SOME COMPARATIVE EVIDENCE ON THE EFFECTIVENESS OF INFLATION TARGETING

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Some Comparative Evidence on the Effectiveness of Inflation Targeting

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* Corresponding author. The views expressed here are solely those of the authors and do not reflect those of the Federal Reserve Bank of New York, the Federal Reserve System, or any other member of their staff. Work on this project was undertaken while Laubach was a graduate intern at the Federal Reserve Bank of New York. We are grateful to Ben Bernanke, Ben Friedman, Andrew Haldane, Ken Kuttner, Rick Mishkin, Mark Watson, and participants in seminars at the Bank for International Settlements, the Bank of England, the Federal Reserve Bank of New York, Harvard University, and the Swiss National Bank for comments and suggestions.

Does the adoption of an inflation target by a country have an effect on that country's rate of inflation and on inflation's interaction with real economic variables? Does inflation targeting alter private-sector inflation expectations? Theoretical appeals to nominal anchors may justify countries' various moves via targeting towards greater monetary policy transparency, but the actually realized economic effectiveness of their targeting experiences should be assessed as well. The question of effectiveness must be posed as a counterfactual - did target adopting countries find economic benefits they would not have found had they not targeted?

Since only a few countries for only a short span of time have been targeting, there is no simple conclusive econometric test for the effectiveness of inflation targets. Instead, we offer three sets of measurements of the effect of inflation targeting: the first concerning whether the disinflation has been achieved at lower cost, or whether inflation has come down in targeters to a greater extent than we would attribute to normal cyclical factors, domestic and international; the second concerning whether the interactions between inflation, monetary policy, and real variables have changed; and the third concerning whether private-sector inflation expectations have come down after targeting beyond that drop usually associated with a drop in inflation. This multifaceted and (perhaps unfashionably) straightforward approach differs from that of the few prior comparative empirical assessments of inflation targeting, which tend to focus on solely one measure, usually having to do with extracting financial market expectations.[1]

The sample of countries which adopted inflation targeting as a framework for monetary strategy we consider consists of New Zealand, Canada, the United Kingdom, and Sweden (in

[1] See Ammer and Freeman (1995), Freeman and Willis (1995), Huh (1996), and Svensson (1993).

order of adoption). These are the OECD countries which have pursued inflation targeting for at least three years. Establishing a baseline for measurement of the effectiveness of inflation targeting in these countries on the three aspects listed, however, is not trivial. Clearly, the first line of measurement must be performance versus a country's past prior to target adoption; equally clearly, since these countries have neither been through a complete business cycle since adoption nor adopted inflation targets under similar circumstances (two replacing a lost exchange rate commitment, two installing a nominal anchor where there was none), this measure is not without limitations.

In response, we also ask whether a inflation targeting has been effective along these lines in comparison to a similar country which did not adopt inflation targeting - for Canada and New Zealand, our point of comparison is Australia[2], another small open resource-exporting U.S.-cycle tied economy, while for Sweden and the United Kingdom, our point of comparison is Italy, another ERM-exiting European industrial economy[3]. Finally, to make sure we are not expecting too much, we compare the effects of monetary policy under inflation targeting to that seen in the two credible nominal targeters of longstanding, Germany and Switzerland. With these three sets of structured comparisons on three criteria, we hope to get a reasonably robust set of evidence on the effectiveness of inflation targeting.

It is worth emphasizing that at first look, inflation targeting has been a success - inflation was in or below the target range for all sample targeting countries, as shown in Figure 1, and

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[2] Which only adopted inflation targeting at the very end of our sample period.

[3] Huh (1996), to our minds, compares apples to oranges by making the focus of his analysis a comparison of the United Kingdom experience to those of France (an ERM adherent with an at-the-time overvalued exchange rate and rising credibility) and of the United States (a country without a declared nominal anchor, a different business cycle, and lesser openness).

noticeably below these countries' average inflation levels of the 1970s and 1980s. Recapping the macroeconomic baslines of Figures 2-5, the low inflation in comparison to these countries' earlier experience was sustained without unusual macroeconomic conditions. In New Zealand, the disinflation during the four years prior to target adoption went with a period of sluggish GDP growth and, since 1988, rising unemployment. The continuation of the disinflation during 1990/91, amidst recession in many other OECD economies, led to recession and sharply rising unemployment in New Zealand. In Canada, the disinflation was achieved along with continued progress in lowering unemployment (Figure 3), only a brief spike in nominal interest rates, and continued positive, though slowing, growth. In the United Kingdom, similar to Canada, the disinflation begun two years prior to target adoption continued on the background of improving growth, falling unemployment, and much lower nominal interest rates in the wake of the UK's exit from the ERM. Yet, while these countries' drops in inflation represent no small feat, it only states that the adoption of inflation targeting was consistent with a preference shift to lower inflation. The question of effectiveness lies in whether targeting made this result less costly in terms of output or easier to maintain in terms of expectations, either of which would make prices more stable over the long-run.

I. Sacrifice Ratios and Phillips Curves

Our first set of evidence concerns the response of inflation to the business cycle. We look at two related measures of the responsiveness of inflation to the real economy, sacrifice ratios and forecasts of moves in inflation from Phillips curves. Sacrifice ratios are the standard measure of how many point-years of unemployment or output growth must be sacrificed to pay for a point of disinflation. It is usually presumed that where a disinflationary policy is believed to be credible, and is clearly announced, disinflation will be less costly because firms and households will reset their expectations and recontract; at lower initial rates of inflation (and under less coordinated or less frequent forms of wage contracting) we expect that sacrifice ratios will be higher, because the relative cost of recontracting versus getting inflation right, is higher. Controlling for the pre-disinflation environment, a potential effect of inflation targeting would be to lower the sacrifice ratio by making monetary policy announcements more immediately credible.

To compute sacrifice ratios for our countries, we follow the methodology of Ball (1994), using quarterly data throughout. Ball defines trend inflation as a centered 9-quarter moving average of annual inflation rates, and then identifies peaks (troughs) in trend inflation as quarters in which trend inflation is higher (lower) than in the previous and the following 4 quarters. A disinflation is an episode that starts at an inflation peak and ends at a trough with an annual inflation rate at least two points lower than at the peak. He assumes that trend output is piecewise log linear, and that output is at its trend level at an inflation peak (since at the peak the change in inflation is zero) and four quarters after a trough (arguing that the effects of disinflation are persistent, and that therefore output returns to trend only with a lag). The numerator of his sacrifice ratios, i.e. the output loss during the disinflation, is computed as the area under the straight line connecting log GDP at the peak with log GDP four quarters after the trough.

In their comments on Ball's paper, Friedman and Cecchetti level a number of criticisms at Ball's methodology. Friedman raises the question of whether the sacrifice should be measured as output foregone, or as the increase in unemployment, and offers some skeptical remarks regarding Ball's assumptions when output is at trend. Justified as these concerns may be, since our goal is to compare sacrifice ratios both across time and across countries, we are primarily interested in the relative magnitude of the ratios. In this sense, consistent mismeasurement would appear not to affect our results. More troublesome is Friedman's suggestion concerning the endogeneity of central bank behavior, in that central banks might "pursue their presumed goal of disinflation more rigorously when they have reason to believe that the short-run trade-offs associated with doing so are more favourable" (p 186). Cecchetti emphasizes this point by showing that Ball's interpretation of the output loss as being due to demand contractions only, thus treating effects of supply shocks as noise, affects the results critically. We will return to this question later when we present results from estimating Phillips curves.

The data we use are real GDP series from the OECD MEI, and all-item CPI series from the BIS. Quarterly inflation is computed as the percent change of the CPI in the last month of the quarter over the corresponding month of the previous year[4]. For each of the eight countries we identify two completed disinflations, following the two oil shocks respectively, and for all but Germany and Switzerland we identify a third completed disinflation during the early 1990s, which gives us 22 disinflationary episodes from which we compute sacrifice ratios. As a check for the reasonability of our figures, we compare results with Ball for the first two disinflations for six countries in our sample for which Ball also reports sacrifice ratios based on quarterly data. The mean of Ball's sacrifice ratios is 1.50, while that of the comparable episodes in our sample is 1.33, and the correlation coefficient between the two sets of ratios is 0.75, indicative of good

[4]Using alternatively the percent change of the middle month of the quarter, or the average of the inflation rates of the three months within the quarter, did not affect the results strongly.

consistency[5].

Given this standard, we consider whether the countries that adopted inflation targets did in fact lower their costs of disinflation, both relative to their own past and relative to comparable countries that did not adopt inflation targets. The regression reported in Table 1 attempts to explain variation in the sacrifice ratio by the initial level of inflation (as above, assuming that at lower inflation levels disinflation is more costly), the total amount of inflation disinflated in the episode (assuming that a larger disinflation should lead to a smaller cost per unit disinflated once recontracting begins), and the length of time of the disinflation (assuming that quicker disinflations should be more credible and therefore less costly). Our results confirm the importance of initial inflation to determining the sacrifice ratio, and we use this fact to forecast the expected cost of disinflation for each of the countries in its most recent disinflation. For all four inflation targeters except Sweden, the actual sacrifice ratio experienced was not only higher than the average sacrifice ratio of previous disinflations, but higher than forecast, even controlling for the low initial levels of inflation in the UK and Canada. For Australia and Italy, our non-targeting comparison countries, the actual sacrifice ratio during the latest disinflation was by contrast lower than forecast, although higher than the past average sacrifice ratio. Finally, the sacrifice ratios for

[5]Discrepancies between our results and those in his Table 5.1 can be either due to differences in the timing of disinflations, or differences in the measured output gap for a given episode. When performing the exercise of using Ball's episodes and changes in inflation, our results are almost identical to his, which means that the measured output gaps are not the cause for the discrepancies. When instead using Ball's episodes, but our own measure of change in inflation, there are discrepancies between Ball's and our ratios of the order of magnitude of 0.2 to 0.5. Finally, when we date the disinflationary episodes ourselves using Ball's criteria, we arrive at differences in the beginning and end dates of the order of 1 to 3 quarters. These differences in episodes have strong effects on the resulting sacrifice ratios. This suggests that Ball computed inflation in a different way, and therefore identifies slightly different episodes, from us.

Germany and Switzerland (from an earlier period) are both lower than the predicted values and lower than their own past sacrifice ratios. Disinflation under inflation targeting - or at least the *first* disinflation under targeting - is not less costly than without targets[6].

We also examine the question of whether inflation targeting countries saw inflation come down more than the business cycle predicted from a second related vantage point. We forecast inflation for each country from a Phillips curve, in the manner of Gordon (1985) and Fuhrer (1995). We regress quarterly inflation on lags of itself, a measure of output, and on two measures of supply pressures, the lagged change in the nominal effective exchange rate, and the lagged change in a U.S. dollar denominated commodity price index.[7] This exercise is intended to see whether inflation dropped beyond the extent we would attribute to normal cyclical factors, domestically and internationally, as well as whether introducing inflation targeting induced some changes in the countries' wage- and price-setting structures. It also addresses Friedman's and Cecchetti's criticism, which we discussed earlier, that Ball's measure of the sacrifice ratio attributes all of the output movement during disinflations to demand reductions, and none to

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[6] The absence of a direct credibility bonus for sacrifice ratios from monetary institutions is consistent with the evidence on the effects of central bank independence (see Debelle and Fischer [1995], Posen [1995]).

[7] Inflation for New Zealand and Australia was computed using the two Reserve Banks' underlying CPI series, for Canada using CPI excluding food and energy, for the UK using RPIX, and for Sweden using CPI excluding indirect taxes and subsidies. Except for New Zealand and Australia, CPI series for all countries are from the BIS. The measure of output was either the unemployment rate, or residuals from Hodrick-Prescott filtered GDP (meant to capture the output gap). Except for New Zealand, unemployment and real GDP are from the OECDMEI. Below we will report on the robustness of our results with respect to the choice of output measure. The nominal effective exchange rate and the US dollar denominated commodity price index, excluding oil, are from the BIS (replacing this with an oil price index made no difference in the results). The measures of supply pressures were only included if they improved the fit, as measured by the adjusted R^2.

supply-side factors.

The regression is estimated over the period 1971:2 to time of target adoption for each of the four inflation targeters. For Australia, the sample for the estimation is the same as for New Zealand, while for Italy it is the same as for the UK, i.e. until the lira's exit from the ERM in 1992:3. For Germany and Switzerland, the regression is estimated up to German economic reunification in 1990:2, allowing comparison with credible nominal targeters of long-standing.

In Table 2 we report results from the regressions and the inflation forecasts. As a check of the robustness of the results with respect to the number of lags included, for each country we report results from two different lag specifications. The first specification is a fairly unrestricted one, including four lags of each variable so as to produce the best possible fit. The second is a more parsimonious specification, in which we reduced for each variable the number of lags until the t statistic of the last lag included was significant at the 5% level. The adjusted R^2's indicate a good fit of both regressions for all countries except Sweden. Also, for Sweden the lags of the output gap are jointly insignificant, which is why we do not report a parsimonious specification (see also Footnote 5 below). For each regression and each of the variables included in the regression we report the sum of the coefficients on all lags of that variable, as well as their joint significance (i.e., the F-statistic from testing the exclusion of all lags of that variable; 5% critical values are between 2.50 and 2.53). The sum of the coefficients captures the cumulative response of inflation to a unit change in the variable considered.

The fact that the nominal exchange rate and commodity price inflation apparently do not have a significant impact on inflation in a number of countries is rather surprising, in particular in open economies with sizeable raw materials production such as Canada and Australia. The exchange rate appears significant in half of the regressions, commodity price inflation only in two out of eight.

An interesting result from the German regression is the insignificant impact of past on present inflation. This result can be construed as supporting the view that over time the Bundesbank has been successful in its attempt to keep inflation permanently around 2%, with past deviations being corrected in due course. However, this interpretation begs the question why the same does not seem to hold for Switzerland, despite the similar past inflation record of the two countries.[8]

Our interest in these Phillips curve regressions, however, is to obtain evidence which would help us to identify changes in the co-movements of inflation and unemployment or output following inflation target adoption. We therefore turn now to structural break tests and out-of-sample forecasts generated from the Phillips curves.

In Table 2 results from reestimating the regressions from 1971:2 through 1995:4[9] and

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[8] The major changes to the results reported in the last paragraphs from choosing the alternative output measure are as follows. For New Zealand, the output gap does not enter significantly, the significance of past inflation increases, and commodity price changes are again significant; the implied sacrifice ratio is 9.35. For Canada, the exchange rate is again included but insignificant, and the implied sacrifice ratio increases to 1.56. For Australia, neither the exchange rate nor commodity prices are included, and the lags of the output gap are jointly insignificant; the implied sacrifice ratio is 2.23. For the UK, the exchange rate is now included in the regression, but the four lags are jointly insignificant. The implied sacrifice ratio falls to 0.3. For Italy, the exchange rate is included and significant, while commodity prices are excluded. The implied sacrifice ratio rises to 3.71. Finally, for Germany, lagged inflation enters now highly significantly, the output gap does not enter significantly, and the implied sacrifice ratio is 3.66, as reported earlier. Since Swiss unemployment data start only in 1983, and the Swedish unemployment rate exhibits a break in the early 1990s, we do not report results for these two countries using unemployment.

[9] Through 1995:3 for Italy, through 1995:2 for Australia, and through 1995:1 for New Zealand due to data availability.

testing for a structural break are reported. For three of the four inflation targeters the hypothesis of a structural break in the Phillips curve at the time of target adoption is clearly rejected at the 5% level. Only for Canada do we find evidence of a structural break. For neither the targeters of long-standing nor the two comparison countries in our sample is there evidence of a structural break around this time. The results for all eight countries are robust with respect to the choice of output measure and the choice of lag length.

Although, with the exception of Canada, there is no evidence for a structural break following target adoption, it is nevertheless interesting to ask whether inflation was below the values predicted by the Phillips curve during this period. Furthermore, we are interested in the distribution of the forecast errors, in order to make some sense out of the question whether the actual value of inflation is enough different, given other variables, to indicate that targeting affected inflation dynamics. In other words, we want to be able to ask whether a variable comes in significantly under forecast at a specific time. Since the forecasts are out-of-sample, the distribution of the forecast errors is a nonlinear function of the estimated parameters[10]; since the forecasts are conditional, by definition, their distributions also depend on the actual values of the remaining variables in the regression.

We address the measurement of the distribution as follows. Since we want to forecast inflation from time target adoption+1 quarter over a horizon of 8 periods, we need to construct an estimate of the standard deviation of the forecast error at each quarterly horizon from 1 to 8. To do so, we compute 15 forecasts of each length (1-8 quarters) for each country, beginning at

More precisely, the forecast error of a k-horizon out-of-sample forecast is a function of the k-th power of the estimated parameters.

dates sufficiently long before time of adoption such that the forecast horizon does not extend beyond time of adoption. We use these pre-adoption forecasts only for estimating the standard deviation of the forecast. This means that we first estimate the Phillips curve regression for each country until twenty-three quarters prior to adoption, and then perform a forecast from adoption minus 22 quarters to adoption minus 15 quarters. In the next step we estimate the Phillips curve until adoption minus 22 quarters, and perform a forecast from adoption minus 21 quarters to adoption minus 14 quarters. In this fashion we construct 15 different forecasts, and we estimate the standard deviation of the forecast error at each quarterly horizon, 1-8, as the empirical standard deviation of the 15 different forecast errors at each horizon we obtained[11].

The results of these forecasts are shown graphically in Figure 6, where the vertical line represents the onset of forecasting, the dashed line is the forecast of inflation, the two heavy lines are one standard error bands generated as described, and the simple line is the actual course of inflation[12]. In Table 2 we report the average forecast error from forecasting inflation over 8 quarters following target adoption, expressed in points of annual inflation (likewise in Figure 6 quarterly inflation has been annualized on the axes to facilitate interpretation). A positive forecast error implies that actual inflation was on average below what we would predict from the regression results.

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[8] The fact that the r forecasts are overlapping introduces serial correlation between the forecast error at horizon j from forecast l and the forecast error at horizon j-1 from forecast l+1 (see e.g. Hansen and Hodrick 1980). The empirical standard deviation of the forecast errors at a specific horizon is nevertheless an unbiased estimate of the true standard deviation at this horizon.

[12] We discuss (and Figure 6 shows) only the results from the forecasts using the basic specification with four lags of all variables included, since the parsimoniously specified models are less good forecasting equations.

For three of the four inflation targeters, actual inflation during the eight quarters following target adoption shows no sign of persistent deviations from the forecast, and stays well within the one-standard-deviation band. The average overprediction for New Zealand is 0.77, that for Canada 0.61, while for Sweden actual inflation exceeds the forecast on average by 0.11 percent. For the UK, however, there is stronger evidence that inflation is lower than would be expected, being below forecast in 7 out of 8 quarters, and outside the error band in 3 out of 8 quarters. On average, inflation is below forecast by 1.9 percent (Robustness of these results is discussed in Footnote 10 below).

Consistent with the results from the structural break tests, for none of the other four countries is there much evidence of a change in the behavior of inflation. In Australia, inflation is almost consistently below forecast (0.86% on average), but mostly inside the error band. In Italy, inflation is more often above than below the forecast (0.95% on average), but again mostly within the error band. After the demand shock of economic reunification in Germany, inflation exceeded the predicted values in all but one quarter, twice (in the third quarters of 1990 and 1991) by far more than one standard deviation, resulting in an underprediction on average of 1.78%. Yet, by the end of the forecast horizon, German inflation has returned to its predicted value, which we interpret as being consistent with a successful price-stability commitment based on targeting of a nominal anchor. Likewise, the upsurge of inflation in Switzerland during 1989/90 is reversed during the next two years, almost exactly in line with the predictions. On average, inflation exceeds the forecast by only 0.11%.[13]

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[13] For most countries, the results reported in the preceding paragraph are fairly robust with respect to the choice of output measure. If the output gap is chosen, the average forecast error increases to 3.65 for New Zealand, to 5.98 for Australia, and to -1.26 for Germany, while that

In view of the potential shortcomings of Ball's methodology that have been discussed earlier, we consider it interesting to compute sacrifice ratios from these regressions and compare them to our earlier results. Dividing the sum of the coefficients on unemployment (the output gap) by 1 minus the sum of the coefficients on lagged inflation yields a measure of the effect of a 1-point increase in unemployment (the output gap) sustained over four quarters on long-run or "steady state" inflation. Hence the inverse of this ratio measures the increase in unemployment (the output gap) over four quarters necessary to achieve a 1 percent reduction of inflation in the long run, i.e. the sacrifice ratio. However, these estimates of the sacrifice ratio are not exactly the same as the ones we presented earlier. First, in the regressions we control for external and commodity price shocks (insofar as they appear significant). Second, in five out of eight regressions we use unemployment, not a measure of output lost as in Ball's methodology, and this may affect the estimated ratio.

Since the four lags of inflation included may not be sufficient to capture all autoregressive dynamics of inflation, we report ratios computed from regressions including 8 lags of inflation, and four lags of all other variables. For five out of eight countries the sacrifice ratios are broadly similar to those obtained by using Ball's method. For New Zealand, Australia, and most notably for Germany the ratios reported in Table 2 are much higher. However, when using the output gap instead of unemployment as the output measure, for Australia and Germany the ratios fall to 2.23 and 3.66 respectively, while that for New Zealand rises to 9.35. In

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for Italy decreases to -1.34. As a result, the overprediction of inflation for New Zealand and Australia becomes more significant, while the underprediction for Germany becomes less, and that for Italy more significant. By contrast, choosing the unemployment rate as the output measure for Canada leads to an (insignificant) average underprediction of -0.75, while choosing the output gap for the UK leads to an (again insignificant) underprediction of -1.06.

particular for Germany this discrepancy between the results may be due to hysteresis effects. For seven out of eight countries, therefore, the earlier results are confirmed. Only for New Zealand does it appear as if Ball's method would lead to underestimate the sacrifice ratio (which means that it would be even more clearly above forecast or previous average).

In summary, our Phillips curve and sacrifice ratio results together present a robust result that the adoption of inflation targeting did not alter the costs of disinflation, and therefore we presume not the underlying wage- and price-setting structures either, of our four inflation targeting countries. Given their desires to move inflation down, the inflation targeters got only small, if any, extra disinflationary effect beyond the business cycle they experienced (or induced), or beyond the disinflation experienced by countries without inflation targets for that matter. Compared to the baseline of the German and Swiss experience, however, it is clear that even a credible targeter of longstanding does not see these benefits, that they may be too much to expect of even a successful price stability commitment. It is worth noting that, in comparison to the explicit hopes of New Zealand and Canada (who similarly to Germany and Switzerland adopted targeting without prompting of a crisis) detailed in the case studies, neither country expressed an expectation that the cost of disinflation would decline with maintained credibility.

II. Dynamic Simulation from Target Adoption

Even if inflation targeting does not move the terms of the output-inflation tradeoff in times of disinflation, inflation targeting could alter the process by which inflationary shocks are responded to in the economy. Once a commitment to price stability would be made transparent and credible through inflation targeting, some inflationary shocks could be discounted by the private-sector rather than passed through, or at least discounted more quickly and completely upon a given monetary policy response. Our second set of exercises focusses on the dynamic interaction of inflation, output, and monetary policy.

We estimate a 3-variable unrestricted VAR model of core inflation, GDP growth, and the central bank's overnight instrument interest rate[14] from 1971:2 to target adoption[15]; we then allow the system to run forward five years from time of target adoption, plugging in the model's forecast values as lagged values. This exercise is meant to give a qualitative impression of whether the interaction between inflation and short-term interest rates exhibits a markedly different pattern of behavior after the adoption of the inflation target from that before[16]. The unconditional forecast of each variable represents the way we would expect the system to behave in the absence of shocks from the situation at time of target adoption. Given the absence of major supply and demand shocks, and even political shocks, in our case economies over the periods since their adoption of targets, this is appears an appropriate comparison.

In the adopting countries, disinflation through tighter monetary policy had largely been completed by the time of target adoption, allowing real rates to come down (the year or less of

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[14] For New Zealand, we use the discount rate as the only continuously available series which can be seen as reflecting the stance of monetary policy. Since the late 1980s, the Reserve Bank is keeping the discount rate 0.9% above the interbank overnight rate.

[15] Ammer and Freeman (1995) perform a similar exercise for three countries for a much shorter period.

[16] A formal test for structural breaks in monetary policy reaction functions has three limitations preventing its use in this assessment of inflation targeting's effectiveness: first, the tests would be of extremely low power given the limited time since adoption even in New Zealand; second, the tests would require us to impose a structural model of monetary policymaking for each country which appears excessive; third, it would provide a yes/no answer where more qualitative results are of interest.

disinflation remaining attributable to prior instrument interest rate moves, given policy lags). This is consistent with the pattern remarked upon in the case studies of targets being adopted when there was a desire to lock-in inflation expectations at a low level when loosening first occurs *after a disinflation*. Our sacrifice ratio data from the previous part of this section, it should be remembered, only runs to that point, so to look for the effect of inflation targeting on the response to monetary policy we must look out a year or more after adoption. The question is whether upward blips in inflation do or do not lead to persistent rises - holding output and inflation constant - as they would have in a system estimated under the prior regime.

Figures 7-9 plot the results of these simulations (dashed line) versus the actual path of the inflation and output over the period for each of our sample countries, as well as the implied short-term real interest rate (the difference between the overnight rate and inflation). As might be expected, the simulations over time flatten out towards their sample means or a slight trend (given the absence of shocks imposed by the unconditionality of the simulation). For all four inflation targeters, the actual inflation rate comes in consistently below what would have been expected after one year from adoption, and exhibits something of a downward trend as opposed to the simulations' slight upwards leaning. A year after target adoption output gap was visibly below forecast at the same time inflation was below for all four target adopters (a negative output gap in the figure indicates an expanding economy), but then went above expectations after another year of low inflation (consistent with the Phillips curve results). In short, while there is some indication from the simulations that target adoption gave rise to an initial boom, the basic co-movement of inflation and output remains unaltered in pattern.

The key point is that in all the target adopters except Sweden (and there at least initially) this movement downwards of inflation, and then output, was induced with real interest rates below the forecast levels for such a movement. This is consistent with the idea that under targets there is a greater response of the economy to movements in instrument interest rates than there was in the pre-targeting regime. This interpretation, in turn, supports the concept raised in the case studies that the majority of economic benefits accrued through inflation targeting come through greater transparency and lesser confusion about the stance of monetary policy, rather than broader credibility effects on price- and wage-setting.

In the comparison non-targeting countries, the results are more mixed. Australian inflation is below forecast, but follows the general downwards trend of the forecast, versus New Zealand's coming in well below a forecast rise; in Italy, a drop in inflation was predicted as opposed to the UK and Sweden, and it popped up well above it in contrast to those targeters. These inflation movements were accompanied by large booms in output and extremely low real interest rates.

By contrast, the simulations for Germany reflect clearly the effects of reunification, with both inflation and the monetary policy instrument above their projections, and returning to them only in early 1994. GDP growth initially exceeds the projection as a result of the expansion in aggregate demand, until in 1992 and 1993 the effects of the increasingly restrictive monetary policy - as seen in the implied real interest rate well above forecast into the second half of 1994 - force output growth below its projected trend. As in the earlier forecast exercise (compare Figure 6) we interpret the return over time of inflation and the monetary policy instrument to its projection after a surprise demand shock of great magnitude as a characteristic of a successful targeting regime. It should be noted that while Switzerland did manage to bring inflation below forecast even after the transmitted foreign inflation shock, it had more than forecast drop in output as well overall, and persistently high rates to accompany it. In other words, the targeters of long standing largely behaved as expected estimated on their prior behavior - responding to large inflationary shocks with tight monetary policy and dropping output. Monetary policy following a credible path still requires tightness to respond to even one time shocks, and that tightness still has real effects.

III. Evidence on Inflation Expectations

The third kind of evidence to assess the effect of inflation targeting concerns expectations of inflation. We look at consensus forecasts of inflation, and at changes in interest differentials vis-a-vis the United States or Germany at a long and short maturity, and at movements in the government nominal rate bonds yield curve[17] as a variety of measures for directly unobservable inflation expectations. The question is whether the inflation target confers greater credibility either in the form of either less uncertainty about policy or lower risk premia on government debt. Even if the structures in the economy which determine the response of inflation to the cycle remained fixed at the start of inflation targeting in our case countries, as indicated by our first set of investigations, expectations for future inflation might have moved. This could reflect a greater flexibility of financial market expectations than of wage- and product-market

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[17] The United Kingdom, and more recently Canada, have sold "real bonds" guaranteeing a fixed return. While these can be used to back out inflation expectations, there are some uncertainties given illiquidities in these markets and the nature of holders of these bonds (especially for Canada, given the limited size and age - on the order of C$5 billion for three years - of the market). We discuss these in the text but do not feature analysis of these imputed expectations.

contracting; it also would be consistent with the dynamic simulations' result that over time inflation did not bounce back up as forecast, despite good forecasts of output.

The panels of Figure 10 show for each country actual CPI inflation rates as well as consensus private-sector forecasts for inflation by the end of each year since 1990. A square denotes the consensus forecast of inflation done 18 months prior (an asterisk 12 months prior, a triangle 6 months prior) to the date at which the symbol appears, forecasting inflation at that specific point in time. In New Zealand, the forecasts at all three horizons show a continuous downward trend (with the exception of the 6-month forecast in 1995). Yet for the first four years for which targets were announced, inflation expectations were either at the upper end of, or exceeding the target range, although inflation was within or below target at the end of 1991, 1992, and 1993. It was only in mid-1993 that the 18-month forecast was within the target range. Once inflation expectations had adjusted, the New Zealand targeting regime seems to have acquired credibility: in mid-1995, while headline inflation was 3% above the target range, the 18-month forecast for inflation at the end of 1996 was still at 1.1%.

In Canada, while not unexpectedly the forecasts of 1991 inflation made prior to target adoption predicted a rise in inflation, interestingly so did the prediction made in June 1991. Again, as in New Zealand, it would appear reasonable to model private-sector inflation forecasts as (at least partially) a function of lagged inflation; the regime change does not appear to have induced a revolution in expectations formation. Both 12-month and 18-month ahead forecasts exhibited consistent downward trends over the remainder of the target period, with all of these forecasts made after target adoption lying within the target range (even when the six-month ahead forecast dropped below in accord with the first-round tax effect of 1994). On this measure, the Canadian inflation targets appear to have gained great credibility.

In the UK inflation expectations at the longer horizon stayed stubbornly at the upper end of the 1-4% target range, even during periods when headline inflation was well within, or at the bottom of the lower half of the target range. For all four years following target adoption (1993 to 1996) inflation expectations were initially higher than the outcome, and were revised downwards continuously.

The Swedish disinflation during 1992 was partially anticipated, as shown by the 18-month forecast for inflation by the end of 1992, but not completely, as the successive downward revisions of inflation expectations reveal. Vice-versa, the impact of the devaluation of the krona in fall 1992 on inflation in 1993 was initially underestimated. Since the end of 1993, inflation expectations at all horizons have remained just below, or slightly above the upper end of the target range, although inflation has been kept consistently inside of it.

Inflation expectations in Australia, a country converging upon inflation targeting, had until 1994 followed a similar course to those in New Zealand. Inflation expectations at all horizons exhibited a consistent downward trend, and for each year inflation expectations were successively revised downwards. In contrast to New Zealand, however, since 1995 inflation expectations in Australia at the 18-month horizon have trended upwards, although the actual inflation performance in Australia was not much different from the one in New Zealand. Expectations for inflation by the end of 1996 are now 1% above Australia's informal target range of 2-3%. The divergence in medium-term expectations between the comparable Antipodes would suggest some direct role for the difference between explicit and implicit medium-term targets as an anchor.

Italy, used for comparison to the other ERM-exiters Sweden and the United Kingdom, has been remarkably successful in containing the inflationary consequences of its massive devaluation following the lira's exit from the ERM. That this came largely as a surprise to private sector forecasters is shown by the 12-month forecast for inflation during 1993, which was revised upwards (on average) from the 18-month forecast of 4.8% by 0.9%, only to be revised downwards six months later by 1%. As the downward trend of inflation continued during 1993 and 1994, inflation expectations at the long horizon fell to 3.7%. This latest gain in lowering inflation expectations has been lost, however, during the 1995 upsurge in inflation. Still, inflation expectations at the long horizon are below their levels during the last years of Italy's ERM membership, despite lack of target or explicit nominal anchor.

The extent to which inflation in Germany rose during 1991 and 1992 appears unsurprisingly to have been unexpected; interestingly, the speed of the subsequent disinflation seem to have been unexpected as well. While at the time of economic reunification inflation expectations for the end of 1991 were barely above 3%, once inflation expectations had risen close to 4% it took almost two years of disinflation until, in mid-1994, long-run inflation was expected to be back around 2%. A very similar picture emerges from the Swiss data. In mid-1990, while inflation was running above 5%, inflation during 1991 was still expected to be around 3.1%. Neither did long-term inflation expectations increase by much during 1991, when inflation peaked. Inflation expectations at the 18-month horizon then fell gradually from a peak of 3.7% to 2.4%, staying consistently above realized inflation rates during the past two years.

The experiences of Germany and Switzerland suggest that in a reliably proven targeting regime inflation expectations exhibit a high degree of inertia, limiting both the upwards motion in inflation after shocks and the speed of reaction to disinflation. Moreover, as seen in the experiences of the recent adopters of targets, and especially in the New Zealand-Australia comparison, the inertia comes with a nailing down of the medium-term expectations for inflation. The formation of expectations in the short-term quite rationally appears to allow for upwards movements in inflation and gradual disinflation, under the medium-term guidepost, consistent with the targeters' demonstrated operational behavior.

Another perspective on inflation expectations is given by interest rates. The charts in the left column of Figure 11 show the differentials between the yields on United States and New Zealand, Canadian, and Australian 10-year government bonds and on 3-month treasury bills respectively, while the right column presents the same differentials of UK, Swedish, and Italian government securities vis-a-vis German ones. The assumption is that cross-national interest rate differentials are driven by expected changes in exchange rates, which are in turn largely determined by expected differences in inflation rates. In New Zealand, the long-term interest rate differential in particular mirrors very closely the course of the disinflation for the three years following target adoption. At its lowest point in early 1994, long-term investments in NZ$ yielded lower than comparable investments in US$, while the 3-month differential had fallen below 2%. Interestingly, while headline inflation was well above target during 1995, both interest rate differentials rose only modestly, apparently reflecting continued confidence in New Zealand's commitment to low inflation.

In Canada, while short-term interest rates spiked enormously in late 1992 and 1993, even after targeting, this has to been seen as a reflection of the general turmoil in world exchange markets following the ERM shakeout and moves in the US bond market, followed by the

Canadian constitutional crisis and election; except for this spike, the differential on 3-month interest rates has been on a consistent downward trend, and even briefly was in favor of Canada at the end of 1994. The long-term interest rate differential has moved down slightly on average in the second half of the targeting period, but remains on the order of 200 basis points, which is on the high end of the historical range for the Canada/US differential. The ongoing fiscal and Quebec doubts about the long-term future of Canadian policy apparently cannot be fully compensated for by monetary policy.

The successive cuts in UK official interest rates following sterling's exit from the ERM, combined with only cautious decreases in the German repo rate, is reflected in a negative short-term interest rate differential between the UK and Germany from late 1992 until mid-1994. Through this whole period the long-term interest rate differential hovered around 1%, only briefly (in early 1994 before the onset of US monetary tightening) dipping to 0.5%. Thereafter the long-term differential rose above 1%, and has been staying between 1 and 2% since. If one is willing to interpret this differential as the difference in long-term inflation expectations between the UK and Germany, and assuming those expectations for Germany are around 2%, the resulting expectations for the UK are close to 4%, confirming the evidence from the consensus forecasts. It should be emphasized that these UK-Germany differentials are relatively low for the post-Bretton Woods period, and suggest that inflation targeting was a largely successful substitute nominal anchor for ERM membership (given the continuing low levels after devaluation).

The Riksbank's efforts in September 1992 to defend the Swedish krona caused a sharp spike in the T-bill yield differential vis-a-vis Germany, while the differential between government bond yields also rose considerably. The subsequent cuts in the Marginal Rate following the Riksbank's decision on November 19, 1992 to float the krona narrowed the short-term differential during the following months, to 1.1% in August 1993. From then until the end of 1995 it widened to almost 6%, and has narrowed since then to below 3%. The fall in the long-term differential continued until February 1994, when it reached 0.8%. On the background of the 1994 bond market downturn, over the following six months the long-term differential rose to 4%, and remained in the 3-4% range for another year. Of late, however, the long-term differential has steadily fallen to below 2%. A potential gain in credibility for Sweden's inflation targets may explain the recent narrowing of both interest rate differentials, as may the prospect of European Monetary Union and the fiscal consolidation required in connection.

Interest rate differentials between Australian and US government bonds and treasury bills respectively rose above their New Zealand counterparts from mid-1988 to mid-1990, when New Zealand headline inflation fell below the Australian one. Since 1991, the Australian short-term differential vis-a-vis the US has been lower than the New Zealand one. By contrast, since 1992 the differential between yields on New Zealand and US government bonds has been below the one between Australian and US government bonds, despite the two countries' almost identical inflation performance during those years, and arguably lower liquidity in the New Zealand bond market as compared to the Australian one. Only lately have the two long-term differentials converged.

Interest rate differentials between Italian and German government securities have followed very similar patterns to their Swedish counterparts. A sharp rise in both short and long-term differentials during fall 1992 was reversed, with both differentials falling to historical lows. As in Sweden, the narrowing of the short-term differential came to an end in August 1993, by which time it had reached 1.5%, while the long-term differential bottomed out in February 1994 at 1.1%. The short-term differential then rose steadily to reach 6.5% by the end of 1995, and has since fallen to 4.2%. The long-term differential peaked in April 1995 at 4.1%, and has since fallen to 1%. To what extent the recent narrowing of both differentials reflects expectations concerning European Monetary Union, and Italian membership in it, is again an open question.

Finally, Figure 12 depicts movements in the nominal government bond yield curves for Canada, the United Kingdom, Australia, and Sweden[18]. In Canada, yield curves start rising in early 1987, with the onset of monetary tightening and, possibly, inflationary fears on the background of strong growth. During 1987 and 1988, both ends of the yield curve move roughly in proportion, with 3-month yields rising from 7 to 10.4%, and 10-year yields from 7.8 to 10.2%. Only in 1989 does the hitherto relatively flat yield curve turn inverted, with monetary policy being tight on this measure until mid-1991. During 1991 yield curves fall over the entire length: while short rates fall from above 13 to below 7%, long-term yields are reduced by 2.5% during 1991. The evidence from consensus forecasts presented earlier suggests that this fall in long-term yields is mostly attributable to a strong downward revision in inflation expectations. During 1992 and 1993 yield curves are positively sloped, with short rates falling to 4.6% and 10-year yields to 7.4% by September 1993. The worldwide downturn in bond markets during 1994 following the onset of monetary tightening in the US, and the subsequent recovery during the first months of

[18] There is no market in New Zealand government bonds of sufficient depth to generate such an analysis. Detailed yield curve data for Switzerland were not available, while only in 1990 Italy started issuing non-indexed Government Bonds with maturities longer than three years.

1995 are clearly visible, with yield curves only briefly becoming inverted in early 1995. Long-term bond yields in mid-1995 had approximately returned to their level of early 1993, again confirming the evidence from the consensus forecasts.

Yield curves in the UK soared during late 1989 and 1990, and became sharply inverted as the extent of the inflationary pressures, and of the required monetary tightening to bring them under control, became apparent. The easing following sterling's entry into the ERM in October 1990 was accompanied by improvements in long-term inflation expectations, as long-term yields fell 0.8% within the next quarter, and by 1.6% during the 12 months following sterling's entry. Yield curves remained mostly flat until the ERM crisis in September 1992. Following sterling's exit, the slope of the yield curve turned sharply positive, driven by a 4% fall in overnight rates at the short end, and presumably a considerable increase in inflation expectations at the long end. Only during the second quarter of 1993 long-term bond yields began to fall below their levels during sterling's ERM membership of around 9.5%. As in Canada, yield curves in the UK rose during early 1994 along the whole horizon, although more so at the short end than at the long end, leading to a slightly inverted yield curve. Since then, long-term bond yields have remained around 8.5%, almost 1% below their levels during ERM membership.

As shown in the lower right panel of Figure 12, during the late 1980s yield curves in Sweden, as in the UK, were rising sharply along the entire horizon. Short-term rates peaked at around 15% in August 1990, at which point long-term rates had been falling from their peak of 13.8% in April 1990 to around 13.4%, giving rise to an inverted yield curve. Yield curves then fell rapidly along the entire length until August 1991. Yields at longer maturities continued to fall until summer 1992, with the 10-year bond yield falling below 10%. Short-term rates, however, spiked during the fall of 1991, as the Riksbank was forced to defend the krona's peg to the ecu. In the runup to the speculative attacks of September 1992 the yield curve rose during the summer of 1992 at the entire horizon, with short-term rates standing at 13.25%, and long-term yields at 11% by August 1992. After the Riksbank's decision to float the krona, yield curves fell along the entire horizon, and had turned flat by the end of 1993, with both short- and long-term yields around 7% at historically low levels. While monetary policy tightened moderately during 1994, with the Marginal Rate rising from 7 to 8%, bond yields soared by over 4% from February to August, leading to a steeply sloped yield curve. Since the end of 1994, yield curves have been falling.

During 1988 and 1989 the Reserve Bank of Australia tightened monetary policy considerably, with real short-term rates rising from below 4% in early 1988 to above 12% in mid-1989. By the end of 1989 nominal short-term rates peaked at around 18%, and, as the lower left panel in Figure 12 shows, the yield curve had by then turned inverted. The rapid decline of the Cash Rate that began in January 1990 was until May accompanied by rising long-term rates, with 10-year bond yields climbing to 13.8%. During the summer of 1990 long-term rates began to fall as well, although initially slower than short-term rates, and by August the yield curve had turned flat. Until the end of 1991 both long- and short-term rates fell in tandem, and since then the yield curve has been positively sloped. Interest rates bottomed out at the beginning of 1994, with short-term rates falling to 4.5% and long-term yields to 6.7%. During 1994 the yield curve rose at all horizons, and turned somewhat flatter. By the end of 1994 short-term rates had increased to 8.25%, and long-term rates to 10%. During the first half of 1995 yields at all maturities have been falling, by 1.5% at intermediate maturities, and by 0.5% at both ends of the curve.

On balance, private-sector inflation expectations appear to have declined for all the inflation targeters, but most clearly for the medium-term and beyond for the targeters of longer standing, Canada and New Zealand. It would be consistent with the eventual decline of expectations in Canada and New Zealand to state that the United Kingdom and Sweden could be merely too short a time away from adoption to have reaped the full benefits. The comparisons with Australia and Italy, respectively, however, work against this interpretation, with Canada and New Zealand clearly registering counterinflationary credibility gains vis-a-vis Australia, while the United Kingdom and Sweden are not so clearly outperforming Italy on this score. The experiences of Germany and Switzerland during the strains of reunification seem to indicate that the true test of target credibility is the resistance of medium- to long-term inflation expectations to influence from short-term inflationary pressures. As discussed in the case studies, Canada has already shown strong evidence of such a "lock-in" effect, preventing pass-through to prices of tax rises or constitutionally prompted exchange fluctuations, while Sweden has fared considerably less well in the face of one-time shocks since leaving ERM.

IV. A Preliminary Assessment of Inflation Targeting's Effectiveness

Taken all together, the adoption of inflation targets as the framework for monetary policy in the four countries examined here appears to have been a success. While we cannot perfectly answer the counterfactual of what would have happened had they not adopted inflation targeting, these countries seem to have seen inflation levels and expectations drop far more for the point in the business cycle than we would have expected on the basis of their past performance. And for three of the four of them, this was achieved with smaller rises in short-term real interest rates than past experience would have predicted. The hopes of some adopting countries, particularly of Canada and New Zealand, to see the costs of disinflation drop versus past levels, however, were not fulfilled through the first post-adoption disinflations. Whether this should be seen as a failure of inflation targeting credibility, or a confirmation of the limited effect of variation in monetary policy structures on the output-inflation tradeoff seen before, is left to the reader. The comparison of the adopting countries' inflation record to that of the respective "control" countries, Australia and Italy, underscores the apparent effect of inflation targeting on expectations and the economic response to monetary policy.

It is the comparison of the effect of inflation target adoption in the sample countries to the baseline of what longstanding targeters Germany and Switzerland experience which brings home two crucial points. First, it may be too much to expect monetary regimes to alter the output-inflation tradeoff, even when credibly believed, and therefore the lack of effect of inflation targeting upon them may be an uninformative result. Second, it is reasonable to expect that a credible transparent targeting regime locks-in medium- to long-term inflation expectations in the face of temporary shocks, and therefore demands less of monetary policy in order to limit the pass through effect of those shocks. In other words, the primary effect of any nominal targeting regime may be through increased transparency of monetary policy, rather than through increased commitment to price stability[19]. This transparency to the public may give the targeting monetary authority the flexibility with support necessary to repeatedly cope with inflation even when disinflation remains expensive in terms of output, producing sustained price stability.

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[19] For an interpretation of the operational effects of the German and Swiss monetary targeting frameworks consistent with this view, see Laubach and Posen (1997).

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TABLE 1: SACRIFICE RATIOS AND THEIR DETERMINANTS

Results from regressing a sample of 22 sacrifice ratios (3 for each country except for Germany and Switzerland) on a constant, inflation at the beginning of the disinflation, change in inflation during the disinflation, and the length (in quarters) of the disinflation. T statistics in parantheses.

Constant	1.99 (2.37)
Initial Inflation	-0.17 (2.73)
Change in Inflation	0.07 (0.66)
Length of Disinflation	0.06 (1.13)
Adjusted R-Square	0.39

Sacrifice Ratios for the Latest Completed Disinflation

	New Zealand	Canada	Australia	UK	Sweden	Italy	Germany	Switzerland
Disinflation	86Q3 - 92Q4	90Q3 - 93Q4	89Q2 - 93Q1	90Q1 - 93Q4	90Q4 - 93Q1	90Q2 - 93Q4	80Q4 - 87Q1	82Q1 - 87Q1
Initial Inflation	15.38%	5.25%	7.62%	8.64%	9.55%	6.42%	5.87%	5.93%
Change in Inflation	14.25%	4.16%	6.22%	6.48%	6.43%	2.17%	5.75%	4.82%
Sacrifice Ratio	2.05	3.04	1.89	2.14	0.36	0.62	2.47	2.15
Predicted Sacr Ratio	1.78	2.13	1.98	1.83	1.33	1.85	2.81	2.45
Past Avg Sacr Ratio	0.98	1.06	0.28	0.55	0.59	0.41	4.46	2.34

TABLE 2: RESULTS FROM MODELLING AND FORECASTING INFLATION

Results from regressing inflation on its own lags and those of some output measure, changes in the nominal effective exchange rate, and changes in commodity prices prior to the adoption of inflation targets (prior to German reunification for Germany and Switzerland, prior to 1990Q1 for Australia, and prior to 1992Q4 for Italy), and from forecasting inflation conditional on actual values for the remaining variables over 8 quarters following target adoption.

Country	New Zealand	Canada	Australia	UK	Sweden	Italy	Germany	Switzerland
Output Measure	Unemployment	Output Gap	Unemployment	Unemployment	Output Gap	Unemployment	Unemployment	Output Gap
Sample	71Q2 - 89Q4	71Q2 - 90Q4	71Q2 - 89Q4	71Q2 - 92Q3	71Q2 - 92Q4	71Q2 - 92Q3	71Q2 - 90Q2	71Q2 - 90Q2
Forecast Horizon	90Q1 - 91Q4	91Q1 - 92Q4	90Q1 - 91Q4	92Q4 - 94Q3	93Q1 - 94Q4	92Q4 - 94Q3	90Q3 - 92Q2	90Q3 - 92Q2
A. BASIC SPECIFICATION, FOUR LAGS OF EACH VARIABLE INCLUDED								
Adj R Square	0.61	0.64	0.63	0.56	0.23	0.73	0.57	0.42
Sum of coefficients on all lags (joint significance of all lags) of variable:								
Inflation	0.54 (7.87)*	0.87 (28.00)*	0.83 (25.54)*	0.63 (7.44)*	0.67 (5.66)*	0.80 (21.86)*	-0.01 (0.24)	0.50 (3.63)*
Output Measure	-0.09 (4.03)*	0.09 (3.62)*	-0.06 (1.88)	-0.14 (3.83)*	0.13 (1.55)	-0.13 (6.25)*	-0.14 (6.26)*	0.13 (5.59)*
NEER	-0.10 (4.86)*					-0.04 (4.26)*	-0.15 (3.08)*	0.01 (2.51)*
Commodity Prices		0.02 (1.44)			0.08 (2.70)*	0.01 (1.30)	0.04 (3.28)*	
Implied Sacrifice Ratio (8 Lags of Inflation)	3.95	1.29	3.47	2.33	0.56	0.95	6.56	2.95
Structural Break (5% Critical Value)	0.64 (1.73)	2.16* (1.72)	0.41 (1.70)	0.39 (1.85)	1.11 (1.88)	0.92 (1.89)	0.93 (1.78)	0.40 (1.76)
Avg Forecast Error	0.77	0.61	0.86	1.90	-0.11	-0.95	-1.78	-0.11
B. PARSIMONIOUS SPECIFICATION								
Adj R Square	0.61	0.63	0.64	0.53	N/A	0.73	0.59	0.40
Sum of coefficients on all lags (number of lags, joint significance of all lags) of variable:								
Inflation	0.47 (4, 7.21)*	0.84 (3, 41.70)*	0.75 (1, 109.95)*	0.48 (1, 27.05)*		0.71 (1, 84.23)*		0.40 (3, 3.54)*
Output Measure	-0.11 (4, 4.49)*	0.10 (1, 12.34)*	-0.06 (1, 4.49)*	-0.17 (1, 13.70)*		-0.15 (2, 15.62)*	-0.14 (3, 31.28)*	0.15 (4, 5.44)*
NEER	-0.14 (3, 5.66)*					-0.02 (4, 5.80)*	-0.15 (4, 3.75)*	0.01 (3, 3.92)*
Commodity Prices							0.04 (4, 3.37)*	
Structural Break (5% Critical Value)	0.57 (1.73)	1.98* (1.71)	0.42 (1.70)	0.42 (1.85)		0.89 (1.88)	0.95 (1.78)	0.38 (1.76)
Avg Forecast Error	0.38	0.93	2.79	2.40		1.64	-1.78	-0.14

FIGURE 1: INFLATION AND TARGETS

FIG 1.1: NEW ZEALAND, CORE AND HEADLINE CPI INFLATION, AND TARGET

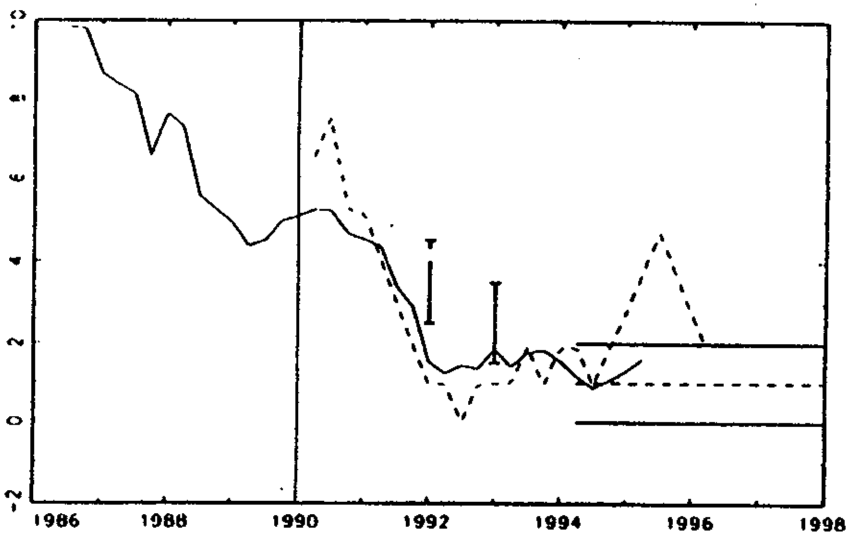


FIG 1.2: CANADA, CPI INFLATION EXCL FOOD AND ENERGY, AND TARGET

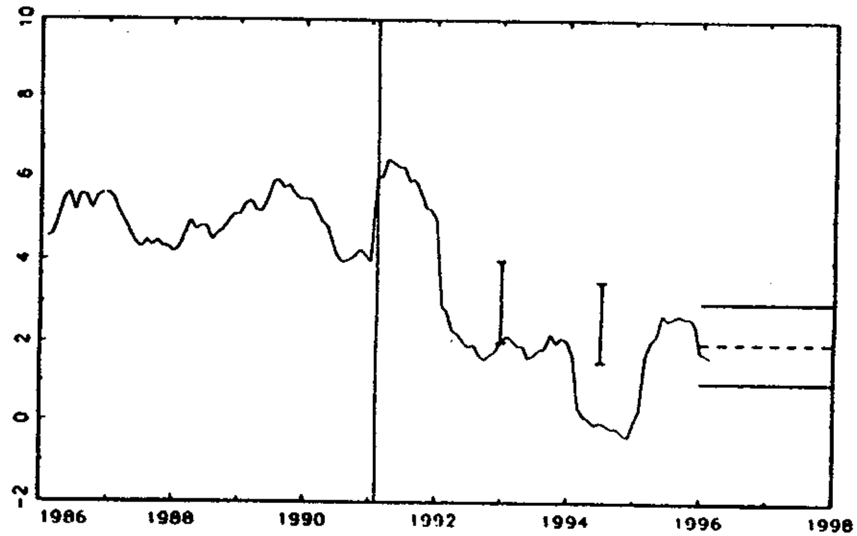


FIG 1.3: UK, RPIX INFLATION AND TARGET

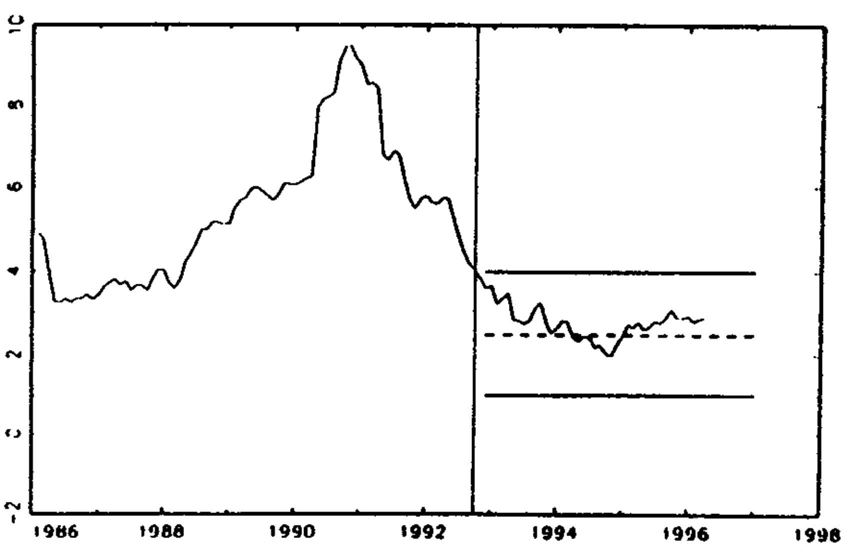


FIG 1.4: GERMANY, CPI INFLATION AND UNAVOIDABLE INFLATION

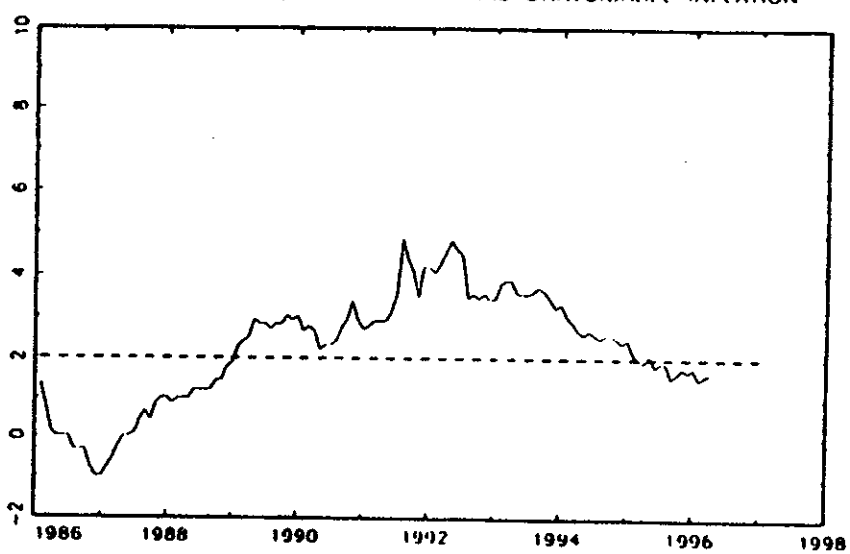


FIGURE 2: NEW ZEALAND MACROECONOMIC BASELINE

FIG 2.1: GDP GROWTH

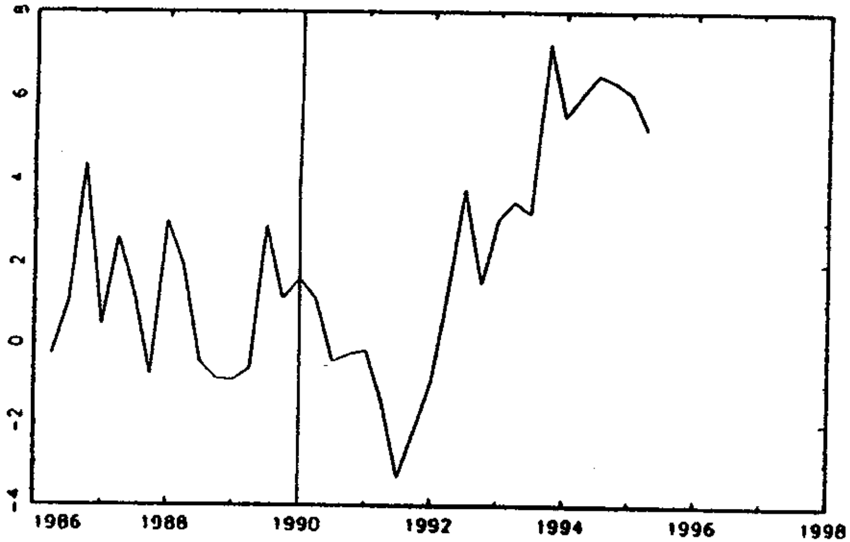


FIG 2.2: NOMINAL EFFECTIVE EXCHANGE RATE

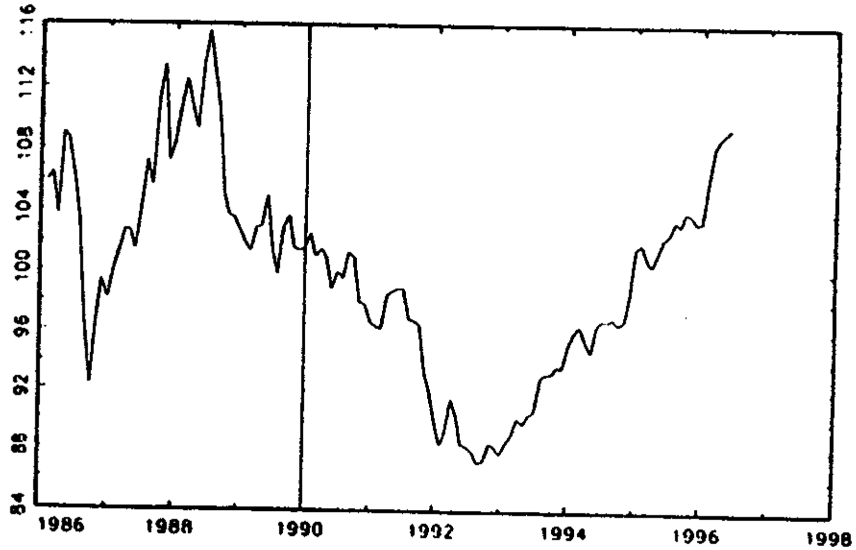


FIG 2.3: UNEMPLOYMENT RATE

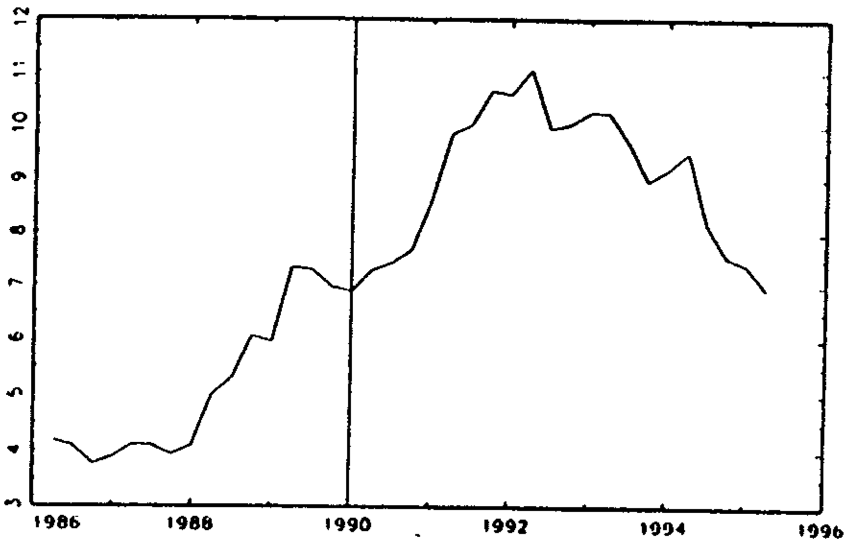


FIG 2.4: DISCOUNT RATE

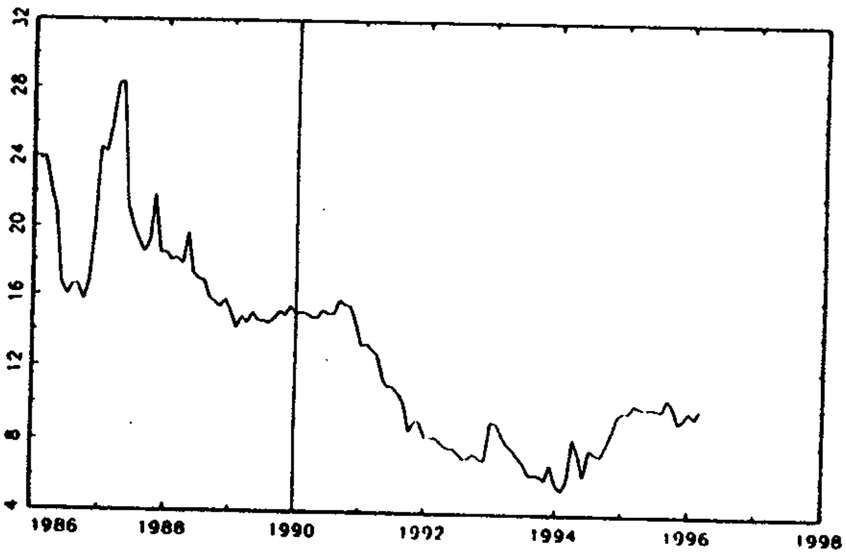


FIGURE 3: CANADIAN ECONOMIC TIME LINE

FIG 1.1: ANNUAL AND AVERAGE INFLATION, AND TARGETS

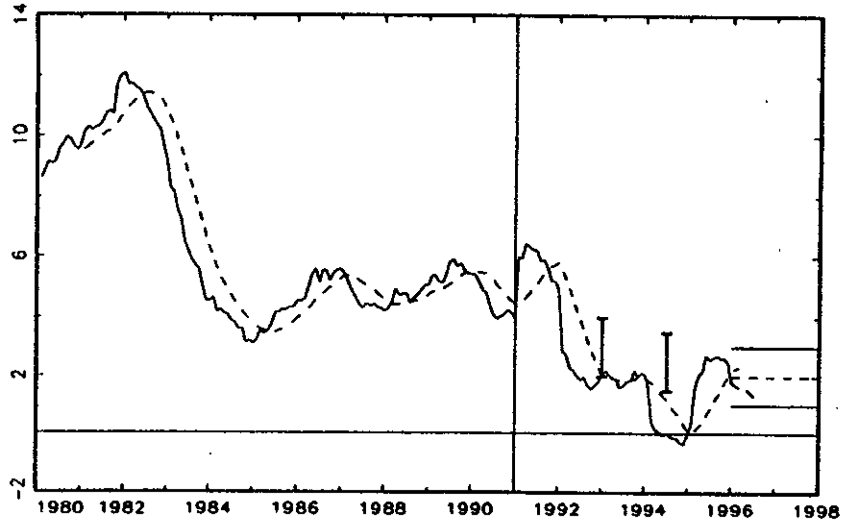


FIG 1.2: OVERNIGHT AND LONG-TERM INTEREST RATES

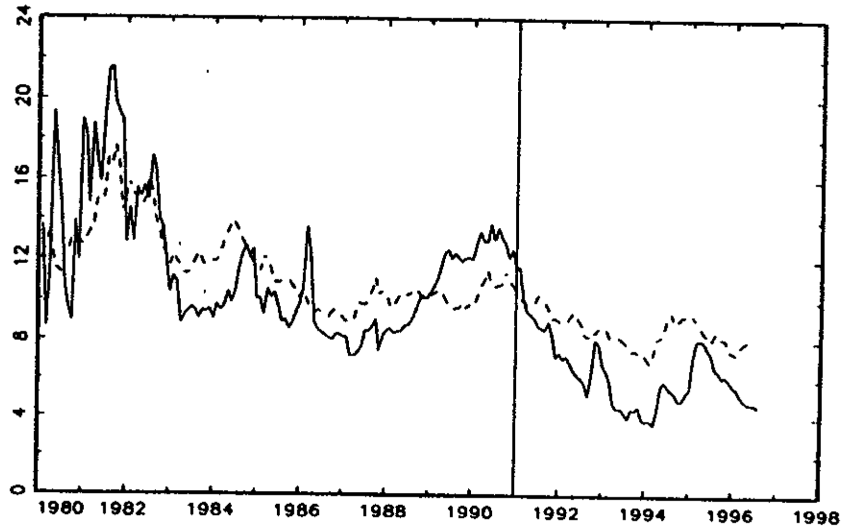


FIG 1.3: NOMINAL EFFECTIVE EXCHANGE RATE

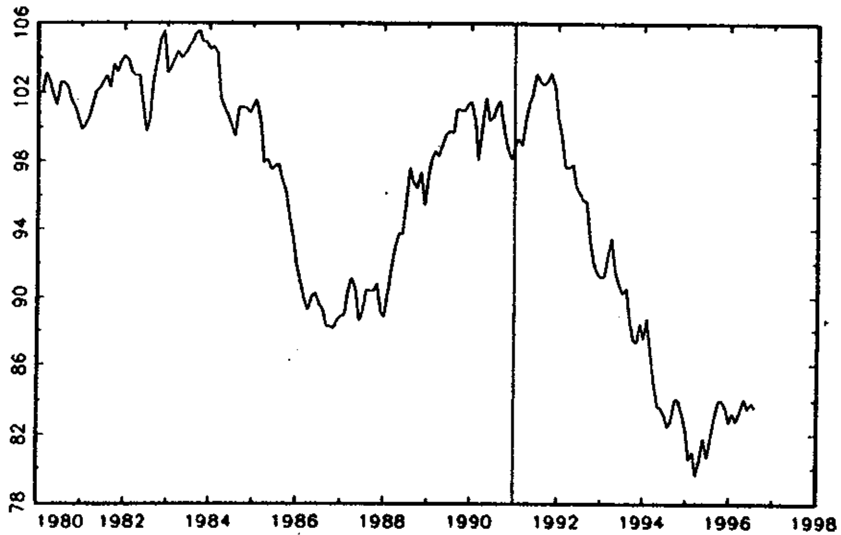


FIG 1.4: GDP GROWTH AND UNEMPLOYMENT

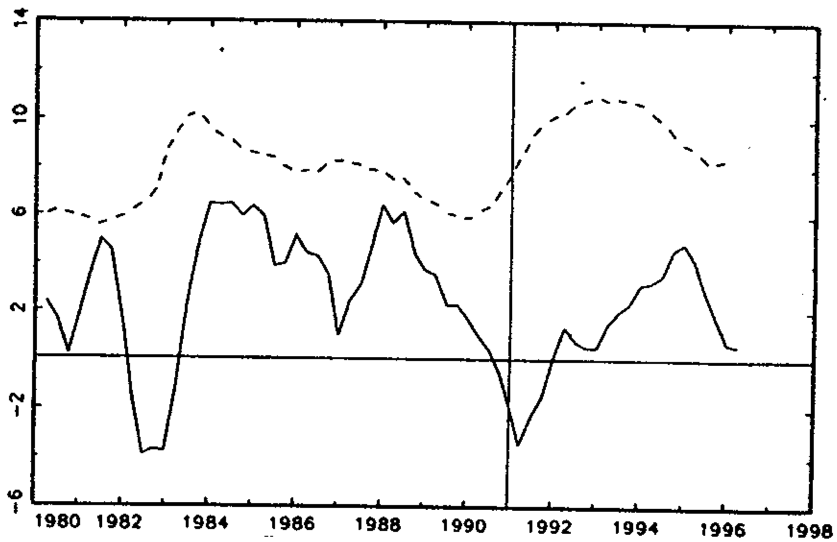


FIGURE 4: UK ECONOMIC TIME LINE

FIG 1.1: ANNUAL AND AVERAGE INFLATION, AND TARGETS

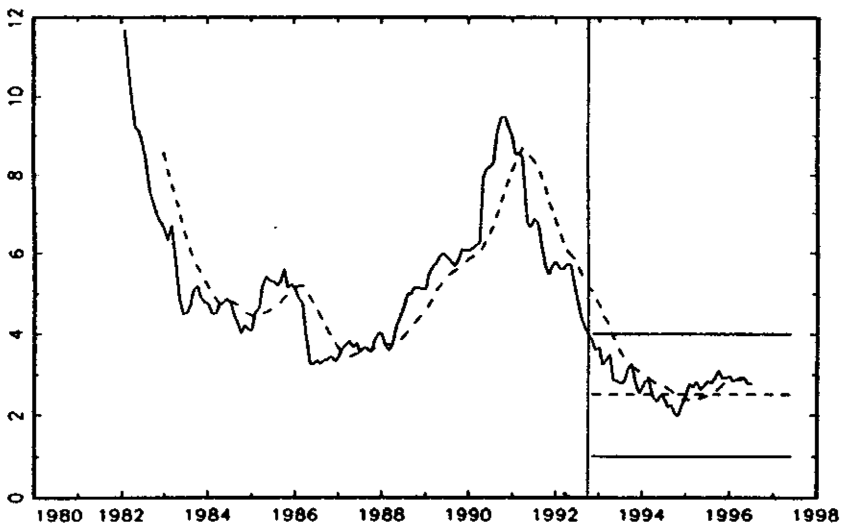


FIG 1.2: OVERNIGHT AND LONG-TERM INTEREST RATES

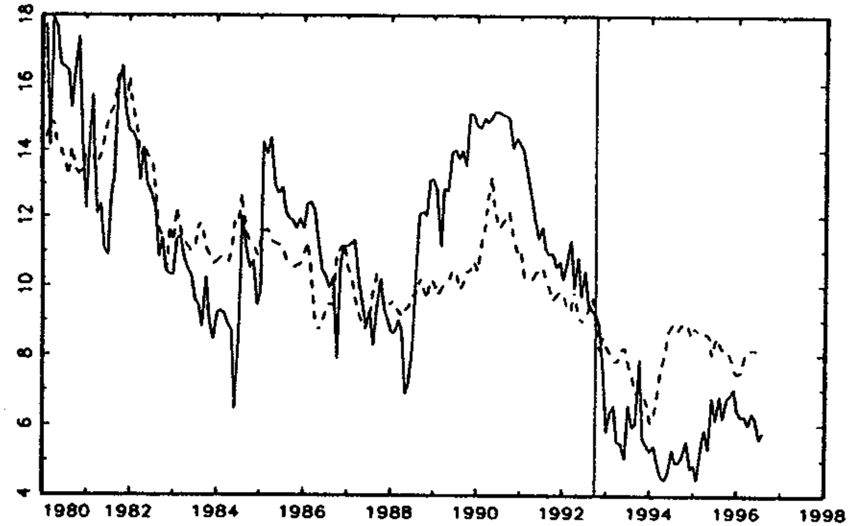


FIG 1.3: NOMINAL EFFECTIVE EXCHANGE RATE

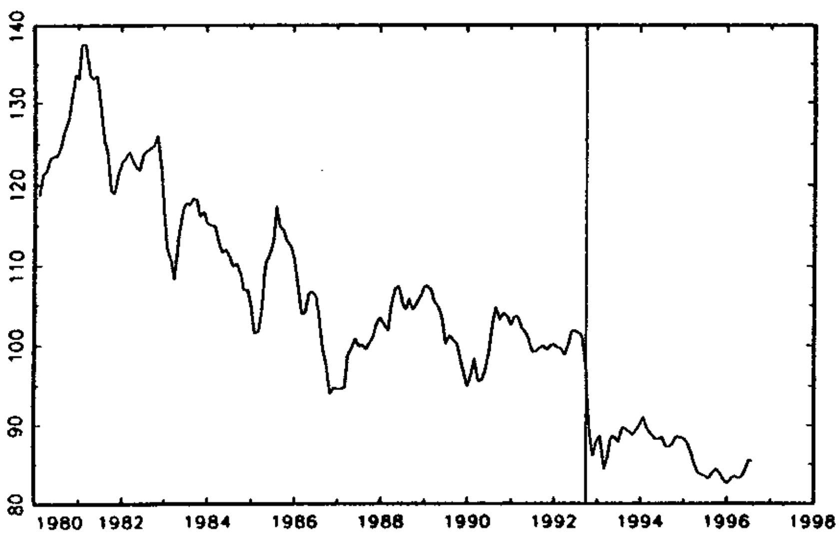


FIG 1.4: GDP GROWTH AND UNEMPLOYMENT

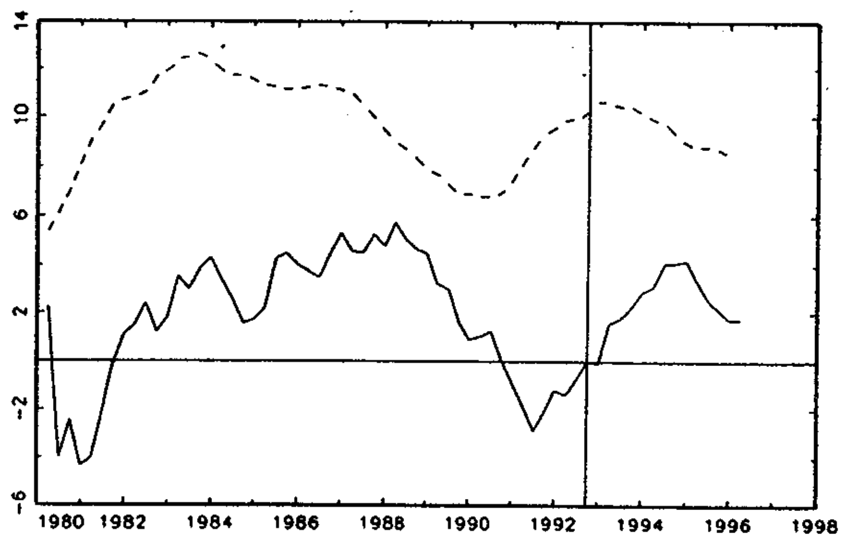


FIGURE 5: SWEDISH ECONOMIC TIME LINE

FIG 1.1: ANNUAL AND AVERAGE INFLATION, AND TARGETS

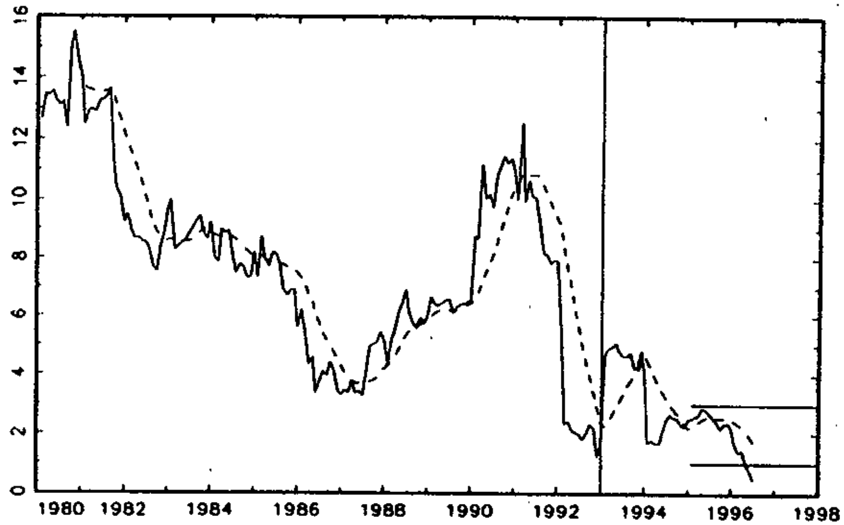


FIG 1.2: MARGINAL AND LONG-TERM INTEREST RATES

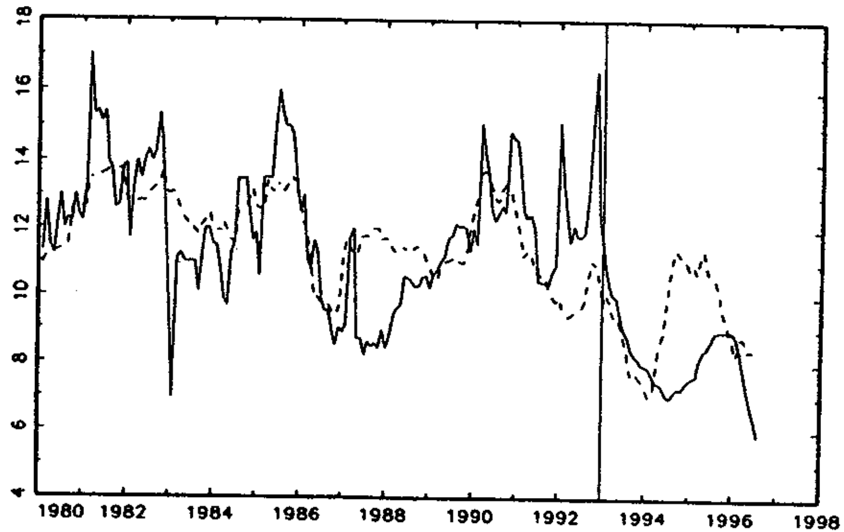


FIG 1.3: NOMINAL EFFECTIVE EXCHANGE RATE

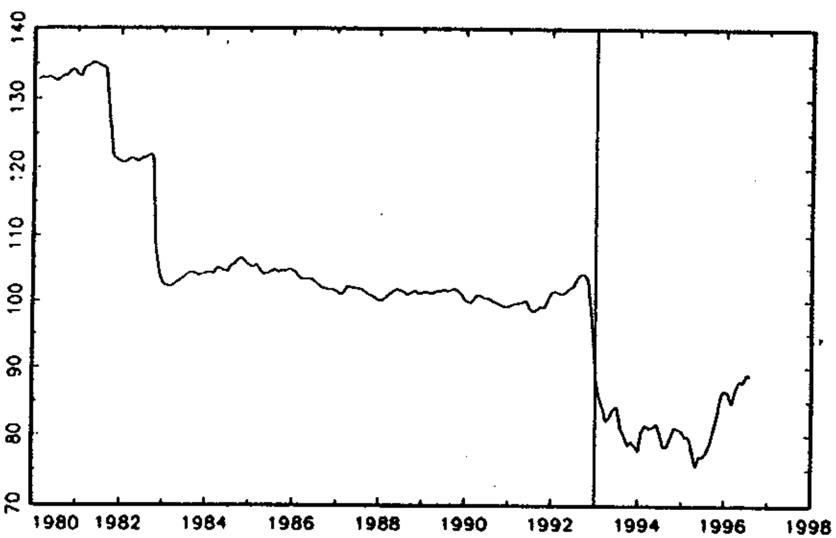


FIG 1.4: GDP GROWTH AND UNEMPLOYMENT

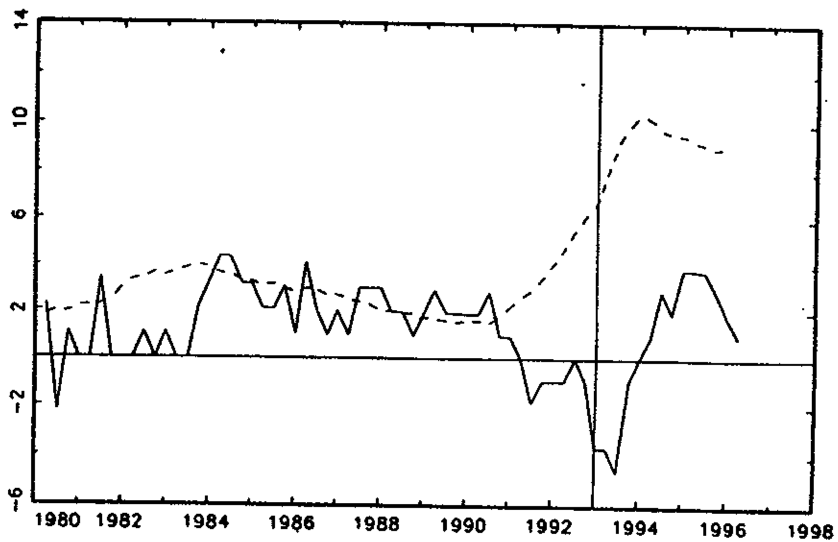


FIGURE 5: INFLATION FORECASTS

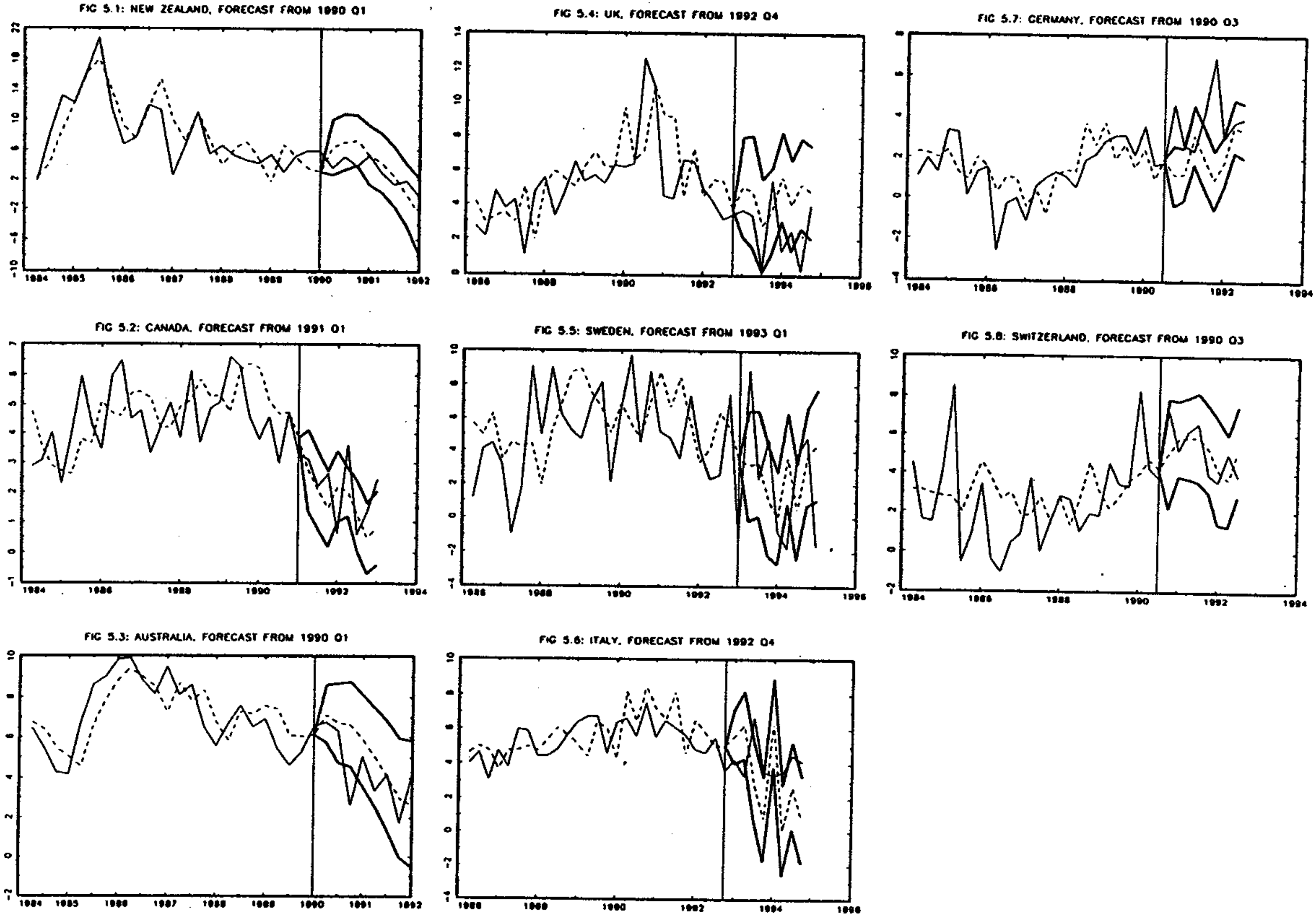


FIGURE 7: DYNAMIC SIMULATIONS

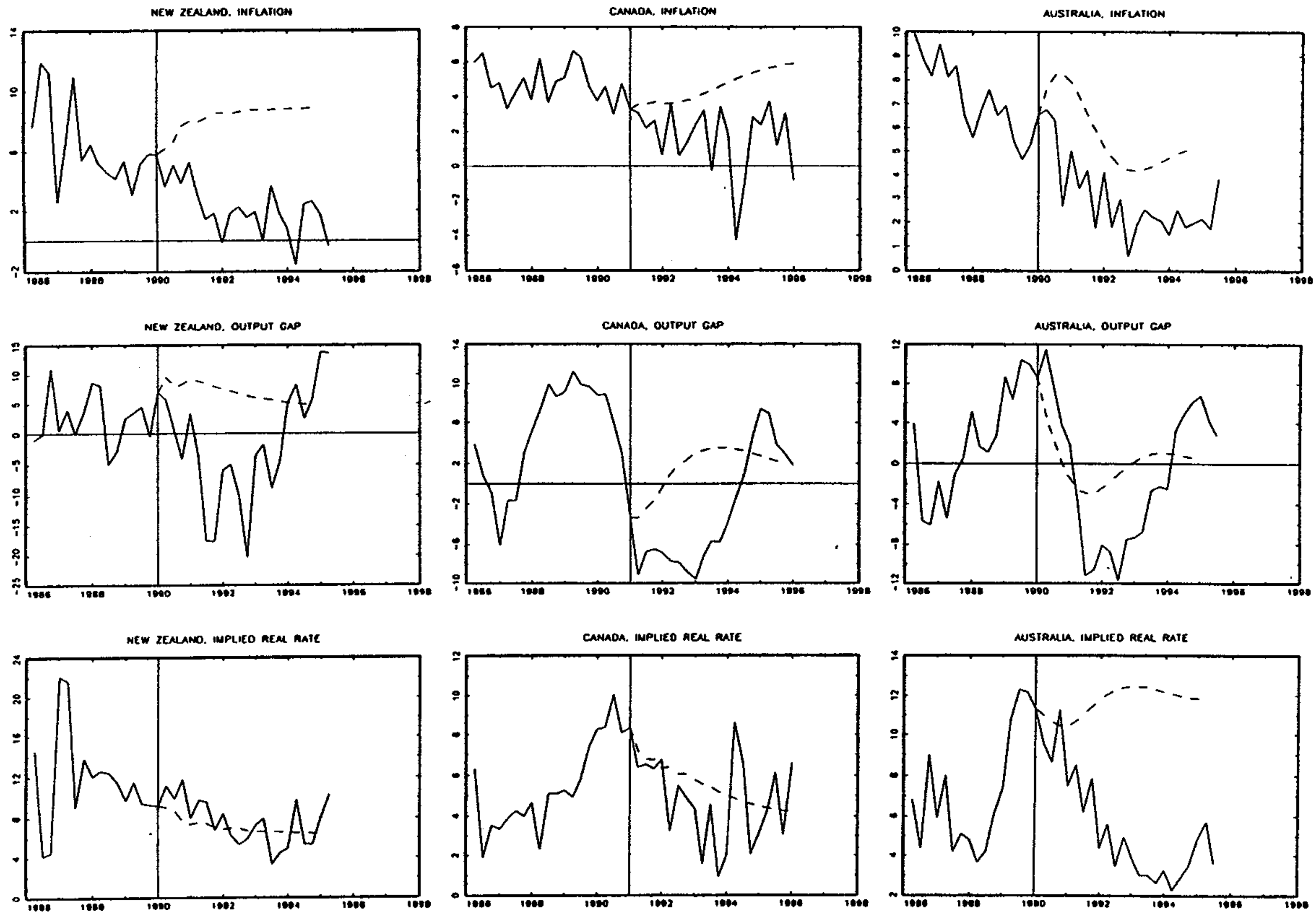


FIGURE 8 : DYNAMIC SIMULATIONS

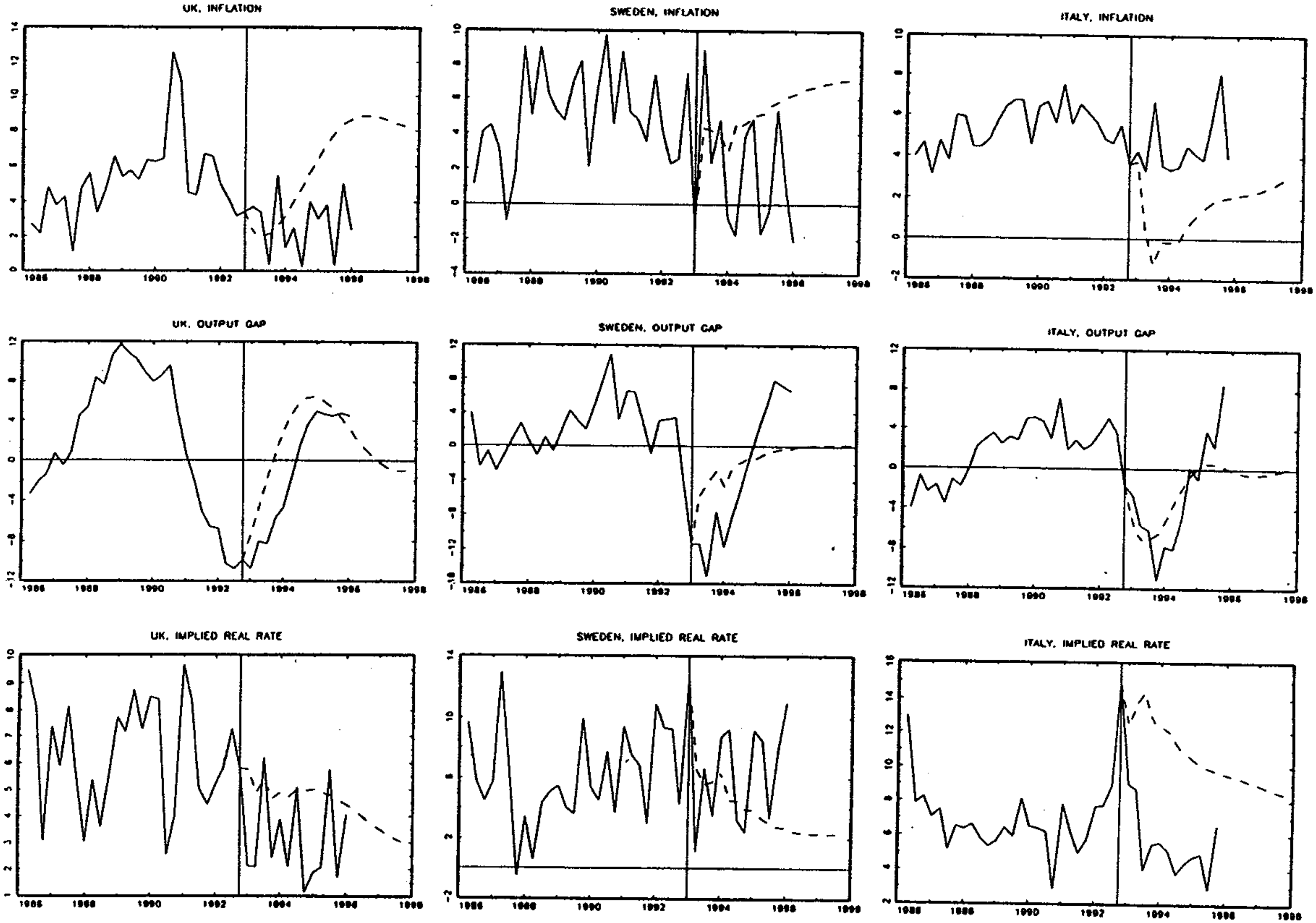


FIGURE 9: DYNAMIC SIMULATIONS

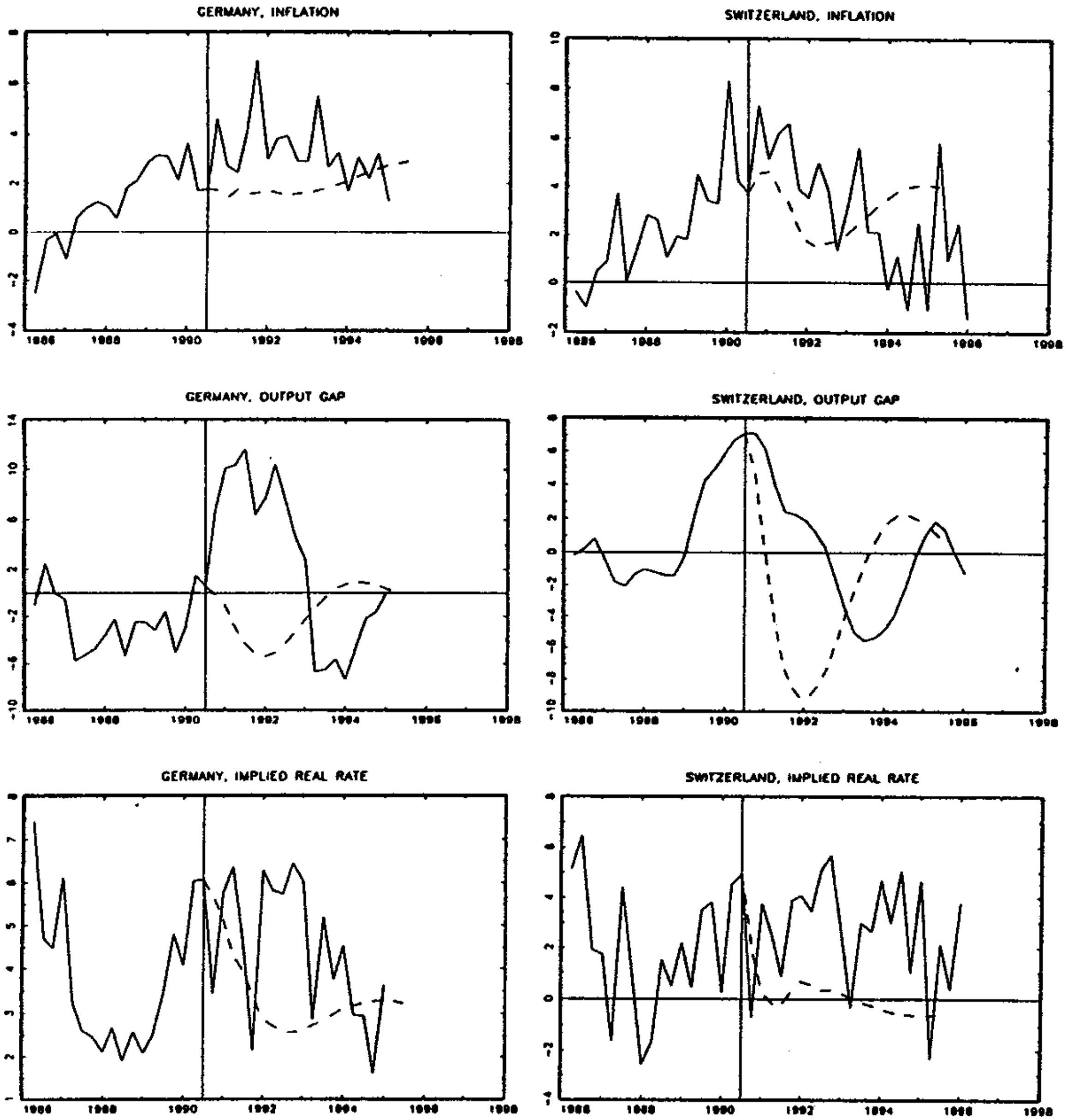


FIGURE 10: CONSENSUS FORECASTS OF INFLATION

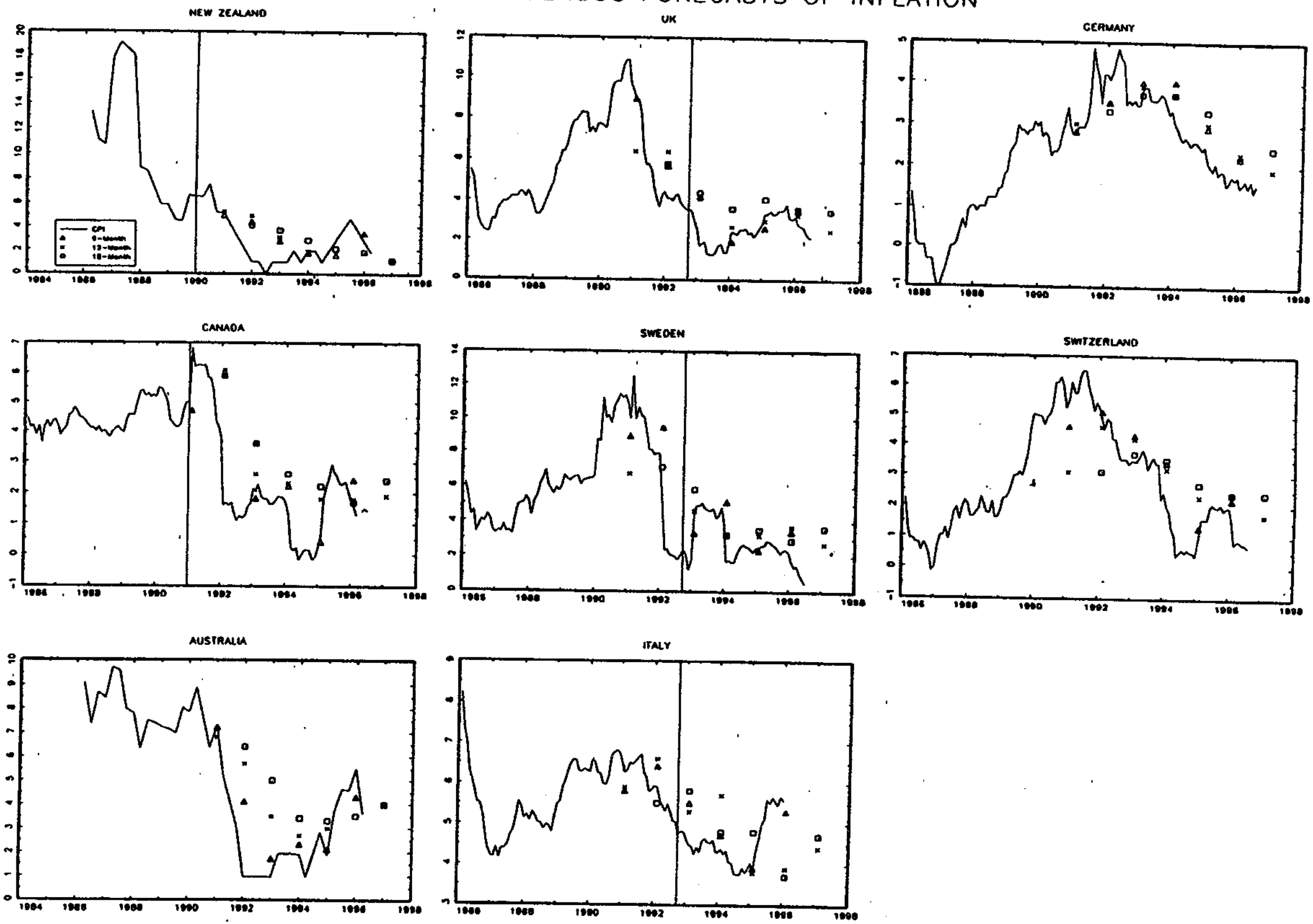


FIGURE 11 : 10-YEAR AND 3-MONTH INTEREST RATE DIFFERENTIALS

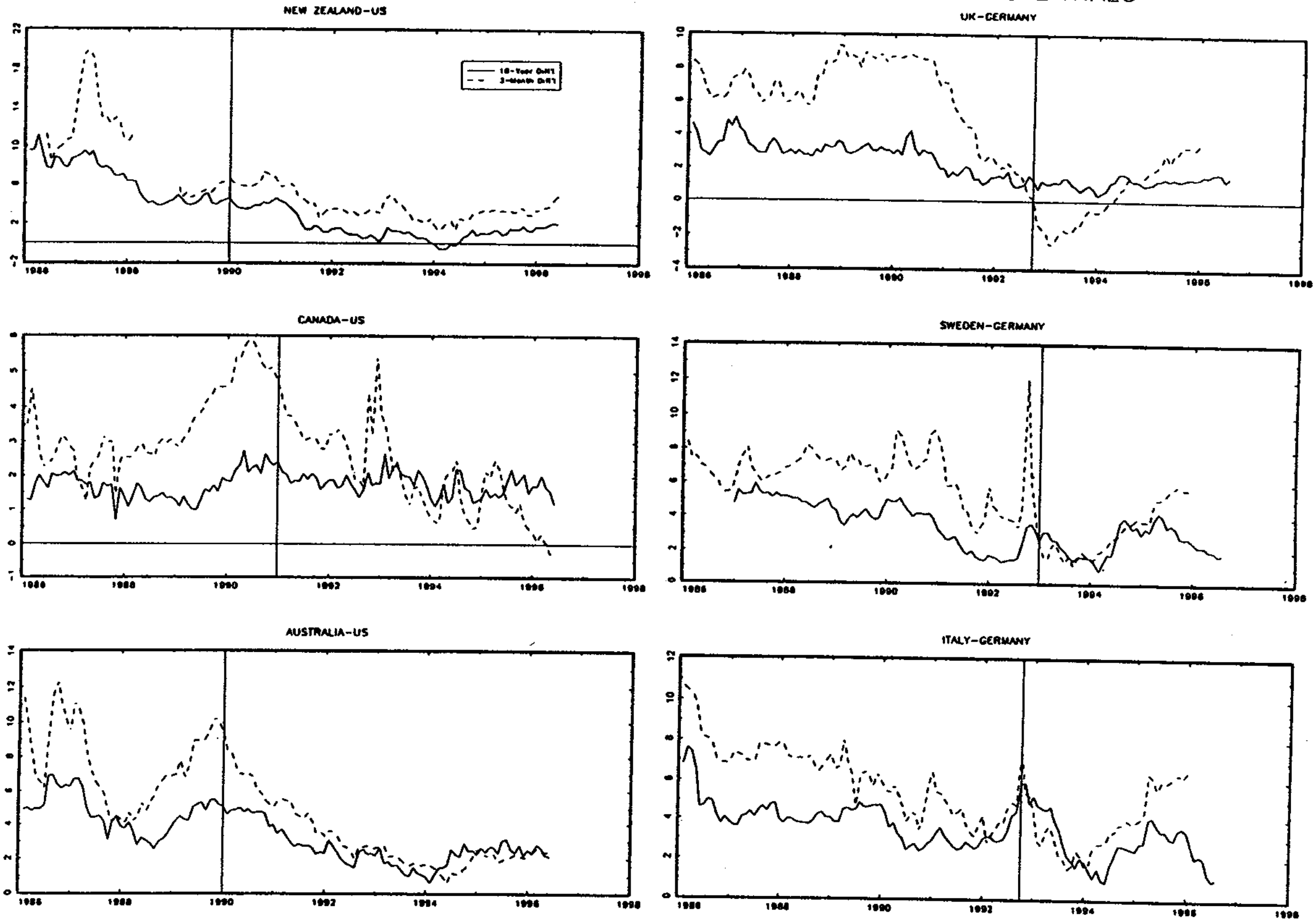
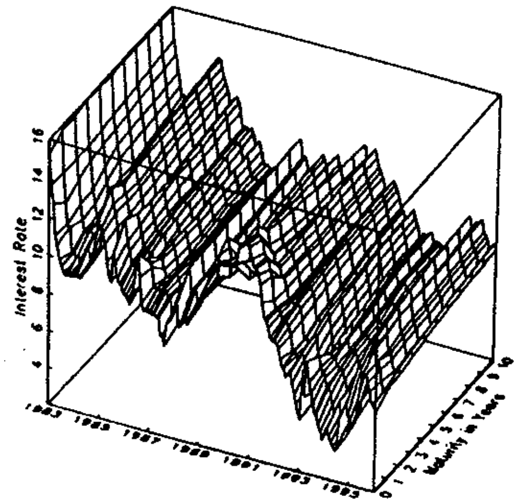
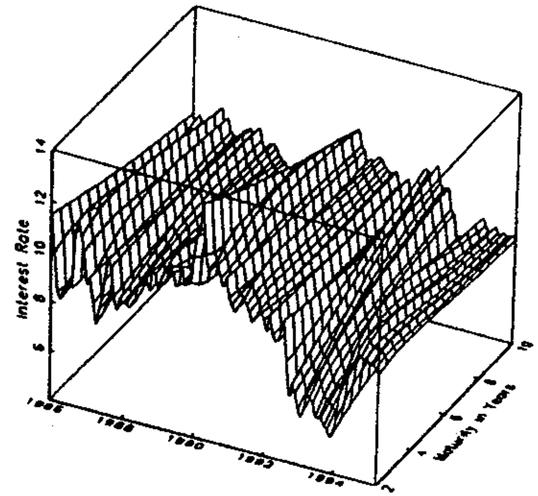


FIGURE 12 . NOMINAL YIELD CURVES FOR GOVERNMENT BONDS

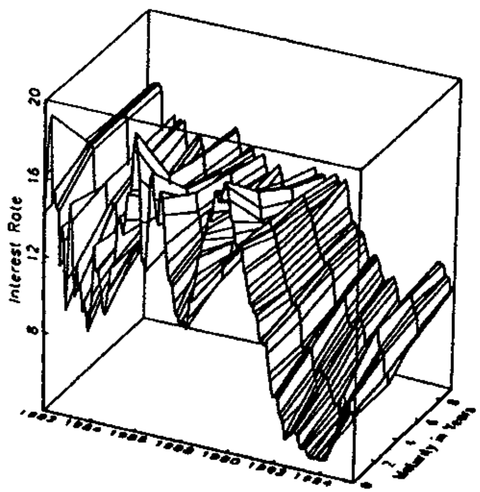
Nominal Yield Curves for Canadian Government Bonds, 1982–1994



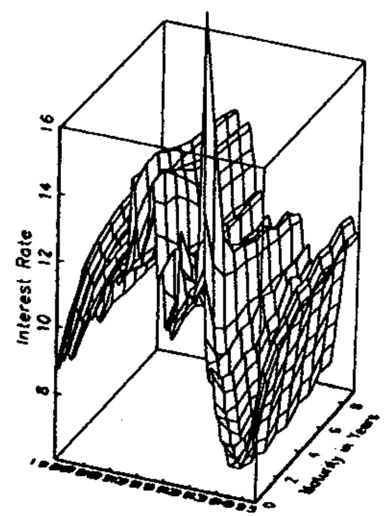
Nominal Yield Curves for UK Government Bonds, 1986–1995



Nominal Yield Curves for Australian Govt Bonds, 1982–1995



Nominal Yield Curves for Swedish Govt Bonds, 1987–1994



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