Japanese Monetary Policy, a Comparative Analysis*

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I. Introduction

This paper presents an analysis of Japanese monetary policy, and concentrates on the operating mechanisms used by the Bank of Japan in conducting policy. References are made to U.S. monetary policy in an attempt to highlight the major similarities and differences between the respective monetary policies. The major conclusion is that although there are some interesting differences, the two central banks' daily operating procedures are very similar. Both monetary authorities basically use the interbank market interest rate as their policy instrument. Therefore, the reasons for the differences in macroeconomic performance attributable to the Bank of Japan and the Federal Reserve System of the United States will be found elsewhere. Profitable research attempting to discover reasons for the differences should concentrate on understanding the political nature of the institutions and the political constraints that are associated with each country's institutional framework.

This conclusion, that both the U.S. and Japanese central banks use similar operating procedures casts doubt on the importance of many criticisms directed at the Federal Reserve. These criticisms often emphasize poorly constructed operating procedures as being responsible for perceived failures of U.S. monetary policy. For example, Friedman (1982) states that one of the five major points of monetarist policy is that "monetary authorities should avoid trying to manipulate either interest

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rates or exchange rates." The basic idea that is often stressed in many criticisms of this type is that an interest rate instrument is inconsistent with the objectives of long-term monetary control and price stability. Further, the Japanese experience is often cited as the shining example among advanced economies of achieving monetarist objectives. Yet, as is shown below, the Bank of Japan uses an interest rate instrument in achieving the objectives of its monetary policy. While there may exist differences in the relative efficiency of various operating procedures, these differences do not account for the variation in performance between the central banks of the United States and Japan. Concentrating on operating policies is probably counterproductive in trying to understand the relative performance of each monetary authority.

The structure of the paper is as follows. In Section II, the macroeconomic performances of the United States and Japan over the last decade is compared and contrasted. Japan is observed to have lower, although not less variable, inflation and to have higher and less variable real output growth. In Section III, interest rates are examined. With the exception of the behavior of the long-term government bond rate, both countries appear quite similar. Section IV includes a detailed lock at the Japanese interbank market and discusses some of the operations conducted by the Bank of Japan. The behavior of this market is quite similar to the behavior of the U.S. Federal funds market. Section V discusses Japanese monetary policy in more depth while Section VI presents a simple model that captures a number of essential characteristics of Japanese monetary policy. The model is similar in spirit to McCallum's (1981) investigation of interest rate pegs and McCallum-Hoehn's (1983) investigation of various U.S. operating procedures. Section VII contains a brief summary and conclusions.

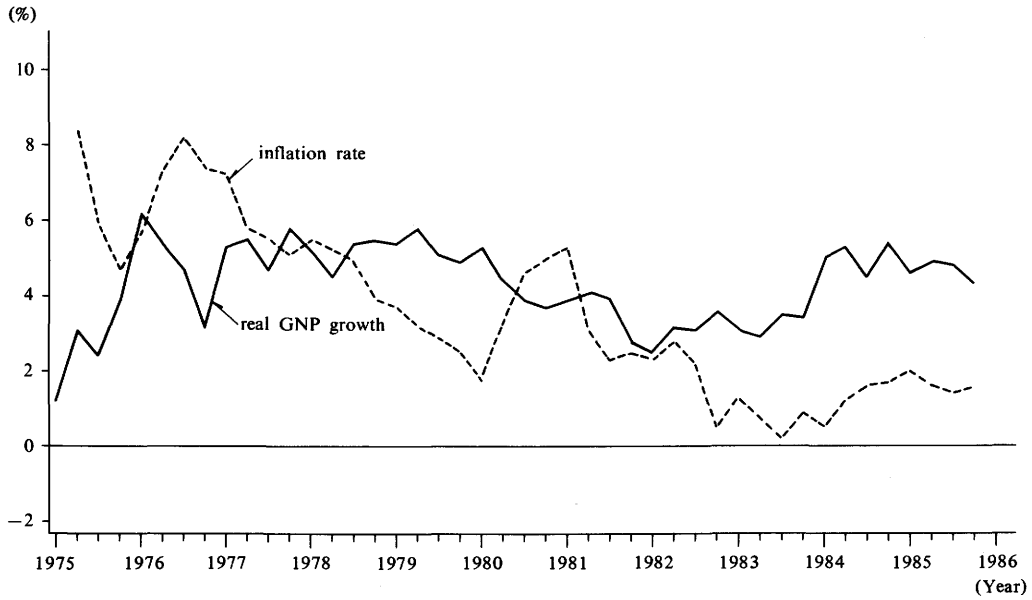
II. Comparative Macroeconomic Performances of the United States and Japan (1975-1985)

In this section, a brief overview of the macroeconomic performance of the United States and Japan is presented for the period 1975-1985. This sample is chosen to avoid the contaminating influence of the First Oil Crisis which had a differential impact on the two countries. Also, it wasn't until the mid-1970s, with the creation of large government bond issues, that the Bank of Japan could initiate monetary policy in a manner comparable to policy in the United States. Prior to the 1970s a money market in Japan was not nearly as active or diversified as in the United States.

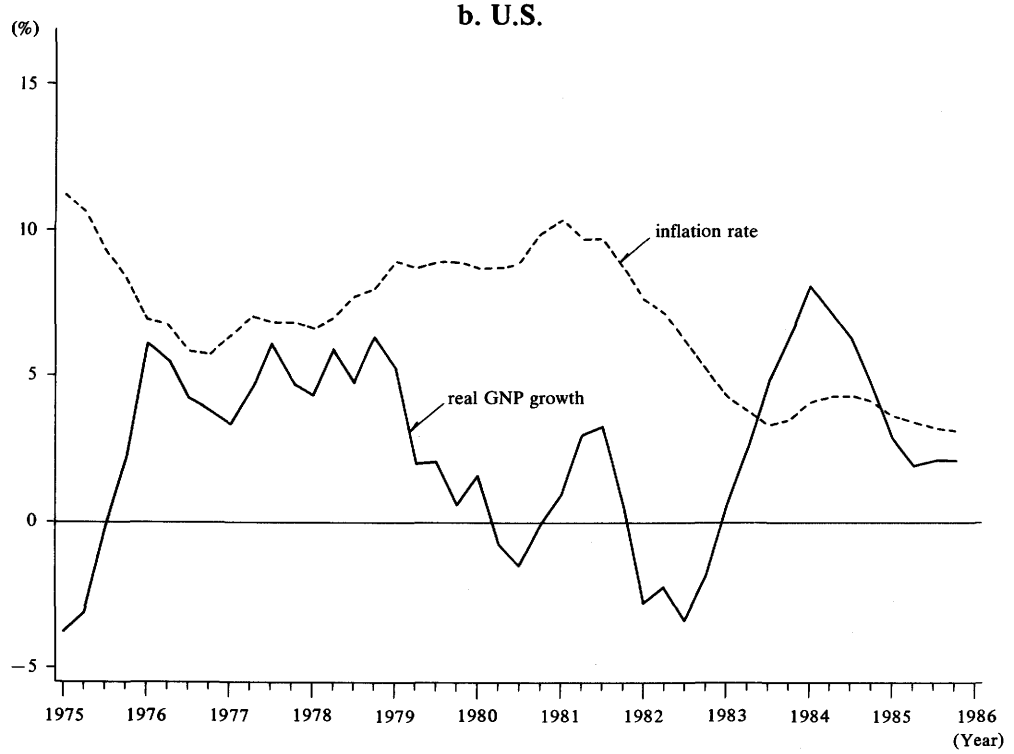
Figures 1a, 1b, 2 and Table 1 depict the relevant data. In comparing monetary aggregates, U.S. M_1 is compared with Japanese M_2 + CD, although Japanese M_1 statistics are given in parenthesis in Table 1. The different aggregates are used for two reasons. One reason is that these are the aggregates that each central bank pays

Figure 1 Inflation Rate and Real GNP Growth

a. Japan



b. U.S.



the closest attention to and generally uses as an intermediate target. The other reason is that in terms of controllability and the implications for nominal determinacy,

Figure 2 Monetary Growth and Inflation

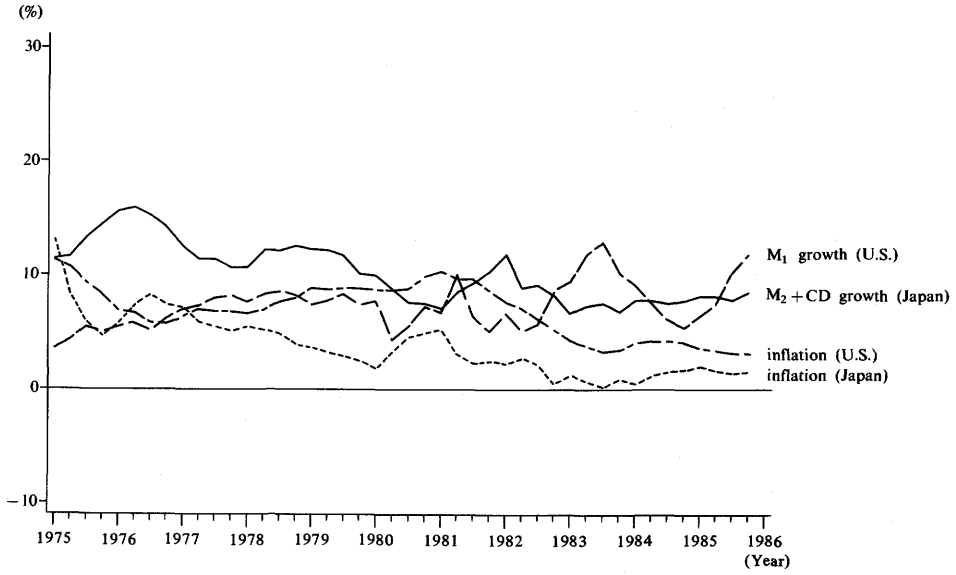


Table 1 Macroeconomic Data

	Japan	U.S.
Sample 1975 I – 1985 IV (quarterly data)		
Average real output growth (y) S.D. of real output growth*	4.30 1.10	2.52 3.06
Average inflation (using GNP deflator) (π) S.D. of inflation	3.78 2.63	6.86 2.31
Average monetary growth** (m) S.D. of monetary growth	10.26 (6.79) 2.54 (4.53)	7.36 2.08
Sample 1981 I – 1985 IV		
Average real output growth (y) S.D. of real output growth	3.94 0.87	2.35 3.21
Average inflation (π) S.D. of inflation	1.78 1.12	5.48 2.40
Average monetary growth (m) S.D. of monetary growth	8.28 (4.30) 1.19 (2.87)	8.19 2.39

* The abbreviation S.D. indicates standard deviation.

** Monetary growth for Japan is M_2+CD, while for the U.S. it is M_1. The M_1 figure for Japan is included in parenthesis.

Japanese M_2 and U.S. M_1 are quite similar (the CD component in Japan is under quantity restrictions and is relatively small). Specifically, most of the components of these two aggregates are subject to reserve requirements and binding interest rate ceilings. Unlike Japanese M_2, U.S. M_2 contains many components that have market determined interest rates and no reserve requirements. Therefore, U.S. M_2 does not meet the requirements given in Patinkin (1961) and Fama (1983) for determining a well-defined aggregate price level.

The data shows that Japanese monetary growth has been less erratic than U.S. monetary growth. This is visible in the Figures and is confirmed by the standard deviations of monetary growth in Japan and the United States of 1.19 and 2.39 over the second half of the sample, a period reflecting extremely low Japanese inflation rates of less than 2% on average. The standard deviation for the entire sample in some sense overstates Japanese monetary variability, since Japan was following a gradual reduction in its rate of monetary growth. Therefore, differences in monetary growth from its mean indicate quite a bit of variability which is merely a reflection of a gradual disinflationary policy.

This gradual slowdown in monetary growth is reflected by lower inflation rates in Japan than in the United States of 3.78 versus 6.86 for the entire sample and 1.78 versus 5.48 over the last five years. The reduction in inflation was accomplished without significantly affecting real output growth. In contrast, the United States reduced its monetary growth from 6.9% in 1979-1980 to 2.4% in 1980-1981.[1] This resulted in a slowdown in inflation and a severe decline in output growth. Also, real activity is much less variable in Japan than in the United States as measured by standard deviations of 1.10 and 3.06 respectively.

When comparing the relative performance of the two economies, it is clear why many regard Japan as an outstanding example of sensible monetary policy.

III. A Comparison of Interest Rate Behavior

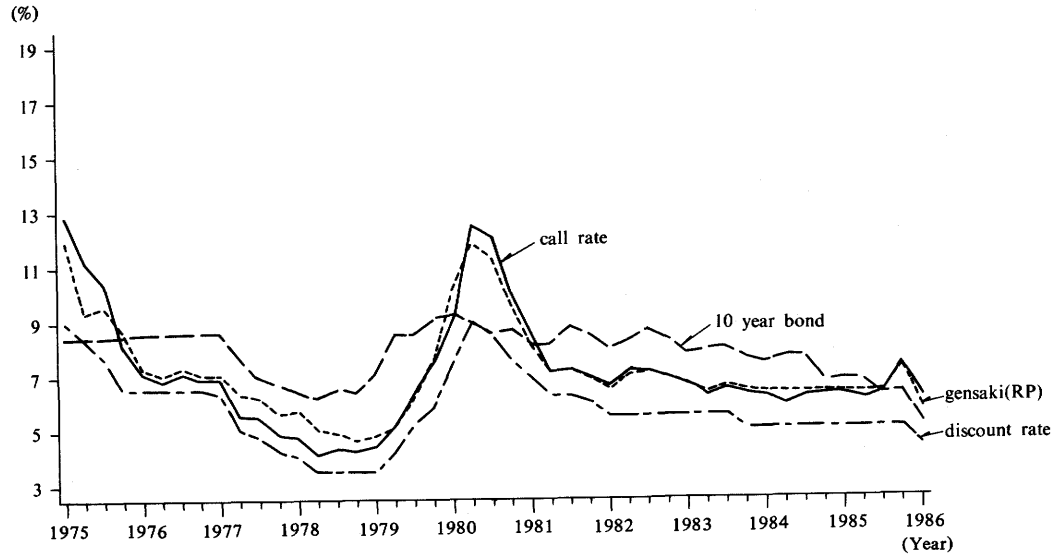
The basic behavior of interest rates is depicted in Figures 3a, 3b and Table 2. Regarding the short-term money market, overall interest rate behavior in both countries appears to be quite similar. Rates in the United States are somewhat higher and more variable reflecting higher levels of inflation and perhaps more variable monetary policy. The rates in both countries show a good deal of flexibility and are characterized by similar correlation coefficients.

The lower variability of Japanese money market rates may also be due to greater restrictions on movements in rates in the call market and bill discount markets prior

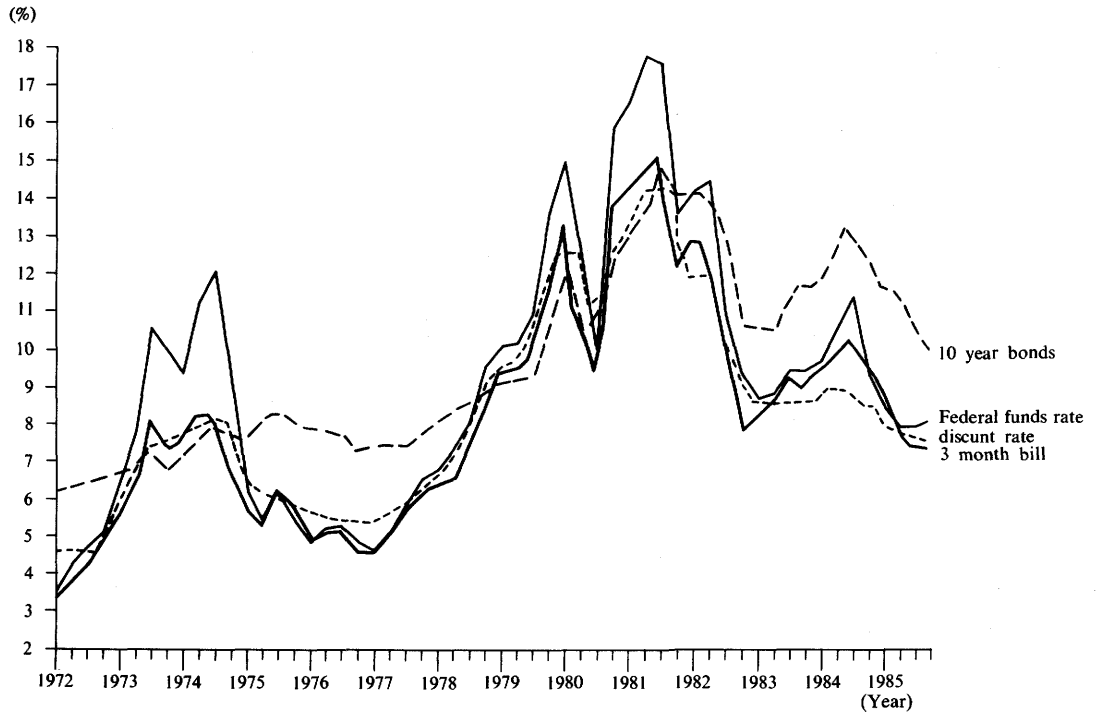
1. These figures are for effective M_1 growth and are taken from Broaddus-Goodfriend (1984).

Figure 3 Interest Rates

a. Japan



b. U.S.



to 1979.[2] Many of these restrictions prohibited interbank rates from changing on a daily basis, but still allowed for flexibility on a biweekly basis. The use of quarterly data may effectively mask these rigidities since the money market rates in Japan show even less variability over the 1981 I – 1985 IV period when interbank rates fluctuated freely. Also in the 1970s, the Bank of Japan probably used its interest rate instrument more aggressively to bring down monetary growth and inflation than did the Federal Reserve.[3] This would tend to offset the effects of institutional rigidities on short-term Japanese interest rates when analyzing quarterly data.

Table 2 Interest Rates
1975 I – 1985 IV

	Japan	U.S.
Average discount rate (d)	5.74	8.74
S.D. of discount rate	1.40	2.61
Average interbank rate * (i)	7.07	9.54
S.D. of interbank rate	2.09	3.67
Average 3 month rate **(r_3)	7.14	8.67
S.D. of 3 month rate	1.73	2.96
Average 10 year bond rate (r_{10})	7.85	10.31
S.D. of 10 year bond rate	0.89	2.30

Correlation Coefficients

Japan				U.S.			
	d	i	r_3		d	i	r_3
i	0.96			i	0.97		
r_3	0.95	0.98		r_3	0.96	0.99	
r_{10}	0.73	0.61	0.61	r_{10}	0.92	0.94	0.95

* The interbank rate in Japan is the overnight call market rate while in the U.S. it is the overnight Federal funds rate.

** The 3 month rate for Japan is the Gensaki or RP rate, while for the U.S. the 3 month Treasury bill rate is used. There is no comparable Treasury bill in Japan.

2. For more detail, see Cargill (1985) and Fukui (1986).

3. For a detailed discussion concerning the Federal Reserves operating procedures in the 1970s, see Hetzel (1981).

Although the behavior of money market rates shows great similarity in the two countries, the behavior of long-term yields on government bonds is quite different. In the United States, long-term bond yields fluctuate a good deal more as depicted by a standard deviation of 2.30 versus a standard deviation of 0.89 for Japan. Also, these yields are much more highly correlated with other interest rates in the United States than in Japan. Again, one may conjecture that the high degree of regulation that existed in the Japanese bond market during the 1970s is responsible. Prior to 1975, there were relatively few long-term government bonds and during the late 1970s, long-term bonds were marketed entirely to financial institutions that were "requested" not to resell them in the secondary market.

Gradually as the government tried to market more debt, it was forced to liberalize subscription rates and resale arrangements if entire issues were to receive subscriptions. For instance, in April 1977, members of the government bond purchasing syndicate were permitted to resell bonds after holding them for one year and in 1978, the Bank of Japan repurchased bonds on an auction basis. In May 1980, government bonds could be resold after they were listed on the securities exchange, amounting to a holding period of seven-nine months, and in 1981, the holding period was shortened to 100 days. Furthermore, the initial subscription yield has gradually liberalized and the difference between this yield and the yield in the secondary market has become virtually nonexistent. Furthermore, if one examines only the last five years of the sample, the comparative statistics are very similar. Long-term bonds have a standard deviation of 0.75 in Japan as compared to 1.51 in the United States and have a correlation coefficient with the three month market rate of 0.47 as compared to 0.88 for the United States.

With the loosening of regulations in both domestic and foreign exchange markets and the large increase in government debt, the Japanese bond market has become the second most active bond market in the world. This growth is also reflected in the money markets giving Japan well-diversified and deep markets for borrowing and lending. Although not as large or diversified as markets in the United States, differences in the money and bond markets can not be responsible for difference in the performance of the Japanese and U.S. monetary authorities.[4]

4. The above discussion has concentrated on deregulation in the long-term government bonds market. However, many other liberalization measures have taken place in this same period, for example, the liberalizations in the markets of CDs, BAs and the conversion of foreign currency into yen. The working of the interbank market is strongly affected by the working of these new markets, and it might be useful to examine this interaction. However, this point is not discussed explicitly, since several papers are already available on this issue. See Cargill (1985) and Fukui (1986), among others.

IV. The Japanese Interbank Market

A. Overview

In order to understand Japanese monetary policy, it is essential to examine the workings of the Japanese interbank market, since this is the market in which the Bank of Japan performs daily operations. Currently, there are two markets in which Japanese banks exchange reserves. There is the call market, which is a short-term market analogous to the Federal funds market, and there is a bill discount market where commercial bills are discounted. The maturity of loans in the call market varies from one-half day to three weeks, while the maturity of bills traded in the bills discount market varies from 30 days to 180 days.[5]

Over the period 1975 - present, there have been a number of changes liberalizing the movements of rates in these markets. Prior to 1978, both the call rate and bill discount rate were based on a quotation system in which the rate was determined by a consensus of major borrowers and lenders. At this time, the call rate was changed only once or twice a month while the bill rate fluctuated less frequently. Also, participants in the bill market were prohibited from rediscounting bills. Starting in June 1978, quotations on the call rate were changed more frequently and permission was given to resell bills freely one month after their purchase. In October 1978, seven-day call money with a freely determined rate was introduced, while in November, one-month bills were introduced at an unregulated rate. Also, rates on three-month bills were liberalized. The process of liberalizing the interbank market was largely concluded in 1979. In April, the quotation system in the call market was abolished and call money with terms between two and six days was introduced. In October, rates on two-month bills were also liberalized. Thus from late 1979 until present, rates in both the call and bill market can fluctuate on a daily basis and interdaily fluctuation although infrequent does occur.[6] However, rates do not fluctuate quite as freely as in the Federal funds market. This may be due to the fact that interest rates are used as an operating target. Specifically, the Bank of Japan stands ready to supply or absorb funds at its target rates in order to achieve equilibrium in the short-term money markets.

The volume of trading in the call and bill markets has increased three fold over the last decade with monthly volume in June 1985 reaching ¥13.4 trillion. The

5. The maximum term of call loans was extended from seven days to three weeks in August 1985, while the maximum term in bill discount market was extended from 120 days to 180 days in June 1985.

6. Another movement toward liberalization occurred in November 1980 which allowed institutions to simultaneously borrow in one market and lend in the other.

market is therefore quite active in allocating funds among banks.

B. Detailed Organization of the Interbank Market

1. Call Market

The major participants in the call market are the Bank of Japan, the six Tanshi Kaisha or dealers, city banks, long-term credit banks, regional banks, mutual loan and savings banks, trust banks, foreign bank branches, Norin Chukin Bank (the central cooperative of agriculture and forestry credit unions), and insurance companies. Also beginning in November 1980, securities companies that are authorized to underwrite public and corporate debentures have gradually been allowed to take funds in this market.[7] City banks are the major takers (demanders of funds) in the call market while the major placers are Norin Chukin Bank, trust banks, regional banks, and life insurance companies. Regarding the Norin Chukin Bank, proceeds from the rice crop and other agricultural products flow into this institution, making its supply of funds vary seasonally. The supply of funds originating with regional banks is also significant but fluctuates seasonally. They are particularly big suppliers when central government subsidies are paid to local governments.

With respect to the actual workings of the markets, the Tanshi Kaisha are the pivotal figures both with regard to the implementation of the Bank of Japan's monetary policy and the movement of funds among the various participants. This is because almost all call fund transactions must involve a Tanshi Kaisha as a counterparty. At the beginning of each day, the Tanshi Kaisha quote the placers' rate (takers' rate is usually 1/16 higher). Placers and takers then submit orders with the Tanshi Kaisha. Unlike the Federal funds market, each transaction, with the exception of half day calls, requires collateral.[8] At the initially quoted rate demand and supply may not be equalized and the rate may change (an occasional occurrence), or the Bank of Japan may enter the market rate in the day and supply or absorb funds as needed. There are primarily four means for absorbing funds in the call market. One is the sale of Treasury bills to the market at a rate that is based on the mean of the bill discount rate and the Gensaki rate.[9] A second method is through the sale of bills drawn on the Bank of Japan (Bank of Japan bills) while a third method is the sale of commercial

7. For a more detailed listing and description of institutions participating in this market, see *Short-Term Fund Market in Japan* (1983).

8. Starting in July 1985, noncollateralized call loans of all maturities have been allowed. They still represent a small portion of overall call market volume.

9. Treasury bills are sold by the government at yeilds well below market. Consequently the Bank of Japan purchases all Treasury bills.

bills in the Bank of Japan's portfolio directly to city banks. A fourth method, which accounts for roughly 30% of the absolute volume of monthly reserve operations, is the use of the discount window to change the volume of outstanding loans to banks. In the case of absorbing funds, the volume of loans would be decreased. Supplying extra funds to the call market is accomplished by reversing the transactions just described.

In employing the various methods of reserve operations, the Bank of Japan tries to take into account the nature of the reserve deficiency or excess. If the conditions in the reserve market appear to be of a long-run nature, the Bank of Japan conducts operations with long-term government bonds. Seasonal, or short-term reserve fluctuations are primarily met through the use of commercial bills when there is a need to add reserves and by selling Treasury bills or Bank of Japan bills when there is a desire for draining reserves. Discount window lending is the major avenue for supplying or absorbing reserves in response to daily fluctuations. Thus, the type of transaction conducted by the Bank of Japan in response to reserve market conditions may serve as a valuable source of information to participants in the interbank market. For example, an excess demand for reserves that is met by a purchase of long-term bonds could indicate that the prevailing level of interest rates is consistent with the long-run policy objectives of the Bank of Japan. The use of different operations as a potential signal and the effects that signaling has on the equilibrium conditions in the interbank market is explored in more detail in Section VI.

The types of call loans are quite varied and provide a great deal of funding flexibility. Transactions are generally in multiples of ¥100 million and range in term from one half day to three weeks. There are also unconditional calls that are automatically renewed if no notice is given prior to 1:00 p.m. (11:30 a.m. on Saturdays). The rate applicable to the renewed call is the rate prevailing at the time of reserve settlement. Half day calls are of two types, morning and afternoon. A morning call fund begins at 9:00 a.m. and last until the first daily clearing settlement at 1:00 p.m. (11:30 a.m. on Saturdays). An afternoon call fund begins at the end of the first settlement and ends at final settlement (3:00 p.m. on weekdays and 12:00 noon on Saturdays). These calls are used when a bank expects large withdrawals or deposits that will be reversed later in the day and are a direct result of twice a day settlement of reserve balances.

2. Bill Discount Market

The bill discount market is also an active market for transferring interbank funds over a longer time interval and is analogous to the term market in Federal funds, although the bill discount market may be somewhat deeper. Currently, there are four terms of bills that are transacted with the transaction size in multiples of ¥100

million. The shortest term is 30 days while the longest term is 180 days with terms of maturity varying anywhere between 30 and 180 days. Bills may also be rediscounted after they have been held for one month, and there is no minimum holding time for future rediscounts. Also, when rediscounting, the Tanshi Kaisha involved in the original discount is usually given priority in buying the bill back.

Bills that may be used in this market are original bills which consist of commercial bills, prime industrial bills, trade bills, prime single-name papers and yen denominated export/import usance bills. Cover bills which are bills that financial institutions draw on themselves and that are secured by original bills are also used and currently constitute almost all of the transactions.

Bill discount rates are quoted each day by each Tanshi Kaisha. As with call money rates, these rates may not clear the market. The rate may change during the day, but the more usual practice is for the Bank of Japan to enter the market and supply or absorb the necessary funds. The Bank of Japan participates in the bill market by drawing bills for sale on the Bank of Japan, buying and selling original or cover bills through Tanshi Kaisha or directly dealing with financial institutions. The initial use of Bank of Japan bills was to provide collateral to Tanshi Kaisha in the call market, but with the growth of the bill market, the Tanshi Kaisha may also be authorized to rediscount these bills. Regarding the use of cover bills, the Bank of Japan informs the Tanshi Kaisha of its intentions and the Tanshi Kaisha acting as brokers find institutions willing to participate in the transaction.

From the above description, it is evident that the call and bill discount markets constitute active, deep and will-diversified markets that allow financial institutions to allocate funds among themselves. It is also clear that this market gives the Bank of Japan flexibility in terms of using open market operations for the purpose of administering monetary policy.

V. Monetary Policy

A. Overview

Over the last decade, the Bank of Japan has successfully implemented a monetary policy that has been noninflationary when compared with the policies of most developed nations. It has accomplished this with daily operating procedures that are not based on procedures that many monetarists advocate. For example, the Bank of Japan uses the interbank market rates as its operating target rather than total reserves. Further, the reserve accounting regime is not contemporaneous, but is a mixture of contemporaneous and lagged reserve accounting. Specifically, the deposit base used to calculate required reserves for a given month is based on deposits for that month. Average reserve balances used to meet this requirement are held from

the 16th day of that month to the 15th day of the next month. Also, the Bank of Japan does not place a great deal of weight on short-term movements in money but seems to be quite concerned with producing a low inflationary environment for the economy. While the long-run policy of the Bank of Japan appears to take seriously some monetarist proposals, its method of operation does not seem to be that prescribed by mainstream monetarists.

The description of the Bank of Japan's operations in the interbank markets is certainly consistent with the use of an interest rate instrument. Call rates do not frequently fluctuate on an intraday basis.[10] The Tanshi Kaisha, with close informational contact with the Bank of Japan, set the rates at the opening of the markets and the Bank of Japan stands willing to supply or absorb the necessary funds.

B Discount Window Lending

While direct open market operations in the call and bill discount markets form an integral part of monetary policy, the Bank of Japan has another extremely important and flexible means of influencing conditions in the interbank markets. This instrument is the discount window and it operates in a very different manner from the discount window in the United States.

In Japan, the discount window is an extremely important avenue for supplying funds to banks. As shown in Figure 4, the level of discount window borrowing frequently exceeds the level of required reserves.[11] By comparison, in the United States the ratio of borrowed reserves to required reserves rarely exceeds 5%.

The administration of the discount window is also very different in the two countries. In the United States banks initiate the decision to borrow and the borrowing privilege is subject to a complex non-price rationing scheme.[12] In Japan, the Bank of Japan decides on the level of bank borrowing up to a predetermined quarterly ceiling, the term of the borrowing, and therefore the effective interest rate associated with borrowing. Also, the interaction between city banks and the Bank of Japan through the discount window constitutes an important line of communication between banks and the monetary authority.

10. However, there is a trend of increasig intraday fluctuations. This is especially so since the mid-1980s.

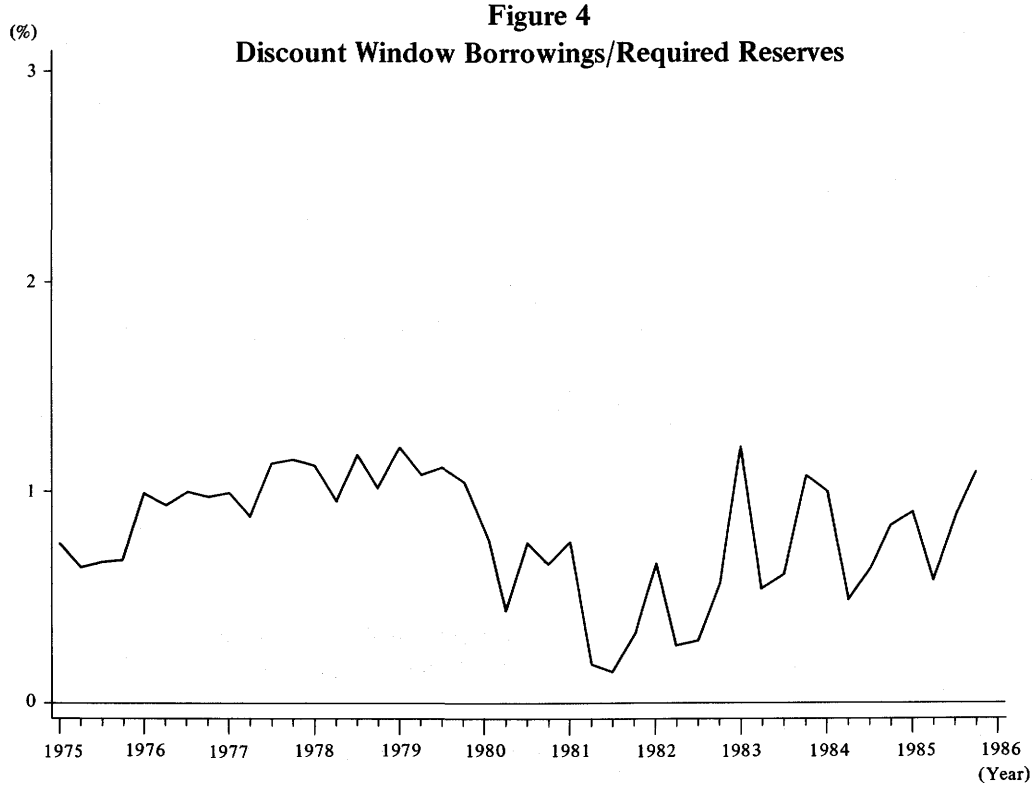
11. In Japan, some of the large fluctuations in discount window lending are due to the large fluctuations in currency holdings by the public. Currency is supplied elastically by essentially lending the needed reserves to banks.

12. For a detailed analytical model of the discount window and bank borrowing behavior in the United States, see Goodfriend (1983).

Borrowings from the Bank of Japan are usually at a subsidized rate, although the amount of the subsidy varies with the term of the loan. This occurs, because accounting practices at the discount window require an extra-days interest payment on any loan. Thus a one-day loan requires two days worth of interest and is therefore usually associated with a penalty rate. As the length of the loan increases, the effective interest rate approaches the official discount rate and the amount of subsidy increases. It is, therefore, undesirable for a bank to be caught with a severe shortage of reserves near the end of a reserve maintenance period, since any discount window loans (if the loans are forthcoming) would by definition be for a short period of time. Further, if a bank should fail to meet its reserve requirement, it must borrow at a one-day rate or pay a penalty of 3.75% above the official discount rate on the amount of the reserve deficiency. Given the accounting practices, this would amount to a severe penalty and banks, therefore, are rarely in this position.

The large volume of discount window borrowings means that the Bank of Japan is able to confer substantial subsidies to individual banks. This practice may also give the Bank of Japan some leverage in influencing bank behavior, a process referred to as "window guidance," although the extent and effectiveness of this activity is open

Figure 4
Discount Window Borrowings/Required Reserves



to debate.[13]

In administering the discount window, the Bank of Japan basically has the ability to call up each city bank and tell them how much they will borrow on any given day. The length of the borrowing need not and is not generally specified. However, since borrowing usually amounts to a subsidy, city banks never refuse the amount offered. A refusal, could end up reducing future subsidization as well. Even though this practice, especially from the viewpoint of banks, seems arbitrary, it is generally performed in a more subtle manner.

A member of the banking division of the Bank of Japan is given oversight responsibilities of each city bank. Officials at each bank communicate their expected funding needs over a reserve maintenance period and they also have close contact with the members of the Bank of Japan. The Bank of Japan usually gives them in a very general way, information concerning its outlook on money market conditions and on the method of fund supply (bills purchase, loan and so on). This communication is not exact and is not a commitment by the Bank of Japan. If for some unexpected reason the reserve positions of banks are not behaving in a manner consistent with policy objectives, discount window lending is adjusted.

The Bank of Japan has the ability to use the term of loans to signal expected future money market conditions. In an effort to maximize profits, banks attempt to satisfy their reserve requirements by holding higher than average reserve balances when the call rate is relatively low and desire to economize on reserve balances when they believe that the call rate is relatively high. By intimating the amount of lending that will be forthcoming and the future looseness or tightness that can be expected in the interbank market, the Bank of Japan can influence the expectations of future call rates. In doing so, the pattern of reserve accumulation can be changed without movement in the current call rate.

This communication of information to the banking system may be an important component of window guidance. There are many different views of window guidance in Japan and there is debate over the extent to which it is used. One interpretation is that since the Bank of Japan is able to confer subsidies on city banks who are regular borrowers, it has power to influence bank behavior without resorting to market mechanisms. While there may be some truth to this claim, it is difficult to see in any equilibrium context why such a policy would be useful in obtaining the objectives of price stability or desired long-run monetary growth. In the case of money, equilibrium of the demand and supply of money is achieved through movements in interest

13. There are two distinct usages of the term "window guidance." One refers to directing the credit expansion of banks on a quarterly basis, while the other refers to shorter term behavior in the interbank market. It will be shown that the former interpretation is difficult to understand as a means of controlling credit in an equilibrium context (for a more detailed critique of the first definition, see Horiuchi (1984)).

rates and prices. Since the targeted level of money must lie on the demand curve for money, merket rates must adjust so that the demand for money is consistent with the target. Moral suasion with respect to banks can not alter this.

Another interpretation of window guidance is given by Yasuda (1981). In that view, because loan supply is determined by both today's call rate and the future path of call rates, the movement of today's call rate will not have a large immediate effect on bank behavior. This lack of sensitivity by banks to current call market conditions implies that the Bank of Japan would have to initiate drastic movements in the call rate in order to generate a contemporaneous response. Rather than doing so, it signals (or threatens) that it will do so if banks do not alter their behavior. The signal is a rise in the official discount rate. City banks then solve a cooperative game that results in an immediate decline in loan supply preventing the Bank of Japan from following through on its threat. The cooperative nature of the game results from direct communication between banks, although it would be possible for the Bank of Japan to transmit information.

The implicit assumption in this theory is that banks have fairly static expectations of future call rates. For instance, if banks had the same information set as the Bank of Japan, knew the policy objective, and formed expectations rationally, they should be able to discern the implications of any deviations from policy objectives on the expected future path of the call rate. Thus, if a rise in the call rate is called for because money is growing too fast, banks' expectations of future call rates should rise as well and no dramatic swings in interest rates are needed to generate a contemporaneous response. There is therefore no need for moral suasion.

The position taken here is that what is normally called window guidance is largely a signaling process in which the Bank of Japan communicates some information that it alone possesses. This information may result from observations of aggregate reserve balances or aggregate money balances that would not be observed by individual banks. The seeming complexity of the relationship between the Bank of Japan and individual banks may indicate that more than just a signaling process is going on, but signaling is certainly an important part of the relationship.

VI. A Model of Discount Window Guidance

A. General Set Up

In this section, the effects of signaling through window guidance (and similarly through different types of reserve supply procedures) are investigated. Particular attention is given to the way in which signaling affects the behavior of the call market rate. It is shown that signaling can lower the variance of the call rate forecast error but that it also raises the variance of the call rate. Since the Bank of Japan may be

interested in lowering both variances, signaling implies a trade-off that could result in the use of a noisy signal.

The model used to investigate the effects of window guidance is one in which the Bank of Japan pegs the interest rate. Detailed studies of an interest rate instrument are found in McCallum (1981, 1984), Dotsey-King (1983, 1986), and Canzoneri, Henderson, and Rogoff (1983). In all these studies the interest rate is used as a policy instrument and the pegging scheme is related to a money supply rule.

For the purpose of this study, the exactness of detail found in these papers is not necessary. Rather the Bank of Japan's objective is postulated in terms of a price level target, while its instrument is the interbank rate. Casting the analysis in terms of money supply targets (or growth rates) would not alter the qualitative results of the model. Futher, it is unclear whether the Bank of Japan uses long-term monetary growth as an intermediate target or merely as an information variable for achieving a desired price level or inflation rate. For example, the Bank of Japan does not announce any monetary targets, but merely gives a forecast of monetary growth that is consistent with its policies. Also, over the past four years when prices have been fairly stable, monetary growth rates have fluctuated more than prices, varying between annual growth rates of 7.1 and 9.6% while inflation has only varied between 0.8 and 1.65%. On the basis of the data, it would be difficult to discriminate between which policy is actually in effect.

The basic model used for analyzing the signaling effects of window guidance is a somewhat standard rational expectations macro-model. However, in this model, decisions in the interbank market are assumed to be made over a shorter time interval than decisions in the output market. Specifically, the interbank market period is half that of the output market.

The log of output supply (y_t^s) is positively related to unanticipated movements in the log of the price level (p_t) and is depicted by:

$$y_t^s = a_1^s(p_t - E^*_{t-1/2}\, p_t) + u_t \tag{1}$$

where $E^*_{t-1/2}$ is the conditional expectations operator based on the information set $I^*_{t-1/2}$. $I^*_{t-1/2}$ contains all prices, quantities, and disturbances dated $t-1/2$ and earlier. The disturbance u_t is a random walk that reflects technological innovations and is equal to $u_{t-1} + v_t$ where v_t is a mean zero, serially uncorrelated normally distributed random variable with variance σ_v^2.

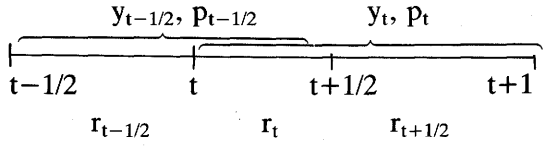
The log of output demand (y_t^d) is negatively related to the expected real rate of interest, $i_t + p_t - E^*_{t-1/2}\, p_{t+1}$, where i_t is the one period nominal rate. This relationship is given by:

$$y_t^d = a_0 - a_1^d(i_t + p_t - E^*_{t-1/2}\, p_{t+1}) + w_t \tag{2}$$

where $w_t = \rho w_{t-1} + n_t$ and n_t is a mean zero serially uncorrelated normally distributed random variable with variance σ_n^2. It is also uncorrelated with v_t. Output demand disturbances have some persistence but gradually dampen over time.

The timing of the model works in the following manner. At each half period $(t-1/2, t, t+1/2, \cdots)$ the interbank market meets and the call rate $(r_{t-1/2}, r_t, r_{t+1/2})$ is determined. The one period nominal rate i_t is related to the call rate by the arbitrage condition $i_t = r_t + E_t r_{t+1/2}$ where the information set $I_t = I^*_{t-1/2} \cup (r_t, p_t)$. Output markets also meet at the beginning of each half period, but prices and output are determined for a period one unit in length. The model is, therefore, similar to Fischer's (1977) overlapping contracts model and is schematically, depicted in the Figure 5.

Figure 5 Fischer's Overlapping Contracts Model



The policy of the Bank of Japan is to target the price level, p^*, and therefore produce stable prices. While this is a simplification of the actual policy process, it is a convenient device for examining the role of signaling. The instrument used for implementing policy is the call market rate. In order to investigate the effect of signaling, the model will be solved with and without signaling. It is assumed that the Bank of Japan possesses full current information and that in the case of signaling, it accurately communicates this information to market participants.

B. The Solution without Signaling

Given the assumptions concerning the information possessed by the Bank of Japan (that is, it knows v_t and n_t), it can set the call rate r_t to hit p^* exactly. This rate is given by:

$$r_t=(1/a_1^d)[a_0-a_1p^*-a_1^dE_tr_{t+1/2}+a_1^sE^*_{t-1/2}p_t+a_1^dE^*_{t-1/2}p_{t+1}+\rho w_{t-1/2} +n_t-u_{t-1/2}-v_t] \quad (3)$$

where $a_1 = a_1^d + a_1^s$.

Because this procedure produces a price of p^* each period, expectations of the current and future price level will be p^*. Therefore, (3) can be rewritten as

$$r_t = a_0/a_1^d - E_t r_{t+1/2} + 1/a_1^d(\rho w_{t-1/2} + n_t - u_{t-1/2} - v_t). \quad (4)$$

Using the method of undetermined coefficients, yields the reduced form expression for interest rates

$$r_t = \frac{a_0}{2a_1^d} - \frac{1}{2a_1^d}u_{t-1/2} - \frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}v_t + \frac{\rho}{a_1^d(1+\rho)}w_{t-1/2} + \frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}n_t \quad (5)$$

where $\theta = \frac{\sigma_v^2}{\sigma_v^2+\sigma_n^2}$.

Analogously, if the Bank of Japan accurately reveals v_t and n_t to the market, then

$$r_t = \frac{a_0}{2a_1^d} - \frac{1}{2a_1^d}u_{t-1/2} - \frac{1}{2a_1^d}v_t + \frac{\rho}{a_1^d(1+\rho)}w_{t-1/2} + \frac{1}{a_1^d(1+\rho)}n_t. \quad (6)$$

Equations (5) and (6) can be updated and used to calculate the conditional forecast error of next periods call rate under conditions of signaling and no signaling (see Appendix). One observes that the accuracy of the forecast in terms of the conditional variance of the forecast error generally improves with signaling, implying that providing information is desirable from the standpoint of improving market forecasts. However, the ability of the Bank of Japan to control the price level is not affected by whether or not it provides additional information to the market.[14] Therefore, the affects of signaling are not a major determinant in determining the success or failure of monetary policy.

A more exact treatment of this process would endow the monetary authority with superior rather than complete information. One might reasonably believe that observing aggregate reserve behavior would only transmit a signal to the Bank of Japan that was a linear combination of real and money demand disturbances. This would imply that the price level would deviate from its targeted value as a result of expectational errors on the part of the Bank of Japan. This would make agents signal extraction problem more complex but would not alter the basic result that the communications involved in window guidance reduce the forecast error variance of future call rates.

In general, the type of signaling that occurs through window guidance is not precise. This is in part due to the fact that the Bank of Japan does not possess

14. This result would also apply to monetary targeting. It would also apply to situations where the Bank of Japan had imperfect knowledge of current shocks, but where the information set of market participants was a subset of the information possessed by the Bank of Japan.

complete information. However, it may also in part be due to a desire to smooth movements in the call rate by reducing the variance of $r_{t+1/2} - r_t$. Analysis of U.S. monetary policy indicates that this is an objective of Federal Reserve behavior (see Goodfriend (1986a, 1986b) and Dotsey (1986)), and it may also be important to the Bank of Japan. If so, one can show that signaling increases the variance of $r_{t+1/2} - r_t$ and hence a desire to smooth interest rates would make signaling undesirable. The presence of a desire for both better forecasting and smoother interest rates would imply the use of a noisy signal.

VII. Summary

This article gives a description of operating procedures used by the Bank of Japan and concludes that it is not operating procedures that distinguish the different macroeconomic outcomes of monetary policy in Japan and the United States. In fact, Japan achieves results that are monetarist in nature without using the procedures frequently advocated by monetarist. This indicates that attempts to understand the general behavior of monetary authorities should be focused on areas other than operations.

In analyzing Japanese monetary policy, the article presents a description of the environment in which policy is implemented and finds that this environment is quite similar to that of the United States. One major difference, however, is the discount window and it is analyzed in detail. A model is derived based on the premise that an important aspect of window guidance is its use as a signaling device. This behavior is shown to effect the forecastibility and variance of call rate movements, two subjects that are likely to concern any monetary authority. The use of a noisy signal is consistent with a trade-off between improving the forecast error variance of future call rates and smoothing the variability of interest rates. However, while window guidance is an interesting and important part of Japanese monetary policy, it does not appear to account for the lower inflation experienced by the Japanese economy.

APPENDIX

To calculate the conditional variance of the forecast error of next periods call rate, $r_{t+1/2}$, first update equations (5) and (6) and subtract $E_t r_{t+1/2}$ where the information set depends on whether or not the Bank of Japan signals the value of v_t and n_t. Without signaling,

$$r_{t+1/2}-E_t r_{t+1/2} = -\frac{1}{2a_1^d}((1-\theta)v_t+\theta n_t)+\frac{\rho}{a_1^d(1+\rho)}(\theta n_t+(1-\theta)v_t) \\ -\frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}v_{t+1/2}+\frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}n_{t+1/2}. \tag{A1}$$

Let the conditional variance of the forecast error without signaling be denoted by CV. With signaling,

$$r_{t+1/2}-E_t r_{t+1/2} = -\frac{1}{2a_1^d}v_{t+1/2}+\frac{1}{a_1^d(1+\rho)}n_{t+1/2}. \tag{A2}$$

Denote the conditional variance of the forecast error with signaling by CV*. Then using (A1) and (A2), it can be shown that CV > CV* if and only if $\rho(1-\rho)\theta>0$. For $\rho=0$ or 1, CV= CV*. Therefore, signaling is likely to improve the quality of market forecasts.

With respect to the variance of $r_{t+1/2} - r_t$, using (5) yields,

$$r_{t+1/2}-r_t = \frac{(1-\theta)(1+\rho)}{2a_1^d(1+\rho)}v_t-\frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}v_{t+1/2}-\frac{\rho(1-\rho)}{a_1^d(1+\rho)}w_{t-1/2} \\ +\frac{\theta(1-\rho)-2(1+\rho)}{2a_1^d(1+\rho)}n_t+\frac{2-\theta(1-\rho)}{2a_1^d(1+\rho)}n_{t+1/2}. \tag{A3}$$

The signaling case employes (6) to give,

$$r_{t+1/2}-r_t = -\frac{1}{2a_1^d}v_{t+1/2}-\frac{\rho(1-\rho)}{a_1^d(1+\rho)}w_{t-1/2}-\frac{1-\rho}{a_1^d(1+\rho)}n_t+\frac{1}{a_1^d(1+\rho)}n_{t+1/2}. \tag{A4}$$

It can be shown that the variance of $r_{t+1/2} - r_t$ is greater under signaling if and only if $\theta(\rho-2)<0$, which is the case for non finite variances of output supply and demand shocks and for $-1 \leqq \rho \leqq 1$.

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