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Forecasting Some Low-Predictability Time Series Using Diffusion Indices*

Marc Brisson†, *Bryan Campbell*‡, *John W. Galbraith*§

Résumé / Abstract

Les taux de croissance de production et d'investissements réels sont deux séries macroéconomiques qui sont particulièrement difficiles à prévoir. Nous considérons dans cet article l'application des méthodes d'indice de diffusion à ce problème. Nous commençons avec une caractérisation de la performance des méthodes de prévision standards, via les mesures nouvelles de prévisibilité et la valeur ajoutée des prévisions, en notant l'horizon maximal auquel les prévisions ont de la valeur. Nous comparons les prévisions provenant des indices de diffusion avec les alternatives, incluant les prévisions de l'OCDE. Nous trouvons des gains en précision des prévisions, mais ne trouvons pas que l'horizon maximal de prévision peut être augmenté.

The growth rates of real output and real investment are two macroeconomic time series which are particularly difficult to forecast. This paper considers the application of diffusion index forecasting models to this problem. We begin by characterizing the performance of standard forecasts, via recently-introduced measures of predictability and the forecast content, noting the maximum horizon at which the forecasts have value. We then compare diffusion index forecasts with a variety of alternatives, including the forecasts made by the OECD. We find gains in forecast accuracy at short horizons from the diffusion index models, but do not find evidence that the maximum horizon for forecasts can be extended in this way.

Mots Clés : Indice de diffusion, prévisions, investissement, PNB

Keywords: Diffusion index, forecasting, investment, GDP

JEL : C22, C53

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1. Introduction

Different economic time series display very different degrees of predictability whether predictability is defined by the relative variances of the forecast errors and of observations, or by the value of particular conditioning information in reducing the expected loss of a forecast. Some of the most important and interesting economic time series are particularly difficult to predict; among these are the growth rate of real national income and the growth rate of investment.

Recent literature in economic forecasting suggests progress in two directions which may be interesting in handling such time series. First, work on the measurement of predictability and information content of forecasts offers methods of characterizing both the difficulty of a forecasting problem and the contribution of a particular forecasting model, and offers methods of conducting inference on related hypotheses. Second, a large body of literature examines statistical forecasting methods which depart from, or extend, traditional linear time series models. Much of this work uses non-linear devices such as artificial neural networks, modifying the form of forecasting model but retaining the same (often univariate) input information; other work, in particular by Stock and Watson (1998b, 1999) increases the range of data that is used in the forecast through devices such as dynamic factor models (diffusion indices).

In the present study we apply these advances to the problem of forecasting the growth rates of investment and of real national income, on Canadian data, and evaluate the improvement in forecasting power available, and in particular the possible extension of the maximum forecast horizons beyond those attainable through standard time series forecasting models. We begin by examining the predictability of these time series and the performance of standard statistical forecasting models, using the measure of predictability of Diebold and Kilian (1998) and of forecast information content of Galbraith (1999). Neither of these time series can be forecast with particular success by standard methods. We then apply the diffusion index method of Stock and Watson (1998b) to each series, allowing us to extend the conditioning information set substantially while controlling the loss of degrees of freedom in the forecasting model. We find marked gains in forecasting power at short ho rizons for these two difficult cases, although the time series remain relatively difficult to predict. We then evaluate the ability of the models to extend maximum forecast horizons; here, the results are less favourable.

In section 2 we describe the data and present measures of predictability and information content of standard statistical forecasts for the time series of interest. For comparison with Stock and Watson's results on U.S. data we also present results for forecasts of inflation, a relatively predictable time series. In section 3 we describe the computation of diffusion index forecasts for each of the three time series. In section 4 the results are evaluated in comparison with some other model types to determine whether the diffusion index class is dominated by any alternatives for particular problems. We find that it is not, and diffusion indexes therefore constitute a sensible class to examine for potential to increase maximum forecast horizons. We also consider the problem of forecast horizon extension via diffusion indices. Section 5 concludes.

2. Data, predictability and content of forecasts

2.1 Data

In addition to data on the series to be forecast, we use data on numerous other series from which the diffusion index forecasts of section 3 will be constructed. These series cover ten major categories of macroeconomic time series: output, employment, personal consumption expenditure, housing starts, orders, equity prices, exchange rates, interest rates, money, price indexes, and investment. Two sets of these series are used. First, the monthly and quarterly panels of data described in the Appendix are used to estimate static factor models.[1] Next, these series are also lagged twice in order to compute forecasts with dynamic factor models. These panels are categorized by the source of information: some have purely Canadian data, some also contain US data, and some other countries' data as well. All panels span the 1967:1-1998:12/1967Q1-1998Q4 time period and contain numbers of series ranging from 62 to 119 for monthly data and 66

[1] The Canadian panel used for GDP excludes investment series.

to 133 for quarterly data, in the Canadian and International panels respectively. Although the series end in 1998:12/1998Q4 for the present exercise, they represent revised historical series available in November 2000.

A comprehensive list is given in the Appendix. Most of the series are taken from Datastream, including CPI and the macroeconomic series in the panels. By contrast, GDP and and all of the series in the investment category are taken from CANSIM. Some series from Datastream were converted from monthly to quarterly, while some, as indicated in the Appendix, are computed from other series in the data set (for example, an interest rate spread is computed as a difference between long-term and short-term rates).

Leading indicators are needed to compute, for comparison, multivariate leading indicator forecasts. We use eight of the ten series used by Statistics Canada in their composite leading index.[2] The data series included in the panels and the leading indicators are transformed to approximate stationarity: logarithms are taken for nonnegative series not in rates or in percentage, first differences are taken for all real and nominal quantities.

The variables to be forecast were converted to rolling one year (12 month or 4 quarter) growth rates, as $y = ln(z_{t+k}/z_t),\ k = 4$ or 12. For real output we use quarterly, seasonally adjusted, expenditure-based Gross Domestic Product, and for investment, the series is quarterly seasonally adjusted Gross Business Capital Formation, each transformed with its appropriate implicit price index.

2.2 Measurement of predictability and forecast content

For the three series that we will forecast, we begin by presenting some measures of the difficulty of the forecast problem and of the information content of standard forecasts based on autoregressions.

Diebold and Kilian (1998) present a measure of predictability which, in its

[2]They are: average weekly hours worked in manufacturing; shipment-to-inventory ratio in manufacturing of finished goods; real money supply; TSE 300 index; new orders of durable goods; housing index; retail sales of furniture and appliances; US composite leading index; see Cross and Roy-Mayrand (1989).

most general form, may be expressed as

$$P(s,k) = 1 - \frac{E(L(\varepsilon_{t+s|t}))}{E(L(\varepsilon_{t+k|t}))}, \tag{2.1}$$

where $\varepsilon_{t+s|t}$ is the forecast error in the $s-$ period-ahead forecast made at time t, $L(.)$ is the loss function and $E(L(\varepsilon_{t+k|t}))$ is the expected loss of a long-run forecast, such that $k >> s$ and k is fixed while s varies within some range. Diebold and Kilian plot the loss function for a range of values of s, and operationalize the definition by choosing a particular loss function and class of forecasting models–in particular, the mean squared error and the AR(p) model class. The parameter k is chosen in their empirical implementation as 40, and $s = 1, \ldots 20$.

The second measure that we record is the forecast content explored in Galbraith (1999). The forecast content is defined as the reduction in MSE, or other loss, available from the use of a forecasting model rather than the unconditional mean; it is therefore a measure of the value of conditioning information in forecasting a particular series with a particular model type. The forecast content at s is described by the content function,

$$C(s) = 1 - \frac{MSE_{\tilde{y}(s)}}{MSE_{\overline{y}(s)}}, \qquad s = 1, \ldots, S, \tag{2.2}$$

where $\text{MSE}_{\tilde{y}(s)}$ is the expected squared error of the model-based s-step forecast, and $\text{MSE}_{\overline{y}(s)}$ is the corresponding expected squared error of the unconditional mean as a forecast of the process.

Because the loss of the unconditional mean rather than the loss at horizon k (as is Diebold-Kilian) is the comparator, the measure is analogous to the use of $k \rightarrow \infty$ in Diebold-Kilian; stationarity is therefore required, but there is no choice of finite k. Analytical results are given in Galbraith (1999) that allow the computation of forecast content at horizon s from the parameters of an AR forecasting model; these analytical results are used in the computations below (Figures 1–3), in place of the computation of an estimate at each s based on empirical out-of-sample mean squared errors. Since the latter method is used by Diebold-Kilian, the forecast content measures recorded in the figures are in general smoother than the analogous Diebold-Kilian predictability measures. Inference for either measure may be conducted using the bootstrap.

Figures 1 (inflation), 2 (real GDP growth) and 3 (real investment growth) record these measures for each of the series that we will forecast, and for both one-period growth rates and for rolling one-year growth rates (that is, twelve months for inflation, four quarters for each of the other series).

For our present purposes, the essential elements of these results are revealed by both predictability and forecast content measures. The inflation series, included here as a comparator and because it is often treated in forecast assessments such as those that we will undertake, is quite a 'predictable' series; standard autoregressive forecasts have substantial content. Even at two years (twenty-four months), autoregressive forecasts use conditioning information to yield one-month-ahead forecasts that are substantially informative relative to the unconditional mean of the process. In the rolling annual inflation measures, conditioning information is informative to three years (for this variable the predictability measure shows weak results beyond about two years, however). Clearly there is substantial gain in prediction of this variable through standard autoregressive models.

By contrast, real GDP growth displays very low predictability; forecast content is virtually zero beyond one quarter, or one year for the annual aggregates. Regardless of the measure chosen, forecasts that move more than approximately one step beyond the period covered show very little content. The same is true for real investment growth; whether we look at Diebold and Kilian's predictability measure, or the forecast content, zero is within the confidence bands everywhere for the one-quarter values, and everywhere beyond one year (and even within the year) for the annual values. These standard forecasting models have little, if any, ability to predict deviations from the unconditional mean of the process.

To investigate the potential for obtaining forecasts that have more predictive ability for these two difficult cases, and the obtential for obtaining corresponding extensions to the forecast content horizons, is the aim of the rest of this study.

3. Computation of the diffusion index forecasts

The model that we will use to attempt to improve forecasting power for these series of interest is the diffusion index model discussed by Stock and Watson (1998), which is related to earlier use of dynamic factor models in econometric modelling by, for example, Engle and Watson (1981) and Connor and Korajczyk (1988, 1993). These models balance the potential to improve forecasting by extracting information from a larger number of data series against the necessity of predicting based on a restricted number of factors, for reasons of efficiency. To do so, methods similar to traditional factor analysis are used to extract a set of factors from a data set; prediction is based on projection of the variable to be forecast onto this set. These methods have been developed to allow dynamic elements in the factors and forecasting model, and endogenous choice of the number of factors. Stock and Watson also provide consistency results for time varying factor loadings (i.e., the weights relating the underlying explanatory series to the factors), and methods based on the EM algorithm applicable to panels of explanatory factors which do not contain the same numbers of observations. We will not, however, use such 'unbalanced' panels in the present study.

The forecasting model embodies two elements, for which we use the notation of Stock and Watson. The variable to be forecast is $\{y_{t+1}\}_{t=1}^{T}$, and the explanatory series are represented by the $N-$ dimensional time series $\{X_t\}_{t=1}^{T}$, modelled using the factor structure

$$X_t = \Lambda_t F_t + e_t. \tag{3.1}$$

The conditional expectation of y_{t+1} is obtained by the projection onto the factors, as

$$y_{t+1} = \beta' F_t + \varepsilon_t. \tag{3.2}$$

This linearity of structure is retained throughout; however, as in Stock and Watson, we allow the possibility of lagged values of the dependent variable or factors to enter the forecast specification. We abstract here from the possibility of time-variation in the weights β.

The factor extraction procedure involved in Stock and Watson's method is quite simple. The matrix X is first standardized to have mean zero and variance one (we allow this matrix X to contain lags of the series for our dynamic model). The factors F are estimated using the q eigenvectors associated with the q greatest eigenvalues of this matrix, as (up to scale) $\hat{F} = X\hat{\Lambda}$, where $\hat{\Lambda}$ is the matrix of eigenvectors associated with the q largest eigenvalues.[3] Although any number of factors may be included in the projections, a simple information criterion is known to consistently estimate the population number of factors. Whether the model with the estimated population number of factors outperforms models with a fixed number of factors in a forecasting exercise is investigated in the next section.[4]

4. Comparative forecasting power

4.1 Simulated real-time forecasting exercise

The methods and procedures of the previous section are now applied to problem of forecasting Canadian real GDP growth, inflation (as measured by the CPI) and real investment growth, with the particular aims stated above: increasing forecast content, and later extending forecast horizons, for the two especially difficult cases. We begin with an evaluation which simulates real-time forecasting in the sense that the sequence of forecasts is based on a model re-estimated on an updated sample before each pseudo-out-of-sample forecast is computed. However, the simulation uses final revisions of the macroeconomic data series, not the interim values that would be available in true real-time forecasting.

In the notation of the previous section the variables to be forecast are $y^1_{t+1} = ln(z^1_{t+12}/z^1_t)$, where z^1_t denotes the monthly seasonally-adjusted CPI index; $y^2_{t+1} = ln(z^2_{t+4}/z^2_t)$, where z^2_t denotes quarterly real seasonally-adjusted GDP; and $y^3_{t+1} = ln(z^3_{t+4}/z^3_t)$, where z^3_t is quarterly real seasonally-adjusted investment. The complete data set extends from the beginning of 1967 through the end of 1998. The three variables are forecast from 1980 until 1998 using variants of the methodology presented in the previous section, that is, using the diffusion index forecasts. These forecasts will also be compared with those of some tradi-

[3]The estimated moment matrix must be scaled down by the number of series N, that is, to $N^{-1}(X'X)$, to ensure consistency of the estimated factors, assuming the existence of a true number of factors.
[4]We use the Gauss procedure **eigrs2** to compute these eigenvectors.

tional time series models used in macroeconomic forecasting, and for the models with the most apparent potential, we will investigate the potential to extend the useful forecast horizons for our low-predictability processes.

We now describe the alternative forecasting models.

Diffusion Index forecasts

Four classes of forecasts are generated from the general diffusion index model given by:

$$y_t^i = \beta_0 + \sum_{i=1}^{q} \beta_i \hat{F}_{it} + \sum_{j=0}^{p} \gamma_j y_{t-j}^i + \tilde{\varepsilon}. \tag{4.1}$$

Two of the classes, termed static and dynamic, are characterized by whether the panel of data described in section 2 contains lags or not. In dynamic models, the panel of data at time t contains all the variables presented in the Appendix as well as two lags of each variable; whereas the static model extracts factors from the panel containing no lags. Next the static and dynamic models can be further characterized as having AR components or not according to whether p is non zero or zero in the above equation. A final issue concerns the number of factors to be included in the model specification (ie, the value of q) and, in models where there are AR components, the number of lags. We will consider forecasts generated by models where the number of factors is fixed throughout the forecasting period; in this instance 12 different sets of forecasts are generated as we consider q from 1 to 12. The Bayesian Information Criterion (BIC) is used to choose the optimal number of factors when q is not fixed, and the number of factors and lag length when there are AR components in the specification. In all, 52 diffusion forecasts are determined.

Autoregressive forecasts

These forecasts are based on the model

$$y_t^i = \mu + \sum_{j=0}^{p} \gamma_j y_{t-j}^i + \tilde{\varepsilon}. \tag{4.2a}$$

where the number of lags $p(0 \leq p \leq 5)$ is determined by the BIC. It should be noted that Stock and Watson offer a variant of this model where the lags refer not to lags in the annual growth rate as above but to lags in quarterly growth rates in the case of real GDP or lags in monthly growth rates in the case of the CPI. That is, they use the form

$$y_t^i = \mu + \sum_{j=0}^{p} \gamma_j \tilde{y}_{t-j}^i + \tilde{\varepsilon}, \tag{4.2b}$$

where the lag terms are defined based on $\tilde{y}_{t+1}^i = ln\{z_{t+1}^i / z_t^i,\}$ rather than being lags of the terms y_{t+1}^i defined earlier. The empirical results for this variant of the model are also reported in what follows.

Leading Indicator forecasts

The indicators used in the following model are described in section 2.

$$y_t^i = \beta_0 + \sum_{i=1}^{q} \sum_{i=1}^{m} \delta_{ij} w_{i,t-j} + \sum_{j=0}^{p} \gamma_j y_{t-j}^i + \tilde{\varepsilon}. \tag{4.3}$$

The lag length associated with the indicators and the autoregressive component are both determined by the BIC; this approach is denoted MLI1 in the presentation of results. In so far as we use the same eight series to forecast the three variables considered in this exercise, we depart from Stock and Watson's presentation where the choice of indicator variables is tailored to the series to be forecasted to reflect previous known forecasting success with regard to the variable. For comparison, we also search systematically over combinations of indicators to find another forecast denoted MLI 2. According to this procedure, any combination of from 1 to 5 indicators is used; the preferred combination along with the lag lengths of the combination and the autoregressive component is determined by the BIC.

Phillips Curve forecasts

A variant of the Phillips Curve is also used to generate forecasts for inflation.

$$y_t^i = \beta_0 + \sum_{i=1}^{q} \beta_i u_{t-i} + \sum_{j=0}^{p} \gamma_j y_{t-j}^i + \tilde{\varepsilon}. \tag{4.4}$$

where u_t is the unemployment rate. As usual, the lag lengths ($p \geq 0,\ q \leq 5$) are selected by the BIC.

Within each class of models, the forecasts are determined in a manner that simulates real-time forecasting. Parameter estimation and factor extraction are repeated from period to period; the information criterion is then applied to select the specific model that determines the forecast. It is clear that the model may vary from period to period; what is important is that the rule that selects the model is fixed from period to period, a point emphasized by Stock and Watson.

Before comparing the diffusion index and alternative forecasts, consider the problem of selection of the number of factors. In Figures 4–6, we present the results (in the sense of RMSE) of selection of this number based on the Bayesian Information Criterion (BIC), relative to the the RMSE's produced by models with number of factors given on the x-axis. The four quadrants represent the four types of diffusion index model, distinguished by static/dynamic and AR/no AR components. We see, particularly in Figures 4a-d and 6a-d, that the BIC tends to select a number of factors which nearly attains the best within the set considered, and avoids the extreme outcomes associated with numbers of factors that are excessively high or low. In Figure 5 performance of the BIC is less favourable, tending to miss the U-shaped interior with lowest RMSE. Note however that the scale is finer in Figure 5 than in the other figures, showing a total range of variation between minimum and maximum RMSE typically around 0.005 or less. On balance these figures suggest that the BIC provides a reasonably good data-dependent selection rule, and it is used in the following results.

The results of the out-of-sample forecasting exercise for each of the variables are summarized in Table 1. In each column, the cumulative root mean squared error (RMSE) associated with the forecasts determined by the autoregressive model has been normalized to be 1. The relative RMSE's reported on each row correspond to different models, including the two leading indicator models and the Phillips curve model for inflation. Finally, the results for the four diffusion models that use the BIC to determine the number of factors are given.

Table 1

Comparative forecast performance of model classes[5]

	y^1	y^2	y^3
Benchmark models			
AR	1.000	1.000	1.000
AR[SW]	1.067	0.979	0.825
MLI_1	1.417	0.870	1.091
MLI_2	1.472	0.895	1.176
Phillips curve	1.541		
Diffusion models			
Static, no AR	0.855	0.811	0.950
Dynamic, no AR	0.803	0.879	0.835
Static, AR	0.850	0.824	0.975
Dynamic, AR	0.784	0.877	0.828

Two conclusions are suggested by Table 1. First, the diffusion index models, regardless of form and additional AR content, produce gains relative to the autoregressive benchmark. Second, the class of diffusion index models appears to provide a fairly generally applicable method of embodying conditioning information other than that on the past of the variable of interest: the diffusion index forecasts are comparable to the best of the benchmark forecasts for our two low-predictability cases, and are markedly better than any of these for the relatively high-predictability inflation series. This result mirrors the conclusion of Kisinbay (2001) for inflation forecasts, in a larger comparative exercise which also includes non-linear models. For this reason, the diffusion index class appears to offer a strategy for forecast improvement that may be applied to any of our series of interest.

[5]Forecast period is 1980-1998. Figures are ratios of MSE to the MSE of the AR forecast. AR[SW] refers to the variant on the autoregressive model used by Stock and Watson.

The diffusion forecasts of inflation, GDP growth and investment growth considered in Table 1 are based for the most part on Canadian data. A natural question is whether these forecasts can be improved by broadening the conditioning information. Accordingl y, we consider forecasts based on the two wider sets of information described in section 2; the first extends the Canadian data by adding U.S. data as described above, while the second further extends the data base with the inclusion of international dat a. Diffusion forecasts are now generated relative to these data sets. The results are given in Table 2, where the entries represent MSE ratios relative to AR forecasts as in the previous Table.

Table 2

Comparative forecast performance of model classes and data panels[6]

	y^1	y^2	y^3
Static, no AR			
Canadian panel	0.855	0.811	0.950
North American panel	0.605*	0.616*	0.935
International panel	0.589*	0.644*	1.005
Dynamic, no AR			
Canadian panel	0.803	0.879	0.835
North American panel	0.746	0.777	1.099
International panel	0.677	0.823	1.079
Static, AR			
Canadian panel	0.850	0.824	0.975
North American panel	0.624*	0.667*	0.961
International panel	0.591*	0.653*	1.035
Dynamic, AR			
Canadian panel	0.784	0.877	0.828
North American panel	0.738	0.792	1.185
International panel	0.668	0.828	1.166

[6]Forecast period is 1980-1998. Figures are ratios of MSE to the MSE of the AR forecast. The first line of each block is the same as the corresponding line in Table 1; subsequent lines extend the data set.

The diffusion forecasts of both CPI and GNP growth show considerable improvement when the conditioning information is expanded. But whereas the forecast performance for CIP improves as the conditioning set is expanded both for North American and International data, there appears to be no such gain in using international information over North American information in forecasting GNP growth. No improvement whatsoever in forecasting investment growth is suggested by the results in Table 2.

The improvement in forecast accuracy appears to be statistically significant as well. The stars (*) in Table 2 indicate that the Diebold-Mariano (asymptotic) test for comparing the predictive accuracy of the static diffusion forecasts relative to the AR forecasts becomes significant (at the 10% level for CPI and at the 5% for GNP growth) when the conditioning information set is expanded. Note that the standard errors of the statistics were computed to reflect the correlation in forecast errors in makin g 12 step-ahead or 4 step-ahead forecasts.

4.2 Comparison with OECD forecasts

It seems natural to compare the forecasts from the diffusion index models with those offered on an annual basis by a statistical agency. We consider in this section OECD forecasts for real GDP growth which are published very December. These forecasts are not strictly model based. Rather they reflect an internal consensus within the OECD shaped to some extent by consultation with the Department of Finance in Ottawa as to potential developments in the Canadian economy during the upcoming year.

In the context of the methodology developed in the paper, two issues are important. The first concerns the conditioning information for the diffusion index models. Fourth-quarter economic results are not available until March of the following year. For this reason, we take the forecasting horizon for the diffusion index models to be five quarters ahead. Of course, this restriction puts these models somewhat at a disadvantage, since the OECD forecasters will certainly be aware of fourth-quarter developments and will have as well a good understanding of future policy initiatives to be undertaken by the Canadian government.

A second issue concerns the nature of the forecasts offered. The OECD forecasts are annual calendar-year forecasts. Forecasted economic growth for 2001, for example, refers to economic growth during 2001 relative to that of 2000. Growth rates considered to this point in the paper are computed with respect to specific quarters, as they are in the U.S. where annual growth rates refer to fourth-quarter over fourth-quarter changes. To incorporate calendar-year forecasts, we define following the notation in section 4:

$$y^4_{t+1} = ln\left[\frac{(z^2_{t+5} + z^2_{t+4} +^2_{t+3} +^2_{t+2})}{(z^2_{t+1} + z^2_t +^2_{t-1} +^2_{t-2})}\right],$$

and consider Diffusion Index forecasts generated by equation (4.1). The calendar year forecasts are then simply the third quarter forecasts from this model.

A host of forecasts of calendar-year GDP growth are considered in Table 3. Mean Squared Errors are reported based on current revised figures for GDP growth. The OECD forecast errors are considered as a benchmark. We include for reference results for the AR and ML1 models in the previous section. Four Diffusion index models are considered; models with AR terms do no perform well. Finally, a variety of ‘consensus’ forecasts, being combinations of forecasts by different methods, are considered.

Table 3
Comparative forecast performance of OECD and DI forecasts: Δ rgdp[7]

Benchmark models	MSE	ratio
OECD	3.13	1.00
AR	7.60	2.43
AR[SW]	6.04	1.93
MLI_1	3.65	1.17
Diffusion models	ratio-Cdn	ratio-Int'l
D_1 : Static, no AR, 8 factors	1.15	1.14
D_2 : Static, no AR, BIC	1.43	1.16
D_3 : Dynamic, no AR, 8 factors	1.20	1.08
D_4 : Dynamic, no AR, BIC	1.52	1.08
consensus forecasts	ratio-Cdn	ratio-Int'l
OECD + D_1 :	0.90	0.91
OECD + D_2 :	1.05	0.90
OECD + D_3 :	0.92	0.84
OECD + D_4 :	1.04	0.87

The results for the diffusion forecasts based on Canadian data suggest that their OECD counterparts embody a source of information not exploited by the diffusion index forecasts. One possibility, implying a limitation of the forecasting technique, is that OECD forecasts embody a superior statistical procedure. A second possibility, implying a limitation of a different kind, is that information of an informal type, not readily quantifiable or exploitable by statistical forecasts, is observable to OECD forecasters. Such information might be 'insider information' available through early exposure to statistical agencies' data, or yet more informal knowledge such as impressions gathered from casual observation, which may prove valuable in the context of a process such as this for which measurable series provide little forecasting power. A third possibility is that the informational advantage arises from the incorporation of information on other economies

[7]Figures are absolute MSE's and ratios of MSE's to that of the OECD forecast for the first block; ratios to the OECD forecasts in the cases of (i) the Canadian panel and (ii) the International panel, for the second and third blocks.

not captured in the data set used here for the diffusion index forecasts (for example, Japanese GDP growth). To test this last hypothesis, diffusion forecasts were generated incorporating additional North American and international economic data. The results show evident improvement, particularly for the cases where the numbe r of factors is chosen by BIC. The possibility of further forecast improvement based on extensions of the conditioning information set is the subject of ongoing research.

The lower part of Table 3 investigates whether DI forecasts are encompassed by the OECD forecasts in the sense that using both types of forecasts produces results no better than those of the OECD alone. Consensus forecasts are formed here as the mean of t he component forecasts. The relative MSE for the consensus involving DI forecasts based on Canadian data is centered on 1, suggesting that the DI forecasts add little to the information content of the OECD forecasts. The situation improves when DI forecas ts based on international data is used in determining the consensus forecast; here the consensus forecast systematically reduces MSE relative to the OECD forecasts from 10 to 15

The possibility of forecast improvement along these lines may be tested in a more formal framework; see Diebold and Lopez (1996) for references. The idea is to regress the realized value of the variable to be forecast on a constant and the two competing f orecasts; here, $y_{t+1} = \beta_0 + \beta_1 \tilde{y}_{OECD} + \beta_2 \tilde{y}_{DI} + \epsilon$. If one forecast dominates or encompasses the other its regression coefficient will be one and that of the other zero (with the intercept also zero). Table 4 presents results involving the OECD forecasts and DI forecasts, the latter based on Canadian data in one instance and on international data in the other. The reported p-values are associated with F-tests of the joint hypothesis just described; the resul ts of more robust asymptotic procedures are similar and not reported here.

The results in Table 4 reflect the marked forecast improvement when the DI procedures use the expanded information set. The hypothesis that the OECD forecasts encompass the DI forecasts created from the Canadian panel cannot be rejected, but does show p-v alues in the neighbourhood of the conventional rejection region (0.04 to 0.08) when the DI forecasts use international data; accordingly, it is not surprising that a consensus forecast involving this DI forecast outperforms the OECD forecast alone. The p-values for the hypothesis that DI forecasts encompass the OECD forecasts all fall between 0.02 and 0.07; that is, there is substantial evidence against this hypothesis in all cases.

Table 4
Forecast Encompassing: OECD vs. Diffusion Index[8]

	β_1(OECD)	β_2(DI)	$p : H_{0,A}$	$p : H_{0,B}$
Canadian panel				
OECD + D1	1.05	0.59	0.19	0.07
OECD + D2	1.19	0.38	0.52	0.05
OECD + D3	1.08	0.51	0.26	0.07
OECD + D4	1.21	0.36	0.46	0.03
International panel				
OECD + D1	1.02	0.79	0.08	0.03
OECD + D2	1.07	0.77	0.07	0.02
OECD + D3	1.05	0.75	0.04	0.02
OECD + D4	0.95	0.89	0.04	0.02

4.3 Potential for forecast horizon extension

We now consider whether the diffusion index models allow us to increase the maximum horizon at which forecasting models have positive content, that is, the maximum horizon at which conditioning information has value. In particular, we examine the first horizons at which forecast content or predictability is approximately zero in our investigation of Section 2, and ask whether the diffusion index now allows us to obtain positive forecast content or predictability at this horizon.

To do so, we compute forecasts of the one-year aggregates, from the diffusion index models, at each horizon s, $s = 1, \ldots, 8$. A sequence of forecasts is produced and the mean squared errors of each of six variants on the diffusion index are compared: that is, static and dynamic versions of diffusion models based on

[8] $H_{0,A} : \beta_0 = 0, \beta_1 = 1, \beta_2 = 0$; $H_{0,B} : \beta_0 = 0, \beta_1 = 0, \beta_2 = 1$. Values in the first two columns are the coefficients in the test regression, values in the last two columns are p-values for the two hypotheses.

three possible panels of data, the Canadian, Canadian + US, and Canadian + US + other. For each we record the mean squared error of the forecasts on the pseudo-out-of-sample period 1980:1 to 1998:4, and compare with the MSE of a forecast using the estimated mean alone, which is 0.559. The forecast content is then computed at each horizon and for each technique by the ratio $1 - \frac{MSE_i}{0.559}$, where MSE_i is the mean squared error of the particular diffusion index model used.

Although forecast content rises within the forecast horizon–a result which follows from the improvements in RMSE noted above in the short-horizon comparisons with benchmark models–the horizon itself is not extended in any case. Each of the static models gives a content horizon of three quarters, and the dynamic models only two quarters; that is, these models without AR components approximately match, in the static case, the horizon obtainable with autoregressions (compare Figures 2d, 3d). Only with autoregressive components can the horizons attained with the pure AR models actually be matched.[9] That is, the predictive content of the diffusion index models appears to dissipate at approximately the same point as that of the benchmark models, for each of the low-predictability series.

5. Concluding remarks

Time series such as the quarterly growth rates of output and investment present a considerable challenge to the forecaster. On each of the measures of forecasts' usefulness that we examine, these time series show little value in standard forecasts beyond a short horizon. It is natural to ask whether the large bodies of data exploitable through diffusion-index forecasts allow us to improve forecast performance markedly.

The answer to the question is mixed. With respect to a measure such as the MSE of forecast performance at short horizons, the diffusion indices do pro-

[9]Representative results are those for the static diffusion index on the international panel, for which the content $C(s)$ at $s = 1, 2, 3$ is 0.459, 0.443, 0.093. The content is negative thereafter; that is, observed forecast MSE at horizons exceeding three is higher than that of the sample-mean forecast.

duce clear gains relative to other standard methods, and indeed seem to match approximately the performa nce of the best model tailored specifically to the series of interest, in each case. There are substantial gains relative to the pure autoregressive benchmark, regardless of the variant of the diffusion index which is applied. These positive results und erscore the flexibility of the diffusion index as a relatively atheoretical tool which may be widely applied without extensive and time-consuming modification to suit the features of a particular application.

We do not however find evidence that the diffusion index extends the relatively short horizons beyond which forecasts lose their usefulness. This result is compatible with the idea that the diffusion index exploits relatively efficiently the information available in past observations, but that changes in these series depend so importantly on very recent information that longer-horizon forecasts may remain no more informative than the unconditional mean.

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APPENDIX: DATA SOURCES

This appendix lists the time series used to build the diffusion indices and produce the forecasts. All starred (*) series were taken from CANSIM; other are from Datastream. All series span the 1967:1−1998:12/1967Q1−1998Q4 time period. Transfomations and codes are described at the end of this list.

Dependent variables

Name	Trans	Code
CN CONSUMER PRICE INDEX NADJ	(r)Δln	CNCP....F
CN GDP (SA,AR)	(r)Δln	D14840*
CN BGFCF (SA,AR)	(r)Δln	D14825*

Implicit deflators

Name	Trans	Code
CN IMPLICIT PRICE INDEX: GROSS DOMESTIC PRODUCT (SA) SADJ		CND15612
CN IMPLICIT PRICE INDEX: BUSINESS GROSS FXD.CAP. FORM. (SA) SADJ		CND15601

Indicators

Name	Trans	Code
CN AVERAGE WEEKLY HOURS WORKED IN MANUFACTURING VOLN		CN100042
CN SHIPMENTS TO INVENTORY RATIO: FINISHED GOODS (SA) SADJ	Δ	CN100049
CN REAL MONEY SUPPLY M1 (SA) CONA	Δln	CN100045
CN TORONTO STOCK PRICE INDEX, TSE300 NADJ	Δln	CN100050
CN NEW ORDERS: DURABLE GOODS (SA) CONA	Δln	CN100046
CN HOUSING INDEX NADJ	Δ	CN100043
CN RETAIL SALES: FURNITURE & APPLIANCES (SA) CONA	Δln	CN100047
CN UNITED STATES COMPOSITE LEADING INDEX SADJ	Δ	CN100044

Monthly Canadian Panel

#	Name	Trans	Code
	Output		
1	CN GDP: INDUSTRIAL PRODUCTION (SA,AR) CONA (C$)	Δln	CNINPRDND
2	CN GDP: DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56012
3	CN GDP: NON−DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56011
4	CN GDP: GOODS PRODUCTION INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56008
5	CN GDP: SERVICES PRODUCING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56009
6	CN GDP: MANUFACTURING (SA,AR) CONA (C$)	Δln	CNI56036
7	CN GDP: GOVERNMENT SERVICES (SA,AR) CONA (C$)	Δln	CNI56283
8	CN GDP: BUSINESS SERVICES (SA,AR) CONA (C$)	Δln	CNI56275
9	CN GDP: MINING (SA,AR) CONA (C$)	Δln	CNI56021
10	CN GDP: PULP AND PAPER (SA,AR) CONA (C$)	Δln	CNI56116
11	CN GDP: RETAIL TRADE (SA,AR) CONA (C$)	Δln	CNI56261
12	CN GDP: WHOLESALE TRADE (SA,AR) CONA (C$)	Δln	CNI56260
13	CN GDP: BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56002
14	CN GDP: NON−BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56005
15	CN SPREAD GDP :DURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
16	CN SPREAD GDP :NONDURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
	Employment		
17	CN TOTAL UNEMPLOYMENT RATE (%) SADJ		CNTOTUN%E
18	CN AVERAGE WEEKLY HOURS:MANUFACTURING NADJ		CNL59695
19	CN AVERAGE WEEKLY EARNINGS FOR ALL INDUSTRIAL WORKERS CURN	Δln	CNINSAVEA
	Housing		
20	CN BUILDING PERMITS:RESIDENTIAL (SEAS.ADJUSTED) CURA	Δln	CND2681

21	CN HOUSING STARTS: URBAN CENTERS − ALBERTA (SA, AR) VOLA	ln	CNHBAL..O
22	CN HOUSING STARTS: URBAN CENTERS − ATLANTIC (SA, AR) VOLA	ln	CNHBAT..O
23	CN HOUSING STARTS: URBAN CENTERS− BRITISH COLUMBIA (SA, AR) VOLA	ln	CNHBBC..O
24	CN HOUSING STARTS: URBAN CENTERS − MANITOBA (SA, AR) VOLA	ln	CNHBMA..O
25	CN HOUSING STARTS: URBAN CENTERS − ONTARIO (SA, AR) VOLA	ln	CNHBON..O
26	CN HOUSING STARTS: URBAN CENTERS − QUEBEC (SA, AR) VOLA	ln	CNHBQB..O
27	CN HOUSING STARTS: URBAN CENTERS − SASKATCHEWAN (SA, AR) VOLA	ln	CNHBSA..O
28	CN HOUSING STARTS: URBAN CENTERS − MULTIPLES (SA, AR) VOLA	ln	CNHBM..O
29	CN HOUSING STARTS: URBAN CENTERS − SINGLES (SA, AR) VOLA	ln	CNHBS..O
30	CN HOUSING INDEX NADJ	Δ	CN100043
	Orders		
31	CN NEW ORDERS: DURABLE GOODS (SA) CONA	Δln	CN100046
	Equities		
32	US STANDARD & POOR’S INDEX OF 500 COMMON STOCKS(MONTHLY AVE)	Δln	US500STK
33	CN TORONTO STOCK EXCH. ’300’ SHARE PRICE INDEX (END MONTH)	Δln	CNB4237
34	CN VALUE OF EQUITIES TRADED:TORONTO STOCK EXCHANGE CURN	Δln	CND4560
	Exchange rates		
35	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR (MONTHLY AVERAGE)	Δ	CNB3400
36	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR REAL (MONTHLY AVERAGE)	Δ	USCP..F
37	CN CANADIAN DOLLARS TO 1 FRENCH FRANC (MONTHLY AVERAGE)	Δ	CNB3404
38	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK (MONTHLY AVERAGE)	Δ	CNB3405
39	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK REAL (MONTHLY AVERAGE)	Δ	BDCP..F
40	CN CANADIAN DOLLARS TO 1 JAPANESE YEN (MONTHLY AVERAGE)	Δ	CNB3407
41	CN CANADIAN DOLLARS TO 1 JAPANESE YEN REAL (MONTHLY AVERAGE)	Δ	JPCNPRICF
42	CN CANADIAN DOLLARS TO 1 STERLING POUND (MONTHLY AVERAGE)	Δ	CNB3412
43	CN CANADIAN DOLLARS TO 1 STERLING POUND REAL (MONTHLY AVERAGE)	Δ	UKRP....F
	Interest rates		
44	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER (MONTHLY AVE)	Δ	CNB14001
45	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER REAL (MONTHLY AVE)	Δ	
46	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER (END MONTH)	Δ	CNB14008
47	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER REAL (END MONTH)	Δ	
48	CN INTEREST RATES:1 MONTH PRIME CORPORATE PAPER (END MONTH)	Δ	CNB14039
49	CN SPREAD 3−MONTH/SHORT TERM RATES		
50	CN SPREAD 6−MONTH/SHORT TERM RATES		
	Money		
51	CN MONETARY BASE (SA) CURA	Δln	CNB1646
52	CN CHARTERED BANKS: CN$ MAJOR ASSETS (SA) CURA	Δln	CNB1605
53	CN CHARTERED BANKS: CN$ ASSETS EXCLUDING LIQUID (SA) CURA (C$)	Δln	CNB1616
54	CN CHARTERED BANKS: CN$ PERSONAL LOANS (SA) CURA	Δln	CNB1622
55	CN CHARTERED BANKS: CN$ BUSINESS LOANS (SA) CURA	Δln	CNB1623
56	CN CHARTERED BANKS: CN$ PERSONAL SAVINGS DEPOSITS CURN	Δln	CNB451
	Prices		
57	CN CONSUMER PRICE INDEX NADJ	(r)Δln	CNCP....F
58	CN CPI: GOODS NADJ	(r)Δln	CN100270
59	CN CPI: SERVICES NADJ	(r)Δln	CN100274
60	CN CPI: DURABLE GOODS NADJ	(r)Δln	CN100271
61	CN CPI: NONDURABLE GOODS NADJ	(r)Δln	CN100273
62	CN INDUSTRIAL PRICE INDEX:ALL MANUFACTURING INDUSTRIES NADJ	(r)Δln	CNSELPRCF

Monthly International Panel

#	Name	Trans	Code
	Output		
1	CN GDP: INDUSTRIAL PRODUCTION (SA,AR) CONA (C$)	Δln	CNINPRDND
2	CN GDP: DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56012
3	CN GDP: NON−DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56011

4	CN GDP: GOODS PRODUCTION INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56008
5	CN GDP: SERVICES PRODUCING INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56009
6	CN GDP: MANUFACTURING (SA,AR) CONA (C$)	Δln	CNI56036
7	CN GDP: GOVERNMENT SERVICES (SA,AR) CONA (C$)	Δln	CNI56283
8	CN GDP: BUSINESS SERVICES (SA,AR) CONA (C$)	Δln	CNI56275
9	CN GDP: MINING (SA,AR) CONA (C$)	Δln	CNI56021
10	CN GDP: PULP AND PAPER (SA,AR) CONA (C$)	Δln	CNI56116
11	CN GDP: RETAIL TRADE (SA,AR) CONA (C$)	Δln	CNI56261
12	CN GDP: WHOLESALE TRADE (SA,AR) CONA (C$)	Δln	CNI56260
13	CN GDP: BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56002
14	CN GDP: NON−BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	Δln	CNI56005
15	CN SPREAD GDP :DURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
16	CN SPREAD GDP :NONDURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
	Employment		
17	CN TOTAL UNEMPLOYMENT RATE (%) SADJ		CNTOTUN%E
18	CN AVERAGE WEEKLY HOURS:MANUFACTURING NADJ		CNL59695
19	CN AVERAGE WEEKLY EARNINGS FOR ALL INDUSTRIAL WORKERS CURN	Δln	CNINSAVEA
20	US UNEMPLOYED FOR LESS THAN 5 WEEKS VOLA	Δln	USUNWK5.O
21	US UNEMPLOYED FOR 5 TO 14 WEEKS VOLA	Δln	USUNWK14O
22	US UNEMPLOYED FOR 15 WEEKS OR MORE VOLA	Δln	USUNPLNGE
23	US UNEMPLOYED FOR 15 TO 26 WEEKS VOLA	Δln	USUNWK26O
24	US UNEMPLOYED FOR 27 WEEKS & OVER VOLA	Δln	USUNWK27O
	Housing		
25	CN BUILDING PERMITS:RESIDENTIAL (SEAS.ADJUSTED) CURA	Δln	CND2681
26	CN HOUSING STARTS: URBAN CENTERS − ALBERTA (SA, AR) VOLA	ln	CNHBAL..O
27	CN HOUSING STARTS: URBAN CENTERS − ATLANTIC (SA, AR) VOLA	ln	CNHBAT..O
28	CN HOUSING STARTS: URBAN CENTERS− BRITISH COLUMBIA (SA, AR) VOLA	ln	CNHBBC..O
29	CN HOUSING STARTS: URBAN CENTERS − MANITOBA (SA, AR) VOLA	ln	CNHBMA..O
30	CN HOUSING STARTS: URBAN CENTERS − ONTARIO (SA, AR) VOLA	ln	CNHBON..O
31	CN HOUSING STARTS: URBAN CENTERS − QUEBEC (SA, AR) VOLA	ln	CNHBQB..O
32	CN HOUSING STARTS: URBAN CENTERS − SASKATCHEWAN (SA, AR) VOLA	ln	CNHBSA..O
33	CN HOUSING STARTS: URBAN CENTERS − MULTIPLES (SA, AR) VOLA	ln	CNHBM..O
34	CN HOUSING STARTS: URBAN CENTERS − SINGLES (SA, AR) VOLA	ln	CNHBS..O
35	CN HOUSING INDEX NADJ	Δ	CN100043
	Orders		
36	CN NEW ORDERS: DURABLE GOODS (SA) CONA	Δln	CN100046
	Equities		
37	US STANDARD & POOR’S INDEX OF 500 COMMON STOCKS(MONTHLY AVE)	Δln	US500STK
38	CN TORONTO STOCK EXCH. ’300’ SHARE PRICE INDEX (END MONTH)	Δln	CNB4237
39	CN VALUE OF EQUITIES TRADED:TORONTO STOCK EXCHANGE CURN	Δln	CND4560
40	US DOW JONES INDUSTRIALS SHARE PRICE INDEX (EP)	Δln	USSHRPRCF
41	US STANDARD AND POORS’ COMPOSITE INDEX (EP)	Δln	USS&PCOM
	Exchange rates		
42	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR (MONTHLY AVERAGE)	Δ	CNB3400
43	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR REAL (MONTHLY AVERAGE)	Δ	USCP..F
44	CN CANADIAN DOLLARS TO 1 FRENCH FRANC (MONTHLY AVERAGE)	Δ	CNB3404
45	CN CANADIAN DOLLARS TO 1 FRENCH FRANC REAL (MONTHLY AVERAGE)	Δ	FRI64...F
46	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK (MONTHLY AVERAGE)	Δ	CNB3405
47	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK REAL (MONTHLY AVERAGE)	Δ	BDCP..F
48	CN CANADIAN DOLLARS TO 1 JAPANESE YEN (MONTHLY AVERAGE)	Δ	CNB3407
49	CN CANADIAN DOLLARS TO 1 JAPANESE YEN REAL (MONTHLY AVERAGE)	Δ	JPCNPRICF
50	CN CANADIAN DOLLARS TO 1 STERLING POUND (MONTHLY AVERAGE)	Δ	CNB3412
51	CN CANADIAN DOLLARS TO 1 STERLING POUND REAL (MONTHLY AVERAGE)	Δ	UKRP....F
	Interest rates		
52	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER (MONTHLY AVE)	Δ	CNB14001

53	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER REAL (MONTHLY AVE)	Δ	
54	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER (END MONTH)	Δ	CNB14008
55	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER REAL (END MONTH)	Δ	
56	CN INTEREST RATES:1 MONTH PRIME CORPORATE PAPER (END MONTH)	Δ	CNB14039
57	CN CHARTERED BANK PRIME BUSINESS LOAN RATE	Δ	B14020*
58	GOVT. OF CANADA BOND YIELD AVERAGE − 1 TO 3 YEARS	Δ	B14009*
59	GOVT. OF CANADA BOND YIELD AVERAGE − 3 TO 5 YEARS	Δ	B14010*
60	GOVT. OF CANADA BOND YIELD AVERAGE − 5 TO 10 YEARS	Δ	B14011*
61	GOVT. OF CANADA BOND YIELD AVERAGE 10 YRS AND OVER	Δ	B14013*
62	CN SPREAD 3−MONTH/SHORT TERM RATES		
63	CN SPREAD 6−MONTH/SHORT TERM RATES		
64	CN SPREAD 1−3 Y/SHORT TERM RATES		
65	CN SPREAD 3−5 Y/SHORT TERM RATES		
66	CN SPREAD 5−10 Y/SHORT TERM RATES		
67	CN SPREAD 10+ Y/SHORT TERM RATES		
	Money		
68	CN MONETARY BASE (SA) CURA	Δln	CNB1646
69	CN CHARTERED BANKS: CN$ MAJOR ASSETS (SA) CURA	Δln	CNB1605
70	CN CHARTERED BANKS: CN$ ASSETS EXCLUDING LIQUID (SA) CURA (C$)	Δln	CNB1616
71	CN CHARTERED BANKS: CN$ PERSONAL LOANS (SA) CURA	Δln	CNB1622
72	CN CHARTERED BANKS: CN$ BUSINESS LOANS (SA) CURA	Δln	CNB1623
73	CN CHARTERED BANKS: CN$ PERSONAL SAVINGS DEPOSITS CURN	Δln	CNB451
	Prices		
74	CN CONSUMER PRICE INDEX NADJ	(r)Δln	CNCP....F
75	CN CPI: GOODS NADJ	(r)Δln	CN100270
76	CN CPI: SERVICES NADJ	(r)Δln	CN100274
77	CN CPI: DURABLE GOODS NADJ	(r)Δln	CN100271
78	CN CPI: NONDURABLE GOODS NADJ	(r)Δln	CN100273
79	CN INDUSTRIAL PRICE INDEX:ALL MANUFACTURING INDUSTRIES NADJ	(r)Δln	CNSELPRCF
	International output		
80	US INDUSTRIAL PRODUCTION VOLA	Δln	USIPTOT.G
81	US INDUSTRIAL PRODUCTION − DURABLE MANUFACTURING VOLA	Δln	USDURBLIG
82	US INDUSTRIAL PRODUCTION − NONDURABLE MANUFACTURING VOLA	Δln	USNONDBIG
83	US INDUSTRIAL PRODUCTION − CONSUMER GOODS VOLA	Δln	USCONSMIG
84	US INDUSTRIAL PRODUCTION − BUSINESS EQUIPMENT VOLA	Δln	USBUSEQIG
85	US INDUSTRIAL PRODUCTION − MANUFACTURING VOLA	Δln	USIPMAN.G
86	US INDUSTRIAL PRODUCTION − MINING VOLA	Δln	USMININGG
87	US PERSONAL INCOME (MONTHLY SERIES) (AR) CURA	Δln	USPERINCB
88	BD INDUSTRIAL PRODUCTION SADJ	Δln	BDI66..CE
89	BD MANUFACTURING PRODUCTION VOLA	Δln	BDMANPRDG
90	UK INDUSTRIAL PRODUCTION SADJ	Δln	UKI66..CE
91	FR INDUSTRIAL PRODUCTION SADJ	Δln	FRI66..CE
92	IT INDUSTRIAL PRODUCTION SADJ	Δln	ITI66..CE
93	JP INDUSTRIAL PRODUCTION SADJ	Δln	JPI66..CE
94	KO INDUSTRIAL PRODUCTION SADJ	Δln	KOI66..CE
	International exchange rates		
95	BD NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	BDI..AF.
96	UK US $ TO £1	Δ	UKXUS$..
97	FR NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	FRI..AF.
98	JP NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	JPI..AF.
99	KO NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	KOI..AF.
	International interest rates		
100	US FEDERAL FUNDS RATE	Δ	USFEDFUN
101	US TREASURY BILL SECONDARY MKT RATE ON DISCOUNT BASIS−3 MONTH	Δ	USTRB3AV
102	US TREASURY BILL SECONDARY MKT RATE ON DISCOUNT BASIS−6 MONTH	Δ	USYTB6SM

103	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 1 YEAR	Δ	USTRCN1.
104	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 5 YEAR	Δ	USTRCN5.
105	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 10 YEAR	Δ	USTRCN10
	International money		
106	US MONETARY BASE CURA	$\Delta\ln$	USM0....B
107	US MONEY STOCK − CURRENCY IN CIRCULATION CURA	$\Delta\ln$	USCURRNCB
108	US MONEY STOCK − DEMAND DEPOSITS CURA	$\Delta\ln$	USDEMDEPB
109	US MONEY STOCK − OTHER CHECKABLE DEPOSITS CURA	$\Delta\ln$	USOTHCHKB
	International prices		
110	US CPI, ALL URBAN: ALL ITEMS SADJ	(r)$\Delta\ln$	USCP....E
111	US CPI: DURABLES SADJ	(r)$\Delta\ln$	USCPD...E
112	US CPI: NONDURABLES SADJ	(r)$\Delta\ln$	USCPN...E
113	US CPI: SERVICES SADJ	(r)$\Delta\ln$	USCPSERVE
114	US CPI: COMMODITIES SADJ	(r)$\Delta\ln$	USCPCOMME
115	BD CPI NADJ	(r)$\Delta\ln$	BDCP....F
116	UK PRODUCER PRICE INDEX NADJ	(r)$\Delta\ln$	UKI63...F
117	FR CPI NADJ	(r)$\Delta\ln$	FRI64...F
118	JP CPI NADJ	(r)$\Delta\ln$	JPI64...F
119	KO PRODUCER PRICE INDEX NADJ	(r)$\Delta\ln$	KOI63...F

Quarterly Canadian Panel

#	Name	Trans	Code
	Output		
1	CN GDP: INDUSTRIAL PRODUCTION (SA,AR) CONA (C$)	$\Delta\ln$	CNINPRDND
2	CN GDP: DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56012
3	CN GDP: NON−DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56011
4	CN GDP: GOODS PRODUCTION INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56008
5	CN GDP: SERVICES PRODUCING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56009
6	CN GDP: MANUFACTURING (SA,AR) CONA (C$)	$\Delta\ln$	CNI56036
7	CN GDP: GOVERNMENT SERVICES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56283
8	CN GDP: BUSINESS SERVICES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56275
9	CN GDP: MINING (SA,AR) CONA (C$)	$\Delta\ln$	CNI56021
10	CN GDP: PULP AND PAPER (SA,AR) CONA (C$)	$\Delta\ln$	CNI56116
11	CN GDP: RETAIL TRADE (SA,AR) CONA (C$)	$\Delta\ln$	CNI56261
12	CN GDP: WHOLESALE TRADE (SA,AR) CONA (C$)	$\Delta\ln$	CNI56260
13	CN GDP: BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56002
14	CN GDP: NON−BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56005
15	CN SPREAD GDP :DURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
16	CN SPREAD GDP :NONDURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
	Employment		
17	CN TOTAL UNEMPLOYMENT RATE (%) SADJ		CNTOTUN%E
18	CN AVERAGE WEEKLY HOURS:MANUFACTURING NADJ		CNL59695
19	CN AVERAGE WEEKLY EARNINGS FOR ALL INDUSTRIAL WORKERS CURN	$\Delta\ln$	CNINSAVEA
	Housing		
20	CN BUILDING PERMITS:RESIDENTIAL (SEAS.ADJUSTED) CURA	$\Delta\ln$	CND2681
21	CN HOUSING STARTS: ALL AREAS − ALBERTA (SA, AR) VOLA	ln	CNHBAL..QO
22	CN HOUSING STARTS: ALL AREAS − NOVA SCOTIA (SA, AR) VOLA	ln	CNHBAT..QO
23	CN HOUSING STARTS: ALL AREAS − BRITISH COLUMBIA (SA, AR) VOLA	ln	CNHBBC..QO
24	CN HOUSING STARTS: ALL AREAS − MANITOBA (SA, AR) VOLA	ln	CNHBMA..QO
25	CN HOUSING STARTS: ALL AREAS − ONTARIO (SA, AR) VOLA	ln	CNHBON..QO
26	CN HOUSING STARTS: ALL AREAS − QUEBEC (SA, AR) VOLA	ln	CNHBQB..QO
27	CN HOUSING STARTS: ALL AREAS − SASKATCHEWAN (SA, AR) VOLA	ln	CNHBSA..QO
28	CN HOUSING STARTS: ALL AREAS − NEW BRUNSWICK (SA, AR) VOLA	ln	CNHBNB..QO
29	CN HOUSING STARTS: ALL AREAS − NEWFOUNDLAND (SA, AR) VOLA	ln	CNHBNF..QO
30	CN HOUSING INDEX NADJ	Δ	CN100043

	Orders		
31	CN NEW ORDERS: DURABLE GOODS (SA) CONA	$\Delta\ln$	CN100046
	Equities		
32	US STANDARD & POOR'S INDEX OF 500 COMMON STOCKS(MONTHLY AVE)	$\Delta\ln$	US500STK
33	CN TORONTO STOCK EXCH. '300' SHARE PRICE INDEX (END MONTH)	$\Delta\ln$	CNB4237
34	CN VALUE OF EQUITIES TRADED:TORONTO STOCK EXCHANGE CURN	$\Delta\ln$	CND4560
	Exchange rates		
35	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR (MONTHLY AVERAGE)	Δ	CNB3400
36	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR REAL (MONTHLY AVERAGE)	Δ	USCP..F
37	CN CANADIAN DOLLARS TO 1 FRENCH FRANC (MONTHLY AVERAGE)	Δ	CNB3404
38	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK (MONTHLY AVERAGE)	Δ	CNB3405
39	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK REAL (MONTHLY AVERAGE)	Δ	BDCP..F
40	CN CANADIAN DOLLARS TO 1 JAPANESE YEN (MONTHLY AVERAGE)	Δ	CNB3407
41	CN CANADIAN DOLLARS TO 1 JAPANESE YEN REAL (MONTHLY AVERAGE)	Δ	JPCNPRICF
42	CN CANADIAN DOLLARS TO 1 STERLING POUND (MONTHLY AVERAGE)	Δ	CNB3412
43	CN CANADIAN DOLLARS TO 1 STERLING POUND REAL (MONTHLY AVERAGE)	Δ	UKRP....F
	Interest rates		
44	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER (MONTHLY AVE)	Δ	CNB14001
45	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER REAL (MONTHLY AVE)	Δ	
46	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER (END MONTH)	Δ	CNB14008
47	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER REAL (END MONTH)	Δ	
48	CN INTEREST RATES:1 MONTH PRIME CORPORATE PAPER (END MONTH)	Δ	CNB14039
49	CN SPREAD 3−MONTH/SHORT TERM RATES		
50	CN SPREAD 6−MONTH/SHORT TERM RATES		
	Money		
51	CN MONETARY BASE (SA) CURA	$\Delta\ln$	CNB1646
52	CN CHARTERED BANKS: CN$ MAJOR ASSETS (SA) CURA	$\Delta\ln$	CNB1605
53	CN CHARTERED BANKS: CN$ ASSETS EXCLUDING LIQUID (SA) CURA	$\Delta\ln$	CNB1616
54	CN CHARTERED BANKS: CN$ PERSONAL LOANS (SA) CURA	$\Delta\ln$	CNB1622
55	CN CHARTERED BANKS: CN$ BUSINESS LOANS (SA) CURA	$\Delta\ln$	CNB1623
56	CN CHARTERED BANKS: CN$ PERSONAL SAVINGS DEPOSITS CURN	$\Delta\ln$	CNB451
	Prices		
57	CN CONSUMER PRICE INDEX NADJ	(r)$\Delta\ln$	CNCP....F
58	CN CPI: GOODS NADJ	(r)$\Delta\ln$	CN100270
59	CN CPI: SERVICES NADJ	(r)$\Delta\ln$	CN100274
60	CN CPI: DURABLE GOODS NADJ	(r)$\Delta\ln$	CN100271
61	CN CPI: NONDURABLE GOODS NADJ	(r)$\Delta\ln$	CN100273
62	CN INDUSTRIAL PRICE INDEX:ALL MANUFACTURING INDUSTRIES NADJ	(r)$\Delta\ln$	CNSELPRCF
	Investment		
63	CN BUSINESS GFCF: NON−RESIDENTIAL STRUCTURES	$\Delta\ln$	D15677*
64	CN BUSINESS GFCF: MACHINERY&EQUIPMENT	$\Delta\ln$	D15678*
65	CN BUSINESS GFCF: RESIDENTIAL STRUCTURES	$\Delta\ln$	D15675*
66	CN GOVERNEMENT GFCF	$\Delta\ln$	D15672*

Note: the Canadian panel used for GDP excludes investment series.

Quarterly International Panel

#	Name	Trans	Code
	Output		
1	CN GDP: INDUSTRIAL PRODUCTION (SA,AR) CONA (C$)	$\Delta\ln$	CNINPRDND
2	CN GDP: DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56012
3	CN GDP: NON−DURABLE MANUFACTURING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56011
4	CN GDP: GOODS PRODUCTION INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56008
5	CN GDP: SERVICES PRODUCING INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56009
6	CN GDP: MANUFACTURING (SA,AR) CONA (C$)	$\Delta\ln$	CNI56036
7	CN GDP: GOVERNMENT SERVICES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56283

8	CN GDP: BUSINESS SERVICES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56275
9	CN GDP: MINING (SA,AR) CONA (C$)	$\Delta\ln$	CNI56021
10	CN GDP: PULP AND PAPER (SA,AR) CONA (C$)	$\Delta\ln$	CNI56116
11	CN GDP: RETAIL TRADE (SA,AR) CONA (C$)	$\Delta\ln$	CNI56261
12	CN GDP: WHOLESALE TRADE (SA,AR) CONA (C$)	$\Delta\ln$	CNI56260
13	CN GDP: BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56002
14	CN GDP: NON−BUSINESS SECTOR INDUSTRIES (SA,AR) CONA (C$)	$\Delta\ln$	CNI56005
15	CN CAPACITY UTILIZATION RATE:MANUFACTURING INDUSTRIES NADJ		CN883647
16	CN CAPACITY UTILIZATION RATE:DURABLE GOODS MANUFACTURING NADJ		CN883648
17	CN CAPACITY UTILIZATION RATE:NON−DURABLE GOODS MFG. NADJ		CN883658
18	CN CAPACITY UTILIZATION RATE:FINAL GOODS MANUFACTURING NADJ		CN883675
19	CN PERSONAL INCOME (SA,AR) CURA	$\Delta\ln$	CND14895
20	CN DISPOSABLE PERSONAL INCOME (SA,AR) CURA	$\Delta\ln$	CNPERDISB
21	CN SPREAD GDP :DURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
22	CN SPREAD GDP :NONDURABLE MANUFACTURING INDUSTRIES−INDUSTRIAL PRODUCTION		
	Employment		
23	CN TOTAL UNEMPLOYMENT RATE (%) SADJ		CNTOTUN%E
24	CN AVERAGE WEEKLY HOURS:MANUFACTURING NADJ		CNL59695
25	CN AVERAGE WEEKLY EARNINGS FOR ALL INDUSTRIAL WORKERS CURN	$\Delta\ln$	CNINSAVEA
26	US UNEMPLOYED FOR LESS THAN 5 WEEKS VOLA	$\Delta\ln$	USUNWK5.O
27	US UNEMPLOYED FOR 5 TO 14 WEEKS VOLA	$\Delta\ln$	USUNWK14O
28	US UNEMPLOYED FOR 15 WEEKS OR MORE VOLA	$\Delta\ln$	USUNPLNGE
29	US UNEMPLOYED FOR 15 TO 26 WEEKS VOLA	$\Delta\ln$	USUNWK26O
30	US UNEMPLOYED FOR 27 WEEKS & OVER VOLA	$\Delta\ln$	USUNWK27O
	Personal consumption expenditures		
31	CN PERSONAL CONSUMPTION EXPENDITURES (SA,AR) CURA	$\Delta\ln$	CNCNPER.B
32	CN PCE: DURABLES (SA,AR) CURA	$\Delta\ln$	CND14818
33	CN PCE: NONDURABLES (SA,AR) CURA	$\Delta\ln$	CND14820
34	CN PCE: SERVICES (SA,AR) CURA	$\Delta\ln$	CND14821
	Housing		
35	CN BUILDING PERMITS:RESIDENTIAL (SEAS.ADJUSTED) CURA	$\Delta\ln$	CND2681
36	CN HOUSING STARTS: ALL AREAS − ALBERTA (SA, AR) VOLA	$\ln$	CNHBAL..QO
37	CN HOUSING STARTS: ALL AREAS − NOVA SCOTIA (SA, AR) VOLA	$\ln$	CNHBAT..QO
38	CN HOUSING STARTS: ALL AREAS − BRITISH COLUMBIA (SA, AR) VOLA	$\ln$	CNHBBC..QO
39	CN HOUSING STARTS: ALL AREAS − MANITOBA (SA, AR) VOLA	$\ln$	CNHBMA..QO
40	CN HOUSING STARTS: ALL AREAS − ONTARIO (SA, AR) VOLA	$\ln$	CNHBON..QO
41	CN HOUSING STARTS: ALL AREAS − QUEBEC (SA, AR) VOLA	$\ln$	CNHBQB..QO
42	CN HOUSING STARTS: ALL AREAS − SASKATCHEWAN (SA, AR) VOLA	$\ln$	CNHBSA..QO
43	CN HOUSING STARTS: ALL AREAS − NEW BRUNSWICK (SA, AR) VOLA	$\ln$	CNHBNB..QO
44	CN HOUSING STARTS: ALL AREAS − NEWFOUNDLAND (SA, AR) VOLA	$\ln$	CNHBNF..QO
45	CN HOUSING INDEX NADJ	Δ	CN100043
	Orders		
46	CN NEW ORDERS: DURABLE GOODS (SA) CONA	$\Delta\ln$	CN100046
	Equities		
47	US STANDARD & POOR'S INDEX OF 500 COMMON STOCKS(MONTHLY AVE)	$\Delta\ln$	US500STK
48	CN TORONTO STOCK EXCH. '300' SHARE PRICE INDEX (END MONTH)	$\Delta\ln$	CNB4237
49	CN VALUE OF EQUITIES TRADED:TORONTO STOCK EXCHANGE CURN	$\Delta\ln$	CND4560
50	US DOW JONES INDUSTRIALS SHARE PRICE INDEX (EP)	$\Delta\ln$	USSHRPRCF
51	US STANDARD AND POORS' COMPOSITE INDEX (EP)	$\Delta\ln$	USS&PCOM
	Exchange rates		
52	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR (MONTHLY AVERAGE)	Δ	CNB3400
53	CN CANADIAN DOLLARS TO 1 U.S. DOLLAR REAL (MONTHLY AVERAGE)	Δ	USCP..F
54	CN CANADIAN DOLLARS TO 1 FRENCH FRANC (MONTHLY AVERAGE)	Δ	CNB3404
55	CN CANADIAN DOLLARS TO 1 FRENCH FRANC REAL (MONTHLY AVERAGE)	Δ	FRI64...F
56	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK (MONTHLY AVERAGE)	Δ	CNB3405

57	CN CANADIAN DOLLARS TO 1 DEUTCHEMARK REAL (MONTHLY AVERAGE)	Δ	BDCP..F
58	CN CANADIAN DOLLARS TO 1 JAPANESE YEN (MONTHLY AVERAGE)	Δ	CNB3407
59	CN CANADIAN DOLLARS TO 1 JAPANESE YEN REAL (MONTHLY AVERAGE)	Δ	JPCNPRICF
60	CN CANADIAN DOLLARS TO 1 STERLING POUND (MONTHLY AVERAGE)	Δ	CNB3412
61	CN CANADIAN DOLLARS TO 1 STERLING POUND REAL (MONTHLY AVERAGE)	Δ	UKRP....F
	Interest rates		
62	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER (MONTHLY AVE)	Δ	CNB14001
63	CN INTEREST RATES:3 MONTH TREASURY BILL TENDER REAL (MONTHLY AVE)	Δ	
64	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER (END MONTH)	Δ	CNB14008
65	CN INTEREST RATES:6 MONTH TREASURY BILL TENDER REAL (END MONTH)	Δ	
66	CN INTEREST RATES:1 MONTH PRIME CORPORATE PAPER (END MONTH)	Δ	CNB14039
67	CN CHARTERED BANK PRIME BUSINESS LOAN RATE	Δ	B14020*
68	GOVT. OF CANADA BOND YIELD AVERAGE − 1 TO 3 YEARS	Δ	B14009*
69	GOVT. OF CANADA BOND YIELD AVERAGE − 3 TO 5 YEARS	Δ	B14010*
70	GOVT. OF CANADA BOND YIELD AVERAGE − 5 TO 10 YEARS	Δ	B14011*
71	GOVT. OF CANADA BOND YIELD AVERAGE 10 YRS AND OVER	Δ	B14013*
72	CN SPREAD 3−MONTH/SHORT TERM RATES		
73	CN SPREAD 6−MONTH/SHORT TERM RATES		
74	CN SPREAD 1−3 Y/SHORT TERM RATES		
75	CN SPREAD 3−5 Y/SHORT TERM RATES		
76	CN SPREAD 5−10 Y/SHORT TERM RATES		
77	CN SPREAD 10+ Y/SHORT TERM RATES		
	Money		
78	CN MONETARY BASE (SA) CURA	Δln	CNB1646
79	CN CHARTERED BANKS: CN$ MAJOR ASSETS (SA) CURA	Δln	CNB1605
80	CN CHARTERED BANKS: CN$ ASSETS EXCLUDING LIQUID (SA) CURA	Δln	CNB1616
81	CN CHARTERED BANKS: CN$ PERSONAL LOANS (SA) CURA	Δln	CNB1622
82	CN CHARTERED BANKS: CN$ BUSINESS LOANS (SA) CURA	Δln	CNB1623
83	CN CHARTERED BANKS: CN$ PERSONAL SAVINGS DEPOSITS CURN	Δln	CNB451
	Prices		
84	CN CONSUMER PRICE INDEX NADJ	(r)Δln	CNCP....F
85	CN CPI: GOODS NADJ	(r)Δln	CN100270
86	CN CPI: SERVICES NADJ	(r)Δln	CN100274
87	CN CPI: DURABLE GOODS NADJ	(r)Δln	CN100271
88	CN CPI: NONDURABLE GOODS NADJ	(r)Δln	CN100273
89	CN INDUSTRIAL PRICE INDEX:ALL MANUFACTURING INDUSTRIES NADJ	(r)Δln	CNSELPRCF
	Investment		
90	CN BUSINESS GFCF: NON−RESIDENTIAL STRUCTURES	Δln	D15677*
91	CN BUSINESS GFCF: MACHINERY&EQUIPMENT	Δln	D15678*
92	CN BUSINESS GFCF: RESIDENTIAL STRUCTURES	Δln	D15675*
93	CN GOVERNEMENT GFCF	Δln	D15672*
	International output		
94	US INDUSTRIAL PRODUCTION VOLA	Δln	USIPTOT.G
95	US INDUSTRIAL PRODUCTION − DURABLE MANUFACTURING VOLA	Δln	USDURBLIG
96	US INDUSTRIAL PRODUCTION − NONDURABLE MANUFACTURING VOLA	Δln	USNONDBIG
97	US INDUSTRIAL PRODUCTION − CONSUMER GOODS VOLA	Δln	USCONSMIG
98	US INDUSTRIAL PRODUCTION − BUSINESS EQUIPMENT VOLA	Δln	USBUSEQIG
99	US INDUSTRIAL PRODUCTION − MANUFACTURING VOLA	Δln	USIPMAN.G
100	US INDUSTRIAL PRODUCTION − MINING VOLA	Δln	USMININGG
101	US PERSONAL INCOME (AR) CURA	Δln	USPERINCB
102	BD INDUSTRIAL PRODUCTION SADJ	Δln	BDI66..CE
103	BD MANUFACTURING PRODUCTION VOLA	Δln	BDMANPRDG
104	UK INDUSTRIAL PRODUCTION SADJ	Δln	UKI66..CE
105	FR INDUSTRIAL PRODUCTION SADJ	Δln	FRI66..CE
106	IT INDUSTRIAL PRODUCTION SADJ	Δln	ITI66..CE

107	JP INDUSTRIAL PRODUCTION SADJ	Δln	JPI66..CE
108	KO INDUSTRIAL PRODUCTION SADJ	Δln	KOI66..CE
	International exchange rates		
109	BD NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	BDI..AF.
110	UK US $ TO £1	Δ	UKXUS$..
111	FR NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	FRI..AF.
112	JP NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	JPI..AF.
113	KO NATIONAL CURRENCY UNIT TO US $ − EXCHANGE RATE (AVG)	Δ	KOI..AF.
	International interest rates		
114	US FEDERAL FUNDS RATE	Δ	USFEDFUN
115	US TREASURY BILL SECONDARY MKT RATE ON DISCOUNT BASIS−3 MONTH	Δ	USTRB3AV
116	US TREASURY BILL SECONDARY MKT RATE ON DISCOUNT BASIS−6 MONTH	Δ	USYTB6SM
117	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 1 YEAR	Δ	USTRCN1.
118	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 5 YEAR	Δ	USTRCN5.
119	US TREASURY YIELD ADJUSTED TO CONSTANT MATURITY − 10 YEAR	Δ	USTRCN10
	International money		
120	US MONETARY BASE CURA	Δln	USM0....B
121	US MONEY STOCK − CURRENCY IN CIRCULATION CURA	Δln	USCURRNCB
122	US MONEY STOCK − DEMAND DEPOSITS CURA	Δln	USDEMDEPB
123	US MONEY STOCK − OTHER CHECKABLE DEPOSITS CURA	Δln	USOTHCHKB
	International prices		
124	US CPI, ALL URBAN: ALL ITEMS SADJ	(r)Δln	USCP....E
125	US CPI: DURABLES SADJ	(r)Δln	USCPD...E
126	US CPI: NONDURABLES SADJ	(r)Δln	USCPN...E
127	US CPI: SERVICES SADJ	(r)Δln	USCPSERVE
128	US CPI: COMMODITIES SADJ	(r)Δln	USCPCOMME
129	BD CPI NADJ	(r)Δln	BDCP....F
130	UK PRODUCER PRICE INDEX NADJ	(r)Δln	UKI63...F
131	FR CPI NADJ	(r)Δln	FRI64...F
132	JP CPI NADJ	(r)Δln	JPI64...F
133	KO PRODUCER PRICE INDEX NADJ	(r)Δln	KOI63...F

Transformations

(r)Δln	rolling 1 year (12 month/4 quarter) difference of logarithm
Δln	first difference of logarithms
ln	logarithm
Δ	first difference

Datastream codes

9th letter of code		abbreviation
A	current prices, not seasonally adjusted	CURN
B	current prices, seasonally adjusted	CURA
C	constant prices, not seasonally adjusted	CONN
D	constant prices, seasonally adjusted	CONA
E	price index, seasonally adjusted	SADJ
F	price index, not seasonally adjusted	NADJ
G	volume index, seasonally adjusted	VOLA
H	volume index, not seasonally adjusted	VOLN
O	volume, seasonally adjusted	SADJ
P	volume, not seasonally adjusted	NADJ
Q	seasonally adjusted	SADJ
R	not seasonally adjusted	NADJ

Country codes

BD	Germany
CN	Canada
FR	France
IT	Italy
JP	Japan
KO	South Korea
UK	United Kingdom
US	United States

Figure 1a:
D–K Predictability, 1–month inflation

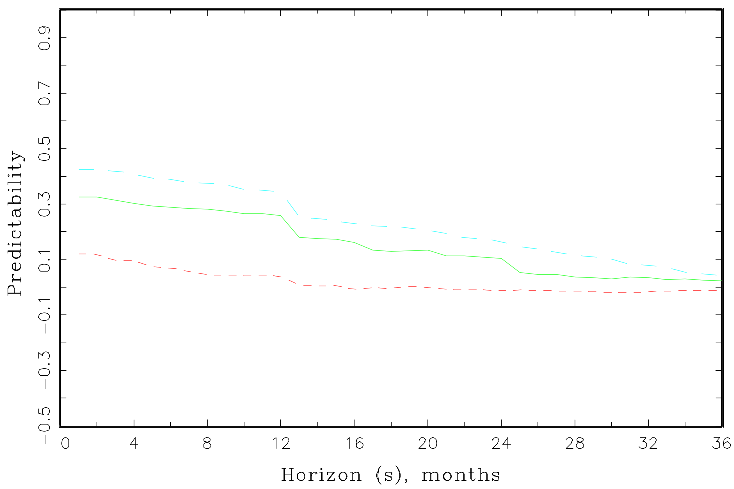


Figure 1b:
Forecast content, 1–month inflation

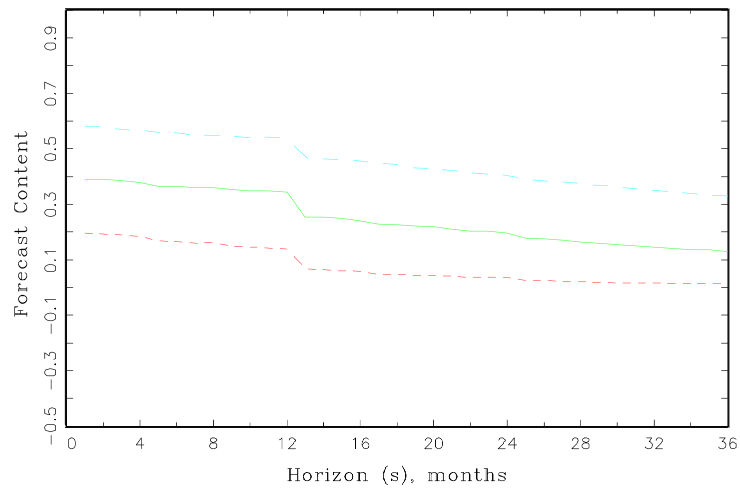


Figure 1c:
D–K Predictability, 12–month inflation

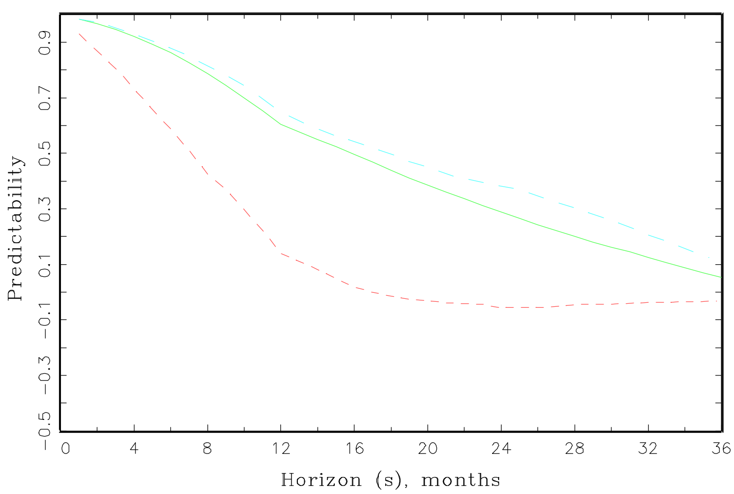


Figure 1d:
Forecast content, 12–month inflation

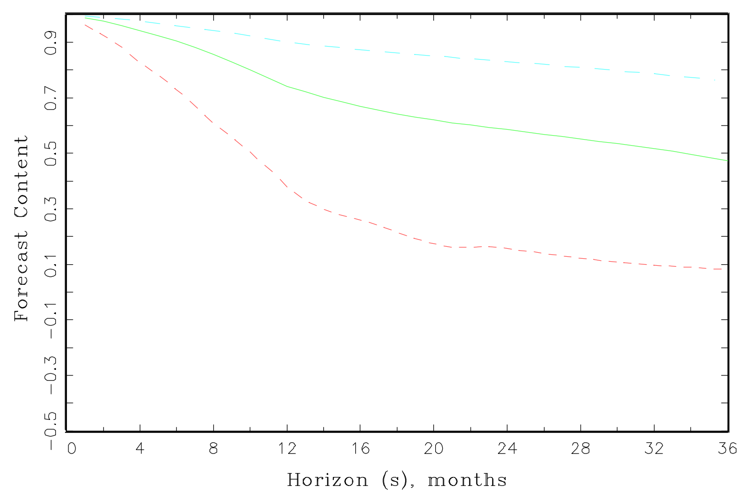


Figure 2a:
D-K Predictability, 1-quarter real GDP growth

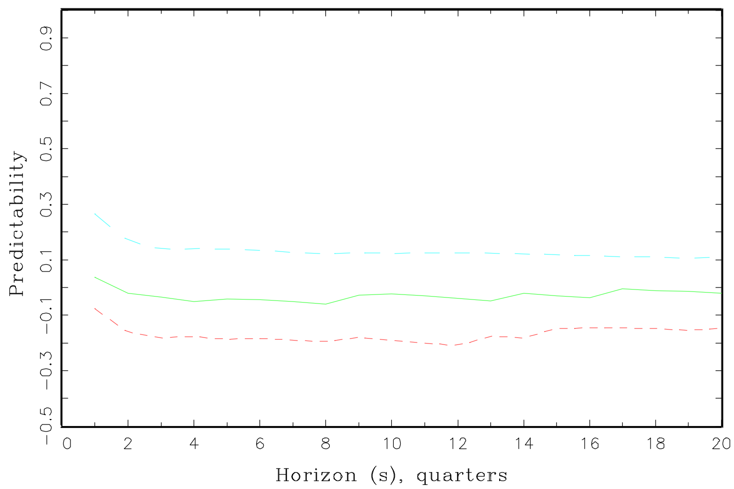


Figure 2b:
Forecast content, 1-quarter real GDP growth

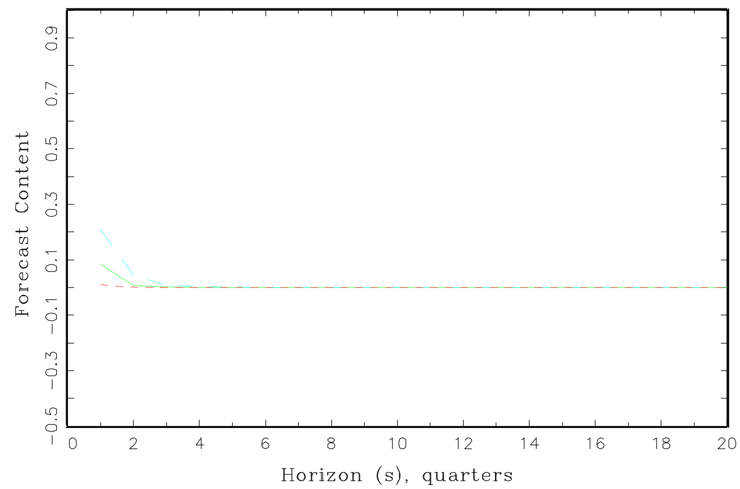


Figure 2c:
D-K Predictability, 4-quarter real GDP growth

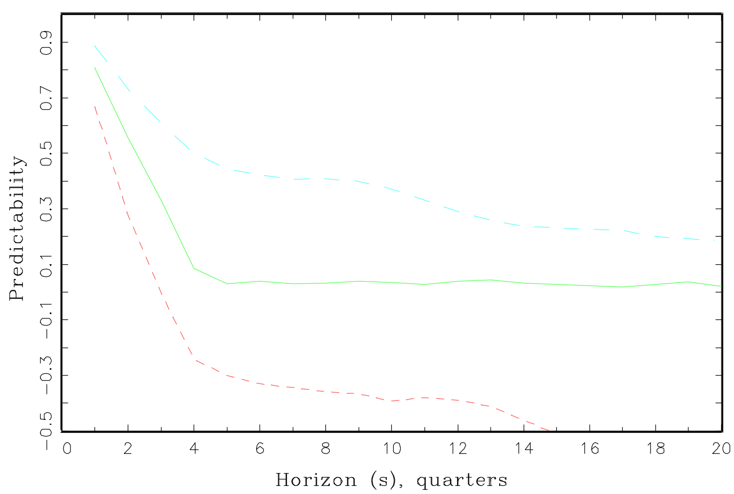


Figure 2d:
Forecast content, 4-quarter real GDP growth

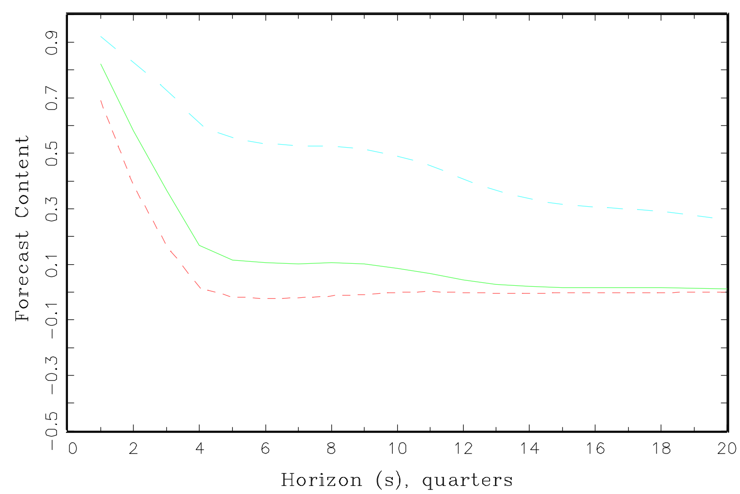


Figure 3a:
D−K Predictability, 1−quarter real investment growth

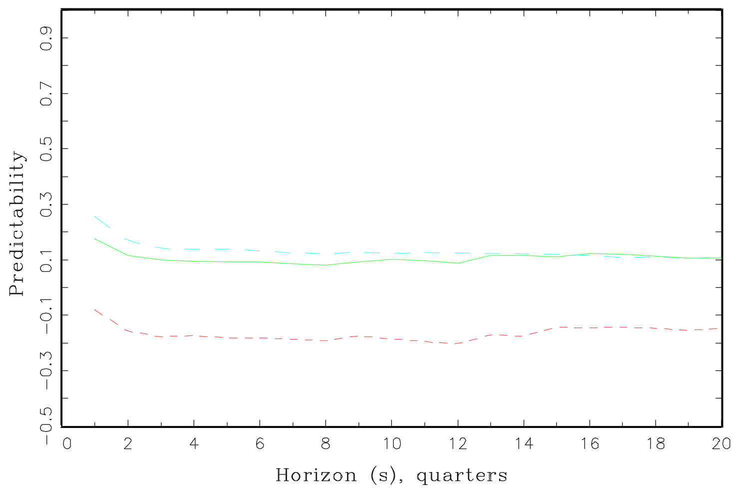


Figure 3b:
Forecast content, 1−quarter real investment growth

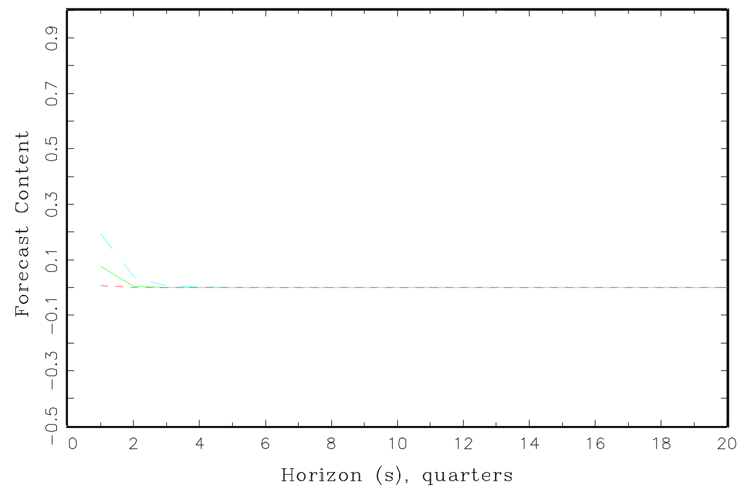


Figure 3c:
D−K Predictability, 4−quarter real investment growth

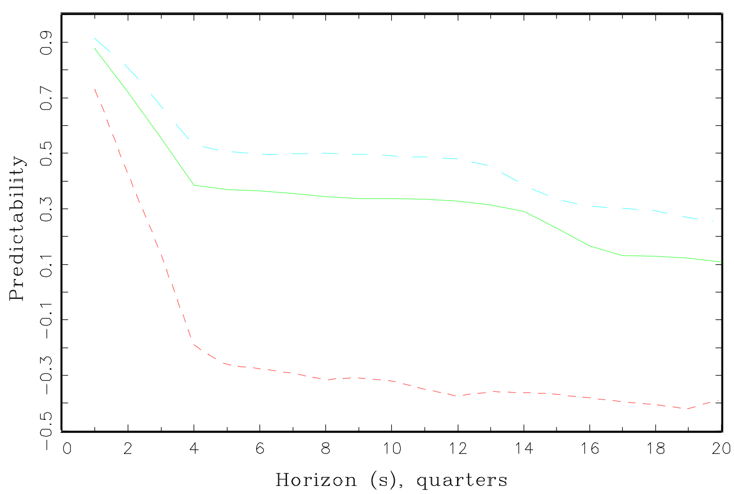


Figure 3d:
Forecast content, 4−quarter real investment growth

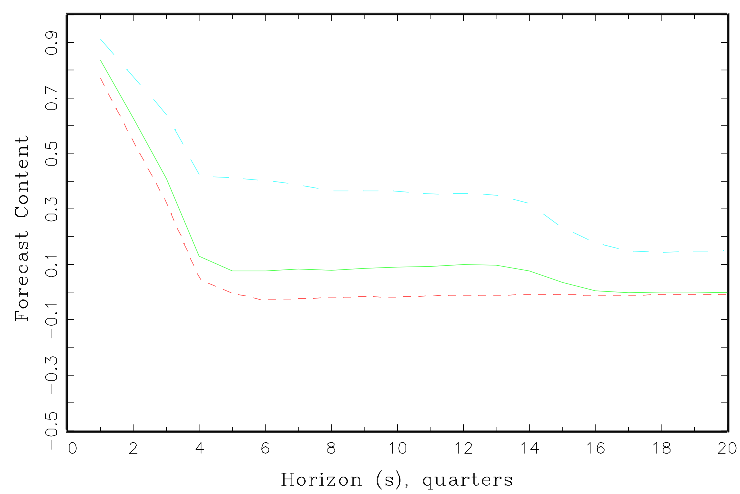


Figure 4a:
Inflation forecasts, no AR components
RMSE by number of factors: static model

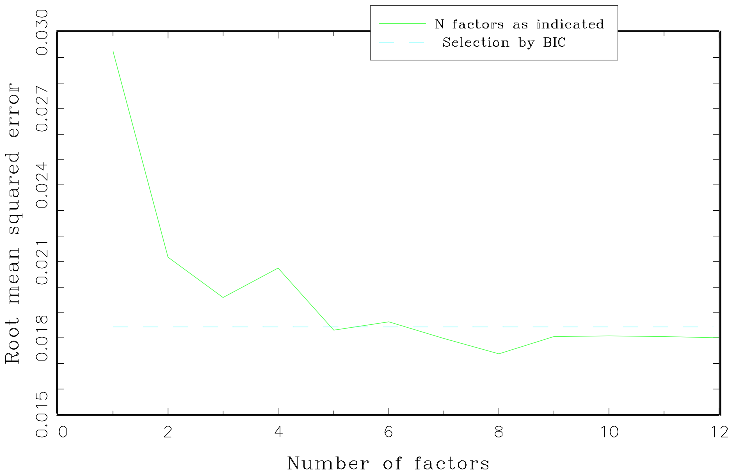


Figure 4b:
Inflation forecasts, no AR components
RMSE by number of factors: dynamic model

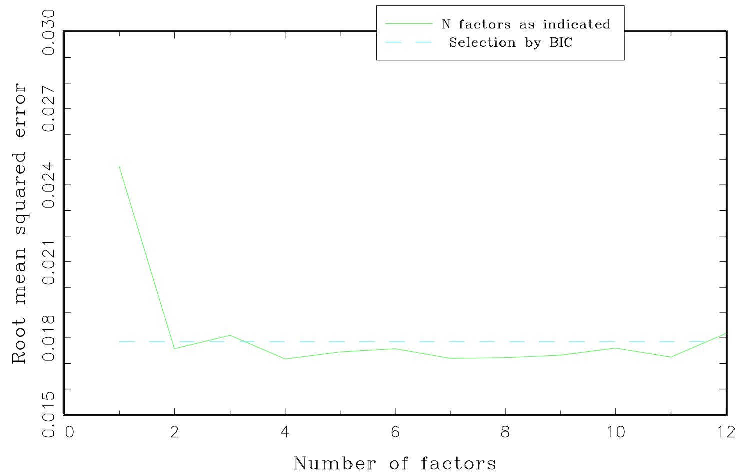


Figure 4c:
Inflation forecasts, AR order selected by BIC
RMSE by number of factors: static model

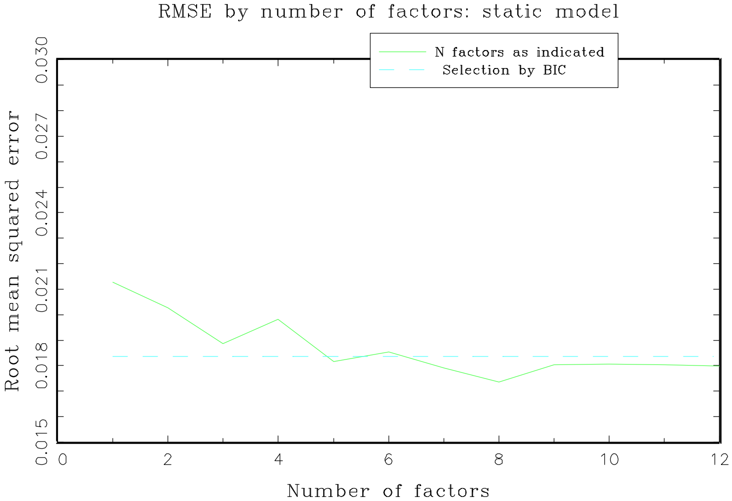


Figure 4d:
Inflation forecasts, AR order selected by BIC
RMSE by number of factors: dynamic model

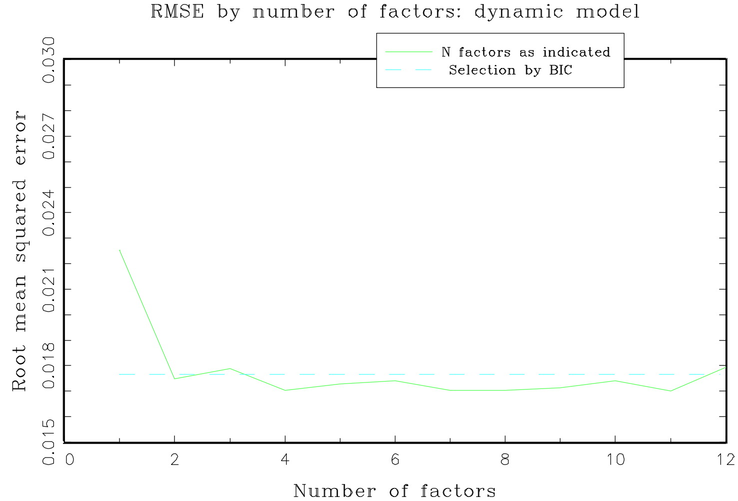


Figure 5a:
Real GDP growth forecasts, no AR components
RMSE by number of factors: static model

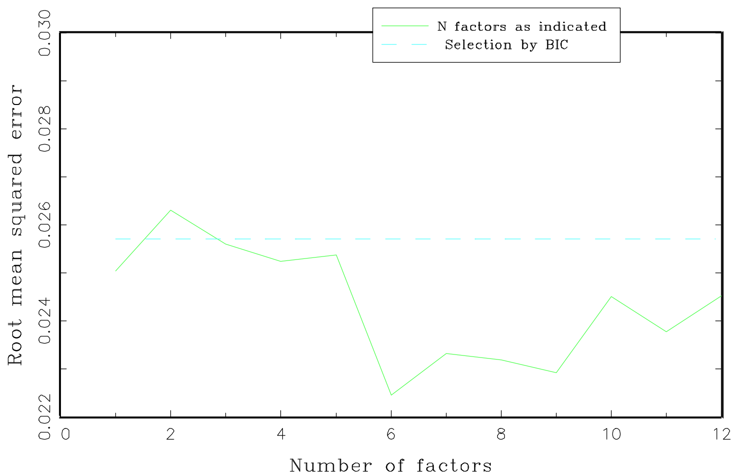


Figure 5b:
Real GDP growth forecasts, no AR components
RMSE by number of factors: dynamic model

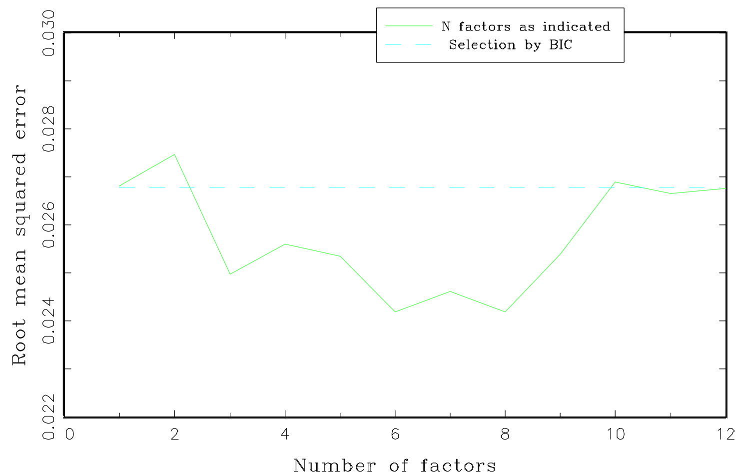


Figure 5c:
Real GDP growth forecasts, AR order selected by BIC
RMSE by number of factors: static model

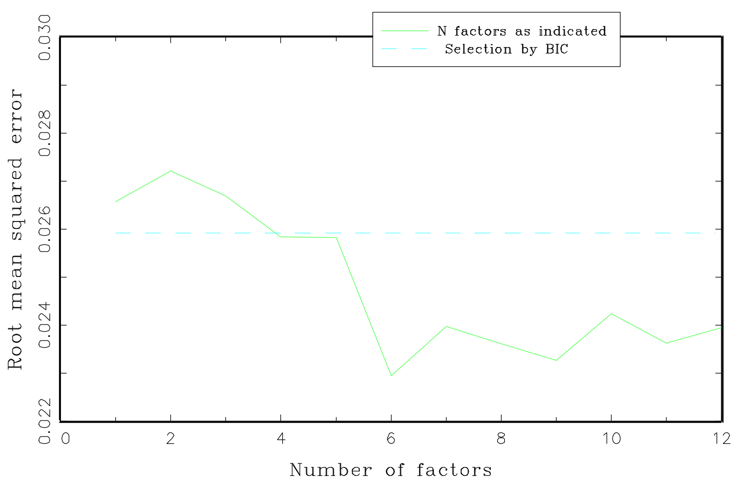


Figure 5d:
Real GDP growth forecasts, AR order selected by BIC
RMSE by number of factors: dynamic model

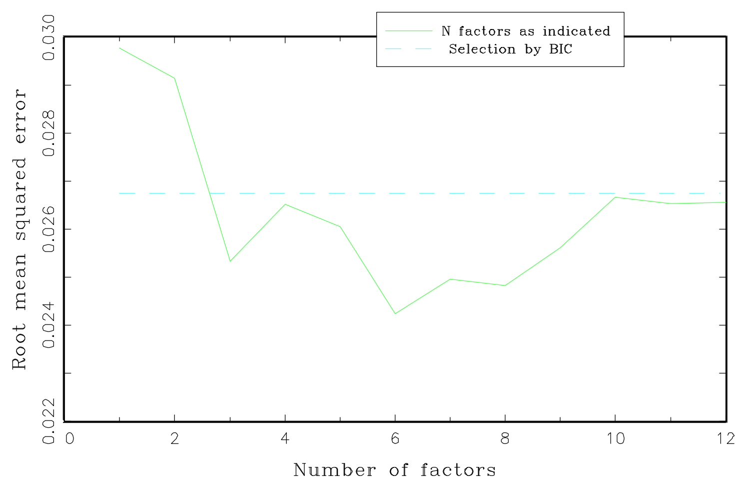


Figure 6a:
Real investment growth forecasts, no AR components
RMSE by number of factors: static model

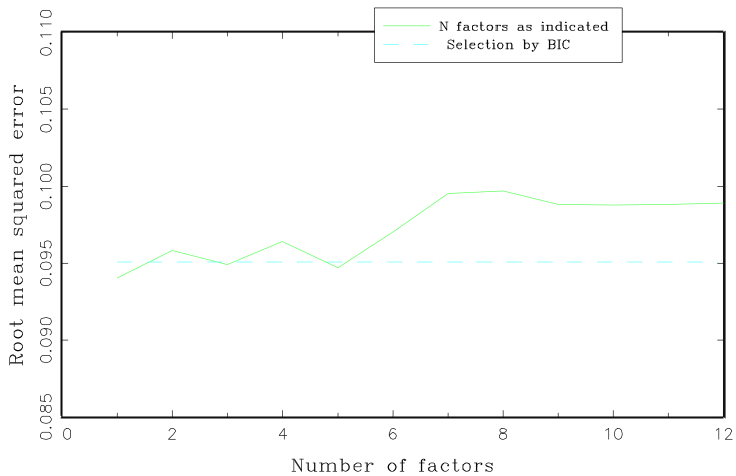


Figure 6b:
Real investment growth forecasts, no AR components
RMSE by number of factors: dynamic model

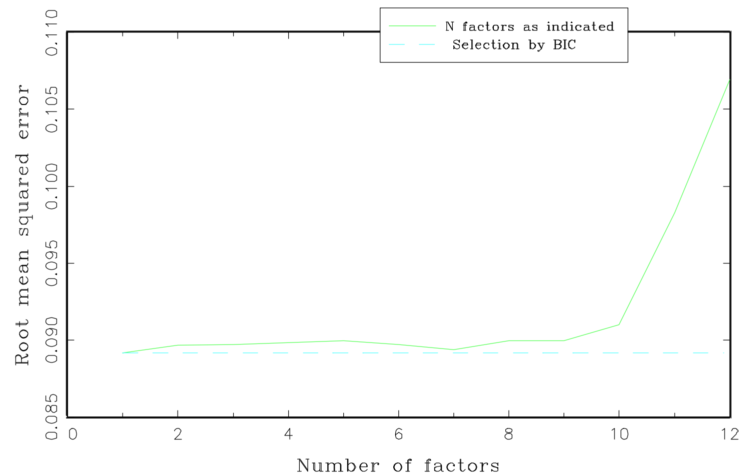


Figure 6c:
Real investment growth forecasts, AR order selected by BIC
RMSE by number of factors: static model

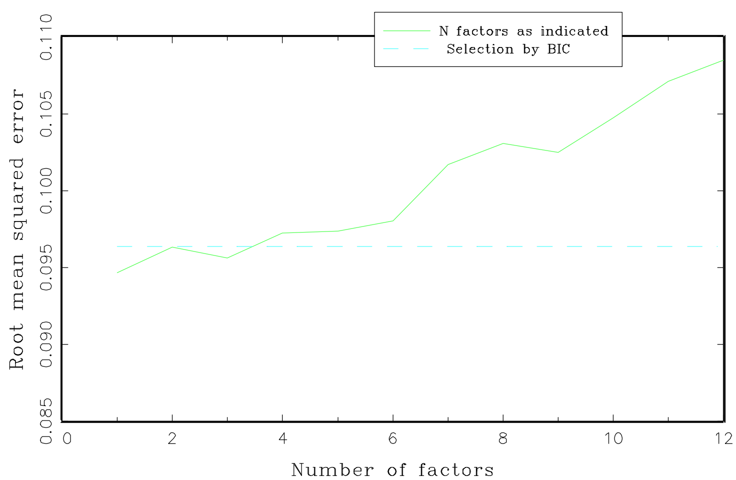
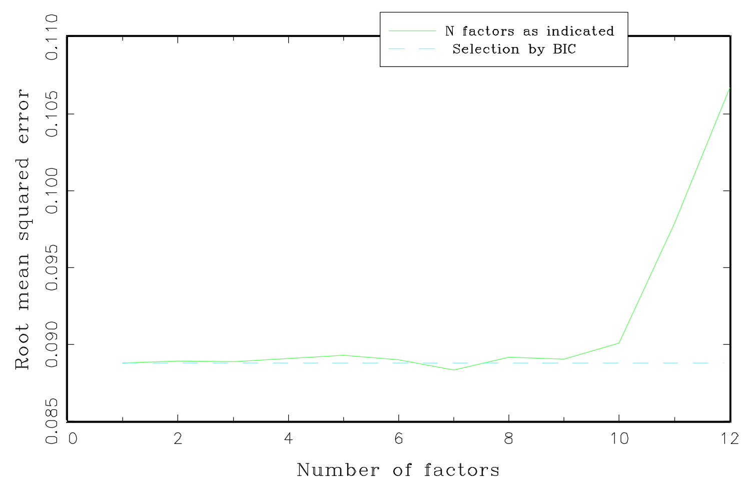


Figure 6d:
Real investment growth forecasts, AR order selected by BIC
RMSE by number of factors: dynamic model



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