Use of Money Supply in the Conduct of Japan's Monetary Policy: Reexamining the Time Series Evidence*

September 2004

Ryuzo Miyao
Research Institute for Economics and Business Administration
Kobe University
(miyao@rieb.kobe-u.ac.jp)

Abstract

Japan's money supply and its role in monetary policy have drawn considerable attention especially since the Bank of Japan adopted its "quantitative easing" scheme in March 2001. This paper focuses on the role of money supply as an information variable and reexamines the empirical relationship between money and economic activity with recent data extending through 2003. We show that the linkage between M2+CD and income or prices largely disappeared in the 1990s and explore possible reasons for this breakdown. The evidence suggests that (i) time deposits lost their predictive content for future economic activity in the 1990s, which seems a primary reason for the breakdown in the M2-income relationship, (ii) bank loans also became no longer useful in forecasting subsequent movements in output in the late 1990s, and (iii) there has been a close link between time deposits and bank loans throughout the period examined. We argue that Japan's persistent non-performing loans problem and ongoing efforts by firms and banks to trim excessive and inefficient bank loans may have caused the breakdown in the bank loan-income relationship and accordingly the breakdown in the M2-income relationship by way of time deposits over the last decade.

* The author is grateful to Hiroshi Fujiki and seminar participants at the Bank of Japan and JICA Hyogo for helpful comments and discussions.

1. Introduction

Japan's money supply has drawn considerable attention over the last few years, particularly since the Bank of Japan adopted the unprecedented "quantitative easing" scheme in March 2001. The amount of bank reserves — more precisely, demand deposits at the Bank of Japan — is regarded as a policy indicator and has been sharply increased, reaching 30-35 trillion yen (i.e. excess reserves of more than 25 trillion yen) at the time of this writing. Nonetheless, the broad measure (M2+CD) in Japan has exhibited only modest growth of around 3%. Obviously there is little linkage between the new policy instrument and money supply. It is natural to ask if money supply still plays a useful role in monetary policy in Japan[1]

The literature on monetary policy usually stresses two potential roles of money supply. The first is its role as "an intermediate target" and the second as "an information variable." For money supply to be a reliable intermediate target, a stable long-run relationship between money and policy goal variables (such as income or prices) is required. The central bank should also be able to control money supply balances reasonably well by implementing its policy instruments. However, several studies have already documented that a long-run or cointegrating relationship among Japan's M2, output, and prices became instable or disappeared in the 1980s and early 1990s (see e.g. Yoshida and Rasche 1990, Miyao 1996, Tsukuda and Miyakoshi 1998). Lack of the money supply controllability should be apparent in light of these recent conclusions.[2]

What about the second role of money supply as an information variable? It seems reasonable to use money supply as a guide to conduct monetary policy when money supply has the predictive content for subsequent movements in income or prices. This analysis on short-run forecastability is also known as the Granger causality (or money-income causality) and a number of studies have investigated this issue for the case of Japan. Researchers such as Honda et al (1995) and Tsukuda and Miyakoshi

[1] Hereafter we use the term "money supply" to mean the broad money supply (M2+CD) rather than a narrow measure of money supply (M1). Note also that M2 and M2+CD are used interchangeably.

[2] The Bank of Japan has announced the "money supply forecast" since the late 1970s but it has never been used formally as an intermediate target (see e.g. Okina 1993). Ito (1989) showed that the behavior of M2 forecasts had violated a rigid monetarist rule for the period 1978-1988.

(1998) claimed that money-to-income causality weakened or almost disappeared in the 1980s. Morimune and Zhao (1997) found the causality from nominal income to money but not vise versa for the period of 1960-1990. Following the work of Feldstein and Stock (1994), Ikeno (2001) reexamined the evidence in a more systematic way and argued that a stable causal relationship from M2 to nominal GDP growth may exist even in the 1980s. More recently, the Bank of Japan (2003, Chart 15) showed evidence of Granger causality suggesting that the predictability of M2 disappeared in the 1990s.

The existing empirical evidence appears mixed in Japan. But more importantly, detailed investigations for the late 1990s are missing in the literature. We need to closely study developments in these recent years because they have potential implications for the conduct of monetary policy in Japan especially under the new policy of zero interest rates and quantitative easing.

Motivated by these observations, this paper focuses on the role of money supply as information variables and reexamines evidence on the short-run money-income relationship in Japan for the period of 1975-2003. In Section 2, we investigate three forecasting models, i.e. forecasting nominal GDP growth, real GDP growth, and GDP deflator inflation with several different sets of regressors. Time-series properties (i.e. unit root and cointegration) of the variables are also carefully examined.

To anticipate the main findings here, we show that the empirical relationship between M2 and income or prices largely disappeared in the 1990s. The result seems reasonably robust as it is consistently shown with several different model specifications. We then explore possible reasons for this breakdown in Section 3. Dividing M2+CD into two series (M1 and time deposits plus CD), we investigate the predictive contents of these series. We further study the short-run forecastability of bank loans as it may give us additional insight. The evidence suggests that (i) time deposits lost the predictive content for subsequent economic activities in the 1990s, which seems a primary reason for the breakdown in the M2-income output relationship, (ii) bank loans also became no longer useful in forecasting future economic activity in the 1990s, and (iii) there has been a close link between time deposits and bank loans throughout the period examined. We argue that Japan's persistent non-performing loans problem and ongoing efforts by firms and banks to trim excessive and inefficient bank loan balances may have caused the breakdown in the bank loan-income relationship and accordingly the breakdown in the M2-income relationship through time deposits over the last decade.

2. Reexamining Predictive Content of M2 in Japan

This section reexamines the evidence on the predictive content of M2 in Japan. We address this issue by using updated, quarterly data on money, output, prices, and interest rates for the period of 1975:1-2003:4.

The following variables are used in our analysis: logged M2 (LM2), logged nominal GDP (LY), logged GDP deflator (*LP*), logged real GDP (*LY95*), call rate (*RCALL*), and logged call rate (*LRCALL*).[3]

As a preliminary step, we perform unit root tests for each of the variables. We run the augmented Dickey Fuller (1979) tests of a unit root against no unit root (denoted as ADF), and a modified Dickey-Fuller test based on GLS (Generalized Least Squares) detrending (denoted as DF-GLS), a powerful univariate test proposed by Elliot, Rothenberg, and Stock (1996). A constant and a time trend are included for variables in levels (i.e. detrended test) except for the call rate series. A constant is included for the call rate series in levels and the variables in first differences (i.e. demeaned test). In all these tests, the optimal lag length is chosen based on the Schwarz Bayesian Information Criterion (SBIC) up to eight lags.

As shown in Panel A of Table 1, no test rejects the null of a unit root against the alternative of stationarity. Taking the first difference, both tests detect strong rejections for almost all the cases (Panel B). In particular, powerful DF-GLS tests result in rejections for all the variables. These results indicate that each of the variables can be treated as a single unit root process or integrated of order one (*I(1)*). They also imply

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[3] M2 is the seasonally adjusted, monthly average series taken from the Nikkei Database (code: MNQMACD@) and monthly observations are averaged within each quarter to obtain quarterly series. Nominal GDP, real GDP, and GDP deflators are seasonally adjusted and retrieved from 93SNA. Because 93SNA data are available from 1980, they are linked with corresponding 68SNA data at 1980:1. These SNA statistics can be taken from the Cabinet Office of Japan's website at www.esri.cao.go.jp/en/sna/menu.html. The call rate series is constructed first by linking the uncollateralized overnight rate (monthly average) after July 1985 and the collateralized rate (monthly average) until June 1985, and then taking the average of monthly observations in each quarter. In linking the two series, the mean difference between the two is added to the collateralized rate. These call rate data are taken from the statistics section of the Bank of Japan's website (www.boj.or.jp).

that we may take the first differences for each variable in the short-run forecasting analysis below.

Next we proceed to the cointegration analysis and examine whether there exists a long-run cointegrating relationship among money, income, and prices or interest rates. The following systems are considered: (*LM2, LY*), *(LM2, LP, LY95),* (*LM2, LY, RCALL*), and *(LM2, LY, LRCALL*). Here two conventional cointegration tests are performed: the augmented Dickey-Fuller test of no cointegration against cointegration (denoted ADF again) and Johansen's (1988) and Johansen and Juselius's (1990) maximal eigen value test of no co-integration against one cointegrating vector (JOH). All the tests assume that some regressors in the system contain a time trend. The lag length for the ADF test is chosen based on the SBIC. Four lags are arbitrarily used for JOH.[4] Critical values are tabulated by Fuller (1976) and Phillips and Ouliaris (1990) for ADF and Osterwald-Lenum (1992) for JOH. As for JOH, following the procedure by Cheung and Lai (1993), Osterwald-Lenum's critical values are corrected to account for possible size distortions in finite samples.

Table 2 reports the cointegration test results. We cannot reject the null of no cointegration from either of these tests. The evidence of no cointegration is consistent with earlier results such as Miyao (1996) and Tsukuda and Miyakoshi (1998). Accordingly, a stable long-run relationship among money, output, and prices is not supported by our updated data.[5] It also implies that the short-run forecasting regressions below do not have to include an error-correction term.

We now examine the predictive content of M2 in the forecasting regressions. Dependent variables are LY95, LP, and LY, all in first differences. The sets of regressors

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4 Using the SBIC, we consistently select one lag, which appears too short to analyze dynamic interactions of the economy. We employ the likelihood ratio tests for the vector autoregressive systems, such as one vs. two lags, two vs. four lags, four vs. six lags or eight lags, and select four or six lags. We consider four lags as our benchmark. Note that test results are unaffected using six lags.

5 Other evidence includes Morimune and Zhao (1997) and Ikeno (2001) where more or less mixed results are reported. We also allow for a possible break in cointegration employing procedures by Gregory and Hansen (1996). We implement the augmented Dickey-Fuller test of no cointegration against cointegration with a structural shift in the cointegrating vector (i.e. a break in the intercept term only, or in both the intercept and slope coefficients) in an unknown timing. But again the null of no cointegration is not rejected with any of these models.

for forecasting LY95 and LP are

(LY95, LP, LM2)

(LY95, LP, LM2, RCALL)

(LY95, LP, LM2, LRCALL)

and those for forecasting LY are

(LY, LM2)

(LY, LM2, LP)

(LY, LP, LM2, LRCALL)

(LY, LP, LM2)

(LY, LP, LM2, RCALL)

(LY, LP, LM2, LRCALL)

all of which enter in first differences. F tests are performed to examine whether the restriction on coefficients on M2 growth are zero. Four lags and a constant term are included in the system. We also consider two lags. Sample periods are the full sample (1975:1-2003:4) and two subsamples (1975:1-1992:4 and 1993:1 -2003:4).[6]

Table 3 reports the test results. These F statistics indicate that the restriction of zero coefficients is strongly rejected for all the models in the full sample and the 1975-92 subsample except for the cases of LP equation with four lags. On the contrary, M2 is no longer statistically significant for almost all the cases with the subsample after 1993 and the result looks quite robust. These empirical results suggest that the short-run predictive content of M2 indeed disappeared in the 1990s.[7]

Visual inspection of the actual data may also be helpful to confirm these findings. Figure 1 displays M2 growth and output growth (changes from the previous year) for 1976-2003. Positive associations between money growth and income growth (both real and nominal) are observed until the early 1990s, but afterwards these two series started

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[6] Note that the M2 growth rate (changes from the previous year) turned negative in late 1992, which motivates our selection of these subsamples. We also use six lags but the results are quite similar to the four-lag case.

[7] We also employ Toda and Yamamoto's (1995) causality analysis as an alternative testing procedure, in which all the variables enter in levels with a constant, a time trend, and five lags of explanatory variables (thus we assume the true model contains four lags and the maximum order of integration is one). Using this procedure, we find somewhat weaker rejections in the pre-1993 subsample (mostly with LP equations), but again these rejections disappear with the post-1993 subsample.

to move independently. The formal econometric analysis, controlling for other factors, indeed supports this observation.

3. Why Did the Predictive Content of M2 Disappear in the 1990s?

Why did M2 lose the predictive content for future output or prices in the 1990s? To answer that question, we may need to identify which component of M2 lost the predictability. Specifically, we divide M2+CD into two series: M1 and time deposits plus CD, both in log (denoted as LM1 and LTDCD, respectively).[8] The same causality tests are performed for the models that now include LM1 or LTDCD instead of LM2.

Table 4 shows the results on the predictive content of LM1.[9] Clearly M1 is not statistically significant in predicting output or prices for any sample period, even with the former 1992 subsample. Because the M1 component had little predictive content even in the pre-1993 period, the insignificance of M1 may not be a major factor to explain the breakdown in the M2-income relationship in the 1990s.

Table 5 demonstrates the causality results with LTDCD. Time deposits plus CD had the predictive content for the pre-1993 period, and it disappeared after 1993. These are virtually the same results as the M2 case (Table 3). The evidence suggests that the behavior of time deposits, rather than the M1 component, is a primary reason for the diminishing role of M2.

Then a further question arises: Why did LTDCD lose the predictability in the 1990s? It has been pointed out that M2 behavior is largely linked with movements in bank loans. If this is the case, then examining the predictive content of bank loans may be useful to gain some insight. To this end, we once again perform the same forecasting exercises with the regression models that contain logged bank loans (LBL) instead of

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[8] M1, time deposits (quasi money), and CD (certificates of deposits) are seasonally adjusted, monthly average series taken from the Nikkei Database (code: MONEYA@, MDTA@, and MNCDA@). For each series, monthly observations are averaged within each quarter to obtain quarterly series.

[9] As for M1, a stable cointegrating money demand relationship may exist when the logged call rate is used (see Miyao 2002 and Nakashima and Saito 2002). In this case, an error-correction term needs to be included in the equations. However, our investigation reveals that the long-run M1 demand residual has only limited marginal predictive power in the case of Japan.

M2.[10]

Table 6 provides test results for LBL. It conveys the same impression as before, namely the bank loans series is statistically significant in most cases for the pre-1993 sample, and loses the predictive content after 1993. Therefore, bank loans no longer contain useful information for subsequent economic activity in the 1990s.

One can observe a strong link between bank loans and time deposits by looking at the time series data. Figure 2 displays the time series data of bank loans, time deposits plus CD, and demand deposits, all in levels. Bank loans and time deposits move very closely for almost all of our sample period. There is a noticeable jump in the bank loan series in 1993 due to a definitional change (see footnote 9), but if that effect is subtracted from the data, high growth until the late 1980s and subsequent stagnation in the 1990s correspond with each other. On the other hand, the behavior of demand deposits appears independent of movements in bank loans and shows persistent increases rather than stagnation in the late 1990s. This can be attributed at least partly to increases in precautionary money demand during the time of Japan's financial crisis.[11] These observations suggest that the textbook explanation of deposit creation, in which changes in bank loans correspond to changes in deposits in the form of derivative deposits, has been particularly relevant for time deposits rather than demand deposits in Japan. While this fact is yet to be explained theoretically, the strong association observed in the actual time series is indeed suggestive to establish the linkage.[12]

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[10] The bank loans series is total loans and discounts outstanding by domestically licensed banks. The series is retrieved from the statistics section of the Bank of Japan's website and is seasonally adjusted by X11. Note that this series contains a definitional change at 1993:2 when overdrafts and cash advances are additionally included in the data. This effect is taken into account in the causality analysis here by using a corresponding dummy variable (which is set to one at 1993:2 and zero otherwise).

[11] Notice also that in April 2002, the pay off for time deposits started in Japan and consequently a substantial amount of time deposits shifted to demand deposits and/or cash currency.

[12] This theory on "deposit creation" may be more relevant for time deposits held by private corporations (denoted as TDP) rather than those by individuals (TDI) as the latter may be more or less viewed as primitive liabilities for banks. To check this possibility, we similarly investigate predictive contents of TDP and TDI series, both in log, with four lags. These series (end-of-month observations) are taken from the Nikkei database and transformed to quarterly observations (and also seasonally adjusted by X11). The results indicate that using TDP, somewhat weaker but similar rejections are detected with the pre-1993 subsample and again those rejections disappear with the

Taking into account all this evidence, we may be able to identify bank loan behavior as the primary reason for the breakdown in the causal relationship between M2 and economic activity in the 1990s. There is little doubt that the presence of severe bad loans accumulated in the post-bubble period significantly diminished its forecastability. Both banks and firms have tried to trim inefficient and excessive loans outstanding from the late 1990s after the banking-sector problem was finally disclosed to the public. Japan had to maintain these efforts to correct the excess supply structure of the whole economy no matter what economic conditions were expected in the near future. As a result, bank loans lost the short-run predictive content for future economic activity. In Figure 3, the time series data of bank loan growth and real GDP growth (changes from the previous year) are plotted. It is also evident from this figure that bank loans have been declining and therefore have lost a close empirical relationship with real GDP since the mid-1990s. And this would lead to the corresponding breakdown in the short-run M2-income relationship by way of the behavior of equally stagnant time deposits.

Our empirical investigation suggests that Japan's broad money supply no longer has a reliable empirical relationship with output or prices from the perspectives of short-run forecasting or information variables. Recall also that the evidence does not support a stable relationship with long-run, cointegration perspectives. Accordingly, the use of money supply in carrying out monetary policy may remain limited until these broken relationships are adequetly restored.

4. Discussions

In this section we discuss several issues related to our main findings on the predictive content of money supply in Japan.

4.1 Predictive content of other financial variables

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post-1993 subsample. As for TDI, virtually no (i.e. only one) rejection is found before 1993 and no rejection is found after 1993. Thus one may conclude that time deposits held by private corporations are most responsible for the breakdown in the M2-income relationship in the late 1990s and this actually lends support to our "deposit creation" theory that tries to connect time deposits and bank loans. I am indebted to Hiroshi Fujiki for suggesting this possibility.

First, we examine whether any other financial variables may possess predictive power even in the 1990s. For this exercise, we employ the series of monetary base, stock prices, and foreign exchange rates, all in logarithm and in first differences.[13] Monetary base is another measure of monetary aggregates, which may be more controllable than broader aggregates such as M1 or M2.[14] Stock prices and exchange rates are typically known as "forward looking" variables as economic theories usually predict that they are determined by the public expectation of future economic variables. We follow the same exercises as above to study the role of these financial variables as information variables.

Tables A-1, A-2, and A-3 in the appendix indicate the results. As shown in Table A-1, the monetary base largely had the predictive content for the pre-1993 period, but it disappeared after 1993. Stock prices are found to be generally significant for the pre-1993 and full samples, but again, rejections are no longer detected with the post-1993 period (see Table A-2). As seen in Table A-3, the exchange rate series has virtually no marginal predictive power for future economic activity in any of the sample periods.[15] Thus, the role of the three financial variables considered here seems limited in the 1990s.

4.2 Predictive content of interest rates and the term structure

Second, we further examine the predictive content of interest rate variables (RCALL, LRCALL) and the term structure of interest rates (i.e. the spread between long-term and short-term interest rates, denoted as SPRD).[16] There is a large body of literature in

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[13] The monetary base series is monthly average, seasonally adjusted by X12-ARIMA and taken from the Bank of Japan's website. Note that the effects of changes in the reserve requirement rate are adjusted in this series. The stock price series is the Nikkei Stock Average (225 selected stocks in the Tokyo Stock Exchange), monthly average, and is taken from the Nikkei Database (code: JSRSPA). The exchange rate series is the yen-dollar spot rate, monthly average, and is taken from the Nikkei Database (code: REXDA). Monthly observations for each series are averaged within each quarter to obtain quarterly series. Unit root properties for these series are checked by ADF and DF-GLS tests and each of them is shown to be I(1).

[14] Honda et al (1995) stressed that the monetary base (reserve adjusted) has superior predictive power to M2 in the 1980s.

[15] The Japanese tend to overreact to movements in exchange rates, but too much concern with exchange rate behavior (especially yen appreciation) may not be warranted from short-run forecasting perspectives.

[16] The interest rate spread series is the 10-year government bond rate minus the 3-month Gensaki rate, retrieved from the Nikkei Database (code: BYR3AV and

the U.S. investigating whether interest rates and/or spread variables have superior predictive value over monetary aggregates (see e.g. Stock and Watson 1989, Bernanke and Blinder 1992, Friedman and Kuttner 1992). We check the significance of RCALL and LRCALL in our main analysis using M2. The role of the spread series is also examined by augmenting SPRD in the benchmark M2 models.

Results are reported in Tables A-4 and A-5. In Table A-4, we find several rejections in terms of RCALL and LRCALL for the pre-1993 and full sample periods. Yet, compared with Table 3, they have less predictive content than M2. In some models LRCALL is found (weakly) significant with the latter subsample. This may indicate that since the late 1990s when interest rates dropped to very low or near zero levels, specifying models with logged interest rates provide more useful information in terms of forecasting.[17]

Table A-5 shows that the spread variable may have marginal predictive value in the late 1990s, especially in forecasting LY (nominal GDP). Note that several studies examined the role of the term structure spread in predicting future output or recessions in Japan (e.g. Kim and Limpaphayom 1997, Hirata and Ueda 1998, Ikeno 2003, Nakaota 2003). Using different approaches from ours, most of the studies found the spread largely significant.[18] The interest rate spread appears to be the most promising predictor after the late 1990s of all the variables considered here. Nevertheless, our results indicate only partial significance and further scrutinies are warranted.

4.3 Stability tests

Third, we conduct several formal tests of parameter stability in our forecasting equations. Given that M2 lost its predictive content in the 1990s, there may be a break in the parameters of these forecasting equations. Following the approach by Feldstein and Stock (1994) and Ikeno (2001), we adopt the CUSUM-type test proposed by Ploberger and Kramer (1992), the exponential average LM test (Exp-LM) proposed by Andrews and Ploberger (1994), and conventional Chow tests. The regressions include four lags for all these tests. The CUSUM-type test rejects the stability if the model

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LBBLTYNKM).

17 Not to mention, interest rates in log move to a larger extent under the near zero environment than interest rates in levels.

18 Among the studies cited here, Ikeno (2003) provided the most cautious assessment on the predictive role of the interest rate spread.

systematically over- or under-forecasts the dependent variable. Exp-LM procedures, which are known to be most powerful against distant local alternatives, test the null of parameter constancy against the alternative that regression coefficients shift at an unknown date. The first and last 15% of observations of the total sample are trimmed in this procedure. As to conventional Chow tests, we test a possible shift in the parameters at given break dates: 1995:3 and 1997:4 (denoted as CHOW95 and CHOW97, respectively). These dates correspond to episodes of major bank failures in Japan.[19] These banking crisis episodes may have possibly influenced the M2-income relationship by way of a shift in the bank loans behavior on both lending and borrowing sides.

Table A-6 reports stability test results. According to the CUSUM-type test, we cannot reject the null of stability. This indicates that one-step-ahead forecast errors, which are computed by the regression models as a whole, do not become too large in absolute values even in the 1990s. Thus the models may not be so instable from the in-sample forecast error perspective. On the other hand, Exp-LM and Chow tests reject the stability in most of the model specifications. Note that these test statistics are all computed based on F statistics and therefore they have more direct relevance with our main analysis. Taking these results and considerations together, we view that the test results generally lend support to a break in the regression coefficients in the late 1990s.

4.4 Further comments on the reasons for a breakdown in the M2-income relationship

Finally, we discuss other possible reasons for a breakdown in the M2-income relationship. Having a similar motivation as ours, the Bank of Japan (2003) studied the role of money supply in recent years and gave two explanations why the *long-run* stable relationship between M2 and economic activity broke down in the late 1990s. The first explanation is that a large increase in precautionary money demand took place due to the reductions in excess liabilities of firms and the non-performing loan problems of the 1990s. The second is that a large amount of funds shifted from riskier financial assets into deposits, partly due to problems with the financial system. Thus the Bank of Japan

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[19] In August 1995, the largest credit union (Kizu Credit Union) and the largest secondary regional bank (Hyogo Bank) failed simultaneously. In November 1997, Yamaichi Securities and Hokkaido Takushoku Bank consecutively failed, which spurred a sense of financial crisis in Japan.

pointed out similar underlying causes, but with different channels.

Note that these explanations may be valid as potential reasons from the perspective of a *long-run cointegrating* relationship. But, from the *short-run forecasting* perspective, we have stressed that the channel from bank loans to time deposits is more important than channels originated in M1 components. Because large increases in precautionary money demand or safer deposits mainly appear in M1 components (such as demand deposits) and time deposits remain stagnant through the 1990s, these channels may be of secondary importance from our forecasting perspective.

5. Concluding Remarks

This paper has reexamined the evidence on Japan's money-income causality for the period of 1975-2003 to see if a broad money supply (M2+CD) still plays its role as an information variable in the conduct of monetary policy. Our systematic investigation with several different specifications showed that M2 no longer has the predictive content for future economic activity from the late 1990s.

We further explored possible reasons for this breakdown by providing the following evidence: (i) time deposits lost the predictive content in the 1990s, which seems a primary reason for the breakdown in the M2-income relationship, (ii) bank loans also became no longer useful in forecasting future economic activity in the 1990s, and (iii) there has been a close link between time deposits and bank loans throughout the period examined. We argued that Japan's persistent non-performing loans problem and ongoing efforts by firms and banks to trim excessive and inefficient outstanding bank loans can be a chief cause of the breakdown in the bank loan-income relationship, which in turn would lead to the breakdown in the M2-income relationship by way of equally stagnant behavior of time deposits.

In sum, our empirical investigations consistently suggest that Japan's broad money supply no longer has a reliable empirical relationship with output or prices from short-run forecasting or information variables perspectives. Recall also that the evidence does not support the presence of a stable long-run relationship from cointegration analysis, either. Accordingly, the use of money supply in the conduct of monetary policy may remain limited until these broken relationships are satisfactorily restored. It is highly important to look for other information variables that maintain a robust empirical relationship with economic activity even in the recent years of financial instability and near zero interest rates. A preliminary investigation in this paper indicates that the interest rate spread may be a potentially important candidate, which deserves further scrutiny.

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Table 1. Unit Root Test Results

Variable	ADF	DF-GLS
	A. In levels	
LM2	-1.09(1)	-0.42(1)
LY	-1.14(0)	-0.79(3)
LP	-1.97(2)	-0.36(3)
LY95	-0.29(0)	-1.23(3)
RCALL	-2.10(1)	-0.06(3)
LRCALL	3.67(5)	4.38(5)
	B. In first differences	
Δ LM2	-2.29(0)	-2.38(0)*
Δ LY	-2.25(3)	-2.32(2)*
Δ LP	-2.63(2)†	-2.47(2)*
Δ LY95	-8.44(0)**	-3.62(2)**
Δ RCALL	-6.39(0)**	-5.58(2)**
Δ LRCALL	-4.82(5)**	-4.51(5)**

Notes: This table reports statistics testing for a unit root for logged M2 (*LM2*), logged nominal GDP (*LY*), logged GDP deflator (*LP*), logged real GDP (*LY95*), call rate (*RCALL*), and logged call rate (*LRCALL*). ADF is the augmented Dickey-Fuller (1979) test of a unit root against no unit root, and DF-GLS is a Dickey-Fuller test based on GLS-detrended series, proposed by Elliott, Rothenberg, and Stock (1996). A constant and a time trend are included for variables in levels except for the call rate series (i.e. detrended test). A constant is included for the call rate series in levels and variables in first differences (i.e. demeaned test). In all these tests, the optimal lag length is chosen based on the SBIC and is shown in parentheses. The sample period is 1975:1-2003:4. Critical values, tabulated by Fuller (1976), Elliott, Rothenberg, and Stock (1996) are:

		10%(†)	5%(*)	1%(**)
Detrended	ADF	-3.15	-3.45	-4.40
	DF-GLS	-2.74	-3.03	-3.58
Demeaned	ADF	-2.58	-2.89	-3.51
	DF-GLS	-1.61	-1.95	-2.60

Table 2. Cointegration Test Results

System	ADF	JOH
(*LM2, LY*)	0.11(0)	6.50
(LM2, LP, LY95)	-2.02(3)	10.96
(*LM2, LY, RCALL*)	-1.40(1)	16.53
(LM2, LY, LRCALL)	-2.60(0)	20.38

Notes: This table reports statistics testing for cointegration in the systems listed in the first column. ADF is the augmented Dickey-Fuller (1979) test of no cointegration against cointegration. JOH is Johansen's maximal eigenvalue test of no cointegration against one cointegrating vector. All the tests assume that some variables in the system contain a time trend. The lag length for ADF test is chosen based on the SBIC and is shown in parentheses. Four lags are arbitrarily used for JOH. Critical values are tabulated by Fuller (1976) and Phillips and Ouliaris (1990) for ADF, and Osterwald-Lenum (1992) for JOH. As for JOH, following the procedure by Cheung and Lai (1993), Osterwald-Lenum's critical values are corrected to account for possible size distortions in finite samples.

		10%(†)	5%(*)	1%(**)
Two-variable	ADF	-3.15	-3.45	-4.40
	JOH	12.91	15.07	19.95
Three-variable	ADF	-3.52	-3.80	-4.36
	JOH	20.62	23.30	28.36

Table 3. Predictive Content of M2

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM)	5.516(0.005)**	6.113(0.004)**	0.556(0.578)
(LY95, LP, LM, RCALL)	5.924(0.004)**	6.784(0.002)**	0.457(0.637)
(LY95, LP, LM, LRCALL)	6.158(0.003)**	6.171(0.004)**	0.618(0.545)
	B. Predicting LP		
(LY95, LP, LM)	4.044(0.020)*	4.322(0.017)*	2.151(0.131)
(LY95, LP, LM, RCALL)	3.589(0.031)*	4.063(0.022)*	1.395(0.261)
(LY95, LP, LM, LRCALL)	4.382(0.015)*	4.088(0.022)*	1.969(0.155)
	C. Predicting LY		
(LY, LM)	11.943(0.000)**	9.684(0.000)**	1.913(0.161)
(LY, LP, LM)	11.180(0.000)**	14.055(0.000)**	2.757(0.077) †
(LY, LM, RCALL)	12.442(0.000)**	10.611(0.000)**	1.451(0.247)
(LY, LM, LRCALL)	12.442(0.000)**	10.197(0.000)**	1.744(0.189)
(LY, LM, RCALL, LP)	11.468(0.000)**	15.375(0.000)**	2.027(0.147)
(LY, LM, LRCALL, LP)	12.738(0.000)**	14.509(0.000)**	2.916(0.067) †
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM)	2.293(0.065)†	2.603(0.046)*	0.716(0.587)
(LY95, LP, LM, RCALL)	2.575(0.043)*	3.038(0.026)*	1.083(0.385)
(LY95, LP, LM, LRCALL)	2.009(0.100)	2.826(0.034)*	0.973(0.439)
	B. Predicting LP		
(LY95, LP, LM)	1.524(0.201)	1.334(0.269)	1.187(0.336)
(LY95, LP, LM, RCALL)	0.667(0.617)	0.574(0.683)	0.724(0.583)
(LY95, LP, LM, LRCALL)	1.689(0.159)	0.945(0.446)	1.381(0.267)
	C. Predicting LY		
(LY, LM)	3.941(0.005)**	3.806(0.008)**	0.939(0.453)
(LY, LP, LM)	3.959(0.005)**	5.099(0.001)**	2.121(0.102)
(LY, LM, RCALL)	3.655(0.008)**	3.451(0.014)*	1.006(0.420)
(LY, LM, LRCALL)	3.591(0.009)**	3.863(0.008)**	1.091(0.378)
(LY, LM, RCALL, LP)	3.483(0.011)*	4.497(0.004)**	2.299(0.085) †
(LY, LM, LRCALL, LP)	3.752(0.007)**	4.762(0.002)**	2.997(0.036)*

Notes: This table reports F statistics testing the restriction that coefficients on M2 growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences. Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table 4. Predictive Content of M1

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM)	0.302(0.740)	0.419(0.660)	0.044(0.957)
(LY95, LP, LM, RCALL)	0.408(0.666)	0.778(0.464)	0.035(0.966)
(LY95, LP, LM, LRCALL)	0.432(0.651)	0.551(0.579)	0.145(0.865)
	B. Predicting LP		
(LY95, LP, LM)	0.667(0.516)	0.996(0.376)	1.339(0.274)
(LY95, LP, LM, RCALL)	0.303(0.739)	0.842(0.436)	1.351(0.272)
(LY95, LP, LM, LRCALL)	0.533(0.588)	1.345(0.269)	1.342(0.274)
	C. Predicting LY		
(LY, LM)	0.018(0.982)	0.289(0.750)	0.061(0.941)
(LY, LP, LM)	0.168(0.845)	0.891(0.416)	0.378(0.688)
(LY, LM, RCALL)	0.083(0.920)	0.956(0.391)	0.023(0.977)
(LY, LM, LRCALL)	0.086(0.918)	0.826(0.443)	0.619(0.544)
(LY, LM, RCALL, LP)	0.145(0.865)	1.641(0.203)	0.409(0.667)
(LY, LM, LRCALL, LP)	0.162(0.851)	1.613(0.209)	0.326(0.724)
＜LAG = 4＞	*A. Predicting LY95*		
(LY95, LP, LM)	0.208(0.934)	0.261(0.901)	0.175(0.950)
(LY95, LP, LM, RCALL)	0.294(0.881)	0.507(0.731)	0.224(0.923)
(LY95, LP, LM, LRCALL)	0.243(0.913)	0.491(0.742)	0.521(0.721)
	B. Predicting LP		
(LY95, LP, LM)	0.583(0.676)	1.113(0.361)	0.201(0.936)
(LY95, LP, LM, RCALL)	0.453(0.770)	1.175(0.335)	0.113(0.977)
(LY95, LP, LM, LRCALL)	0.326(0.860)	1.985(0.114)	0.370(0.828)
	C. Predicting LY		
(LY, LM)	0.496(0.738)	1.049(0.391)	0.095(0.983)
(LY, LP, LM)	0.391(0.815)	1.277(0.292)	0.169(0.953)
(LY, LM, RCALL)	0.741(0.566)	1.528(0.209)	0.269(0.896)
(LY, LM, LRCALL)	0.496(0.739)	1.895(0.127)	1.086(0.381)
(LY, LM, RCALL, LP)	0.359(0.837)	1.871(0.133)	0.200(0.936)
(LY, LM, LRCALL, LP)	0.204(0.936)	2.262(0.078)†	0.959(0.446)

Notes: This table reports F statistics testing the restriction that coefficients on M1 growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences. Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table 5. Predictive Content of Time Deposits and CD

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
＜LAG = 2＞	*A. Predicting LY95*		
(LY95, LP, LM)	1.864(0.160)	5.726(0.006)**	0.095(0.910)
(LY95, LP, LM, RCALL)	1.882(0.158)	5.799(0.005)**	0.073(0.930)
(LY95, LP, LM, LRCALL)	2.859(0.062)†	6.031(0.004)**	0.114(0.892)
	B. Predicting LP		
(LY95, LP, LM)	2.383(0.098)†	1.171(0.318)	0.901(0.415)
(LY95, LP, LM, RCALL)	2.370(0.099)†	0.446(0.642)	0.906(0.413)
(LY95, LP, LM, LRCALL)	2.003(0.140)	0.335(0.717)	0.769(0.471)
	C. Predicting LY		
(LY, LM)	6.135(0.003)**	8.536(0.001)**	0.259(0.773)
(LY, LP, LM)	4.675(0.011)*	9.147(0.000)**	0.160(0.852)
(LY, LM, RCALL)	5.887(0.004)**	7.045(0.002)**	0.232(0.794)
(LY, LM, LRCALL)	7.512(0.001)**	6.837(0.002)**	0.866(0.429)
(LY, LM, RCALL, LP)	4.641(0.012)*	7.564(0.001)**	0.153(0.858)
(LY, LM, LRCALL, LP)	5.704(0.005)**	7.403(0.001)**	0.119(0.888)
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM)	0.701(0.594)	2.431(0.061)*	0.108(0.979)
(LY95, LP, LM, RCALL)	0.653(0.626)	2.599(0.049)*	0.062(0.992)
(LY95, LP, LM, LRCALL)	1.923(0.114)	3.093(0.025)*	0.263(0.899)
	B. Predicting LP		
(LY95, LP, LM)	0.562(0.691)	0.843(0.505)	0.241(0.913)
(LY95, LP, LM, RCALL)	0.456(0.767)	0.398(0.809)	0.182(0.946)
(LY95, LP, LM, LRCALL)	0.506(0.732)	0.413(0.798)	0.437(0.781)
	C. Predicting LY		
(LY, LM)	1.469(0.218)	4.418(0.004)**	0.389(0.815)
(LY, LP, LM)	1.357(0.255)	4.959(0.002)**	0.124(0.973)
(LY, LM, RCALL)	1.289(0.280)	3.404(0.016)*	0.436(0.782)
(LY, LM, LRCALL)	3.114(0.019)*	3.767(0.010)**	1.101(0.374)
(LY, LM, RCALL, LP)	1.164(0.332)	3.879(0.009)**	0.113(0.977)
(LY, LM, LRCALL, LP)	2.869(0.028)*	4.256(0.005)**	0.478(0.751)

Notes: This table reports F statistics testing the restriction that coefficients on time deposits plus CD growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table 6. Predictive Content of Bank Loans

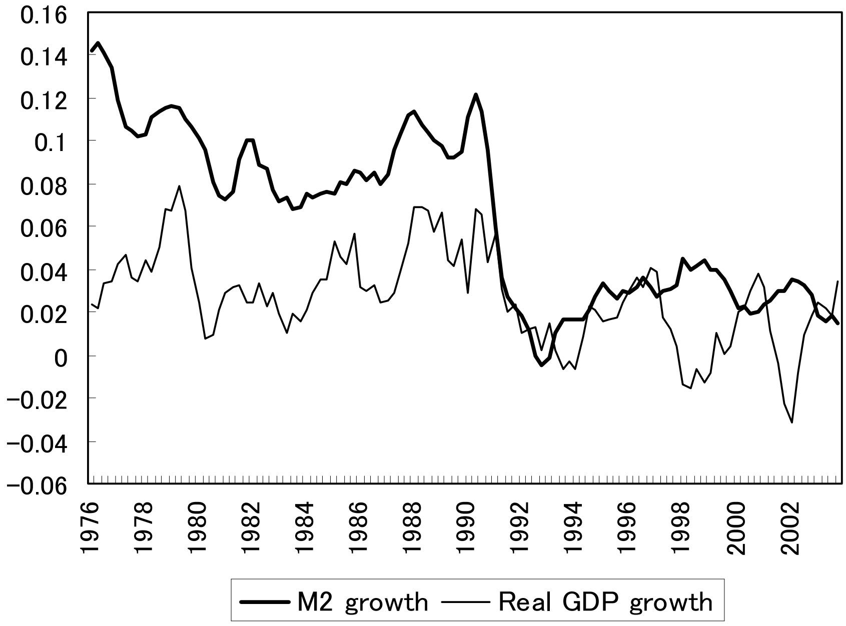
Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM)	0.341(0.712)	2.448(0.096)†	0.446(0.644)
(LY95, LP, LM, RCALL)	0.333(0.718)	2.476(0.094)†	0.849(0.437)
(LY95, LP, LM, LRCALL)	0.261(0.771)	2.464(0.095)†	0.655(0.526)
	B. Predicting LP		
(LY95, LP, LM)	1.656(0.196)	1.053(0.356)	1.225(0.306)
(LY95, LP, LM, RCALL)	2.586(0.081)†	0.690(0.506)	0.808(0.454)
(LY95, LP, LM, LRCALL)	1.628(0.202)	0.761(0.472)	1.213(0.310)
	C. Predicting LY		
(LY, LM)	2.081(0.130)	2.583(0.084)†	0.006(0.994)
(LY, LP, LM)	1.336(0.268)	3.922(0.026)*	0.040(0.961)
(LY, LM, RCALL)	2.435(0.093)†	2.436(0.097)†	0.217(0.806)
(LY, LM, LRCALL)	1.999(0.141)	2.394(0.101)	0.001(0.999)
(LY, LM, RCALL, LP)	1.643(0.199)	3.447(0.039)*	0.292(0.749)
(LY, LM, LRCALL, LP)	1.180(0.312)	3.474(0.038)*	0.038(0.963)
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM)	1.116(0.354)	1.943(0.119)	0.746(0.568)
(LY95, LP, LM, RCALL)	0.979(0.424)	2.082(0.100)	0.368(0.829)
(LY95, LP, LM, LRCALL)	1.310(0.273)	2.303(0.074)†	1.079(0.387)
	B. Predicting LP		
(LY95, LP, LM)	0.475(0.754)	0.527(0.716)	0.727(0.581)
(LY95, LP, LM, RCALL)	0.734(0.571)	0.224(0.924)	0.336(0.851)
(LY95, LP, LM, LRCALL)	0.517(0.723)	0.262(0.901)	0.874(0.493)
	C. Predicting LY		
(LY, LM)	1.966(0.106)	2.201(0.082)†	0.798(0.535)
(LY, LP, LM)	1.512(0.205)	3.099(0.024)*	0.643(0.636)
(LY, LM, RCALL)	2.016(0.099)†	2.092(0.097)†	0.638(0.639)
(LY, LM, LRCALL)	2.150(0.081)†	2.174(0.086)†	1.352(0.274)
(LY, LM, RCALL, LP)	1.488(0.213)	2.501(0.056)†	0.381(0.820)
(LY, LM, LRCALL, LP)	1.743(0.148)	2.660(0.045)*	1.344(0.280)

Notes: This table reports F statistics testing the restriction that coefficients on bank loan growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences. Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Figure 1. Money Supply Growth and Income Growth in Japan

—— 1976:1-2003:4, changes from the previous year ——

A. M2 growth and real GDP growth



B. M2 growth and nominal GDP growth

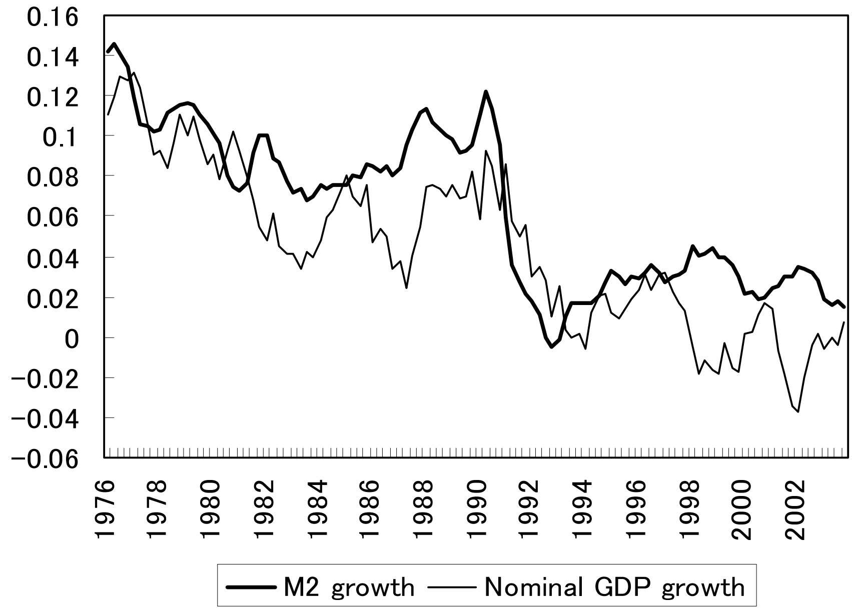


Figure 2. Bank Loans, Time Deposits+CD, and Demand Deposits in Japan
—— 1975:1-2003:4 (in trillion yen) ——

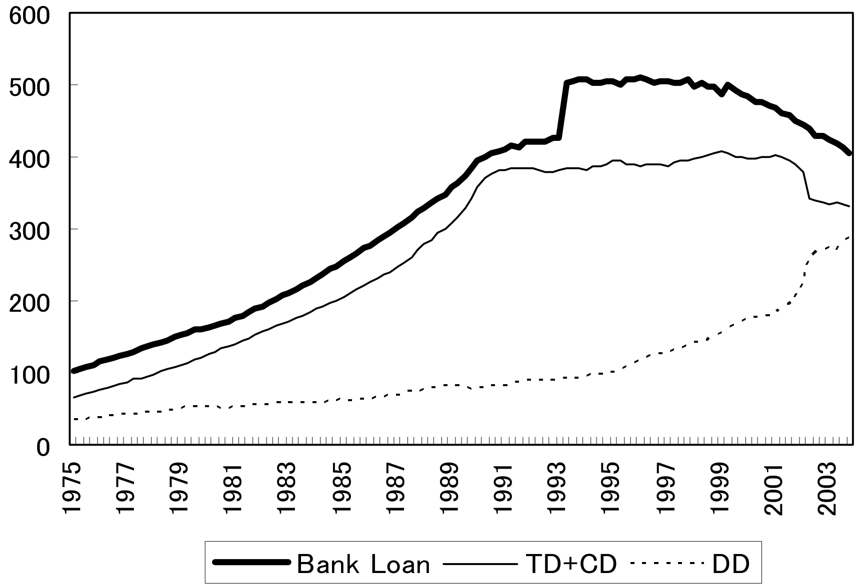
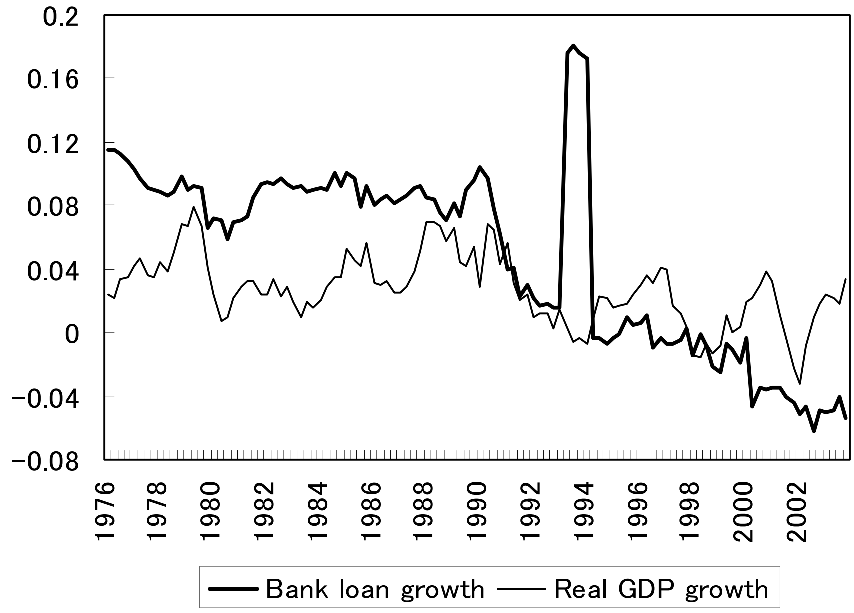


Figure 3. Bank Loan Growth and Income Growth in Japan
—— 1976:1-2003:4, changes from the previous year ——



Appendix

Table A-1. Predictive Content of Monetary Base

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM)	2.258(0.110)	2.209(0.120)	0.626(0.540)
(LY95, LP, LM, RCALL)	2.428(0.094)†	2.422(0.098)†	0.684(0.511)
(LY95, LP, LM, LRCALL)	2.275(0.108)	2.432(0.098)†	0.719(0.494)
	B. Predicting LP		
(LY95, LP, LM)	0.321(0.726)	0.566(0.571)	2.434(0.102)
(LY95, LP, LM, RCALL)	1.223(0.299)	0.043(0.958)	1.934(0.160)
(LY95, LP, LM, LRCALL)	0.078(0.925)	0.062(0.940)	2.247(0.121)
	C. Predicting LY		
(LY, LM)	0.675(0.512)	2.136(0.127)	0.276(0.760)
(LY, LP, LM)	1.159(0.318)	3.424(0.040)*	0.024(0.976)
(LY, LM, RCALL)	0.398(0.673)	1.052(0.356)	0.375(0.690)
(LY, LM, LRCALL)	0.657(0.521)	1.166(0.319)	0.114(0.893)
(LY, LM, RCALL, LP)	0.750(0.475)	2.132(0.129)	0.037(0.964)
(LY, LM, LRCALL, LP)	1.514(0.225)	2.277(0.113)	0.075(0.928)
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM)	2.150(0.081)†	2.454(0.059)†	0.327(0.858)
(LY95, LP, LM, RCALL)	2.630(0.040)*	3.007(0.028)*	0.839(0.512)
(LY95, LP, LM, LRCALL)	0.778(0.542)	3.400(0.017)*	0.093(0.984)
	B. Predicting LP		
(LY95, LP, LM)	0.091(0.985)	0.949(0.444)	0.893(0.480)
(LY95, LP, LM, RCALL)	0.396(0.811)	1.091(0.373)	0.551(0.700)
(LY95, LP, LM, LRCALL)	0.129(0.971)	0.824(0.517)	1.146(0.356)
	C. Predicting LY		
(LY, LM)	1.644(0.170)	3.957(0.007)**	0.248(0.909)
(LY, LP, LM)	1.923(0.113)	4.957(0.002)**	0.031(0.998)
(LY, LM, RCALL)	1.301(0.276)	3.356(0.017)*	0.502(0.735)
(LY, LM, LRCALL)	0.616(0.652)	3.833(0.009)**	0.609(0.659)
(LY, LM, RCALL, LP)	1.552(0.194)	4.394(0.005)**	0.359(0.836)
(LY, LM, LRCALL, LP)	0.777(0.543)	4.879(0.002)**	0.504(0.733)

Notes: This table reports F statistics testing the restriction that coefficients on monetary base growth are zero (LM = logged monetary base). The regressions include two or four lags of variables listed in the first column, all in first differences. Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table A-2. Predictive Content of Stock Prices

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, FIN)	4.695(0.011)*	3.022(0.057)†	2.324(0.112)
(LY95, LP, FIN, RCALL)	4.858(0.010)*	3.173(0.050)†	2.243(0.121)
(LY95, LP, FIN, LRCALL)	4.046(0.021)*	3.199(0.049)*	2.717(0.080)†
	B. Predicting LP		
(LY95, LP, FIN)	0.865(0.424)	0.295(0.745)	1.724(0.192)
(LY95, LP, FIN, RCALL)	0.571(0.567)	0.306(0.737)	2.937(0.066)†
(LY95, LP, FIN, LRCALL)	0.841(0.434)	0.450(0.640)	1.492(0.239)
	C. Predicting LY		
(LY, FIN)	3.869(0.024)*	3.136(0.051)†	1.354(0.270)
(LY, LP, FIN)	3.949(0.022)*	3.531(0.036)*	0.743(0.483)
(LY, FIN, RCALL)	4.726(0.011)*	4.081(0.022)*	1.087(0.348)
(LY, FIN, LRCALL)	3.548(0.033)*	4.395(0.017)*	1.725(0.192)
(LY, FIN, RCALL, LP)	4.558(0.013)*	4.164(0.021)*	0.487(0.618)
(LY, FIN, LRCALL, LP)	3.606(0.031)*	4.484(0.016)*	0.926(0.406)
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, FIN)	2.720(0.034)*	2.653(0.045)*	1.219(0.323)
(LY95, LP, FIN, RCALL)	2.622(0.040)*	2.434(0.062)†	0.984(0.433)
(LY95, LP, FIN, LRCALL)	1.720(0.153)	2.212(0.084)†	1.026(0.412)
	B. Predicting LP		
(LY95, LP, FIN)	0.250(0.909)	0.633(0.641)	0.747(0.567)
(LY95, LP, FIN, RCALL)	0.110(0.979)	1.074(0.381)	1.364(0.273)
(LY95, LP, FIN, LRCALL)	0.279(0.891)	1.403(0.249)	1.082(0.385)
	C. Predicting LY		
(LY, FIN)	2.186(0.076)†	2.108(0.093)†	1.142(0.353)
(LY, LP, FIN)	2.428(0.053)†	2.928(0.030)*	0.963(0.442)
(LY, FIN, RCALL)	2.465(0.051)†	2.653(0.045)*	0.940(0.454)
(LY, FIN, LRCALL)	1.470(0.218)	2.321(0.071)†	1.341(0.277)
(LY, FIN, RCALL, LP)	2.513(0.047)*	3.403(0.017)*	1.211(0.329)
(LY, FIN, LRCALL, LP)	1.588(0.185)	3.075(0.026)*	1.232(0.321)

Notes: This table reports F statistics testing the restriction that coefficients on stock price growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences (FIN = logged stock prices). Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table A-3. Predictive Content of Exchange Rates

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, FIN)	0.800(0.452)	0.700(0.501)	0.349(0.708)
(LY95, LP, FIN, RCALL)	0.682(0.508)	0.620(0.542)	0.306(0.739)
(LY95, LP, FIN, LRCALL)	0.728(0.485)	0.639(0.532)	0.352(0.706)
	B. Predicting LP		
(LY95, LP, FIN)	1.388(0.254)	2.085(0.134)	0.013(0.987)
(LY95, LP, FIN, RCALL)	1.283(0.282)	2.221(0.119)	0.114(0.893)
(LY95, LP, FIN, LRCALL)	1.267(0.286)	1.861(0.166)	0.033(0.967)
	C. Predicting LY		
(LY, FIN)	0.097(0.907)	0.087(0.917)	0.258(0.774)
(LY, LP, FIN)	0.098(0.907)	0.007(0.993)	0.322(0.727)
(LY, FIN, RCALL)	0.274(0.761)	0.027(0.973)	0.143(0.867)
(LY, FIN, LRCALL)	0.099(0.905)	0.079(0.924)	0.184(0.833)
(LY, FIN, RCALL, LP)	0.320(0.727)	0.070(0.933)	0.172(0.843)
(LY, FIN, LRCALL, LP)	0.134(0.875)	0.146(0.865)	0.269(0.766)
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, FIN)	1.116(0.354)	1.103(0.366)	0.783(0.545)
(LY95, LP, FIN, RCALL)	1.043(0.390)	1.100(0.369)	0.983(0.434)
(LY95, LP, FIN, LRCALL)	1.281(0.284)	0.966(0.436)	0.725(0.583)
	B. Predicting LP		
(LY95, LP, FIN)	2.315(0.063)†	2.210(0.082)†	0.508(0.730)
(LY95, LP, FIN, RCALL)	1.045(0.389)	1.040(0.398)	0.648(0.633)
(LY95, LP, FIN, LRCALL)	2.102(0.087)†	0.938(0.451)	0.551(0.700)
	C. Predicting LY		
(LY, FIN)	0.367(0.831)	0.351(0.842)	0.978(0.432)
(LY, LP, FIN)	0.264(0.900)	0.122(0.974)	1.265(0.305)
(LY, FIN, RCALL)	0.515(0.725)	0.305(0.873)	0.920(0.465)
(LY, FIN, LRCALL)	0.182(0.947)	0.280(0.889)	0.847(0.506)
(LY, FIN, RCALL, LP)	0.474(0.755)	0.289(0.883)	1.255(0.312)
(LY, FIN, LRCALL, LP)	0.138(0.968)	0.271(0.895)	1.160(0.350)

Notes: This table reports F statistics testing the restriction that coefficients on foreign exchange rate growth are zero. The regressions include two or four lags of variables listed in the first column, all in first differences (FIN = logged yen-dollar rate). Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table A-4. Predictive Content of Interest Rates

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM, RCALL)	0.919(0.402)	1.165(0.320)	0.063(0.939)
(LY95, LP, LM, LRCALL)	2.563(0.082)†	0.669(0.517)	2.887(0.069)†
	B. Predicting LP		
(LY95, LP, LM, RCALL)	3.118(0.049)*	4.368(0.018)*	0.069(0.933)
(LY95, LP, LM, LRCALL)	1.081(0.343)	4.458(0.016)*	0.290(0.750)
	C. Predicting LY		
(LY, LM, RCALL)	1.645(0.198)	3.642(0.033)*	0.195(0.824)
(LY, LM, LRCALL)	1.400(0.251)	2.463(0.095)†	1.434(0.251)
(LY, LM, RCALL, LP)	1.152(0.320)	1.975(0.149)	0.088(0.916)
(LY, LM, LRCALL, LP)	2.752(0.069)†	1.223(0.302)	2.500(0.097)†
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM, RCALL)	0.617(0.652)	0.516(0.724)	1.570(0.211)
(LY95, LP, LM, LRCALL)	2.060(0.093)†	0.830(0.513)	2.723(0.050)†
	B. Predicting LP		
(LY95, LP, LM, RCALL)	3.901(0.006)**	2.981(0.029)*	0.181(0.946)
(LY95, LP, LM, LRCALL)	1.492(0.212)	2.516(0.055)†	1.837(0.151)
	C. Predicting LY		
(LY, LM, RCALL)	1.045(0.388)	1.483(0.222)	0.863(0.497)
(LY, LM, LRCALL)	2.088(0.089)†	1.241(0.307)	2.152(0.098)†
(LY, LM, RCALL, LP)	1.009(0.407)	0.672(0.615)	1.594(0.205)
(LY, LM, LRCALL, LP)	2.229(0.072)†	0.599(0.665)	3.462(0.021)*

Notes: This table reports F statistics testing the restriction that coefficients on interest rate variables (RCALL or LRCALL) are zero. The money supply variable (LM) is M2. The regressions include two or four lags of variables listed in the first column, all in first differences. Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table A-5. Predictive Content of the Interest Rate Spread

Regressors	75:1-2003:4	75:1-92:4	93:1-2003:4
<LAG = 2>	*A. Predicting LY95*		
(LY95, LP, LM, SPRD)	0.276(0.759)	0.476(0.624)	1.958(0.156)
(LY95, LP, LM, RCALL,SPRD)	0.064(0.938)	0.021(0.979)	2.175(0.130)
(LY95, LP, LM, LRCALL,SPRD)	0.513(0.600)	0.092(0.913)	1.640(0.209)
	B. Predicting LP		
(LY95, LP, LM, SPRD)	2.049(0.134)	1.634(0.205)	2.185(0.128)
(LY95, LP, LM, RCALL,SPRD)	0.222(0.801)	0.486(0.618)	2.389(0.107)
(LY95, LP, LM, LRCALL,SPRD)	1.408(0.250)	0.439(0.647)	2.195(0.127)
	C. Predicting LY		
(LY, LM, SPRD)	0.898(0.411)	1.187(0.313)	5.279(0.010)*
(LY, LM, SPRD, LP)	0.096(0.909)	0.098(0.907)	6.297(0.005)*
(LY, LM, RCALL, SPRD)	0.336(0.716)	0.028(0.972)	5.144(0.011)*
(LY, LM, LRCALL, SPRD)	1.002(0.371)	0.125(0.883)	5.496(0.008)**
(LY, LM, RCALL, LP, SPRD)	0.079(0.924)	0.174(0.841)	6.367(0.005)**
(LY, LM, LRCALL, LP, SPRD)	0.007(0.993)	0.063(0.939)	6.330(0.005)**
<LAG = 4>	*A. Predicting LY95*		
(LY95, LP, LM, SPRD)	0.524(0.718)	0.757(0.559)	1.699(0.179)
(LY95, LP, LM, RCALL,SPRD)	0.648(0.630)	0.667(0.619)	0.570(0.687)
(LY95, LP, LM, LRCALL,SPRD)	0.787(0.537)	0.862(0.495)	0.761(0.561)
	B. Predicting LP		
(LY95, LP, LM, SPRD)	4.029(0.005)*	3.697(0.011)*	1.707(0.178)
(LY95, LP, LM, RCALL,SPRD)	1.161(0.334)	0.885(0.482)	1.798(0.164)
(LY95, LP, LM, LRCALL,SPRD)	3.805(0.007)*	1.422(0.245)	1.372(0.274)
	C. Predicting LY		
(LY, LM, SPRD)	0.436(0.782)	1.878(0.130)	3.252(0.024)*
(LY, LM, SPRD, LP)	0.444(0.777)	1.182(0.332)	2.845(0.043)*
(LY, LM, RCALL, SPRD)	0.781(0.540)	1.508(0.217)	2.322(0.082)†
(LY, LM, LRCALL, SPRD)	1.033(0.395)	2.683(0.044)*	1.775(0.163)
(LY, LM, RCALL, LP, SPRD)	0.744(0.565)	1.239(0.311)	1.790(0.165)
(LY, LM, LRCALL, LP, SPRD)	0.553(0.697)	1.844(0.140)	1.272(0.310)

Notes: This table reports F statistics testing the restriction that coefficients on the interest rate spread (10-year government bond rate minus 3-month Gensaki rate, denoted as SPRD) are zero. The money supply variable (LM) is M2. The regressions include two or four lags of variables listed in the first column, all in first differences (except for SPRD). Dependent variables in first differences are indicated at the top of each panel. P-values are reported in parentheses. **, *, and † indicate that the restriction is rejected by the 1%, 5%, and 10% significance levels, respectively.

Table A-6. Stability Test Results

Model	CUSUM-type	Exp-LM	CHOW95	CHOW97
		A. Predicting LY95		
(LY95, LP, LM2)	0.73	11.18†	1.70†	2.07*
(LY95, LP, LM2, RCALL)	0.69	14.73†	2.01*	1.74†
(LY95, LP, LM2, LRCALL)	0.77	15.11*	1.66†	1.39
		B. Predicting LP		
(LY95, LP, LM2)	0.59	20.39**	1.07	0.81
(LY95, LP, LM2, RCALL)	0.53	21.33**	1.04	0.83
(LY95, LP, LM2, LRCALL)	0.63	24.91**	1.10	0.77
		C. Predicting LY		
(LY, LM2)	0.68	7.39	1.42	2.36*
(LY, LM2, LP)	0.83	14.40*	2.17*	2.60**
(LY, LM2, RCALL)	0.77	9.64	1.35	1.85*
(LY, LM2, LRCALL)	0.83	9.27	1.14	1.36
(LY, LM2, LP, RCALL)	0.81	16.41*	2.16*	1.98*
(LY, LM2, LP, LRCALL)	0.87	15.43*	1.82*	1.65†

Notes: This table reports statistics testing for parameter stability in the regression models listed in the first column. Variables are all in first differences and dependent variables are indicated at the top of each panel. The CUSUM-type test is proposed by Ploberger and Kramer (1992) and rejects the stability if the model systematically over- or under-forecasts the dependent variable. Exp-LM is proposed by Andrews and Ploberger (1994) and tests the null of parameter constancy against the alternative that regression coefficients shift at an unknown date. The first and last 15% of observations of the total sample are trimmed in this procedure. CHOW95 and CHOW97 are the conventional Chow tests, testing for a break in 1995:3 and 1997:4, respectively. The regressions include four lags for all these tests. **, *, and † indicate that the null of stability is rejected by the 1%, 5%, and 10% significance levels, respectively.