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Monetary Policy of the Bank of Japan – Inflation Target versus Exchange Rate Target*

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Abstract

The paper reviews the evidence on the monetary policy of the Bank of Japan. The new empirical evidence brought by this analysis confirms McKinnon and Ohno (1997) thesis that the BOJ has tried to stabilize the exchange rate. The estimated reaction function suggests that shocks in the exchange rate affect the short run interest rate along with the output gap. The time series modeling, through an ADL, indicates that the interest rate is counter cyclical in relation to the exchange rate. Finally, the history decomposition analysis reveals that exchange rate stabilization has been a major target, particularly during the bubble period.

Key words: target inflation, monetary policy, Taylor rule
Classification JEL: C3, C5, E3, E5, J3.

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main economic aggregates that are related to monetary policy following Clarida and Gertler (1996). The results indicate the relevance of inflation and output stabilization. The inclusion of real exchange rate deviations are not statistically significant.

A much stronger evidence in favor of inflation target is found in Clarida et al (1997). They estimate a reaction function using a forward looking reaction function, where expected deviations of inflation and output in relation to their targets were considered. Their results would be consistent with the view that exchange rate contains all the information on future inflation as suggested by McKinnon and Ohno. Their empirical analysis, however, did not consider adequately the properties of the time series. They use non stationary series, or integrated of first order, in a GMM model without testing the possibility of cointegration among them. This procedure limits seriously the results of the assyntotic theory and may invalidate their estimation process [Davidson and Mackinnon (1993)].

This paper aims at identifying the behavior of the BOJ in the management of the monetary policy using the methodology of cointegration analysis and the history decomposition of the residuals during the cyclical movements of the nominal interest rate. The period of the analysis is the same considered by Clarida et al. (1998).

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In addition to this formulation we assume that the central banks have a tendency to smooth changes in the interest rates (see, e.g., Goodfriend (1991)).

$$i_t = (1-\rho)i_t^* + \rho\, i_{t-1} + \upsilon_t \tag{2}$$

where $\rho \in [0,1]$ captures the degree of interest rate smoothing.

Combining the target model with the partial adjustment mechanism we have:

$$i_t = (1-\rho)\{\alpha + \beta(E[\pi_t|\Omega_t] - \pi^*) + \gamma(E[h_t|\Omega_t]) + \xi(E[e_t|\Omega_t] - e_t^*)\} + \rho\, i_{t-1} + \upsilon_t \tag{3}$$

where

$$\alpha \equiv \bar{i} - \beta\pi^*$$

This model should be estimated by GMM if the series or the instruments are stationary. In the case, however, they are integrated of first order, cointegration should be tested and the ADL modeling is the appropriate method to be used.

The static long run solution of (3) can be written as:

$$i^* = \alpha + \beta\pi + \gamma h + \xi e' + u \tag{4}$$

where, $i^* = i_t^* = i_{t-1}$, $e' = e - e^*$ and $\upsilon = \frac{\upsilon}{(1-\upsilon)}$

This model can be estimated by an auto-regressive distributed lag (ADL) model.

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Hypotheses of unit root is not rejected for all series, except for the inflation rate in the Phillips-Perron test. Since the others tests indicate that this series is non stationary, we have accepted this conclusion.

Once all the series are non stationary in the level, one can estimate an econometric model only if they are cointegrated. The cointegration test based on Johansen (1988, 1991) and Johansen and Juselius (1990) is presented in Table 2 below. The results indicate that the hypotheses that there is only one cointegration vector among the series can not be rejected neither by the trace nor by the lambda max statistics and so the series are cointegrated. This allows us to estimate the ADL model with the series in levels because the residuals of the model will be stationary and so the long run solution will not be spurious.

[Figure 1 here]

[Table 1 here]

The cointegration vector normalized to the interest rate is shown in Table 3. One can see that the coefficient of the inflation rate is unit indicating the absence of an

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rule for the period.

The ADL model was estimated from a recursive search of the optimal number of lags through the Akaike and Schwarz selection criteria and from the diagnostic statistics. The adequate specification was an ADL (18)[3]. The results of the long run static solution are presented below, where the values in parenthesis under each coefficient are the respective standard deviations.

$$i_t = \underset{(0.003)}{0.03} + \underset{(0.24)}{0.17}\, cpi_t + \underset{(0.01)}{0.04}\, rdp_t + \underset{(0.02)}{0.08}\, gap_t + S_t + D_t \qquad (7)$$

T=171 [79(4) – 94(12)]; $R^2 = 0.994$; $F(80,90) = 173.65$; $\sigma^2 = 0.001$; RSS = 9.111; DW = 1.93; AR 1-7 $F(7,83) = 1.135$ [0.34]; ARCH 7 $F(7, 76) = 0.392$ [0.90];

Norm. $\chi^2(2) = 2.157$ [0.34]; RESET $F(1, 89) = 3.692$ [0.06].

where S is for seasonal dummies and D is for impulse dummies.[4]

The model diagnostic tests, shown above, indicate that there are no specification problems with the estimated model.

The results of the model suggest that both the reaction coefficient of interest rate

[3] This lag structure is not so high for the monthly nature of the data.

[4] The impulse dummies were important in the ADL modeling for the following periods 80:11, 85:11, 85:12 and the seasonal dummies were included in the month 6 and 9.

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The analysis of the impulse response functions indicate that, while all the variables stabilize very quickly, inflation rate takes a long time to converge under any shock.

[Figure 2 here]

Figure 2 indicates that the variables follow a cyclical path after an output shock. It is noticeable that the output gap and the deviation of the exchange rate converge quickly while inflation followed a cyclical path.

[Figure 3 here]

Figure 3 shows that the reaction of the interest rate to the shock of the exchange rate is in the expected direction. Exchange rate and output gap converge quickly while inflation rate again followed a cyclical path.

[Figure 4 here]

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estimated VAR, the technique, termed historical decomposition, assigns responsibility for fluctuations in any one of the VAR's variables, beyond a specified point in the available time series, among all the variables included in the system of equations comprising the VAR. The technique of historical decomposition is most easily explained by reference to the VAR's moving average representation,

$$X_t = C(B)\mu_t = \sum_{i=0}^{\infty} C_i \mu_{t-i} \tag{8}$$

where X_t is a column vector of n endogenous variables, $C(B)$ is a matrix of polynomials in the lag operator B and μ_t is a vector of innovations. Now consider T as some base period in the sample. We can write X_{T+j} as

$$X_{T+j} = \sum_{i=0}^{j-1} C_i \mu_{T+j-i} + \sum_{i=j}^{\infty} C_i \mu_{T+j-i} \tag{9}$$

the sum of two components. The first represents that part of the historical time series attributable to innovations since T. The second component is termed a 'base projection' of X_{T+j} and is formed solely from information available at time T. The historical decomposition assigns responsibility for the difference between the base projection and the actual series among the innovations of the variables in the VAR. The second equation makes it clear that the innovations since T in all variables yields the actual series.

The importance of any one variable, or set of variables, can be determined by the

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[Figure 8 here]

During the second period the analysis suggests that product gap had some importance. Exchange rate deviation, however, plays an important role in the second half of the period. The overshooting of the interest rate forecast due to exchange rate deviation compensates the persistence effect of the interest rate.

[Figure 9 here]

After the Plaza Agreement the interest rate suffered a substantial fall that was explained remarkably well by exchange rate deviation.

[Figure 10 here]

In the second half of the cycle of the bubble, exchange rate becomes important followed by the product gap.

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shows that exchange rate has been an important factor to explain the behavior of the Bank of Japan.

The time series modeling through an ADL suggests that the reaction function of the Bank of Japan is counter cyclical in relation to the exchange rate deviations to its parity value. This means that the money supply increases each time the exchange rate overvalues in relation to its parity value and it is tightened otherwise. The role of the inflation rate is questionable since the reaction coefficient is not significant.

The impulse response functions that come from a structural VAR of the variables indicate that a shock in any of the variables does not lead to a response in the interest rate in order to stabilize the inflation rate. While after a shock the output gap and exchange rate converge quickly, the inflation rate follows a cyclical path and takes longer time to converge.

Finally the history decomposition analysis reveals that, in three out of the five major interest rate cycles in the recent period, exchange rate has had a major role, particularly during the bubble period. The output gap has shown a minor role. On the other hand the inflation rate has not revealed any importance to explain the interest rate cycles.

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Figure 1
Autocorrelations Functions

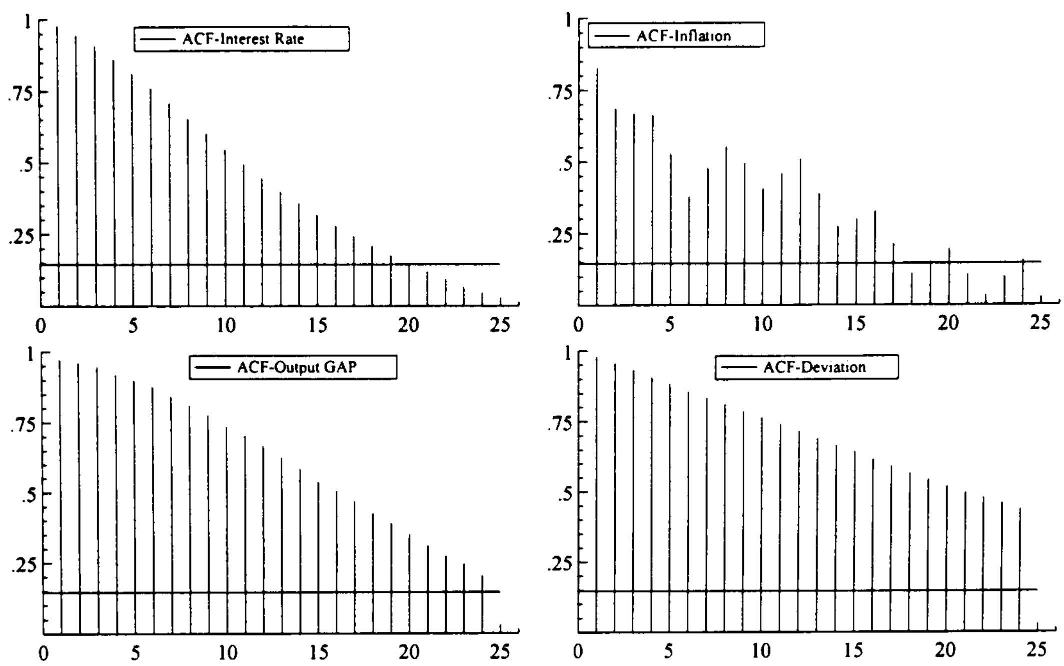

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Table 2

Cointegration Test

Null Hypotheses:	r = 0	r = 1	r = 2	r = 3
λ_{max}	61.51**	5.38	2.65	1.29
Critical value 95%	27.1	21.0	14.1	3.8
Null Hypotheses:	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
$\lambda_{traço}$	70.83**	9.32	3.94	1.29
Critical value 95%	47.2	29.7	15.4	3.8

** Indicates that the coefficient is significant to the level of 1%.

Figure 2

Impulse Response Functions to shocks in Output Gap

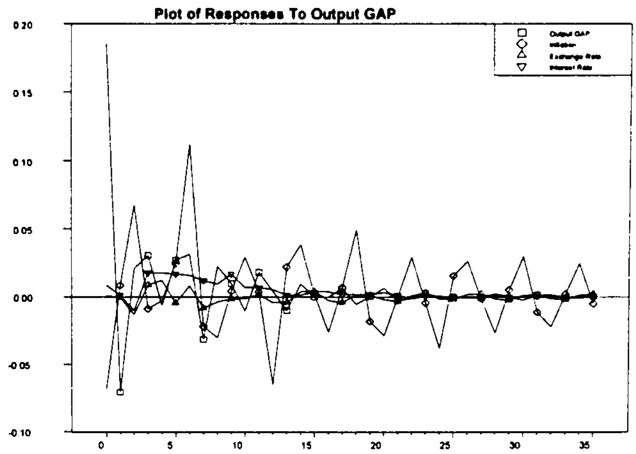

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Figure 4
Impulse Response Functions to shocks in Inflation

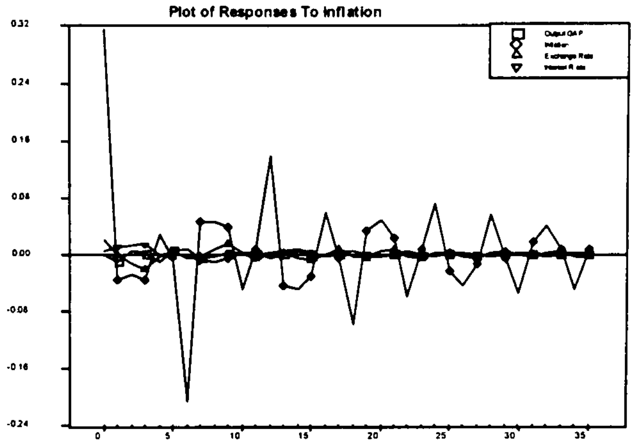

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Figure 6: Call Rate

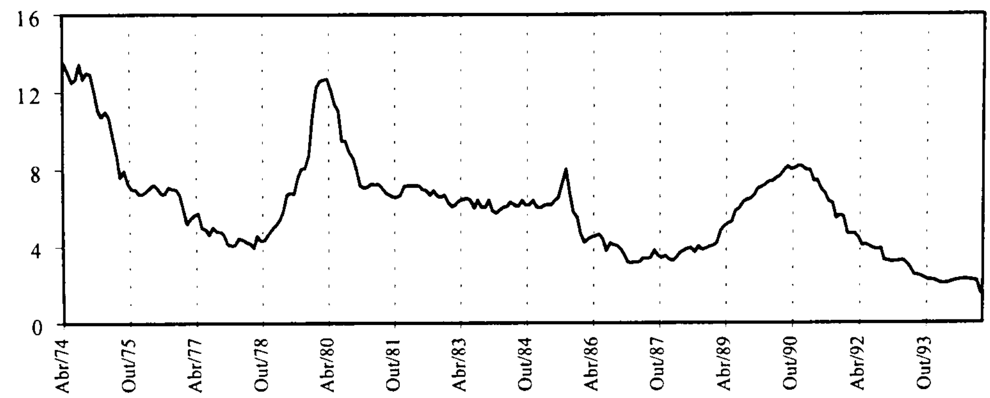

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Figure 8
Historical Decomposition - cycle 1982:02 to 1983:05

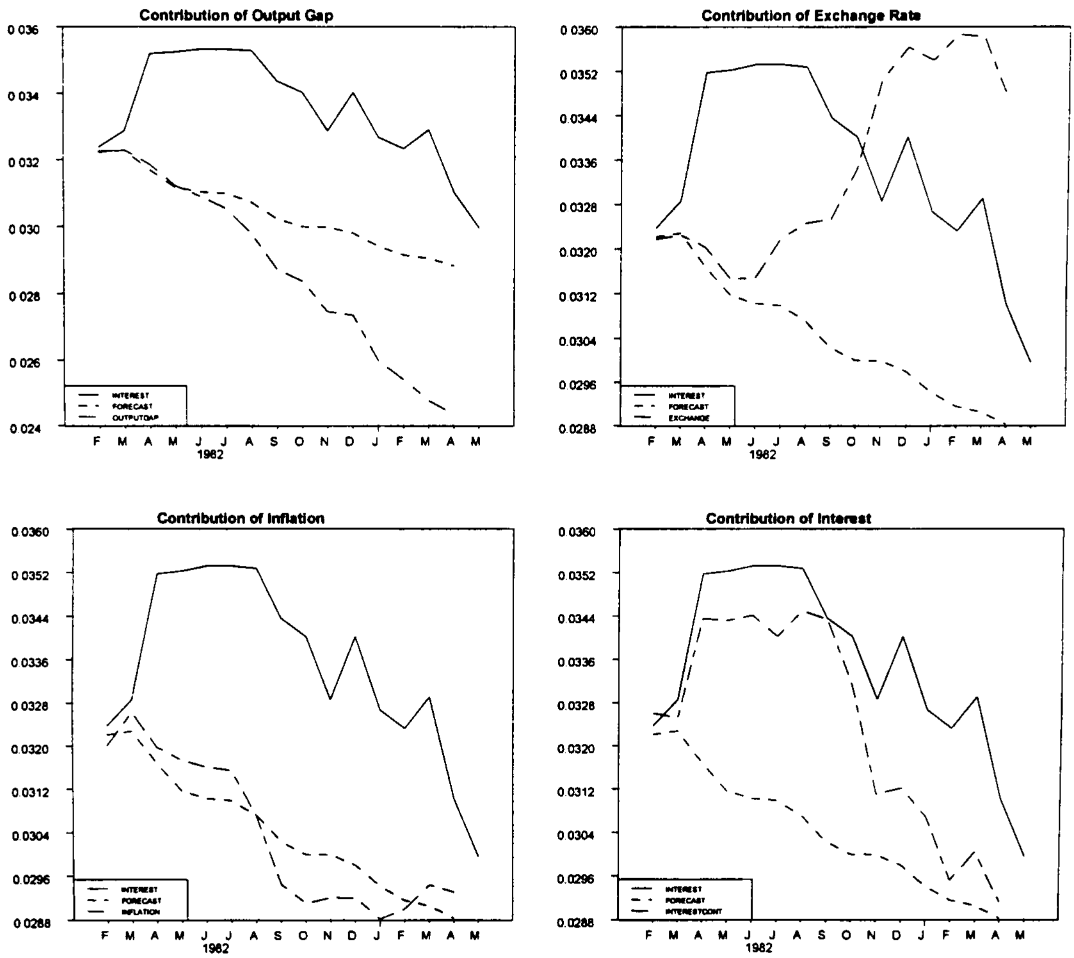

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Figure 10
Historical Decomposition - cycle 1987:09 to 1989:01

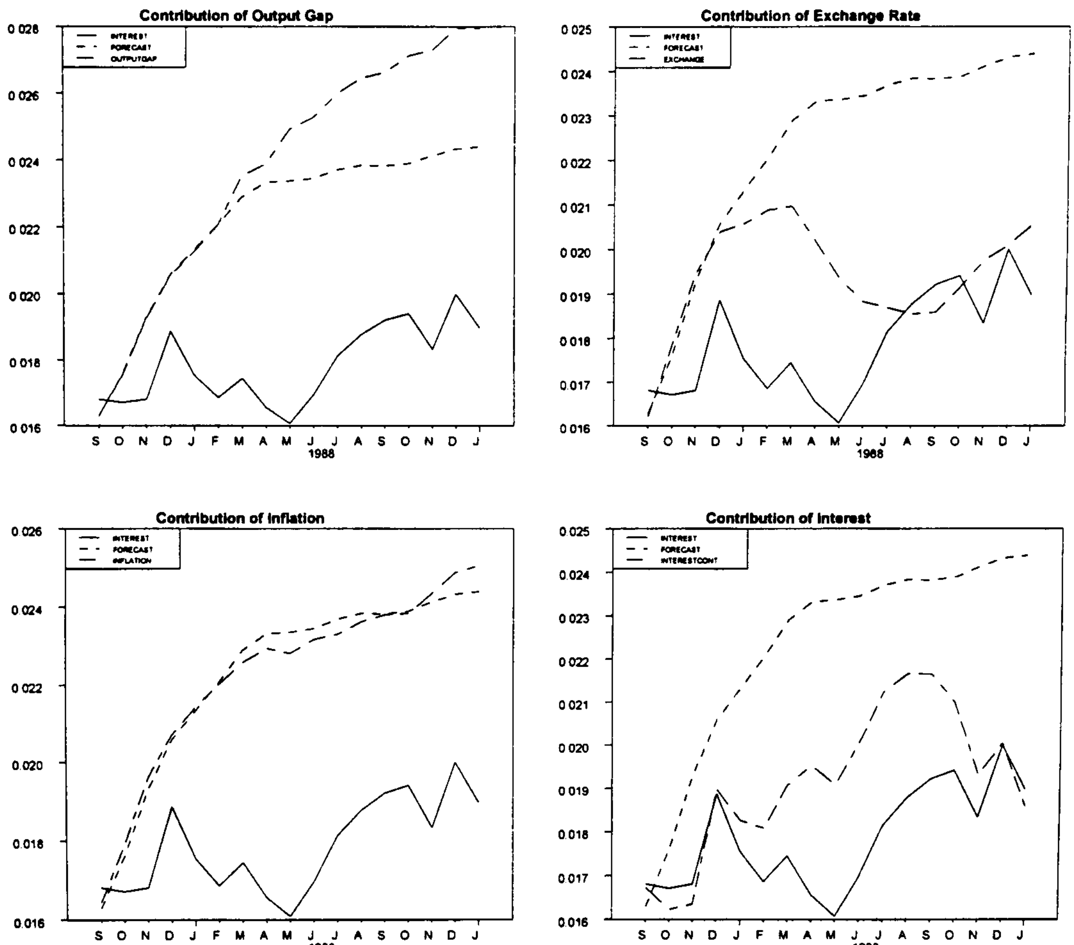

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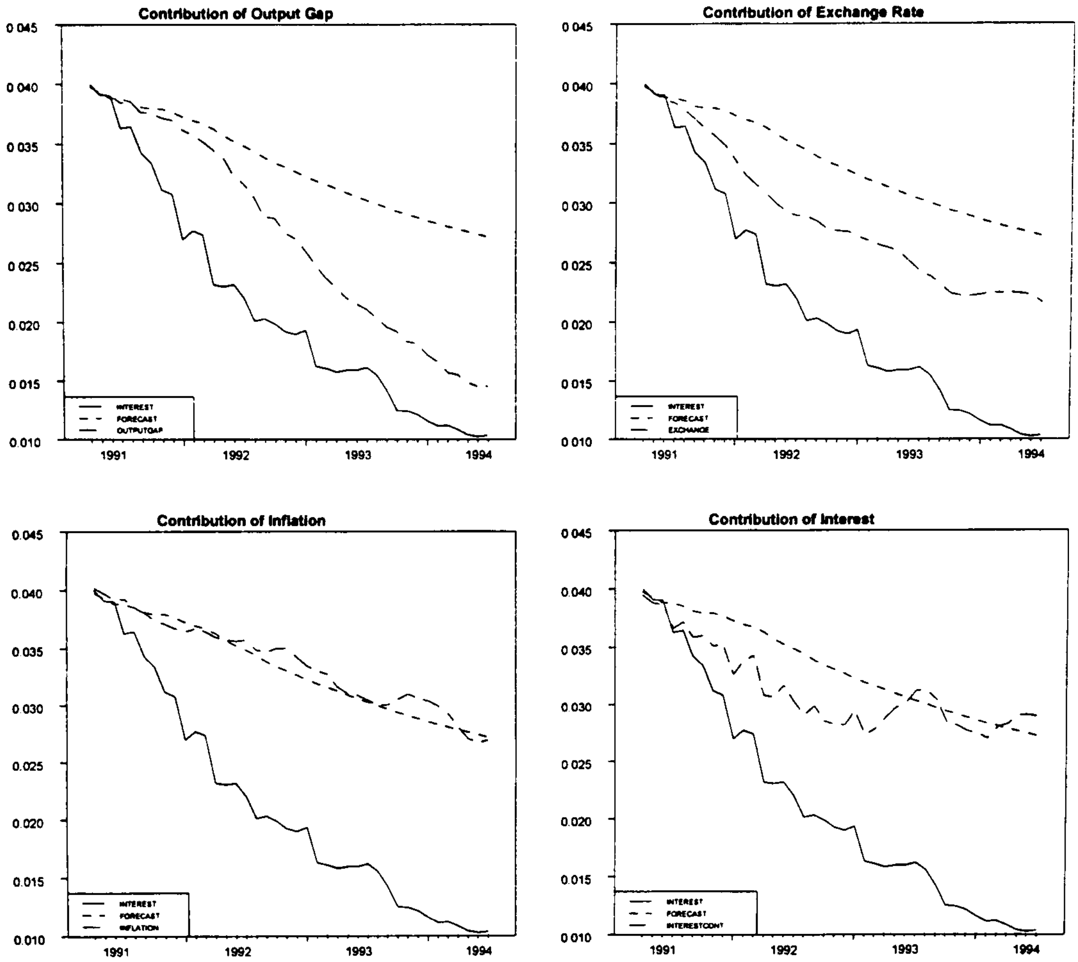
Figure 12
Historical Decomposition - cycle 1991:04 to 1994:07



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