NBER WORKING PAPER SERIES

EFFICIENT INFLATION FORECASTS: AN INTERNATIONAL COMPARISON

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Working Paper No. 1542

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 1985

The research reported here is part of the NBER's research program in Financial Markets and Monetary Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #1542
January 1985

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ABSTRACT

This paper addresses the question of whether nominal Eurocurrency interest rates provide significant information about expected inflation. To test this question two sets of inflation forecasts for the U.S. and five European countries were generated: 1) from time series of past inflation rates; 2) by forecasting real rates from time series of past real rates and subtracting these forecasts from nominal rates. The accuracy of the two sets of inflation forecasts was compared. The results indicate that nominal Eurocurrency rates provide valuable marginal information about expected inflation for the U.S. and U.K., but not for the other European countries.

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EFFICIENT INFLATION FORECASTS:

AN INTERNATIONAL COMPARISON

I. Introduction

The Fisher hypothesis [5] that nominal interest rates adjust fully to expected inflation has been the subject of several studies in recent years.[1] Any test of the forecasting efficiency of nominal rates with respect to expected inflation has to incorporate a hypothesis about the behavior of the expected real rate of interest. In his pioneering work, Fama [3] hypothesized a constant expected real rate. He concluded that nominal rates on U.S. Treasury bills reflect efficient forecasts of expected inflation. Nelson and Schwert [12] questioned the validity of these results by showing that the assumption of a constant expected real rate is not supported by the data. They compared the accuracy of inflation forecasts generated from a time series of past inflation rates with inflation forecasts obtained by subtracting the mean real rate from nominal interest rates. The forecasts generated from past inflation rates were better than those implicit in nominal rates. Nelson and Schwert attributed these results to Fama's failure to account for the variability in expected real rates.

In a later paper, Fama and Gibbons [4] reexamined the issue of constancy of the real rate. Using a procedure developed by Ansley [1], they estimated the expected real rate while simultaneously regressing inflation on nominal rates. Fama and Gibbons found that the expected real rate varies over time, following a slow moving random walk and that nominal interest rates are informationally efficient. Work by Kane and Rosenthal [8] and by Kane, Rosenthal and Ljung [9] has shown that cross-sectional tests using Eurocurrency rate data provide reasonable support for the concept that nominal rates efficiently reflect expected inflation.

A different approach was taken by Hess and Bicksler [6]. These authors looked at whether nominal interest rates adjust to expected inflation by comparing the accuracy of inflation forecasts obtained in two ways. First, they fitted the parameters of an autoregressive model to the time series of inflation rates and used this model to produce forecasts of future inflation rates. The second approach involved forecasting real rates from a series of past real rates using a time series model and subtracting these forecasts from nominal interest rates to obtain inflation forecasts. Hess and Bicksler found that forecasts obtained from the series of past inflaton rates were slightly better than those obtained from nominal rates.

The present paper extends Hess and Bicksler's approach to an international setting. Eurocurrency rates as well as inflation rates from six countries - U.S., U.K., Switzerland, West Germany, France and the Netherlands - are used to derive inflation forecasts using the two methods described above. These forecasts are compared using two different measures. The first comparison uses the root mean square error and shows that for the U.S. and U.K., inflation forecasts generated from Eurocurrency rates provide slightly better forecasts than those generated from past inflation rates. For the other countries, the forecasts generated from past inflation rates are better.

The second comparison is made by combining the two alternative forecasts and examining whether the forecast from nominal rates has a significant weight in the optimal combination forecast. The results indicate that this is the case for the U.S. and the U.K. For the other countries, the test shows that using nominal rates adds little or nothing to the forecasts derived from past inflation rates.

The paper is organized as follows. Section II describes the data and the selection of time series models for the inflation and real rates. Section III discusses the procedures used to generate one-ahead and two-ahead forecasts. Section IV presents the results from the comparison of the forecasts using root mean square error. And section V presents results of the tests based on the optimal combination forecasts.

II. Data and Model Identification

Ideally, tests of whether nominal interest rates embody efficient forecasts of inflation should be based on Treasury bill rates. However, T-bills are issued in only two of the countries in this study - the United States and the United Kingdom. As an alternative, one month Eurocurrency rates from the U.S., the U.K., as well as Switzerland, Germany, France and the Netherlands were used.[2] One month inflation rates from these countries were calculated from the respective one month consumer price indices. The data, which were obtained from Data Resources, Inc., cover the period of 108 months from January 1974-December 1982. It should be noted that this period is one of floating international exchange rates.

Inflation was forcecasted in two ways - from past inflation rates and from nominal interest rates. In the latter case, forecasted real rates were subtracted from nominal rates. These forecasted real rates were based on a series of past real rates. The forecasts were, in both cases, generated from ARIMA models fitted to the data for the six countries.

To identify an appropriate ARIMA model the autocorrelation and the partial autocorrelation functions of the two sets of time series and the first differences of the series were computed and plotted. Identification was made for the entire 108 months and for the first 69 months from January 1974 through September 1979, as it was found that the shift in U.S. monetary policy in October 1979 affected the U.S. interest rate series significantly.[3] The first 69 months were used to identify the time series models for this series thus making it possible to later test the accuracy of the forecasts using data not included in the estimation period. For the other countries, the autocorrelation functions were similar for the whole period and the subperiod, suggesting that a model of the same general form could be used for the two periods.

The autocorrelation functions of the inflation rates and the real rates declined quickly for all countries indicating that a time series model could be fitted to the original series without any differencing. The pattern of the autocorrelation functions suggested that a low order autoregressive model would be appropriate for these time series. However, for most of the series, the autocorrelation coefficients at lags 6 and/or 12 were also large, indicating that some seasonality was present in the data.

As an approximation, a first order autoregressive model was initially fitted to all the time series. This model was later augmented by adding parameters as needed to account for the seasonality in the data. The fitted models were checked by examining the residuals and the autocorrelation function of the residuals.

The results of fitting the inflation and real rate data for the first 69 months using an AR(1) model and the best alternative ARIMA model with seasonal parameters are summarized in Tables 1 and 2, respectively.[4] These tables show the form of the fitted models. For the real rates in Table 2, the first order autoregressive coefficients are generally small indicating a rather weak correlation between successive observations in these series. The forecasts generated for the real rates using the AR(1) model will therefore be close to the mean of the respective series. The tables also show the significance levels of the Q statistic for testing the adequacy of the fitted models. The values for the first order autoregressive model are in most cases small, indicating as expected, some lack of fit in this model. The results for the augmented models are generally adequate although occasional outliers in the data increased the value of the Q statistic for some of the series.

III. Procedures Used to Generate Forecasts

When making forecasts, by extrapolating time series one faces the trade-off between using an interval as long as reasonably possible to estimate the parameters of the appropriate time series models and the problems created by structural shifts in the process. The forecasts which are analyzed in this paper were generated by fitting a moving series of 36 monthly observations. Since the overall sample includes 108 months we generate 72 one month ahead and 71 two month ahead forecasts. This procedure was repeated four times, i.e., it was applied to the real interest rate and inflation series using AR(1) and ARIMA specifications. To evaluate the efforts of lengthening the estimation interval we also fitted the models to moving series of 48 and 60 observations, reducing the number of forecasts to 60 and 48, respectively. As we show below, the length of the estimation period did not greatly affect the quality of the forecasts of the inflation rates.

The sampling procedure used by the respective governmental agencies to compute the consumer price index (CPI), and the fact that the CPI is announced one to two weeks after the end of the month, makes the index about one month old by the time it is announced. To take this into account, the models were used to make two month ahead as well as one month ahead forecasts. (Hess and Bicksler recognized the same problem and also generated one and two month ahead forecasts.)

In all, four series of one month ahead and four series of two month ahead inflation forecasts were generated for each country: the first pair uses past inflation rates while the other uses past real rates. Each set uses an AR(1) model and an alternative ARIMA model to obtain the forecasts. These four monthly series of forecasts cover the period from January 1977 through December 1982.

IV. Comparison of Forecasting Accuracy

The accuracy of the forecasts generated by the methods described above were compared by using the root mean square error (RMSE) of the forecast. This was done by taking the ratios of the RMSEs from the different forecasts. (One should not make any statistical inferences from these ratios since the time series of forecasting errors are not independent.)

Table 3 presents the results for the one month ahead forecasts using 36 month estimation intervals. The results for the U.S. are shown on the first two rows. The first row reports RMSEs and the ratios for the 72 forecasts made for January 1977 through December 1982. The second row shows results for the 33 month period from January 1977 through September 1979 (that is, before the change in Federal Reserve policy). For the other five countries, the results for the 72 monthly periods are shown. Comparing the 72 month period to the 33 month period for the U.S., one can see that the RMSEs for the 33 months are noticeably smaller when forecasts are generated from nominal rates. When forecasts are generated from inflation rates, the RMSEs for the 33 months (up to October 1979) do not differ much from the RMSEs for the 72 months. This implies that while the change in the Federal Reserve policy increased the variation in nominal rates and thus reduced their informational content, the change did not affect inflation rates to the same degree. As a result the relative value of inflation forecasts from past rates are improved for this period. For the other five countries there was little difference in the RMSEs using 72 or the first 33 forecasts only, implying that the increased variability in U.S. nominal rates was offset by changes in exchange rates and nominal rates in these countries.

It is worth noting that for the U.S. and the U.K., the root mean square errors using the alternative ARIMA model are equal to or slightly lower than when an AR(1) model is used. This is true for forecast errors from both the inflation and real rate series. For the other countries, the alternative ARIMA model as applied to the inflation series gives lower RMSEs than the AR(1) model, whereas the AR(1) model gives lower RMSEs for the real rate series.

The last column of Table 3 shows the ratio of the lowest RMSE from the forecast generated from past inflation rates to lowest RMSE from the forecasts generated from nominal rates. A ratio greater than 1.0 would indicate that forecasts derived from nominal rates provide better forecasts than those derived from past inflation rates. This is the case for both the U.S. and the U.K. For the other countries, forecasts generated from past inflation rates are better than those generated from nominal rates. These results are consistent with the conventional wisdom that financial markets are less efficient in these other European countries.[5]

The forecasts just discussed were obtained using a series of 36 observations. Forecasts based on longer estimation intervals of 48 and 60 months were slightly less accurate. This can be seen from Table 3a which presents the RMSEs by length of estimation interval and type of model. For the ARIMA model, the forecasts were extrapolated from past inflation rates while for the AR(1) model the forecasts were derived by subtracting the extrapolated real rates from current nominal Eurocurrency rates. For the six countries and the two forecasting methods, Table 3a shows that the estimation interval of 36 months generated the best forecast in 7 cases. For the other five cases, the 60 months estimation interval was better in three cases and the 48 months interval in two cases. However, the differences range from 1/2 percent to 13 percent and generally are too small to be of much significance. This comparison is representative for the other models as well.

As indicated above, the inflation rates as measured by the CPI are announced after the end of the month, and represent sampling which on average takes place in the middle of the month. It is of interest to compare the two ahead forecasts of inflation rates to the one ahead forecasts. Table 4 presents the RMSEs for the two ahead forecasts. The best time series specifications for the two series (inflation and real rates) varies for the countries somewhat differently from the one-ahead forecasts. Nevertheless, the results are similar to the one-step ahead forecasts and it is worth noting that the magnitude of the RMSEs is virtually the same for the two step ahead forecasts compared to the one step ahead forecasts for all countries.

The results based on the RMSEs presented above do not provide a clear cut answer as to whether use of past inflation rates provides a better forecast of inflation than nominal rates. Traditionally, forecasters have used a series of past inflation rates. If additional information could be gleaned from nominal rates, it would be worthwhile to compute a combined forecast based on the two series. With experience, the forecaster would be likely to weight one forecast more heavily than the other. This approach is discussed in the next section.

V. Optimal Use of Forecasts and Implications for Market Efficiency

One way to use two inflation forecasts is to form the linear combination

(1) $$CPI_c = bCPI_1 + (1-b)CPI_2$$

where CPI_1 is the inflation forecast obtained from nominal rates and CPI_2 is the inflation forecast obtained from past inflation rates. This approach was suggested by Nelson [10,11] and adopted by Hess and Bicksler. The combination forecast of inflation, CPI_c, can be related to the actual inflation rate, CPI as

(2) $$CPI = CPI_c + e = bCPI_1 + (1-b)CPI_2 + e$$

or,

(3) $$CPI - CPI_2 = b(CPI_1 - CPI_2) + e$$

Under the standard assumptions on the error term e, the coefficient b in this equation can be estimated by ordinary least squares. The magnitude of the estimate of b indicates the incremental value of using the forecast derived from nominal rates.

When Hess and Bickler (6) adopted this approach they subtracted the inflation forecasts obtained using nominal rates from the actual inflation rates. Hence they have, on the left hand side of (3), the difference between actual inflation rates and forecasts from nominal rates. Their null hypothesis is that b = 0, i.e., there is no incremental value in adding a forecast from past inflation rates when one from the nominal rate is available. This approach is justified when the expected expected real rate is known so that the inflation forecast embedded in nominal rates is known. In this case, all information about future inflation rates is in the difference between the nominal rate and the (known) expected real rate. Extrapolation from past inflation rates should include no significant marginal information if the money market is efficient. However, if the expected real rate is unknown, one has to subtract an estimate of the expected real rate from the nominal rate. That difference is now a combination of the forecast for inflation, which is contained in the nominal rate plus the error in the forecast of the real rate. In this case, any other source of information which is correlated with expected inflation may be of value (even if money markets are efficient) in that it helps one get around the forecasting error in the expected real rate. Thus in the specification of equation (3) the question is turned around. We ask whether nominal rates include valuable information that is not included in past inflation rates. This is a necessary and sufficient condition for money market interest rate efficiency when real rates are uncertain and expected real rates are unobservable.

The results of running equation (3) using one step ahead forecasts are presented in Table 5. The forecasts underlying the reported results were generated using the alternative ARIMA model specification. Using the AR(1) model did not make a noticeable difference in the regression results. As in the previous tests, 72 and 33 data points are used for the U.S.[6] For all other countries 72 forecasts are used. The results for the U.S. show that the coefficient on the forecast using nominal rates (b) is positive (.44) and significant for the whole period and especially for the period prior to October 1979 (.71). This is probably due to the increased variability in real rates that occurs in the longer series as it includes the period after the shift in U.S. monetary policy. That increased variability in real rates results in a forecast from nominal rates which is less accurate relative to the one derived from past inflation rates. Note that the intercept is significantly greater than 0 for the U.S. (t = 2.17), indicating that a constrained linear combination of forecasts may not be justified.

With respect to the U.K., the estimate of b is large (.63) and significant. That is, Eurosterling rates provided important additional information about future inflation, a result which is consistant with those discussed before. The marginal value of the nominal rate forecast is significantly positive for Germany and the Netherlands although the value of b is much lower than for the U.S. and U.K. The results also suggest that for Switzerland and France, nominal rates did not provide any additional information relative to forecasts derived from past inflation rates.

The results for the two ahead forecasts are presented in Table 6. Again, the forecasts generated from nominal rates make a significant contribution to the composite forecast for the U.S. (much more before the change in Fed Policy, i.e., using the first 33 observations) and the U.K. The coefficients for Germany and France are much larger and more significant than in the previous test. The Durbin-Watson statistics in both Tables 5 and 6 indicate that the marginal contribution of forecasts from nominal rates are serially uncorrelated. All in all, of the six countries only the results for Switzerland and France indicate that forecasts from nominal rates are of little or no value. In general, the two ahead tests provide stronger support for using forecasts derived from nominal rates.

Another approach to forming a combination of forecasts is suggested by Hasbrouck [7]. His method would result in an unconstrained linear combination in the form of

$$CPI = a + b_1 CPI_1 + b_2 CPI_2 \tag{4a}$$

which can be estimated by

$$CPI = a + b_1 CPI_1 + b_2 CPI_2 + e \tag{4b}$$

The absolute magnitudes of the coefficients b_1 and b_2 are indications of the relative contribution of each forecast. Should the sign of one of the coefficients (b_2 for example) be negative, it can be interpreted as an offset by that forecast to an upward bias in the first forecast. The intercept can be viewed as a measure of the additive bias in the combined forecast.

Table 7 presents the estimates of the parameters from equation (4b) for one-ahead forecasts. The first two lines show the results for the U.S. for the overall period (72 observations) and for the subperiod ending September 1979 (33 observations). The first two columns show that the coefficient on the forecasts from nominal rates for the U.S. is significant in both periods and larger when only the early subperiod is used. Furthermore, the coefficient on the forecasts from past inflation rates is not significant in either case, and is smaller in the early subperiod. The combination forecast explains 40 percent of the variation in actual inflation rates for the overall forecasting period and 37 percent for the period prior to October 1979. At the same time, inflation forecasts using only past inflation rates explain 29 percent (for 72 observations) of the variation in actual inflation. This means that the forecast from nominal rates contributes .11 (.40 minus .29) to the explanatory power of .40 of the combination forecast. When the first subperiod is examined, the increment to explanatory power contributed by the nominal rate forecast is even higher (.19 out of a total R^2 of .37). The implication is that for this period, ignoring the forecast generated from nominal rates would substantially reduce the accuracy of the inflation forecast. Similar results for the 72 months period are observed for the U.K. The coefficient on the nominal rate is significant, while the coefficient on the forecast from past inflation is not. Of the explanatory power of .16, the marginal contribution of the nominal rate forecast is .12.

The results for the other countries are different. The coefficients on the forecasts from nominal rates are always low, and except for the Netherlands, are not significant. The contribution of these forecasts to the explanatory power of the combination is small.

Estimates for the two ahead forecasts are presented in Table 8. The conclusion that forecasts from nominal rates are important for the U.S. and the U.K. is again valid. It is worth noting that increased volatility of real rates in the U.S. over the period 10/79-12/82 does not weaken the contribution of the nominal rate forecast to the combination forecast. Again, the nominal rate forecasts for the four continental European countries is not important, as indicated by the relatively low and insignificant coefficients and contributions to the explanatory power of the combination forecasts.

VI. Summary and Conclusions

Traditionally, inflation forecasters have used a series of past inflation rates to forecast future inflation rates. In this paper, we examine whether significant incremental information about future inflation is provided by nominal rates in the form of Eurocurrency rates. Forecasts of inflation for six countries were generated in two ways: 1) We estimated the parameters of an autoregressive model for past inflation rates and used the model to forecast future inflation rates; 2) We estimated the parameters of an autoregressive model for past real rates and used the model to generate forecasts of the real rate. The real rate forecasts were then subtracted from nominal rates to produce the inflation forecasts. The accuracy of the two methods was first compared using the root mean square error. In a second set of tests, the two forecasts for each country were combined, and the relative weights of the forecasts in the optimal combined forecast were estimated.

The results indicate that nominal Eurocurrency rates provide valuable marginal information about inflation for the U.S. and U.K. The results for Switzerland, West Germany, France and the Netherlands show that inflation forecasts from nominal rates add little information to that derived from a series of past inflation rates. Taken as a whole, the results suggest that money markets in these countries are less efficient than their counterparts in the U.S. and the U.K. This may be due to the impact of the joint float of certain European currencies on the nominal interest rates of these countries.

Notes

1. See Summers, for example [13], and references therein.

2. We recognize that Eurocurrency rates reflect a risk premium for default risk. The use of Eurocurrency rates to derive real rates will incorporate this risk premium and introduce noise into the real rate time series. To this extent, the tests of forecasting accuracy will be biased against those methods which use the nominal rate.

3. See Bodie, Kane and McDonald [2].

4. No alternative ARIMA model using 69 months of inflation data was satisfactory for France. AR(1) fit the data well enough so as not to require adding seasonal parameters.

5. The efficiency of capital markets in continental Europe may be lessened by agreement to jointly float exchange rates.

6. All tests are based on forecasts using 36 month estimation intervals.

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TABLE 1

ARIMA Models for the Inflation Rates; 69 Observations

Country	Model	t-Statistics of Lags: 1	2	6	12	X^2 prob. of $Q=n\sum_{k=1}^{6} r_k^2$
U.S.	$(1-0.43B)y_t = a_t$	4.1				0.004
	$(1-0.26B-0.36^2)\ (1+0.27B^{12})y_t = a_t$	2.3	3.2		-2.8	0.197
U.K.	$(1-0.25B)y_t = a_t$	3.1				0.027
	$(1-0.50B)\ (1-0.35^{12})y_t = a_t$	4.3			3.4	0.319
Switzerland	$(1-0.23B)y_t = a_t$	2.0				0.006
	$(1-0.18B-0.30B^2)y_t = a_t$	1.5	2.7			0.142
W. Germany	$(1-0.25B)y_t = a_t$	2.2				0.002
	$(1-0.19B)\ (1+0.30B^6-0.40B^{12})y_t = a_t$	1.4		-2.4	3.1	0.169
France	$(1-0.14B)y_t = a_t$	1.2				0.290
	$(1-0.38B)\ (1-0.38B^{12})y_t = a_t$	0.3			3.4	0.081
Netherlands	$(1-0.18B)y_t = a_t$	1.5				0.001
	$(1+0.39B)\ (1-0.28B^6-0.53B^{12})y_t = a_t$	-3.1		2.5	4.7	0.056

TABLE 2

ARIMA Models for the Real Rates; 69 Observations

Country	Model	t-Statistics of Lags: 1	2	6	12	χ^2 prob. of $Q=n\sum_{k=1}^{6} r_k^2$
U.S.	$(1-0.14B)y_t = a_t$	1.2				0.009
	$(1-0.09B)\ (1+0.33B^6)y_t = a_t$	0.7		-2.8		0.301
U.K.	$(1.022B)y_t = a_t$	1.9				0.043
	$(1-0.36B)\ (1-0.30B^{12})y_t = a_t$	2.9			2.8	0.360
Switzerland	$(1-0.20B)y_t = a_t$	1.9				0.060
	$(1-0.44B)\ (1-0.34B^6)y_t = a_t$	3.9		3.3		0.147
W. Germany	$(1-0.38B)y_t = a_t$	3.4				0.002
	$(1-0.15B)\ (1+0.46B^6-0.27B^{12})y_t = a_t$	1.1		-3.6	2.2	0.132
France	$(1-0.29B)y_t = a_t$	2.5				0.494

Netherlands	$(1-0.23B)y_t = a_t$	2.0				0.022
	$(1-0.11B-0.38B^2)\ (1-0.59B^{12})y_t = a_t$	0.9	3.2		5.3	0.207

Table 3

Comparison of Forecasting Accuracy for RMSE
for One-Step-Ahead-Monthly Forecasts (percent per month)

Country	N(a)	Forecasts from Past Inflation Rates			Forecasts from Nom. Interest Rates			RMSE from CPI Over That From Nominal Rates (c)
		AR(1)	ARIMA	$\frac{\text{RMSE AR(1)}}{\text{RMSE ARIMA}}$ (b)	AR(1)	ARIMA	$\frac{\text{RMSE AR(1)}}{\text{RMSE ARIMA}}$	
U.S.	72	.352	.341	1.03	.358	.364	.98	$\frac{\text{ARIMA}}{\text{AR (1)}}$ = .95
U.S.	33	.355	.317	1.12	.303	.285	1.06	$\frac{\text{ARIMA}}{\text{ARIMA}}$ = 1.11
U.K.	72	.678	.685	.98	.644	.625	1.03	$\frac{\text{AR (1)}}{\text{ARIMA}}$ = 1.08
Switz.	72	.431	.440	.98	.459	.600	.77	$\frac{\text{AR (1)}}{\text{AR (1)}}$ = .94
Germany	72	.307	.282	1.09	.315	.543	.58	$\frac{\text{ARIMA}}{\text{AR (1)}}$ = .90
France	72	.332	.329	1.01	.445	.502	.89	$\frac{\text{ARIMA}}{\text{AR (1)}}$ = .74
Neth.	72	.414	.349	1.19	.415	.512	.81	$\frac{\text{ARIMA}}{\text{AR (1)}}$ = .84

(a) The subperiod of 33 forecasts for the U.S. (Jan. 1977-Sept. 1979) is shown to account for the changed monetary policy announced in October 1979. There is no significant difference for RMSE of forecasts from nominal rates for other countries between these two subperiods.

(b) Since the forecasting errors are not serially independent, only a descriptive statistic can be used.

(c) The ratio is taken from the best model for each series as determined by the ratio of the RMSE.

Table 3a

Comparison RMSE of One-Month-Ahead Forecasts From Different Lengths

of Estimation Intervals (% per month)

Forecasts From Past-Inflation Rates Using ARIMA Model

Country	36 months	48 months	60 months	Best Interval	% diff. from 36 months
U.S.	.341	.418	.384	.036	0
U.K.	.685	.660	.626	.060	8.6
Switz.	.440	.474	.451	.036	0
W. Germany	.282	.361	.332	.036	0
France	.329	.309	.298	.060	9.4
Holland	.349	.304	.315	.048	12.9

Forecasts From Past-Real Rates and Current Nominal Eurorates Using the AR(1) Model

Country	36 months	48 months	60 months	Best Interval	% diff. from 36 months
U.S.	.358	.408	.379	.036	0
U.K.	.644	.714	.641	.060	.5
Switz.	.459	.539	.491	.036	0
W. Germany	.315	.377	.341	.036	0
France	.445	.482	.447	.036	0
Holland	.415	.378	.401	.048	8.9

Table 4

Comparison of Forecasting Accuracy for RMSE
for Two-Step-Ahead-Monthly Forecasts (percent per month)

Country	N (a)	Forecasts from Past Inflation Rates			Forecasts from Nom. Interest Rates			RMSE from CPI Over That From Nominal Rates (c)
		AR (1)	ARIMA	RMSE AR(1) / RMSE ARIMA (b)	AR(1)	ARIMA	RMSE AR(1) / RMSE ARIMA	
U.S.	71	.409	.391	1.05	.393	.407	.97	ARIMA / AR(1) = .99
U.S.	33	.292	.328	.89	.285	.333	.86	AR(1) / AR(1) = 1.02
U.K.	71	.710	.698	1.02	.642	.600	1.07	ARIMA / ARIMA = 1.16
Switz.	71	.440	.443	.99	.481	.577	.83	AR(1) / AR(1) = .91
Germany	71	.341	.295	1.16	.358	.554	.65	ARIMA / AR(1) = .82
France	71	.335	.350	.96	.479	.474	1.01	AR(1) / ARIMA = .71
Neth.	71	.419	.344	1.22	.425	.494	.86	ARIMA / AR(1) = .81

(a), (b) and (c): See Table 3.

Table 5

Tests of Constrained Linear Combination
with One-Ahead Forecasts

Country	Optimal Weight b	s(b)	Intercept t(a)	DW	N
U.S.	.44	.14	-1.07	1.71	72
U.S.	.82	.13	2.17	2.50	33
U.K.	.63	.13	-.88	1.92	72
Switz.	.10	.12	.55	1.89	72
Germany	.16	.07	-1.39	1.84	72
France	.07	.09	.84	1.51	72
Neth.	.28	.07	-1.74	1.86	72

Table 6

Tests of Constrained Linear Combination
with Two-Ahead Forecasts

Country	Optimal Weight b	s(b)	Intercept t(a)	DW	N
U.S.	.34	.14	-1.11	1.86	71
U.S.	.57	.15	2.52	1.99	33
U.K.	.72	.14	-1.19	1.90	71
Swita.	-.14	.12	.90	1.88	71
Germany	.30	.09	-1.76	1.56	71
France	.20	.10	.70	1.58	71
Neth.	.48	.10	-.86	1.99	71

Table 7

The Optimal, Unconstrained, Linear Combination of One-Ahead Forecasts

Country	Coefficient of Forecast from Nominal Rates b_1	$s(b_1)$	Coefficient of Forecast from Past Inflation Rates b_2	$s(b_2)$	Combined Bias t(a)	R^2	ΔR^2 from Adding the Forecast from Nominal Rates	DW
US (72 obs.)	.50	.14	.22	.23	1.41	.40	.11	2.03
US(33 obs.)	.65	.22	.13	.29	1.43	.37	.19	2.44
UK	.53	.17	.23	.19	.71	.16	.12	1.82
Switz.	-.11	.14	.33	.23	2.71	.04	.01	1.61
Germany	.15	.09	.79	.15	-.29	.30	.03	1.79
France	.04	.09	.42	.24	2.41	.05	.00	1.56
Netherlands	.21	.09	.62	.10	.26	.38	.05	1.78

Table 8

The Optimal, Unconstrained, Linear Combination of Two-Ahead Forecasts

	Coefficient of Forecast from Nominal Rates b_1	$s(b_1)$	Coefficient of Forecast from Past Inflation Rates b_2	$s(b_2)$	Combined Bias $t(a)$	R^2	ΔR^2 from Adding the Forecast from Nominal Rates	DW
US (71 obs.)	.41	.14	.22	.25	1.63	.29	.09	1.65
US (33 obs.)	.43	.21	.24	.34	1.50	.21	.10	2.48
UK	.54	.18	.05	.21	1.13	.11	.11	1.77
Switz.	-.28	.13	.63	.26	2.37	.14	.06	1.77
Germany	.19	.10	.39	.18	.90	.10	.05	1.39
France	.13	.10	.01	.26	3.57	.03	.03	1.51
Netherlands	.13	.11	.06	.13	3.67	.02	.02	1.67