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ABSTRACT

Should Monetary Policy be Adjusted Frequently?*

This paper considers the optimal frequency of central bank decision-making. This frequency affects the central bank's flexibility to respond to economic shocks in a timely fashion and also its credibility to maintain low inflation. Generally, the central bank resets monetary policy less often than the arrival of economic news. By adjusting monetary policy less frequently, the central bank achieves lower inflation at the cost of somewhat higher output variability. Evidence for several key countries (Australia, Germany, Japan, the United Kingdom and the United States) shows that the frequency of actual monetary policy changes is indeed positively related to the inflation rate.

JEL Classification: D78, E58
Keywords: monetary policy frequency, inflation

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NON-TECHNICAL SUMMARY

The frequency of monetary policy adjustments varies considerably among nations. Measured by discount rate changes, Japan, Germany, the United States, the United Kingdom and Australia change monetary policy with a frequency in increasing order. As proxied by the indices of Boschen and Mills (1995) and Dominguez (1996), again Japan, Germany and the United States change their monetary policy with increasing frequency. This variation probably does not only reflect differing arrival frequencies of relevant economic data in these countries. Policy adjustment frequencies no doubt also reflect central bankers' views on how often they should signal a change in policy. Asked whether monetary policy should be conducted by way of many small interest steps, the European Central Bank (ECB) president Duisenberg responded: 'No, as few steps as possible. Rather a policy that is not influenced by the folly of the day, but directed at the medium-term future.'

Why do central bankers restrain themselves from fine-tuning policy in response to news as it arrives? To answer this question, this paper suggests that central bankers gain credibility by having a reputation for maintaining the same policy stance for some time. If today's policy is meant to be still in force several months or even half a year from now, then the cost of an inflationary policy today (i.e. higher inflation) is still around in the medium term, while the benefits (higher output growth because of the 'surprise' element of the policy) have worn out by then. A policy focused on the medium term thus is less inflationary. At the same time, policies that are maintained for some time, almost by definition are less responsive to economic shocks as they occur. Maintaining a monetary policy stance for some time may therefore produce higher costs in terms of output growth variability.

These issues are considered in a theoretical model where shocks occur each period, but the monetary authority has chosen to change monetary policy only every *n* periods. Generally, the central bank adjusts monetary policy every period, every so often, or once-and-for-all. These are the cases where the central bank focuses on the very short term, the medium term, or the (very) long term. The optimal decision-making frequency is shown to increase with the variability of output shocks and the central bank's discount rate applied to future economic outcomes, while it decreases with the responsiveness of output to inflation and the central bank's weight on its output target. By choosing a lower policy frequency, the central bank, *ceteris paribus*, achieves a lower average inflation and variability of inflation, while the average level of output growth and its variability are not, respectively, positively affected.

International variation in actual monetary policy frequencies may reflect different deviations from the optimal monetary policy frequencies, as well as different underlying economic fundamentals and thus different optimal frequencies. As an example of the latter, we consider international differences in the variability of output growth shocks. With this kind of variation, the optimal frequency of monetary policy and the average level and variability of inflation are positively related. Average output growth is not correlated with the monetary policy frequency, while the correlation between output growth variability and the monetary policy frequency is theoretically ambiguous. These relationships are illustrated with a simple parameterization of the model.

For five countries (Australia, Germany, Japan, the United Kingdom and the United States) we construct, where feasible, indices of the actual frequency of monetary policy changes. For these countries, we also present evidence on the average levels and variability of inflation and output growth. The apparent cross-country relationships between the monetary policy frequency and the inflation and output variables correspond well with the model. In particular, countries with a low monetary policy frequency appear to have lower average inflation and variability of inflation. The low average inflation in Japan in particular matches well with the relatively low frequency of monetary policy decisions in this country. In previous work, the low inflation rate of Japan has figured as a puzzle, as several authors have reported that the Bank of Japan has a relatively low degree of independence (see Cargill, Hutchison and Ito, (1997)).

In sum, the experiences of the Bundesbank, the Bank of Japan and, to a lesser extent, the Federal Reserve System show that a low frequency of monetary policy adjustments is associated with a low (variability of) inflation. The evidence of this paper is especially relevant for the ECB, which is responsible for monetary policy-making in Euroland as of 1 January 1999. As suggested by Duisenberg, president of the ECB, monetary policy should not be conducted by way of many small interest steps. Indeed, the value of a central banker may be determined as much by the number of policy interventions they make as by the policies they choose at those occasions.

1. Introduction

Central banks tend to have well worked-out decision making procedures. These procedures stipulate who has the power to decide about what monetary policy variables at what moment. The design of the central bank decision making council and its degree of independence are generally agreed to be important in determining inflation outcomes (see e.g. Eijffinger and De Haan (1996)). For decisions to be made, the central bank council generally has to meet in one place and, therefore, the rules that determine when central bankers meet are important as well. Central banks tend to hold meetings to discuss monetary policy at regular intervals. The Federal Open Market Committee (FOMC) of the Federal Reserve System in the United States, for instance, meets every six weeks. The Governing Council of the European Central Bank (ECB) is scheduled to meet every two weeks, thereby copying the frequency of meetings by the council of the Deutsche Bundesbank.

The frequency of formal central bank council meetings can be taken to be an upper bound on the frequency of actual monetary policy meeting, although in exceptional circumstances the council may decide to adjust policy in between official council meetings. More important than the frequency of formal policy meetings is, of course, the frequency of actual monetary policy making. Given the importance of the discount rate in many countries, a change in actual monetary policy making can be proxied by a change in this interest rate. More broadly, a change in monetary policy can be seen as a change in the overall monetary policy stance (generally speaking, monetary policy can be expansionary, neutral, or contractionary). Boschen and Mills (1995) have constructed a useful index of the monetary policy stance for the United States, which was subsequently extended to Germany and Japan by Dominguez (1996).

The actual frequency of monetary policy changes by nations of interest with autonomous monetary policies shows considerable variation. As proxied by discount rate changes, Japan, Germany, the United States the United Kingdom and Australia change monetary policy with a frequency in increasing order. Measured by the indices of Boschen and Mills (1995) and Dominguez

(1996), we see that Japan, Germany and the United States change their monetary policy stance with increasing frequency. It is not likely that this variation in monetary policy frequency only reflects differing arrival frequencies of relevant economic data in these countries. These frequencies no doubt also reflect central bankers' views on how often they should signal a change in policy. Asked whether monetary policy should be conducted by way of many small interest steps, ECB president Duisenberg responded: 'No, as few steps as possible. Rather a policy that is not influenced by the folly of the day, but directed at the medium term future.' [1]

Why do central bankers restrain themselves from fine-tuning policy in response to news as it arrives? To answer this question, this paper suggests that central bankers gain credibility by having a reputation for maintaining the same policy stance for some time. If today's policy is meant to still be in force several months or even half a year from now, then the cost of an inflationary policy today (i.e. higher inflation) is still around in the medium term, while the benefits (higher output growth because of the 'surprise' element of the policy) by then have worn out. A policy focused on the medium term thus is less inflationary. At the same time, policies that are maintained for some time almost by definition are less responsive to economic shocks as they occur. Maintaining a monetary policy stance for some time may therefore produce higher costs in terms of output growth variability.

These issues are considered in a theoretical model where shocks occur each period, but the monetary authority has chosen to change monetary policy only every *n* periods. Generally, the central bank adjusts monetary policy every period, every so often, or once-and-for-all. These are the cases where the central bank focuses on the very short term, the medium term, or the (very) long term. The optimal decision making frequency is shown to increase with the variability of output shocks and the central bank's discount rate applied to future economic outcomes, while it decreases with the responsiveness of output to inflation and the central bank's weight on its output target. By choosing a lower policy frequency, the central bank ceteris paribus achieves a lower average inflation and variability of inflation, while the average level of output growth and its variability are not, respectively, positively affected.

International variation in actual monetary policy frequencies may reflect different deviations from the optimal monetary policy frequencies, as well as different underlying economic fundamentals and thus different optimal frequencies. As an example of the latter, we consider international differences in the variability of output growth shocks. With this kind of variation, the optimal frequency of monetary policy and the average level and variability of inflation are positively related. Average output growth is not correlated with the monetary policy frequency, while the correlation between output growth variability and the monetary policy frequency is theoretically ambiguous. These relationships are illustrated with a simple parameterization of the model.

For five countries (Australia, Germany, Japan, the United Kingdom, and the United States) we construct where feasible indices of the actual frequency of monetary policy changes. For these countries, we also present evidence on the average levels and variability of inflation and output growth. The apparent cross-country relationships between the monetary policy frequency and the inflation and output variables correspond well with the model. In particular, countries with a low monetary policy frequency appear to have lower average inflation and variability of inflation. The low average inflation in Japan in particular matches well with the relatively low frequency of monetary policy decisions in this country. In previous work, the low inflation rate of Japan has figured as a puzzle, as several authors have reported that the Bank of Japan has a relatively low degree of independence (see Cargill, Hutchison and Ito, (1997)).

The remainder of this paper is as follows. Section 2 sets out the theoretical model and its implications. Section 3 presents the empirical measures of the frequency of central bank policy adjustments for respectively five and three countries against the background of these countries' inflation and growth experiences. Section 4 concludes.

2. **The model**

Let y_t be the output growth in period t. In standard fashion, output growth is related to inflation in excess of the inflationary expectations, $\pi_t - \pi_t^e$, and to an economic shock, ε_t, as follows

$$y_t = \alpha(\pi_t - \pi_t^e) + \varepsilon_t \qquad t = 1, .., n \tag{1}$$

The shock ε_t is an independently and identically distributed random variable with zero mean and variance σ_ε^2. The inflationary expectations π_t^e for period t are formed by private agents as of period $t - 1$, before they have observed the realization of ε_t. Monetary policy in period t consists of the determination of the actual inflation rate, π_t. When setting period t's inflation rate, the central bank council has learned the realization of the economic shock, ε_t.

The central bank resets monetary policy as proxied by the inflation rate each period or instead at a lower frequency. If the duration of the monetary policy cycle is n, then the central bank sets monetary policy in period 1 for periods $1,...,n$. The next opportunity to reset monetary policy then arrives in period $n + 1$. We will assume that central banks themselves, or the empowering governments, can choose the frequency n of central bank decision making. It is less important whether this is done by formal or informal arrangements.

Two different stages of monetary policy making can now be distinguished. First, the central bank chooses the duration n of the monetary policy cycle. Second, the central bank sets actual monetary policy at the beginning of each monetary policy cycle to remain in force for the duration of the cycle. These two aspects of the monetary policy problem are analyzed in reverse order. Thus, we first consider the determination of inflation for a given frequency, n, and then return to the question of the optimal monetary policy itself.

Following earlier work, e.g. Kydland and Prescott (1977) and Barro and Gordon (1983), the government has an output growth target of $y^* > 0$, and an inflation target of zero. Deviations from these targets figure in the government's loss function, L_t, as follows

$$L_t = \lambda(y_t - y^*)^2 + \pi_t^2 \quad t = 1, .., n \tag{2}$$

The government's discount rate is δ. When setting the inflation rate π_1 in period 1, the central bank has an effective horizon till the end of the current monetary policy cycle in period n. Therefore, the government will choose π_1 so as to maximize the present value of expected losses till period n. Equivalently, the government minimizes the certainty equivalence of the expected economic loss, denoted L_n^a, over the decision making cycle as given by

$$L_n^a = \frac{1}{\Delta_n} \sum_{i=1}^{n} \delta^{i-1} E L_i$$

(3)

where $\Delta_n = \frac{1-\delta^n}{1-\delta}$ is the value of a unit annuity stream from period 1 to period n, and E is the expectations operator. The central bank sets inflation for the entire decision making cycle, and hence π_t^2 in (1) is fixed at π_1^2 during the entire cycle. In period 1, agents observe the actual inflation π_1 and they (correctly) set their inflationary expectations for periods $2,\ldots,n$ equal to π_1. Noting (1), we see that output now just equals the random shock, i.e. $y_t = \varepsilon_t$ during periods $2,\ldots,n$.

Minimizing L_n^a in (3) now implies the following optimality condition regarding first-period monetary policy

$$\alpha \lambda \, [\alpha(\pi_1 - \pi_1^e) - y^* + \varepsilon_1] + \Delta_n \pi_1 = 0 \tag{4}$$

The weight Δ_n on first-period inflation π_1 in (4) reflects that inflation remains at the same level for the entire n-period cycle. Knowing the central bank's decision rule in (4), private agents form their inflationary expectation, π_1^e, as of the previous period as follows

$$\pi_1^e = \frac{\alpha\lambda}{\Delta_n} y^* \tag{5}$$

Substituting for π_1^e from (5) into (4), we see that the actual inflation rate, π_1, is given

$$\pi_t = \alpha \lambda \left[\frac{y^*}{\Delta_n} - \frac{\varepsilon_1}{\Delta_n + \varphi} \right] \qquad t = 1, .., n \tag{6}$$

with $\varphi = \alpha^2 \lambda$. From (6), we see that the responsiveness of actual inflation to the economic shock, ε_1, declines with the policy duration n, as Δ_n increases with n.[2]

Next, we turn to the determination of the optimal monetary policy length, n. As a first step, we need to evaluate the expression for the certainty equivalence of the central bank's loss in (3). To do so, note that we can calculate the expected (constant) loss associated with inflation for all periods $1,...,n$, after the duration n is determined, as follows

$$E\pi_t^2 = \lambda \varphi \left[(\frac{y^*}{\Delta_n})^2 + \frac{\sigma_\varepsilon^2}{(\Delta_n + \varphi)^2} \right] \qquad t = 1, .., n \tag{7}$$

The expected loss associated with first period output and the expected loss associated with output in periods $2,...,n$ are given by

$$E\,(y_1 - y^*)^2 = (y^*)^2 + \left(\frac{\Delta_n}{\Delta_n + \varphi} \right)^2 \sigma_\varepsilon^2 \tag{8a}$$

$$E\,(y_t - y^*)^2 = (y^*)^2 + \sigma_\varepsilon^2\,, \qquad t = 2, ..., n \tag{8b}$$

Eq. (7) indicates that a longer decision cycle n generates smaller expected losses associated with inflation (as Δ_n increases with n), while a longer decision horizon leads to higher expected losses associated with first period output only in (8a). We can use eqs. (7)-(8) to construct the certainty-equivalent economic loss function, L_n^a, for a given decision horizon n as follows

$$L_n^a = \lambda \left[\left(1 + \frac{\varphi}{\Delta_n^2} \right) (y^*)^2 + \left(1 - \frac{\varphi}{(\varphi + \Delta_n)\Delta_n} \right) \sigma_\varepsilon^2 \right] \tag{9}$$

Eq. (9) reflects the trade-off that a longer decision cycle, *n*, generates smaller inflation losses and higher overall output losses. The optimal horizon, *n*, is the one that minimizes L_n^a in (9) subject to the constraint that *n* is an integer. To gain insight into this problem, it is useful for now to ignore the integer constraint and to differentiate (9) with respect to *n* to reach

$$\frac{d L_n^a}{dn} = \frac{2\lambda\varphi}{\Delta_n^3}\left[-(y^*)^2 + \frac{1}{2}\left(1 + \frac{\Delta_n}{\varphi + \Delta_n}\right)\left(\frac{\Delta_n}{\varphi + \Delta_n}\right)\sigma_\varepsilon^2\right]\frac{d\Delta_n}{dn} \tag{10}$$

where $d\Delta_n / dn > 0$. The expression for dL_n^a/dn (10) can be of either sign. However, the term within square brackets in (10) increases with the duration *n*, so that $d L_n^a / dn = 0$ for at most one value of *n*. These facts allow for three possible values for the optimal decision horizon: (i) the optimal *n* equals *1* (monetary policy is reset each period), (ii) the optimal value of *n* is more than *1* but finite (monetary policy is reset every so often), (iii) the optimal *n* is infinite (monetary policy is set once-and-for-all).[3]

As sufficient conditions for cases (i) and (iii) to apply, we can state

a) If $\frac{d L_n^a}{d n}/_{n=1} > 0$, the optimal *n* is unity. As $\Delta_1 = 1$, we see from (9) that $\frac{d L_n^a}{dn}/_{n=1}$ has the same sign as

$$-(y^*)^2 + \frac{1}{2}\left[1 + \frac{1}{\varphi + 1}\right]\left[\frac{1}{\varphi + 1}\right]\sigma_\varepsilon^2$$

b) If $\frac{d L_n^a}{dn}/_{n=\infty} < 0$, then the optimal *n* is infinity. As $\Delta_\infty = 1/(1-\delta)$, we see from (10) that $\frac{d L_n^a}{d n}/_{n=\infty}$ has the same sign as

$$-(y^*)^2 + \frac{1}{2}\left[1 + \frac{1}{\varphi(1-\delta) + 1}\right]\left[\frac{1}{\varphi(1-\delta) + 1}\right]\sigma_\varepsilon^2$$

These sufficient conditions immediately indicate how various model parameter affect the occurrence of the extreme cases of either continually or never adjusted monetary policies. For instance, for σ_ε^2 large (small) enough, monetary policy will always (never) be adjusted. Next, we consider the possibility of case (ii) with an interior optimal monetary policy frequency. Clearly, the sufficient conditions for cases (i) and (iii) as stated above now have to be violated. These violations, however, by themselves are not a sufficient condition for the optimal value of *n* to indeed have an interior value. The reason is that these conditions do not exclude the possibility that $L_1^a < L_2^a$ (in this instance, the continuous loss function L_t^a reaches a minimum for *n* between *0* and *1)*. Hence, apart from the violation of the above conditions a necessary condition for an interior optimal frequency is $L_1^a \geq L_2^a$.[4] In practice, central banks appear to reset monetary policy with some regularity, but less frequently than the arrival of economic news. This suggests that the optimal monetary policy frequency has an interior value as in case (ii).

For now, assume that indeed there is a unique interior optimal frequency of central bank decision making. A (very) small change in a model parameter then generally does not change the optimal frequency, given that this frequency is constrained to be an integer. The optimality condition (10), however, indicates how large enough changes in model parameters affect the optimal frequency. Specifically, from (10) we see that the optimal *n* is positively related to large increases in y^*, α and λ, while it is negatively related to large increases in σ_ε^2 and δ.[5]

Next, we examine the implications of the monetary policy frequency for inflation and output growth performance. To start, we consider variation in the policy frequency per se that is unrelated to model fundamentals. First, from (5) we already saw that the expected, average inflation is negatively related to the policy duration *n* (and thus positively related to the monetary policy frequency *1/n*), while average output growth is always unaffected by the policy duration. Using (6), we further see that the variance of inflation can be written as

$$\sigma_{\pi}^{2} = \frac{\lambda \varphi}{(\Delta_n + \varphi)^2} \sigma_{\varepsilon}^{2} \tag{11}$$

which is negatively related to *n*. Finally, the variance of output growth is found to be

$$\sigma_{y}^{2} = \left[1 + \frac{1}{n} \left((\frac{\Delta_n}{\Delta_n + \varphi})^2 - 1 \right) \right] \sigma_{\varepsilon}^{2} \tag{12}$$

which is positively related to *n*.

Alternatively, let us assume that a given variation in the policy duration *n* optimally reflects variation in model fundamentals. As a relevant example, we focus on variation in the variability of economic growth shocks or σ_{ε}^{2}. Changes in σ_{ε}^{2} now generally affect the inflation and growth variables directly and through their effects on the policy duration *n*. The implied correlation between the expected inflation rate and the policy duration remains negative. To see this, simply note that the policy duration *n* is negatively related to σ_{ε}^{2} from (10) (if we ignore the integer constraint on *n*), while the expected inflation rate is negatively related to the policy duration *n* from (5).

To incorporate the integer constraint on *n*, the model is best analyzed with some simple calculations, as represented in Table 2. Here the growth shock variability σ_{ε}^{2} is increased from 1.0 to 2.0 with increments of 0.1. The optimal duration is consequently reduced from 7 to 4 in unit steps. The expected inflation increases in steps, only as *n* falls. Turning to the variance of inflation, σ_{π}^{2}, we see from eq. (11) that this variance increases on account of the assumed increases in σ_{ε}^{2} and the resulting reductions in n. In the table, we indeed see that the increase in σ_ε^2 is relatively large, as n falls. Finally, eq. (12) indicates that the output growth variability σ_y^2 increases with σ_ε^2 as well as with n. As n is reduced with σ_ε^2, there results an ambiguous correlation between the output growth variability σ_y^2 and the policy duration n. In the table, we see that indeed σ_y^2 increases with σ_ε^2, as long as n is kept unchanged. Each time n is reduced, however, the growth variability σ_y^2 falls. In these instances, the mitigating effect of a higher policy frequency on the variability of output growth dominates. Overall, the growth variability σ_y^2 is be positively correlated with the frequency of monetary policy (or $1/n$) in the table Finally, note that the value of the economic loss function unambiguously increases with the growth variability.

3 Empirical evidence

The section presents some international evidence on the frequency of monetary policy adjustments and its relationship with inflation and output growth experiences. The frequency of actual monetary policy making is, in first instance, proxied by the total number of discount rate changes during the sample period from January 1977 to December 1993.[6] The chosen countries are Australia, Germany, Japan, the United Kingdom and the United States. These five countries have maintained autonomous monetary policies during the sample period, and they were not materially restrained by an exchange rate regime like the EMS Exchange Rate Mechanism.[7] For the United Kingdom, the base rate of London clearing bank is chosen as the relevant proxy. This base rate is the rate at which clearing banks lend in the short run to high-quality borrowers, e.g. large companies. By its very short-term dealing rate, the Bank of England guides the base rate and, thus, the private sector lending rate of banks.

The time paths of the end-of-month discount rates (rediscount rate for Australia and base rate for the UK) is given in Figures 1 to 5. From January 1977 to December 1993, the total number of discount rate changes in Australia, Germany, Japan, the UK and the US is respectively 95, 32, 31, 87 and 47. Apparently, the highest numbers of official rate changes are found in Anglo-Saxon countries, such as Australia and the UK, while the lowest numbers apply to countries like Germany and Japan. The number of US discount rate changes is intermediate.

Another way of approximating the frequency of actual monetary policy making is by measuring changes in the monetary policy index as constructed by Boschen and Mills (1995) for the United States, and as subsequently extended to Germany and Japan by Dominguez (1996). In order to measure the US monetary policy stance, Boschen and Mills (1995) have created a dummy variable that takes on a value of two (or negative two) during periods when the Federal Reserve was strongly expansionary (contractionary), a value of one (or negative one) during periods of mild expansion (contraction), and a value of zero in case of neutral monetary policy.

The measurement of the monetary policy intentions of the Federal Reserve System are based on the minutes of meetings of its Federal Open Market Committee (FOMC) where monetary policy decisions are made. The FOMC usually meets eight times a year and consists of the seven members of the Board of Governors, the President of the Federal Reserve Bank of New York and four other Presidents of Federal Reserve Banks on a rotating basis. The Chairman of the Board of Governors is, by tradition, also chairman of the FOMC. The minutes of the FOMC are made public, including any dissenting statements, on the Friday after the following meeting, i.e. with a six week lag. A graphical depiction of the Boschen and Mills (1995) index is presented in Figure 6. From January 1977 to December 1993 the number of US monetary policy changes, according to the Boschen and Mills index, is a total of 24.

Analogous to the Boschen and Mills index, Dominguez (1996) describes the monetary policy decision process in Germany and Japan and creates monetary policy indices for the Bundesbank and the Bank of Japan. The Dominguez index equally ranges from -2 to +2 depending on the expansiveness of the monetary policies of the Bundesbank and the Bank of Japan.

Decisions on German monetary policy have been made until January 1, 1999 by the Central Bank Council (Zentralbankrat) of the Bundesbank which is made up of the Board of Directors (Direktorium) and the Presidents of the regional central banks (Landeszentralbanken). The Board of Directors is appointed by the federal government and the Presidents of the regional central banks by the upper house of the German parliament (Bundesrat) which itself is elected by the governments of the regional states (Länder). The Central Bank Council meets biweekly on Thursdays.

The Bundesbank, unlike the U.S. Federal Reserve, does not publish minutes of Council meetings where monetary policy decisions have been made. Therefore, Dominguez (1996) has inferred German monetary policy changes from monetary targets, movements in interest rates and monetary aggregates, and from descriptions provided in Bundesbank publications. The creation of the German monetary policy index requires three steps.

(1) Monetary policy regimes are categorized based on movements in the discount and Lombard rates. These rates determine the range within all other short-term interest rates move. Changes in

money growth targets are also examined determining the level of intensity of policy stances.

(2) Movements of the repo rate identify policy changes (or signals) if the repo rate changes prior to a change in the discount or Lombard rate, and if the repo is a volume-tender.

(3) The description of interest rate and monetary target changes in the Bundesbank Monthly Report are examined because they provide information on the magnitudes of policy changes and resolve areas of ambiguity.[8]

Dominguez (1996) describes in detail the major changes in Bundesbank monetary policy during the period from January 1977 to December 1993, and the ways in which the index reflects these decisions. Figure 7 presents a graphical depiction of the German monetary policy index. According to this index, the total number of monetary policy changes in Germany were only 15 within the sample period and, thus, less than in the United States.

According to the Bank of Japan Law, the Policy Board (Nihon Ginko Seisaku Iinkai) is the highest policy making body of the Bank of Japan.[9] It has the duty "... to formulate, direct and/or supervise currency regulation, credit control and other basic monetary policies" (article 13.2). The jurisdiction of the Policy Board covers all the major policy instruments such as the official discount rate, interbank and open-market operations, reserve requirement ratios and regulation of deposit interest rates. The Policy Board, whose meetings are usually held twice a week, consists of seven members: the Governor (Sosai) who customarily acts as chairman, four representatives of respectively the city banks, the regional banks, commerce and industry, and agriculture, and two representatives from the Ministry of Finance and the Economic Planning Agency who do not have voting rights. The decision making process in the Board, which is not made public, is done by majority voting.

In practice, the Policy Board has an advisory role, since monetary policy is effectively conducted by the Executive Committee (Yakuinkai) which includes only BoJ officials. The Executive Committee or "round table meeting" is actively engaged in day-to-day monetary policy implementation. It is composed of the Governor, Senior Deputy-Governor, Deputy-Governor for International Relations and the Executive Directors (currently six).

The Bank of Japan does not publish minutes of the Executive Committee meetings where monetary policy decisions are made. Consequently, Dominguez (1996) has inferred Japanese monetary policy changes, as for Germany, from movements in interest rates, the reserve progress ratio, monetary aggregates and from descriptions in Bank of Japan publications. The creation of the Japanese monetary policy index also requires three steps.

(1) Monetary policy regimes are categorized based on movements in the discount rate.

(2) Movements of the call rate and the reserve progress ratio, supplemented by press accounts, identify policy changes (or signals) prior to discount rate changes.

(3) Additional information on policy changes appears in discussions in the Bank of Japan Annual Report, its Annual Review, and its Monthly Economic Review.[10]

Dominguez (1996) again provides a detailed description of the major changes in Bank of Japan monetary policy during the period from January 1977 to December 1993, and the ways in which the index reflects decisions. Figure 8 gives a graphical depiction of the Japanese monetary policy index and shows that the total number of monetary policy changes in Japan were merely 13, the lowest within the G-3 countries.

The Boschen and Mills (1995) index of US monetary policy changes is, according to

Dominguez (1996), fundamentally an ex ante measure because it is based on the policy intentions of the FOMC as documented by the minutes of each meeting. The Dominguez (1996) indices of German and Japanese monetary policy changes instead are, by necessity, based on after-the-fact accounts of policy in central bank publications and on historical movements in monetary aggregates and interest rates and are, thus, not entirely equivalent. All three indices will be addressed by us together as the BMD indices.

Table 1 summarizes the data on the frequency of monetary policy changes, as measured by the number of discount rate changes and BMD index changes, respectively, and provides information on economic performance in terms of the average level and variance of the inflation rate (CPI; RPI for the UK), and the average level and variance of output growth (GDP) for Australia, Germany, Japan, the United Kingdom, and the United States for the period 1977-1993. Apparently, both the average inflation and the variance of the inflation are considerably higher in Anglo-Saxon countries, in particular Australia and the UK, than in Germany and Japan. The average inflation rate in the US appears to be intermediate, but the variance of its inflation rate is of the same order as in Australia. The differences in the levels and variances of output growth among the five countries are much smaller, although in Japan the average output growth is relatively high and its variance relatively low.

Figure 9 pictures the empirical relationship between the number of discount rate changes on the one hand, and the average and variance of inflation and output growth on the other for the five key countries. The empirical results support the idea that the level and variability of inflation are positively related to the frequency of monetary policy adjustments. They also suggest that the level of output growth is independent of the frequency of monetary policy adjustments. At the same time, the variability of output growth appears to be positively related to the frequency of monetary policy changes. An international variation in the variability of economic shocks can be a possible explanation of this last result, as analyzed before..

Figure 10 shows the empirical relationship between the number of BMD index changes on the one hand and the average and variance of inflation and output growth on the other. These relationships are largely in accordance with the earlier ones, but now only for the G-3 countries. Thus the empirical relationships in Figures 9 and 10 are robust across two different indices of monetary policy adjustment.[11]. Nevertheless, it should be emphasized that the empirical evidence presented here is just a first test of the implications of our model relating the frequency of monetary policy adjustments and and economic performance.

4. Conclusions

The experiences of the Bundesbank, the Bank of Japan and, to a lesser extent, the Federal Reserve System show that a low frequency of monetary policy adjustments is associated with a low (variability of) inflation. A relatively low frequency of policy adjustment is, of course, consistent with a medium term orientation on price stability. The evidence of this paper is especially relevant for the - European Central Bank, which is responsible for monetary policy making in Euroland as of January 1, 1999. As suggested by Duisenberg, president of the ECB, monetary policy should not be conducted by way of many small interest steps, or as he put it be ’influenced by the folly of the day’. Indeed, the value of a central banker may be determined by the number of his or her policy interventions as much as by the policies he chooses at those occasions.

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Table 1. Frequency of monetary policy changes and economic performance (January 1977 - December 1993)

Countries	Australia	Germany	Japan	UK	US
Discount rate changes	95	32	31	87	47
BMD index changes	-	15	13	-	24
Average inflation rate (CPI)	7.45	3.17	2.98	7.81	5.68
Variance inflation rate (CPI)	9.82	2.78	4.89	20.23	9.97
Average output growth (GDP)	2.85	2.28	3.91	1.95	2.51
Variance output growth (GDP)	4.66	3.68	2.25	5.00	4.53

Notes:

Rediscount rate for Australia and base rate for the UK.

BMD index based on Boschen and Mills (1995) for the US and on Dominguez (1996) for Germany and Japan.

Monetary policy changes are based on monthly data.

Relative changes of respectively CPI (RPI for UK) and GDP based on yearly data.

Sources: International Financial Statistics, IMF; Main Economic Indicators, OECD; Federal Reserve Bank of Australia; authors' own calculations.

Table 2. The monetary policy duration and output growth variability

σ_ε^2	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
Duration *n*	7	6	6	6	6	5	5	5	5	5	4
Economic Performance (x10)											
$E\pi$	1.32480	1.53794	1.53794	1.53794	1.53794	1.83636	1.83636	1.83636	1.83636	1.83636	2.28403
σ_π^2	0.16464	0.21512	0.21725	0.21938	0.22151	0.30154	0.30441	0.30728	0.31015	0.31302	0.45068
σ_y^2	9.65691	9.64451	9.74000	9.83549	9.93098	9.84856	9.94236	10.03615	10.12995	10.22375	9.99940
Loss value											
L_n^a	1.80866	1.81846	1.82822	1.83797	1.84772	1.85742	1.8671	1.87673	1.88638	1.89603	1.90566

Note that $y^* = 0.9$, $\alpha = 1$, $\lambda = 1$.

Endnotes

1. NRC Handelsblad, July 27, 1998, p. 35.

2. Even with a very long horizon, however, inflationary policy in the first period remains responsive to the first period shock, as Δ_∞ equals $1/(1-\delta)$.

3. Given that n is not a continuous but rather a discrete variable, there may be two rather than a single optimal n. Specifically, it is possible that the goverment obtains equal losses for discrete values of n equal to i and $i+1$, with i a positive integer. In these instances, the continuous loss function achieves a minimum for a value of n between i and $i+1$.

4. This can be seen to be equivalent to

$$\left[1-\frac{1}{(1+\delta)^2}\right](y^*)^2-\left[1-\frac{1}{(\varphi+1+\delta)(1+\delta)}\right]\sigma_\varepsilon^2 \geq 0.$$

5. Ignoring the integer constraint, we can solve for $\Delta_n = (1-\delta^n)/(1-\delta)$ from $dL_n^a/dn = 0$ in (10) as follows

$$\Delta_n = \varphi\left[\frac{\sqrt{\frac{1}{4}+2(\frac{y^*}{\sigma_\varepsilon})^2}-\frac{1}{2}}{1\frac{1}{2}-\sqrt{\frac{1}{4}+2(\frac{y^*}{\sigma_\varepsilon^2})}}\right].$$

6. Rediscount rates for Australia are available only till June 1993.

7. The United Kingdom participated only two years, specifically from October 1990 to September 1992, out of the 17 seventeen years in the EMS Exchange Rate Mechanism. In the paper, we abstract from this short period of EMS participation (and relatively restrained monetary policy) for the United Kingdom.

8. Finally, newspaper accounts reported in NEXIS resolve cases where the timing or magnitude of policy changes remain ambiguous.

9. For a detailed description of Japanese monetary policy making and the role of the Policy Board of the Bank of Japan, see Van Rixtel (1997), in particular pp. 206-214.

10. These publications generally contain formulaic discussions of policy so that when new sentences or phrases are included, it is reasonable to infer that a change has occurred. Finally, NEXIS coverage of statements and comments made by Bank of Japan officials provides additional information in cases where the timing or magnitude of a policy change remain ambiguous.

11. It should be noted that the BMD index, while incorporating discount rate changes, by construction is a much wider and more sophisticated measure of the monetary policy stance.

Figure 1 Rediscount rate Australia end of month

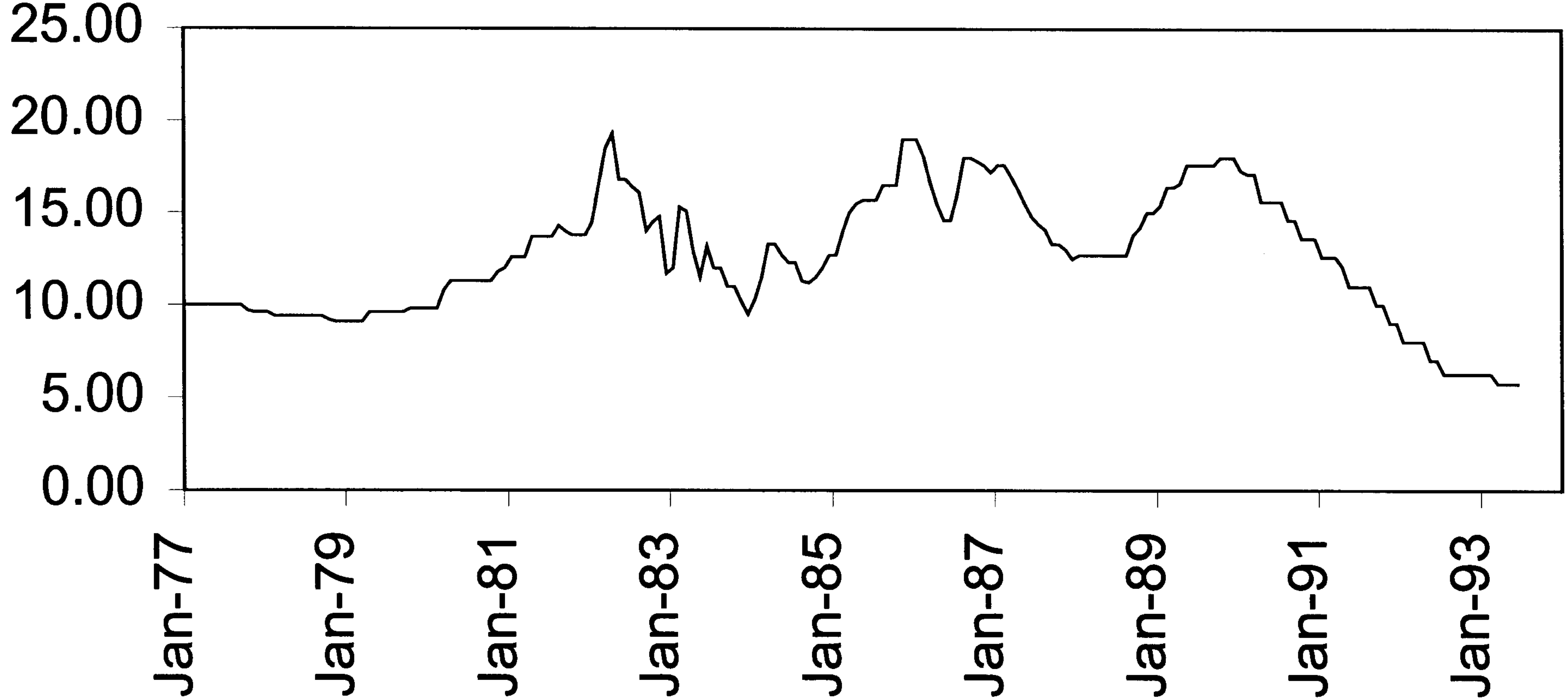

Figure 2 Discount rate Germany end of month

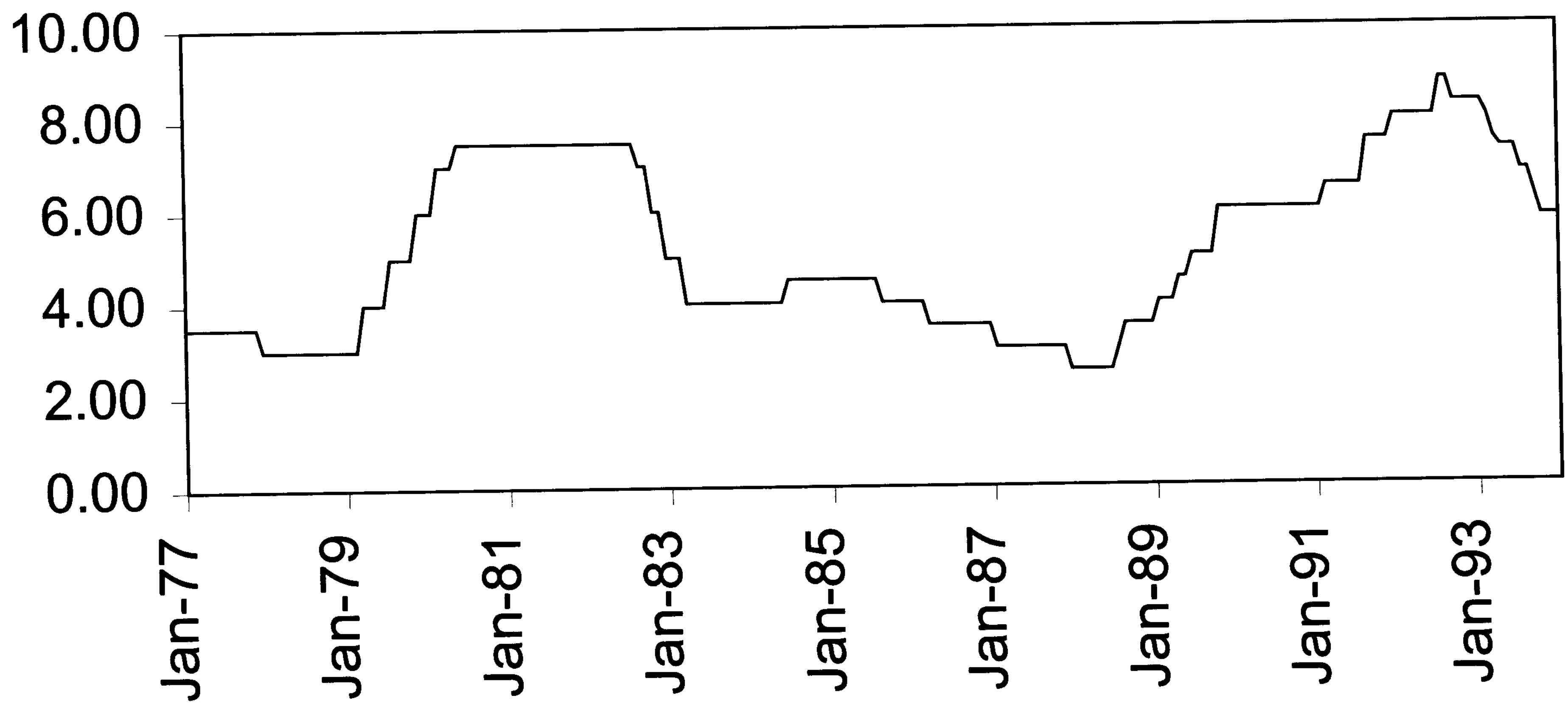

Figure 3 Discount rate Japan
end of month

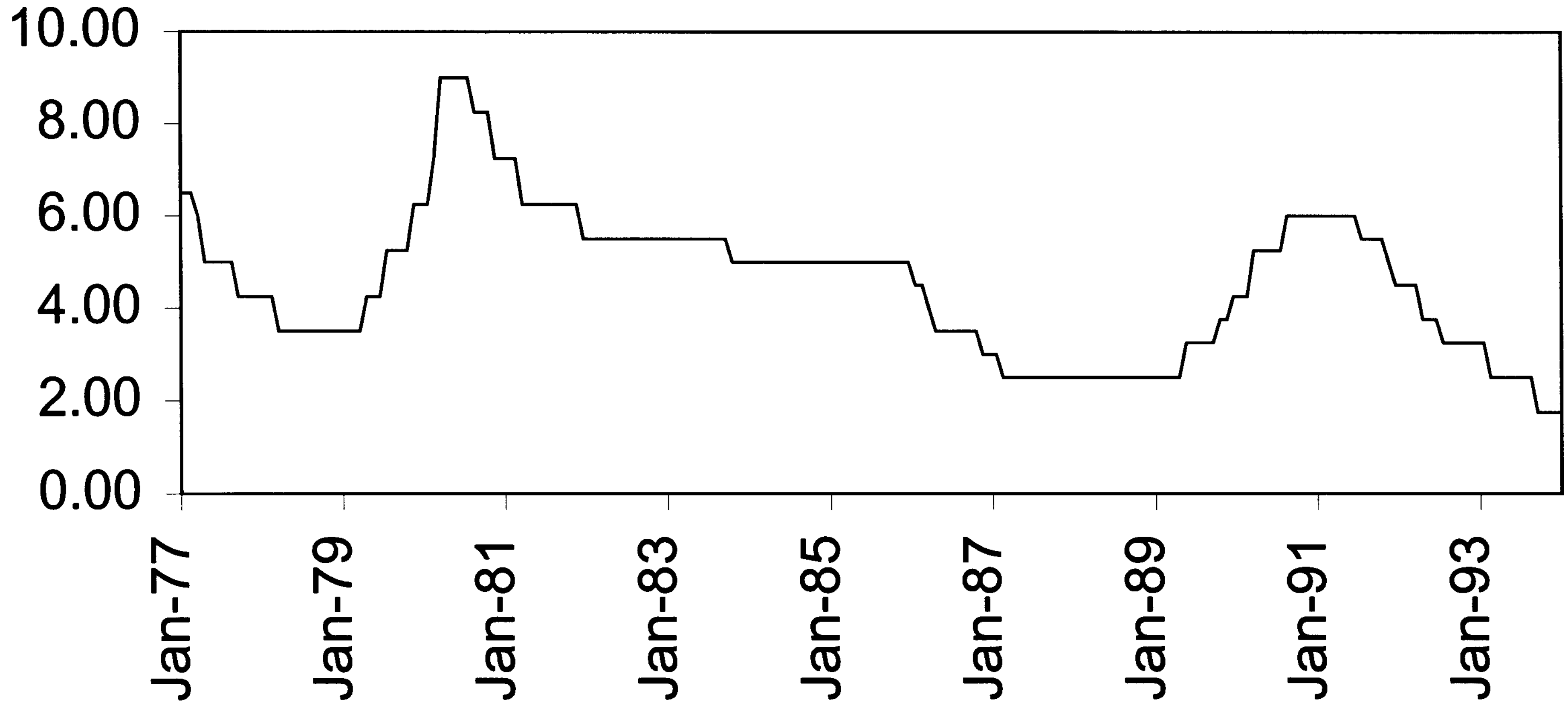

Figure 4 Clearing banks base rate U.K end of month

Figure 5 Discount rate U.S. end of month

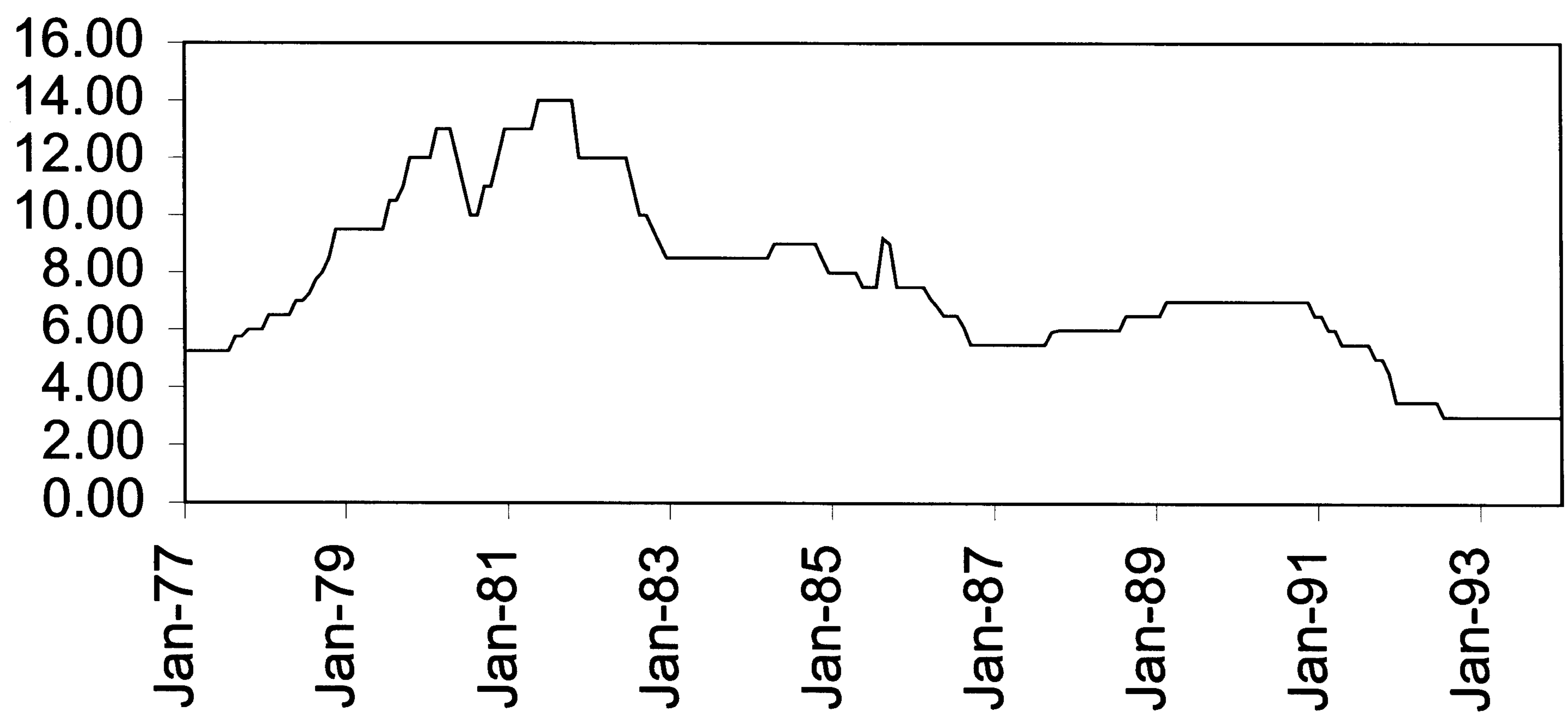

Figure 6 BMD index U.S.

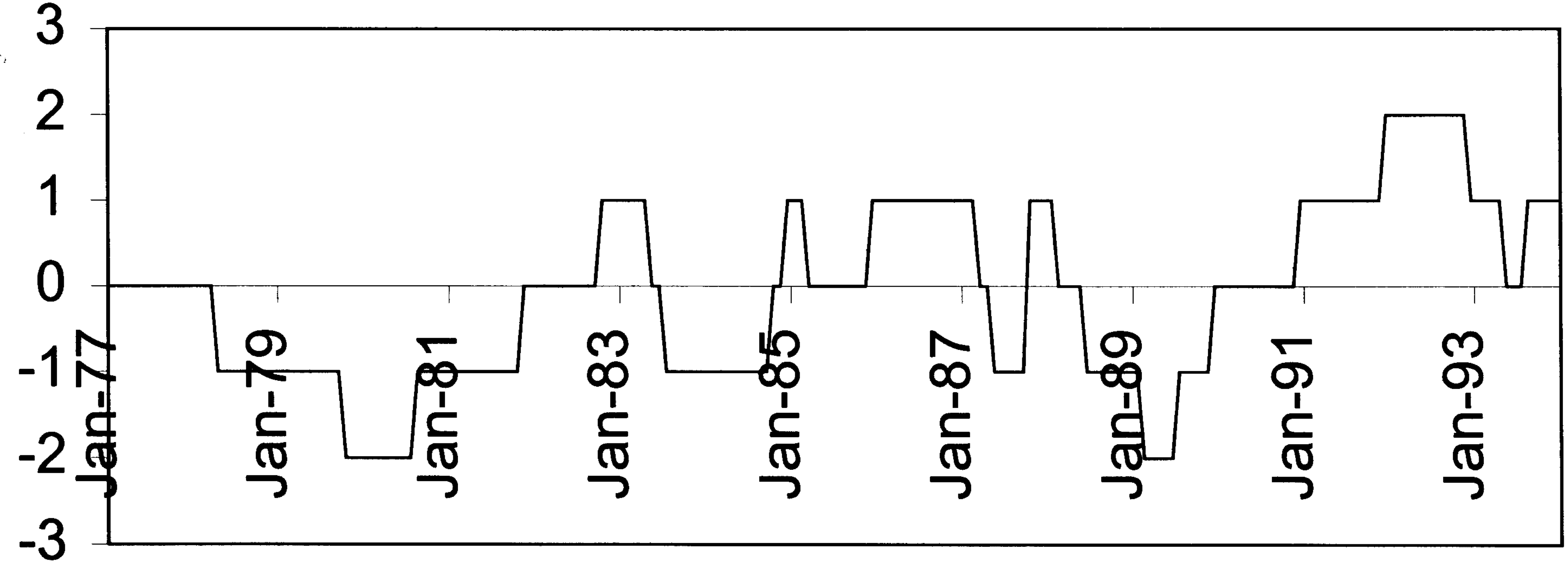

Figure 7 BMD index Germany

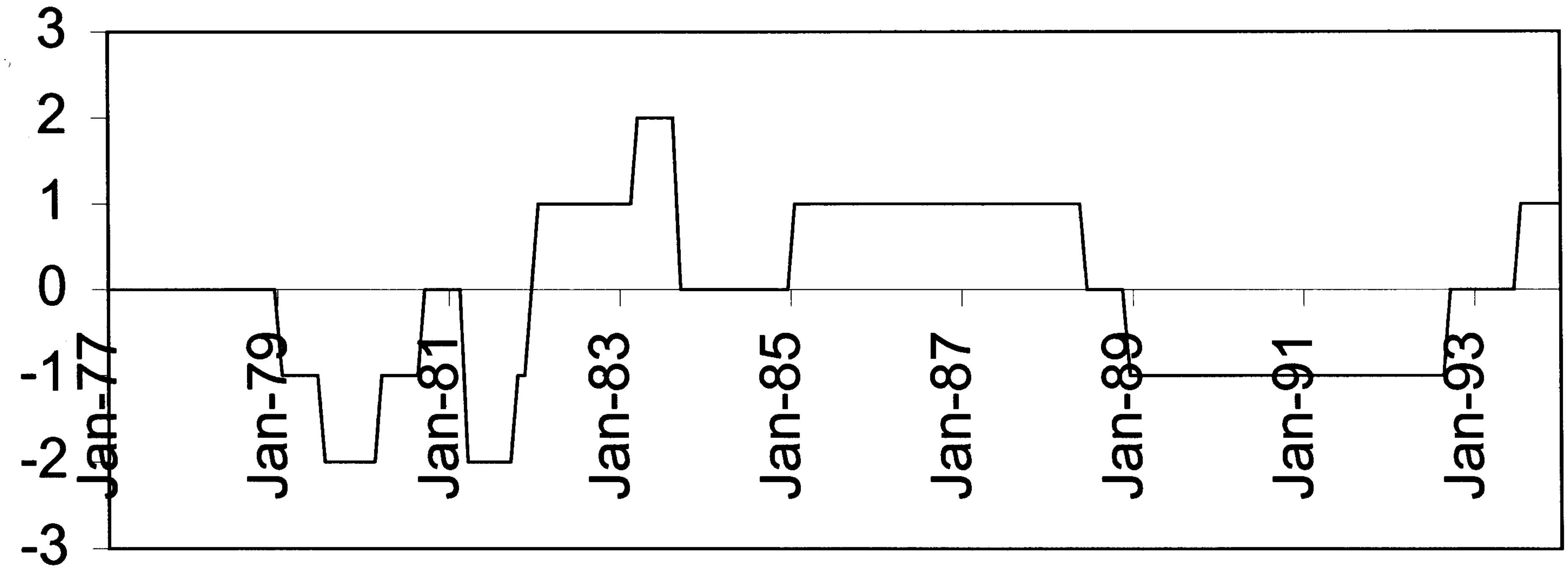

Figure 8 BMD index Japan

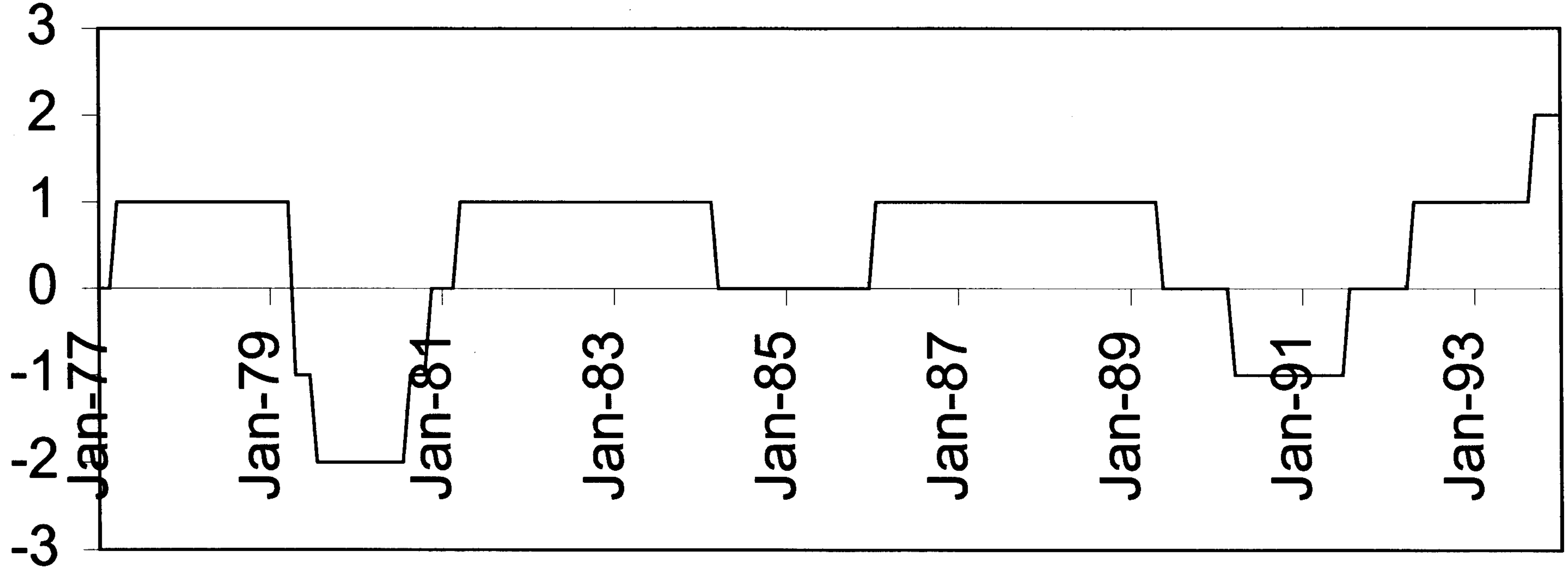

Figure 9 Discount rate changes and economic performance

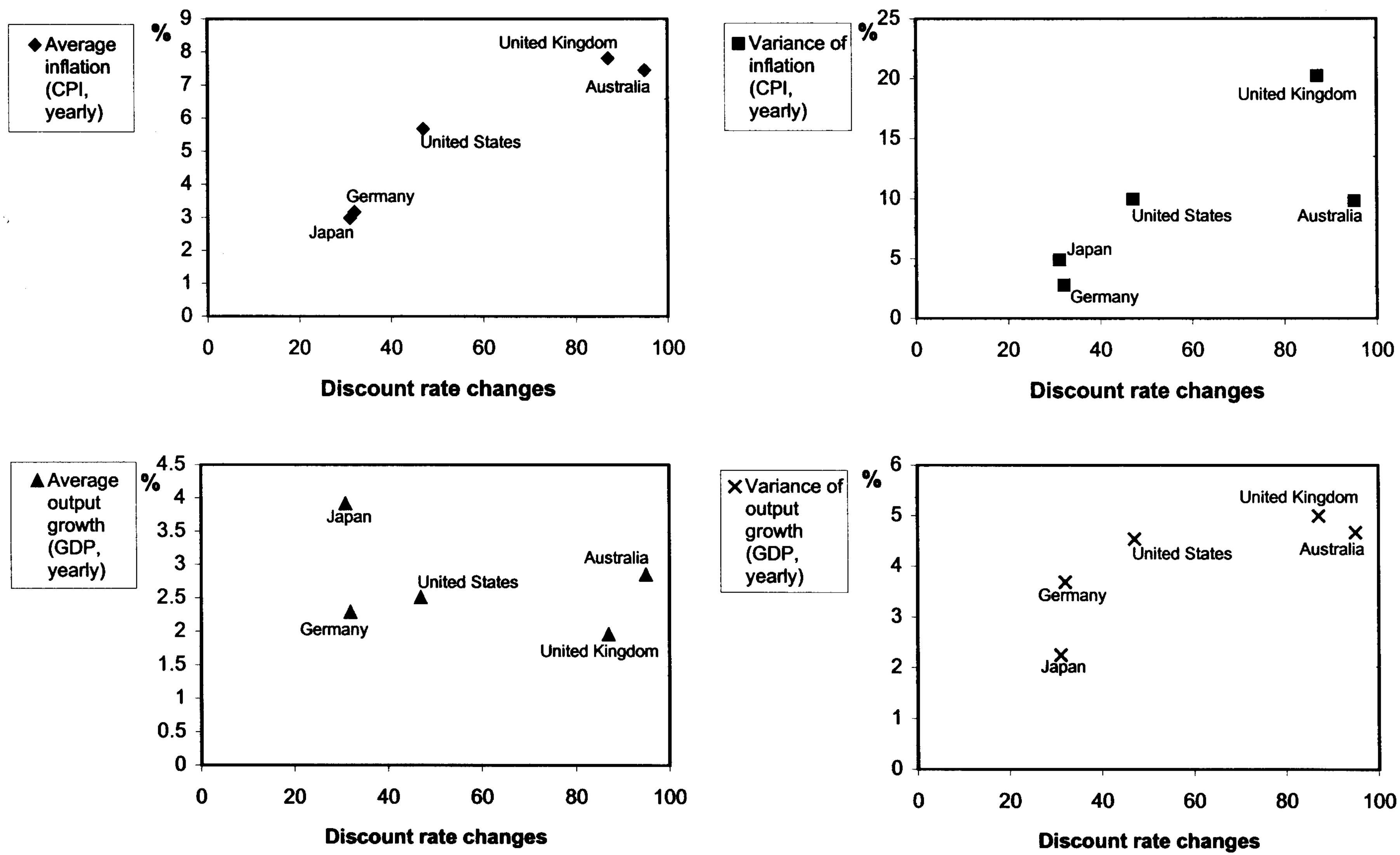

Figure 10 BMD index changes and economic performance