Monetary Policy and the Business Cycle in Postwar Japan

Working Paper No. 3
(Revised)

Monetary Policy and the Business Cycle in Postwar Japan

University of Chicago Press - Forthcoming

Michael W. Keran
April 30, 1968

TABLE OF CONTENTS

Figures

Tables

MONETARY POLICY AND THE BUSINESS CYCLE IN POSTWAR JAPAN

I - Introduction

The postwar growth of Japan is an authentic economic miracle. Since recovering her prewar levels of per capita production and income in 1953, the growth rate in real terms has averaged close to 10 per cent a year. This performance is by far the most impressive of any of the major industrial countries in the world. Even the Japanese business cycle has been relatively mild, reflecting mainly variations in a positive growth rate. Optimists have speculated that the "Japanese type business cycle" is what may be in store for many industrial countries in the future because the economic policy tools necessary to prevent major economic declines have been developed.

The object of this study is to analyze the postwar cyclical experience of Japan which has taken place within the context of rapid secular growth in real income. This will be done by developing a business cycle model which uses as one of its assumptions the modern Quantity Theory of Money. This will not be a monetary business cycle theory in the usual sense because disturbances from sources other than money can trigger the cycle.

Modern business cycle models have typically been constructed on the basis of assumptions about interaction among various components of the national income accounts. The Keynesian income-expenditure framework is usually the static equilibrium limit.[1/] Most of the initial work in this area was concentrated on specifying alternative lags and analyzing their effects on the cycle. Lloyd Metzler (1948) postulated

---

1/ Some business cycle model building has been based on the assumption that the economy was in unstable equilibrium. The best known of these is perhaps the Hicks-Domar growth model, with its knife's edge equilibrium growth path.

that there are "Three lags in the circular flow of income." The major segments of the circular flow and the possible sources of lags suggested by Metzler are as follows:

$$\text{Production} \xrightarrow{(1)} \text{Income} \xrightarrow{(2)} \text{Consumption (sales)} \xrightarrow{(3)} \text{Production.}$$

The first lag between production and income was not considered important because the largest component of income, wages and salaries, are paid with a very short lag, usually weekly or biweekly. The second lag between income and consumption was incorporated in Samuelson's (1939) "Interactions between Multiplier Analysis and Principle of Acceleration." The third lag between sales and production was used by Meltzer (1941) in his "The Nature and Stability of Inventory Cycles." 2/

Such lagged endogenous business cycle models (given realistic values of the parameters) are analogous to the operation of a defective thermostat. If the thermostat is working properly, it can keep the actual temperature in a room very close to the desired temperature. However, if the thermostat is defective in the sense that it transmits signals to the furnace with a lag, then the actual temperature will fluctuate around the desired temperature. The reason is fairly obvious. If the actual temperature rises above the desired temperature, the defective thermostat will not signal the furnace to turn off immediately. Conversely, if the actual temperature falls below the desired temperature, the defective thermostat will not signal the furnace to turn on immediately. In business cycle models the lags in behavioral responses lead to similar deviations between desired and actual income.

2/ The earliest work incorporating dynamic properties into the Keynesian system was done contemporaneous with the publication of the General Theory. D. H. Robertson considered a second type lag in "Some Notes on Mr.Keynes' General Theory of Employment." Quarterly Journal of Economics, Vol. LI (1936), pp. 168-91. Erik Landberg considered the third type lag in Studies in the Theory of Economic Expansion (London 1937), Ch. 9.

The business cycle model developed in this study follows in the footsteps of these earlier models. Its cyclical properties are based on highly simplified assumptions about lagged behavior of decision-making units in the economy.

Eight variables are considered in this model: real and nominal variables for income, money, international reserves and imports. All are measured as quarterly rates of change: 3/

3/ Because of the impressive growth Japan has enjoyed over the period of this study, virtually all of the economic series considered here have a strong upward time trend. To estimate meaningful behavioral relations under this circumstance requires recognition of this time trend. A variety of techniques are possible, such as scaling, deviation from trends, or first differences. In this study, scaling was not considered feasible and deviations from trends were not reliable. Thus, first differences in the form of rates of change were employed.

The general convention for computing rates of change at period (t) is to base it on the difference between period (t-1) and (t).

$$\dot{Y}_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

However, it would be equally reasonable to compute the change at (t) as the difference between (t) and (t + 1).

$$\dot{Y}_t = \frac{Y_{t+1} - Y_t}{Y_t}$$

Either alternative would be the rate of change between periods and not the rate of change for a period. To more closely approximate a smooth rate of change at a point of time, this paper employs a modified form of the central difference theorum used by John Kareken and Robert Solow in "Research Study One, "Lags in Monetary Policy" Stabilization Policies, A Series of Research Studies Prepared for the Commission on Money and Credit (CMC). Prentice-Hall, Inc., 1963, p. 18. The rate of change for any period (t) equals:

$$\dot{Y}_t = \frac{\frac{Y_t - Y_{t-1}}{Y_{t-1}} + \frac{Y_{t+1} - Y_t}{Y_t}}{2}$$

$\dot{Y}$ = Nominal Gross National Product

$\dot{X}$ = Index of industrial production

$\dot{M}_t$ = Nominal money stock. Currency in the hands of the non-bank public plus designated monetary deposits of the banking system.

$\dot{M}^*$ = Real money stock. The nominal money stock divided by the GNP implicit price deflator.

$\dot{R}$ = Nominal International Reserves. The foreign exchange special account of the Ministry of Finance Government of Japan. (This series is exclusive of changes in reserves which arise from transactions with foreign central banks or international organizations.)

$\dot{R}^*$ = Real International Reserves. Nominal International Reserves divided by the import price index.

$\dot{Im}$ = Nominal imports on a customs clearance basis.

$\dot{Im}^*$ = Real inputs. Nominal imports divided by the import price index.

The first assumption in this model is that the modern version of the Quantity Theory of Money provides an accurate determination in the short run of the level of national income. Given a predictable and quantifiable link between the money stock and money income, there will also be a predictable and quantifiable link between changes in the money stock, $\dot{M}$, and changes in money income, $\dot{Y}$. Therefore,

$$1.1 \qquad \dot{Y} = \alpha_o + \alpha_1 \dot{M}_{t-m} + v_1$$

The second assumption in this model is that variations in the money supply represent a discretionary policy tool in the hands of the monetary authorities. As such, the money supply can be manipulated in such a way as to achieve some target policy goal. In the case of Japan, this goal is postulated to be attainment of "external stability"; i.e.,

reducing variations in the growth of international reserves, $\dot{R}$. When $\dot{R}$ declines, monetary policy becomes "tighter," and when $\dot{R}$ increases, monetary policy becomes "easier." This is a statement about the behavior of the policy authorities and, as such, is capable of theoretical analysis and statistical verification in the same way as statements about behavior of other elemental decision-making units in the economy. In this sense money supply is an endogenous variable.

$$1.2 \qquad \dot{M}_t = \beta_o + \beta_1 \dot{R}_{t-n} + v_2$$

The third assumption is that variations in international reserves, $\dot{R}$, are largely dependent upon variations in imports rather than upon variations in exports or capital movements.

$$1.3 \qquad \dot{R} = \rho_o + \rho_1 \dot{Im}_{t-p} + v_3$$

This unusual assumption about the behavior of international reserves will be considered in some detail in Section 4-B.

The final assumption in this model is that variations in imports are dependent upon variations in income.

$$1.4 \qquad \dot{Im}_t = \gamma_o + \gamma_1 \dot{Y}_t + v_4$$

The dynamic process of adjustment implied by these statements about behavior can be described as follows: [4/] Assume an initial

---

4/ Previous work linking money, income, and the balance of payments was done by J. J. Polak (1957,1960). He makes roughly the same set of behavioral assumptions as in this paper. However, the Polak study differs from this one in several important respects. The statistical testing in that study compared average values and ratios of important time series with the underlying theoretical relationship to determine the long-run effect of money on the balance of payments. The present study utilizes regression techniques and difference equations to measure the short-term effect of money on international reserves and income.

condition of equilibrium growth in income, money, international reserves, and imports. Some exogenous event occurs which causes a deceleration in international reserves. The authorities react with a restrictive monetary policy. $\dot{M}$ decreases causing money income and imports to decelerate. The decline in $\dot{Y}$ and $\dot{Im}$ will lead to a reversal of the deceleration in international reserves. An increase in $\dot{R}$ will allow the authorities to ease monetary policy and $\dot{M}$ will increase. The resulting rise in $\dot{Y}$ and $\dot{Im}$ will eventually lead to a decline in $\dot{R}$ and the whole process will be repeated again.

It can be observed that increases in income in one period will lead to decreases in income in a future period. The transmission mechanism can be illustrated as follows:

$$\uparrow \dot{Y} \rightarrow \uparrow \dot{Im} \rightarrow \downarrow \dot{R} \rightarrow \downarrow \dot{M} \rightarrow \downarrow \dot{Y}$$

The implications can be seen more formally by a simple process of algebraic substitution. The four equations 1.1 through 1.4 can be reduced to one equation of the following form:

$$1.5 \qquad \dot{Y}_t = A_o + A_1 (\dot{Y})_{t-z}$$

Where

$$A_o = \alpha_o + \alpha_1 \beta_o + \alpha_1 \beta_1 \rho_o + \alpha_1 \beta_1 \rho_1 \gamma_o,$$

$$A_1 = \alpha_1 \beta_1 \rho_1 \gamma_1,$$

and

$$z = m + n + p.$$

The change of income in period t-z will lead to a predictable change in income in period t. The direction and degree of the change will depend upon the size and sign of A_1.

In Section 2, a brief summary of postwar Japanese economic history is presented, including a description of the Japanese financial structure and of the four business cycles from 1953 to 1966. Section 3 discusses the mechanism by which central bank actions affect the money supply. In Section 4, the behavioral relations which link income, money, international reserves, and imports are considered. Finally, in Section 5, the underlying difference equation is analyzed and the effects of alternative monetary policy actions on the business cycle are considered. The study is closed with a summary and suggestions for future research.

II. The Japanese Economy 1946-1966

The postwar economic history of Japan can be separated into two periods: (1) an immediate postwar period of reconstruction and attainment of prewar levels of per capita output (1946-52), (2) a latter period of rapid but fluctuating growth in output and income (1953-1966). In order to set the stage for a description of Japanese financial institutions and the business cycles which emerged in the latter period, it would be useful to briefly review the early postwar years.

A. Economic Reconstruction 1946 to 1952

From 1946 until 1952 Japan was in a period of reconstruction from the devastation suffered during World War II. At the beginning of 1946 Japan was a broken nation, with over 20 per cent of its capital stock destroyed, its people dispersed to the countryside, and its business organization in chaos.

A sudden termination of the war in August 1945 led to a drastic decline in industrial production to one-third of the 1944 level. As this reflected a termination of war production, it had little effect on the civilian population which had already experienced a sharp reduction in consumption in the last year of the war. The average level of production in 1946 was only about one-half of the 1945 level as the effects of

terminating war production continued to unwind and civilian production did not grow. Only a relatively good agricultural harvest in the summer of 1946 plus the massive infusion of food aid from the United States maintained consumption above starvation levels.

During 1947 industrial production hit its postwar trough and started to rise: by 22 per cent in that year, by 46 per cent in 1948, and by 30 per cent in 1949. In spite of these growth rates, however, industrial production in 1949 was only 71 per cent of the 1934-36 average. In this context economic recovery had not been impressive.

The decline in production in 1946 and the relatively slow recovery through 1949 can be attributed in part to the disorganized state of Japanese business and its inability to adjust to the new conditions of civilian production. A major factor in this disorganization was the maldistribution of resources due to a price inflation which averaged 247 per cent per year from 1945 to 1948. These increases were partially due to the elimination of price controls and thus reflected de jure the inflationary pressure built up in the last years of the war. The price increase from 1945 to 1946 was 365 per cent.

The price increases in 1946-1948 which averaged 180 per cent per year were due largely to the very easy monetary policy pursued by the early postwar government. On top of a tripling of the money stock in 1945, [5] the money supply grew at an average annual rate of 90 per cent in 1946 through 1948. The expansionary policy, which received the support and encouragement of the United States occupation authorities, was designed to channel resources into what the government considered high-priority basic industries necessary for reconstruction. [6]

In the latter part of 1948 increasing concern was expressed regarding the effects of rising prices on the distribution of resources and the possible adverse effect this was having on industrial recovery. This concern led to a major shift in monetary policy. Growth in the money supply was virtually stopped in 1949 largely because the government sector shifted from substantial deficits in 1948 to a moderate surplus in 1949. Rather surprisingly, this sudden shift in policy seems to have had only a moderately depressing effect on the growth in industrial production in 1949. Although

---

5/ A major factor in the rise of the money stock in 1945 was the action of the Japanese government at the very end of the war. They paid off all of the long-term government debt in cash, doubling the money supply in one stroke. This is a very curious and perhaps unique experience in modern monetary history and would be worth further detailed investigation. It is curious in that the government thought that it was doing the bond holder a favor by substituting a non-interest-bearing note for an interest-bearing bond. Perhaps the government was afraid that the occupation authorities would repudiate the war debt and thus leave the bond holders with worthless pieces of paper. But even if this action protected the bond holders, it hurt the rest of the Japanese people by adding to price inflation and thereby leaving everyone with less valuable assets denominated in nominal value.

6/ Economic Stabilization Board, annual Economic Survey of Japan, 1951-52 (July, 1952).

prices increased by 60 per cent in 1949, the rate was only one-third of the two previous years. In 1950 the price rise slowed to 18 per cent.

Japan was fortunate in picking this time to put her financial house in order because it allowed her to take effective advantage of the great increase in export demand stemming from the Korean War which started in June 1950. By the middle of 1951 Japan was a major workshop and arsenal in direct support of U.N. troops in Korea. This favorable status resulted in substantial increases in exports. By 1952 this source was almost two-thirds the size of all other forms of exports combined. From the end of 1950 to the end of 1952 foreign exchange reserves increased 100 per cent, from $560 million to $1,138 million.

At the end of 1952 a formal peace treaty with Japan had been signed and the allied occupation was about to terminate (April 19, 1953). Industrial production was 126 per cent of the 1934-36 level, and per capita income was approaching its prewar peak. Traditional foreign markets were again opening up, prices had been stabilized, and some sense of confidence had been restored to the Japanese people.

With the end of the allied occupation, full control of the levers of economic policy-making was returned to Japanese hands. The analysis of Japanese business cycles would most appropriately be started at this point.

The remainder of this section will consider briefly the institutional structure in which monetary policy operated, and describe the four business cycles Japan experienced between 1953 and 1966.

B. The Financial Structure of Japan

The institutional underpinning of Japan's financial structure is different from that of the United States and Western European countries. This difference is even deeper than can be presented in a simple quantitative framework. Japan is strongly influenced by the Oriental culture in which the role of the individual is subordinated to the role of the group in the decision-making process. Therefore, business transactions in Japan are substantially different than in the West. These quantitative and qualitative differences would seem to imply that the transmission mechanism by which changes in the financial sector lead to changes in the real sector would be different, and yet this does not seem to be the case. A major implication of this study is that the highly generalized statement of economic behavior embedded in the quantity theory of money is a useful tool of analyzing short-term fluctuations in income in a wide variety of institutional environments.

There are two important features to consider in the institutional structure of Japanese finance: (1) the dependence of the corporate business sector on the banking system for external financing, and (2) the dependence of the banking system on the central bank for reserves.

Neither of these conditions is, of course, unique to Japan. What is unique is their extent and how they operate.

Corporate dependence on the banking system. The dependence of corporations on the banking system for a large share of their financing is due to the very rapid rate of growth in corporate investment which has out-stripped the rate of growth in corporate profits and retained earnings. This forced corporations to rely heavily on external rather than internal sources of financing. The banking system is the major financial intermediary through which corporations borrow because of the underdeveloped structure of alternative markets.

By the standards of other industrialized nations (or Japan before World War II), the share of internal financing by Japanese business is quite small. Net worth is only one-third of total liabilities plus net worth. In the United States and Western Europe and in prewar Japan, net worth was about two-thirds of liabilities plus net worth. 7/ Most of this external financing is done through the banking system.

The immediate postwar chaos in the Japanese economy combined with the Allied Occupation policy of destroying the prewar economic power centers which were believed to have contributed to the expansionist

---

7/ Patrick, Hugh T. Monetary Policy and Central Banking in Contemporary Japan University of Bombay Press 1962 p. 28. The description of Japanese financial institution in this study draws heavily on Professor Patrick's work.

military policy, led to the destruction of the equity structure of the major segments of Japanese business. The inflation of the middle and late 1940s also wiped out most of the bonded debt of Japanese corporations. 8/

As a result, the corporate cash flow in the form of retained earnings and depreciation allowances was small relative to the need to finance corporate investment and meet liquidity needs. Corporations were forced to rely heavily on external sources of funds.

Table 1

Sources of Funds for Non-Financial Corporations 9/
(Share of Total)

	1953	1955	1957	1959	1961	1963
External Sources	.68	.61	.66	.66	.65	.68
Internal Sources	.32	.39	.34	.34	.35	.32
Retained Profit	(.18)	(.18)	(.14)	(.15)	(.16)	(.12)
Dep. Allowance	(.12)	(.21)	(.20)	(.19)	(.19)	(.20)

Source: Economic Planning Agency, Government of Japan.

Institutionally, domestic loans from commercial banks were the most important external source of financing. Alternative sources

---

8/ When serious recovery started in 1948-49, many corporations had no real financial ties with the past. The only continuity was personal ties and a strong sense of identity with the organization. It is interesting to note that although many firms were forced to change their names as a part of the general Occupation policy of breaking up the Zaibatsu structure, they reverted to something closely approximating their prewar names only a few months after the effective date of the Peace Treaty in April, 1953.

9/ As demonstrated by Meiselman (1967) and others, there are serious conceptual problems in the uses of flow of funds data in economic analysis because of the difficulty of arriving at meaningful gross flow data. Thus, Tables 1 and 2 should be interpreted as only a very rough measure of the financing conditions of Japanese nonfinancial corporations.

have not developed to sufficient size or flexibility to meet the financing needs of business. The bond market provided an insignificant 3 to 6 percent of total external financing. It was badly hit by the early postwar inflation, and attempts at recovery were handicapped by government policy of pegging interest rates at a relatively low level. No effective device seems to have been developed to increase the real interest rate sufficiently to make bonds attractive to the investing public. Of the modest amount of bonds issued, 80 to 90 percent was purchased by the banking system.[10/]

The stock market has grown rapidly since it was re-opened in 1949, but it is a relatively expensive source of funds. Traditionally, new stock issues are offered at par value to old stockholders. As the market price is generally several times the par value, corporations consider that the effective annual interest cost of acquiring funds through stock issues is about 25 per cent. In addition, there are substantial tax advantages to acquiring funds by issuing debt rather than equity instruments. Thus, the incentives are great for corporations not to raise funds through the stock market. [11/]

11/ In the late 1950s and early 1960s there was great interest on the part of the small investor in the stock market. The peak was reached in 1961 when investment trusts, which are purchased exclusively by small investors, received over $1.5 billion in new funds. In September, 1961, the market broke and the price fell by more than one-third in less than a year. This collapse in stock prices brought to light the most flagrant form of market manipulations practiced by the security companies which dominate the market and which are virtually free of supervision. There followed a massive decline in small investor-participation in the market, and investment trusts received only $140 million in new funds by 1963 and no new funds in 1964.

10/ Since 1962 bonds of the largest corporations held by commercial banks have been eligible for discounting with the Bank of Japan.

In the years just after the war, governmental financial institutions provided an important source of external funds to private corporations. However, over the period considered in this study there has been a steady decline in the importance of this source. Foreign borrowing is also a marginal source of funds. The banking system, on the average, provides two-thirds of the external funds to non-financial corporations.

Table 2

External Sources of Funds for Non-Financial Corporations
(Share of Total)

	Total (Billions of ¥)	Private Domestic Sources			Gov't. Sources	Foreign Sources
		Banking System	Stock Market	Bond Market		
1953	966	66	17	4	13	-
1954	637	57	19	2	19	2
1955	844	65	10	4	12	9
1956	1,805	70	13	4	6	6
1957	1,612	75	15	2	10	- 2
1958	1,729	71	12	5	9	4
1959	2,418	65	14	6	8	7
1960	3,631	64	14	9	6	7
1961	4,236	61	22	4	6	6
1962	5,090	73	14	2	6	4
1963	5,831	71	11	3	6	8
*1964	5,274	70	12	3	9	6

* Estimated.

Source: Economic Planning Agency, Government of Japan.

Dependence of the Banking System on the Central Bank. In general, the loan policy of the banking system can be strongly influenced by central bank actions which affect bank reserves. This influence is enhanced in the case of Japan by the substantial and continuous debt of the banking system with the central bank. The natural sources of reserves for the banking system are from government deficits financed by the central

bank and balance of payments surpluses. The use of reserves by the banking system is to meet the increased demand for currency by the non-banking public. In Japan, the natural sources of reserves have not been sufficient to meet this demand. The central bank had to meet this deficiency through extensions of central bank credit. From 1953 to 1966 the cumulative increase in central bank credit to the banking system was ¥ 1,969 billion ($5.5 billion). During the same period the cumulative increase in the reserves of the banking system has been ¥ 525 billion ($1.4 billion).

The major device for extending Bank of Japan credit is through loans and discounts on commercial paper held by the banks. Starting in the fall of 1962 central bank credit was expanded to include what the Bank of Japan calls open market operations. These operations do not differ substantially from loans and discounting of commercial paper except that the eligible instruments are long-term bonds rather than short-term bills and notes. In each open market transaction the seller must agree to repurchase the bond at the option of the Bank of Japan. This option can be exercised only on certain stipulated dates, usually three months apart, and has substantially the same impact on commercial banks as discounting regular commercial paper with a 90-day due date.

Because central bank loans and discounts and open market operations are essentially identical instruments, they are treated here as one instrument and called central bank credit. Tools other than central bank credit are unimportant. Official reserve requirements

have been applied since 1959, but they average only 1/2 of one per cent of deposits. [12]

The Bank of Japan did not regulate its credit extension to the banking system through the price mechanism. The discount rate, plus penalty charges, were the cheapest marginal source of funds. Thus, a non-price rationing technique called madoguchi shido, or window guidance, was used. The operational mechanism of window guidance has evolved over the years. Each commercial bank is given a ceiling beyond which it may not borrow from the central bank. The exact formula for determining the height of this ceiling is a well-kept secret of the Bank of Japan. However, according to Patrick (1962) who has closely investigated the institutional structure of Japanese monetary policy, it is generally geared to the amount of deposits held by each bank. There are only twelve major "city" banks which, under normal conditions, are allowed to borrow from the Bank of Japan. [13]

---

[12] The use of a single policy variable makes appraisal of central bank policy easier than if a variety of tools were utilized. With more than one central bank tool, one is faced with the important methodological difficulty which is generally referred to as the index number problem. For instance, how does one determine the relative importance of a one per cent change in the discount rate versus ¥ 100 billion change in open market operations? When this problem arises, it is frequently necessary to construct an indirect test of central bank policy before appraising monetary actions. See Kareken and Solow, op. cit., p. 78.

[13] Each of the "city" banks has a nation-wide system of branches, and all but two are headquartered in Tokyo. The fastest growing corporations are also headquartered in Tokyo and acquire most of their external financing from the "city" banks. There are sixty-four local banks which are restricted by law to doing business only with corporations in their prefectures. Thus, city banks have greater demand than supply of funds from deposits, while the local banks are in the opposite position. This not only creates the condition where the city bank is the dominant borrower from the Bank of Japan, but also a major borrower from the local bank through the call market.

In the early years of window guidance, central bank credit in excess of ceiling amounts was made available to individual banks at a special penalty rate, and then only on the promise of the affected bank that it would restrict the growth of the loans outstanding. However, as these penalty rates were lower than the cost of alternative marginal sources of funds, the banking system was not discouraged from borrowing, and many of the promised reductions in bank loans were not realized. As the Bank of Japan seemed unwilling to make the penalty rate high enough to discourage borrowing, this technique was gradually reduced in importance and finally abolished in 1962. It was replaced by a system in which banks which requested central bank credit in excess of their ceiling allotment, were told to meet their needs in the interbank call market. This market, which was quite small prior to 1955, grew to substantial proportions by 1961. Interest rates in the call market are highly sensitive to changes in demand. Peak interest rates in the call market reached 20 per cent per annum in 1957 and 1961 and 13 per cent in 1963. This expensive marginal source of funds put a more effective profit squeeze on the banking system than the central bank penalty interest rates which never were more than 9.5 per cent.

Under this revised system, window guidance procedures also changed. Not only were commercial banks given a ceiling beyond which they could not borrow from the central bank, they were also given a ceiling beyond which they were asked not to extend loans, which was usually stated in the form of a fixed per cent increase in loans outstanding over some base period, e.g., 10 per cent increase over the same quarter in the previous year. Those banks which succeeded in maintaining their

outstanding loans close to the target figures established by the Bank of Japan, were allowed to replenish their reserve deficiencies from the relatively low-cost central bank credit. Those banks which exceeded their ceiling loan target were denied central bank credit and forced to meet their reserve needs from the high-cost call market. [14]

One of the costs of non-price rationing of central bank credit, was that the commercial banks which were more expansionist and innovating were unable to increase their share of the market. These banks were the first to approach their central bank borrowing ceilings and the first to exceed the central bank's suggested ceiling on new loan commitments to the public. Banks which were less expansionary and less innovating were less likely to exhaust their borrowing ceilings from the central bank and were less likely to exceed their suggested loan ceilings.

The Bank of Japan's window guidance techniques tended to keep the growth rates of the member banks relatively even with one another, irrespective of differences in management or efficiency. Table 3 illustrates this result. The twelve major city banks are listed in order of the size of their deposits as of March 31, 1956. The same

---

[14] Many banks attempted to hide the fact that their loans exceeded the recommended ceiling. This was typically done by repayment of the loan on the statement day at the end of the month and re-loaning on the next day. These "hidden" loans were estimated to be over $500 million in early 1962.

Table 3

Deposits of Japan's Major City Banks

(Billions of ¥en)

	March 31, 1956	March 31, 1961	March 31, 1965
Fuji	319 (1)	745 (1)	1,354 (1)
Miysubishi	302 (2)	712 (2)	1,311 (2)
Sanwa	286 (3)	686 (3)	1,288 (3)
Sumitomo	280 (4)	674 (4)	1,274 (4)
Tokai	203 (5)	486 (5)	1,029 (5)
Dai-Ichi	187 (6)	457 (6)	914 (6)
Mitsui	184 (7)	433 (8)	846 (7)
Kangyo	181 (8)	435 (7)	829 (8)
Kyowa	156 (9)	318 (9)	592 (9)
Daiwa	130 (10)	308 (10)	555 (10)
Kobe	102 (11)	228 (11)	479 (11)
Hokhaido	91 (12)	187 (12)	353 (12)

Source: Economic Statistics of Japan, 1965, Bank of Japan.

Note: Numbers in brackets ( ) refer to cardinal ordering of banks in each period according to value of deposits.

ordering of banks was also true as of March 31, 1961 and March 31, 1965, the only exception being that bank number eight moved slightly ahead of bank number 7 in the March 31, 1961 observation. This stability in the ordering of Japan's major banks is probably a necessary condition for their acceptance of non-price rationing of central bank credit. Whatever its inherent logic it is generally accepted that a fair "rule" for accepting non-price rationing is where each participant maintains his same relative position in the group.

C. Cyclical Experience, 1953-66.

Each of Japan's four cyclical declines in production was induced by restrictive government policy to correct a decline in international reserves. The Japanese authorities initially experimented with a variety of techniques for implementing this restrictive policy. In the first cycle they employed a wide range of small restrictions, hoping to prevent the effects from being concentrated in any one segment of the economy. Government spending was to be reduced by stretching out some programs and terminating others; special credit facilities to importers were eliminated, and the Bank of Japan initiated a form of rationing central bank credit to the banking system.

It soon became clear that planned restrictions in government spending could not be realized because of the intense political pressures for increased spending from inside the coalition of special interest groups which made up the party in power. For example, in the first restrictive period although Government spending was planned to be reduced by 2 per cent, spending actually increased

17 per cent. In succeeding periods when restrictive actions were called for, no serious effort was made to restrict the increase in Government spending or increase taxes.

With most of the weight for restrictive actions imposed on monetary policy, the authorities gradually moved from emphasis on particular credit restrictions to generalized credit restrictions. In the early stages it was believed that if restrictions were needed to correct a deterioration in the balance of payments, then a policy which directly discouraged imports and encouraged exports would be the most useful. However, experience with such policies convinced the authorities that the only effective way to reduce imports and encourage exports was to impose generalized restrictions. 15/

Japan has not employed the orthodox monetary measures to achieve generalized credit restrictions. Reserve requirements did not exist in law or custom until 1959, and since then have only been used moderately; open market operations were unfeasible because the appropriate market structure did not exist, and the basic central bank discount rate was either not raised at all or not raised sufficiently to discourage the borrowing demands of the banking system.

15/ The commitment to general rather than particular credit restrictions did not prevent the authorities from attempting to shield certain "preferred" industries from the effects of the credit restrictions. Basic industries, such as iron and steel, whose long-term growth was considered an important national goal, were supposed to receive sufficient funds to insure that their investment plans were not curtailed. There is, however, little evidence to indicate that the "preferred" industries were any less adversely affected by tight money than was industry as a whole.

The emergence of tight money occurred in substantially the same way in all four cycles. In the late boom phase of the cyclical upswing, the Government's cash debt to the Bank of Japan was reduced as tax and other receipts exceeded Government spending. At the same time, imports accelerated causing international reserves to decline. Both of these actions tended to reduce the reserves of the banking system, causing them to increase their borrowings from the central bank. Precisely at the time when the central bank was considering the need to impose restrictive monetary policy because of a decline in international reserves, the amount of central bank credit was growing faster than at times when restrictive monetary policy was not being considered. Tight money policy consisted of insuring that the increase in central bank credit was not sufficient to completely offset the reserve losses of the banking system from Government surpluses and balance of payments deficits.

This set of circumstances made it politically easier for the authorities to implement a restrictive monetary policy. The initial loss of reserves of the banking system did not come from any overt action of the monetary authorities. As a matter of fact, the authorities permitted a substantial increase in central bank credit to ease the reserve loss. This kept the monetary authorities in a strong position to implement effective restrictions through the window guidance technique while at the same time appearing to be quite generous in providing credit to the banking system. Therefore the monetary authorities were able to follow a restrictive policy even when the political authorities were not completely in favor of it.

First Cycle, 1953-56. [15-1/2/] Japan entered 1953 with abundant foreign exchange reserves and an optimistic business community eager to modernize its plant and equipment. Investment in fixed capital was 21 per cent larger in 1953 than 1952, which had also been a year of rapid growth in investment. In addition, consumer spending increased 20 per cent as the fruits of the first postwar wave of prosperity were enjoyed by the individual Japanese household. Although the overall increase in nominal demand was 15 per cent, the increase in output was less than 8 per cent. Consequently, prices increased 7-1/2 per cent, and imports increased 21 per cent. Because of the termination of the Korean War, exports showed no increase. The current account of the balance of payments deteriorated $500 million and, because capital movements were insignificant, there was a similar deterioration in international reserves.

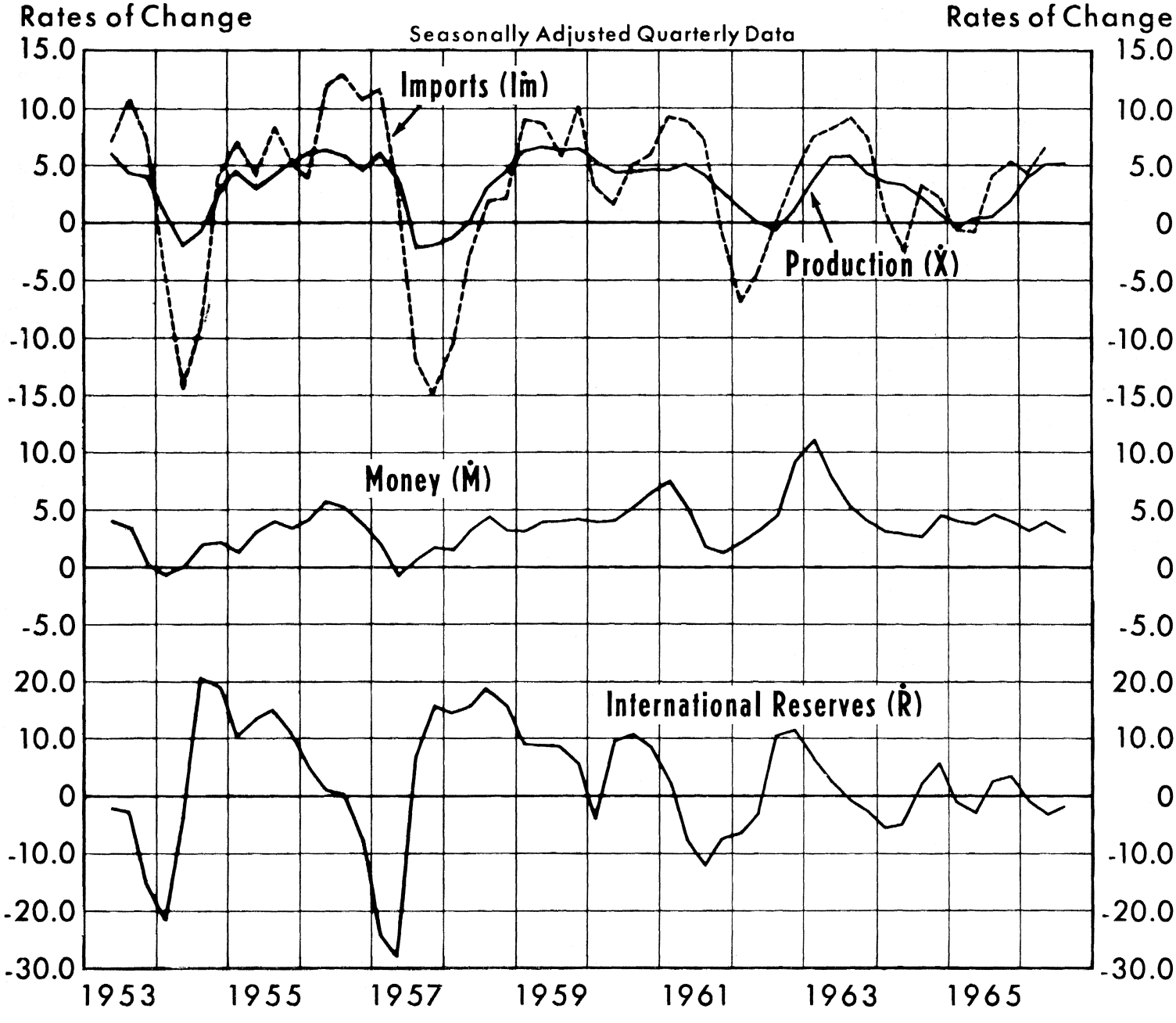
In this first postwar balance of payments problem the authorities planned moderately restrictive fiscal and monetary policies. The General Account Budget expenditures for 1954 were planned to be 2-1/2 per cent below 1953. But, because of pressures from within the Liberal Democratic Party which was in power throughout this period, spending actually increased 17 per cent over 1953. The result was a relatively large cash deficit.

15-1/2/ Most business cycle analysts date turning points on the basis of the peaks and troughs in the level of business activity. However, because this study concentrates on rates of change, the timing of each cycle is based on peaks and troughs in the rate of change of business activity. As would be expected, turning points in the level of business activity generally occur after turning points in the rate of change in business activity because a deceleration generally occurs before a decline.

Figure 1

Japan

International Reserves, Money, Production, and Imports



Source: Bank of Japan

With respect to monetary policy, there was no increase in the central bank discount rate because of fear that higher interest costs would weaken the competitive position of Japanese exporters.16/ Other monetary actions were taken. The special credit facilities available to importers since the Korean War period were terminated; in addition, importers were required to make advance deposits with commercial banks at the time the import contracts were signed. Finally, the Bank of Japan initiated window guidance (madoguchi shido), a form of credit rationing discussed above.

These money and credit restrictions were initially imposed in September, 1953, and gradually tightened and expanded until they were fully in effect by April, 1954. The effects of this policy were felt quickly as the money stock stopped growing in the fourth quarter of 1953 and declined slightly in the first and second quarters of 1954. This had a prompt effect on industrial production and imports; they both stopped growing in the first quarter of 1954 and declined in the second and third quarters. Exports in 1954, responding to a cyclical upswing in the United States and to some dismantling of import controls in Europe, increased at an 8 per cent rate. The sharp decline in imports and the resumption of normal growth in exports permitted international reserves to recover rapidly from the second half of 1954. This improvement continued through the end of 1955.

Second Cycle, 1956-58. Starting in the second quarter of 1956, the quarterly growth in imports more than doubled from the average of the previous six quarters because continued growth in industrial production in excess

---

16/ Patrick, Op. cit., p. 270.

of 5 per cent per quarter required an accelerated use of imported materials. The acceleration in imports caused international reserves to decelerate in the first three quarters of 1956 and to decline sharply in the fourth quarter.

The decline in international reserves triggered a debate within the Japanese government as to whether policy should become restrictive. One group in the Ministry of Finance insisted that a tight policy was not necessary.[16-1/2/] It considered that the increase in imports was mainly due to speculative materials imports and that foreign exchange was simply being turned into industrial materials inventories. Their policy prescription was to wait out the speculators, and import demand would soon decline to a more normal level.

Another group in the Bank of Japan contended that the increase in imports was induced by the high level of domestic demand and would continue as long as demand was not curtailed. [17/]

In public, the politically more powerful Ministry of Finance group had apparently won the debate, as no official monetary restrictions were introduced in late 1956 or early 1957. Moreover,

---

16-1/2/ See Shimomura, Osamu, "Tomen no Keizai Kyokumen o Tauranuku Kohon Dōko." (Basic Tendencies in the Present Economic Situation) Kinyū Kaisei Jojō, VII (February 11 and 18, 1957 - two parts).

17/ See Goto, Yonosuke "Keiki Doko to Junkan Kyokumen no Rikan no Tome ni," (Understanding the Tendency Towards Economic Growth and Cycles), Kinyu Kaisei Jojō VIII (February 25 and March 4, 1957).

a Government budget calling for a large increase in spending passed the Diet (Parliament) in early 1957. But later events did not support the contentions of the winning group. During the first half of 1957 international reserves declined 55 per cent because of a continued sharp rise in imports. By early May, it was obvious that corrective steps had to be taken immediately.

The discount rate was increased on May 8 from 7.67 to 8.40, and window guidance procedures originally developed in the first cycle were again applied. No selective credit controls were used, and there was no increase in tariffs or other particular restrictions on imports. However, more preferential treatment was given to exporters with a reduction in the central bank rate on export bills.

Although the Bank of Japan seemed to have lost the policy fight, in fact the money stock had started to decelerate three quarters before the public announcement of tight money and had reached its trough in the second quarter of 1957, when the tight money policy was officially announced. Government cash surpluses and balance of payments deficits had drained reserves out of the banking system. The Bank of Japan had been able to follow appropriate monetary action even in the face of a publicly-stated rejection of tight money policy.

The effects of the monetary restraints were felt promptly. The rate of growth in industrial production and imports reached its cyclical peak in the first quarter of 1957, decelerated moderately in the second quarter, and fell in

absolute amount in the third and fourth quarters. An impressive turnaround in international reserves followed, from a 28 per cent decline in the second quarter of 1957 to an 8 per cent increase in the third quarter, and to a 15 per cent increase in the fourth quarter. The growth in international reserves continued at a very rapid rate through 1958 and at a decelerated rate into 1960.

Third Cycle, 1958-62. In the period from 1958 to 1961 Japan enjoyed the most rapid growth in her history, perhaps the most rapid growth any country had ever experienced. Real output increased at an average annual rate of 14 per cent, while prices increased at a rate of only 3 per cent. This experience affected the outlook of the Japanese businessmen who became very optimistic about the future.

The policy authorities were also caught up in this optimistic mood. Some believed that their major contribution to stimulating growth was to provide an easy monetary and fiscal environment. The political leader most thoroughly committed to this point of view was Mr. Hideo Ikeda who had been Finance Minister during the 1957-1958 cycle. The Ikeda "group" was brought into power in July, 1960 because of a political incident. In the summer of 1960 there were massive student riots against the Japanese-United States Military Security Treaty and the visit of President Eisenhower to Japan. Because the Government of Prime Minister Kishi could not control the rioters or guarantee the safety of the President, the visit was cancelled resulting in the downfall of the Kishi Government.

Because Prime Minister Kishi's main mistakes were considered to have been an overly aggressive foreign policy and a domestic policy of riding roughshod over the opposition Socialist Party, it was deemed advisable to bring in a new face who would take a "low posture" on these sensitive political issues. Ikeda was made Prime Minister in July 1960 on this basis. His interests were largely economic; indeed, he considered himself an economist, and took an active interest in the implementation of monetary policy. In the spring of 1961 he presented a plan to the public which was designed to double National Income in one decade, 1960-70.

To implement this plan, Ikeda intended to follow an expansionist monetary policy. As indicated in Table 4 during the four-year period of the Ikeda Administration the money supply increased at a rate twice as fast as in the previous four-year period. On the other hand, industrial production and employment increased at the same rate, while prices rose five times faster and imports rose almost twice as fast. Exports increased at the same rate in both periods. The expansionary Ikeda policies did not increase the rate of real growth but only added to price inflation and balance of payments problems.

TABLE 4 18/

Per Cent Change In	1956-III to 1960-III	1960-III to 1964-III
Money	60	120
Industrial Production	70	70
Consumer Price Index	5	26
Import Value	37	65
Export Value	66	63
International Reserves	72	- 10
Employment	6	5

18/ The beginning and terminal dates for each period were all in the late boom phase of the business cycle.

Ikeda initiated an expansionary policy as soon as he came into office. The rate of growth of the money supply, which had been at an average quarterly rate of about 4 per cent from the middle of 1958 to the middle of 1960, increased to 5.5 per cent in the third quarter of 1960, 7 per cent in the fourth quarter, and 7.5 per cent in the first quarter of 1961. The acceleration in the money stock led to an increase in aggregate demand, causing imports to accelerate and breaking the price stability which had characterized the Japanese economy since 1954.

International reserves decelerated in the first quarter of 1961 and fell during the next five quarters. As in the previous cycle, a public debate ensued between the Bank of Japan which proposed a policy of restraint, and the Ministry of Finance which proposed a policy of continued expansion. Publicly the issue was again settled in favor of the Ministry of Finance.

The stated policy of the Bank of Japan remained expansionary. The discount rate, which was acknowledged as the official expression of policy, was reduced in August 1960 and again in January 1961. Only towards the end of July 1961, when international reserves had declined by nearly 20 per cent in six months in spite of a large short-term capital inflow, did the Ikeda Administration introduce a tight monetary policy.

On July 22 the discount rate was raised from 6.57 to 6.94, and window guidance procedures reinstituted. On September 29 the

discount rate was raised again to 7.30 and the window guidance procedures tightened. However, as in the 1957-1958 downturn, the deceleration in the money stock actually started earlier. Growth in the money stock reached a peak in the first quarter of 1961 and decelerated rapidly through the fourth quarter of 1961.

The deceleration in the money stock was followed by a deceleration in production and imports starting in the third quarter of 1961. However, the rate of deceleration in production was slower than in the two previous downturns. The business community was aware that the tight money policy was in response to balance of payments considerations and would be eased when international reserves started to recover. Past experience had taught them that if they maintained their investment projects through the period of tight money, they would be in better position to take advantage of new and profitable sales opportunities when monetary policy was eased. Thus, a great deal of private effort was put into reducing imports rather than production.

International reserves showed gradual improvement from late 1961; the money stock accelerated moderately during the first three quarters of 1962 and accelerated rapidly in late 1962 and early 1963.

Fourth Cycle, 1962-66. The deceleration in production which took place in 1962 was moderate compared with previous downturns. As a result, the margin of unused capacity created was also smaller than in previous downturns. When the growth in production was resumed in the fourth quarter of 1962, the margin of unused capacity was quickly eliminated. This led to the emergence of domestic bottlenecks in

certain sectors of the Japanese economy and caused a sharper acceleration in imports in 1963 than had taken place in previous periods of early cyclical upswing. The acceleration in imports pushed the current account into deficit in 1963, even with strong growth in exports. A large short-term capital inflow was not sufficient to prevent international reserves from declining moderately in the last half of 1963.

In reaction to this deceleration in international reserves, the money stock was gradually decelerated from the high levels reached in the first half of 1963 to a growth rate of about 3.5 per cent in the middle of 1964. By previous cyclical standards, such a growth in the money stock would have been consistent with moderately expansionary monetary policy. However, rising prices had induced an increase in the transactions demand for money which absorbed the 3.5 per cent rate of growth in nominal cash balances. Thus production also decelerated slowly through early 1965.

Given the large growth in exports which was taking place in 1963 and 1964, it was apparently the hope of the government that only a moderately restrictive monetary policy would correct the decline in international reserves. This expectation proved correct. By the third quarter of 1964 international reserves started to increase. As in previous cycles, this was the signal to end tight money.

In November, 1964 Ikeda resigned as Prime Minister for health reasons. He left a Japanese business community in what was generally

referred to as a "recession mood." It was called a "mood" because the aggregate economic data indicated that this downturn had been much smaller and more gradual than previous cyclical downturns. And yet the optimism of the business community about the future had been impaired as reflected in the statistics on new investment which showed no prompt recovery as in previous periods of monetary ease.

Prior to the fourth cycle, Japanese businessmen had enjoyed three to four years of prosperous growth in sales and profits between periods of tight money. Such a spacing of cyclical downturns allowed business to pass through a period of tight money with no impairment of their view of real long-term growth prospects. The Japanese business practice of increasing capacity in excess of short-term expectations of increase in sales had paid off handsomely in these cycles. Even though the fourth cyclical decline in production was relatively moderate, profits had not recovered and inventories had not been worked down from the third cycle just two years before. 19/

The new Prime Minister, Mr. Esako Sato, was faced with a serious economic policy dilemma. Should the government take drastic and

---

19/ There were two reasons for the rise in inventories. First, the optimism of businessmen that the rise in inventories would only be temporary, as was the case in previous cycles. Second, given the lifetime employment tradition in Japan, the permanent production workers are not laid off unless there is a permanent reduction in the work force.

immediate monetary and fiscal actions which would be necessary to turn the economy around quickly in the face of the "recession mood," or, should the government follow a less expansionary policy which might provide a more stable growth in production. The Sato Administration chose the latter policy, holding the average quarterly growth in the money stock to around 4 per cent during 1965 and 1966. 20/

Although the recovery in production was somewhat slower than in previous cyclical upswings problems with the balance of payments were avoided permitting growth in production to be sustained for a larger period.

20/ The major factor in the moderate monetary response was to avoid the expansionist excesses of the previous administration. However, a secondary factor was that international reserves showed no consistent growth in 1965 and 1966. Although the current account registered a large surplus because of a moderate growth in imports and very rapid growth in exports, there was a large capital outflow. The easing of monetary policy and the weakness in business investment pushed Japanese interest rates down just at a time that rates were rising to new historic highs in the United States and money was generally tight in Europe. This caused a substantial shift in trade financing from foreign to domestic sources and made Euro-dollars a less attractive source of funds to Japanese banks. At the same time, the U.S. Interest Equalization Tax (July 1963) and the President's "Voluntary" program to support the United States balance of payments (February 1965) reduced the long-term capital flow.

Section 3: Central Bank Actions and Monetary Policy

This section will consider two questions. First, the link between the monetary policy variable (money stock) and the monetary target variable (international reserves), and second, how central bank actions affect the money stock. The latter can be broken down into two subsidiary questions. How does central bank action affect high-powered money, and how does high-powered money affect the money stock?

A. Monetary policy and monetary targets

In the late 19th century, most advanced monetary systems were on a gold standard. This meant that gold coins and warehouse receipts for gold bars circulated freely with domestically-issued paper to form the basis for the money stock. Because gold was also the international medium of exchange, the money stock was automatically linked to the balance of payments and to the level and rate of change in international reserves. A balance of payments deficit meant a decline in international reserves, an outflow of gold, and a decline in the domestic money stock. A balance of payments surplus meant an increase in international reserves, an inflow of gold, and an increase in the domestic money stock.

This automatic link between money and international reserves is now considered broken because gold is no longer a component of the domestic money stock. 21/ The monetary authorities have the

---

21/ Domestic gold stocks may affect the supply of money even if they are not directly measured in the stock of money. If the central bank must hold a certain stock of gold as a reserve against central bank notes or deposits outstanding, an outflow of gold could theoretically affect the domestic money supply. However, in Japan,

(cont'd.)

ability to achieve any desired money stock through expansion and contraction of central bank credit. With the automatic link between international reserves and money broken, the monetary authorities can direct monetary policy toward achieving any monetary target variable they desire, such as a target level of prices, unemployment, or international reserves.

The most generalized method of presenting the link between a target variable and a policy variable is in a stock adjustment mechanism. It is generally recognized that Japanese monetary policy is sensitive to changes in international reserves.[22] If the target level of international reserves is different from the actual level of international reserves then monetary policy will be adjusted accordingly. If the actual level is less than the target level, policy will be restrictive. If the actual level is greater than the target level, policy will be easy. The stock adjustment mechanism is consistent with a wide range of observed behavior. For example, an acceleration in international reserves could be associated with a restrictive policy if the level of reserves is below the target, while a deceleration in international reserves could be associated with an expansionary policy if the level of reserves is above the target.

21/ (continued)

central bank notes are backed by full faith and credit of the government and not by gold or any other internationally liquid assets.

Only Belgium, The Netherlands, and Switzerland have a legal requirement for a gold backing to control central bank note issue. The United States ceased its gold backing on March 15, 1968.

22/ See Hugh T. Patrick, Monetary Policy and Central Banking in Contemporary Japan, p. 24. University of Bombay Press, 1962. Miyosho Shinokara, Growth and Cycles in the Japanese Economy, Tokyo, Kenkyusho Printing Company, Ltd., 1962. Money and Banking in Japan, Research Department, Bank of Japan, 1964, p. 51.

The observed behavior of the Japanese monetary authorities is that when international reserves decline, monetary policy in the form of changes in the money stock is restrictive, and when international reserves increase, monetary policy is expansionary. This behavior is consistent with a specific form of the international reserve target which says that if international reserves are falling, the target level is greater than the actual level of reserves. If international reserves are rising, the target level is equal to the actual level of reserves.

The monetary authorities are sensitive to changes in international reserves because of the relatively low level of international reserves held by Japan and the rapidity with which these reserves can be drawn down during periods of balance of payments difficulties. The ratio of international reserves (gold plus convertible currencies) to imports has fallen from one-third in 1954 to one-fourth in 1964 and to one-fifth in 1966. The ratio of international reserves to imports of the EEC (Common Market) countries, which Japan resembles in terms of industrial development and absence of reserve currency status, has increased from 41 per cent in 1954 to 44 per cent in 1966. The rate of growth in Japanese reserves from 1954 to 1964 has been about 60 per cent of the rate of growth in imports. For common market countries the rate of growth in reserves has been close to 110 per cent of the rate of growth in imports. [23/]

23/ See International Financial Statistics, February 1967, published by the International Monetary Fund.

The cost of this slow growth in international reserves is the large potential decline in reserves in a short period of time. In the first two periods of balance of payments weakness, Japan's reserves declined 40 per cent and 55 per cent in six months. In the last two periods reserves declined 35 per cent and 15 per cent in nine months. [24]/

The observed policy relations between changes in the money stock and changes in international reserves can be stated as follows:

$$3.1 \quad \dot{M}_t = \alpha_0 \alpha_1 \dot{R}_{t-n}$$

An increase in $\dot{R}$ will lead to an increase in $\dot{M}$, and conversely a decrease in $\dot{R}$ will lead to a decrease in $\dot{M}$. The only difference between this hypothesis and others which attempt to explain economic behavior is that there is only one decision-making unit in this case which is generally and vaguely referred to as the "monetary authorities."

Although the monetary authorities are sensitive to changes in international reserves, the degree of sensitivity varies, depending upon the importance which they attach to other goals. Japanese monetary policy can be divided into two sub-periods on the

---

[24]/ The relatively modest decline in reserves during the last two periods is because Japan was able to tap the international short-term capital market to a significant extent. The absolute size of Japan's current account deficit was actually much larger in 1964 than in 1954. Although the inflow of short-term capital had increased the apparent stability of the official international reserves position in the third and fourth cycle, it had increased claims against these reserves. For example, Eurodollar deposits in Japanese commercial banks (which have an average maturity of 45 days) were about $150 million at the end of 1960 and about $1,250 million at the end of 1964.

basis of differing sensitivity to changes in international reserves; the first period from 1953 to the middle of 1960, and the second period from 1960 to the end of 1964. Monetary policy in 1965 and 1966 was essentially a reversion to the first period.

There were three Prime Ministers during the first period: Mr. Yoshida, Mr. Ishibashi, and Mr. Kishi. None of these men had any immediate interest in the day-to-day operation of monetary policy, leaving most decisions to the Finance Minister, the Planning Agency Director, and the Central Bank Governor. Thus, policy during most of this period was conducted by a committee with no "strong personality" dominating the decision-making process. Although individual members of this ad hoc committee changed during the period, the collective nature of the decision-making process kept policy relatively uniform in terms of the international reserve constraint.

In July 1960, Mr. Kishi was forced to resign and Mr. Ikeda (Finance Minister on two former occasions), was made Prime Minister. Ikeda took over the day-to-day direction of economic policy and the committee approach to policy formulations was abandoned. 25/ In an

---

25/ There are no parliamentary obstacles to the Prime Minister controlling the levers of monetary policy if he wishes. The Japanese Cabinet is structurally similar to the United Kingdom Parliamentary Ministerial System. The Prime Minister appoints the Minister of Finance and the Director of the Economic Planning Agency. The Governor of the Bank of Japan is accountable to the Minister of Finance and can be removed at the discretion of the Finance Minister. Although this has never been done, it is a powerful potential threat.

attempt to accelerate the growth in the Japanese economy, Mr. Ikeda initiated a substantially more expansionist monetary policy than did his predecessors. This policy continued over four years until Mr. Ikeda resigned for health reasons in November 1964.

The increased emphasis on growth during the Ikeda period did not mean that the international reserve constraint was ignored. It meant that the policy coefficients relating changes in international reserves to changes in the money stock were different in these two sub-periods. To determine the value of the coefficients, regressions were run on the money and international reserve time series for each sub-period: [26]

Sub-Period: 1953-II to 1960-IV: [26-1/2]

3.2 $\dot{M}_t = 2.65 + \underset{(.022)}{.087}\ \dot{R}_{t-1}$ $\qquad r^2 = .37$

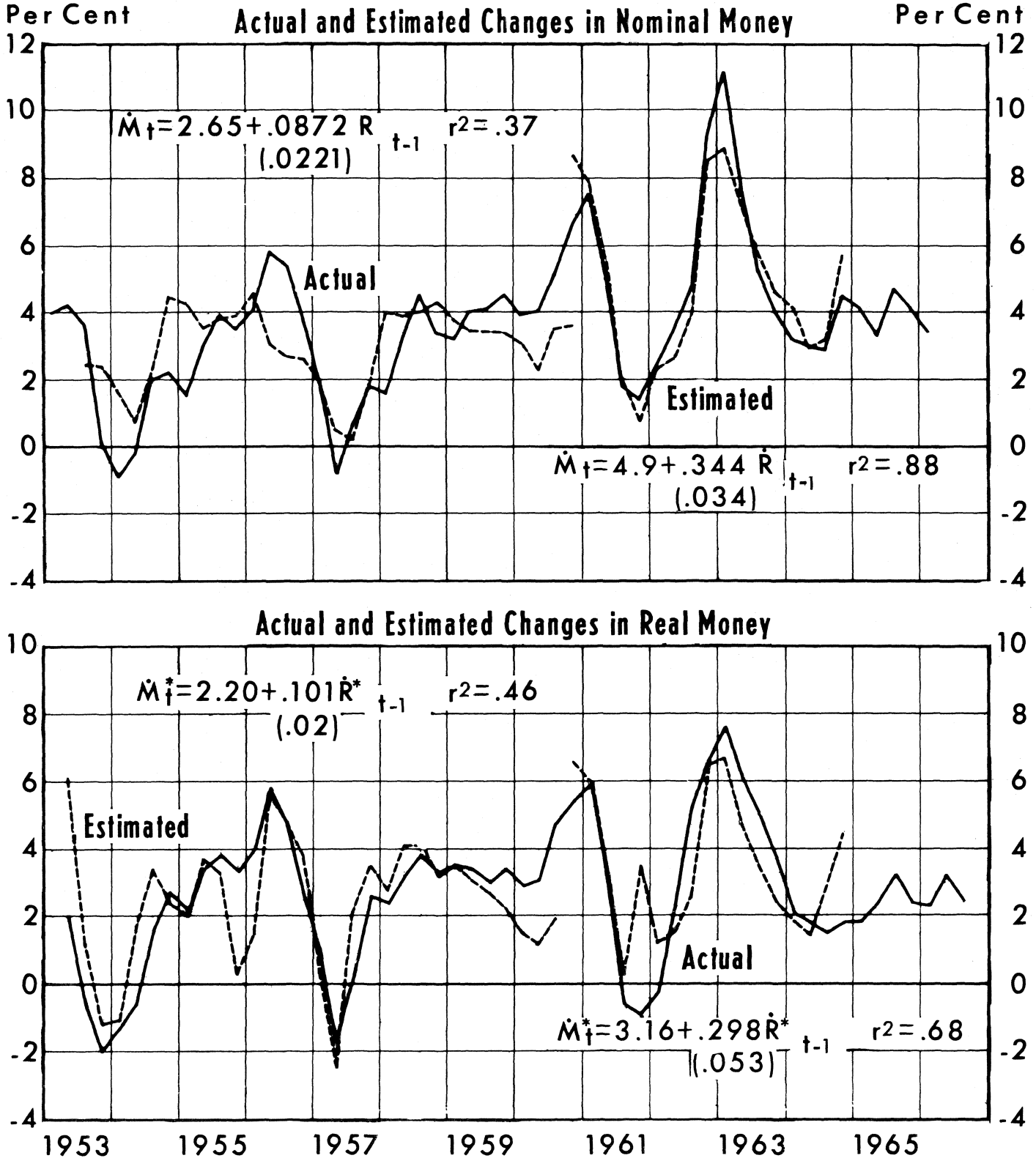
---

[26] A statistical test of the relationship between two variables where only one decision-making unit is involved may have greater systematic variation between observed and estimated values of the dependent variable than when a large number of decision-making units are involved. For example, the estimated movement in $\dot{M}$ was greater than the observed movement in late 1954 and early 1955, and less than the observed movement in late 1956. These discrepancies between observed and actual movements in $\dot{M}$ are not as apparent when the decision-making unit looks at real rather than nominal variables.

[26-1/2] The lags reported here and in the rest of this study are of the single non-distributed type. Alternative lags were tested and the one with the lowest standard error and highest r^2 was used. This procedure was used whenever lagged relationships were tested statistically.

Figure 2

Japan



Sub-Period: 1960-IV to 1964-IV

$$3.3 \quad \dot{M}_t = 4.9 + \underset{(.034)}{.344} \dot{R}_{t-1} \qquad r^2 = .88$$

These two equations illustrate the wide range of discretionary monetary policies which can be accommodated within an international reserves constraint in the short run.[27/] With no change in the reserve level, monetary policy in the second period was almost twice as expansionary as in the first period (4.9 per cent per quarter versus 2.6 per cent per quarter). For every 10 per cent acceleration in international reserves, there was a 3.4 per cent acceleration in the money stock during the expansionary sub-period and a .9 per cent acceleration in the money stock in the nonexpansionary sub-period. Conversely, deceleration in international reserves led to a sharper deceleration in the money stock in the expansionary sub-period than in the nonexpansionary sub-period. Given Japan's slim foreign exchange reserves, this pattern of behavior is reasonable. A monetary policy which, on the average,

---

27/ During the last half of 1960 and the first half of 1961, neither equation 3.2 nor 3.3 provides an accurate estimate of the actual changes in money. This period can be considered a transition from a less to a more expansionary monetary policy. As a result, 3.2, our policy equation for pre-Ikeda years, under-estimates the growth in this period, while 3.3, the policy equation for the Ikeda period, over-estimates changes in money in this period. This pattern is quite reasonable and reminds us that great caution must be used in applying policy equations in the early period of any new political administration. The Sato Administration, which came into power in November 1964, abandoned the expansionist monetary policies of its predecessor. In the first five full quarters of the Sato Administration the actual stock of money increased 20 per cent, while the growth in the money stock using the Ikeda policy equation would have been 27 per cent. The growth in money, using the pre-Ikeda policy equation, would have been 13 per cent. Before a realistic policy equation can be established for this new administration, it will probably be necessary to observe one cyclical decline in reserves.

is more expansionist must also be more sensitive to declines in international reserves. Whether an expansionary policy with such implications for $\dot{M}$ is desirable will be considered explicitly in Section 5.

This study considers real as well as nominal business cycle movements, therefore a structural equation relating real money stock to real reserves was also estimated. The money series was deflated by the implicit price deflator, and international reserves by the import price index:

Sub-Period 1953-II to 1960-IV

$$\dot{M}^*_t = 2.20 + \underset{(.020)}{.101}\ \dot{R}^*_{t-1} \qquad r^2 = .46$$

Sub-Period 1960-IV to 1964-IV

$$\dot{M}^*_t = 3.16 + \underset{(.053)}{.298}\ \dot{R}^*_{t-1} \qquad r^2 = .68$$

These results are substantially the same as above. The results are statistically significant and the values of the coefficients are larger in the expansionary sub-period than in the non-expansionary sub-period.

B. Central Bank Actions and Monetary Policy Variables.

The Central Bank does not have direct control of the money stock; it can only vary the volume or price at which it extends credit to the banking system. The central bank is in a position similar to that of a monopolist because it can control the price and allow the quantity to vary, or it can control the quantity and allow the price to vary. The comparison is not exact, of course, because a monopolist is a profit maximizer and a central bank is not.

If the central bank wants to control the amount of credit it extends to the banking system, it has essentially two choices: (1) it can price its credit facilities at the rate which will keep commercial bank demand for this credit at the level desired by the central bank; or (2) it can allow the price of central bank credit to remain unchanged and ration the quantity directly. The advantage of the first approach is that rationing is done by market forces like most other commodities and keeps the central bank out of a difficult administrative process. The advantage of the second approach is that if the short-run demand for central bank credit is price inelastic, then a very high interest rate to ration credit by the price mechanism is avoided.

Traditionally, central banks have been unwilling to suffer the public criticism associated with high rates and have chosen non-price rationing of their credit. Thus, the best measure of central bank action is the volume of credit extended rather than the price at which it is extended.

This generalization applies to Japan. The Bank of Japan has a penalty rate on top of its basic discount rate which is applied to those commercial banks which exceed their designated borrowing ceilings. Because most banks are above the ceiling during periods of tight money, the penalty rate is the operational rate. When the penalty rate is compared with the closest alternative market rate of interest, it is always lower. This differential widens during periods of tight money. Interest rates for call money have gone as high as 20 per cent, while the highest central bank penalty rate has been 9.5 per cent. Non-price rationing of credit is the major monetary tool of the Bank of Japan.

To understand the effect of changes in central bank credit on the money stock requires consideration of the links which connect these two variables. This can be done by utilizing the analytical technique developed by Friedman and Schwartz. 28/

28/Milton Friedman and Anna Schwartz, A Monetary History of the United States (National Bureau of Economic Research), 1964. Appendix B, pp. 776-808.

The money stock is defined as:

$$3.4 \quad M = C + D$$

where M = Money Stock,

D = Designated monetary deposits of the banking system, [29]

and C = Currency in the hands of the public.

High-powered money is defined in two ways. The uses of high-powered money are:

$$3.5 \quad H = C + BR$$

where H = High-powered money,

and BR = Reserves of the banking system.

The sources of high-powered money are:

$$3.6 \quad H = B + R + G$$

where B = Central Bank credit to the banking system,

R = International Reserves,

and G = Government debt to the central bank. [30]

---

[29] This is drawn from the money supply statistics of the Bank of Japan. Throughout this study references are made to the banking system when in fact other financial intermediaries such as agricultural cooperatives, mutual loan and savings banks and credit associations also hold monetary deposits. This is done for simplicity in explanation and because commercial banks hold 80-85 per cent of all monetary deposits. These deposits include current deposits, ordinary deposits, deposits at notice, and special deposits. The only one against which checks can be drawn is current deposits. Other deposits pay interest and are similar to passbook savings in the United States. What the Bank of Japan calls time and savings deposits are excluded from the money supply. These are fixed maturity deposits similar to certificates of deposits (CD's) in the United States. Thus, the Japanese money stock concept is closer to M2 than M1. See Money and Banking in Japan, The Bank of Japan, Economic Research Department 1964. pp. 52-53.

The money identity can be written in terms of high-powered money and a money multiplier based on the deposit-currency ratio, $\frac{D}{C}$, and the deposit-reserve ratio, $\frac{D}{BR}$:

$$3.7\quad M = H\left(\frac{D}{BR}\right)\left[\frac{1 + \frac{D}{C}}{\frac{D}{BR} + \frac{D}{C}}\right]$$

Alternatively, the money identity can be written in terms of the sources of high-powered money, including central bank credit, and the money multiplier:

$$3.8\quad M = (B + R + G)\left(\frac{D}{BR}\right)\left[\frac{1 + \frac{D}{C}}{\frac{D}{BR} + \frac{D}{C}}\right]$$

The Central Bank can only control B directly. The other influences on the money stock are determined by other decision-making units: R largely depends upon the decision of exporters and importers; G depends upon the fiscal policy decisions of the Ministry of Finance, and the government; the deposit-currency ratio, D/C, depends upon the decision of the non-bank public with respect to the desired composition of their money holdings; the deposit-reserve

---

30/ The Bank of Japan is the sole custodian of central Government cash and supplier of credit to the Government. Government receipts, including receipts for sales of bonds and notes to the public, less Government payments to the public, are disposed of by changes in the Government's current account with the Bank of Japan. An increase in this account is an increase in high-powered money, and a decrease in this account is a decrease in high-powered money. These transactions between the Government the Bank of Japan are in addition to those related to purchases and sales of international reserves. See Money and Banking In Japan, op. cit., pp. 56-57.

ratio, D/BR depends upon the desire of the banking system for excess reserves. It is useful to analyze the linkages between B and M in two stages: first, the link between B and H, and second, the link between H and M.

The Relation between B and H: The amount of high-powered money in circulation can be found in the balance sheet of the central bank. The uses are central bank notes and deposits of the banking system which are liabilities of the Bank of Japan. 31/ The sources are found on the asset side of the balance sheet, central bank credit to the banking system, central bank credit to the Government, and central bank holdings of foreign exchange. 32/

High-powered money in the form of currency reaches the nonbank public through the banking system. This is accomplished through the public's drawdown of deposits with the banking system.

31/ Deposits of the banking system with the Bank of Japan are an insignificant use of high-powered money. Reserve requirements have existed in law since 1957 and have only been applied to banks since 1959. The range is from one-quarter of one per cent for banks with deposits of less than ¥ 20 billion, to 1.5 per cent for banks with deposits in excess of ¥ 100 billion. Total deposits of the banking system with the Bank of Japan were ¥ 89 billion as of December 31, 1966. On that same date central bank note issue was ¥ 2,914 billion, of which ¥ 477 billion was in the vaults of the banking system.

32/ Another source of high-powered money is subsidiary coins issued by the Treasury. However, the amount is trivial, adding less than 2 per cent to the volume of central bank notes. Subsidiary coins are included with central bank notes in this study.

The banks maintain working balances of vault cash to meet the expected demands of the nonbank public for currency. These working balances must be restored continuously by acquisitions of additional central bank notes from the Bank of Japan. For the banking system as a whole, central bank notes can be acquired in only three ways:

1) selling foreign exchange to the central bank, which can only be generated by a surplus in the balance of payments; [33] 2) presenting a draft on the government's account with the Bank of Japan, which can be generated only by a government cash deficit; 3) borrowing from the Bank of Japan.

All increases in high-powered money, whether it stays in the banks or in the hands of the nonbank public, affect the balance sheet of the banking system. The first two sources of high-powered money reduce other assets of the banking system /because foreign exchange assets and claims on the government are converted into high-powered money assets; the third source of high-powered money increases the banking system's liabilities by increasing the debt to the Bank of Japan.

An important institutional question with respect to the operation of monetary policy is whether the banking system responds

---

[33] This assumes that commercial banks do not change their working balances of foreign exchange.

differently to an increase in its liabilities than it does to a decrease in its other assets. This same issue arises in international financial discussions about the characteristics of a new international reserve asset; should it be in the form of borrowed reserves through the IMF which must theoretically be repaid, or in the form of owned reserves for which repayment is not even theoretically required? This issue also arises in U.S. financial discussions about whether Federal Reserve credit extended through the discount window is less expansionary than when extended through open market purchases of government bills. Some authors consider that U.S. commercial banks prefer to build their reserves on the sale of assets rather than on the basis of debt to the Federal Reserve System. It is postulated that U.S. banks will reduce loans and take other restrictive actions to clear themselves of debt to the Federal Reserve as soon as possible.

In the case of Japan, virtually all central bank credit is in the form of direct increases in the debt of the banking system.[34] If Japanese banks treat such debt in the same way as U.S. banks are postulated to treat borrowings from the Federal Reserve, it is quite possible that central bank credit would be a less expansionary source of high-powered money than, for example, sales

---

[34] It is interesting to note, however, that small prefectural banks in Japan do have a traditional reluctance to borrow from the central bank. This is because small banks as a whole are not subject to the same intense reserve pressures as the large city banks. Those small prefectural banks which do attempt to borrow are considered to have poor management policies.

of international reserves. However, the institutional factors surrounding central bank borrowing in Japan are different from those in the United States. The Bank of Japan, as a long-term policy, must increase the amount of credit provided to the banking system because alternative sources of high-powered money are not sufficient to meet demand, as illustrated in table 5.

Table 5

Sources of High-Powered Money, 1953-66

(Billions of Yen)

Cumulative increase in:	
High-powered money	2,455
International Reserves	432
Government debt to central bank	700
Other */	- 646
Central bank credit to Banking System	1,969

* Mostly profits of the Bank of Japan.

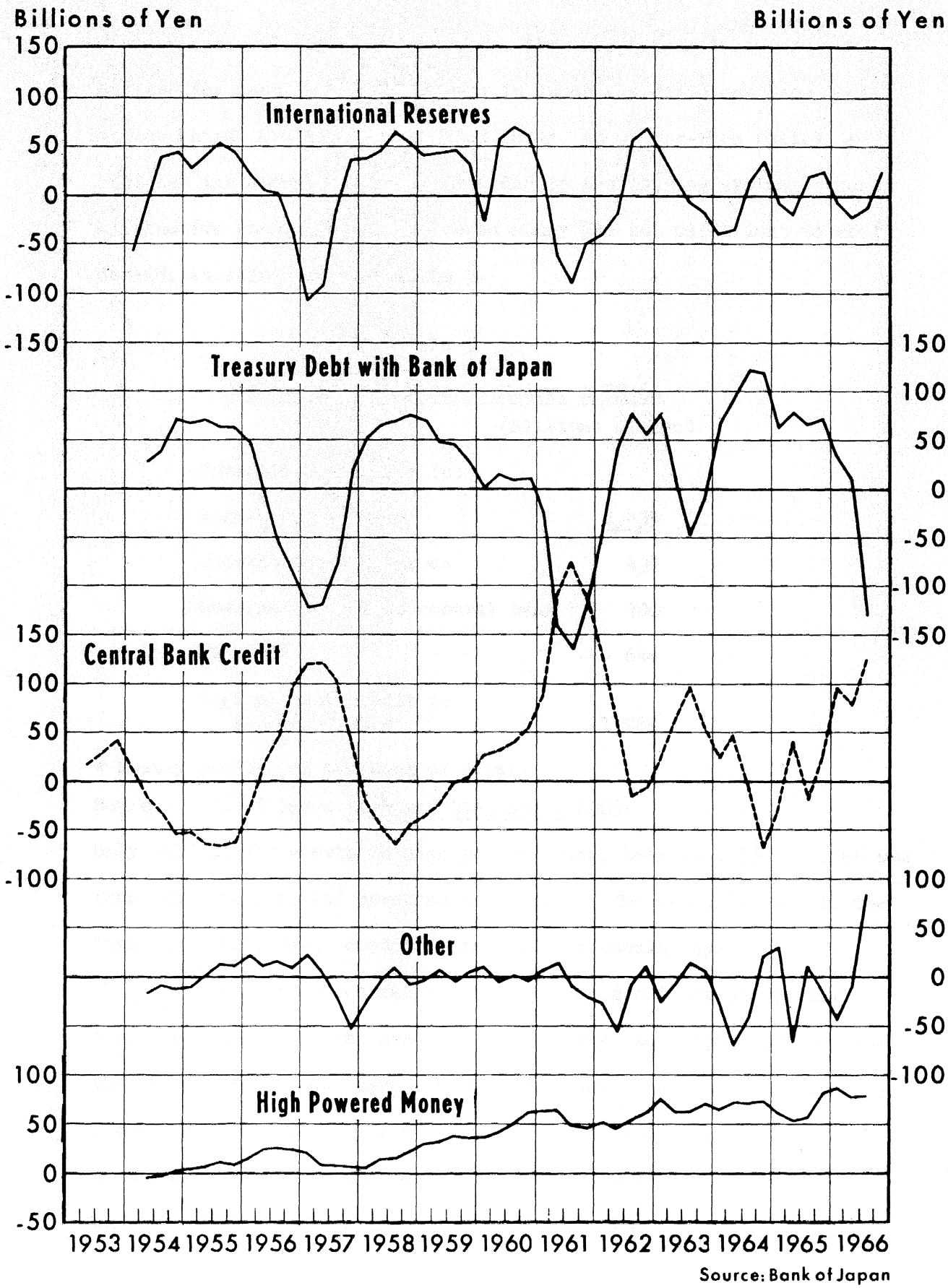
Source: Bank of Japan Economic Statistics 1966.

Only half of the growth in high-powered money between 1953 and 1966 was from international and government sources. The remainder was in the form of Bank of Japan credit to the private banking system.

Open market transactions as a technique to extend central bank credit have not been used in Japan because the appropriate short-term financial markets have not been developed. As a result, the large commercial banks are constantly in direct and substantial debt to the central bank. The reluctance of the American commercial banker to be in debt to the Federal Reserve is not found

Figure 3

Changes in the Sources of High-Powered Money



Source: Bank of Japan

among the managers of large Japanese commercial banks.[35] Central bank credit extended through the discount window is as expansionary a source of high-powered money as any other source. This is an important consideration because it allows one to treat high-powered money as a homogeneous product which does not change in quality, because of a change in the composition of its sources.

Although fluctuations in international reserves, the government debt with the central bank and the level of central bank credit to the banking system do not change the quality of high-powered money, they quite obviously change the quantity of high-powered money. Because all sources of high-powered money are on its balance sheet, the Bank of Japan knows from day to day not only the amount of high-powered money in circulation, but also the changes in the various sources of high-powered money creation. As indicated in Figure 3, there have been substantial variations in the sources of high-powered money creation. The "natural" sources of high-powered money fluctuated because of domestic economic conditions.

During periods of economic boom, tax receipts accelerate and the government tends to reduce its debt with the central bank; also imports accelerate and international reserves of the central bank are reduced. The sharp decline in high-powered money that could result is prevented by an expansion of central bank credit to the banking system. Periods of domestic boom and inflation are

---

35/ Money and Banking in Japan, op. cit., p. 123.

associated with periods of the largest Bank of Japan credit extensions.

The same results apply during periods of slowdown in domestic activity. Imports decline and foreign exchange holdings of the central bank increase; tax receipts decline and the Government's cash debt to the central bank increases. Both actions tend to increase the supply of high-powered money. To prevent the full amount of the increase, the Bank of Japan reduces its credit to the banking system.

In order to have expansion and contractions in high-powered money consistent with monetary policy objectives, the central bank must take substantial actions to break the "natural" expansion and contractions in high-powered money from international and government transactions.

High-powered money is a homogeneous financial asset which the Bank of Japan can control to any degree of accuracy it wishes. This is because it knows the level of high-powered money at any time by striking a balance sheet and because it can change the level at any time by changing central bank credit. Thus, the observed level of high-powered money and the target level of high-powered money are assumed to be the same at all times.

The Relationship Between H and M: High-powered money can be viewed as a pool into which banks dip to meet reserve needs and the public draws on to meet currency needs. The banks and public are, in a sense, competing for use of the high-powered money which the central bank supplies. By definition (H = BR + C), the entire pool is always claimed. If the relation desired by the banking system for deposits to reserves, D/BR, and the relation desired by the public of deposits to currency, D/C, are known, then the money stock, M, can be determined given the amount of high-powered money, H.

The relationship between high-powered money and the total money stock can be seen by recalling equation 3.7:

$$M = \left[\frac{D/BR\ (1 + D/C)}{D/BR + D/C}\right] H.$$

The information needed to compute these ratios comes from the consolidated balance sheet of the banking system and is available only once a month with a four-week time lag. In contrast with H, which can be controlled quite closely, the monetary authorities could miss the money stock target by a substantial margin from month to month because of this information lag. If the time period for determining the target

money stock is lengthened, this error will decline because of the decline in the relative importance of the information lag. In this study the time period for determining the money stock target is one quarter, which reduces the error from the information lag to moderate proportions. It is assumed that the observed quarterly money stock is a close approximation of the target money stock.

The deposit-currency ratio, D/C, and the deposit-reserve ratio, D/BR, jointly determine the value of the money multiplier. If these ratios are constant, the money multiplier will be constant and the link between high-powered money and the total money stock will also be constant. If these ratios vary over the cycle, the money multiplier will not be constant and the relationship between high-powered money and the total money stock will fluctuate. 36/

36/ The reserves of the banking system are equal to required reserves established by the Bank of Japan and excess reserves of the banking system. There were no required reserves from 1953 to September 1959. During that period the deposit-reserve ratio remained relatively constant and exhibited no significant fluctuations over the cycle. After reserve requirements were imposed, there were sharp changes in the deposit-reserve ratio every time reserve requirements were changed. The ratio fell in the quarter reserve requirements increased, and rose in the quarter reserve requirements decreased. Each time the requirements were changed, finer distinctions were made with respect to the size and source of deposits and the type of bank. By April 1963, there were ten categories of reserve requirements. As requirements were changed for different categories of deposits at different times, variations in the deposit-reserve ratio had a strongly random character from 1959 to 1966.

To eliminate these random fluctuations in the deposit-reserve ratio, changes in reserves due to changes in requirements were eliminated. Only desired reserves of the banking system were used in computing the deposit-reserve ratio, which made the ratio consistent before and after September 1959. The ideal method of making this adjustment in reserves would be to compute the value of required reserves for each time period by multiplying the reserve requirement by the size of deposits by category. Unfortunately, the appropriate deposit data are not available to make this computation.

(continued)

The regression between rates of change in H and rates of change in M is:

$$\dot{M}_t = .60 + \underset{(.15)}{1.01}\ \dot{H}_t \qquad r^2 = .51$$

For every one percent change in H, there is a one percent change in M. These results are statistically significant, but examination of the residuals in Figure 4 indicates that there is a systematic cyclical discrepancy between actual and estimated $\dot{M}$. The residuals fall in periods of tight money and rise in periods of easy money. In a purely definitional sense, this residual is explained by changes in the money multiplier and, underlying that, changes in the deposit-currency ratio and in the deposit-reserve ratio.

36/ (continued)

There is, however, another method of estimating required reserves. The law states that required reserves must be held as deposits with the Bank of Japan. Such deposits had existed prior to September 1959, when required reserves were enforced, but the amounts were small -- between ¥ 2 billion and ¥ 6 billion. Rough estimates of required reserves in 1965 and 1966 indicate that amounts in excess of those required were about the same as in the 1953-1959 period. As deposits in excess of required are less than one percent of other reserves of the banking system, i.e., vault cash, a rough but reasonably accurate adjustment of total bank reserves could be achieved by subtracting all deposits of the banking system with the Bank of Japan from reserves.

This adjustment in reserves of the banking system means that the total uses of high-powered money have been reduced by an equal amount requiring that the sources of high-powered money also be reduced. Typically, the banking system has met increased needs for required reserves by increasing borrowings from the Bank of Japan. Thus, it seems reasonable to make the adjustment on the sources side in Central Bank credit.

The deposit-reserve ratio, D/BR, is dependent on the level of desired reserves of the banking system as described in footnote 36. This ratio has a relatively stable value with no observable cyclical variations.

The deposit-currency ratio, on the other hand, showed substantial deviations from trend with a cyclical pattern which followed closely the acceleration and deceleration of the money stock. During periods of tight money, deposits decrease sharply relative to currency, pushing the ratio down. During periods of easy money, deposits increased sharply relative to currency, pushing the ratio up. Regressing $(\dot{D}/C)$ and $\dot{H}$ on $\dot{M}$ yields the following results:

$$\dot{M}_t = -.169 + \underset{(.05)}{1.02}\ \dot{H}_t + \underset{(.037)}{.737}\ (\dot{D}/C)_t \qquad r^2 = .94$$

This means that cyclical movements and high-powered money are reinforced by cyclical movements in the deposit currency ratio. In some periods, movement in the deposit-currency ratio plays a more important role in changing the total money stock than does the rate of change in high-powered money. 37/

The aggregate deposit-currency ratio is a weighted average of the deposit-currency ratios of the sub-sectors of the economy of which the household and business sectors are the most important. The

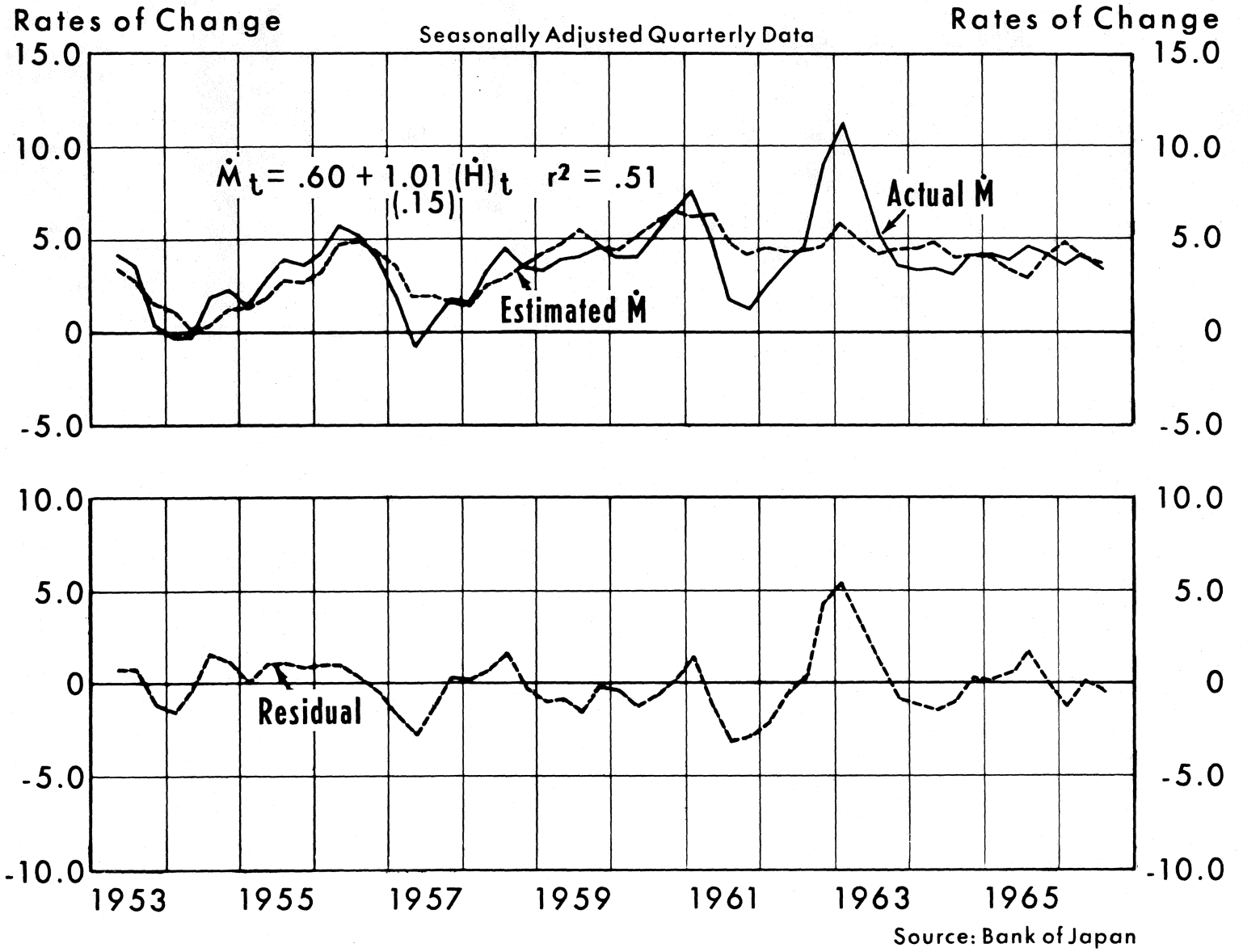
---

37/ Cagan observed the same results in his study of U.S. money stock High-powered money was the major determinant of the secular movement in the money stock, but the deposit-currency ratio was the major determinant of the cyclical movement in the money stock. See Determinants and Effects of Changes in the U.S. Money Stock, 1875 to 1960.

Figure 4

Japan

Actual and Estimated Value of Money Stock



Source: Bank of Japan

cyclical fluctuations in the aggregate deposit-currency ratio can be explained by two factors: first, the deposit-durrency ratio of the corporate business sector is much higher than that of the household sector, and second, the effects of tight money policy fall more heavily on the corporate business sector than on the household sector. 37-1/2/

The business sector holds its money primarily as monetary deposits, while the household sector holds money primarily in the form of currency. 38/ This phenomenon can be observed in the flow-of funds data. 39/ In the household sector, which includes non-incorporated business, for every Y 100 held in the form of currency, only Y 6 are

---

37-1/2/ If the deposit-currency ratio maintained by each sector is constant but differ between themselves, then the aggregate ratio will vary if there is a change in the currency holdings between sectors.

The aggregate deposit-currency ratio can be expressed as follows:

$$(D/C)_a \equiv (D/C)_h \ (C_h/C_a) + (D/C)_b \ (C_b/C_a)$$

$$\equiv (D/C)_h \ C_h/C_a + (D/C)_b \ \frac{C_a - C_h}{C_a}$$

$$\equiv \left[(D/C)_h - (D/C)_b\right] C_h/C_b + (D/C)_b$$

where subscript h stands for household sector, b for business sector, and a for aggregate ratio. Hence, if the sector deposit-currency ratio remains constant, the aggregate ratio can vary as follows:

$$\frac{d(D/C)_a}{dt} = \left[(D/C)_h - (D/C)_b\right] \frac{d(C_h/C_b)}{dt}$$

If monetary policy primarily affects the business sector, there will be a proportionately larger decline in C_b then in C_h and the ratio C_h/C_b will rise. Because $\left[(D/C)_h - (D/C)_b\right]$ is negative, the value of $(D/C)_d$ will decline.

38/ The strongly divergent ratios in the personal sector and the corporate sector are due to the fact that individual household checking accounts are almost non-existent in Japan. Only corporations which do extensive and continuous business with each other find settlement of bills through exchange of monetary deposits a convenient procedure. It is virtually impossible for private persons to transfer funds by check because, legally, a bad check is considered only a breach of contract, not a theft. Thus, the procedure for collecting on a bad check is more expensive and complicated in Japan than in countries where writing a bad check is a criminal offense.

39/ Economic Statistics of Japan, 1966, Bank of Japan.

held as deposits on the average. This ratio has been quite stable, ranging between 5 per cent and 7 per cent. In the case of the non-financial corporate business sector, for every ¥ 100 held in the form of currency, there has been about ¥ 340 held in the form of deposits. The deposit-currency ratios are strongly divergent between the household and business sectors.

The business sector is more affected by changes in monetary policy than is the household sector. The loans of the banking system are largely concentrated in loans to business, with virtually no loans to households. Household debt is not significant even in the mortgage market for single-family residences. Thus, a deceleration in bank loans has its initial effect on business. In attempting to adjust to the resulting liquidity squeeze, there is a strong incentive to economize on money stocks. Because business has a much higher deposit-currency ratio than households, a deceleration in money stocks of business will have a greater effect on deposits than on currency, with the result that the aggregate deposit-currency ratio will fall in periods of tight money and tend to rise in periods of easy money.

The Bank of Japan can come quite close to achieving its money stock target within a quarter time period because it can achieve its high-powered money target exactly and can estimate with a relatively short time lag the predictable cyclical movement in the deposit-currency ratio.

Section 4. The Behavioral Link Between Money, Income, Imports and International Reserves.

The model which ties this study together was presented in Section 1. It can be summarized as follows: an acceleration in the money stock leads to an acceleration in income and imports which causes international reserves to decelerate. The policy response is to decelerate the money stock, which will decelerate income and imports and reverse the decline in international reserves. Monetary policy is then eased, which leads to a new acceleration in income and imports. In Section 3, the behavior of the policy authorities, the determinants of the money stock, and the relation of the money stock to international reserves were considered. In this section the hypothesized behavior of the decision-making units which provide the other links in the model is investigated. There are three such links: the relation between money and income, between income and imports, and between imports and international reserves.

A. The Relation of Money to Income

The relationship hypothesized between money and income is derived from the quantity theory of money. It states that the level of income, Y, is dependently related to the stock of money, M; also, that variations in income, $\dot{Y}$, are dependently related to variations in money, $\dot{M}$. The existence of such a functional relationship does not imply that velocity, V, is constant. However, it does imply that it is functionally stable. This has been the case in Japan. Velocity has not been constant over time, but has exhibited two stable and independent characteristics.

The first was the secular tendency of velocity to rise in the first decade after the war and to decline in the second decade. The second was the cyclical tendency for velocity to rise during periods of tight money and fall during periods of easy money. The secular pattern of velocity may be attributed to the postwar price experience of Japan. Table 6 provides three indexes of prices: wholesale, consumer, and the GNP price deflator. Although the average rate of change in prices measured by each of these indexes varies, they all show the same inflationary direction.

Table 6

Price Changes

	Average Annual Percent Change In:		
	Wholesale Prices	Consumer Prices	GNP Price Deflator
1946-48	180.0	93.6	
1948-53	22.5	8.6	
1953-60	0.0	1.9	2.0
1960-66	1.0	6.0	4.8

Source: Bank of Japan, Economic Statistics, 1967.

In the early postwar period, 1946 to 1948, the inflation was substantial. In the period 1948 to 1953 the inflation was sharply reduced and in the period 1953 to 1960 there was virtually no inflation. The period 1960 to 1966 brought an emergence of new price increases.

According to Cagan (1956), desired real cash balances of money holders in periods of hyper-inflation are inversely related to the expected rate of change in prices. An expectation of rapid price increases creates an incentive to reduce the value of real cash balances. When the expected rate of change in prices is small, the desire for real cash balances is unchanged or rising. Cagan's study dealt with relatively short time periods and with high average monthly rates of price increases.

When the analysis of real cash balances is conducted in a longer time period with lower price increases, changes in real income also affect the results. Deaver, in a companion study, considers this issue using Chilean data. His results indicate that as inflation becomes less intense, money holders become less sensitive to the rate of inflation. Because they have less at stake, their reactions to price changes are not as prompt. It seems to take several years for money holders to adjust their expectations to relatively moderate changes in inflation.

Deaver's results with respect to Chile seem to be supported by the Japanese case. The rise in velocity (the reciprocal of real cash balances), in the period 1946 to 1955 was in response to the rapid but decelerating inflation of the period 1946 to 1953. There was a gradual decline in velocity from 1955 to 1962, a sharp decline in velocity in 1963, and a continued gradual decline in velocity through 1965.

The decline in velocity from the middle of the 1950's until the early 1960's is consistent with the expectations of continued price stability which followed from 1953-60 price experience. Because the price rise from 1960 through 1966 was largely in consumer goods, it is not surprising that the response in the form of a rise in velocity was lagged. This is especially true considering that real income during this period was rising at a substantial rate. (See pages 4-11 for further discussion of this issue.)

The cyclical tendency for velocity to rise during the early period of tight money and fall during the early period of easy money is consistent with rational behavior on the part of money holders. The deceleration in the money stock tends to create an excess demand for money, which pushes up short-term interest rates. The incentive of households and firms is to economize on cash balances / At the same time reduced spending commitments affect inventories and later production and income. The deceleration in income slows the rise in velocity and in time reverses it. increasing velocity.

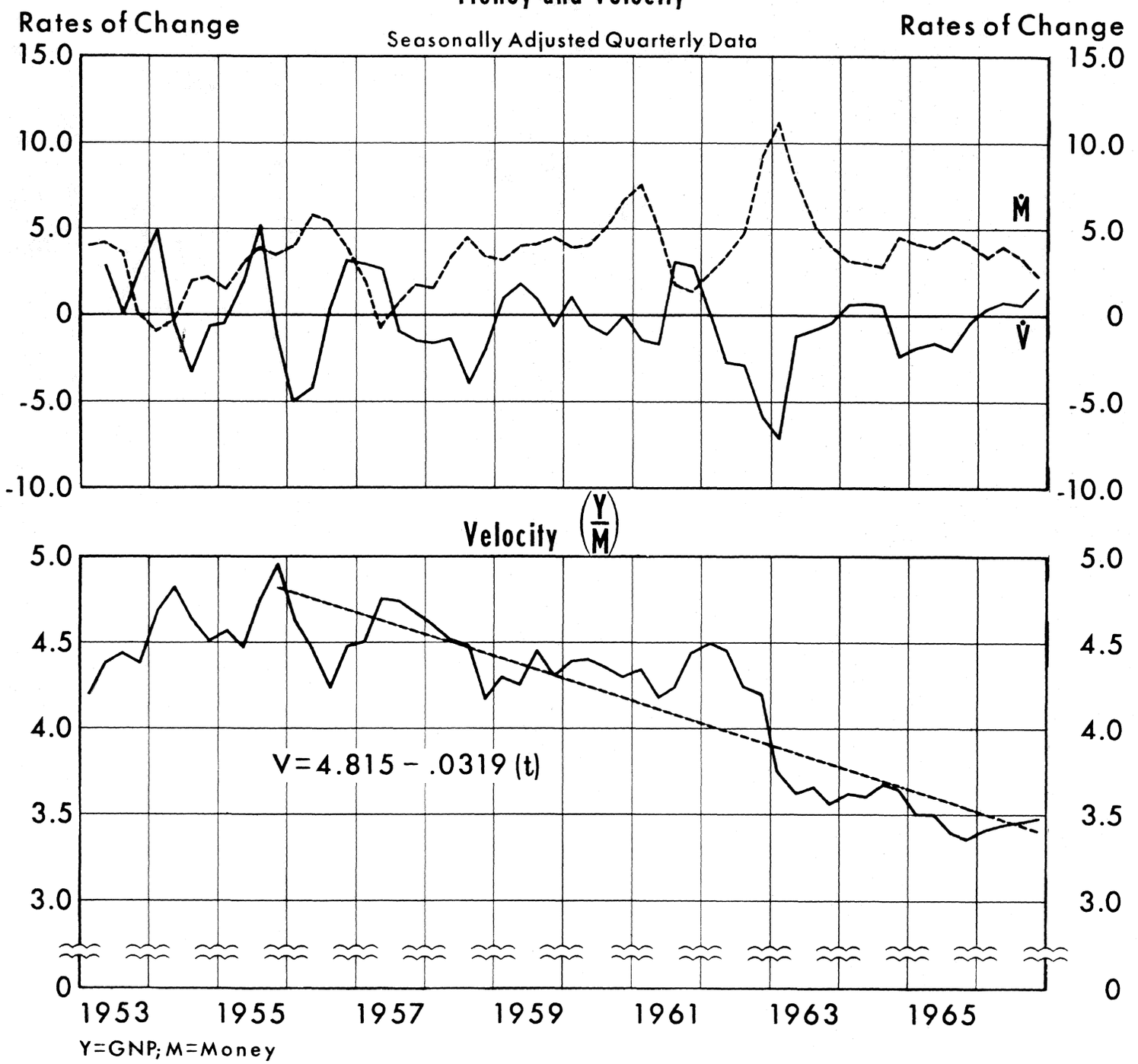
The opposite process takes place when the stock of money accelerates. The temporary excess supply of money leads to a sharp decline in short-term interest rates, easing the incentive of money holders to economize on cash balances, causing velocity to decline. Associated increase in spending commitments reduces inventories and, after some time lag, leads to increased production and income, slowing the decline in velocity. 40/

40/ In the United States, the cyclical pattern of velocity is similar to that of Japan, in spite of the fact that the secular trend of velocity has been just the opposite of Japan from 1955 to 1965.

Figure 5

Japan

Money and Velocity



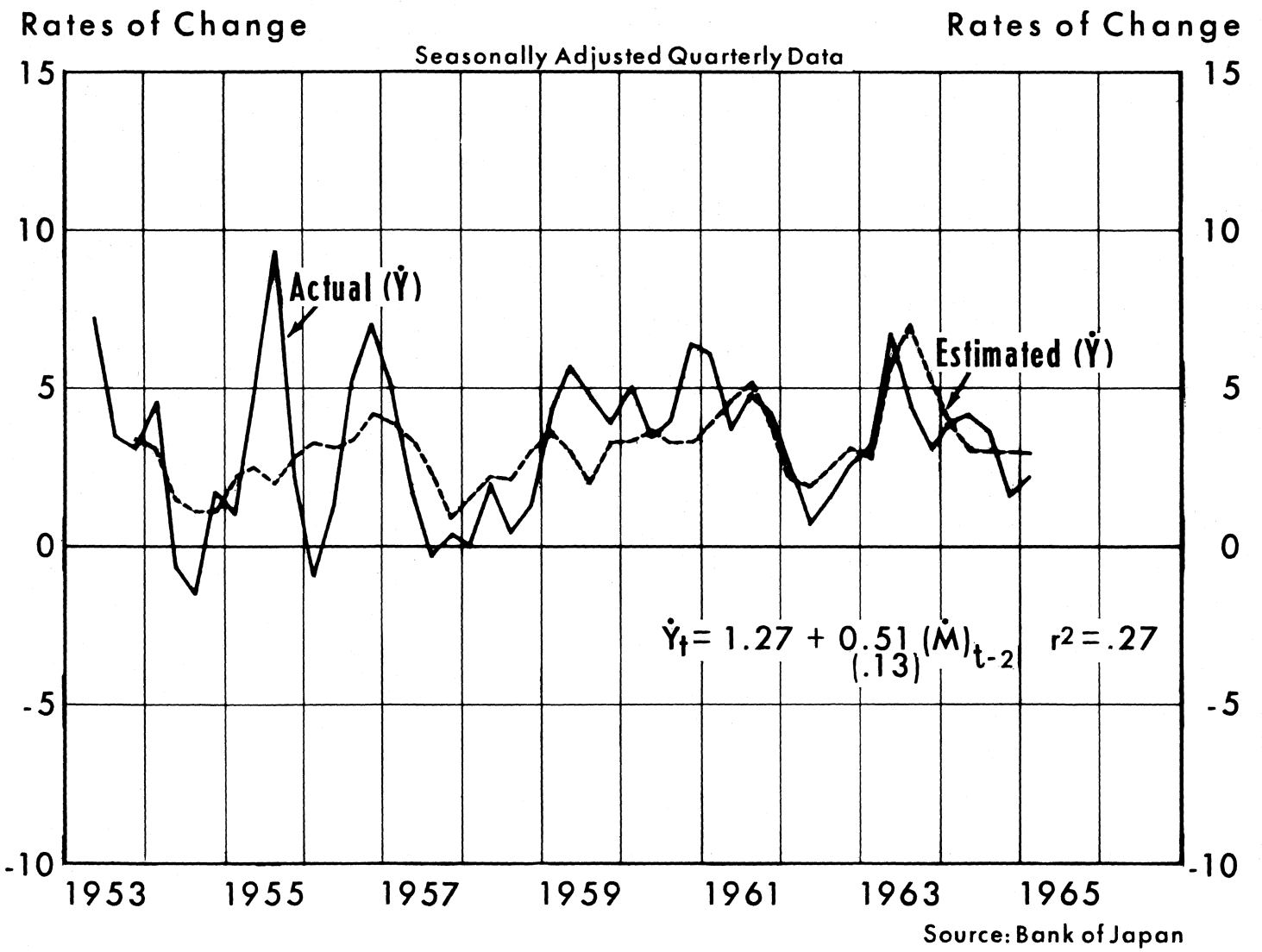
Y=GNP; M=Money

Sources: Bank of Japan; Economic Planning Agency, Government of Japan.

Figure 6

Japan

Actual and Estimated Changes in Nominal GNP



Source: Bank of Japan

In spite of this cyclical flexibility in the relationship between money and income, the fluctuations in velocity were not sufficiently large or long-lasting to prevent changes in money from dominating changes in income.

Comparing quarterly rates of change in money with quarterly rates of change in nominal GNP gave the following result:

$$(4.1) \quad \dot{Y}_t = 1.27 + \underset{(.13)}{0.51}\, \dot{M}_{t-2} \qquad r^2 = .27$$

The two-quarter lag in $\dot{M}$ gives the best statistical results with a one-quarter lag being almost as good. The r^2 with alternative lags in $\dot{M}$ were as follows:

$$\dot{M}_t = .10;\ \dot{M}_{t-1} = .26;\ \dot{M}_{t-2} = .27;\ \dot{M}_{t-3} = .15;\ \dot{M}_{t-4} = .03$$

(Appendix B gives details of all regressions considered in this study.)

Even the best correlation of determination (r^2) is not especially high. One reason for this is that quarterly national income accounts in Japan are still in an experimental stage. And there are frequent changes in accounting practices, coverage, and reporting techniques. Thus, there is some uncertainty of the degree to which the sample is representative of the universe. Large sampling fluctuations result in a substantial amount of random variation in the GNP series.[41/] When quarterly rates of change are taken, this random element is magnified, as can be seen in Figure 6. A 5-term moving average of the GNP series improves the relationship between $\dot{M}$ and $\dot{Y}$, which implies that measurement

---

41/ See Adelman and Adelman, Readings and Business Cycles, (1965) pp. 290-291.

errors rather than specification errors were the source of irregularity. However imperfect the data, the only information available on nominal GNP is from the quarterly national income accounts.

This study is not only interested in considering the effects of alternative monetary policies on the business cycle measured in terms of nominal income, but also in terms of real income. There are several choices open for measuring the relationship between money and real income.

Consider a money-real income relation expressed in log linear terms.

$$(4.2)\quad \log Y = \log \alpha_0 + \log \alpha_1 M_{t-2}$$

where $\log Y = \log X + \log P$,

and Y = nominal GNP

X = real GNP

P = price index

So $$(4.3)\quad \log X = \log \alpha_0 + \log \alpha_1 M_{t-2} - \log P_t.$$

In first differences:

$$(4.4)\quad \Delta \log X_t = \Delta \log \alpha_1 M_{t-2} - \Delta \log P_t.$$

Fitted to the statistical time series of real GNP, money and the price deflator measured as quarterly rates of change gives:

$$\dot{Y}^{*}_{t} = 1.00 + \underset{(.13)}{0.40}\ \dot{M}_{t-2} - \underset{(.38)}{0.18}\ \dot{P}_{t} \qquad r^2 = .19$$

The signs are as expected for both the money and the price variables. However, the analysis implies a price coefficient homogeneous to the first degree and an insignificant constant term. In fact, the constant term is large, and the price coefficient is closer to zero than to (-1.0). The fact that the price coefficient is not statistically significant is reassuring. In addition, the coefficient of determination is low. The reason has already been suggested. Nominal income as reported in the national income accounts has a large random element. Dividing through by the implicit price deflator to get real GNP does not reduce the random element. A meaningful statistical test of the underlying behavioral relation is therefore difficult using real GNP.

Fortunately, there is an alternative measure of real output -- industrial production. 42/ Movements in industrial production and real GNP are quite close when the random element in the real GNP series is accounted for by smoothing with a 5-term moving average. The coefficient of determination between/in industrial production and/real GNP is .60. The industrial production series

rates of change

rates of change in

42/ The relation between industrial production, money, and consumer prices has a closer fit than when real GNP is used:

$$\dot{X}_{t} = .97 + \underset{(.15)}{.75}\ \dot{M}_{t-2} - \underset{(.39)}{.46}\ \dot{P}_{t} \qquad r^2 = .39$$

However, the same statistical problems are evident, a large constant term and an absolute value of the price coefficient less this minus one (-1.0) which is statistically insignificant.

has been collected for many years, is easily understood, and is relatively straightforward to calculate. Thus, random errors are reduced. In addition, because the quarterly figures are the average of three-month figures, random variations are reduced further. Thus, industrial production exhibited relatively stable rates of change over time.

This study is concerned with the differing effects of monetary policy on real and nominal income, and not directly concerned with effects on prices. To handle the real output-money relation without the added complication of explicitly introducing prices into the model, two techniques were tried. First, coefficients relating observed changes in the nominal money stock to changes in industrial production were estimated separately for periods with different rates of change in prices. Second, the money series was deflated by the GNP price deflator and changes in real money compared with changes in industrial production.

With the first technique, the sub-period 1953 to 1960 (when prices increased at a moderate 2 per cent per year) was separated from the sub-period 1960 to 1964 (when prices rose 5 per cent per year). The coefficients estimated separately for each sub-period were:

Sub-period 1953-II to 1960-IV

$$\dot{X}_t = -0.07 + \underset{(.19)}{1.21}\ \dot{M}_{t-2} \qquad r^2 = .59$$

Sub-period 1960-IV to 1964-IV

$$\dot{X}_t = -0.54 + \underset{(.08)}{0.66}\ \dot{M}_{t-2} \qquad r^2 = .83$$

This split in the series corresponds to the one in Section 3 relating changes in money, $\dot{M}$, to changes in international reserves, $\dot{R}$. The reasons for splitting this series in 1960 are substantially the same in both cases. The monetary policy followed from 1960 to 1964 by Prime Minister Ikeda was more expansionary than that of his predecessors in the years 1953-60.

It should be noted that the coefficieint relating $\dot{M}$ to $\dot{X}$ in the period 1953 to 1960 is almost twice as large as the value of that coefficient during the period 1960 to 1964 (1.21 versus 0.66). Put another way, a one percent increase in the money stock in the earlier period had almost twice as big an effect on real output as a one percent increase in the money stock in the latter period. These results are reasonable under the circumstances. The average growth in real output over the long run is a function of the growth in real inputs of labor, capital, and technology. The average secular growth in the stock of money will not necessarily affect the secular growth in real output. Variations in the growth in the stock of money will, of course, have a major effect on the short-term growth in real output. If the secular growth in the stock of money increases, the coefficient relating the quarterly values of $\dot{M}$ to $\dot{X}$ would be expected to decrease roughly in proportion to the change in the average growth in nominal money stock. This is what happened in the case of Japan. The average quarterly value of $\dot{M}$ moved from 3.1 percent per quarter in 1953-60 to 4.8 percent per quarter in 1960-64 (an increase of 55 per cent), while the coefficient relating $\dot{M}$ to $\dot{X}$ moved from 1.21 to .66 in the same period (a decrease of 45 per cent).

The second method of adjusting for changes in prices was to compute coefficients relating changes in the real stock of money to changes in industrial production. The values of the coefficients were estimated for the whole period and also estimated separately for each of the policy sub-periods:

Period 1953-II to 1964-IV

$$X = 1.23 + \underset{(.12)}{.77}\ \dot{M}^*_{t-2} \qquad r^2 = .47$$

Sub-Period 1953-II to 1960-IV

$$X = 1.37 + \underset{(.18)}{.98}\ \dot{M}^*_{t-2} \qquad r^2 = .51$$

Sub-Period 1960-IV to 1964-IV

$$\dot{X}_t = .14 + \underset{(.08)}{.75}\ \dot{M}^*_{t-2} \qquad r^2 = .85$$

As with other measures of the money-income relation, the best fit was with a two-quarter time lag in money.

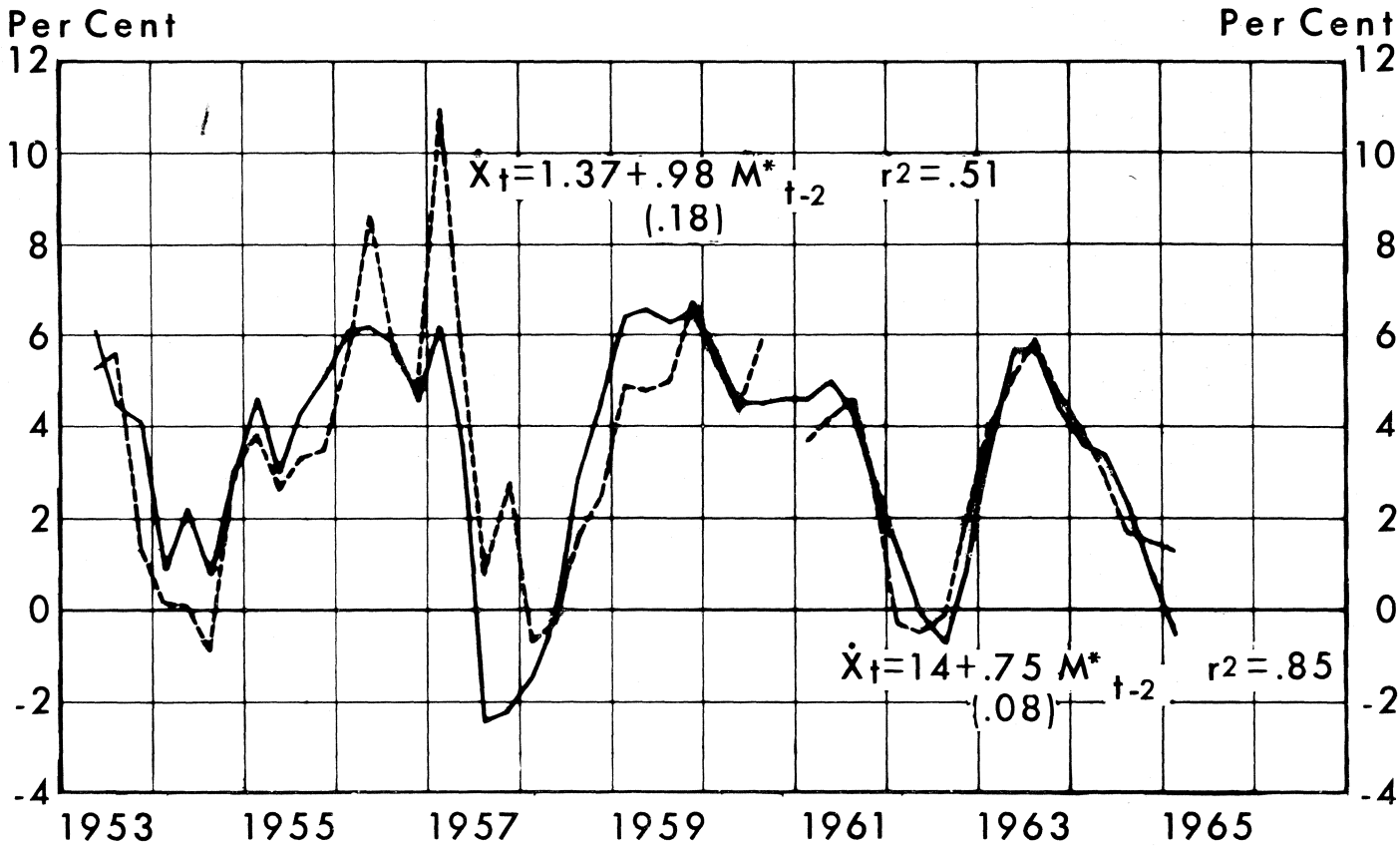
The difference in the value of the coefficients between the two policy sub-periods was just barely significant. The differences were smaller but in the same direction as in the nominal money -- real output relationship. This implies that the amount of real money which households and firms were willing to hold increased in the 1960-64 period relative to the 1953-60 period. How was this possible in the face of an increase in inflationary pressure in 1960-64?

The reasons were suggested on page 4.4. The inflationary pressures in the early and middle 1960's were relatively moderate compared to the early postwar years and compared to the contemporaneous growth in real income. Under such circumstance money holders may not

Figure 7

Japan

Actual and Estimated Changes in Real Product



reduce their desired real cash balances.

The reasoning is analogous to substitution and income effects in price theory. An increase in the expected price level will cause the demand for real cash balances to decline,[43] while a rise in real income will cause the demand for real cash balances to increase. If, as some evidence suggests, the income elasticity of demand for real cash balances is greater than one,[44] then the simultaneous rapid increase in real income and moderate increase in prices could lead to an increase in observed real cash balances and a decline in velocity. Given Japan's rapid growth in real income and relatively mild price increases, the decline in velocity from 1961 to 1965 is not unreasonable.

B. The Relation of Income to Imports

A popular saying is that "Japan must export to live." The truth in this phrase lies in the fact that Japan must import to live. Although the ratio of imports to income in Japan is lower than for many industrial nations, she lacks significant quantities of most raw materials required for industrial development. In 1964 she imported 96 per cent of her iron ore, 100 per cent of her raw cotton and wool, 60 per cent of her copper, 99 per cent of her petroleum,

---

43/ A complete measure of the substitution effect would require taking account of the cost of holding money relative to the cost of holding alternative assets. One or more interest rate variables would be needed to measure the demand for money balances. The sharp quarter-to-quarter movements in short-term interest rates have affected the cyclical movement in velocity. But the long-term trend in interest rates has been stable, after adjustment for price expectations, and therefore probably played little role in the trend of velocity. Because most interest rate data for Japan are misleading, it is not possible to quantify this observation.

44/ Milton Friedman, "The Demand for Money," Journal of Political Economy LXVII (August 1959, pp. 328-29).

and 49 per cent of her industrial coal. With the third largest steel industry in the world, she must import 24 per cent of her steel scrap. In recent years there has also been a significant increase in food imports, as the Japanese diet has shifted towards Western eating patterns more rapidly than has Japanese food production. 45/ Finally, Japan imports a wide range of sophisticated machinery and, with the recent trend towards import liberalization, a small but increasing amount of finished consumer goods.

The relationship between income and imports in Japan is substantially different when viewed in secular terms than when viewed in cyclical terms. The elasticity of nominal imports with respect to nominal GNP for the period 1953 to 1965 was not significantly different from 1.0. The elasticity of real imports with respect to industrial production was also not significantly different from 1.0. However, when the relationship between imports and income is computed on a quarter-to-quarter basis, the elasticity varied widely, with most observations in the range of - 1 to + 4 and some much larger in absolute value. This variation in elasticity is implicit in the following equations:

Nominal imports ($\dot{Im}$) to nominal GNP ($\dot{Y}$):

$$\dot{Im}_t = -3.16 + \underset{(.36)}{1.91}\ (\dot{Y})_t \qquad r^2 = .39$$

Real imports ($\dot{Im}^*$) to industrial production ($\dot{X}$):

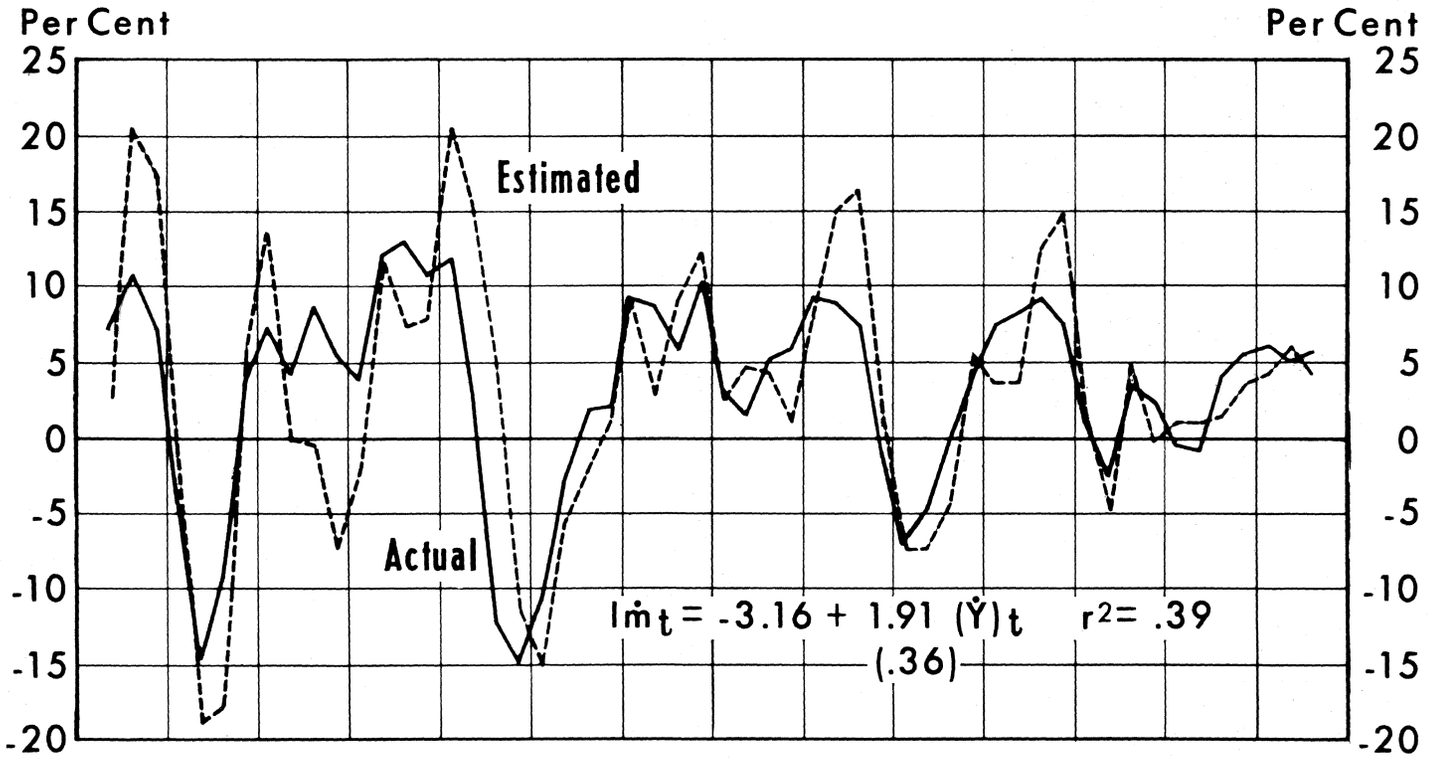
$$\dot{Im}^* = -3.26 + \underset{(.17)}{2.04}\ (\dot{X})_t \qquad r^2 = .76$$

45/ The government's price support program for rice discourages shifting to production of other crops.

Figure 8

Japan

Actual and Estimated Changes in Nominal Imports ($\dot{Im}$)



Actual and Estimated Changes in Real Imports ($\dot{Im}_t^*$)

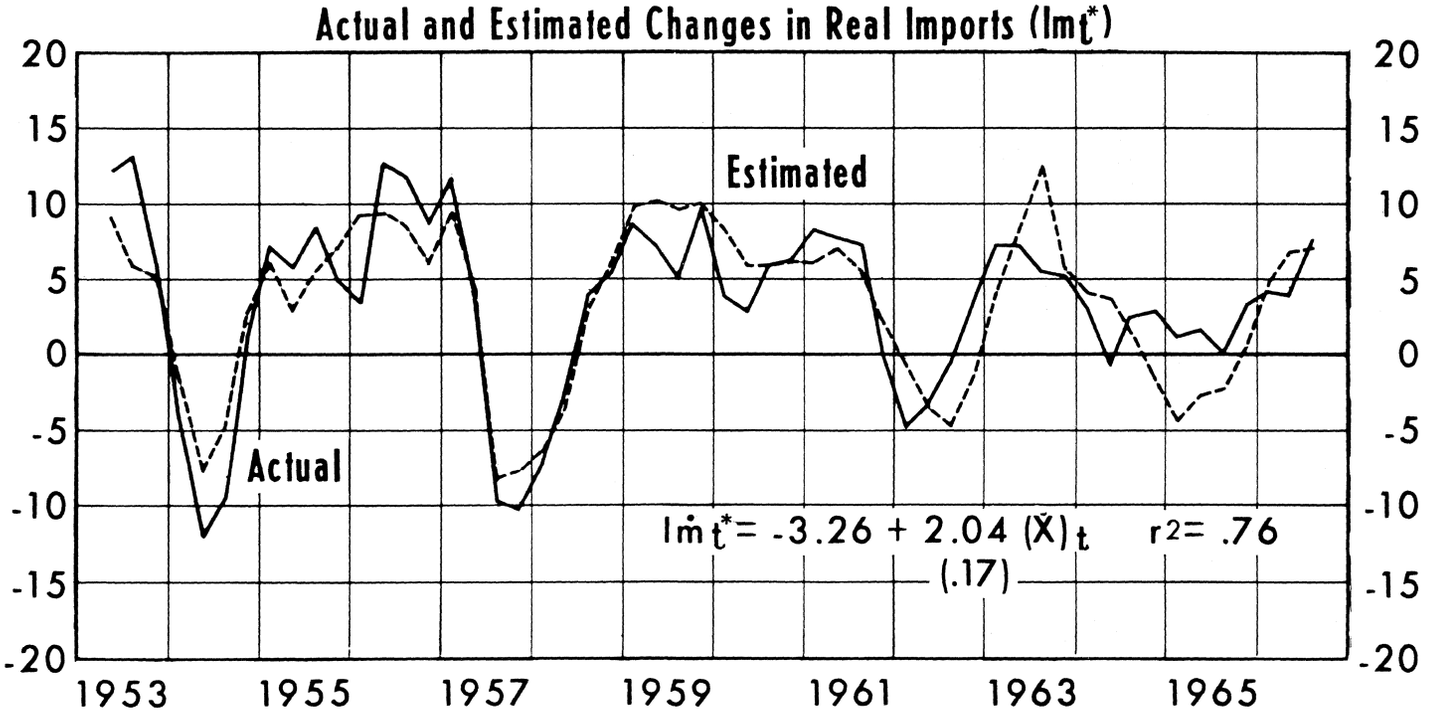


TABLE 7

Relationship of Production and Imports to Consumption and Inventories of Semi-Processed Materials

(Percentage Change in 4 Quarters Before and After Peak)

	Industrial Production	Consumption Semi-Processed Materials	Consumption of Imported Semi-Processed Materials	Inventories of Imported Semi-Processed Materials	Total Imports
1st Cycle Peak 1954 I					
Before Peak	22 %	20 %	60 %	59 %	32 %
After Peak	1	6	- 20	- 13	- 20
2nd Cycle Peak 1957 II					
Before Peak	26	18	48	49	58
After Peak	- 8	- 10	- 33	- 28	- 39
3rd Cycle Peak 1961 IV					
Before Peak	19	16	53	25	33
After Peak	1	- 3	- 41	- 28	- 12
4th Cycle Peak 1964 I					
Before Peak	21	24	97	99	34
After Peak	8	5	- 11	- 22	- 1
Four Cycle Averages					
Before Peak	22	20	65	58	39
After Peak	0	1	- 26	- 23	- 18

Note: Data for the table were available only through 1964-IV. As a result, the timing of the fourth cycle peak is only approximate.

Source: Bank of Japan, "Basic Data for Economic Analysis."

The higher income elasticity of imports observed in the cyclical measure than in the secular measure is due to sharp cyclical movements in the imports of some commodities.

Table 7 illustrates the problem. The average experience during the four business cycles was that the industrial consumption of all semi-processed materials rose and fell proportionately with the rise and fall in industrial production. However, the consumption of imported semi-processed materials tended in the last year of the upswing to rise 3-1/4 times as rapidly as total consumption of semi-processed materials. In the downswing (four quarters following the peak), the consumption of imported semi-processed materials declined on the average by 26 per cent, while total consumption was virtually unchanged. This pattern implies a strong cyclical shift between foreign and domestic sources of supply.

This dependence on imports as a marginal source of supply makes Japanese businessmen sensitive to their needs for inventories of such materials. A rise in the consumption of imported semi-processed materials is associated with a correspondingly sharp rise in the stock of inventories of these materials. Conversely, a decline in the consumption of imported semi-processed materials is associated with a decline in inventories. As a result, inventories have typically increased 58 per cent in the four quarters before the peak of the cycle when industrial consumption was rising 65 per cent. In the four quarters after the peak in the cycle, inventories of imported semi-processed materials declined 23 per cent, while their consumption declined 26 per cent.

The dual impact of sharp changes in consumption and inventories of imported semi-processed materials over the cycle plays a key role in the cyclical pattern of total imports. 46/

The observed cyclical shift between foreign and domestic sources of supply for these important industrial inputs is due to shifts in the relative cost of domestic versus foreign sources of supply. Although the market price of these domestic products does not exhibit a strong cyclical pattern, its non-market price does. The non-market price of a commodity may be defined as the indirect cost to the consumer of a given purchase. These indirect costs consist of such things as queuing, delays in delivery, and decline in quality of product or services. These non-market prices increase substantially during periods of acceleration in domestic demand and decline sharply in periods of deceleration in domestic demand. This creates the incentive to shift from domestic to foreign sources of supply during the late phase of the boom, and to shift from foreign to domestic sources of supply during the period of business decline.

46/ It is interesting to note that raw materials which represent 60 per cent of Japan's total imports make a relatively small contribution to the deviation of imports from its trend. The relatively modest cyclical pattern in the movement of raw material imports is due to Japan's almost complete dependence on foreign sources of supply. Therefore, shifts between domestic and foreign sources of supply do not play an important role in the quarter-to quarter fluctuations in these imports.

C. The Relation of Imports to International Reserves

The change in international reserves for any time period can be defined as equal to the surplus or deficit in the balance of payments for that time period. For Japan this procedure presents no serious problems because its currency is not held as an international reserve asset by other countries. The accounting definition of changes in international reserves is as follows:

$$(4.5) \quad \Delta R_t \equiv BP_t \equiv E_t - Im_t + K_t$$

Δ R = change in international reserves

BP = balance of payments

E = exports of goods and services

Im = imports of goods and services

K = Net capital receipts 47/

The relation hypothesized in the model is that the rate of change in international reserves is predictably related to the rate of change in imports.

$$(4.6) \quad \dot{R}_t = \rho_0 + \rho_1 \dot{Im}_{t-p}$$

47/ All international capital transfers are handled in either dollars or pound sterling. The domestic currency is converted into one of the international currencies at a domestic bank which is authorized to deal in foreign exchange. These banks will match their international receipts and payments daily or weekly and make up the balance with either a purchase or a sale of foreign exchange from the Bank of Japan which acts as an agent for the Foreign Exchange Special Account of the Ministry of Finance.

This relation is derived from the following transformation:

$$(4.7) \quad R_t \equiv R_{t-1} + K_t + E_t - Im_t$$

Differentiating with respect to time

$$(4.8) \quad \frac{dR_t}{dt} \equiv \frac{dR_{t-1}}{dt-1}\left(\frac{dt-1}{dt}\right) + \frac{dK_t}{dt} + \frac{dE_t}{dt} - \frac{dIm_t}{dt} .$$

Find the percent change in Reserves by dividing by R_{t-1} and re-stating other terms so they can be written in rate of change form.

$$(4.9) \quad \dot{R}_t \equiv \frac{1}{R_{t-1}}\left(\frac{dR_{t-1}}{dt}\right) + \frac{K_{t-1}}{R_{t-1}}\cdot\frac{1}{K_{t-1}}\left(\frac{dK_t}{dt}\right) + \frac{E_{t-1}}{R_{t-1}}\cdot\frac{1}{E_{t-1}}\left(\frac{dE_t}{dt}\right)$$

$$- \frac{Im_{t-1}}{R_{t-1}}\cdot\frac{1}{Im_{t-1}}\left(\frac{dIm_t}{dt}\right)$$

Replace t with t-1 in 4.8 and substitute into 4.9.

$$(4.10) \quad \dot{R}_t \equiv \frac{1}{R_{t-1}}\left[\frac{dR_{t-2}}{dt} + \frac{dK_{t-1}}{dt} + \frac{dE_{t-1}}{dt} - \frac{dIm_{t-1}}{dt}\right] + \frac{K_{t-1}}{R_{t-1}}\left(\dot{K}_t\right)$$

$$+ \frac{E_{t-1}}{R_{t-1}}\left(\dot{E}_t\right) - \frac{Im_{t-1}}{R_{t-1}}\left(\dot{Im}_t\right)$$

By repeated substitution of 4.8 into 4.9 until such point that $\frac{dR_{t-n}}{dt}$ equals zero we get the following identity:

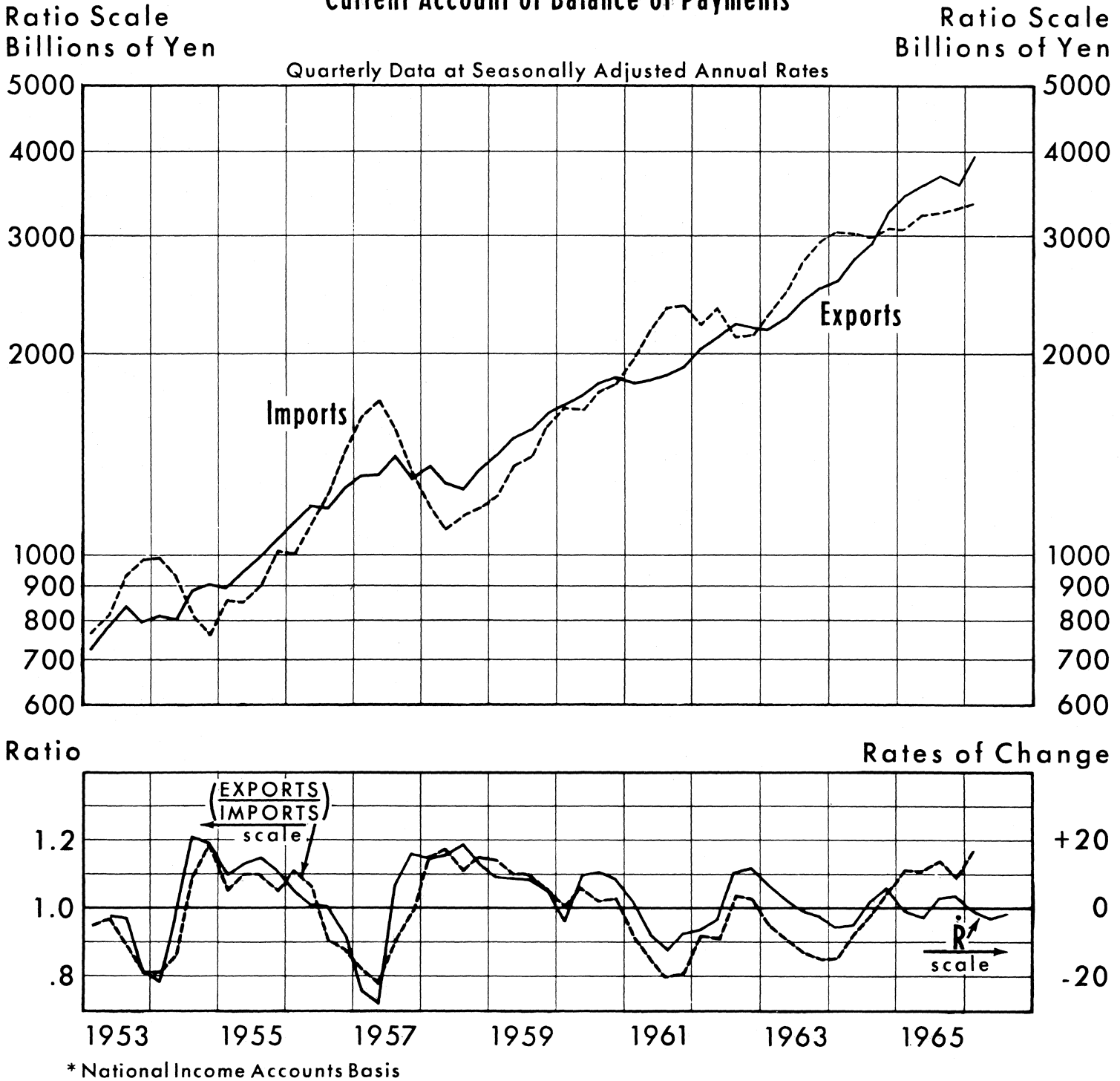
$$(4.11) \quad \dot{R}_t \equiv \frac{1}{R_{t-1}}\cdot\frac{dR_{t-n}}{dt} + \frac{1}{R_{t-1}}\left[\sum_{i=o}^{n-1}\left(K_{t-i-1}\right)\left(\dot{K}_{t-i}\right)\right]$$

$$+ \frac{1}{R_{t-1}}\left[\sum_{i=o}^{n-1}\left(E_{t-i-1}\right)\left(\dot{E}_{t-i}\right)\right] - \frac{1}{R_{t-1}}\left[\sum_{i=o}^{n-1}\left(Im_{t-i-1}\right)\left(\dot{Im}_{t-i}\right)\right]$$

Figure 9

Japan

Current Account of Balance of Payments *



* National Income Accounts Basis

Source: Government of Japan Economic Planning Agency

The identify shows that the percent change in reserves is a weighted sum of the percent rate of change of past imports, exports, and capital back to some point in time when the rate of change in reserves was zero. To assert that this identity can be approximated solely by the lagged rate of change to imports, one must show that exports and net capital flows have grown at a relatively stable rate.

The identity 4.11 can be re-written factoring out one lagged value of the rate of change of imports.

$$(4.12)\quad \dot{R}_t \equiv \frac{1}{R_{t-1}} \cdot \frac{dR_{t-n}}{dt} + \frac{1}{R_{t-1}}\left[\sum_{i=o}^{n-1} (\dot{K}_{t-i-1}).\dot{K}_{t-i}\right] + \frac{1}{R_{t-1}}\left[\sum_{i=o}^{n-1} (E_{t-i-1})(\dot{E}_{t-i})\right]$$
$$- \frac{1}{R_{t-1}}\left[\sum_{\substack{i=o \\ i\neq p}}^{n-1} (Im_{t-i-1})\,(\dot{Im}_{t-i})\right] - \frac{Im_{t-p-1}}{R_{t-1}}\,(\dot{Im}_{t-p})$$

The best linear approximation of this identity is specified as follows: The term factored out of the import summation is the "active" term, since it is approximated by $\rho_1 \dot{Im}_{t-p}$ in the regression equation $\dot{R}_t = \rho_o + \rho_1 \dot{Im}_{t-p}$. The sum of the other terms on the right-hand side is approximated by the constant term ρ_o. The lagged time index "p" is selected so as to minimize the variation in the terms represented by ρ_o. Conceptually, "p" should be the time lag that most closely synchronizes turning points in the rate of change of reserves to the negative of the turning points in the rate of change of imports. 48/ A polynomial of the form $\dot{R}_t = \rho_o + \rho_1 \dot{Im}_{t-p} - \rho_2 \dot{Im}^2_{t-p} - \ldots - \rho_n \dot{Im}^n_{t-p}$.

48/The assumption would be that the two time series would be out of phase by approximately one-quarter of a cycle. As analyzed in Section 5, it will be shown that the cycle is ten quarters long. Therefore, the estimated lags between rates of change of imports and reserves of two quarters is quite consistent.

can be used to simulate the cyclical movements of the coefficient $\left[-\frac{Im_{t-p-1}}{R_{t-1}}\right]$ in the identity. In fact, the polynomial form gives the best regression fit and was incorporated into this model as a result. The evidence presented to justify this form of the identity is of two types. First, that exports and net capital flows exhibit a stable growth relative to imports and, second, that regressions between rates of change in imports and reserves have reasonably good statistical fits. As the regression evidence is the most straightforward to present, it is given first.

A second degree polynomial regression gave the best results.

Nominal Imports and Nominal Reserves:

$$\dot{R}_t = \underset{}{9.69} - \underset{(.17)}{1.16}\ Im_{t-1} - \underset{(0.22)}{0.56}\ \dot{Im}(2)_{t-2} \qquad r^2 = .54$$

Real Imports and Real Reserves:

$$\dot{R}^*_t = \underset{}{10.1} - \underset{(.10)}{1.23}\ \dot{Im}^*_{t-2} - \underset{(.027)}{.056}\ \dot{Im}^*(2)_{t-2} \qquad r^2 = .54$$

With respect to the first type of evidence, it can be noted that Japan has benefited substantially from the stable and prosperous international economic environment which has existed in the postwar period. 49/ Of course, the fact that Japan's export growth has been two to three times the growth in world trade is largely due to domestic considerations, such as a growing and sophisticated capital plant and well-trained and motivated work force, and an imaginative application of technology to the needs of world trade. None of these domestic factors are strongly influenced by the short-run Japanese business cycle.

49/ This raises some interesting questions about the international transmission of business cycles. This analysis implies that Japan has been

As can be seen in Figure 9, none of the four periods of decline in reserves can be attributed primarily to export considerations. 49-1/2/ During two periods, 1957 and 1963, Japanese exports were rising at a rate faster than average, and in the other two periods, 1953-54, and 1961 exports were rising at a rate slower than average. Each of the four decelerations in international reserves was associated with a rapid increase in imports, and the acceleration in reserves was associated in the first two periods with a rapid decrease in imports, and the last two periods

---

49/ (continued)

relatively little affected by fluctuations from abroad in the postwar period. Thus, the popular saying that when the U.S. sneezes Europe catches cold and Japan is confined to its bed, doesn't seem to hold. Of course, these observations are based on a quite mild business cycle pattern. If the fluctuations were more severe, the international transmission of cycles would probably be more apparent, as was the case in the 1930's.

49-1/2/ Cyclical movements in the current account have been the major cause of fluctuations in foreign exchange reserves, with net capital movements playing a growing but secondary role. Since the mean import-reserve ratio has been close to one (.92), it is possible to illustrate the relative importance of current account and capital flows to the rates of change of reserves by superimposing the export-import ratio graph on the rate of change of reserves graph. Algebraically, the procedure is justified as follows:

$$\dot{R} = \frac{\Delta R_t}{R_{t-1}} = \frac{K_t + E_t - Im_t}{R_{t-1}} \equiv \frac{K_t}{R_{t-1}} + \frac{Im_t}{R_{t-1}}\left[\frac{E_t}{Im_t} - 1\right]$$

The mean import-reserve ratio is the factor of proportionality between the scale for the rate of change of reserves and the export-import ratio scale. In effect, the export-import ratio is used as a proxy for the measure of the rate of change of reserves due to net quantity flows of current account. The export-import ratio somewhat exaggerates rates of change in reserves due to current account flows, whenever the import reserve-ratio is below the mean. The opposite case holds when the import-reserve ratio is above the mean.

with a moderate decrease in imports.

Fluctuations in imports have played a major role not only in the timing of changes in international reserves, but also in the size of their deterioration and subsequent improvement. Notice in Figure 9 that variations in imports in the first two cycles were larger than in the last two cycles, and also that fluctuations in international reserves were larger in the first two cycles than in the last two.

From 1953 to the middle of 1960, the ratio of exports to imports moved in a pattern and amplitude almost identical to that of the rate of change in international reserves. This implies that imports not only dominated the current account but also capital movements were relatively unimportant in the Japanese balance of payments during this period. However, from the middle of 1960 until the end of 1964, the rate of change in international reserves was at a much higher average level than the ratio of exports to imports. This implies a heavy capital inflow during the period. 50/

The emergence of a heavy capital inflow from 1960 to 1964 is consistent with the previous analysis of monetary policy. It will be recalled that Prime Minister Ikeda (July 1960-November 1964) wished to push an expansionary monetary policy. Hoping to prevent such a policy

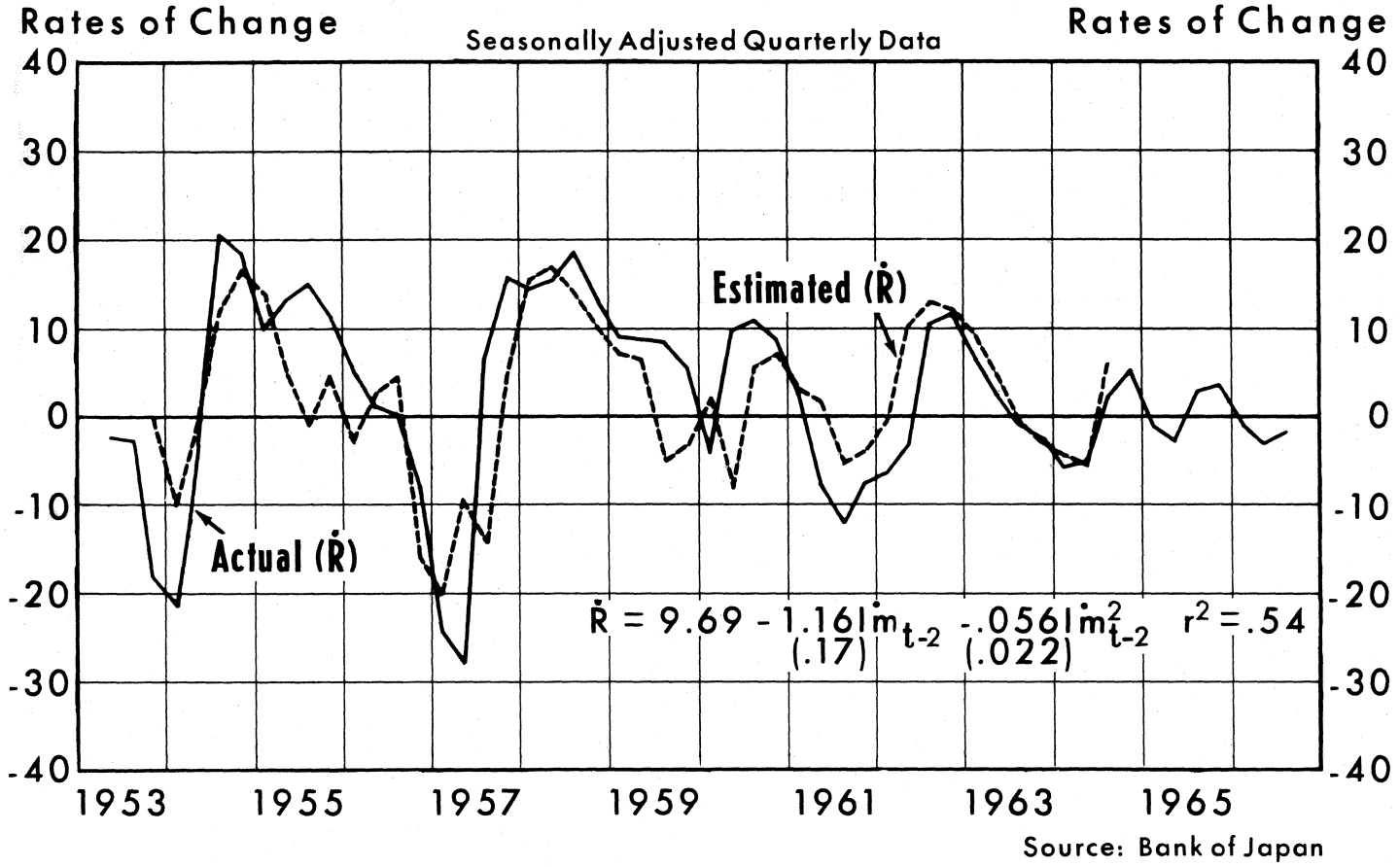
---

50/ Consistent data on the Japanese capital account are not available during this whole period because of changes in the method of presentation. However, what data are available, confirm this result. The sum of long- and short-term capital receipts between 1956 and 1959 was -$126 million; the sum of long- and short-term capital receipts between 1960 and 1964 was +$2.3 billion.

Figure 10

Japan

Actual and Estimated Changes in Nominal International Reserves



Source: Bank of Japan

from causing the balance of payments to deteriorate, the Ikeda Administration substantially reduced restrictions on short-term capital imports and moderately liberalized long-term capital imports. 51/ Because controls on export of capital by European countries were also being relaxed, and because Japanese growth rate and domestic interest rates were considerably higher than in other industrial countries, the reductions of controls on capital led to an immediate and heavy inflow of foreign funds.

51/ A partial listing of the capital liberalization moves taken by the Ikeda Administration include:

(A) In July 1960 non-residents of Japan were permitted to purchase Yen accounts with foreign currency which were automatically reconvertible into foreign exchange. This permitted Japanese banks with branches in Europe to take advantage of the Euro-dollar market. Within less than three years Euro-dollar deposits in Japanese banks increased more than $1 billion.

(B) In the fall of 1960, domestic Japanese banks were given increased freedom to refinance import trade credits with foreign banks. This permitted a substantial expansion in the amount of short-term credit which was available to Japan from foreign sources.

(C) From 1960 to 1962, the Japanese government gradually eased restrictions on domestic business organizations' floating bonds abroad, permitted foreign purchasers of Japanese stocks to repatriate their income with only a minimum waiting period, and generally eased the government's administrative restrictions of Japanese corporations assuming foreign liabilities.

The purpose of these liberalization moves was to increase the amount of capital inflow, but because of the Japanese native suspicion of foreign influences, there was relatively little improvement in the attitude of the Japanese government regarding foreign direct investment. Such investment was, and still is, restricted to minority participation to insure that Japanese nationals control the decision-making process.

In spite of this capital inflow from 1960 to 1964, Japan's balance of payments was still dominated by fluctuations in imports. The capital inflow could only reduce the magnitude of the international reserve loss. 52/

52/ The relative stagnation in international reserves in the face of a strong current account surplus since the end of 1964 is due to the cyclical decline in Japanese interest rates relative to those in the rest of the world. To a lesser extent, it is due to the "voluntary program" of the United States to correct its balance of payments problem, which was initiated on February 10, 1965. The decline in interest rates has hit short-run capital flows, while the "voluntary program has primarily affected long-term capital flows. In 1965-66 there was net capital outflow of $1.3 billion.

The reemergence of boom conditions towards the end of 1965 took longer than usual to affect interest rates. But when rates started to rise towards the end of 1966, the capital outflow was reversed. In the first half of 1967 there was a net capital inflow of $244 million.

Section 5. MONETARY POLICY AND THE BUSINESS CYCLE

The 4-equation model of the Japanese business cycle which was presented briefly in Section 1 and considered in detail in Sections 3-4, can be analyzed formally with the help of difference equations. The unique advantage of difference equations is that in its application to economics, the solution traces out a path over time. In this way the dynamic properties of the model can be analyzed.

A. The Simplest Example.

The structural equations which underlie this difference equation in their simplest form are as follows:

$$(5.1)\quad \dot{Y}_t = \alpha_0 + \alpha_1 \dot{M}_{t-2}$$

$$(5.2)\quad \dot{M}_t = \beta_0 + \beta_1 R_{t-1}$$

$$(5.3)\quad \dot{R}_t = \rho_0 + \rho_1 \dot{Im}_{t-2}$$

$$(5.4)\quad \dot{Im}_t = \gamma_0 + \gamma_1 \dot{Y}_t$$

The lagged values are determined by the statistical results presented in sections 3 and 4.

The reduced form of this system of equations (5.1 through 5.4) is:

$$(5.5)\quad \dot{Y}_t = A_0 + A_1 \dot{Y}_{t-5}$$

Where $A_0 = \alpha_0 + \alpha_1\beta_0 + \alpha_1\beta_1\rho_0 + \alpha_1\beta_1\rho_1\gamma_0$

$A_1 = \alpha_1\beta_1\rho_1\gamma_1$

While this equation appears to be of the fifth order, it is in fact a system of five first order equations, because all equations are of the form:

$$\dot{Y}_t = f(\dot{Y}_{t-h}).$$

Because (h) is a constant time interval, the equation can be handled as if it were of the first order. For example, instead of saying t-5 (quarters), we can say t-1 (5-quarter interval). To illustrate this, consider the following initial conditions:

$$\dot{Y}_{-4} = 9, \quad \dot{Y}_{-3} = 6, \quad \dot{Y}_{-2} = 1, \quad \dot{Y}_{-1} = 2$$

$$\dot{Y}_{o} = 5$$

and the determining equation: $\dot{Y} = 1 - 2\dot{Y}_{t-5}$

The sequence, including the initial conditions, that would be generated is:

$$\left\{\begin{array}{l} 9, 6, 1, 2, 5, -17, -11, -1, -3, -9 \\ 35, 23, 3, 7, 19, -63, -45, -5, -13, -37, \\ 125, 89, \ldots \end{array}\right\}$$

The original sequence can be decomposed into five separate subsequences which have no common elements. Eace element of the original sequence with subscript "t" is placed in the corresponding i^{th} (i = 1,2,3,4,5) subsequence when ${}^{i}t = \frac{(t + 5 - i}{5}$ assumes an integral value. Each subsequence can be generated by a 1st order difference equation of the form $\dot{Y}_{i_t} = 1 - 2\ \dot{Y}_{i_{t-i}}$.

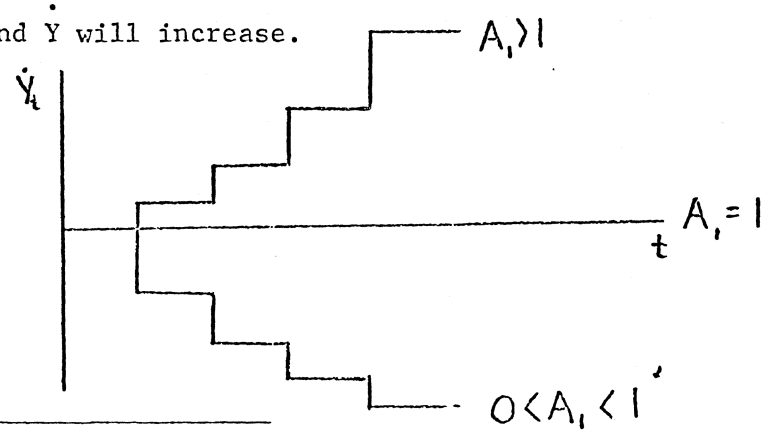
1 { 9, -17, 35, -63, 125 ... }
2 { 6, -11 23, - 45, 89 ... }
3 { 1, -1, 3, -5 ... }
4 { 2, -3, 7, -13 ... }
5 { 5, -9, 19, -37 ... }

The elements of each subsequence are uniquely related to the initial condition (1st element) of that subsequence. The "behavior" of any

one subsequence is mathematically independent of the "behavior" of the other subsequences. However, as the initial conditions are drawn from consecutive observations of the Japanese economy, the subsequences are assumed to be consistently related to one another. Given these non-random initial conditions, it is not unreasonable to reassemble the five subsequences (generated from the 1st order difference equations) to form the fifth order difference equation, approximating the cyclical behavior of the Japanese economy.

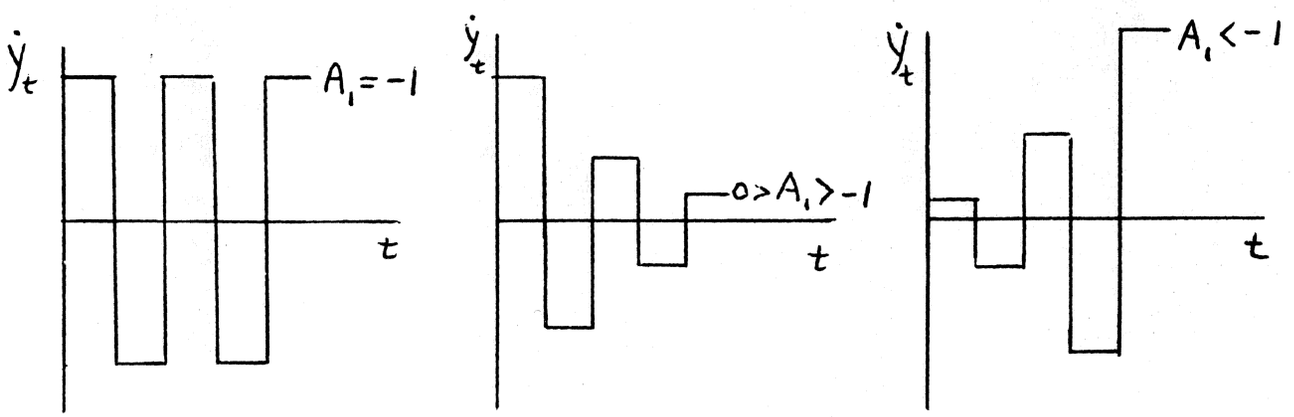
Specifying the behavior of the first order equation $\dot{Y}_t = A_0 + A_1 \dot{Y}_{t-1}$ also specifies the behavior of the fifth order equation $\dot{Y}_t = A_0 + A_1 \dot{Y}_{t-5}$. For purposes of tracing out the solution of a first order difference equation, the constant term A_0 can be omitted as the value A_1 determines the cyclical properties of the model. 53/

If the value of A_1 is positive, then the rate of change in income, $\dot{Y}$, will not have a cyclical pattern. If A_1 is equal to one, income will grow at a constant rate each period and $\dot{Y}$ will be constant. If A_1 is less than one but greater than zero, income will grow at a constantly decreasing rate each period and $\dot{Y}$ will decrease. If A_1 is greater than one, income will grow at a constantly increasing rate each period and $\dot{Y}$ will increase.



53/ See Baumel, Economic Dynamics, 2nd ed., p. 1963.

If, on the other hand, the value of A_1 is negative, the time path of $\dot{Y}$ will oscillate in a regular cyclical pattern. If the value of A_1 is equal to minus one, the cyclical path of $\dot{Y}$ will be of constant amplitude. If the value of A_1 is less than zero but greater than minus one, the cylical path of $\dot{Y}$ will be damped. If A_1 is less than minus one (its absolute value is greater than one), the cyclical path of $\dot{Y}$ will be explosive.



On <u>a priori</u> grounds we can postulate that the value of A_1 in this model of the business cycle is negative. This is because in Equation 5.3 the value ρ_1 is negative; that is, an acceleration in imports will lead to a deceleration in international reserves. As the value of coefficients in the other three equations are positive, the product $A_1 = \alpha_1 \beta_1 \rho_1 \gamma_1$ will be negative. Thus, the model has a built-in cyclical property.

These results can be seen intuitively. Consider the reduced form equation:

$$\dot{Y} \cdot A_o + A_1 \dot{Y}_{t-5}$$

If A_1 is negative and the value of $\dot{Y}_{t-5}$ is positive, then the product of these two values will be negative. This means that the value of $\dot{Y}_t$ will be smaller than that of $\dot{Y}_{t-5}$. If the value of $\dot{Y}_{t-5}$ is negative and is multiplied by A_1 which is also negative, then the product will be positive and the value of $\dot{Y}_t$ will be larger than $\dot{Y}_{t-5}$. Thus, the value of $\dot{Y}_t$ over time is periodically larger and smaller. 54/

These relations can be viewed schematically.

$$\dot{M}_t \xrightarrow{(+)} \alpha_1 \dot{Y}_{t-2} \xrightarrow{(+)} \gamma_1 \dot{Im}_{t+2} \xrightarrow{(-)} \rho_1 \dot{R}_{t+4} \xrightarrow{(+)} \beta_1 \dot{M}_{t+5}$$

The arrow indicates the hypothesized direction of causality. The sign above the arrow indicates whether the relation is positive or negative. The time subscript indicates the number of quarters between the change in $\dot{M}$ and the change in the other variables. The sequence takes five quarters from peak to trough and ten quarters for the entire cycle.

An increase in $\dot{M}$ will increase $\dot{Y}$ and $\dot{Im}$ in about two quarters and reduce $\dot{R}$ in about four quarters. The monetary policy response will lead to a decline in $\dot{M}$ in about five quarters. The cyclical process could be equally well described starting with any of the other variables and lead to the same results.

There are two major implications of this model. First, the built-in cyclical property is due to monetary policy responding

---

54/ The value around which $\dot{Y}_t$ will fluctuate depends strongly on the value of A_o. If A_o is large, the average value of $\dot{Y}_t$ will be high, and if A_o is small or negative, the average value of $\dot{Y}_t$ will be low or negative. In one sense, A_o can be considered as all the unexplained factors in the economy which contribute to its average growth rate, while A_1 represents all of the explicitly considered factors which explain the fluctuations in the growth rate.

exclusively to changes in international reserves when such changes are due to domestic considerations. Second, the more expansionary monetary policy, the greater the cyclical fluctuations in income.

The first implication is derived directly from the structure of the model. Coefficient β_1 is a measure of the policy response to changes in international reserves. If monetary policy was not responsive to changes in international reserves, β_1 would be equal to 0. This implies that the product of $\alpha_1 \beta_1 \rho_1 \gamma_1 = A_1 = 0$. In this case, money would grow at a steady rate, β_0, and income would grow at a steady rate $(\beta_0 \alpha_1 + \alpha_0)$ subject only to random exogenous influences. Divorcing monetary policy from fluctuations in international reserves would also lead to increased stability in the growth of international reserves. This can be seen by solving the reduced form of the four structural equations for $\dot{R}$ rather than for $\dot{Y}$. A_1 would still be equal and the product of $1 \quad 1 \quad 1 \quad 1$.

$$\dot{R}_t \quad A_{oo} + A_1 \quad (\dot{R})_{t-5}$$

If β_1 is zero, then A_1 is also zero and $\dot{R}$ will grow at a steady rate determined by the value A_{oo} and random exogenous events.

55/ Not all target growth rates in the money stock would be sustainable. If the target growth rate is too high, international reserves will decline and a restrictive monetary policy would have to be initiated. Judging by the 1953-66 experience, target growth rate of 3-4 per cent per quarter would be sustainable.

The economic reasoning behind this is that fluctuations in international reserves are due to domestic factors, i.e., variations in imports, and fluctuations in money lead to fluctuations in domestic income. The relationship is, in a sense, a closed loop, with increases in money causing increases in income, and increases in income causing decreases in money. If the money stock grows at a steady rate, this will lead to a steady rate of growth in income and imports and thereby reduce the variability in international reserves. 55/

The second implication of this model follows easily from the first implication. The more expansionary monetary policy leads to greater fluctuations in income because the more expansionary policy leads to a larger value for the coefficient β_1. As a result, the absolute value of A_1 is larger, which implies larger absolute fluctuations in income.

B. The Actual Dynamic Properties

The actual set of structural equations used to estimate the behavior postulated in this model is somewhat more complicated than presented in the above example. The statistical estimation of the relation of $\dot{Im}$ to $\dot{R}$ was a second degree polynomial:

$$\dot{R}_t = \rho_0 + \rho_1 \dot{Im}_{t-2} + \rho_2 \dot{Im}^{(2)}_{t-2}$$

When this is substituted for equation 5.3 in the example, the reduced form of this system of four equations is as follows:

$$5.6 \quad \dot{Y}_t = A_0 + A_1 \dot{Y}_{t-5} + A_2 \dot{Y}^{(2)}_{t-5}$$

Where,

$$A_o = \alpha_o + \alpha_1 \beta_o + \alpha_1 \beta_1 \rho_o + \alpha_1 \beta_1 \rho_1 \gamma_o + \alpha_1 \beta_1 \rho_2 \gamma_o^2,$$

$$A_1 = \alpha_1 \beta_1 \rho_1 \gamma_1 + 2\alpha_1 \beta_1 \rho_2 \gamma_o \gamma_1,$$

And

$$A_2 = \alpha_1 \beta_1 \rho_2 \gamma_1^2$$

Equation 5.6 can be simplified into a first order difference equation of the second degree by the same process described above. Thus, it can be re-written as follows:

$$\dot{Y}_t = A_o + A_1 \dot{Y}_{t-1} + A_2 \dot{Y}^{(2)}_{t-1}$$

The implications for the time path of $\dot{Y}_t$ in this more complicated reduced form are not as straightforward mathematically or as intuitively understandable as in our previous example. However, in the range of values of A_1 and A_2 which are observed in the case of Japan (between 0 and -1), the results are the same as in the simple case and can be shown by simulation.

This business cycle model was tested for both real and nominal values. The value of the nominal coefficients are as follows:[56/]

5.7 $\dot{Y}_t = 1.27 + 0.51 \dot{M}_{t-2}$

5.8 $\dot{M}_t = 2.65 + 0.09 \dot{R}_{t-1}$ 5.8a $\dot{M}_t = 4.90 + 0.34 \dot{R}_{t-1}$

5.9 $\dot{R}_t = 9.69 - 1.16 \dot{Im}_{t-2} - 0.06 \dot{Im}^2_{t-2}$

5.10 $\dot{Im}_t = -3.16 + 1.91 \dot{Y}_t$

Equation 5.8 and 5.8a were estimated for separate periods of monetary policy response to the balance of payments. Therefore, the reduced form has two versions:

56/ These coefficients are drawn from Sections 3 and 4 where each of the behavioral relations was discussed and the statistical results

$$5.11 \quad \dot{Y}_t = 3.19 - 0.068\,\dot{Y}_{t-5} - 0.009\,\dot{Y}^2_{t-5}$$

$$5.12 \quad \dot{Y}_t = 6.01 - 0.269\,\dot{Y}_{t-5} - 0.035\,\dot{Y}^2_{t-5}$$

Equation 5.11 represents the period of less expansionary monetary policy between 1953 and 1960 and 5.12 the period of more expansionary monetary policy between 1960 and 1964. The results of simulating this equation over time are presented in Figure 11. The initial conditions are the first five observations in 1953 and 1954. It confirms the implications of the simple example. A monetary policy which is responsive to changes in international reserves leads to an internally generated cycle in income, and when monetary policy is more expansionary ($\beta_1 = .34$), the fluctuations in nominal income are larger than when monetary policy is less expansionary ($\beta_1 = .09$).

Even though the more expansionary monetary policy leads to larger fluctuations, it also leads to a higher average growth in nominal income. Some fluctuation in the rate of growth of nominal income may seem like a small price to pay for increasing the average growth rate. However, this result is illusionary. This can be seen by looking at the real variant of the business cycle model. The values of real coefficients are given below:[57/]

$$5.13 \quad \dot{X}_t = 1.37 + .98\,\dot{M}^*_{t-2} \qquad 5.13a \quad \dot{X} = 0.14 + .75\,\dot{M}^*_{t-2}$$

$$5.14 \quad \dot{M}^*_t = 2.20 + .101\,\dot{R}^*_{t-1} \qquad 5.14a \quad \dot{M}^*_t = 3.16 + .298\,\dot{R}^*_{t-1}$$

$$5.15 \quad \dot{R}^*_t = 10.1 - 1.23\,\dot{Im}^*_{t-2} - .056\,\dot{Im}^*_{t-2}$$

$$5.16 \quad \dot{Im}^*_t = -3.26 + 2.04\,\dot{X}_t$$

57/ Sources of those coefficients are the same as in footnote 56, page 87.

Figure 11

Japan

Simulation of Nominal GNP with Alternative Monetary Policies (β_1)

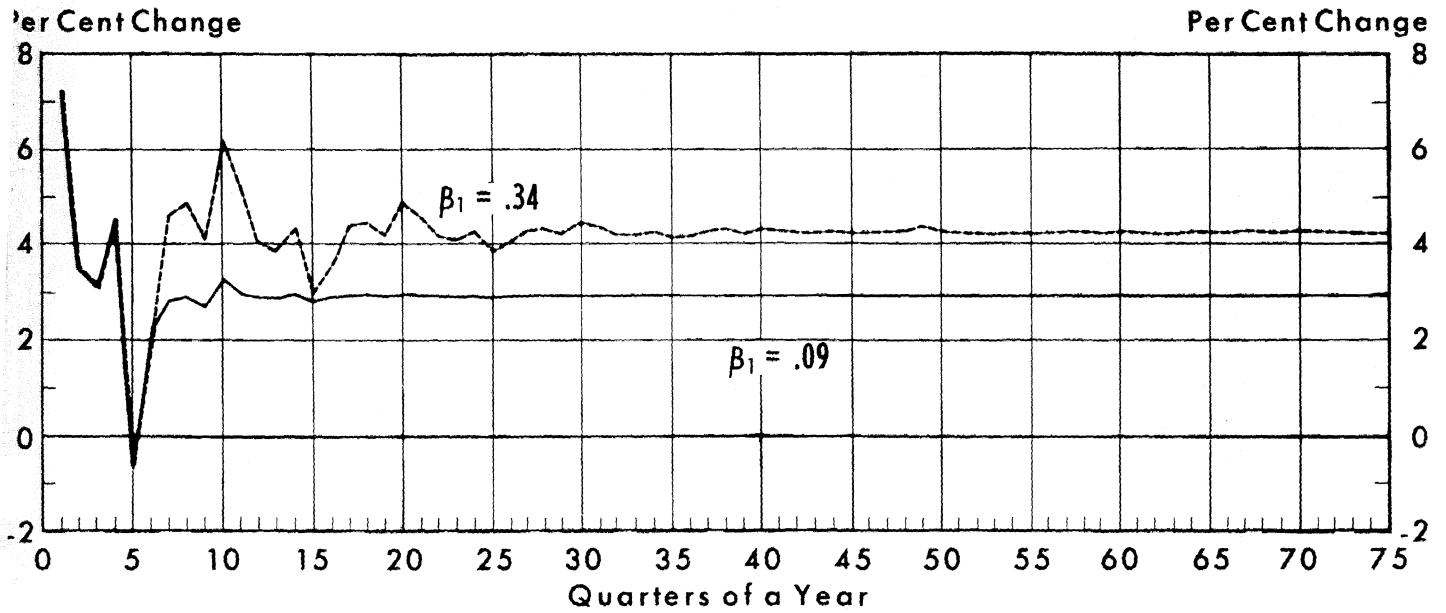
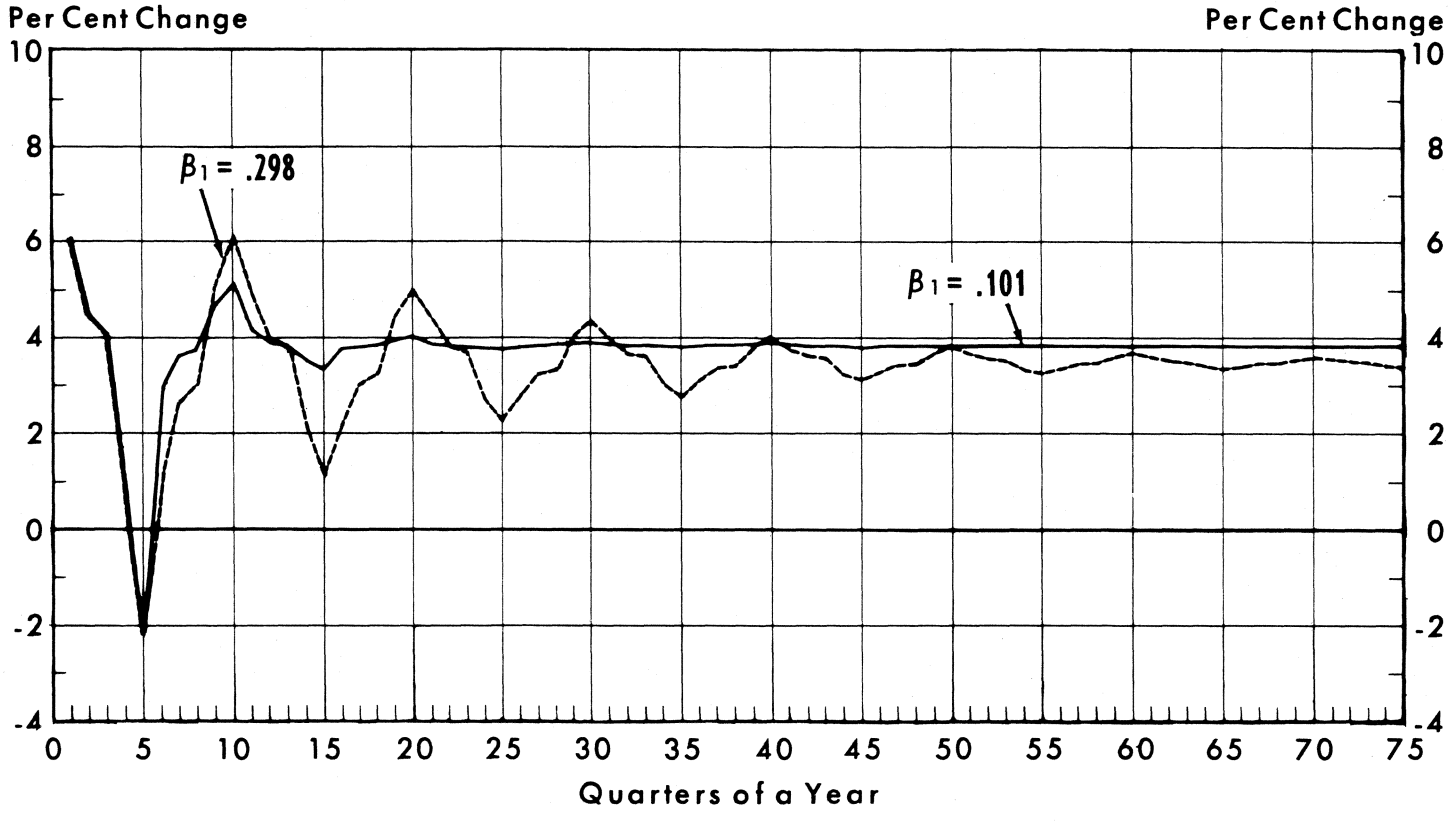


Figure 12

Japan

Simulation of Real Product with Alternative Monetary Policies (B_1)



In the real version of the business cycle model, there are two monetary policy sub-periods as in the nominal version. Thus, in the reduced form, there are also two real variants, one for the period of moderate policy (1953-60) and one for the period of expansionary policy (1960-64):

$$5.17 \quad \dot{X}_t = 4.86 - .175\, \dot{X}_{t-5} - .023\, \dot{X}^2_{t-5}$$

$$5.18 \quad \dot{X}_t = 5.53 - .394\, \dot{X}_{t-5} - .052\, \dot{X}^2_{t-5}$$

When 5.17 and 5.18 are simulated in the same manner as in the nominal version, the same results are observed with respect to the effects of monetary policy in the business cycle. A policy responsive to changes in international reserves leads to cyclical movements in income, and the more expansionary policy ($\beta_1 = .298$) leads to greater fluctuation than the less expansionary policy ($\beta_1 = .101$). However, in this case the average rate of growth of real output is actually somewhat less in the expansionary period than in the non-expansionary period. These results can be seen in Figure 12.

The different results in the nominal and in the real business cycle models are reasonable. In the nominal business cycle model, the more expansionary period is also one of rising prices, while the less expansionary period is one of relative price stability. Thus, one would expect that a business cycle model utilizing nominal values would exhibit a higher average growth rate in periods of monetary expansion. One would also expect that a business cycle model using real values would not necessarily show a higher average growth rate during expansionary periods. These results are constant with the historic evidence. Nominal income grew more rapidly in the expansionary period (1960-64) than in the less expansionary period (1953-60). But real income grew at about the same rate in both periods.

C. The Shocked Dynamic Properties

So far the cyclical properties of this model have been investigated under a very restrictive set of assumptions. The functional relationships have been treated as if they were exact. But, in fact, random elements are inherent in the statistical estimation of all the equations. By ignoring the random elements we have deliberately sacrificed much of the inherent cyclical properties of the model. As pointed out by Frisch (1933), the random elements alone could induce a cycle.

In spite of the limitation of treating the model as if each of the four equations were exact, the cyclical pattern of the model has been apparent. However, this cyclical pattern is both damped and highly regular in timing. Although the Japanese business cycle has shown some regularity in timing, its pattern has not been damped. Specifically recognizing the random element will eliminate the dampening observed in the simulation of the model.

Because the four structural equations which underlie this model are probabilistic, there is a random error term in each of the equations. These random error terms stem from specification errors, measurement errors, and exogenous factors such as strikes, natural calamities, etc., which temporarily distort the systematic behavioral relation among the variables, and represent sources of irregularity in estimating the original structural equation. The residuals of the four equations in this model can, therefore, be attributed to a number of different types of errors. Since there appears to be no a priori

Figure 13

Japan

Shocked Simulation of Nominal GNP with Alternative Monetary Policies (β_1)

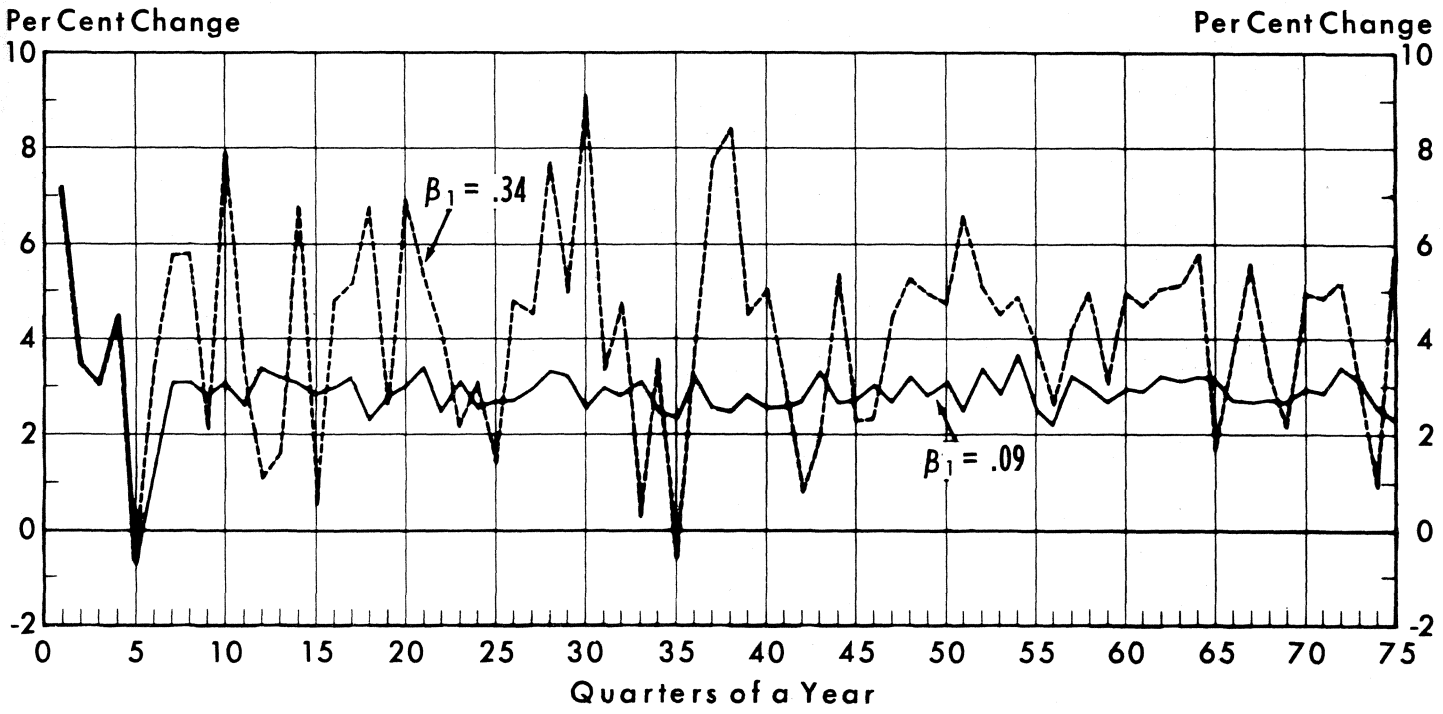
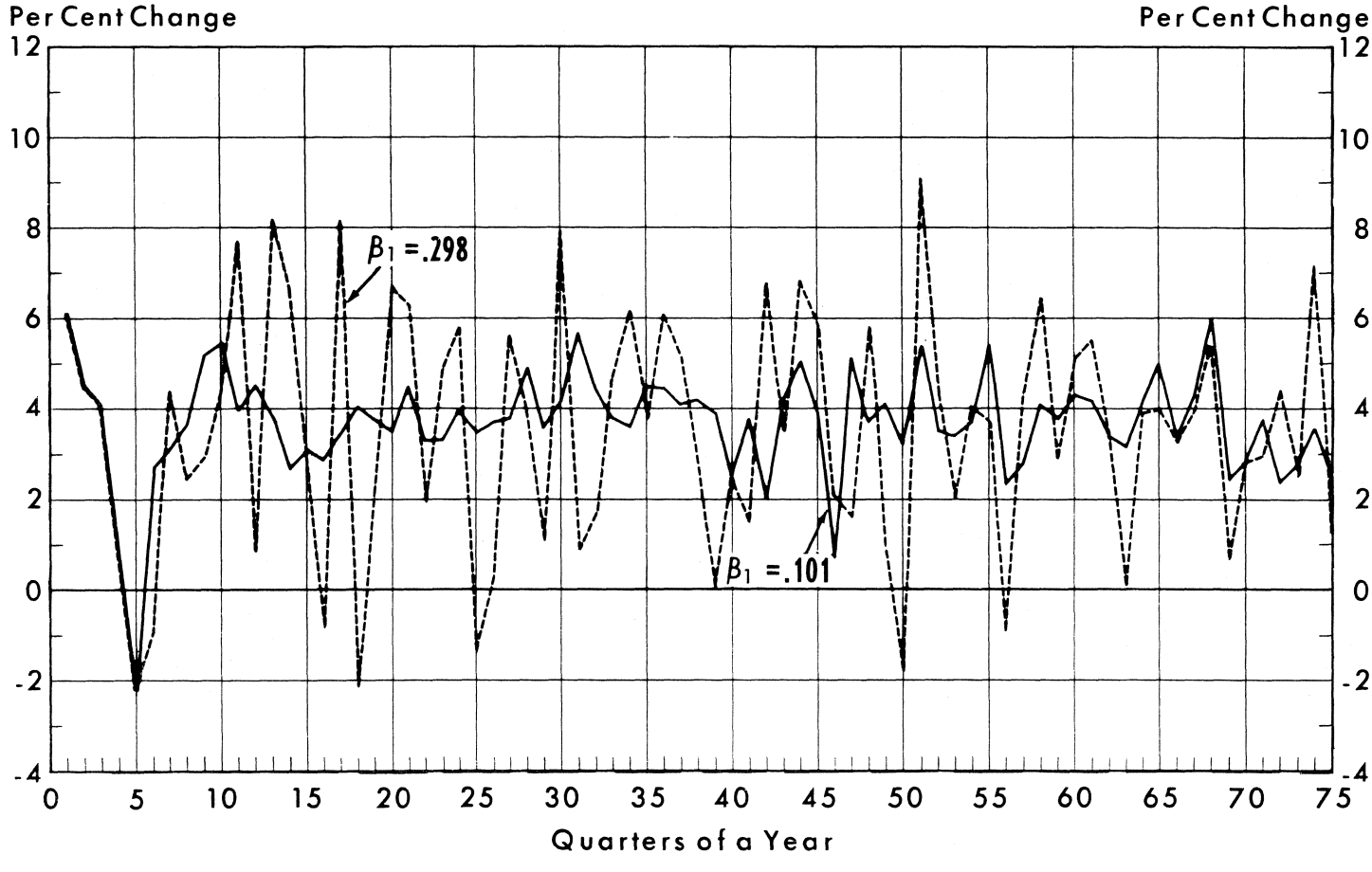


Figure 14

Japan

Shocked Simulation of Real Product with Alternative Monetary Policies (β_1)



correlation among the individual sources of error, these residuals or error terms are assumed to be normally distributed.

These error terms have been utilized to introduce realistic random shocks into the model. For each of the structural equations, an additive random error term was specified. Using the same process of algebraic substitution which was used in solving the reduced form of the unshocked system, a new reduced form equation was constructed. In this equation several error terms appear as parameters analogous to lagged endogenous variables. The size and direction of these shocks are determined by selection of random numbers out of a normally distributed population based on the size of the error terms in each of the structural equations.

The results of simulating this model for both its real and nominal versions are shown in Figures 13 and 14. It can be observed that the cyclical pattern of income is no longer damped nor as regular in timing as in the unshocked simulation of the model. It is a more realistic representation of the Japanese business cycle. It is interesting to note that the more expansionary policy leads to larger fluctuations in both nominal GNP and in real product than does the less expansionary policy. This is true in spite of the fact that the error terms in the expansionary period are smaller.

It should be kept in mind that contrary to the dynamic properties of more elaborate economic models which have been tested for the United States and elsewhere, 58/ the cyclical fluctuations of this model are inherent in its dynamic properties. The application of random shocks to the system only makes the magnitude and timing of the cycles more in line with real world observations.

58/ Adelman and Adelman, Ibid., p. 252.

D. Conclusion

The Japanese business cycle can be understood reasonably well on the basis of the highly simplified model developed in this study. This model, as with any economic model, is useful only to the extent that its underlying assumptions remain valid. The statements that monetary policy is a function of fluctuations in international reserves, and that changes in international reserves are a function of changes in imports are special assumptions which may not be applicable in the future.

The relatively stable international economic environment of post-World War II has led to the dismantling of exchange controls and steady expansion in world trade. In the short-run each country's exports is largely a function of the growth and stability of world trade so it is not unreasonable to attribute fluctuations in Japan's international reserves primarily to domestic factors. A useful direction for future reasearch would be to see whether this same phenomenon can be observed in other countries. If it holds reasonably well, this model may have wider implications for analyzing business cycle developments in other countries. 59/

59/ There is some evidence to indicate that a model similar to that developed in this study could explain much of the postwar business cycle experience of the major western European countries. See, Federal Reserve Bank of St. Louis Review, November, 1967, "Monetary Policy, Balance of Payments, and Business Cycles -- The Foreign Experience."

The major conclusion of this study is that given the assumptions made, monetary policy directed at reducing fluctuation in international reserves will not only lead to greater fluctuations in income but also to greater fluctuations in international reserves. An important consideration in future research would be to see if alternative monetary policy targets, such as stable prices or reduced unemployment, led to the same results. The basic structural model underlying these alternative policy goals is similar to the one constructed in this study.

Consider the price stability target. The model would be as follows:

$$\dot{Y} = \alpha_o + \alpha_1 \dot{M}_{t-m}$$

$$\dot{M} = \lambda_o + \lambda_1 \dot{P}_{t-p}$$

$$\dot{P} = \partial_o + \partial_1 \dot{Y}_{t-r}$$

The reduced form of this series of equations is:

$$\dot{Y} = A'_o + A'_1 \dot{Y}_{t-(m+p+r)}$$

Where $\dot{P}$ = rate of change in prices, and where $A'_1 = \alpha_1 \lambda_1 \partial_1$. A'_1 is negative because λ_1 is negative.

Consider the unemployment target:

$$\dot{Y}_t = \alpha_o + \alpha_1 \dot{M}_{t-m}$$

$$\dot{M}_t = \theta_o + \theta_1 U_{t-s}$$

$$U_t = \phi_o + \phi_1 \dot{Y}_{t-v}$$

The reduced form is:

$$\dot{Y}_t = A''_o + A''_1 \dot{Y}_{t-(m + s + v)}$$

Where U is the unemployment rate and $A''_1 = \alpha_1 \theta_1 \phi_1$. A''_1 is negative because ϕ_1 is negative.

The difference equations developed with respect to the price and unemployment targets are mathematically equivalent to the one developed in this study with respect to the international reserve target. And in each case there is a build in cyclical bias in the application of monetary policy. Whether this bias is significant depends on how sensitive the policy makers are to these various policy goals. If their response is relatively prompt, i.e., the time lags are short, and if the response is relatively moderate, i.e., the value A_1 is closer to 0 than to -1, the cyclical bias may not be significant. Further research could usefully explore these issues.

Is it inevitable that monetary policy have a bias toward cyclical instability irrespective of the policy target chosen? There is one policy target which does not have the cyclical bias, that is a policy of maintaining a steady growth in the stock of money.

BIBLIOGRAPHY*

1. F. Adelman and I. Adelman, "The Dynamic Properties of the Klein-Goldberger Model," Econometrica, Vol. XXVII, October 1956. Reprinted in Readings in Business Cycles, Richard D. Irwin and Co., 1965.

2. C. G. Allen, Japan's Economic Recovery, Oxford University Press, New York 1958.

3. _____, Japan's Economic Expansion, Oxford University Press, New York 1965.

4. R.G.D. Allen, Mathematical Analysis for Economists, MacMillan and Company, Ltd., London 1938.

5. _____, Mathematical Economics, MacMillan and Company, Ltd., London 1956.

6. Bank of Japan, The Bank of Japan Law and By-Laws, October 1952.

7. Bank of Japan, Monthly Economic Review.

8. _____, Outline of the Financial System in Japan, 2nd revision, January 1957.

9. _____, Foreign Exchange Statistics Monthly. (JE)

10. _____, Economic Statistics of Japan, Annual (JE)

11. _____, Economic Statistics Monthly. (JE)

12. P. Cagan, Determinants and Effects of Changes in the Stock of Money, National Bureau of Economic Research, New York 1963.

13 Baumol, William. Economic Dynamics, 2nd Ed. Macmillan Co.: New York, 1959.

14. W. Dewald and H. Johnson, "An Objective Analysis of the Objectives of American Monetary Policy 1952-61," in Banking and Monetary Studies, Richard D. Irwin and Co., 1963.

* Many official publications of the Japanese Government are in bilingual form in Japanese and English. For such publications the English title only is given, with the symbol (JE) at the end of the entry, indicating that the given publication is in both Japanese and English.

15. J.S. Duesenberry, G. Fromm, L.R. Klein, and E. Kuh, eds., The Brookings Quarterly Econometric Model of the United States, Chicago 1965.

16. Economic Counsel Board, Economic Survey of Japan, 1953-54.

17. Economic Planning Agency, Economic Survey of Japan, 1956, 1957, 1958 1959, 1960, 1961, 1962, 1963, 1964.

18. _____, New Long-Range Economic Plan of Japan, (FY 1953-FY 1962).

19. _____, New Long-Range Economic Plan of Japan, (1961-1970) - Doubling National Income Plan, Japan Times, Tokyo 1961.

20. _____, Medium Term Economic Plan, 1964-68, June 1965.

21. Economic Planning Board, Economic Survey of Japan, 1954-55 and 1955-56.

22. Economic Stabilization Board, Economic Survey of Japan, 1951-52, July 1952.

23. Federal Reserve Bulletin, Board of Governors of the Federal Reserve System, March 1965.

24. Milton Friedman, "The Demand for Money," Journal of Political Economy, LXVII (August, 1959), 327-51.

25. Cagen, P. "The Economics of Hyperinflation" in Studies in the Quantity Theory of Money, Milton Friedman, editor. U. of Chicago Press: Chicago, 1956.

26. _____ and A. Schwartz, A Monetary History of the United States, National Bureau of Economic Research, 1964.

27. R. Frisch, "Propagation Problems and Impulse Problems in Dynamic Economics," in Economic Essays in Honor of Gustav Cassel, London 1933. Reprinted in Readings in Business Cycles, American Economic Association, 1965.

28. Y. Goto, "Keiki Doko to Junkan Kyokumen No Rikan No Tome Ni," (Understanding the Tendency Toward Economic Growth and Cycles), in Kinyū Krisei Jijo, VIII, February 25 and March 4, 1957.

29. J.R. Hicks, "Mr. Keynes and the Classics, a Suggested Interpretation," Econometrica, V (April, 1937), 147-59.

30. International Monetary Fund. International Financial Statistics. Monthly.

31. J. Johnson, Econometric Methods, McGraw-Hill Company, Inc., New York 1963.

32. John Kareken and Robert M. Solow, "Lags in Monetary Policy," Stabilization Policies ("A Series of Research Studies Prepared for the Commission on Money and Credit"), Prentice-Hall, Inc., Englewood Cliffs, N.J., 1963.

33. Lloyd A. Metzler, "The Nature and Stability of Inventory Cycles," The Review of Economic Statistics, Vol. XXIII, August 1941. Reprinted in Readings in Business Cycles, American Economic Association, 1965.

34. Franco Modigliani, "Liquidity Preferences and the Theory of Interest and Money," Econometrica, XII (1944), 45-88. Reprinted in American Economic Association, Readings in Monetary Theory, selected by a committee of the American Economic Association, Richard D. Irwin, Homewood, Illinois 1951.

35. _____, "The Monetary Mechanism and Its Interaction with Real Phenomena," Review of Economics and Statistics, XLV, (February, 1963), 79-107.

36. Hugh Talbot Patrick, Monetary Policy and Central Banking in Contemporary Japan, University of Bombay Press, Bombay 1962.

37. J.J. Polak, "Monetary Analysis of Income Formation and Payments Problems," International Monetary Fund, Staff Papers, Vol. VI, No. 1, November 1957.

38. _____, "Monetary Analysis of Income and Imports and its Statistical Application," International Monetary Fund, Staff Papers, Vol. VII, No. 3, April 1960.

39. P. Samuelson, "Interactions Between Multiplier Analysis and Principle of Acceleration," The Review of Economic Statistics, Vol. XXI, No. 2, May 1939. Reprinted in Readings in Business Cycle Theory, American Economic Association, 1944.

40. Osamu Shimomura, "Tomen No Keizai Kyokumen o Tsuranuku Kihon Dōko," (Basic Tendencies in the Present Economic Situation), in Kimyū Zaisei Jijō, VII, February 11 and 18, 1957.

41. Hiroshi Shinjo, History of the Yen, The Research Institute, Kobe University, Kobe, Japan 1962.

42. Mujohei Shinohara, Growth and Cycles in the Japanese Economy, Kenkyusha Printing Co., Ltd., Tokyo 1962.

APPENDIX 1

KEY TO THE APPENDIX:

	Billions of Yen	Sources
Y	Nominal G.N.P.	(1)
Y*	Real G.N.P.	(2)
M	Nominal Money Supply	(2)
M*	Real Money Supply	(2)
R	Nominal International Reserves	(3)
R*	Real International Reserves	(3)
Im	Nominal Imports (Millions of U.S. $)	(2)
Im*	Real Imports (Millions of U.S. $)	(2)
X	Industrial Production (1960 = 100)	(2)
B	Central bank credit	(2)
G	Treasury cash balance with Bank of Japan	(2)
H	High-powered money	(2)
ΔX	First differences in series	
$\dot{X}$	Rate of change in series	

Sources:

1) Annual Report on National Income Statistics, 1967. Economic Planning Agency, Government of Japan.

2) Basic Data For Economic Analyzing, 1966. Statistics Dept., Bank of Japan.

3) Economic Statistics Monthly, (various issues). Statistics Dept., Bank of Japan.

NOMINAL LEVELS
(BILLIONS OF YEN)

		Y	M	R	Im (MILLIONS OF US $)
1953	I	6403	1525	332	521
	II	6787	1548	303	566
	III	7357	1657	317	640
	IV	7276	1661	285	698
1954	I	7817	1668	202	692
	II	7943	1656	173	633
	III	7700	1664	188	534
	IV	7714	1704	252	519
1955	I	7956	1735	276	556
	II	7866	1768	307	596
	III	8719	1845	358	624
	IV	9400	1894	411	698
1956	I	9114	1967	446	672
	II	9225	2070	455	752
	III	9346	2212	457	856
	IV	10229	2275	458	959
1957	I	10701	2373	382	1056
	II	11286	2382	259	1196
	III	11076	2346	197	1090
	IV	11212	2394	226	914
1958	I	11156	2421	268	811
	II	11219	2488	301	730
	III	11601	2593	358	735
	IV	11298	2702	427	761
1959	I	11905	2764	462	789
	II	12290	2892	509	895
	III	13292	2990	550	912
	IV	13462	3124	600	1003
1960	I	14334	3266	613	1109
	II	14852	3370	649	1063
	III	15364	3531	729	1143
	IV	16047	3741	788	1164
1961	I	17311	4010	851	1292
	II	18053	4296	819	1405
	III	18711	4414	728	1529
	IV	19810	4491	641	1595
1962	I	20320	4531	629	1492
	II	20867	4652	562	1406
	III	20582	4852	595	1367
	IV	21549	5160	673	1374

NOMINAL LEVELS
(BILLIONS OF YEN)

		Y	M	R	Im (MILLIONS OF US $)
1963	I	21616	5764	730	1484
	II	22953	6305	759	1622
	III	24586	6714	763	1756
	IV	24990	7055	746	1872
1964	I	26128	7214	727	1989
	II	26982	7462	666	1965
	III	28340	7716	662	1929
	IV	28944	7780	714	2044
1965	I	29264	8367	732	1993
	II	30209	8605	701	2060
	III	30537	9000	693	2067
	IV	31699	9135	737	2062
1966	I	32738	9760	738	2232
	II	34204	10091	724	2285
	III	35909	10569	694	2431
	IV	36909	10773	700	2592

REAL LEVELS
(BILLIONS OF 1960 YEN)

		Y*	M*	R*	Im* (MILLIONS OF US $)	X (1960=100)
1953	I	7902	1960	264.8	415.5	36.3
	II	8170	1845	260.7	455.3	39.8
	III	8534	1933	256.7	521.6	41.5
	IV	9464	1881	214.6	580.7	43.6
1954	I	9011	1986	171.0	585.9	44.2
	II	8880	1840	164.7	534.6	44.2
	III	8700	1895	199.7	453.7	40.9
	IV	8558	1850	235.0	437.2	43.5
1955	I	9006	2034	256.9	465.3	44.8
	II	8970	1998	292.9	501.7	45.6
	III	9818	2094	333.6	520.4	47.8
	IV	10544	2068	375.3	590.0	49.8
1956	I	10117	2264	396.6	571.9	51.9
	II	10251	2292	396.5	633.0	55.8
	III	10226	2436	399.3	724.2	59.5
	IV	10964	2380	357.2	789.3	62.8
1957	I	11329	2591	265.4	854.4	65.0
	II	11772	2476	194.4	985.2	70.1
	III	11556	2457	185.8	920.6	69.5
	IV	11724	2455	224.1	803.2	67.3
1958	I	11826	2634	267.4	742.7	66.7
	II	11885	2638	319.7	692.6	64.8
	III	12313	2779	383.5	704.7	66.3
	IV	11908	2791	443.1	746.1	69.0
1959	I	12470	2947	489.1	782.7	72.6
	II	12876	3038	528.0	880.0	77.7
	III	13726	3118	574.4	898.5	82.3
	IV	13781	3140	595.4	971.0	88.1
1960	I	14613	3370	575.0	1080.9	92.5
	II	14823	3377	639.1	1048.3	97.8
	III	15258	3542	718.7	1144.1	101.9
	IV	16245	3646	786.1	1174.6	106.9
1961	I	16962	3939	795.0	1292.0	111.9
	II	17401	4139	718.6	1377.5	116.7
	III	17706	4216	631.4	1499.0	122.7
	IV	18388	4124	590.5	1585.5	127.1
1962	I	18613	4161	557.9	1502.5	129.8
	II	19059	4252	546.8	1431.8	130.2
	III	18583	4435	608.2	1402.1	129.0
	IV	19552	4632	680.0	1413.6	128.4

REAL LEVELS (BILLIONS OF YEN)

		X*	M*	R*	Im* (MILLIONS OF US $)	X (1960 = 100)
1963	I	18891	5021	7147	1506.6	131.9
	II	19932	5473	7217	1623.6	138.0
	III	21242	5874	7044	1730.0	146.1
	IV	21513	6014	6728	1806.9	153.7
1964	I	22471	6198	6329	1916.2	158.9
	II	22942	6361	6088	1917.1	165.0
	III	23755	6572	6359	1893.0	168.8
	IV	23726	6488	6722	2011.8	173.2
1965	I	23825	6769	6794	2003.0	174.6
	II	24269	6928	6567	2062.1	173.5
	III	24210	7252	6727	2062.9	174.8
	IV	24498	7247	6977	2064.1	175.5
1966	I	25612	7578	6808	2199.0	182.4
	II			6552	2238.0	189.5
	III			6429	2378.7	199.1
	IV				2589.4	209.6

Nominal Rates of Change

		$\dot{y}$	$\dot{m}$	$\dot{R}$	$\dot{Im}$
1953	I				
	II	7.2	4.2	- 2.4	7.2
	III	3.5	3.6	- .28	10.8
	IV	3.1	.4	-18.1	7.3
1954	I	4.5	- .4	-21.7	- 4.3
	II	- .7	- .3	- 3.5	-14.5
	III	- 1.5	1.9	20.5	- 9.2
	IV	1.7	2.3	18.7	4.5
1955	I	1.0	1.4	10.0	7.3
	II	4.7	2.9	13.4	4.3
	III	9.3	3.9	14.9	8.4
	IV	2.2	3.6	11.0	5.5
1956	I	- .9	4.2	5.0	3.9
	II	1.3	5.7	1.1	12.1
	III	5.3	5.2	.2	12.9
	IV	7.0	3.9	- 8.1	10.7
1957	I	5.0	2.0	-24.4	11.8
	II	1.7	- .8	-28.0	2.9
	III	- .3	.6	- 6.8	-12.3
	IV	.4	1.8	15.9	-14.9
1958	I	0	1.6	14.5	-10.7
	II	2.0	3.3	15.4	- 2.9
	III	.4	4.5	18.7	1.9
	IV	1.3	3.4	13.0	2.1
1959	I	4.3	3.3	9.1	9.1
	II	5.7	3.9	8.9	8.7
	III	4.7	4.0	8.6	5.8
	IV	3.9	4.6	5.5	10.2
1960	I	5.0	4.0	- 4.1	3.1
	II	3.5	4.0	9.8	1.6
	III	4.0	5.1	10.8	5.1
	IV	6.4	6.5	8.5	6.0
1961	I	6.1	7.6	2.1	9.3
	II	3.7	5.0	- 7.8	8.9
	III	4.8	1.7	-12.1	7.4
	IV	4.2	1.2	- 7.8	- 1.1
1962	I	2.6	2.4	- 6.7	- 7.0
	II	.7	3.6	- 3.1	- 4.6
	III	1.6	4.6	10.4	.2
	IV	2.5	8.9	11.5	4.3

Nominal Rates of Change

		$\dot{y}$	$\dot{m}$	$\dot{R}$	$\dot{I}m$
1963	I	3.2	11.2	6.5	7.6
	II	6.7	8.0	2.4	8.3
	III	4.4	5.2	- .8	9.2
	IV	3.1	3.6	- 2.5	7.5
1964	I	3.9	3.3	- 5.7	1.0
	II	4.2	3.4	- 5.0	- 2.5
	III	3.6	3.1	2.2	3.4
	IV	1.6	4.1	5.5	2.3
1965	I	2.2	4.1	- 1.0	- .5
	II	2.2	3.8	- 2.9	- .8
	III	2.4	4.6	2.7	4.0
	IV	3.5	4.1	3.4	5.4
1966	I	4.0		- .9	4.4
	II	4.8		- 3.2	6.5
	III	4.0		- 1.8	
	IV				

REAL RATES OF CHANGE

		$\dot{y}^*$	$\dot{m}^*$	$\dot{R}^*$	$\dot{Im}^*$	$\dot{X}$
1953	I					
	II	3.9	2.0	- 1.6	12.2	6.1
	III	1.8	.6	- 1.5	13.0	4.5
	IV	2.8	- 2.0	-16.4	6.0	4.1
1954	I	2.4	- 1.3	-20.3	- 4.1	.9
	II	- 1.7	- .6	- 3.7	-12.0	- 2.2
	III	- 1.8	1.6	21.3	- 9.5	.8
	IV	1.7	2.7	17.7	1.2	2.9
1955	I	2.4	2.2	9.3	7.2	4.6
	II	4.4	3.4	14.0	5.8	3.0
	III	8.4	3.8	13.9	8.4	4.3
	IV	1.5	3.3	12.5	4.9	5.1
1956	I	- 1.4	4.0	5.7	3.6	6.1
	II	.5	5.8	0.0	12.5	6.2
	III	3.4	4.7	.7	11.7	5.8
	IV	5.3	2.5	-10.6	8.6	4.6
1957	I	3.6	1.0	- 25.7	11.7	6.2
	II	1.0	- 1.7	-26.8	3.9	3.6
	III	- .2	.3	- 4.4	- 9.7	- 2.4
	IV	1.2	2.6	20.6	-10.2	- 2.2
1958	I	.7	2.4	19.3	- 7.1	- 1.5
	II	2.0	3.2	19.6	- 2.6	- .2
	III	.1	3.8	20.0	3.8	2.9
	IV	.6	3.3	15.5	5.4	4.5
1959	I	4.0	3.5	10.4	8.6	6.4
	II	4.9	3.4	8.0	7.2	6.6
	III	3.5	3.0	8.8	5.0	6.3
	IV	3.2	3.4	3.7	9.7	6.5
1960	I	3.7	2.9	- 3.4	3.9	5.6
	II	2.2	3.1	11.1	2.9	4.5
	III	4.7	4.7	12.5	5.9	4.5
	IV	5.4	5.4	9.4	6.3	4.6
1961	I	3.5	5.9	1.1	8.3	4.6
	II	2.2	3.3	- 9.6	7.7	5.0
	III	2.8	- .6	-12.1	7.3	4.3
	IV	2.5	- .9	- 6.5	.1	2.7
1962	I	1.8	- .3	- 5.5	- 4.9	1.3
	II	- .1	2.3	- 2.0	- 3.4	- .1
	III	1.3	5.2	11.2	- .6	- .7
	IV	.8	6.6	11.8	3.7	.9

REAL RATES OF CHANGE

		$\dot{y}^*$	$\dot{m}^*$	$\dot{R}^*$	$\dot{Im}^*$	$\dot{X}$
1963	I	1.0	7.6	5.1	7.2	3.6
	II	6.0	6.1	1.0	7.2	5.7
	III	3.9	5.0	- 2.4	5.5	5.7
	XI	2.9	3.7	- 4.5	5.2	4.4
1964	I	3.3	2.1	- 5.9	3.0	3.6
	II	2.9	1.8	- 3.8	- .6	3.4
	III	1.7	1.5	4.5	2.5	2.3
	XI	.2	1.8	5.7	2.9	.8
1965	I	1.1	1.8	1.1	1.2	- .5
	II	.8	2.4	- 3.4	1.5	.3
	III	.5	3.2	2.4	.1	.5
	XI	2.9	2.4	3.7	3.3	1.9
1966	I		2.3	- 2.4	4.1	4.0
	II		3.2	- 3.8	4.0	5.0
	III		2.4	- 1.9	7.6	5.1
	XI					

RATIOS AND RATES OF CHANGE

		D/C	$\dot{D}/C$	D/K	$\dot{D}/K$
1954	I	2.275		21.8	
	II	2.307	1.3	20.6	- 2.1
	III	2.335	2.3	20.9	6.6
	IV	2.414	2.6	23.4	- .2
1955	I	2.460	2.4	20.8	- 4.6
	II	2.532	2.6	21.3	2.8
	III	2.587	2.1	22.0	2.1
	IV	2.639	2.3	22.2	.5
1956	I	2.707	2.8	22.2	1.3
	II	2.789	2.9	22.8	.9
	III	2.864	1.7	22.6	- 2.0
	IV	2.887	.2	21.9	- 1.6
1957	I	2.877	- .6	21.9	- 3.2
	II	2.854	- 1.3	20.5	- 7.3
	III	2.800	- .2	18.8	- 5.0
	IV	2.843	1.7	18.5	- 1.9
1958	I	2.897	1.9	18.1	- 1.1
	II	2.953	2.3	18.1	1.1
	III	3.030	2.7	18.5	4.1
	IV	3.117	.7	19.6	- .8
1959	I	3.072	.0	18.2	- 2.8
	II	3.116	.4	18.5	- .8
	III	3.095	- .4	17.9	- 1.6
	IV	3.089	.9	17.9	- .3
1960	I	3.151	.6	17.8	- 2.8
	II	3.125	- .2	16.9	- 1.4
	III	3.139	.7	17.3	- .6
	IV	3.170	1.1	16.7	- 1.2
1961	I	3.211	1.4	16.9	3.5
	II	3.260	- .3	17.9	- 1.8
	III	3.194	- 2.0	16.3	- 4.3
	IV	3.134	- 2.8	16.4	- 3.4
1962	I	3.017	- 2.2	15.2	- 3.4
	II	2.997	0	15.3	.7
	III	3.016	2.5	15.4	0
	IV	3.148	7.0	15.3	2.9
1963	I	3.453	7.8	16.3	4.2
	II	3.659	6.1	16.6	1.2
	III	3.889	3.4	16.7	0
	IV	3.913	- .1	16.6	- 2.7

Ratios and Rates of Change

		D/C	$\dot{D}/C$	D/V	$\dot{D}/V$
1964	I	3.878	- 1.4	15.8	- .9
	II	3.807	- 1.0	16.3	1.0
	III	3.799	- .1	16.1	- .3
	IV	3.797	- .1	16.2	3.7
1965	I	3.790	.5	17.3	3.0
	II	3.838	1.3	17.2	2.3
	III	3.890	1.8	18.1	5.7
	IV	3.975	.6	19.2	1.1
1966	I	3.934	- .1	18.5	- 1.0
	II	3.965	.4	18.8	3.2
	III	3.968	- .1	19.7	1.1
	IV	3.955		19.2	