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In 2005 all ECB publications will feature a motif taken from the €50 banknote.

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CONTENTS

Abstract

The accession of ten countries into the European Union makes the forecasting of their key macroeconomic indicators an exercise of some importance. Because of the transition period, only short spans of reliable time series are available, suggesting the adoption of simple time series models as forecasting tools. However, despite this constraint on the span of data, a large number of macroeconomic variables (for a given time span) are available, making the class of dynamic factor models a reasonable alternative forecasting tool. The relative performance of these two forecasting approaches is compared by using data for five new Member States. The role of Euro-area information for forecasting and the usefulness of robustifying techniques such as intercept corrections are also evaluated. We find that factor models work well in general, although with marked differences across countries. Robustifying techniques are useful in a few cases, while Euro-area information is virtually irrelevant.

JEL Classification: C53, C32, E37

Keywords: Factor models, forecasts, time series models, new Member States

Non-technical Summary

The accession of ten countries into the European Union in May 2004 has made the forecasting of their key macroeconomic indicators, such as measures of output growth, inflation and interest rates, an exercise of some importance. The time span of reliable data available for this purpose is small, given the transition period. This suggests the adoption of simple time series models as forecasting tools, because of their relatively simple and concise structure and overall good performance. In recent years, a set of competitor methods has been developed which exploits the fact that although the time span of the data may be relatively short, a large number of macroeconomic variables (for a given time span) are available which are of potential use in forecasting. These methods, collectively known as dynamic factor models, use information from this large set of variables to extract the common trends underlying the evolution of the macro-economy and provide an intuitive and technically reasonable and robust alternative forecasting tool.

Forecasts of key macroeconomic variables may be significantly improved using factor models because of the large amount of information that such models are able summarise. It is well known that in rapidly changing environments (subject to irregular shocks), for example in the economies of the new Member States, the ranking of particular variables as good leading indicators or forecasting devices for, say, inflation or GDP growth, is not at all clear *a priori*. Therefore, factor models provide a methodology that allows us to remain 'agnostic' about the structure of the economy, by employing as much information as possible in the forecasting exercise. This methodology also permits the incorporation of data at different vintages, at different frequencies and different time spans, thereby providing a clearly specified and statistically rigorous but economical framework for the use of multiple data sets.

Our paper is aimed at comparing the relative performance of these two forecasting approaches within the empirically relevant framework of data from five new Member States, namely the Czech Republic, Hungary, Poland, Slovakia and Slovenia. We begin by evaluating the important features of simple time series models and factor models, and describe the competing models which are in fact variations of simpler autoregressive and factor models respectively. We also propose a criterion for evaluating the competing forecasting models, based on the computation of the average sum of squared deviations of the forecasts of the variables of interest (at a particular time horizon) from its actual realization

and comparing this quantity with the corresponding quantity derived from a benchmark model such as simple autoregression.

We continue by describing the data sets for the five new Member States. The country-specific data are collected from OECD Main Economic Indicators, OECD Quarterly National Accounts, and IMF Financial Statistics. We use data at a quarterly frequency because there are very few economic series available at a monthly frequency. The sample for estimation is set to 1994:1 – 2002:2 for all countries. We also use the data for the Area-Wide Model of the Euro area to evaluate the usefulness of Euro-area information in forecasting macroeconomic variables for the new Member States. We finally proceed to the estimation and presentation of the results of the forecasting exercise for the several forecasting approaches described previously.

Although there remain marked differences across countries, we find it appropriate to conclude that the results are supportive of a careful use of factor models for forecasting macroeconomic variables for the new Member States, and more generally in sample sizes and environments akin to those prevailing in these countries. Interesting directions for future research are related to the collection of better data sets, with longer, cleaner and higher frequency time series. Detailed simulation studies to investigate the efficacy of factor methods in panels of data with short time span and but with a relatively large number of variables for this given span could also be undertaken. To our knowledge this paper marks the first time that such methods have been used to model and forecast data in such a context.

1. Introduction

The accession of ten countries into the European Union makes the forecasting of their key macroeconomic indicators such as GDP growth, inflation and interest rates an exercise of some importance. Because of the transition period, only short spans (denoted *T*) of reliable time series are available for each of these countries. This suggests the adoption of simple time series models as forecasting tools, because of their parsimonious specification and good performance (based on results available from studies for other countries).

However, despite the constraints on the time span of data, a large number of macroeconomic series of potential use in forecasting (for a given time span) are available for each country. This makes the recently proposed dynamic factor models a viable and alternative forecasting tool, where the limitations on estimation and forecasting implied by the short length of time series are compensated by extending the longitudinal dimensional (denoted *N*) of the data.

Dynamic factor-models have been successfully applied in a number of papers to forecasting macroeconomic variables for the US and Euro area, including Stock and Watson (1999, 2002a, 2002b) and Marcellino, Stock and Watson (2001, 2003)). Earlier applications of factor models include Geweke (1977), Sargent and Sims (1977), Engle and Watson (1981) and Stock and Watson (1991) who estimated small-*N* dynamic factor models in the time domain, where *N* denotes the number of variables in the data set on which information is available.

The primary justification for the use of factor models in large data sets (where *N* may exceed *T*) is their usefulness as a particularly efficient means of extracting information from a large number of data series, albeit of a short time span. Forecasts of key macroeconomic variables may be significantly improved, not least because in a rapidly changing economy (subject to irregular shocks), especially in the economies of the new Member States, the ranking of variables as good leading indicators or forecasting devices for, say, inflation or GDP growth, is not at all clear *a priori*. Therefore, as described by Bernanke and Boivin (2003), factor models provide a methodology that allows us to remain 'agnostic' about the structure of the economy, by employing as much information as possible in the construction of the forecasting exercise.

This methodology also permits the incorporation of data at different vintages, at different frequencies and different time spans, thereby providing a clearly specified and statistically rigorous but economical framework for the use of multiple data sets.

Our paper is a comparison of the relative performance of the two dominant forecasting approaches (time series models and dynamic factor models), within the empirically relevant framework of data from five new Member States. We start by discussing briefly the key aspects of the competing approaches in Section 2. In this section we also describe the forecasting models and the criteria for forecast comparison. Section 3 describes the data for five of the new Member States, namely the Czech Republic, Hungary, Poland, Slovakia and Slovenia. Section 4 contains the results of the estimation and forecasting exercise using the data sets from the five countries and Euro-area data compiled by Fagan, Henry and Mestre (2001). In this section, we evaluate and report on the relative performance of the competing methods, the role of Euro-area information for forecasting, and the usefulness of robustifying techniques such as intercept corrections and second differencing. Section 5 concludes the paper, and emphasizes the uniqueness and importance of the issues discussed. To our knowledge this paper marks the first time that such methods have been used to model and forecast data from new Member States.

A series of three appendices, following the bibliography, document the details of the work reported in the text of the paper. Appendices A and B respectively provide the tables and figures that form the basis of the discussion in Section 4 while Appendix C describes the data.

2. Methodology

In this section we briefly review the competing forecasting approaches we consider, and the criteria we use to evaluate their relative merits, see *e.g.* Marcellino, Stock and Watson (2003) or Artis, Banerjee and Marcellino (2003) for additional details.

All forecasting models are specified and estimated as a linear projection of an h-step-ahead variable, y^h_{t+h}, onto t-dated predictors, which at a minimum include lagged transformed values (denoted y_t) of x_t, the series of interest. More precisely, the forecasting models all have the form,

$$y^h_{t+h} = \mu + \alpha(L) y_t + \beta(L)' Z_t + \varepsilon^h_{t+h} \qquad (1)$$

where $\alpha(L)$ is a scalar lag polynomial, $\beta(L)$ is a vector lag polynomial, μ is a constant, and Z_t is a vector of predictor variables. Due to the short sample available, the forecast horizon for all the reported empirical results in Section 4 below is one quarter, so that h = 1 in (1).

The construction of y_{t+h}^h depends on whether the series is modelled as I(0), I(1) or I(2), where series integrated of order *d*, denoted I(*d*), are those for which the *d-th* difference (Δ^d) is stationary. Indicating by *x* the series of interest (usually in logarithms), in the I(0) case, $y_{t+h}^h = x_{t+h}$ and $y_t = x_t$. In the I(1) case, $y_{t+h}^h = \sum_{t+1}^{t+h} \Delta x_s$ so that $y_{t+h}^h = x_{t+h} - x_t$, while $y_t = x_t - x_{t-1}$. In words, the forecasts are for the growth in the series *x* between time period *t* and *t*+*h*. Finally, in the I(2) case, $y_{t+h}^h = \sum_{t+1}^{t+h} \Delta x_s - h\Delta x_t$ or $y_{t+h}^h = x_{t+h} - x_t - h\Delta x_t$, *i.e.*, the difference of *x* between time periods *t* and *t*+*h* and *h* times its growth between periods *t-1* and *t*, and $y_t = \Delta^2 x_t$. This is a convenient formulation because, given that x_t and its lags are known when forecasting, the unknown component of y_{t+h}^h conditional on the available information is equal to x_{t+h} independently of the choice of the order of integration. This makes the mean square forecast error (MSE) from models for second-differenced variables directly comparable with, for example, that from models for first differences only. The MSE is computed as the average of the sum of squares of all the comparisons between the actual value of the variable and its forecast (under any of the methods given in Section 2.1 below).

2.1 Forecasting models

The various forecasting models we compare differ in their choice of Z_t in equation (1). Let us list the forecasting models and briefly discuss their main characteristics.

Autoregressive forecast (ar_bic). Our benchmark forecast is a univariate autoregressive (AR) forecast based on (1) excluding Z_t. In common with the literature, we choose the lag length using an information criterion, the BIC, starting with a maximum of 6 lags.

Autoregressive forecast with second differencing (ar_bic_i2). Clements and Hendry (1999) showed that second differencing the variable of interest improves the forecasting performance of autoregressive models in the presence of structural breaks. This is an interesting option to be considered in the case of most of the new Member States, which have undergone several economic and institutional changes even after the fairly rapid transition to a market economy. This model corresponds to (1), excluding Z_t and treating the variable of interest as I(2).

Autoregressive forecast with intercept correction (ar_bic_ic). An alternative remedy in the presence of structural breaks over the forecasting period is to put the forecast back on track by adding past forecast errors to the forecast *e.g.* Clements and Hendry (1999) and Artis and Marcellino (2001). They showed the usefulness of the simple addition of the *h*-step ahead forecast error. Hence, the forecast is given by $\hat{y}^h_{t+h} + \varepsilon^h_t$, where $\hat{y}^h_{t+h}$ is the ar_bic forecast and ε^h_t is the forecast error made when forecasting y_t in period *t-h*. Since both second differencing and intercept correction increase the MSE when not needed, by adding a moving average component to the forecast error, they are not costless and should only be used if needed.

Autoregressive forecast with exogenous regressors (ar_ctr). We consider also AR models to which exogenous regressors are added in order to improve their predictive performance. For each of the variables we forecast, the exogenous regressor is its Euro-area counterpart. For example, when forecasting inflation we choose the Euro-area HICP inflation rate. The forecasts are produced with a model with a fixed lag structure (three endogenous and exogenous lags) (ar_ctrfix) and with BIC selected model (ar_ctr_bic). In addition, intercept corrected versions of both forecasts are computed (ar_ctr_bic_ic and ar_ctrfix_ic respectively).

VAR forecasts (varf). Vector autoregressive (VAR) forecasts are constructed using equation (1) with chosen regressors Z_t. In particular, in the empirical analysis in Section 4, Z_t includes lags of GDP growth, inflation, and a short-term interest rate. Intercept corrected versions of the forecasts are also computed (varf_ic).

Factor-based forecasts. These forecasts are based on setting Z_t in (1) to be the estimated factors from a dynamic factor model due to Stock and Watson (2002b), to which we refer for addition details. Under some technical assumptions (restrictions on moments and stationarity conditions), the column space spanned by the dynamic factors f_t can be estimated consistently by the principal components of the $T\times T$ covariance matrix of the X's. The factors can be considered as an exhaustive summary of the information contained in a large data set.

It is also worth mentioning that the principal component based factor estimate remains consistent even in the presence of limited time variation in the parameters of the underlying factor model. Such a property can be very convenient to analyze the new Member States, whose economies are under constant evolution.

We primarily consider three different factor-based forecasts. First, in addition to the current and lagged y_t up to 4 factors and 3 lags of each of these factors are included in the model (fdiarlag_bic). Second, up to 12 factors are included, but not their lags (fdiar_bic). Third, up to 12 factors appear as regressors in (1), but no current or lagged y_t is included (fdi_bic). For each of these three classes of factor-based forecasts the model selection is again based on BIC. The factors can be extracted either from the unbalanced panel of available time series (prefix fac) or from the balanced panel (prefix fbp) and we consider them both. The missing observations in the unbalanced panel can occur in any series, typically at the beginning of the sample because of non-uniform starting dates. However the algorithm is general enough to handle missing observations that occur in the middle or at the end. The unbalanced panel contains more variables than the balanced, and therefore more information. The drawback is that the estimation of missing observations may introduce noise in the computation of the factors.

In order to evaluate the forecasting role of each factor, for the unbalanced panel, we also consider forecasts using a fixed number of factors, starting with factor 1 and adding up to three other factors (fdiar_01 to fdiar_04 and fdi_01 to fdi_04 respectively). For each of the 14 factor-based forecasts, we also consider the intercept corrected version (prefix ic).

Finally, to characterise the overall performance of factor models we also construct the pooled factor forecasts, denoted fac_pooled, by taking a simple average of all the factor-based forecasts. These pooled forecasts are then compared to the actual values of the series in the same way as for any other forecasting model. It is worth noting that the pooled factor forecasts have particular informative value. Since we consider many different versions of factor models it should not be surprising to find at least one model that forecasts better than simple linear models. The average performance of factor models in this respect tells us whether factor models are in general a better forecasting device or if their relative good performance is limited only to some special sub-models.

We consider factors extracted from country-specific data sets and from the Euro-area data set (see Section 3 for a description of the variables included in each data set). Thus, in addition to considering only country-specific information we also construct factor-based forecasts from the updated data set used in the ECB's Euro Area Wide Model (Henry, Fagan and Mestre, 2001).

Euro-area information is used in three ways. First, Euro-area variables are used as exogenous regressors in the AR forecasts (ar_ctr models). Second, in the factor models, the forecast for each country is constructed using Euro factors only, in the same way as described above for the country-specific factors. Finally, Euro factors are combined with country-specific factors. Up to six of each of these is considered in the factor models without lags. In the models with lags we include up to three factors of both types with a maximum of two lags. Variable selection in the models, both with and without lags, is by the BIC criterion. Additionally, in order to obtain comparable results for the unbalanced panel with a fixed number of factors, we add up to four Euro factors to four country-specific factors (eu2_fac_fdiar_05 to eu2_fac_fdiar_08 and eu2_fac_fdi_05 to eu2_fac_fdi_08). We also consider their intercept corrected versions (prefix ic).

2.2 Forecast Comparison

The forecast comparison is conducted in a simulated out-of-sample framework where all statistical calculations are done using a fully recursive methodology. The models are first estimated on data from 1994:1 to 2000:2 and 1-step-ahead forecasts are then computed. The estimation sample is then augmented by one quarter and the corresponding 1-step-ahead forecast is computed. The forecast period is 2000:3 - 2002:2, for a total of 8 quarters, and the final estimation sample for 1-quarter-ahead forecasts is therefore 1994:1-2002:1. Every quarter, (*i.e.* for every augmentation of the sample) all model estimation, standardisation of the data, calculation of the estimated factors, etc., is repeated.

The forecasting performance of the various methods described is examined by comparing their simulated out-of-sample MSE relative to the benchmark autoregressive (AR) forecast (ar_bic). West (1996) standard errors are computed around the relative MSE in the empirical analysis of Section 4 although they should be interpreted with care and are quite large due to the short evaluation period.

We also consider pooling regressions where the actual values are regressed on the benchmark forecast and, in turn, on each of the competing forecasts. We report the coefficient of the latter, with robust standard errors. This coefficient should be equal to one for the benchmark forecast to be redundant, assuming that the two coefficients have to sum to one. Such a condition is also sufficient for the alternative forecast to MSE-encompass the benchmark forecast, under the additional hypothesis of unbiasedness of the former (see Marcellino, 2000).

3. The data

In the empirical application we consider five new Member States: the Czech Republic, Hungary, Poland, Slovakia and Slovenia. The three Baltic countries (and Cyprus and Malta) have been omitted at this stage due to data availability issues. The data are collected from OECD Main Economic Indicators, OECD Quarterly National Accounts, and IMF Financial

Statistics. We use data at a quarterly frequency because there are very few economic series available at a monthly frequency. Although for some countries many series are available from the beginning of 1992 the sample for estimation is set to 1994:1 – 2002:2 for all countries. The reason for this is direct comparability of results and the availability of a vast majority of series for all countries. National Accounts data for Poland and Hungary start only in 1995, but these missing observations are interpolated using the EM algorithm.

Altogether we have collected a panel with 52 series for the Czech Republic, 60 for Hungary, 56 for Poland, 47 for Slovakia and 38 for Slovenia. The data sets broadly contain output variables (GDP components, industrial production and sales); labour market variables (employment, unemployment, wages); prices (consumer, producer); monetary aggregates; interest rates (different maturities, lending and deposit rates); stock prices; exchange rates (effective and bilateral); imports, exports and net trade; survey data; and other miscellaneous series. A complete list of the variables is reported in Appendix C, which contains also a detailed list of Euro variables from the ECB's Euro Area Wide model that was used to extract Euro factors.

Following Marcellino, Stock and Watson (2003), the data are pre-processed in three stages before being modelled with a factor representation. First, we pass all the series through a seasonal adjustment procedure as very few series are originally reported as seasonally adjusted. Seasonal adjustment is performed with the original X-11 ARIMA procedure. Second, the series are transformed to account for stochastic or deterministic trends, and logarithms are taken of all nonnegative series that are not already in rates or percentage units.[1] We apply the same transformations to all variables of the same type. The main choice is whether prices and nominal variables are I(1) or I(2). The I(1) case is our baseline model and all the results reported in Section 4 apply to this choice. We have also recomputed all the results treating prices, wages, monetary aggregates and nominal exchange rates as I(2) variables. These results are briefly discussed in Section 4.7.[2] Variables describing real economic activity are treated as I(1), whereas survey data are treated as I(0). All series were further standardised to have sample mean zero and unit sample variance.

Finally, the transformed seasonally adjusted series are screened for large outliers (outliers exceeding six times the interquartile range). Each outlying observation is recoded as

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1 Both seasonal adjustment and the data transformations are undertaken once for all the data series for the whole sample length (and not in real time). This is because the short time-span of the samples makes recursive real-time adjustments unreliable.

2 Full details are available from us upon request.

missing data, and the EM algorithm is used to estimate the factor model for the resulting unbalanced panel.

Among the available variables, we have chosen to report forecasting results for GDP growth, inflation and the short-term interest rate (given by the Treasury bill rate where available, otherwise the lending rate). These are also the variables of central importance for policymakers. Note, however, that the generality of the approach would easily allow us to extend the analysis to other variables of interest.

4. Forecasting Results

Using the data sets described in Section 3, we next conduct a forecast-comparison exercise. We include in the comparison all the models described in Section 2. First we present and discuss the results for each country, using country specific information only including factors computed from the country specific data sets (panels a of Tables 1 to 5). We then evaluate the role of Euro-area information by either incorporating control variables as described in Section 2 or by using Euro-area factors (panels b of Tables 1 to 5).

Finally, we summarize the results when nominal variables are treated as I(2).

4.1 The Czech Republic

The MSE of the competing methods relative to the benchmark AR model are reported in Table 1a for the Czech Republic. Four general comments can be made.

First, the factor models often outperform the other methods. The largest gain (67%) with respect to the benchmark AR model is for the interest rate variable (rtb3m). The corresponding number is slightly lower, although still impressive, for inflation (59%) and GDP growth (42%) for the best factor models for these variables. The poor performance of the pooled factor model is however surprising.

Second, using a fixed number of factors is often equivalent or better than BIC selection, and including an AR component in the forecasting model is usually beneficial.

Third, there is no clear cut ranking of the factors extracted from the unbalanced panel and the balanced panel. The former perform better for inflation, the latter for the interest rate, with comparable values for GDP growth. Though the additional information in the unbalanced panel can be useful for forecasting, when there are several missing observations the quality of the estimators based on interpolated data quickly deteriorates and this also has a negative impact on the factor estimators (see Angelini, Henry and Marcellino (2003) for details).

Fourth, to discuss the efficacy of methods to deal with structural breaks, we note that intercept correction is either helpful or not harmful when applied to the benchmark AR forecasts. It increases the MSE of the VAR forecasts for all the three variables under analysis, while mixed results are obtained for the factor forecasts. Second differencing improves significantly the forecasting precision for GDP growth and inflation, while it leaves the results for the interest rate unaffected.

In more detail, for GDP growth the best model is fac_fdiar_02, with a relative MSE of 0.58. For inflation, the best model is fac_fdiarlag_bic with a relative MSE of 0.41. It is worth observing that this is the most general forecasting model, where the lag length of the autoregressive component and the choice of the number of factors and their lags are determined by the BIC criterion. For the interest rate, fac_fdi_04 is the best, namely a model with the first four estimated factors from the unbalanced panel as regressors. Any lags of the dependent variable included as regressors are eliminated by the BIC criterion as shown by the equality of the relative MSE between fac_fdi_04 and fac_fdiar_04. It yields a relative MSE of 0.33 (the second best is the same model with intercept correction, with a relative MSE of 0.60). There are several other factor models that perform well for all the three variables and systematically beat the AR.

Finally, when the forecasts from the best models are inserted in a pooling regression with the benchmark AR, their coefficients are not statistically different from one. As a consequence, there would be no significant gains from forecast pooling, which provides additional support for the best models. However, both the standard errors around the estimated coefficient in the pooling regressions and the West (1996) standard errors around the relative MSE are rather large, which suggests that the rankings reported above should be interpreted with care because most forecasting models are not statistically different from each other.

4.2 Hungary

The results for Hungary are reported in Table 2a. The factor forecasts are not as good as for the Czech Republic. In particular, there are gains for GDP growth and, in a few cases, for the interest rate, but the AR forecast is the best for inflation. The gains for GDP growth are marginally higher than for the Czech Republic - about 47% for the best model. This may be mostly due to the substantially better performance of the AR benchmark for the Czech Republic, with an MSE of 0.005 for the Czech Republic versus 0.031 for Hungary. This may also account for the relatively better performance of the pooled factor forecast for GDP growth relative to the benchmark AR model when compared to the Czech Republic.

Using a fixed number of factors is often equivalent or better than BIC selection, especially for GDP growth. Intercept corrections are useful only for factor forecasts for the interest rate.

In more detail, for GDP growth the best model is fac_fdi_bic, with a relative MSE of 0.53. The best model for the Czech Republic, fac_fdiar_02, with a relative MSE of 1.20, can no longer beat the benchmark. For both inflation and interest rates, the best model is ar_bic_i2, with relative MSE of 0.56 and 0.59 respectively. The best factor model for the interest rate is fac_ic_fdiar_01 with relative MSE of 0.65, which is a close competitior to the non-factor models, but this is not the case for the inflation variable where factor-based forecasts are heavily dominated. The best model for interest rate for the Czech Republic, fac_fdiar_04 is not a strong competitor for Hungary.

Finally, as for the Czech Republic, when the forecasts from the best models are inserted in a pooling regression with the benchmark AR, their coefficients are not statistically different from one, but the related standard errors and those by West (1996) for the relative MSE are even larger than for the Czech Republic.

4.3 Poland

The results for Poland are reported in Table 3a. For GDP growth and inflation, the findings are similar to those for the Czech Republic, with large average gains that reach 64% and 47% respectively for the best factor model. For the interest rate, the factors from the unbalanced panel are now the most useful, and some factor forecasts yield substantial gains. The pooled factor forecast shows gains of roughly 40% over the benchmark for GDP growth and inflation, while no gains are recorded for the interest rate. As in the case of the Czech Republic this again indicates the overall usefulness of factor models as a general methodological approach to forecasting.

It is again confirmed that using a fixed number of factors is often equivalent or better than BIC selection, and no general conclusion can be drawn on including an AR component in the forecasting model. Intercept corrections are sometimes useful for forecasts for GDP growth.

In more detail, for GDP growth the best model is fac_fdiarlag_bic, with a relative MSE of 0.36. It should be noted, however, that the AR model with second differencing is a close competitor. The best model for the Czech Republic, fac_fdiar_02 can still beat the benchmark comfortably, with a relative MSE of 0.71. For inflation the best model is fac_ic_fdi_bic, unbalanced panel, intercept correction and factor chosen by BIC criterion. For the interest rate, fac_fdi_04 is the best model, with a relative MSE of 0.48. The best model for the Czech Republic, fac_fdiar_04, is much worse than the benchmark, with a relative MSE of 2.23.

Finally, as for the Czech Republic and Hungary, when the forecasts from the best models are inserted in a pooling regression with the benchmark AR, their coefficients are not statistically different from one, but the related standard errors and those by West (1996) for the relative MSE are fairly large.

4.4 Slovakia

The results for Slovakia are reported in Table 4a. The performance of factor forecasts for GDP growth is poor on average. The best model is the VAR, with a relative MSE of 0.89. It is, however, possible to beat the benchmark for both inflation and the interest rate using factor models, with the best models being given by fac_ic_fdi_bic (relative MSE 0.41) and fac_fdi_04 (relative MSE 0.44) respectively. Forecasting inflation is also the only case where factor models as a whole produce improvement in forecasting precision (relative MSE of fac_pooled is 0.91). The best model for the interest rate shows no role for the lagged endogenous variable, while for inflation there are some gains after intercept correction of the factor forecasts.

Since the best model for GDP growth is chosen using the BIC criterion, there is a role for its use. Including an AR component in the forecasting model is not always efficacious.

4.5 Slovenia

The results for Slovenia are reported in Table 5a. Overall, the results are mixed, since for GDP growth the gain from using factor models is comparable to Poland, while the best factor model for inflation has a relative MSE of 1.02 and the benchmark AR model cannot be beaten for forecasting interest rates. More generally, forecasts from the class of factor models for inflation and interest rates are systematically beaten by the benchmark AR model, their poor average performance confirmed by looking at the pooled forecast where relative MSEs exceeding one can be noted. For GDP growth however a number of factor models perform well, a result also reflected in a low value of the relative MSE for the pooled forecast.

It is again confirmed that using a fixed number of factors is often equivalent to BIC selection and, as for Slovakia, including an AR component in the forecasting model is not always convenient. Intercept corrections are sometimes useful for GDP growth but not for the remaining two variables. Moreover, forecasting results with factors from balanced and unbalanced panel are virtually identical as the difference between the two panels is only in one series. For this reason there is very small difference between balanced and unbalanced factors estimates.

In more detail, for GDP growth the best model is fac_fdi_03, with a relative MSE of 0.44. Both for inflation and the interest rate no model beats the benchmark, with the VAR intercept corrected model (varfic) providing a relative MSE of 1.02 for inflation, while for the interest rate the relative MSEs are considerably higher.

Figures 1-5 provide a diagrammatic representation for each of the five countries of the forecast derived from the best factor model and the best non-factor model compared with the actual series of inflation, GDP growth and the measure of the nominal interest rate.

4.6 The role of Euro-area information

So far, the factors to be used as regressors in the forecasting models are extracted from the country specific data sets, and no Euro-area information has been incorporated. Yet, as mentioned before, because of the increasing integration with Europe, in particular with the creation of the Euro area, it could be that Euro-area information is also relevant for forecasting macroeconomic variables for the new Member States. To evaluate whether this is the case, we use Euro-area information in two ways. First, we include Euro-area variables in the AR models as described in Section 2.1. Second, we extract factors from the Euro-area data set as described in Section 3, and use them for forecasting either instead of or in combination with the country-specific factors. To save space, we only focus on the results where country-specific and Euro-area data are combined. Details of the results when only Euro-area data are used are available upon request, but the findings are qualitatively similar.

The results are reported in panels *b* of Tables 1-5 for the five countries under analysis, and are directly comparable with those in panels *a*. Three kinds of questions can be asked. First, does the best performing model come from the class that includes Euro-area information? Second, how do AR models with Euro-area variables compare with the ones without such information present? Third, how are factor models affected in their forecasting performance by incorporating Euro-area variables?

The answer to the first question is that for Hungarian GDP growth (eu2_fac_fdi_05) and interest rate (ar_ctr_bic_ic) and Slovenian GDP growth (ar_ctr), the best forecasting models include Euro-area information.

In answer to the second question, and related to the first, it may be seen that the performance of the class of autoregressive models is helped in some instances by the incorporation of Euro-area information. For example, for Hungary, for forecasting GDP growth the best non-factor model overall (looking at Tables 2a and 2b) is ar_ctr_bic, which is an AR model with Euro-area GDP growth as a control variable. Substantial gains are also evident for Hungary for the interest rate series, as ar_ctr_bic_ic with a relative MSE of 0.43 becomes the best non-factor model (and the best model overall). The same model is the best non-factor model for Slovakia in forecasting inflation. The reverse phenomenon however can also be observed, for example for Czech GDP growth where the best non-factor model that does not incorporate Euro area information has a relative MSE of 0.75 compared with a relative MSE of 1.24 for a model which does.

Thus, evaluating the performance of factor models in particular with Euro-area information, it may be noted that the role of such information appears to be limited, although alternative ways of combining Euro-area information into country-specific data sets may yet yield different conclusions.[3] This finding is not surprising in the light of the findings of Artis, Marcellino and Proietti (2003) who highlighted a decrease in business cycle synchronisation between the Euro area and the new Member States, mostly attributable to the process of convergence and thus, in principle, specific to the period studied.

Our finding also matches closely the results reported by Darvas and Szapáry (2004) who undertook an analysis of the synchronisation of business cycles between the EMU and the eight new EU members from Central and Eastern Europe. In contrast to the usually

[3] It is possible that in the single-equation models, better forecasting results using Euro-area information may be found by a more general selection of leading indicators. Thus we may investigate, for example, if inflation in a given new member state is determined not by inflation in the Euro area (which is the implied methodology of the ar_ctr class of models) but by GDP growth in the Euro area. This is less true when factors

analysed GDP and industrial production data, they extended their analysis to the major expenditure and sectoral components of GDP and used several measures of synchronisation. The main findings of their paper were that Hungary, Poland and Slovenia had achieved a high degree of synchronisation with the EMU for GDP, industrial production and exports, but not for consumption and services. The remaining countries had achieved less or no synchronisation. Recalling that it is for Hungary and Slovenia (for GDP growth) that Euro-area information is useful in forecasting, it is natural to assign a key role to synchronisation. This also leads us to conclude in favour of the hypothesis that the role of Euro-area information is greatest in the countries for which synchronisation of the variables with the EMU is high. We do not identify a role for Euro-area information for Poland – the remaining country for which Darvas and Szapáry (2004) found synchronisation – mainly because factor models with Euro-area information are strong overall performers for GDP growth (relative MSE of 0.57 for the pooled factor forecast) and thus hard to beat.

4.7 I(2) prices, wages and money

Since there is uncertainty in the literature about whether prices, wages and money are integrated of order 1 or 2, and the sample sizes are too small for reliable testing of this hypothesis, we prefer to evaluate the robustness of our analysis by repeating it under the assumption of I(2) nominal variables. Note that since the choice of order of integration of the nominal variables affects the computation of all the factors, we can expect differences not only for forecasting inflation but also for GDP growth and short-term interest rate.

Overall, the second differencing of nominal variables does not lead to a significant improvement in forecasting precision.

5. Conclusions

In this paper we have evaluated the relative performance of factor models and more traditional small-scale time series methods for forecasting macroeconomic variables for five new Member States. Since these countries are characterized by short time series, simple methods can be expected to perform comparatively well. On the other hand, the availability of large sets of macroeconomic indicators suggests that factor methods can be also suited.

The results can be summarised as follows. Concentrating first on models with country-specific information, a factor model yields the best forecasts for GDP growth for four

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are extracted from Euro-area data and used for forecasting, since in this case a large amount of information, taking account of such possibilities, is implicitly utilised.

of the five countries in the sample, namely the Czech Republic, Hungary Poland and Slovenia. The gains range from 42% for the Czech Republic to 64% for Poland. A VAR is the best forecasting model for Slovakia. For inflation, in the case of Hungary an AR model with second differencing is the best model, while factor models are preferred for the Czech Republic, Poland and Slovakia. For Slovenia a factor model marginally under-performs the benchmark AR model. For the short-term interest rate, factor models work best for the Czech Republic, Poland and Slovakia. An AR model with second differencing is the best model for Hungary while for Slovenia the benchmark AR model dominates all others. Thus out of the 15 time series (three variables for each of the five countries), factor models provide the best forecasts in 10 cases. When Euro-area information is allowed, this count drops to 8 (or 9) out of 15 cases, with the best forecasting models for Slovenian GDP growth (only marginally) and for Hungarian interest rates switching to non-factor models. The best forecasting model for Hungary for GDP growth remains a factor model, but is one that incorporates Euro-area information.

In order to consider the overall performance of factor models for each of the variables studied, instead of looking only at the best model, the behaviour of the pooled factor forecast (fac_pooled) can be taken to be a good guide. For example, reflective of the results reported above, fac_pooled has relative MSEs of 2.45 and 1.72 (Table 2a) for Hungarian inflation and interest rate (while the corresponding figures are 0.97 and 0.51 for the Czech Republic (Table 1a)). For Poland, a country for which performance of the factor models are on par with the Czech Republic) the relative MSEs are given by 0.57, 0.63 and 1.03 for GDP growth, inflation and interest rate respectively (Table 3a). Similar patterns may be discerned by considering Tables 4a and 5a, where the good performance of a specific factor model is often matched by low numbers for the relative MSE of the fac_pooled forecast while the converse is true in cases where factor models perform poorly.

Four other general results emerge from the analysis. First, in samples as short as ours it may be better to use a fixed model rather than selection using the BIC criterion. Second, adding an AR component to the factor model is usually beneficial. Third, the pooled factor forecasts in general yield smaller gains with respect to the benchmark than the best factor forecasts, indicating that careful model selection is important. Finally, intercept corrections and second differencing (as forecast-robustifying devices against structural breaks) may yield gains in some cases but should be used with care.

With factor models dominating roughly two-thirds of the time, we think it appropriate to conclude that overall the results are supportive of a careful use of factor models for forecasting macroeconomic variables for the new Member States. Interesting directions for future research in this context are mostly related to the collection of better data sets, with longer, cleaner and higher frequency time series, and detailed simulation studies to investigate the efficacy of factor methods in panels of data with short *T* and relatively larger *N*.

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Appendix A: Tables

Table 1a: Results for Czech Republic, *h*=1, I(1) prices and wages, country-specific factors

Forecast Method	gdp		cpi		rtb3m	
ar_bic	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)
ar_bic_i2	0.75 (0.27)	0.75 (0.22)	0.75 (0.27)	1.10 (0.56)	1.01 (0.46)	0.49 (0.49)
ar_bic_ic	1.47 (0.42)	0.23 (0.24)	0.88 (0.36)	0.58 (0.27)	1.03 (0.40)	0.47 (0.39)
_varf	4.17 (5.14)	-0.59 (0.25)	1.08 (0.16)	0.08 (0.80)	5.56 (21.02)	0.07 (0.21)
_varfic	6.12 (11.34)	-0.03 (0.12)	1.48 (0.49)	0.27 (0.17)	6.25 (19.78)	-0.01 (0.12)
a_fac__fdiarlag_bic	1.34 (0.56)	-0.60 (0.38)	0.41 (0.44)	0.80 (0.20)	2.22 (2.51)	0.30 (0.20)
a_fac__fdiar_bic	0.90 (0.09)	9.36 (3.43)	0.43 (0.40)	0.87 (0.15)	1.10 (0.84)	0.48 (0.17)
a_fac__fdi_bic	0.90 (0.09)	9.36 (3.43)	1.17 (0.30)	0.39 (0.15)	1.10 (0.84)	0.48 (0.17)
a_fbp__fdiarlag_bic	2.86 (3.57)	0.25 (0.16)	0.69 (0.39)	0.65 (0.17)	0.89 (0.48)	0.52 (0.08)
a_fbp__fdiar_bic	14.68 (119.39)	-0.04 (0.06)	0.69 (0.39)	0.65 (0.17)	0.89 (0.48)	0.52 (0.08)
a_fbp__fdi_bic	7.08 (34.29)	-0.03 (0.13)	0.74 (0.36)	0.69 (0.26)	0.89 (0.48)	0.52 (0.08)
a_fac__fdiar_01	0.86 (0.37)	0.84 (0.98)	1.35 (0.38)	0.27 (0.16)	1.10 (0.84)	0.48 (0.17)
a_fac__fdiar_02	0.58 (0.48)	0.68 (0.17)	0.52 (0.41)	0.75 (0.16)	0.78 (0.67)	0.56 (0.19)
a_fac__fdiar_03	0.68 (0.32)	1.34 (0.57)	0.43 (0.40)	0.87 (0.16)	0.79 (0.61)	0.54 (0.13)
a_fac__fdiar_04	1.63 (1.35)	0.20 (0.34)	0.44 (0.40)	0.93 (0.19)	0.33 (0.47)	0.73 (0.11)
a_fac__fdi_01	0.86 (0.37)	0.84 (0.98)	2.03 (0.87)	-0.05 (0.21)	1.10 (0.84)	0.48 (0.17)
a_fac__fdi_02	0.72 (0.33)	1.33 (0.74)	0.86 (0.34)	0.62 (0.32)	0.78 (0.67)	0.56 (0.19)
a_fac__fdi_03	0.68 (0.32)	1.34 (0.57)	0.68 (0.38)	0.74 (0.30)	0.79 (0.61)	0.54 (0.13)
a_fac__fdi_04	1.63 (1.35)	0.20 (0.34)	0.64 (0.35)	0.87 (0.34)	0.33 (0.47)	0.73 (0.11)
a_fac_ic_fdiarlag_bic	2.02 (1.34)	0.05 (0.31)	1.30 (0.64)	0.38 (0.19)	4.86 (13.20)	0.15 (0.17)
a_fac_ic_fdiar_bic	1.46 (0.42)	0.23 (0.24)	1.45 (0.80)	0.34 (0.20)	1.26 (0.73)	0.44 (0.15)
a_fac_ic_fdi_bic	1.46 (0.42)	0.23 (0.24)	0.68 (0.47)	0.68 (0.36)	1.26 (0.73)	0.44 (0.15)
a_fbp_ic_fdiarlag_bic	2.31 (1.91)	0.36 (0.10)	2.12 (1.37)	0.19 (0.17)	0.61 (0.51)	0.62 (0.15)
a_fbp_ic_fdiar_bic	35.13 (523.93)	-0.02 (0.03)	2.12 (1.37)	0.19 (0.17)	0.61 (0.51)	0.62 (0.15)
a_fbp_ic_fdi_bic	12.32 (59.11)	0.03 (0.07)	1.56 (0.91)	0.33 (0.18)	0.61 (0.51)	0.62 (0.15)
a_fac_ic_fdiar_01	1.66 (0.70)	0.15 (0.29)	0.64 (0.42)	0.69 (0.26)	1.26 (0.73)	0.44 (0.15)
a_fac_ic_fdiar_02	1.25 (0.59)	0.37 (0.30)	1.82 (1.14)	0.24 (0.20)	1.08 (0.74)	0.47 (0.26)
a_fac_ic_fdiar_03	1.54 (0.51)	0.23 (0.23)	1.46 (0.79)	0.34 (0.20)	1.15 (0.73)	0.45 (0.25)
a_fac_ic_fdiar_04	3.99 (4.95)	-0.05 (0.19)	1.53 (0.85)	0.31 (0.20)	0.60 (0.47)	0.71 (0.28)
a_fac_ic_fdi_01	1.66 (0.70)	0.15 (0.29)	0.77 (0.34)	0.60 (0.14)	1.26 (0.73)	0.44 (0.15)
a_fac_ic_fdi_02	1.50 (0.45)	0.21 (0.26)	1.10 (0.52)	0.46 (0.19)	1.08 (0.74)	0.47 (0.26)
a_fac_ic_fdi_03	1.54 (0.51)	0.23 (0.23)	1.14 (0.57)	0.45 (0.20)	1.15 (0.73)	0.45 (0.25)
a_fac_ic_fdi_04	3.99 (4.95)	-0.05 (0.19)	0.68 (0.46)	0.65 (0.22)	0.60 (0.47)	0.71 (0.28)
fac_pooled	1.76 (0.96)	0.03 (0.35)	0.97 (0.40)	0.52 (0.24)	0.51 (0.49)	0.66 (0.16)
RMSE for AR Model	0.005		0.006		0.389	
MAE for AR Model	0.005		0.005		0.304	
MAE of best non-factor model	0.004		0.004		0.280	
MAE of best factor model	0.004		0.003		0.191	
MAE of fac_pooled	0.006		0.006		0.216	

Table 1b: Results for Czech Republic, *h*=1, I(1) prices and wages, combined Euro-area information

Forecast Method	gdp		cpi		rtb3m	
ar_bic	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)
ar_ctrfix	2.35 (2.93)	-0.29 (0.47)	1.81 (1.10)	-1.66 (0.60)	1.22 (0.39)	0.15 (0.50)
ar_ctr_bic	1.24 (0.23)	-0.85 (0.94)	1.81 (0.82)	-0.35 (0.32)	0.84 (0.15)	1.16 (0.76)
ar_ctrfix_ic	2.59 (3.18)	0.07 (0.25)	0.79 (0.48)	0.62 (0.29)	2.64 (4.26)	-0.02 (0.30)
ar_ctr_bic_ic	1.63 (0.90)	0.14 (0.33)	0.99 (0.71)	0.50 (0.27)	1.31 (0.62)	0.28 (0.33)
eu2_fac__fdiarlag_bic	0.90 (0.09)	9.36 (3.43)	0.41 (0.44)	0.80 (0.20)	2.22 (2.51)	0.30 (0.20)
eu2_fac__fdiar_bic	0.90 (0.09)	9.36 (3.43)	0.43 (0.40)	0.87 (0.15)	1.10 (0.84)	0.48 (0.17)
eu2_fac__fdi_bic	0.90 (0.09)	9.36 (3.43)	2.42 (2.11)	0.16 (0.08)	1.10 (0.84)	0.48 (0.17)
eu2_fbp__fdiarlag_bic	0.90 (0.09)	9.36 (3.43)	0.69 (0.39)	0.65 (0.17)	0.89 (0.48)	0.52 (0.08)
eu2_fbp__fdiar_bic	0.90 (0.09)	9.36 (3.43)	0.69 (0.39)	0.65 (0.17)	0.89 (0.48)	0.52 (0.08)
eu2_fbp__fdi_bic	0.90 (0.09)	9.36 (3.43)	0.74 (0.36)	0.69 (0.26)	0.89 (0.48)	0.52 (0.08)
eu2_fac__fdiar_05	3.23 (4.05)	-0.45 (0.26)	0.42 (0.39)	1.08 (0.20)	0.59 (0.52)	0.60 (0.14)
eu2_fac__fdiar_06	3.24 (4.22)	-0.25 (0.20)	0.49 (0.38)	0.89 (0.17)	0.69 (0.54)	0.57 (0.12)
eu2_fac__fdiar_07	3.30 (4.08)	-0.22 (0.22)	0.84 (0.35)	0.66 (0.35)	0.81 (0.65)	0.56 (0.21)
eu2_fac__fdiar_08	6.24 (15.65)	-0.20 (0.11)	1.38 (1.10)	0.11 (0.69)	1.06 (0.90)	0.49 (0.21)
eu2_fac__fdi_05	3.23 (4.05)	-0.45 (0.26)	0.51 (0.36)	1.11 (0.31)	0.59 (0.52)	0.60 (0.14)
eu2_fac__fdi_06	3.24 (4.22)	-0.25 (0.20)	0.55 (0.34)	1.09 (0.28)	0.69 (0.54)	0.57 (0.12)
eu2_fac__fdi_07	3.30 (4.08)	-0.22 (0.22)	0.89 (0.31)	0.61 (0.32)	0.81 (0.65)	0.56 (0.21)
eu2_fac__fdi_08	6.24 (15.65)	-0.20 (0.11)	1.45 (1.15)	-0.03 (0.70)	1.06 (0.90)	0.49 (0.21)
eu2_fac_ic_fdiarlag_bic	1.46 (0.42)	0.23 (0.24)	1.30 (0.64)	0.38 (0.19)	4.86 (13.20)	0.15 (0.17)
eu2_fac_ic_fdiar_bi	1.46 (0.42)	0.23 (0.24)	1.45 (0.80)	0.34 (0.20)	1.26 (0.73)	0.44 (0.15)
eu2_fac_ic_fdi_bic	1.46 (0.42)	0.23 (0.24)	4.35 (10.18)	-0.11 (0.23)	1.26 (0.73)	0.44 (0.15)
eu2_fbp_ic_fdiarlag_bic	1.46 (0.42)	0.23 (0.24)	8.45 (38.18)	0.00 (0.13)	0.61 (0.51)	0.62 (0.15)
eu2_fbp_ic_fdiar_bic	1.46 (0.42)	0.23 (0.24)	2.12 (1.37)	0.19 (0.17)	0.61 (0.51)	0.62 (0.15)
eu2_fbp_ic_fdi_bic	1.46 (0.42)	0.23 (0.24)	1.56 (0.91)	0.33 (0.18)	0.61 (0.51)	0.62 (0.15)
eu2_fac_ic_fdiar_05	4.30 (5.31)	0.01 (0.16)	1.42 (0.79)	0.35 (0.21)	0.84 (0.41)	0.59 (0.27)
eu2_fac_ic_fdiar_06	7.35 (15.94)	-0.05 (0.12)	1.69 (1.03)	0.28 (0.19)	0.60 (0.41)	0.72 (0.28)
eu2_fac_ic_fdiar_07	7.56 (14.00)	-0.05 (0.13)	1.72 (1.15)	0.22 (0.24)	1.66 (1.21)	0.29 (0.22)
eu2_fac_ic_fdiar_08	10.52 (30.45)	-0.07 (0.11)	2.71 (3.86)	0.13 (0.19)	1.75 (1.37)	0.25 (0.22)
eu2_fac_ic_fdi_05	4.30 (5.31)	0.01 (0.16)	0.81 (0.49)	0.59 (0.26)	0.84 (0.41)	0.59 (0.27)
eu2_fac_ic_fdi_06	7.35 (15.94)	-0.05 (0.12)	0.90 (0.54)	0.54 (0.25)	0.60 (0.41)	0.72 (0.28)
eu2_fac_ic_fdi_07	7.56 (14.00)	-0.05 (0.13)	1.57 (0.98)	0.24 (0.23)	1.66 (1.21)	0.29 (0.22)
eu2_fac_ic_fdi_08	10.52 (30.45)	-0.07 (0.11)	2.73 (3.88)	0.11 (0.19)	1.75 (1.37)	0.25 (0.22)
fac_pooled	2.89 (1.67)	-0.09 (0.27)	1.06 (0.44)	0.46 (0.30)	1.14 (1.05)	0.47 (0.25)
RMSE for AR Model	0.005		0.006		0.389	

Notes:
The initial estimation period is 1994:1-2000:2. The forecast period is 2000:3-2002:2. One-step-ahead forecasts.
For each variable, the four columns report the MSE relative to the benchmark AR model, with West (1996) standard error in parentheses, and the coefficient of the forecast under analysis in a pooling regression with the benchmark forecast, with robust standard error in parentheses. We also report the root MSE and MAE for the AR benchmark, and the MAE for the best non-factor model, factor model and pooled factor forecast.

The forecasts in the rows of tables are (see section 2.1 for details):

ar_bic	AR model (BIC selection),benchmark
ar_bic_i2	AR model (BIC selection) for second-differenced variable
ar_bic_ic	AR model (BIC selection) with intercept correction
ar_ctrfix	AR model (fixed lag) with foreign counterpart to forecast variable as exogenous regressor
ar_ctr_bic	AR model (BIC selection) with foreign counterpart to forecast variable as exogenous regressor
ar_ctrfix_ic	ar_ctrfix with intercept correction
ar_ctr_bic_ic	ar_ctr_bic with intercept correction
_varf	VAR model
_varfic	VAR model with intercept correction
_fac__fdiarlag_bic	Factors from unbalanced panel (BIC selection), their lags, and AR terms
_fac__fdiar_bic	Factors from unbalanced panel (BIC selection), and AR terms
_fac__fdi_bic	Factors from unbalanced panel (BIC selection)
_fbp__fdiarlag_bic	Factors from balanced panel (BIC selection), their lags, and AR terms
_fbp__fdiar_bic	Factors from balanced panel (BIC selection), and AR terms
_fbp__fdi_bic	Factors from balanced panel (BIC selection)
_fac__fdiar_01	n factors from unbalanced panel, n=1,2,3,4, and AR terms
_fac__fdiar_02	
_fac__fdiar_03	
_fac__fdiar_04	
_fac__fdi_01	n factors from unbalanced panel, n=1,2,3,4; n=5,6,7,8 in panel b for models with combined i.e.
_fac__fdi_02	country specific and Euro area factors
_fac__fdi_03	
_fac__fdi_04	
_fac_ic_fdiarlag_bic	As factor models above, but with intercept correction
_fac_ic_fdiar_bic	
_fac_ic_fdi_bic	
_fbp_ic_fdiarlag_bic	
_fbp_ic_fdiar_bic	
_fbp_ic_fdi_bic	
_fac_ic_fdiar_01	
_fac_ic_fdiar_02	
_fac_ic_fdiar_03	
_fac_ic_fdiar_04	
_fac_ic_fdi_01	
_fac_ic_fdi_02	
_fac_ic_fdi_03	
_fac_ic_fdi_04	
_fac_pooled	Average of factor forecasts

Prefix "a" denotes use of country specific factors only. Forecasts with "eu2" prefix are based on country specific and Euro area factors. The suffix 05 to 08 indicates that 1 to 4 Euro area factors are included in the forecasting model in addition to 4 country specific factors. See Section 2.1 for details.

Table 2a: Results for Hungary, *h*=1, I(1) prices and wages, country-specific factors

Forecast Method	gdp				cpi				rtb3m			
ar_bic	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)
ar_bic_i2	2.25	(1.27)	-0.78	(0.29)	0.56	(0.27)	1.37	(0.47)	0.59	(0.46)	0.81	(0.34)
ar_bic_ic	2.31	(1.89)	-0.16	(0.23)	2.17	(2.90)	0.06	(0.32)	0.65	(0.49)	0.70	(0.32)
_varf	1.03	(0.14)	0.45	(0.17)	2.12	(2.48)	0.21	(0.19)	0.81	(0.22)	0.80	(0.35)
_varfic	1.56	(0.82)	-0.06	(0.49)	2.62	(2.35)	0.21	(0.16)	0.82	(0.39)	0.60	(0.21)
a_fac__fdiarlag_bic	0.88	(0.41)	0.58	(0.30)	2.56	(5.05)	0.18	(0.29)	0.93	(0.18)	0.67	(0.44)
a_fac__fdiar_bic	0.64	(0.35)	1.07	(0.45)	4.14	(8.20)	0.10	(0.12)	0.98	(0.18)	0.54	(0.37)
a_fac__fdi_bic	0.53	(0.44)	1.12	(0.34)	2.84	(1.98)	-0.15	(0.17)	0.98	(0.18)	0.54	(0.37)
a_fbp__fdiarlag_bic	1.22	(0.26)	-1.28	(0.89)	0.98	(0.49)	0.51	(0.31)	0.72	(0.35)	1.20	(0.75)
a_fbp__fdiar_bic	1.04	(0.22)	0.17	(1.55)	1.41	(0.59)	0.08	(0.41)	0.96	(0.19)	0.64	(0.62)
a_fbp__fdi_bic	0.83	(0.40)	1.05	(1.07)	1.41	(0.59)	0.08	(0.41)	0.96	(0.19)	0.64	(0.62)
a_fac__fdiar_01	1.25	(0.26)	-1.21	(0.35)	1.40	(0.31)	-0.26	(0.37)	0.89	(0.20)	0.67	(0.30)
a_fac__fdiar_02	1.20	(0.29)	-0.13	(0.79)	1.54	(0.45)	-0.26	(0.40)	0.93	(0.24)	0.61	(0.37)
a_fac__fdiar_03	0.55	(0.38)	1.33	(0.49)	2.34	(2.15)	0.01	(0.13)	0.99	(0.26)	0.51	(0.28)
a_fac__fdiar_04	0.72	(0.50)	0.73	(0.41)	1.80	(1.59)	0.20	(0.18)	1.22	(0.35)	0.32	(0.24)
a_fac__fdi_01	0.89	(0.40)	0.84	(1.16)	2.72	(1.93)	-0.13	(0.16)	0.89	(0.20)	0.67	(0.30)
a_fac__fdi_02	0.89	(0.50)	0.67	(0.73)	2.87	(2.06)	-0.15	(0.20)	0.93	(0.24)	0.61	(0.37)
a_fac__fdi_03	0.56	(0.47)	1.08	(0.37)	2.54	(2.45)	-0.05	(0.17)	0.99	(0.26)	0.51	(0.28)
a_fac__fdi_04	0.70	(0.50)	0.76	(0.43)	1.89	(1.68)	0.16	(0.17)	1.22	(0.35)	0.32	(0.24)
a_fac_ic_fdiarlag_bic	2.48	(2.28)	0.09	(0.14)	4.48	(9.61)	0.09	(0.17)	0.99	(0.52)	0.51	(0.28)
a_fac_ic_fdiar_bic	1.57	(0.61)	0.04	(0.36)	9.19	(52.11)	0.11	(0.10)	0.97	(0.50)	0.52	(0.28)
a_fac_ic_fdi_bic	1.42	(0.94)	0.30	(0.39)	3.67	(6.59)	-0.05	(0.27)	0.97	(0.50)	0.52	(0.28)
a_fbp_ic_fdiarlag_bic	2.62	(2.80)	-0.06	(0.25)	1.89	(1.01)	0.16	(0.18)	0.74	(0.53)	0.63	(0.27)
a_fbp_ic_fdiar_bic	2.37	(2.52)	0.03	(0.33)	2.48	(2.92)	-0.07	(0.32)	0.69	(0.41)	0.76	(0.27)
a_fbp_ic_fdi_bic	2.06	(2.07)	0.15	(0.37)	2.48	(2.92)	-0.07	(0.32)	0.69	(0.41)	0.76	(0.27)
a_fac_ic_fdiar_01	2.77	(3.37)	-0.03	(0.26)	1.96	(1.70)	0.01	(0.38)	0.65	(0.42)	0.76	(0.25)
a_fac_ic_fdiar_02	2.78	(3.56)	0.03	(0.29)	2.19	(2.08)	-0.07	(0.35)	0.72	(0.43)	0.70	(0.28)
a_fac_ic_fdiar_03	1.57	(0.79)	0.10	(0.32)	5.15	(13.87)	-0.17	(0.19)	1.18	(0.72)	0.41	(0.31)
a_fac_ic_fdiar_04	2.22	(1.59)	0.18	(0.21)	4.33	(9.54)	-0.15	(0.21)	1.68	(1.13)	0.26	(0.26)
a_fac_ic_fdi_01	2.22	(2.38)	0.14	(0.35)	3.54	(6.21)	-0.05	(0.28)	0.65	(0.42)	0.76	(0.25)
a_fac_ic_fdi_02	2.37	(2.65)	0.17	(0.32)	4.20	(8.93)	-0.10	(0.26)	0.72	(0.43)	0.70	(0.28)
a_fac_ic_fdi_03	1.71	(1.13)	0.25	(0.32)	5.62	(17.43)	-0.18	(0.18)	1.18	(0.72)	0.41	(0.31)
a_fac_ic_fdi_04	2.18	(1.57)	0.18	(0.22)	4.55	(10.93)	-0.16	(0.21)	1.68	(1.13)	0.26	(0.26)
fac_pooled	0.87	(0.53)	0.59	(0.38)	2.45	(2.10)	0.09	(0.22)	1.72	(0.87)	0.24	(0.21)
RMSE for AR Model	0.031				0.005				0.846			
MAE for AR Model	0.025				0.004				0.624			
MAE of best non-factor model	0.025				0.003				0.432			
MAE of best factor model	0.019				0.004				0.474			
MAE of fac_pooled	0.027				0.007				1.042			

Table 2b: Results for Hungary, *h=1*, I(1) prices and wages, combined Euro-area information

Forecast Method	gdp		cpi		rtb3m	
ar_bic	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)
ar_ctrfix	1.03 (0.09)	-0.12 (1.40)	1.48 (0.64)	-0.01 (0.47)	1.21 (0.45)	0.29 (0.43)
ar_ctr_bic	0.90 (0.24)	1.41 (1.76)	0.84 (0.28)	0.97 (0.80)	1.07 (0.16)	0.28 (0.46)
ar_ctrfix_ic	1.99 (1.33)	-0.09 (0.34)	1.85 (2.34)	0.04 (0.43)	0.44 (0.45)	0.82 (0.19)
ar_ctr_bic_ic	2.08 (1.74)	0.01 (0.36)	2.06 (2.66)	0.11 (0.34)	0.43 (0.41)	0.90 (0.18)
eu2_fac__fdiarlag_bic	0.63 (0.38)	1.12 (0.48)	1.08 (0.25)	0.44 (0.20)	0.88 (0.30)	0.73 (0.54)
eu2_fac__fdiar_bic	0.86 (0.40)	0.64 (0.41)	1.62 (0.64)	-1.62 (0.50)	1.02 (0.20)	0.46 (0.39)
eu2_fac__fdi_bic	0.75 (0.48)	0.70 (0.37)	3.14 (2.82)	-0.11 (0.13)	1.02 (0.20)	0.46 (0.39)
eu2_fbp__fdiarlag_bic	1.17 (0.18)	-1.09 (0.29)	1.54 (0.68)	0.06 (0.32)	1.41 (0.39)	-0.46 (0.55)
eu2_fbp__fdiar_bic	1.40 (0.65)	-0.62 (0.79)	5.51 (21.72)	0.07 (0.04)	0.96 (0.19)	0.64 (0.62)
eu2_fbp__fdi_bic	1.31 (0.83)	0.01 (0.98)	1.41 (0.59)	0.08 (0.41)	0.96 (0.19)	0.64 (0.62)
eu2_fac__fdiar_05	0.50 (0.49)	0.88 (0.34)	2.96 (3.11)	-0.02 (0.10)	1.43 (0.55)	0.27 (0.18)
eu2_fac__fdiar_06	0.51 (0.49)	0.86 (0.35)	1.83 (1.21)	0.16 (0.20)	1.88 (1.12)	0.21 (0.15)
eu2_fac__fdiar_07	0.79 (0.40)	0.65 (0.34)	1.88 (0.93)	0.02 (0.22)	2.06 (1.10)	0.17 (0.11)
eu2_fac__fdiar_08	0.65 (0.48)	0.72 (0.36)	1.33 (0.61)	0.29 (0.31)	2.68 (1.47)	0.01 (0.10)
eu2_fac__fdi_05	0.50 (0.49)	0.88 (0.34)	3.03 (3.17)	-0.04 (0.11)	1.43 (0.55)	0.27 (0.18)
eu2_fac__fdi_06	0.51 (0.49)	0.86 (0.35)	1.83 (1.21)	0.16 (0.20)	1.88 (1.12)	0.21 (0.15)
eu2_fac__fdi_07	0.61 (0.50)	0.74 (0.35)	1.88 (0.93)	0.02 (0.22)	2.06 (1.10)	0.17 (0.11)
eu2_fac__fdi_08	0.65 (0.48)	0.72 (0.36)	1.33 (0.61)	0.29 (0.31)	2.68 (1.47)	0.01 (0.10)
eu2_fac_ic_fdiarlag_bic	2.32 (1.78)	-0.27 (0.26)	2.83 (3.72)	0.13 (0.22)	0.99 (0.52)	0.51 (0.28)
eu2_fac_ic_fdiar_bic	3.09 (2.58)	0.05 (0.13)	2.06 (2.51)	0.05 (0.32)	0.97 (0.50)	0.52 (0.28)
eu2_fac_ic_fdi_bic	2.25 (1.64)	0.18 (0.24)	3.67 (6.59)	-0.05 (0.27)	0.97 (0.50)	0.52 (0.28)
eu2_fbp_ic_fdiarlag_bic	2.37 (2.52)	0.03 (0.33)	2.80 (3.47)	-0.05 (0.26)	0.77 (0.38)	0.64 (0.17)
eu2_fbp_ic_fdiar_bic	3.43 (5.72)	-0.06 (0.25)	14.01 (96.08)	-0.08 (0.09)	0.69 (0.41)	0.76 (0.27)
eu2_fbp_ic_fdi_bic	3.44 (6.34)	0.00 (0.29)	2.48 (2.92)	-0.07 (0.32)	0.69 (0.41)	0.76 (0.27)
eu2_fac_ic_fdiar_05	2.59 (1.99)	0.16 (0.17)	2.84 (2.99)	0.05 (0.27)	5.21 (12.28)	0.09 (0.08)
eu2_fac_ic_fdiar_06	1.60 (1.18)	0.35 (0.19)	5.80 (11.96)	0.09 (0.12)	4.43 (8.30)	0.11 (0.10)
eu2_fac_ic_fdiar_07	1.66 (1.21)	0.33 (0.19)	5.74 (10.59)	0.08 (0.13)	4.97 (10.40)	0.10 (0.10)
eu2_fac_ic_fdiar_08	2.20 (1.95)	0.26 (0.15)	6.59 (14.73)	0.09 (0.10)	5.23 (10.28)	0.08 (0.11)
eu2_fac_ic_fdi_05	2.61 (2.09)	0.16 (0.17)	2.84 (2.99)	0.05 (0.27)	5.21 (12.28)	0.09 (0.08)
eu2_fac_ic_fdi_06	1.56 (1.16)	0.36 (0.20)	5.80 (11.96)	0.09 (0.12)	4.43 (8.30)	0.11 (0.10)
eu2_fac_ic_fdi_07	1.60 (1.17)	0.34 (0.19)	5.74 (10.59)	0.08 (0.13)	4.97 (10.40)	0.10 (0.10)
eu2_fac_ic_fdi_08	2.34 (2.27)	0.25 (0.14)	6.59 (14.73)	0.09 (0.10)	5.23 (10.28)	0.08 (0.11)
fac_pooled	1.02 (0.58)	0.49 (0.32)	2.04 (1.27)	0.01 (0.31)	1.21 (0.62)	0.37 (0.33)
RMSE for AR Model	0.031		0.005		0.846	

See notes to Table 1.

Table 3a: Results for Poland, *h*=1, I(1) prices and wages, country-specific factors

Forecast Method	gdp		cpi		rtb3m	
ar_bic	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)
ar_bic_i2	0.41 (0.52)	0.98 (0.34)	0.79 (0.25)	1.14 (0.84)	1.58 (1.02)	0.13 (0.40)
ar_bic_ic	0.87 (0.29)	0.55 (0.12)	1.88 (1.78)	0.06 (0.38)	3.00 (3.11)	-0.16 (0.23)
_varf	0.81 (0.28)	1.67 (1.21)	0.97 (0.15)	0.66 (0.73)	1.07 (0.26)	0.23 (1.00)
_varfic	0.47 (0.53)	0.72 (0.21)	1.75 (1.64)	0.04 (0.40)	2.30 (1.61)	-0.01 (0.35)
a_fac__fdiarlag_bic	0.36 (0.56)	1.37 (0.31)	1.62 (0.98)	0.11 (0.41)	2.10 (2.36)	0.23 (0.10)
a_fac__fdiar_bic	0.87 (0.49)	0.56 (0.23)	0.73 (0.27)	1.28 (0.63)	2.17 (2.56)	0.23 (0.10)
a_fac__fdi_bic	1.61 (0.55)	0.13 (0.31)	0.85 (0.61)	0.58 (0.36)	0.48 (0.21)	0.69 (0.14)
a_fbp__fdiarlag_bic	1.70 (0.85)	-0.80 (0.41)	0.96 (0.27)	0.74 (1.62)	2.10 (2.36)	0.23 (0.10)
a_fbp__fdiar_bic	1.81 (0.86)	-1.22 (0.41)	0.96 (0.27)	0.74 (1.62)	7.13 (41.14)	0.10 (0.03)
a_fbp__fdi_bic	1.81 (0.86)	-1.22 (0.41)	3.35 (2.03)	-0.08 (0.23)	0.68 (0.22)	0.61 (0.08)
a_fac__fdiar_01	0.85 (0.16)	2.66 (1.46)	0.87 (0.29)	1.15 (1.21)	2.30 (2.84)	0.21 (0.09)
a_fac__fdiar_02	0.71 (0.27)	2.29 (0.87)	0.88 (0.29)	1.10 (1.23)	2.31 (2.86)	0.21 (0.09)
a_fac__fdiar_03	0.80 (0.28)	1.30 (0.98)	0.90 (0.30)	0.94 (1.23)	2.90 (4.98)	0.17 (0.07)
a_fac__fdiar_04	0.74 (0.34)	1.23 (0.76)	1.24 (0.26)	-1.11 (0.81)	2.23 (3.65)	0.34 (0.14)
a_fac__fdi_01	0.85 (0.16)	2.66 (1.46)	1.47 (0.55)	-0.08 (0.31)	1.14 (0.54)	0.37 (0.42)
a_fac__fdi_02	0.71 (0.27)	2.29 (0.87)	1.43 (0.51)	-0.08 (0.32)	0.80 (0.29)	0.72 (0.34)
a_fac__fdi_03	0.70 (0.31)	2.16 (0.97)	1.38 (0.50)	-0.02 (0.36)	0.76 (0.26)	0.73 (0.27)
a_fac__fdi_04	0.69 (0.33)	2.59 (1.05)	1.13 (0.42)	0.28 (0.61)	0.48 (0.21)	0.69 (0.14)
a_fac_ic_fdiarlag_bic	0.50 (0.60)	0.73 (0.26)	4.67 (10.15)	-0.13 (0.23)	2.05 (1.29)	0.28 (0.14)
a_fac_ic_fdiar_bic	2.39 (1.93)	0.26 (0.09)	1.03 (0.66)	0.48 (0.37)	3.28 (4.22)	0.21 (0.10)
a_fac_ic_fdi_bic	2.96 (4.19)	0.24 (0.06)	0.53 (0.41)	0.74 (0.18)	0.90 (0.33)	0.53 (0.10)
a_fbp_ic_fdiarlag_bic	1.17 (0.74)	0.44 (0.22)	1.89 (1.67)	0.20 (0.35)	2.05 (1.29)	0.28 (0.14)
a_fbp_ic_fdiar_bic	0.87 (0.48)	0.56 (0.22)	1.89 (1.67)	0.20 (0.35)	12.20 (81.34)	0.11 (0.03)
a_fbp_ic_fdi_bic	0.87 (0.48)	0.56 (0.22)	5.79 (13.43)	-0.20 (0.18)	0.80 (0.33)	0.57 (0.14)
a_fac_ic_fdiar_01	0.86 (0.35)	0.56 (0.13)	1.79 (1.59)	0.18 (0.39)	2.40 (1.79)	0.26 (0.14)
a_fac_ic_fdiar_02	0.70 (0.46)	0.61 (0.18)	1.77 (1.57)	0.18 (0.39)	2.35 (1.72)	0.25 (0.15)
a_fac_ic_fdiar_03	1.39 (0.30)	0.39 (0.08)	1.84 (1.65)	0.17 (0.38)	3.13 (2.77)	0.22 (0.11)
a_fac_ic_fdiar_04	1.17 (0.36)	0.45 (0.11)	2.62 (3.76)	-0.06 (0.24)	3.55 (5.54)	0.28 (0.06)
a_fac_ic_fdi_01	0.86 (0.35)	0.56 (0.13)	1.59 (1.17)	0.11 (0.40)	1.22 (0.55)	0.34 (0.34)
a_fac_ic_fdi_02	0.70 (0.46)	0.61 (0.18)	1.59 (1.23)	0.14 (0.42)	1.97 (1.03)	-0.07 (0.36)
a_fac_ic_fdi_03	0.88 (0.43)	0.54 (0.15)	1.53 (1.13)	0.17 (0.43)	2.14 (1.52)	-0.09 (0.30)
a_fac_ic_fdi_04	0.73 (0.46)	0.60 (0.17)	1.04 (0.61)	0.46 (0.57)	0.90 (0.33)	0.53 (0.10)
fac_pooled	0.57 (0.49)	0.83 (0.33)	0.63 (0.39)	1.27 (0.44)	1.03 (0.69)	0.49 (0.18)
RMSE for AR Model	0.006		0.009		0.705	
MAE for AR Model	0.005		0.008		0.692	
MAE of best non-factor model	0.004		0.006		0.692	
MAE of best factor model	0.003		0.006		0.491	
MAE of fac_pooled	0.004		0.006		0.519	

Table 3b: Results for Poland, *h*=1, I(1) prices and wages, combined Euro-area information

Forecast Method	gdp				cpi				rtb3m			
ar_bic	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)
ar_ctrfix	2.08	(1.03)	-1.02	(0.38)	0.83	(0.19)	0.84	(0.33)	1.59	(0.64)	-0.69	(0.54)
ar_ctr_bic	1.85	(0.52)	-0.82	(0.20)	0.79	(0.28)	1.42	(0.95)	1.46	(0.56)	-0.43	(0.78)
ar_ctrfix_ic	0.81	(0.37)	0.59	(0.18)	1.22	(0.86)	0.39	(0.40)	4.08	(4.92)	-0.12	(0.23)
ar_ctr_bic_ic	0.59	(0.47)	0.70	(0.24)	1.60	(1.18)	0.25	(0.38)	3.56	(3.91)	-0.11	(0.26)
eu2_fac__fdiarlag_bic	0.36	(0.56)	1.37	(0.31)	0.96	(0.27)	0.74	(1.62)	2.10	(2.36)	0.23	(0.10)
eu2_fac__fdiar_bic	1.15	(0.27)	0.43	(0.13)	1.13	(0.15)	-1.24	(1.40)	2.30	(2.39)	0.15	(0.19)
eu2_fac__fdi_bic	1.35	(0.39)	0.25	(0.26)	1.61	(0.57)	-0.24	(0.31)	3.73	(8.80)	0.06	(0.22)
eu2_fbp__fdiarlag_bic	1.96	(0.93)	-1.03	(0.29)	0.96	(0.27)	0.74	(1.62)	2.10	(2.36)	0.23	(0.10)
eu2_fbp__fdiar_bic	1.37	(0.91)	0.41	(0.19)	3.37	(5.35)	-0.64	(0.25)	4.22	(8.52)	-0.21	(0.15)
eu2_fbp__fdi_bic	2.27	(1.58)	-0.29	(0.29)	3.01	(2.34)	-0.41	(0.23)	0.92	(0.47)	0.54	(0.25)
eu2_fac__fdiar_05	0.70	(0.36)	0.90	(0.36)	1.17	(0.25)	-0.65	(0.95)	2.58	(4.57)	0.30	(0.13)
eu2_fac__fdiar_06	0.87	(0.49)	0.56	(0.23)	0.97	(0.48)	0.55	(0.70)	2.65	(4.60)	0.32	(0.12)
eu2_fac__fdiar_07	0.94	(0.47)	0.53	(0.22)	1.70	(0.61)	-1.57	(0.62)	3.76	(8.82)	0.26	(0.10)
eu2_fac__fdiar_08	1.85	(0.68)	0.08	(0.28)	2.02	(2.54)	0.02	(0.34)	4.48	(10.05)	0.25	(0.08)
eu2_fac__fdi_05	0.70	(0.36)	0.90	(0.36)	1.27	(0.47)	0.05	(0.49)	0.50	(0.22)	0.67	(0.13)
eu2_fac__fdi_06	0.65	(0.48)	0.72	(0.30)	0.97	(0.48)	0.55	(0.70)	0.76	(0.30)	0.56	(0.10)
eu2_fac__fdi_07	0.76	(0.42)	0.66	(0.26)	1.51	(0.29)	-1.29	(0.48)	1.17	(0.48)	0.46	(0.08)
eu2_fac__fdi_08	0.81	(0.38)	0.61	(0.22)	0.97	(0.37)	0.53	(0.41)	2.03	(1.44)	0.37	(0.07)
eu2_fac_ic_fdiarlag_bic	0.50	(0.60)	0.73	(0.26)	1.89	(1.67)	0.20	(0.35)	2.05	(1.29)	0.28	(0.14)
eu2_fac_ic_fdiar_bic	3.40	(3.77)	0.16	(0.08)	1.99	(2.09)	0.13	(0.36)	3.26	(5.21)	0.12	(0.20)
eu2_fac_ic_fdi_bic	2.66	(3.55)	0.26	(0.07)	1.50	(1.03)	0.25	(0.42)	5.21	(12.92)	-0.15	(0.15)
eu2_fbp_ic_fdiarlag_bic	0.90	(0.48)	0.54	(0.22)	2.64	(3.97)	-0.03	(0.26)	2.05	(1.29)	0.28	(0.14)
eu2_fbp_ic_fdiar_bic	2.52	(3.55)	0.29	(0.19)	9.18	(49.73)	-0.14	(0.05)	6.13	(17.55)	-0.15	(0.14)
eu2_fbp_ic_fdi_bic	2.22	(1.98)	0.24	(0.18)	2.01	(1.58)	-0.11	(0.35)	1.81	(1.49)	0.20	(0.30)
eu2_fac_ic_fdiar_05	1.38	(0.68)	0.41	(0.11)	2.60	(3.69)	-0.05	(0.25)	2.93	(3.60)	0.30	(0.07)
eu2_fac_ic_fdiar_06	2.39	(1.93)	0.26	(0.09)	1.87	(1.78)	0.16	(0.37)	3.84	(5.85)	0.27	(0.06)
eu2_fac_ic_fdiar_07	2.62	(2.40)	0.25	(0.09)	2.38	(3.22)	0.02	(0.31)	3.93	(6.22)	0.25	(0.06)
eu2_fac_ic_fdiar_08	3.50	(4.10)	0.18	(0.07)	5.57	(18.57)	-0.06	(0.14)	3.11	(4.19)	0.29	(0.08)
eu2_fac_ic_fdi_05	1.38	(0.68)	0.41	(0.11)	1.38	(0.99)	0.23	(0.53)	0.94	(0.37)	0.52	(0.10)
eu2_fac_ic_fdi_06	1.72	(1.16)	0.35	(0.13)	1.87	(1.78)	0.16	(0.37)	1.14	(0.41)	0.47	(0.08)
eu2_fac_ic_fdi_07	1.94	(1.54)	0.33	(0.12)	2.03	(2.33)	0.11	(0.36)	1.23	(0.48)	0.44	(0.11)
eu2_fac_ic_fdi_08	2.12	(1.94)	0.32	(0.11)	2.38	(3.18)	0.13	(0.31)	1.24	(0.47)	0.43	(0.11)
fac_pooled	1.15	(0.35)	0.44	(0.11)	1.76	(1.54)	-0.12	(0.40)	0.64	(0.26)	0.68	(0.25)
RMSE for AR Model	0.006				0.009				0.705			

See notes to Table 1.

Table 4a: Results for Slovakia, *h*=1, I(1) prices and wages, country-specific factors

Forecast Method	gdp				cpi				lending rate			
ar_bic	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)
ar_bic_i2	1.90	(1.02)	0.08	(0.23)	1.06	(0.41)	0.46	(0.27)	2.42	(3.59)	0.05	(0.37)
ar_bic_ic	2.91	(2.99)	-0.31	(0.31)	0.69	(0.39)	0.60	(0.14)	3.56	(4.99)	-0.37	(0.19)
_varf	0.89	(0.25)	0.62	(0.26)	0.98	(0.29)	0.54	(0.60)	1.27	(0.53)	0.36	(0.22)
_varfic	2.31	(1.31)	0.05	(0.20)	1.08	(0.59)	0.48	(0.16)	3.14	(2.94)	-0.23	(0.25)
a_fac__fdiarlag_bic	6.56	(34.35)	-0.22	(0.01)	1.37	(0.68)	-0.04	(0.64)	1.23	(0.29)	0.30	(0.28)
a_fac__fdiar_bic	14.82	(128.32)	-0.17	(0.01)	1.37	(0.51)	-0.27	(0.25)	6.87	(35.51)	-0.21	(0.02)
a_fac__fdi_bic	27.31	(464.24)	-0.12	(0.00)	1.00	(0.00)	15.87	(48.55)	1.23	(0.29)	0.30	(0.28)
a_fbp__fdiarlag_bic	0.99	(0.11)	0.74	(2.17)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
a_fbp__fdiar_bic	28.26	(645.52)	-0.11	(0.02)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
a_fbp__fdi_bic	0.99	(0.11)	0.74	(2.17)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
a_fac__fdiar_01	1.91	(0.73)	-0.63	(0.44)	0.99	(0.13)	0.58	(1.06)	1.16	(0.29)	0.37	(0.24)
a_fac__fdiar_02	4.12	(5.83)	-0.28	(0.11)	1.26	(0.50)	0.15	(0.41)	1.17	(0.30)	0.36	(0.24)
a_fac__fdiar_03	9.07	(41.41)	-0.26	(0.03)	1.05	(0.43)	0.46	(0.30)	1.18	(0.47)	0.40	(0.23)
a_fac__fdiar_04	8.22	(43.12)	-0.13	(0.11)	1.23	(0.47)	0.27	(0.35)	0.44	(0.35)	0.68	(0.11)
a_fac__fdi_01	1.91	(0.73)	-0.63	(0.44)	0.99	(0.13)	0.58	(1.06)	1.16	(0.29)	0.37	(0.24)
a_fac__fdi_02	2.26	(1.06)	-0.48	(0.23)	1.03	(0.18)	0.43	(0.44)	1.17	(0.30)	0.36	(0.24)
a_fac__fdi_03	3.42	(4.67)	-0.48	(0.10)	1.05	(0.18)	0.38	(0.40)	1.18	(0.47)	0.40	(0.23)
a_fac__fdi_04	5.74	(20.19)	-0.05	(0.17)	0.95	(0.17)	0.61	(0.37)	0.44	(0.35)	0.68	(0.11)
a_fac_ic_fdiarlag_bic	15.36	(120.43)	-0.10	(0.06)	1.73	(1.20)	0.34	(0.18)	2.44	(2.88)	-0.21	(0.22)
a_fac_ic_fdiar_bic	30.60	(317.51)	-0.09	(0.04)	1.22	(0.77)	0.44	(0.18)	15.69	(148.13)	-0.22	(0.02)
a_fac_ic_fdi_bic	55.23	(1174.48)	-0.07	(0.03)	0.41	(0.32)	0.81	(0.14)	2.44	(2.88)	-0.21	(0.22)
a_fbp_ic_fdiarlag_bic	2.66	(1.79)	0.09	(0.18)	0.63	(0.35)	0.64	(0.14)	2.44	(2.88)	-0.21	(0.22)
a_fbp_ic_fdiar_bic	62.29	(1946.59)	-0.07	(0.02)	0.63	(0.35)	0.64	(0.14)	2.44	(2.88)	-0.21	(0.22)
a_fbp_ic_fdi_bic	2.66	(1.79)	0.09	(0.18)	0.63	(0.35)	0.64	(0.14)	2.44	(2.88)	-0.21	(0.22)
a_fac_ic_fdiar_01	4.67	(6.69)	-0.09	(0.18)	0.61	(0.36)	0.65	(0.15)	2.46	(3.41)	-0.21	(0.22)
a_fac_ic_fdiar_02	7.05	(16.08)	-0.20	(0.12)	1.61	(1.07)	0.36	(0.15)	2.53	(3.51)	-0.23	(0.20)
a_fac_ic_fdiar_03	22.78	(247.73)	-0.09	(0.04)	1.95	(1.24)	0.34	(0.11)	2.23	(2.75)	-0.05	(0.34)
a_fac_ic_fdiar_04	17.66	(135.04)	-0.08	(0.05)	1.82	(1.34)	0.36	(0.12)	2.43	(3.79)	0.23	(0.27)
a_fac_ic_fdi_01	4.67	(6.69)	-0.09	(0.18)	0.61	(0.36)	0.65	(0.15)	2.46	(3.41)	-0.21	(0.22)
a_fac_ic_fdi_02	5.73	(9.85)	-0.09	(0.14)	1.01	(0.51)	0.50	(0.16)	2.53	(3.51)	-0.23	(0.20)
a_fac_ic_fdi_03	9.44	(36.28)	-0.10	(0.09)	1.10	(0.57)	0.47	(0.16)	2.23	(2.75)	-0.05	(0.34)
a_fac_ic_fdi_04	9.87	(45.93)	0.00	(0.07)	1.01	(0.44)	0.50	(0.12)	2.43	(3.79)	0.23	(0.27)
fac_pooled	17.35	(138.83)	-0.11	(0.05)	0.91	(0.42)	0.56	(0.27)	2.67	(3.16)	-0.15	(0.31)
RMSE for AR Model	0.004				0.010				0.502			
MAE for AR Model	0.003				0.009				0.402			
MAE of best non-factor model	0.003				0.005				0.458			
MAE of best factor model	0.003				0.007				0.310			
MAE of fac_pooled	0.013				0.007				0.679			

Table 4b: Results for Slovakia, *h*=1, I(1) prices and wages, combined Euro-area information

Forecast Method	gdp				cpi				lending rate			
ar_bic	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)
ar_ctrfix	1.97	(1.48)	-0.07	(0.25)	1.36	(0.62)	0.14	(0.57)	3.52	(5.28)	0.19	(0.18)
ar_ctr_bic	1.45	(0.55)	-0.41	(0.52)	1.22	(0.19)	-1.19	(0.29)	1.41	(0.37)	0.17	(0.24)
ar_ctrfix_ic	4.26	(3.97)	-0.06	(0.13)	1.45	(0.78)	0.41	(0.13)	3.92	(2.68)	0.14	(0.15)
ar_ctr_bic_ic	2.52	(1.97)	-0.06	(0.25)	0.61	(0.43)	0.66	(0.21)	2.84	(2.90)	-0.76	(0.23)
eu2_fac__fdiarlag_bic	0.99	(0.11)	0.74	(2.17)	1.63	(0.81)	-0.58	(0.67)	1.23	(0.29)	0.30	(0.28)
eu2_fac__fdiar_bic	20.24	(363.96)	-0.11	(0.00)	1.37	(0.51)	-0.27	(0.25)	7.32	(40.87)	-0.20	(0.02)
eu2_fac__fdi_bic_f	0.99	(0.11)	0.74	(2.17)	1.00	(0.00)	15.87	(48.55)	1.23	(0.29)	0.30	(0.28)
eu2_fbp__fdiarlag_bic	0.99	(0.11)	0.74	(2.17)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
eu2_fbp__fdiar_bic	0.99	(0.11)	0.74	(2.17)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
eu2_fbp__fdi_bic	0.99	(0.11)	0.74	(2.17)	1.00	(0.13)	0.52	(0.88)	1.23	(0.29)	0.30	(0.28)
eu2_fac__fdiar_05	6.76	(28.44)	-0.05	(0.14)	1.43	(0.61)	0.19	(0.29)	1.01	(0.67)	0.50	(0.20)
eu2_fac__fdiar_06	13.21	(100.70)	-0.06	(0.08)	1.59	(0.90)	0.15	(0.25)	2.39	(2.75)	0.24	(0.16)
eu2_fac__fdiar_07	23.26	(411.48)	-0.08	(0.03)	2.10	(1.46)	0.03	(0.14)	4.90	(20.17)	0.15	(0.13)
eu2_fac__fdiar_08	25.67	(467.98)	-0.09	(0.03)	0.92	(0.64)	0.53	(0.24)	5.17	(14.22)	0.11	(0.17)
eu2_fac__fdi_05	6.39	(21.51)	-0.02	(0.15)	1.11	(0.24)	0.36	(0.26)	1.01	(0.67)	0.50	(0.20)
eu2_fac__fdi_06	13.26	(104.58)	-0.06	(0.08)	1.33	(0.38)	0.22	(0.21)	2.39	(2.75)	0.24	(0.16)
eu2_fac__fdi_07	13.91	(101.01)	-0.05	(0.08)	1.81	(1.13)	0.05	(0.11)	4.90	(20.17)	0.15	(0.13)
eu2_fac__fdi_08	28.62	(547.16)	-0.06	(0.04)	0.49	(0.36)	0.75	(0.23)	5.17	(14.22)	0.11	(0.17)
eu2_fac_ic_fdiarlag_bic	2.66	(1.79)	0.09	(0.18)	1.57	(1.13)	0.34	(0.22)	2.44	(2.88)	-0.21	(0.22)
eu2_fac_ic_fdiar_bic	41.63	(991.76)	-0.06	(0.03)	1.22	(0.77)	0.44	(0.18)	15.04	(143.88)	-0.23	(0.01)
eu2_fac_ic_fdi_bi	2.66	(1.79)	0.09	(0.18)	0.41	(0.32)	0.81	(0.14)	2.44	(2.88)	-0.21	(0.22)
eu2_fbp_ic_fdiarlag_bic	2.66	(1.79)	0.09	(0.18)	1.04	(0.53)	0.49	(0.15)	2.44	(2.88)	-0.21	(0.22)
eu2_fbp_ic_fdiar_bic	2.66	(1.79)	0.09	(0.18)	0.63	(0.35)	0.64	(0.14)	2.44	(2.88)	-0.21	(0.22)
eu2_fbp_ic_fdi_bic	2.66	(1.79)	0.09	(0.18)	0.63	(0.35)	0.64	(0.14)	2.44	(2.88)	-0.21	(0.22)
eu2_fac_ic_fdiar_05	19.51	(186.08)	-0.06	(0.04)	1.62	(0.85)	0.35	(0.15)	4.83	(8.71)	0.11	(0.15)
eu2_fac_ic_fdiar_06	41.45	(849.79)	-0.04	(0.03)	3.03	(4.23)	0.26	(0.12)	9.77	(35.07)	0.03	(0.08)
eu2_fac_ic_fdiar_07	61.95	(2056.85)	-0.05	(0.02)	3.55	(7.36)	0.24	(0.12)	12.26	(66.97)	0.01	(0.06)
eu2_fac_ic_fdiar_08	61.98	(2284.74)	-0.06	(0.03)	2.91	(4.02)	0.26	(0.11)	4.58	(6.41)	-0.10	(0.17)
eu2_fac_ic_fdi_05	12.76	(95.21)	-0.02	(0.06)	1.62	(0.93)	0.37	(0.13)	4.83	(8.71)	0.11	(0.15)
eu2_fac_ic_fdi_06	31.45	(580.20)	-0.03	(0.03)	2.31	(2.00)	0.28	(0.13)	9.77	(35.07)	0.03	(0.08)
eu2_fac_ic_fdi_07	37.32	(824.10)	-0.03	(0.03)	2.46	(2.96)	0.29	(0.13)	12.26	(66.97)	0.01	(0.06)
eu2_fac_ic_fdi_08	74.55	(3312.41)	-0.03	(0.02)	1.45	(1.00)	0.40	(0.14)	4.58	(6.41)	-0.10	(0.17)
fac_pooled	14.52	(112.04)	-0.11	(0.04)	0.84	(0.42)	0.58	(0.23)	1.80	(1.36)	-0.12	(0.49)
RMSE for AR Model	0.004				0.010				0.502			

See notes to Table 1.

Table 5a: Results for Slovenia, *h*=1, I(1) prices and wages, country-specific factors

Forecast Method	gdp		cpi		lending rate	
ar_bic	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)	1.00 (0.00)	. (.)
ar_bic_i2	0.92 (0.56)	0.54 (0.30)	2.07 (1.20)	-0.48 (0.32)	3.07 (3.29)	0.01 (0.14)
ar_bic_ic	0.79 (0.55)	0.59 (0.26)	2.16 (1.32)	-0.09 (0.34)	3.51 (3.30)	-0.03 (0.17)
_varf	2.07 (1.47)	-1.39 (0.21)	1.51 (0.56)	-0.62 (0.58)	5.11 (11.66)	-0.01 (0.24)
_varfic	1.69 (1.62)	0.29 (0.27)	3.66 (3.26)	-0.09 (0.21)	11.53 (42.22)	0.07 (0.09)
a_fac__fdiarlag_bic	1.39 (0.27)	-2.60 (1.44)	1.52 (0.64)	-0.50 (0.41)	2.70 (1.81)	-0.03 (0.24)
a_fac__fdiar_bic	1.39 (0.27)	-2.60 (1.44)	1.52 (0.64)	-0.50 (0.41)	2.84 (2.21)	-0.19 (0.21)
a_fac__fdi_bic	0.92 (0.31)	0.68 (0.79)	1.02 (0.04)	-3.78 (7.54)	2.84 (2.21)	-0.19 (0.21)
a_fbp__fdiarlag_bic	1.39 (0.27)	-2.60 (1.44)	1.02 (0.04)	-3.78 (7.54)	3.20 (2.14)	-0.18 (0.26)
a_fbp__fdiar_bic	1.39 (0.27)	-2.60 (1.44)	1.26 (0.76)	0.31 (0.42)	3.15 (2.44)	-0.30 (0.22)
a_fbp__fdi_bic	1.17 (0.37)	0.22 (0.61)	1.21 (0.75)	0.36 (0.40)	3.15 (2.44)	-0.30 (0.22)
a_fac__fdiar_01	1.46 (0.32)	-2.27 (1.32)	1.19 (0.26)	-0.49 (1.07)	2.84 (2.21)	-0.19 (0.21)
a_fac__fdiar_02	1.33 (0.26)	-0.77 (0.82)	1.23 (0.61)	0.20 (0.59)	2.72 (1.98)	-0.22 (0.23)
a_fac__fdiar_03	1.38 (0.31)	-0.92 (0.76)	1.28 (0.67)	0.20 (0.53)	4.56 (8.18)	-0.28 (0.15)
a_fac__fdiar_04	1.14 (0.32)	0.23 (0.59)	1.14 (0.42)	0.20 (0.79)	6.16 (19.81)	-0.28 (0.07)
a_fac__fdi_01	0.53 (0.26)	1.45 (0.38)	1.03 (0.07)	-1.68 (3.81)	2.84 (2.21)	-0.19 (0.21)
a_fac__fdi_02	0.46 (0.27)	1.33 (0.30)	1.03 (0.07)	-1.03 (3.91)	2.72 (1.98)	-0.22 (0.23)
a_fac__fdi_03	0.44 (0.27)	1.44 (0.32)	1.16 (0.24)	-0.25 (1.09)	2.91 (2.42)	-0.25 (0.23)
a_fac__fdi_04	0.54 (0.26)	1.30 (0.25)	1.14 (0.42)	0.20 (0.79)	2.57 (2.08)	-0.27 (0.22)
a_fac_ic_fdiarlag_bic	0.97 (0.77)	0.51 (0.35)	4.54 (6.31)	-0.06 (0.20)	5.94 (9.53)	-0.29 (0.18)
a_fac_ic_fdiar_bic	0.97 (0.77)	0.51 (0.35)	4.54 (6.31)	-0.06 (0.20)	6.66 (9.77)	-0.26 (0.15)
a_fac_ic_fdi_bic	1.57 (0.49)	0.39 (0.08)	2.16 (1.31)	-0.08 (0.34)	6.66 (9.77)	-0.26 (0.15)
a_fbp_ic_fdiarlag_bic	0.97 (0.77)	0.51 (0.35)	2.16 (1.31)	-0.08 (0.34)	6.32 (12.72)	-0.32 (0.14)
a_fbp_ic_fdiar_bic	0.97 (0.77)	0.51 (0.35)	2.66 (2.73)	-0.04 (0.22)	6.68 (12.68)	-0.37 (0.14)
a_fbp_ic_fdi_bic	1.55 (0.99)	0.40 (0.10)	2.57 (2.50)	0.09 (0.22)	6.68 (12.68)	-0.37 (0.14)
a_fac_ic_fdiar_01	0.98 (0.79)	0.51 (0.34)	3.05 (2.76)	-0.10 (0.26)	6.66 (9.77)	-0.26 (0.15)
a_fac_ic_fdiar_02	0.50 (0.35)	0.77 (0.22)	4.24 (6.43)	-0.01 (0.20)	6.53 (9.79)	-0.27 (0.15)
a_fac_ic_fdiar_03	0.55 (0.37)	0.72 (0.21)	4.40 (6.96)	-0.02 (0.19)	10.37 (40.95)	-0.27 (0.06)
a_fac_ic_fdiar_04	0.45 (0.27)	0.68 (0.13)	3.47 (4.00)	-0.02 (0.22)	14.82 (101.06)	-0.20 (0.04)
a_fac_ic_fdi_01	0.89 (0.46)	0.53 (0.13)	2.27 (1.51)	-0.12 (0.33)	6.66 (9.77)	-0.26 (0.15)
a_fac_ic_fdi_02	0.57 (0.28)	0.60 (0.08)	2.25 (1.48)	-0.13 (0.34)	6.53 (9.79)	-0.27 (0.15)
a_fac_ic_fdi_03	0.46 (0.28)	0.64 (0.09)	2.69 (2.33)	0.01 (0.27)	7.42 (11.48)	-0.34 (0.09)
a_fac_ic_fdi_04	0.47 (0.29)	0.65 (0.10)	3.47 (4.00)	-0.02 (0.22)	6.91 (10.67)	-0.38 (0.08)
fac_pooled	0.67 (0.30)	0.83 (0.30)	1.67 (0.88)	-0.04 (0.41)	5.46 (15.52)	-0.17 (0.10)
RMSE for AR Model	0.006		0.005		0.606	
MAE for AR Model	0.005		0.004		0.517	
MAE of best non-factor model	0.003		0.005		0.729	
MAE of best factor model	0.003		0.004		0.853	
MAE of fac_pooled	0.003		0.005		1.158	

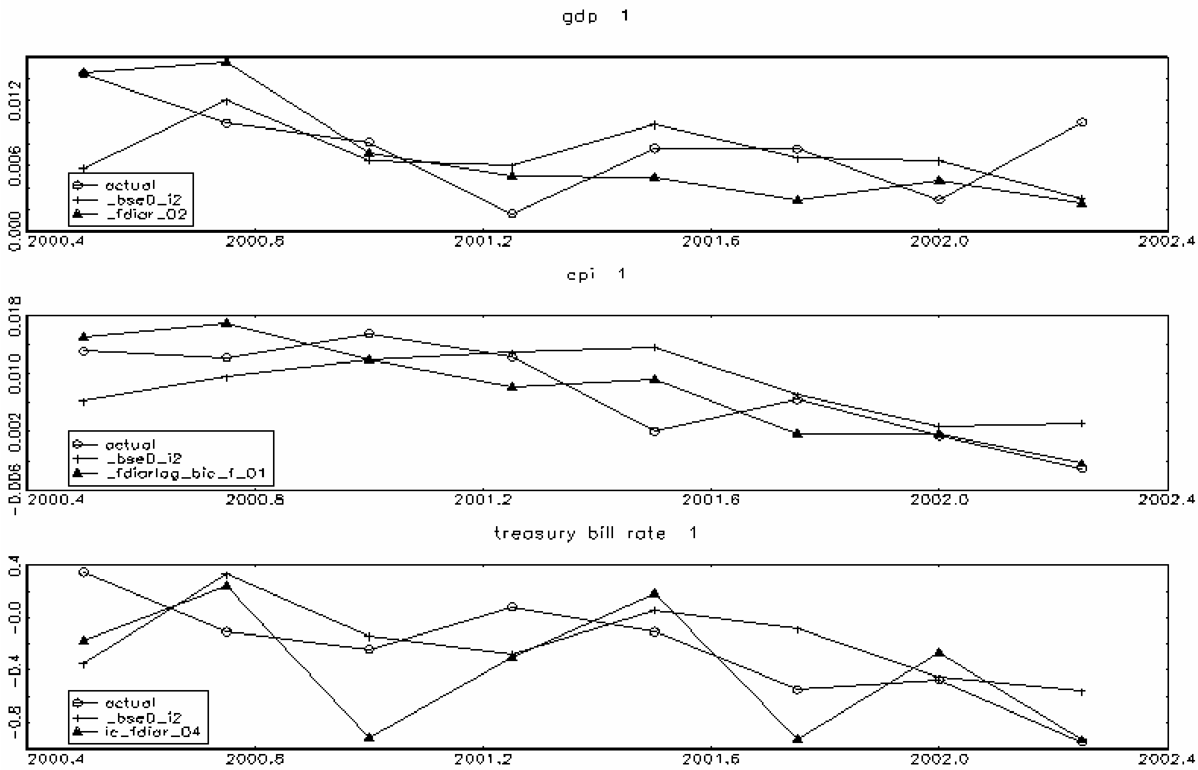
Table 5b: Results for Slovenia, *h*=1, I(1) prices and wages, combined Euro-area information

Forecast Method	gdp				cpi				lending rate			
ar_bic	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)	1.00	(0.00)	.	(.)
ar_ctrfix	1.11	(0.48)	0.42	(0.30)	2.75	(3.62)	-0.22	(0.22)	4.41	(5.97)	-0.07	(0.10)
ar_ctr	0.42	(0.29)	1.20	(0.24)	1.82	(1.07)	-0.56	(0.31)	1.95	(1.23)	-0.17	(0.26)
ar_ctrfixic	0.97	(0.45)	0.51	(0.16)	5.40	(12.84)	-0.03	(0.17)	9.37	(35.09)	-0.04	(0.11)
ar_ctric	0.65	(0.27)	0.60	(0.06)	4.31	(5.88)	-0.02	(0.20)	2.97	(2.57)	-0.38	(0.27)
eu2_fac__fdiarlag_bic	1.39	(0.27)	-2.60	(1.44)	1.52	(0.64)	-0.50	(0.41)	2.70	(1.81)	-0.03	(0.24)
eu2_fac__fdiar_bic	4.81	(10.19)	0.05	(0.14)	1.52	(0.64)	-0.50	(0.41)	2.84	(2.21)	-0.19	(0.21)
eu2_fac__fdi_bic	1.95	(1.67)	0.33	(0.10)	1.02	(0.04)	-3.78	(7.54)	2.84	(2.21)	-0.19	(0.21)
eu2_fbp__fdiarlag_bic	1.39	(0.27)	-2.60	(1.44)	1.02	(0.04)	-3.78	(7.54)	3.49	(2.55)	-0.16	(0.21)
eu2_fbp__fdiar_bic	2.17	(2.80)	0.21	(0.24)	5.59	(18.96)	0.04	(0.14)	12.38	(90.02)	0.02	(0.06)
eu2_fbp__fdi_bic	4.09	(12.41)	0.08	(0.18)	6.30	(30.94)	-0.12	(0.04)	3.15	(2.44)	-0.30	(0.22)
eu2_fac__fdiar_05	1.43	(0.38)	-0.24	(0.41)	1.16	(0.41)	0.11	(0.82)	10.07	(68.94)	-0.11	(0.09)
eu2_fac__fdiar_06	2.01	(2.05)	-0.05	(0.19)	1.51	(0.60)	-0.41	(0.48)	9.52	(53.11)	-0.18	(0.08)
eu2_fac__fdiar_07	1.95	(1.25)	-0.10	(0.36)	1.66	(0.52)	-0.71	(0.37)	10.20	(54.05)	-0.18	(0.06)
eu2_fac__fdiar_08	1.31	(0.57)	0.35	(0.23)	2.36	(2.24)	-0.16	(0.28)	20.35	(185.09)	-0.05	(0.11)
eu2_fac__fdi_05	1.13	(0.36)	0.35	(0.44)	1.16	(0.41)	0.11	(0.82)	4.22	(6.22)	-0.28	(0.16)
eu2_fac__fdi_06	1.10	(0.57)	0.36	(0.63)	1.51	(0.60)	-0.41	(0.48)	4.60	(5.94)	-0.44	(0.13)
eu2_fac__fdi_07	1.07	(0.54)	0.41	(0.65)	1.66	(0.52)	-0.71	(0.37)	5.90	(9.27)	-0.22	(0.16)
eu2_fac__fdi_08	1.40	(1.05)	0.22	(0.43)	2.36	(2.24)	-0.16	(0.28)	14.05	(96.17)	-0.05	(0.14)
eu2_fac_ic_fdiarlag_bic	0.97	(0.77)	0.51	(0.35)	4.54	(6.31)	-0.06	(0.20)	5.94	(9.53)	-0.29	(0.18)
eu2_fac_ic_fdiar_bic	9.19	(52.94)	0.08	(0.11)	4.54	(6.31)	-0.06	(0.20)	6.66	(9.77)	-0.26	(0.15)
eu2_fac_ic_fdi_bic	2.28	(2.45)	0.30	(0.16)	2.16	(1.31)	-0.08	(0.34)	6.66	(9.77)	-0.26	(0.15)
eu2_fbp_ic_fdiarlag_bic	0.97	(0.77)	0.51	(0.35)	2.16	(1.31)	-0.08	(0.34)	6.68	(12.68)	-0.37	(0.14)
eu2_fbp_ic_fdiar_bic	5.61	(15.12)	0.10	(0.09)	8.31	(38.15)	-0.01	(0.12)	11.26	(39.04)	0.05	(0.08)
eu2_fbp_ic_fdi_bic	8.50	(40.94)	0.11	(0.10)	16.26	(144.65)	-0.09	(0.04)	6.68	(12.68)	-0.37	(0.14)
eu2_fac_ic_fdiar_05	1.71	(1.84)	0.34	(0.22)	3.46	(3.97)	-0.05	(0.22)	21.34	(196.53)	-0.02	(0.07)
eu2_fac_ic_fdiar_06	1.22	(0.83)	0.45	(0.16)	4.49	(6.59)	-0.12	(0.17)	21.37	(152.59)	-0.08	(0.06)
eu2_fac_ic_fdiar_07	3.12	(4.23)	0.13	(0.16)	4.75	(7.11)	-0.10	(0.16)	23.87	(193.04)	-0.06	(0.06)
eu2_fac_ic_fdiar_08	2.21	(2.17)	0.24	(0.11)	6.99	(16.30)	-0.07	(0.12)	29.33	(290.15)	-0.02	(0.06)
eu2_fac_ic_fdi_05	2.47	(2.86)	0.28	(0.14)	3.46	(3.97)	-0.05	(0.22)	8.62	(33.73)	-0.08	(0.10)
eu2_fac_ic_fdi_06	1.44	(0.96)	0.42	(0.14)	4.49	(6.59)	-0.12	(0.17)	10.23	(33.83)	-0.16	(0.08)
eu2_fac_ic_fdi_07	1.68	(1.14)	0.38	(0.14)	4.75	(7.11)	-0.10	(0.16)	11.34	(49.32)	-0.08	(0.09)
eu2_fac_ic_fdi_08	2.23	(1.96)	0.32	(0.13)	6.99	(16.30)	-0.07	(0.12)	21.76	(124.84)	-0.01	(0.08)
fac_pooled	1.26	(0.85)	0.40	(0.25)	3.54	(5.40)	-0.14	(0.18)	5.69	(10.88)	-0.08	(0.21)
RMSE for AR Model	0.006				0.005				0.606			

See notes to Table 1.

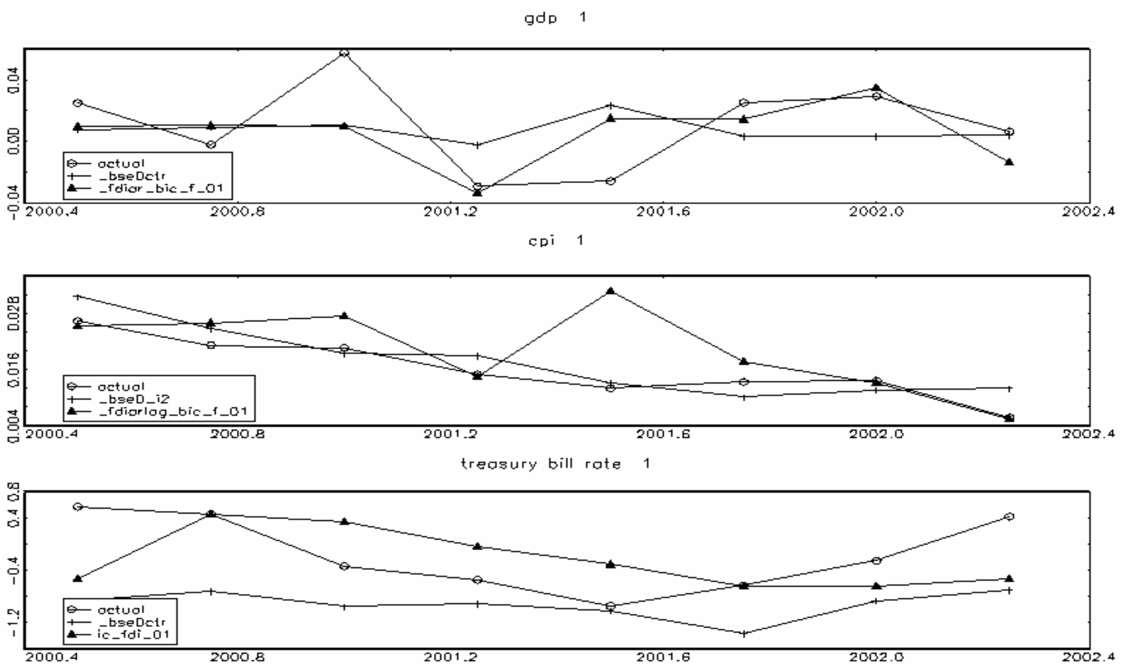
Appendix B: Figures

Figure 1: The Czech Republic (I(1) prices and wages)



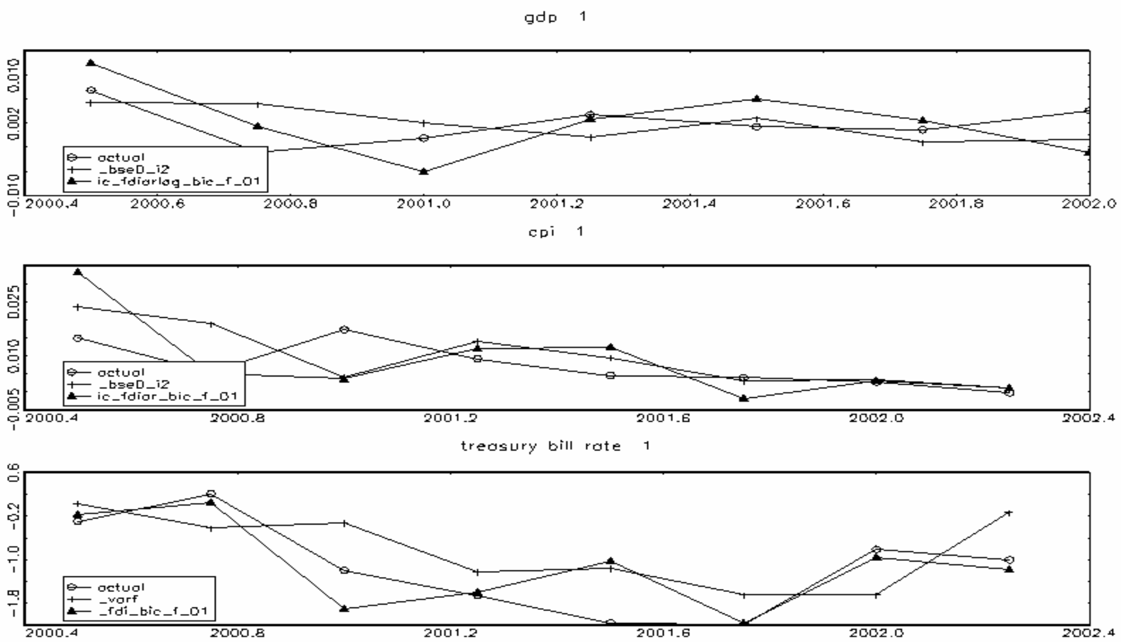
Note: Each figure plots the actual series and the one-step ahead forecasts obtained from the best non-factor model and the best factor model. (See note to Table 1 for definitions of forecasting methods.)

Figure 2: Hungary (I(1) prices and wages)



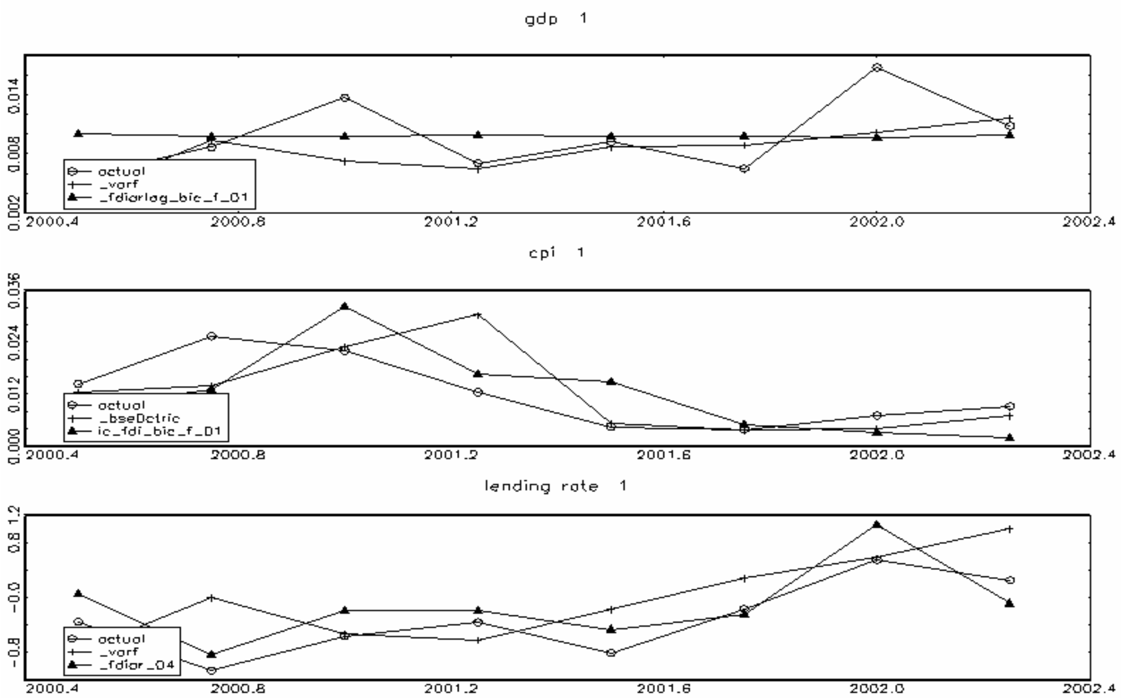
See note to Figure 1.

Figure 3: Poland (I(1) prices and wages)



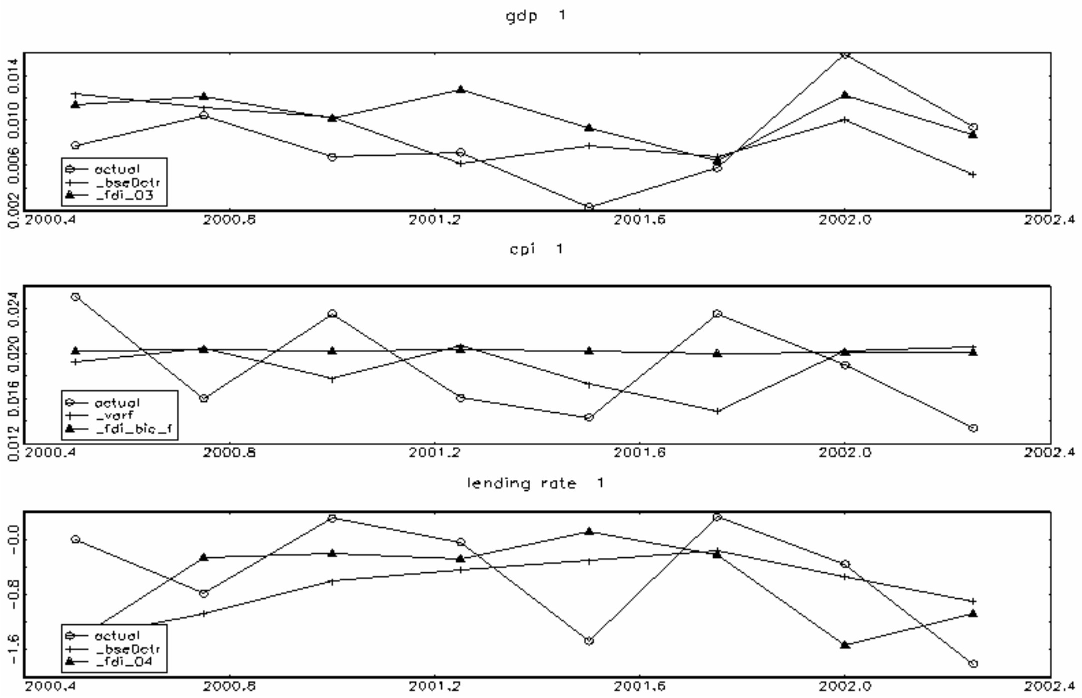
See note to Figure 1.

Figure 4: Slovakia (I(1) prices and wages)



See note to Figure 1.

Figure 5: Slovenia (I(1) prices and wages)



See note to Figure 1.

Appendix C: The data sets

The Czech Republic

gdp	gross domestic product 1995 prices units: 1995 CZK bln
gdphcons	households consumption expenditure 1995 prices
gdpcons	private final consumption expenditure 1995 prices
gdpgov	government final consumption expenditure 1995 prices
gdpi	gross fixed capital formation
gdpstocks	increase in stocks and net acqu.of valuables
gdpex	exports of goods and services 1995 prices
gdpim	imports of goods and services 1995 prices
gdpag	agriculture, hunting, forestry and fishing 1995 prices
gdpman	mining, manufacturing, electricity and gas 1995 prices
gdpcons	construction 1995 prices
gdpserv	services 1995 prices
ipsteel	production crude steel units: tonnes '000
ip	industrial production s.a. units: 1995=100
ipman	IIP manufacturing s.a. units: 1995=100
ipmin	IIP mining s.a. units: 1995=100
ipelec	IIP electricity gas & water s.a. units: 1995=100
ipcons	IIP construction units: 1995=100
capu	BSS Rate of capacity utilisation units: %
cconf	consumer confidence indicator s.a. units: % balance
emplciv	civilian employment (LFS) units: 1995 = 100
empl	employees: total units: '000
emplman	employees: manufacturing units: '000
unemreg	uneployment registered units: '000
unemregr	registered unemp % total labour force s.a. units: %
unemrstand	standardized unemployment rate s.a. units: per cent
vac	unfilled job vacancies units: '000
wman	monthly earnings: manuf. proxy units: 1995 = 100
ppiind	PPI industry units: 1995=100
ppiman	PPI manufacturing units: 1995=100
cpi	CPI all items units: 1995=100
cpinf	CPI all items nonfood nonenergy units: 1995=100
cpien	CPI energy units: 1995=100
cpif	CPI Food proxy incl. restaurants units: 1995=100
cpiserv	CPI services less housing units: 1995=100
cpihous	CPI housing units: 1995=100
m1	monetary aggregate M1 s.a.
m2	monetary aggregate M2 s.a.
rdics	discount rate units: % p.a.
rintb	CZE 3month PRIBOR units: % p.a.
rtb	treasury bill yield units: % p.a.
sharep	share prices: PX50 index units: 1995=100
nxrusd	Koruny/USD exchange rate monthly average
rexr	real effective exchange rate units: 1995 = 100
export	ITS Exports Total s.a. units: billions US dollars; monthly averages
import	ITS Imports Total s.a. units: billions US dollars; monthly averages
tbal	ITS net trade s.a. units: billions US dollars; monthly averages
cabal	BOP Current balance USD s.a. units: billions US dollars

Hungary

gdp	gross domestic product 1995 prices units: 1995 HUF bln
gdphcons	households consumption expenditure 1995 prices
gdpgov	government final consumption expenditure 1995 prices
gdpi	gross fixed capital formation
gdpstocks	increase in stocks and net acqu.of valuables
ipsteel	production crude steel units: tonnes '000
ip	industrial production s.a. units: 1995=100
ipman	IIP manufacturing s.a. units: 1995=100
ipmin	IIP mining s.a. units: 1995=100
ipelec	IIP electricity gas & water s.a. units: 1995=100
prodtend	BSS Production: tendency units: % balance
fprodtend	BSS Production: future tendency units: % balance
stocks	BSS Finished goods stocks: level units: % balance
orders	BSS Order books: level units: % balance
expord	BSS Western export orders: level units: % balance
capu	BSS Rate of capacity utilisation units: %
bustend	BSS Business situation: tendency units: % balance
ecprosp	BSS Prospects for total economy units: % balance
cconf	consumer confidence indicator s.a. units: % balance
saltot	sales volume total s.a. units: 1995=100
saldom	sales volume domestic trade s.a. units: 1995=100
salexp	sales volume export goods s.a. units: 1995=100
hous	dwellings completed s.a. units: '000
retsal	retail sales volume s.a. units: 1995=100
emplciv	civilian employment (LFS) units: 1995 = 100
empl	employees: total units: '000
emplman	employees: manufacturing units: '000
emplind	employees: industry units: '000
unemreg	uneployment registered units: '000
unemregr	registered unemp % total labour force s.a. units: %
unemrstand	standardized unemployment rate s.a. units: per cent
vac	unfilled job vacancies units: '000
hours	monthly hours worked mfg units: hours
wall	monthly earnings: all activities units: 1995=100
wman	monthly earnings: manuf. proxy units: 1995 = 100
ppiind	PPI industry units: 1995=100
ppiman	PPI manufacturing units: 1995=100
whp	wholesale prices
cpi	CPI all items units: 1995=100
cpinf	CPI all items nonfood nonenergy units: 1995=100
cpien	CPI energy units: 1995=100
cpif	CPI Food proxy incl. restaurants units: 1995=100
cpiserv	CPI services units: 1995=100
m1	monetary aggregate M1
m2	monetary aggregate M2
m3	monetary aggregate M3
rdics	discount rate units: % p.a.
rintb	interbank rate <= 2 days units: % p.a.
rtb3m	90 day treasury bill yield units: % p.a.
sharep	Share prices: BUX Share price index units: 1995=100
nxrusd	Forint/USD exchange rate monthly
nxreur	Forint/EUR exchange rate monthly
rexr	real effective exchange rate units: 1995 = 100

export	ITS Exports Total s.a. units: billions US dollars; monthly averages
import	ITS Imports Total s.a. units: billions US dollars; monthly averages
tbal	ITS net trade s.a. units: billions US dollars; monthly averages
cabal	BOP Current balance USD s.a. units: billions US dollars
fdiout	BOP Direct investment abroad units: HUF bln
fdiin	BOP Direct investment in reporting economy units: HUF bln
potrfout	BOP Portfolio investment, assets units: HUF bln
portfin	BOP Portfolio investment, liabilities units: HUF bln

Poland

gdp	gross domestic product 1995 prices units: 1995 SVK bln
gdphcons	Households consumption expenditure 1995 prices
gdpcons	Private final consumption expenditure 1995 prices
gdpgov	government final consumption expenditure 1995 prices
gdpi	gross fixed capital formation
gdpstocks	increase in stocks and net acqu.of valuables
gdpex	exports of goods and services 1995 prices
gdpim	imports of goods and services 1995 prices
gdpag	agriculture, hunting, forestry and fishing 1995 prices
gdpman	mining, manufacturing, electricity and gas 1995 prices
gdpcons	construction 1995 prices
gdpserv	services 1995 prices
taxes	taxes on products less subsidies, 1995 prices
ipsteel	production crude steel units: tonnes '000
ipcem	production cement units: tonnes '000
ipcoal	production coal units: tonnes '000
ip	industrial production units: 1995=100 s.a.
ipman	IIP manufacturing units: 1995=100
ipmin	IIP mining units: 1995=100
ipelec	IIP electricity gas & water units: 1995=100
ipcons	IIP construction units: 1995=100
emplciv	civilian enployment(LFS) units: 1995 = 100
empl	employment: Total (LFS) units: 1995 = 100
emplind	employees: industry units: '000
emplman	employees: manufacturing units: '000
unemreg	uneployment registered units: '000
unemregr	registered unemp % total labour force s.a. units: %
unemrst	standardized unemployment rate s.a. units: per cent
vac	unfilled job vacancies s.a. units: '000
m	money s.a. (from IFS)
rdisc	official discount rate units: % p.a.
rtb3m	3month treasury bill rate units: % p.a.
rdep	average deposit rate units: % p.a.
rlend	average lending rate units: % p.a.
rmm	money market rate
sharep	share prices: WIG all share index units: 1995=100
nexr	nominal effective exchange rate units: 1995 = 100
rexr	real effective exchange rate units: 1995 = 100
gdpdefl	GDP implicit price level, 1995=100
cpi	CPI all items units: 1995=100
cpinf	CPI all item less food less energy units: 1995=100
cpien	CPI Energy units: 1995=100
cpif	CPI Food proxy incl. restaurants units: 1995=100

cpirent	POL CPI RENT units: 1995=100
ppiind	PPI industry units: 1995=100
wall	average monthly earnings units: 1995=100
wman	monthly earnings: manuf. proxy units: 1995 = 100
tbal	ITS net trade s.a. units: billions US dollars; monthly averages
cabal	BOP Current balance USD s.a. units: billions US dollars
cabalg	BOP Balance on goods units: USD mln
cabalinc	BOP Balance on income units: USD mln
cabalser	BOP Balance on services units: USD mln
retval	retail sales value s.a units: PLZ mln
retvol	retail sales volume s.a. units: 1995 = 100

Slovakia

gdp	gross domestic product 1995 prices units: 1995 SVK bln
gdphcons	households consumption expenditure 1995 prices
gdpcons	private final consumption expenditure 1995 prices
gdpgov	government final consumption expenditure 1995 prices
gdpi	gross fixed capital formation
gdpstocks	increase in stocks and net acqu.of valuables
gdpex	exports of goods and services 1995 prices
gdpim	imports of goods and services 1995 prices
gdpag	griculture, hunting, forestry and fishing 1995 prices
gdpman	mining, manufacturing, electricity and gas 1995 prices
gdpcons	construction 1995 prices
gdpserv	services 1995 prices
ipsteel	production crude steel units: tonnes '000
ip	industrial production units: 1995=100
ipman	IIP manufacturing units: 1995=100
ipmin	IIP mining. units: 1995=100
ipelec	IIP electricity gas & water units: 1995=100
empl	employment: Total (LFS) units: 1995 = 100
unempl	unemployment: total (LFS) units: '000
unemreg	uneployment registered units: '000
unemregr	registered unemp % total labour force units: %
unemrstand	standardized unemployment rate s.a. units: per cent
m1	monetary aggregate M1 s.a.
m2	monetary aggregate M2 s.a.
rdep	average deposit rate units: % p.a.
rlend	average lending rate units: % p.a.
sharep	share prices: PX50 index units: 1995=100
nxrusd	US$ exchange rate per. ave. units: Cents/SKK
nxreur	Euro exchange rate per. ave. units: EUR/SKK '000
rexr	real effective exchange rate units: 1995 = 100
cpi	CPI all items units: 1995=100
cpif	CPI Food proxy incl. restaurants units: 1995=100
ppiind	PPI industry units: 1995=100
wall	monthly earnings: all activities units: 1995=100
wman	monthly earnings: manuf. proxy units: 1995 = 100
exp	ITS Exports Total s.a. units: billions US dollars; monthly averages
imp	ITS Imports Total s.a. units: billions US dollars; monthly averages
tbal	ITS net trade s.a. units: billions US dollars; monthly averages
cabal	BOP Current balance USD s.a. units: billions US dollars
fdiout	BOP Direct investment abroad units: USD mln

fdiin	BOP Direct investment in reporting economy units: USD mln
potrfout	BOP Portfolio investment, assets units: USD mln
portfin	BOP Portfolio investment, liabilities units: USD mln
fprodtend	BSS Production: future tendency units: % balance
stocks	BSS Finished goods stocks: level units: % balance
orders	BSS Order books: level units: % balance
capu	BSS Rate of capacity utilisation units: %
bconf	industrial confidence indicator units: % balance

Slovenia

gdp	Gross domestic product at 1995 prices
gdpag	GDP: agriculture 1995 prices
gdpman	GDP: manufacturing 1995 prices
gdpcons	GDP: construction 1995 prices
gdptr	GDP: trade 1995 prices
gdpdistr	GDP: distribution 1995 prices
rintb	money market rate wighted < 30 days, % p.a.
rdep	average deposit rate
rlend	average lending rate
tb3mfx	3 month forex denominated CB's Tbill rate
ip	IIP industrial production all 1992=100 s.a. from IFS
ipmin	IIP mining 1992=100
ipman	IIP manufacturing 1992=100
ipel	IIP electricity 1992=100
empl	total employment '000 persons
emplind	emplyment index
unemreg	registered unemployment '000 persons
unemregr	registered unemployment rate
cpi	consumer price index, all goods, 1992=100
cpigoods	goods prices, 1992:1=100
cpiserv	services prices, 1992:1=100
cpiret	retail prices, 1992=100
ppi	producer price index, 1992=100
wg	average gross real wages, 1992 =100
wn	average net real wages, 1992=100
wmang	average gross real wages, manufacturing, 1992 =100
nxrusd	US$ exchange rate per. ave.
nxreur	Euro exchange rate per. ave.
nexr	nominal effective exchange rate, 1995=100
rexr	real effective exchange rate, cpi deflated, 1995=100
exp	exports f.o.b., mln USD
imp	imports f.o.b., mln USD
tbal	trade balance f.o.b., mln USD
cabal	current account balance, mln USD
fdiout	BOP Direct investment abroad, mln USD
fdiin	BOP Direct investment in reporting economy, mln USD

Euro-area data

YER	GDP
IPtot	Industrial production – total, series starts in 1978q1
IPman	Industrial production – manufacturing, series starts in 1980q1
YGA	Output gap
FDD	Total demand
PCR	GDP – private consumption at constant prices
PCN	GDP – private consumption at current prices
PYR	Household's disposable income
GCR	GDP – government consumption at constant prices
GCN	GDP – government consumption at current prices
GEN	Government expenditure
ITR	gross investment in real terms
ITN	gross investment in nominal terms
YWR	World GDP
YWRX	World Demand Composite Indicator
LNN	Total Employment
LN/LF	Ratio Total Employment/Labour Force
LPROD	Labour Productivity
URX	Unemployment Rate
TFT	Trend Total Factor Productivity
EER	real effective exchange rate
EEN	nominal effective exchange rate
LTN	Long-term interest rate (% p.a.)
STN	Short-term interest rate (% p.a.)
Spread	LTN-STN
M1N	monetary aggregate M1, series starts in 1980q1
M3N	monetary aggregate M3, series starts in 1980q1
HICP	HICP (1996=100)
PCD	Private consumption deflator
PPItot	Producer prices – total industry, series starts in 1980q1
PPIman	Producer prices – manufacturing, series starts in 1985q1
COMPR	Commodity Prices (HWWA)
WIN	Compensation to employees
WRN	Wage rate
ULC	unit labor costs
GDN_YEN	Ratio Public Debt/GDP
GEN_YEN	Ratio Government Expenditure/GDP
GPN_YEN	Ratio Government Primary Surplus/GDP
GRN_YEN	Ratio Government Revenue/GDP
CAN	Current account balance
TBR	Trade balance
MTR	Imports of Goods and Services
XTR	Exports of Goods and Services
Confind	Industrial confidence indicator, series starts in 1985q1
Ecsent	Economic sentiment indicator, series starts in 1985q1

(All data for the Euro area have been seasonally adjusted at source (Eurostat) or using the SABL method (Fagan et al., 2001). The base year for all series is 1990 if not indicated otherwise.)

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