduction of the National Industrial Recovery Act pushing wages upwards, the failure of the United States monetary authorities to pursue aggressive expansion, and finally the beggar-thy-neighbor effects of United States devaluation in 1933.20

The remaining three shocks were relatively mild. In the fluctuations of the money shock component (Figure 2B), one finds a weak downward trend after the departure from the gold standard in December 1931, which is reversed in early 1935. Once the changes in the money supply due to debt monetization are taken into account, the monetary policy of the Bank of Japan turns out to be neutral on the whole.

Exchange-rate shocks refer to those events—outside of world-output, domestic-policy, and wage shocks—that shifted the Japanese real exchange rate. Such exchange-rate shocks include both foreign exchange-market intervention and exchange-rate regime shifts not only in Japan, but also in the rest of the world. Fukai Eigo, a former governor of the Bank of Japan, testified that the Bank of Japan could not afford to support the depreciating yen by selling foreign currencies and hence was led to rely on capital control. Takatoshi Ito, Kunio Okina, and Juro Teranishi analyzed daily fluctuations in the dollar/yen exchange rate from 1931 to 1933. Their findings substantiated Fukai’s statement and identified Japan’s departure from the gold standard, Japan’s invasion of China, and the U.S. decision to abandon gold as the key forces driving down the value of the yen.21 The pattern of the fluctuations of the exchange-rate-shock component (Figure 2B) confirms that the exchange-rate regime shift was indeed one of the important sources of the exchange-rate shocks: the component rises sharply in the month following Japan’s departure from the gold standard, then falls in the following two years, as the number of countries abandoning gold rose. The component rises again from early 1935, when the transition to the floating-exchange-rate regime was virtually complete (with the exception of the gold bloc) and the dollar stabilization had begun.

Finally, turning back to panel A, one finds that wage shocks had a positive impact on output in late 1932 and 1933, when the Japanese labor unions were dealt a blow, as seen in Table 1. The effect, however, was small and transitory. Although real wages fell in Japan throughout the 1930s, this unique phenomenon (not observed in either Nazi Germany or fascist Italy) was a consequence of the rapid recovery from the Depression, rather than of exogenous wage shocks. The rapid recovery depressed real wages in Japan by causing price inflation: the consumer-price index in Japan rose 12 percent from 1931 to 1936, as the index fell in other countries.

The output decomposition results show that different factors supported the Japanese recovery at different times. In 1931 Japan benefited from a world in decline but still not in deep depression and gained from its devaluation in December, a once-time effect, which gradually wore off in 1932 and 1933 as the number of countries abandoning gold increased. The world returned as a positive force in 1933 as recovery began in the rest of the world, particularly in the United States, but faded quickly. Its place was taken by Takahashi’s fiscal expansion, starting from late 1932 and ending by late 1935. Other shocks mattered little in the Japanese recovery from the Great Depression. Overall Takahashi’s fiscal expansion stands out as the single most important cause of the upswing.

CONCLUSIONS

The conventional account of the Japanese economy’s recovery from the Great Depression praises the Keynesian remedies—fiscal and monetary expansion and the consequent depreciation—applied by the Finance Minister Takahashi Korekiyo several years before John Maynard Keynes’s General Theory of Employment, Interest, and Money was published. This article, applying structural vector autoregression analysis to previously unexploited monthly data, confirms that Takahashi’s deficit spending was indeed crucial in ending the depression quickly. Central government spending rose from 1,423 million yen (10.7 percent of nominal gross national product) in 1931 to 2,254 million yen (14.7 percent of nominal gross national product) in 1933, turning a small budget surplus amounting to 0.1 percent of nominal gross national product in 1931 into a deficit accounting for 6.1 percent of nominal gross national product. Financing a major portion of the public

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22 Eichengreen and Hatton, “Interwar Unemployment,” p. 15, table 1.3; and Mattesini and Quintieri, “Italy,” p. 281.
23 These countries include the United States, France, Germany, and Italy. Only in Britain did the index return in 1936 to the level of 1931. Maddison, Dynamic Forces, pp. 300–03, table F.3.
24 These numbers refer to the general account (ippai kaigi); the special account (tokubetsu kaigi) is excluded, as it consisted mostly of accounts of public enterprises, colonial governments, and public funds, most notably postal savings. Emi, “Keizai seicho,” pp. 225–26.
Deficit by printing money, the Bank of Japan at the same time absorbed liquidity to prevent inflation from escalating beyond control.

The Japanese escape, led by fiscal expansion, is both interesting and unique. The fiscal tool was never relied upon seriously for recovery from the Great Depression in other countries. Although the rebound in both Nazi Germany and Sweden relied to some extent on expansionary fiscal policy, in both the British and the U.S. recoveries, policymakers’ contributions were to be found in the sphere of monetary policy—nonsterilization of gold inflows, more specifically. Even during the heyday of Keynesian economics after the Second World War, fiscal expansion was rarely implemented successfully to pull an economy out of a slump.

Why could fiscal expansion be readily and usefully mobilized in interwar Japan? First, the Japanese government has never been seriously bound by the ideology of classical liberalism. Since the Meiji Revolution, the government has almost always believed that it had an important role to play in promoting economic growth, as expressed by the slogan fukoku kyōhei (a rich country, a strong army). One sees the tradition of state interventionism in Japan in the higher share of public spending in national income than in other industrialized countries, as well as in the substantial contribution made by the government in domestic capital formation.

Secondly, the military’s persistent demand for increased budget allocations provided a powerful impetus for fiscal expansion. The pressure for a military buildup first emerged after the end of World War One and became more vociferous after the Manchurian Incident in 1931. Although Takahashi opposed imperialistic ambition toward China and tried to curb military spending, he could not prevent the share of military spending in public deficit by printing money, the Bank of Japan at the same time absorbed liquidity to prevent inflation from escalating beyond control.
expenditure from rising consistently from 31 percent in 1931 to 47 percent in 1936.31

Finally, Takahashi’s reputation as a capable troubleshooter probably helped the prompt provision of bold fiscal stimuli. As the vice governor of the Bank of Japan, he first made himself famous through successful bond sales in London and New York at the time of the Russo-Japanese war. Already having been Finance Minister three times, and Prime Minister once, before taking office in December 1931, Takahashi had played a pivotal role in tiding over two severe financial crises, one from 1920 to 1921 and the other in 1927. His personal popularity, built upon this track record, probably allowed him to stand above political bickering and facilitated the implementation of his Keynesian policy measures.

Appendix 1: Data Sources

The world-output series was taken from Mattesini and Quintieri, “Italy and the Great Depression: An Analysis of the Italian Economy, 1929–1936,” pp. 290–91. The real effective exchange rate is a weighted average of the real exchange rate of the yen vis-à-vis the United States dollar, British pound sterling, French franc, German mark, Indian rupee, colonial Korean won, and Taiwanese yen. For countries outside the Japanese empire, nominal exchange rates are from Japan, Finance Ministry, Kin’yū jikō sankōsho; and price indices are from League of Nations, International Statistical Yearbook. For the two colonies, the nominal exchange rates equal one, and price indices are from Japan, Colonial Government of Korea, Cho’sen kin’yū jikō sankōsho; and Japan, Colonial Government of Taiwan, Taiwan kin’yū nenpō. Trade weights were calculated from Nakamura, “Keiki hendō to keizai seisaku,” p. 310, table 6-13.

Real government deficits were calculated by deflating nominal deficits on the “general account (ippan kaigi)" of the central government with the wholesale price index (available from Japan, Bank of Japan, Oroshiuri bukka shisu). Nominal deficits are derived by deducting monthly revenue from spending (available from Japan, Finance Ministry, Ōkurashō nenpō) and then adding net monthly public debt accumulation (available from Japan, Finance Ministry, Kokusai tokei nenpō). The high-powered money series is from Fujino and Igarashi, Keiki shisu, pp. 400–01. As a measure of the level of activity, the Bank of Japan seemed to rely on railway freight volume, which is available from Kin’yū jikō sankōsho.32 The real-wage series was calculated by dividing nominal wages (from the Japan, Bank of Japan, Rōdō tokei gaisetsu) by the Tokyo retail-price index (from the Bank of Japan, Honpō jūyō keizai tokei) for want of a better cost-of-living index. The nominal-wage series represents “wage income (jitshū chin’gin)” per day, which was obtained by dividing total wage payments by manufacturing and mining firms by days worked per month. The daily-wage income data include overtime payments and, hence, take account of any flexibility coming from shifts in the wage rate or hours worked.

32 Fukai, “Recent Monetary Policy,” p. 394. Studies using monthly railway freight volume data as a proxy for the aggregate output include Goodhart, Business; and Jeanne, “Monetary Policy.”
Appendix 2: Output Decomposition Procedure

I started the process by estimating an ordinary vector autoregressive system, comprising world output, the Japanese real exchange rate, real government deficits, the money supply, railway traffic volume, and the real wage. The variables were seasonally adjusted and log-transformed before estimation. As unit-root tests indicated only the real government deficits series was stationary, the remaining five variables were first-differenced. The Akaike information criteria indicated that nine lags were optimal. The sample period runs from January 1929 to September 1936, an end point dictated by the world-production index compiled by Fabrizio Mattesini and Beniamino Quintieri.

To arrive at a plausible specification relating the residuals from the vector autoregression estimation (reduced-form shocks) to structural shocks, I first carried out Granger-causality tests and calculated correlation coefficients among the reduced-form shocks. Given the results from the preliminary inspection and the standard Keynesian macroeconomic model with sticky nominal wages, I began by estimating the “general” specification as shown in panel A of Appendix Table 1. The specification is “general” in the sense that it incorporates every conceivable contemporaneous link consistent with either the statistical evidence or the Keynesian model. The vector $e = (e_f, e_x, e_g, e_m, e_y, e_w)$ represents the reduced-form shocks, and $\xi = (\xi_f, \xi_x, \xi_g, \xi_m, \xi_d, \xi_w)$ represents the structural shocks: foreign-output, exchange-rate, fiscal, money-supply, domestic-private-demand, and wage shocks.

Equation 1 implies that the shock component in world output ($e_f$) occurs solely due to world-output shock ($\xi_f$). Next comes the real-exchange-rate equation, where only the coefficient associated with wage innovation is significant. The world-output shock fails to lead contemporaneously to exchange-rate shock, probably because the “world” output series (a weighted average of the industrial-production indices in the United States, Germany, France, and Britain) is an imperfect proxy for the level of activity in the world Japan actually dealt with: Europe and the United States accounted for only 37 percent of Japanese exports in 1929–1931, a share which declined to 24 percent in 1934–1936.33 The insignificant coefficient estimates for deficit and money innovations appear to reflect the reduced sensitivity of the exchange rate to policy shocks due to the gradual introduction of capital control beginning with the Capital Flight Prevention Act of July 1932.34

Equation 3 indicates that while Japan’s fiscal policy was aimed at countering external shocks, the finance ministry did not react to reduce output volatility within a month. The insignificant coefficient for domestic output innovation is also consistent with the absence of automatic stabilizers (within a time horizon of one month) in interwar Japan: the unemployment insurance scheme was not introduced until 1 December 1947,35 and taxes were collected mostly on a quarterly or half-yearly basis in interwar Japan,36 with the government determining the level of monthly spending within the annual budget authorized by the Diet in the early months of each year.37

The insignificant coefficient estimates in equation 4 indicate that the Bank of Japan neither tried to stabilize the fluctuating level of activity contemporaneously, nor shifted its money supply to accommodate money demand via discount-window lending.38 When I

33 Calculated from Nakamura, “Keiki hendō,” p. 310.
34 In May 1933 the Foreign Exchange Control Act replaced the Capital Flight Prevention Act, which had been found to be porous. Still, the new act did not provide a watertight barrier against capital flows. Itoh, Nihon, pp. 274–78; and Fukai, Kaiko, pp. 276–77.
35 I am grateful to Professor Konosuke Odaka for this particular piece of information.
36 Japan, Finance Ministry, Shin zeiho yo ran, pp. 228–30; and Sakairi, Shōwa zenki zaiseishi, p. 85.
37 For a detailed description of the fiscal procedure in the early 1930s, see Ohmae, “Saitō.”
38 Fukai, Kaiko, pp. 268–89.
Adding exchange rate shock, also known to work with lags, in equation 5 resulted in an insignificant and wrong (i.e., negative) coefficient for the added term and the failure for the expanded specification to pass over-identification test. 

Equation 5 expresses an IS relationship, where all three coefficients have correct signs. However, the coefficient associated with money innovation is insignificant, confirming the conventional wisdom that money shocks operate with long lags. Finally, equation 6 represents the aggregate-supply relationship, which is augmented by the world-output shocks, as the world-output and wage shocks were found to be highly correlated. The added deficit innovation \( e_d \) in equation 4, and estimated the expanded specification, the coefficient for the added term was insignificantly negative, and the augmented system was found to be over-identified.

Appendix Table 1

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<td>A. General Specification</td>
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<tr>
<td>( e_f = e_f )</td>
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<tr>
<td>( e_f = -0.002 e_f + 0.01 e_g - 0.07 e_m + 0.39 e_w + e_e )</td>
<td>2</td>
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<tr>
<td>( (0.03) (1.37) (0.90) (2.44) )</td>
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<tr>
<td>( e_g = -2.11 e_f - 1.08 e_y + e_e )</td>
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<tr>
<td>( (2.01) (1.11) )</td>
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<tr>
<td>( e_m = -0.22 e_f - 0.01 e_y + e_e )</td>
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<tr>
<td>( (1.33) (0.04) )</td>
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<tr>
<td>( e_y = 0.72 e_f + 0.05 e_w - 0.09 e_m + e_d )</td>
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<tr>
<td>( (5.26) (3.17) (0.33) )</td>
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<tr>
<td>( e_w = -0.09 e_f - 0.11 e_y + e_e )</td>
<td>6</td>
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<tr>
<td>( (1.56) (2.24) )</td>
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Likelihood ratio test for over-identification: Chi-squared(2) = 3.04 with a significance level of 0.22.

B. Simplified Specification

\( e_f = e_f \) | 1’ |
\( e_f = 0.36 e_u + e_e \) | 2’ |
\( (2.37) \) |
\( e_g = -2.76 e_f + e_e \) | 3’ |
\( (2.33) \) |
\( e_m = e_m \) | 4’ |
\( e_y = 0.71 e_f + 0.04 e_w + e_d \) | 5’ |
\( (6.08) (3.51) \) |
\( e_w = -0.14 e_f + e_e \) | 6’ |
\( (3.38) \) |

Likelihood ratio test for over-identification: Chi-squared(10)=13.51 with significance level of 0.20.

Note: Parenthetically shown are \( t \)-statistics.
negative and highly significant coefficient for the domestic-output shock indicates the presence of nominal wage rigidity.

Dropping the terms associated with insignificant coefficients and re-estimating the simplified specification, I obtained broadly similar coefficients for the retained terms, which are estimated more precisely as the larger t-statistics indicate (panel B). Although the output decomposition results were derived using the parsimonious specification, the general specification yields basically the identical outcome. Impulse-response functions were all consistent with the predictions of the Keynesian model with nominal wage rigidity.40

One may recover structural shocks from reduced form shocks using the equations in panel B. The estimated structural shocks together with the impulse-response functions allow decomposition of output fluctuations into six different components. For instance, one can calculate the part in monthly change in output due solely to the money-supply shock by setting the present and past values of structural shocks other than the money-supply shock equal to zero in the impulse-response function for output. Accumulation of this money-supply component yields the path along which the output level would have fluctuated had money-supply shocks alone been generated.

40 Impulse-response functions, Granger-causality test results, and correlation coefficients among reduced form shocks are available upon request.

REFERENCES


