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A wavelet approach for factor-augmented forecasting

António Rua*

Abstract

It has been acknowledged that wavelets can constitute a useful tool for forecasting in economics. Through a wavelet multiresolution analysis, a time series can be decomposed into different time-scale components and a model can be fitted to each component to improve the forecast accuracy of the series as a whole. Up to now, the literature on forecasting with wavelets has mainly focused on univariate modelling. On the other hand, in a context of growing data availability, a line of research has emerged on forecasting with large datasets. In particular, the use of factor-augmented models have become quite widespread in the literature and among practitioners. The aim of this paper is to bridge the two strands of the literature. A wavelet approach for factor-augmented forecasting is proposed and put to test for forecasting GDP growth for the major euro area countries. The results show that the forecasting performance is enhanced when wavelets and factor-augmented models are used together.

Keywords: Wavelets; Multiresolution decomposition; Factor models; Forecasting.

JEL classification: C22, C40, C53.

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1 Introduction

In a context of growing data availability, there has been an increasing focus on factor models as such models allow exploiting large data sets in a simple and parsimonious way. The literature on factor models in economics goes back to Geweke (1977), Sargent and Sims (1977), Geweke and Singleton (1981) and Watson and Engle (1983). In the conventional factor model, the data generating process of each variable is the sum of two components, a component associated with factors common to all series and an idiosyncratic term. The underlying idea is that one can summarize the large information set into a small number of variables, the common factors, which retain the main features of the original data set. In practice, this means that, for forecasting purposes, a large number of predictors can be replaced by a reduced number of variables without a significant loss of information (see Stock and Watson, 1998). The use of those factors as regressors in forecasting equations provides what is known as factor-augmented forecasts. Several work has been done in this line of research, including Stock and Watson (1999, 2002a, 2002b) for the US, Marcellino *et al.* (2003) for the euro area, Artis *et al.* (2005) for the UK, Schumacher (2007) for Germany, Bruneau *et al.* (2007) for France, among others.

From a different perspective, a relatively unexplored tool for forecasting is wavelets. Wavelet multiresolution analysis allows one to decompose a time series into a low-frequency base scale and higher-frequency scales. Those frequency components can be analysed individually or compared across variables. For example, the pioneer work of Ramsey and Lampart (1998a,b) draws on wavelets to study the relationship between several macroeconomic variables, namely money supply and output in the first case and consumption and income in the second. Recent work includes Kim and In (2005), who investigate the relationship between stock returns and inflation, Gençay *et al.* (2005) and Fernandez (2005, 2006) study the Capital Asset Pricing Model at different frequency scales, Crivellini *et al.* (2004), Gallegati *et*

al. (2008) and Yogo (2008) resort to wavelets for business cycle analysis, among others. Although it has been acknowledged the potential usefulness of wavelets in forecasting, there are very few applications of wavelets for forecasting in economics. In particular, Arino (1995) focus on car sales forecasts, Wong *et al.* (2003) provide an application to exchange rates, Conejo *et al.* (2005) forecast electricity prices and Fernandez (2007) focus on forecasting shipments of US manufactured items. In general, the results obtained in terms of forecasting performance seem to be promising.

The wavelet multiresolution approach for forecasting purposes consists in several steps. First, the series to be forecast is decomposed into its constituent time-scale components. In particular, through wavelets, a time series is decomposed into orthogonal components of different frequencies, which in turn are localized in time. Then, for each time-scale a model is fitted and used for forecasting. Finally, an overall forecast is obtained after recombining the components. This multiresolution approach can outperform the traditional single resolution approach for forecasting as it is possible to tailor specific forecasting models to each time-scale component and thereby enhance the forecasting performance.

Up to now, the literature concerning forecasting with wavelets has been restricted to univariate models for modelling each time-scale component (Conejo *et al.* (2005) is an exception, although they only consider one independent variable). Hence, there is scope for extending the current modelling framework. In particular, one can extend the information that is taken on board for forecasting purposes by considering factor-augmented models. The ability to handle large data sets in a straightforward and parsimonious way has contributed to the popularity of such models both in the literature and among practitioners. The aim of this paper is to bridge the wavelet approach and factor-augmented models.

We focus on the short-term forecasting of GDP growth for the major euro area countries, namely Germany, France, Italy and Spain. Resorting

to large data sets for those countries over the last twenty years, we evaluate the out-of-sample performance of several alternatives for forecasting one- and two-quarters ahead GDP growth. Within the single resolution approach, we consider two models, an autoregressive model as the usual benchmark and the factor-augmented model. Regarding the wavelet approach, we consider the corresponding two variants. In the first, an autoregressive model is fitted to each time-scale component whereas in the second, a factor-augmented model is considered for each time-scale.

It is found that the factor-augmented model outperforms, in general, the benchmark for short-term forecasting, in line with the results found in the related literature. When one follows a wavelet approach and considers a univariate model for each time-scale, one also improves on the benchmark. But the best performing procedure is to combine the wavelet approach and factor-augmented models. We find that such approach outperforms all the above-mentioned alternatives for forecasting GDP growth in all countries and for all forecast horizons. In particular, for the one-quarter ahead horizon, the forecasting gains are quite noteworthy. Moreover, the findings are supported by forecast accuracy and encompassing tests.

The paper is organised as follows. In section 2, the wavelet multiresolution decomposition is addressed. In section 3, the wavelet approach for forecasting with factor-augmented models is presented. In section 4, a brief description of the data for the major euro area countries is provided and the results of the out-of-sample forecasting exercise are discussed. Finally, section 5 concludes.

2 Wavelet multiresolution decomposition

The well-known Fourier transform involves the projection of a series onto an orthonormal set of trigonometric components. In particular, Fourier series have infinite energy (they do not fade away) and finite power (do not change over time). In contrast, wavelets have finite energy and compact support,

that is, they grow and decay in a limited time period. Wavelets can be a particular useful tool when the signal shows a different behaviour in different time periods or when the signal is localized in time as well as frequency. As it enables a more flexible approach in time series analysis, wavelet analysis is seen as a refinement of Fourier analysis.

In particular, the discrete wavelet transform (DWT) makes it possible to decompose a time series into its constituent multiresolution components (see, for example, Percival and Walden (2000)).[1] High-frequency components reflect the short-term behaviour, whereas the low-frequency component captures the long-term dynamics of the variable. There are two types of wavelets, father wavelets ϕ and mother wavelets ψ, where

$$\int \phi(t)dt = 1 \tag{1}$$

and

$$\int \psi(t)dt = 0. \tag{2}$$

The smooth and low-frequency part of the series is captured by the father wavelet, while the detail and high-frequency components are described by the mother wavelet.

The orthogonal wavelet series approximation to a series $y(t)$ is defined by

$$y(t) = \sum_k s_{J,k}\phi_{J,k}(t) + \sum_k d_{J,k}\psi_{J,k}(t) + \sum_k d_{J-1,k}\psi_{J-1,k}(t) + \cdots + \sum_k d_{1,k}\psi_{1,k}(t) \tag{3}$$

where J is the number of multiresolution levels (or scales) and k ranges from one to the number of coefficients in the corresponding component. When the number of observations, T, is divisible by 2^J there are $T/2^j$ $d_{j,k}$ coefficients

[1] Recent work drawing on the continuous wavelet transform (CWT) include, for example, Rua and Nunes (2009) and Rua (2010).

at scale $j = 1, ..., J-1$, while at scale J there are $T/2^J$ $d_{J,k}$ coefficients and $T/2^J$ $s_{J,k}$ coefficients. In total, there are T wavelet coefficients, that is, $T = T/2^1 + T/2^2 + ... + T/2^{J-1} + T/2^J + T/2^J$. The coefficients $s_{J,k}$, $d_{J,k}$, $d_{J-1,k}$, ..., $d_{1,k}$ are the wavelet transform coefficients, which are given by

$$s_{J,k} = \int y(t)\phi_{J,k}(t)dt \tag{4}$$

$$d_{j,k} = \int y(t)\psi_{j,k}(t)dt, \qquad j = 1, 2, ..., J. \tag{5}$$

These coefficients give a measure of the contribution of the corresponding wavelet function to the signal.

The functions $\phi_{J,k}(t)$ and $\psi_{j,k}(t)$ are the approximating wavelet functions, generated from ϕ and ψ through scaling and translation as follows

$$\phi_{J,k}(t) = 2^{-J/2}\phi\left(\frac{t - 2^J k}{2^J}\right) \tag{6}$$

and

$$\psi_{j,k}(t) = 2^{-j/2}\psi\left(\frac{t - 2^j k}{2^j}\right), \qquad j = 1, 2, ..., J. \tag{7}$$

The DWT allows to obtain the coefficients of the wavelet series approximation in (3) for a discrete signal of finite extent. The DWT maps the vector $y = (y_1, y_2, ..., y_T)'$ to a vector of T wavelet coefficients that contains the smooth coefficients $s_{J,k}$ and the detail coefficients $d_{j,k}$. In other words, the DWT maps a time series from its original representation in the time domain to a representation in the time-scale domain.

Equation (3) can be rewritten as

$$y(t) = S_J(t) + D_J(t) + D_{J-1}(t) + ... + D_1(t) \tag{8}$$

where $S_J(t) = \sum_k s_{J,k}\phi_{J,k}(t)$ and $D_j(t) = \sum_k d_{j,k}\psi_{j,k}(t)$ for $j = 1, 2, ..., J$ are the smooth and detail components, respectively. The expression (8) represents the decomposition of $y(t)$ into orthogonal components, $S_J(t)$,

$D_J(t)$, $D_{J-1}(t)$,..., $D_1(t)$, at different resolutions and constitutes the so-called wavelet multiresolution decomposition. Note that for a level J multiresolution analysis, the wavelet decomposition of the variable y consists of J wavelet details ($D_J(t)$, $D_{J-1}(t)$,..., $D_1(t)$) and a single wavelet smooth ($S_J(t)$). The wavelet smooth captures the low-frequency dynamics while the wavelet details represent the higher-frequency characteristics of y. The maximum number of scales that can be considered in the analysis is limited by the number of observations ($T \geq 2^J$).

3 Wavelet-based forecasting with factor-augmented models

In the conventional factor model representation, each variable is assumed to be the sum of two components, a common component, driven by a small number of latent common factors, and an idiosyncratic component. Let X_t be a N-dimensional stationary time series observed for $t = 1, \cdots, T$. Consider the static factor representation

$$X_t = \Lambda F_t + e_t \quad (t = 1, \cdots, T) \tag{9}$$

where F_t is a $(r \times 1)$ vector of non-observable factors, Λ is a $(N \times r)$ matrix of (unknown) loadings and e_t is a N-dimensional vector of the idiosyncratic components. When both $N \to \infty$ and $T \to \infty$, Stock and Watson (1998, 2002b), Bai and Ng (2002), Bai (2003) and Amengual and Watson (2007) have shown that, under slightly different sets of assumptions regarding the data generating processes of the factors and the idiosyncratic components[2], the first k principal components $\hat{F}^{(k)} = \left[\hat{F}_1 \cdots \hat{F}_k\right]$ span the factor space.

Suppose that one is interested in forecasting the value of a stationary (or

[2]The typical assumptions allow for some heteroskedasticity and limited dependence of the idiosyncratic components in both the time and cross-section dimensions, as well as for moderate correlation between the latter and the factors.

previously stationarized) variable y for period $T+h$, y_{T+h}. The standard factor-augmented regression to forecast y_{T+h} is given by (see, for example, Stock and Watson (2002a))

$$y_{t+h} = \alpha_0 + \sum_{i=1}^{k} \alpha_i \hat{F}_{t,i} + \sum_{j=1}^{p} \gamma_j y_{t+1-j} + \varepsilon_{t+h} \quad (t = p, \cdots, T-h) \qquad (10)$$

where the number of estimated factors k to be included in the forecasting equation can be determined by minimizing a modified version of the Bayesian information criteria (BIC) suggested by Stock and Watson (1998)[3], whereas the number of autoregressive terms p is usually chosen according to the standard BIC criterion. Through an extensive comparison of several methods for forecasting with many predictors, Stock and Watson (2005a) found that the factor-augmented model (10) performs best.

Instead of fitting a model to the variable y as a whole as done in the standard factor-augmented approach, what we propose here is to fit a model like (10) to each time-scale component of the wavelet multiresolution decomposition of y (see equation (8)). Then, a forecast for the variable y can be obtained by aggregating the forecasts for the orthogonal components using the corresponding estimated models. As far as we know, this has never been done up to now.

Let us sketch in more detail the several steps involved. Firstly, a wavelet multiresolution decomposition is performed to the variable to be forecasted, y, as well as for all the N predictors, as described in section 2. As a result, one obtains $S_J^y(t)$, $D_J^y(t)$, $D_{J-1}^y(t)$, ..., $D_1^y(t)$ for variable y, $S_J^{x_1}(t)$, $D_J^{x_1}(t)$, $D_{J-1}^{x_1}(t)$, ..., $D_1^{x_1}(t)$ for the first predictor, $S_J^{x_2}(t)$, $D_J^{x_2}(t)$, $D_{J-1}^{x_2}(t)$, ..., $D_1^{x_2}(t)$ for the second predictor, and so on. Secondly, for each resolution level, the first principal components are computed from the corresponding components of the N predictors, after being, as usual, standardized. Then, a search for the the values of k and p that minimize the above mentioned

[3] Alternatively, one can use, for example, the criteria proposed by Bai and Ng (2002).

metrics is performed, with the search done up to $k_{\max}$ and $p_{\max}$, which denote the maximum number of factors and autoregressive terms allowed in equation (10) respectively. Once a model like (10) has been estimated for each resolution level, it can be used to produce the h-step ahead forecast of the corresponding component of the variable y. Finally, the h-step ahead forecast for the variable y as a whole can be obtained by adding up those forecasts. Hence, this constitutes the wavelet approach for factor augmented forecasting, where a factor-augmented model is tailored to each time-scale component of y.

4 Forecasting GDP growth in the major euro area countries

In this section, the performance of the wavelet approach for factor-augmented forecasting is evaluated. In particular, we focus on the short-term forecasting of quarterly GDP growth in the major euro area countries namely, Germany, France, Italy and Spain.

4.1 Data

Resorting to the Thomson Financial Datastream database, which covers both international and national data sources, large panel sets of macroeconomic series were compiled for Germany, France, Italy and Spain. For each country, besides GDP series, it was collected a comprehensive panel data set including a wide range of variables, namely industrial production and sales, labour market variables, price series, monetary aggregates, business and consumer surveys, among others (corresponding to 76 series for Germany, 81 for France, 63 for Italy and 72 for Spain).[4] For all countries but Spain, the sample covers the period from the first quarter of 1986 up to the fourth quarter of 2008 while for Spain it starts on the first quarter

[4] See the Annex for the detailed list of series.

of 1989. As usual, data are seasonally adjusted and transformed by taking logs and/or differences when necessary. Following Stock and Watson (2005b), outlier-adjusted series are used for the estimation of the factors[5].

4.2 Empirical results

In Figure 1, the wavelet multiresolution decomposition of quarterly real GDP growth is presented for all countries. Several comments are in order. Regarding the number of scales, taking into account the number of observations available for all countries and the out-of-sample period to be considered later on, we considered $J = 4$. Hence, the growth rate series is decomposed into four wavelet details (D_4, D_3, D_2, D_1) and a wavelet smooth (S_4). Note that the wavelet details and wavelet smooth form an additive decomposition (see equation (8)). That is, adding up the wavelet details and the wavelet smooth at each time t will result in the growth rate series at time t.

The frequency interpretation of the multiresolution decomposition scale levels is the following. D_1 is associated with fluctuations between 2 and 4 quarters, D_2 is related with $4-8$ quarter dynamics, D_3 reflects $8-16$ quarter movements, D_4 captures $16-32$ quarter dynamics and S_4 reflects all the movements with periodicity above a $32-$ quarter period. As one can see from Figure 1, the wavelet smooth captures the low-frequency characteristics while the wavelet details reflect the higher-frequency dynamics.

Concerning the choice of the wavelet function for the multiresolution decomposition, the symmlet4 wavelet was used. The symmlet wavelet is commonly used in multiresolution analysis and a wavelet length of 4 has been argued to be an adequate choice for most macroeconomic data and when working with relatively short data sets as it is the case (see, for example, Crowley (2007)).[6]

[5] The outlier adjustment corresponds to replacing observations of the transfomed series with absolute deviations larger than six times the interquartile range by the median value of the preceding five observations (see, for example Stock and Watson (2005b)).

[6] As a sensitivity analysis, we considered other wavelet families as, for example,

To assess the performance of the wavelet-based forecasts with factor-augmented models an out-of-sample forecasting exercise is carried out. The out-of-sample period runs from the first quarter of 2004 up to the fourth quarter of 2008, corresponding to about one fourth of the sample period, which seems reasonable taking into account the dimension of the sample at hand. As usual, a recursive estimation process is implemented. This involves recursive factor estimation, parameter estimation, model selection, and so forth. Starting from the estimation period (up to the fourth quarter of 2003), in each round a new observation is added to the sample and the h-step ahead forecast is computed. In particular, we focus on short-term forecasting by considering one and two-quarter ahead forecasts, that is, $h = 1, 2$.[7]

For comparison, we consider other natural forecasting alternatives within our framework. Within the single resolution level approach, we consider, as usual, an autoregressive model as the benchmark and the factor-augmented model described earlier. That is, the variable y is forecasted as whole resorting to model (10) with $\alpha_i = 0$ for $i = 1, \cdots, k$ in the first case and without any restriction in the second case.[8] Within the wavelet multiresolution approach, besides using model (10) for forecasting each component, we compute wavelet-based forecasts by fitting an autoregressive model to each component. We set $k_{\max} = 6$ and $p_{\max} = 6$.

In Table 1, we present the mean squared error (MSE) for each of the fore-

daubechies and coiflets, as well as a wavelet length of 8. In general, the results do not change much.

[7] Higher forecast horizons were also investigated but, as found elsewhere for the euro area countries (see, for example, Runstler *et al.* (2009)), the forecasting gains of using factor-augmented models disappear when the forecast horizon increases. This is also found for the wavelet approach.

[8] Stock and Watson (2002a) considered the forecasting model (10) with and without the autoregressive terms (i.e. $\gamma_j = 0$ for $j = 1, \cdots, p$) and found that for forecasting real variables, the latter formulation performed, in general better. Hence, we assess the two variants for the standard and wavelet approaches while presenting the results only for the best one.

casting models relative to the autoregressive benchmark. Several findings emerge. Focusing on $h = 1$, one can see that within the standard approach, factor-augmented models outperform the autoregressive benchmark in all countries but Italy. Note that there is some heterogeneity in the magnitude of the gains. The reduction of the relative MSE is 14 p.p. for Germany, only 3 p.p. for France and more than 65 p.p. for Spain. Within the wavelet approach, wavelet-based forecasts with autoregressive models outperform the benchmark in all countries but France. The reduction of the relative MSE is about 10 p.p. for Germany, more than 18 p.p. for Italy and 63 p.p. for Spain. However, the best forecasting results are obtained through the wavelet approach for factor-augmented forecasting. The wavelet-based forecasts with factor-augmented models outperform all the other methods for all countries. The reduction of the relative MSE is almost 22 p.p. for Germany, 17 p.p. for France, 33 p.p for Italy and more than 66 p.p. for Spain. Hence, there is a noteworthy increase in the forecast accuracy when the wavelet approach is merged with factor-augmented models vis-à-vis all the other alternatives.

When the forecast horizon increases to $h = 2$, one can see that the gains of the standard factor-augmented model almost disappear. Although wavelet-based forecasts with autoregressive models outperform the benchmark model in all countries but Germany, the reduction in the relative MSE is quite marginal (with Spain being an exception). Again, the wavelet approach for factor-augmented forecasting delivers the best forecasting results for all countries. However, the gains are quite smaller than the ones obtained for $h = 1$. The reduction of the relative MSE is almost 7 p.p. for Germany and France, only 3 p.p for Italy and more than 43 p.p. for Spain.

To assess the significance of the gains, we computed the well-known Granger-Newbold test (see, for example, Enders (2004)).[9] Suppose that e_{1t}

[9] We also computed the Harvey *et al.* (1997) modified version of the Diebold and Mariano (1995) test but the results were inconclusive regarding the forecast accuracy of one model relative to another.

and e_{2t} are sequences of forecast errors of models 1 and 2, respectively, of length H. Under the null hypothesis the models have equal forecast accuracy and the test statistic is given by

$$\frac{r_{xz}}{\sqrt{\left(1-r_{xz}^2\right)/\left(H-1\right)}} \sim t_{(H-1)} \tag{11}$$

where r_{xz} denotes the sample correlation coefficient between $x_t = e_{1t} + e_{2t}$ and $z_t = e_{1t} - e_{2t}$. If r_{xz} is positive and statistically different from zero, then model 1 has a larger MSE than model 2. If r_{xz} is negative and statistically different from zero, then model 2 has a larger MSE than model 1. In Table 2, we present the results for the Granger-Newbold test where model 1 is the benchmark model and model 2 corresponds to each of the other models considered. The results confirm the significance of the gains discussed earlier. When $h = 1$, the gains are significant for all countries using the wavelet approach for factor-augmented forecasting whereas when the forecast horizon increases, although there is an improvement, it is not enough to be considered statistically significant, except in the case of Spain.

In addition, we also perform a forecast encompassing analysis. In particular, we take the general specification approach proposed by Fair and Shiller (1989, 1990) and consider the following regression model

$$y_{t+h} = \alpha + \beta_1 \widehat{y}^1_{t+h} + \beta_2 \widehat{y}^2_{t+h} + u_{t+h} \tag{12}$$

where $\widehat{y}^1_{t+h}$ and $\widehat{y}^2_{t+h}$ are the h-step ahead forecasts of models 1 and 2, respectively.[10] If $\beta_1 \neq 0$ and $\beta_2 = 0$ model 1 forecast encompasses the second while if $\beta_1 = 0$ and $\beta_2 \neq 0$ model 2 forecast encompasses the first. If both forecasts contain independent information then both β_1 and β_2 should be different from zero. In Table 3, we present the test statistic for β_i, $i = 1, 2$

[10] Other approaches suggested in the literature consider particular cases of model (12). For example, Nelson (1972) and Granger and Newbold (1973) impose the restrictions $\alpha = 0$ and $\beta_1 + \beta_2 = 1$, Chong and Hendry (1986) impose that $\alpha = 0$ and $\beta_1 = 1$ and Andrews *et al.* (1996) impose that $\beta_1 + \beta_2 = 1$.

under the null hypothesis $\beta_i = 0$. One can see that the results reinforce the above forecast accuracy evaluation. In fact, the forecast encompassing test results highlight the information content of the short-term forecasts provided by factor-augmented models, and in particular, through a wavelet approach. When $h = 1$, wavelet-based forecasts using factor-augmented models are statistically relevant for all countries while encompassing the benchmark in all countries but Spain. When $h = 2$, the usefulness of such forecasts is confirmed in the cases of Germany and Spain.

5 Conclusions

It has been acknowledged that multiresolution approaches can outperform the traditional single resolution approach for forecasting. In particular, through the wavelet multiresolution decomposition, a time series can be disentangled into different time-scale components and a model can be fitted to each component to improve the forecast accuracy of the series as a whole. Despite the potential usefulness of wavelets in forecasting, there are very few applications of the wavelet approach in economics. Moreover, the literature on forecasting with wavelets has mainly focused on univariate models.

Hence, extending the information set that is taken on board in the forecasting model seems to be a natural step in the development of the wavelet approach for forecasting. The aim of this paper is to bridge the wavelet approach and the recently developed literature on factor-augmented models. In a context of growing data availability, factor-augmented models have become quite popular in the literature and among practitioners as they can handle large panel data sets in a simple and parsimonious way. Furthermore, they have proved to be quite useful for forecasting purposes.

To assess the performance of the wavelet approach with factor-augmented models an out-of-sample forecasting exercise has been conducted. In particular, resorting to large data sets collected for the major euro area countries, we assessed the short-term forecasting of GDP growth. We found that

merging the wavelet approach and factor-augmented models enhances, in a noteworthy magnitude, the performance of short-term forecasts. Moreover, this evidence is supported by forecast accuracy and encompassing tests and is cross-country based.

References

[1] Amengual, D. and Watson, M. (2007) "Consistent estimation of the number of dynamic factors in a large N and T panel", *Journal of Business and Economic Statistics*, 25(1), 91-96.

[2] Andrews, M. J., Minford, A. P. L., and Riley, J. (1996) "On comparing macroeconomic forecasts using forecast encompassing tests", *Oxford Bulletin of Economics and Statistics*, 58, 279–305.

[3] Arino, M. (1995) "Time series forecasts via wavelets: an application to car sales in the Spanish market", Discussion Paper no 95-30, Institute of Statistics and Decision Sciences, Duke University.

[4] Artis, M.J., Banerjee, A. and Marcellino, M. (2005) "Factor forecasts for the UK", *Journal of Forecasting*, 24, 279-298.

[5] Bai, J. and Ng, S. (2002) "Determining the number of factors in approximate factor models", *Econometrica*, 70(1), 191-221.

[6] Bai, J. (2003) "Inferential theory for factor models of large dimensions", *Econometrica*, 71(1), 135-171

[7] Bruneau, C., de Bandt, O., Flageollet, A. and Michaux, E. (2007) "Forecasting inflation using economic indicators: the case of France", *Journal of Forecasting*, 26(1), 1–22.

[8] Chong, Y. Y., and Hendry, D. F. (1986) "Econometric evaluation of linear macro-economic models", *Review of Economic Studies*, 53, 671–690.

[9] Conejo, A., Contreras, J., Espínola, R. and Plazas, M. (2005) "Forecasting electricity prices for a day-ahead pool-based electric energy market", *International Journal of Forecasting*, 21, 435– 462.

[10] Crivellini, M., Gallegati, M., Gallegati, M. and Palestrini, A. (2004) "Industrial output fluctuations in developed countries: a time-scale decomposition analysis", Working Papers and Studies, European Commission.

[11] Crowley, P. (2007) "A guide to wavelets for economists", *Journal of Economic Surveys*, vol. 21, no. 2, 207-264.

[12] Diebold, F., Mariano, R. (1995) "Comparing predictive accuracy", *Journal of Business and Economic Statistics* 13, 253–263.

[13] Enders, W. (2004) Applied Econometric Time Series, Wiley Series in Probability and Statistics, 2nd ed., Wiley, New York.

[14] Fair, R. C., and Shiller, R. J. (1989) "The informational content of ex ante forecasts", *Review of Economics and Statistics*, 71, 325–331.

[15] Fair, R. C., and Shiller, R. J. (1990) "Comparing information in forecasts from econometric models", *American Economic Review*, 80, 39–50.

[16] Fernandez, V. (2005) "The international CAPM and a wavelet-based decomposition of value at risk", *Studies in Nonlinear Dynamics and Econometrics* 9 (4) Article 4.

[17] Fernandez, V. (2006) "The CAPM and value at risk at different timescales", *International Review of Financial Analysis* 15, 203–219.

[18] Fernandez, V. (2007) "Wavelet- and SVM-based forecasts: An analysis of the U.S. metal and materials manufacturing industry", *Resources Policy* 32, 80–89.

[19] Gallegati, M., Palestrini, A., and Petrini, M. (2008) "Cyclical behavior of prices in the G7 countries through wavelet analysis", *Advances in Complex Systems*, vol. 11, 1, 119-130.

[20] Gençay, R., Selçuk, F., Whitcher, B. (2005) "Multiscale systematic risk", *Journal of International Money and Finance* 24, 55–70.

[21] Geweke, J. (1977) "The dynamic factor analysis of economic time series", in D. Aigner and A. Goldberger (eds.) Latent Variables in Socio-Economic Models, North-Holland.

[22] Geweke, J. and Singleton, K. (1981) "Maximum likelihood 'confirmatory' factor analysis of economic time series", *International Economic Review*, 22, 37-54.

[23] Granger, C.W. J., and Newbold, P. (1973) "Some comments on the evaluation of economic forecasts", *Applied Economics*, 5, 35–47.

[24] Harvey, D., Leybourne, S., Newbold, P. (1997) "Testing the equality of prediction mean square errors", *International Journal of Forecasting* 13, 281–291.

[25] Kim, S. and In, F. (2005) "The relationship between stock returns and inflation: new evidence from wavelet analysis", *Journal of Empirical Finance*, 12, 435-444.

[26] Marcellino, M., Stock, J. H. and Watson, M. (2003) "Macroeconomic forecasting in the euro area: country specific versus euro wide information", *European Economic Review* 47, 1-18.

[27] Nelson, C. R. (1972) "The prediction performance of the FRB-MIT-PENN model of the US economy", *American Economic Review*, 62, 902–917.

[28] Percival, D. and Walden, A. (2000) Wavelet methods for time series analysis, Cambridge University Press.

[29] Ramsey, J. and Lampart, C. (1998a) "Decomposition of economic relationships by time scale using wavelets", *Macroeconomic dynamics*, 2(1), 49-71.

[30] Ramsey, J. and Lampart, C. (1998b) "The decomposition of economic relationships by time scale using wavelets: expenditure and income", *Studies in Nonlinear Dynamics and Econometrics*, vol. 3, no 1, 23-42.

[31] Rua, A. (2010) "Measuring comovement in the time-frequency space", *Journal of Macroeconomics*, 32, 685-691.

[32] Rua, A., and Nunes, L.C. (2009) "International comovement of stock market returns: A wavelet analysis", *Journal of Empirical Finance* 16, 632-639.

[33] Runstler, G., Barhoumi, K., Benk, S., Cristadoro, R., Den Reijer, A., Jakaitiene, A., Jelonek, P., Rua, A., Ruth, K., Van Nieuwenhuyze, C. (2009) "Short-term forecasting of GDP using large datasets: a pseudo real-time forecast evaluation exercise", *Journal of Forecasting*, vol. 28, no. 7, 595-611.

[34] Sargent, T. and Sims, C. (1977) "Business cycle modelling without pretending to have too much a priori economic theory" in Cristopher A. Sims (ed.) New Methods in Business Research, Federal Reserve Bank of Minneapolis.

[35] Schumacher, C. (2007) "Forecasting German GDP using alternative factor models based on large data sets", *Journal of Forecasting* 26(4), 271–302.

[36] Stock, J., and Watson, M. (1998) "Diffusion Indexes", NBER Working Paper no. 6702.

[37] Stock, J., and Watson, M. (1999) "Forecasting inflation", *Journal of Monetary Economics* 44, 293-335.

[38] Stock, J. and Watson, M. (2002a) "Macroeconomic forecasting using diffusion indices", *Journal of Business and Economics Statistics* 20, 147-162.

[39] Stock, J. and Watson, M. (2002b) "Forecasting using principal components from a large number of predictors", *Journal of the American Statistical Association* 97, 1167-1179.

[40] Stock, J. and Watson, M. (2005a) "An empirical comparison of methods for forecasting using many predictors", mimeo.

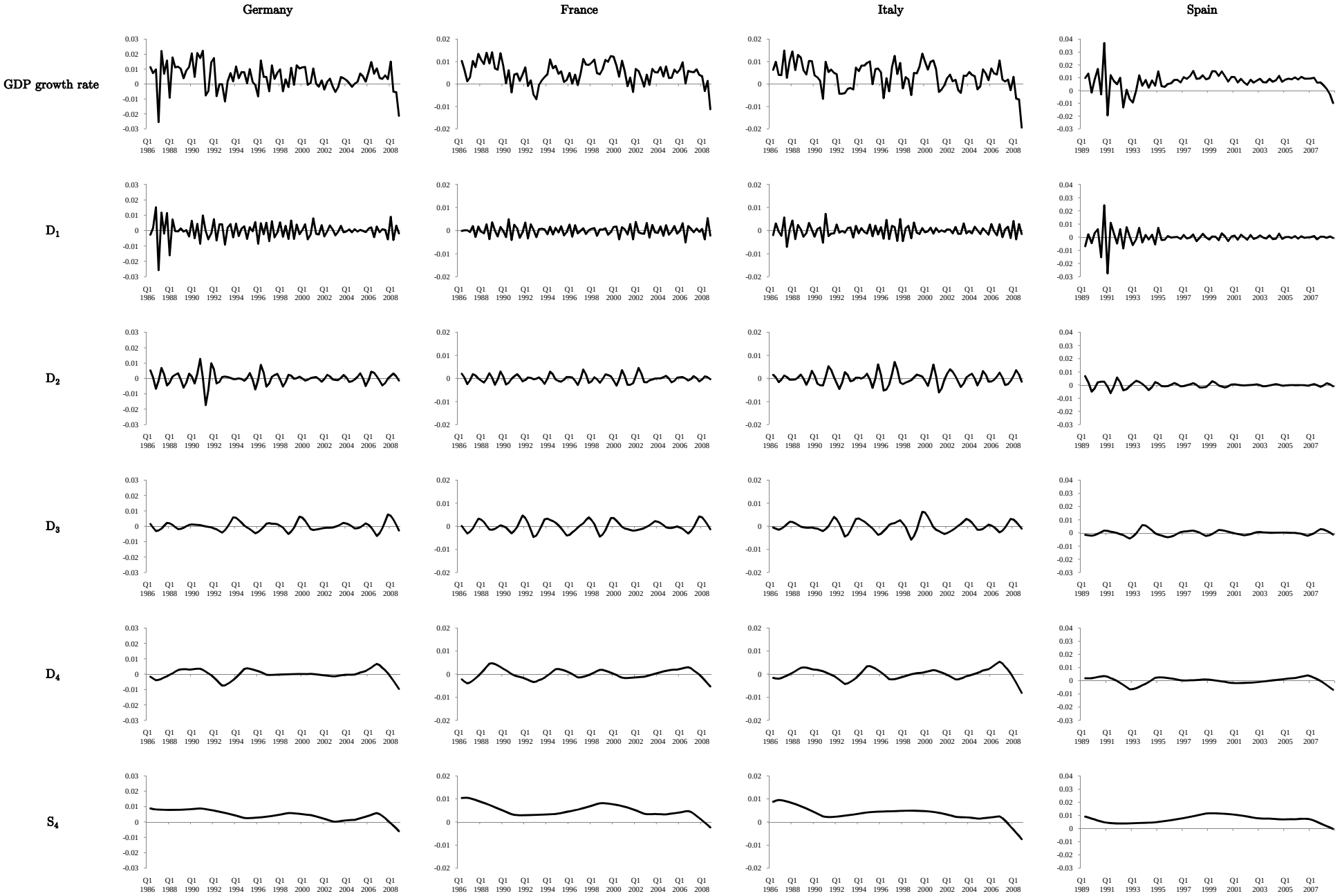
[41] Stock, J. and Watson, M. (2005b) "Implications of dynamic factor models for VAR analysis", mimeo.

[42] Watson, M. and R. Engle (1983) "Alternative algorithms for the estimation of dynamic factors, MIMIC, and varying coefficient regression models", *Journal of Econometrics*, 23, 385-400

[43] Wong, H., Ip, W., Xie, Z., Lui, X. (2003) "Modelling and forecasting by wavelets and the application to exchange rates", *Journal of Applied Statistics* 30 (5), 537–553.

[44] Yogo, M. (2008) "Measuring business cycles: A wavelet analysis of economic time series", *Economics Letters*, 100, 208-212.

Figure 1 - Wavelet multiresolution decomposition



Note: For each country, the GDP growth rate series is plotted in the top row while below it - from top to bottom - are the wavelet details D_1, D_2, D_3, D_4, and the wavelet smooth S_4.

Table 1 - Mean Squared Error (relative to the benchmark model)

	Germany	France	Italy	Spain
h =1				
Standard approach				
AR model	1.000	1.000	1.000	1.000
Factor-augmented model	**0.860**	**0.970**	1.090	**0.347**
Wavelet approach				
AR model	**0.899**	1.295	**0.815**	**0.370**
Factor-augmented model	**0.783**	**0.831**	**0.673**	**0.335**
h = 2				
Standard approach				
AR model	1.000	1.000	1.000	1.000
Factor-augmented model	**0.995**	1.030	1.087	**0.963**
Wavelet approach				
AR model	1.277	**0.995**	**0.994**	**0.740**
Factor-augmented model	**0.934**	**0.934**	**0.974**	**0.665**

Note: Each entry of the table corresponds to the ratio between the MSE of each model and the MSE of the benchmark model (*i.e.* the standard approach AR model). The bold format corresponds to a value lower than one, that is, the model is better than the benchmark whereas the shaded area denotes the best performing model for each forecast horizon.

Table 2 - Granger-Newbold test

	Germany	France	Italy	Spain
h =1				
Standard approach				
AR model	-	-	-	-
Factor-augmented model	0.752	1.553 *	0.034	3.269 ***
Wavelet approach				
AR model	0.332	-1.879 **	0.395	4.246 ***
Factor-augmented model	1.561 *	1.400 *	2.383 **	3.968 ***
h = 2				
Standard approach				
AR model	-	-	-	-
Factor-augmented model	1.590 *	1.262	-0.321	0.010
Wavelet approach				
AR model	-1.184	-0.279	-0.345	2.759 ***
Factor-augmented model	0.549	-0.077	0.273	2.740 ***

Note: *, **, *** denote the rejection of the null hypothesis of equal forecast accuracy at a 10, 5 and 1 per cent significance level, respectively.

Table 3 - Forecast encompassing test

	Germany		France		Italy		Spain	
	β_1	β_2	β_1	β_2	β_1	β_2	β_1	β_2
h =1								
Standard approach								
AR model	-	-	-	-	-	-	-	-
Factor-augmented model	0.026	2.31 **	-0.419	2.17 **	1.650	1.26	0.406	4.41 ***
Wavelet approach								
AR model	0.031	1.62	2.050 *	-1.36	1.330	-0.926	2.850 **	8.00 ***
Factor-augmented model	-0.884	2.6 **	-1.410	2.4 **	-1.330	2.73 **	3.310 ***	8.21 ***
h = 2								
Standard approach								
AR model	-	-	-	-	-	-	-	-
Factor-augmented model	-1.180	1.71	0.567	1.89 *	1.610	0.728	3.430 ***	1.03
Wavelet approach								
AR model	0.380	0.0251	1.770 *	-0.799	2.68 **	-1.8 *	0.544	1.3
Factor-augmented model	-1.040	2.17 **	1.420	-0.481	1.460	-0.308	1.150	2.34 **

Note: *, **, *** denote the rejection of $\beta_1 = 0$ at a 10, 5 and 1 per cent significance level, respectively.

ANNEX - Data set

SERIES	Thomson Financial Datastream code
GERMANY	
BD PRODUCTION OF TOTAL INDUSTRY (EXCLUDING CONSTRUCTION) VOLA	BDOPRI35G
BD PRODUCTION IN TOTAL MANUFACTURING VOLA	BDOPRI38G
BD PRODUCTION OF TOTAL CONSTRUCTION VOLA	BDOPRI30G
BD PRODUCTION OF TOTAL MANUFACTURED INTERMEDIATE GOODS VOLA	BDOPRI61G
BD PRODUCTION OF TOTAL MANUFACTURED INVESTMENT GOODS VOLA	BDOPRI70G
BD ORDERS FOR TOTAL MANUFACTURED GOODS (VOLUME) VOLA	BDOODI45G
BD ORDERS FOR EXPORTED MANUFACTURED GOODS (VOLUME) VOLA	BDOODI54G
BD ORDERS FOR MANUFACTURED GOODS FROM DOM. MARKET (VOLUME) VOLA	BDOODI53G
BD ORDERS FOR MANUFACTURED INTERMEDIATE GOODS (VOLUME) VOLA	BDOODI51G
BD ORDERS FOR MANUFACTURED INVESTMENT GOODS (VOLUME) VOLA	BDOODI52G
BD SALES OF MANUFACTURED INTERMEDIATE GOODS (VOLUME) VOLN	BDOSLI26H
BD SALES OF MANUFACTURED INVESTMENT GOODS (VOLUME) VOLN	BDOSLI27H
BD TOTAL WHOLESALE TRADE (VOLUME) VOLN	BDOSLI22H
BD TOTAL RETAIL TRADE (VOLUME) VOLA	BDOSLI15G
BD TOTAL CAR REGISTRATIONS VOLA	BDOSLI05O
BD PASSENGER CAR REGISTRATIONS SADJ	BDOSLI12E
BD PERMITS ISSUED FOR DWELLINGS VOLA	BDOODI15O
BD IMPORTS CIF CURA	BDOXT009B
BD EXPORTS FOB CURA	BDOXT003B
BD UNEMPLOYMENT: % CIVILIAN LABOUR(% DEPENDENT LABOUR TO DEC 196	BDUN%TOTQ
BD PERSONS IN EMPLOYMENT - MINING AND MANUFACTURINGVOLN	BDUUOA01P
BD UNFILLED VACANCIES VOLA	BDOOL015O
BD PPI - ALL ITEMS NADJ	BDOPP019F
BD PPI - MANUFACTURING INDUSTRY NADJ	BDOPP017F
BD PPI - FOOD, BEVERAGES & TOBACCO NADJ	BDOPP013F
BD PPI - INVESTMENT GOODS NADJ	BDOPP068F
BD PPI - INTERMEDIATE GOODS NADJ	BDOPP064F
BD WPI NADJ	BDOWP005F
BD CPI -HOUSING RENTAL SERVICES NADJ	BDOCP053F
BD CPI - ENERGY (EXCL. GASOLINE BEFORE 1991) NADJ	BDOCP041F
BD CPI - EXCLUDING FOOD & ENERGY NADJ	BDOCP042F
BD CPI - FOOD AND ALCOHOL-FREE DRINKS (EXCL. REST)NADJ	BDOCP019F
BD CPI NADJ	BDOCP009F
BD EXPORT PRICE INDEX SADJ	BDEXPPRCE
BD IMPORT PRICE INDEX SADJ	BDIMPPRCE
BD MONEY SUPPLY-GERMAN CONTRIBUTION TO EURO M1(PAN BD M0690)	BDM1....A
BD MONEY SUPPLY - M2 (CONTINUOUS SERIES) CURA	BDM2C...B
BD MONEY SUPPLY - M3 (CONTINUOUS SERIES) CURA	BDM3C...B
BD FIBOR - 3 MONTH (MTH.AVG.)	BDINTER3
BD YIELD 10-YEAR GOVT.BONDS(PROXY- 9-10+ YEAR FEDERAL SECUR NADJ	BDOIR080R
BD SHARE PRICES - CDAX NADJ	BDOSP001F
BD GERMAN MARKS TO US$ (MTH.AVG.)	BDXRUSD.
UK MARKET PRICE - UK BRENT CURN	UKI76AAZA
BD ECONOMIC SENTIMENT INDICATOR - GERMANY SADJ	BDEUSESIG
BD CONSTRUCTION CONFIDENCE INDICATOR - GERMANY SADJ	BDEUSBCIQ
BD CONSTRUCTION SURVEY: ACT.COMPARED TO LAST MONTH-GERMANY SADJ	BDEUSBACQ
BD CONSTRUCTION SURVEY: EMPLOYMENT EXPECTATIONS - GERMANY SADJ	BDEUSBEMQ
BD CONSTRUCTION SURVEY: ORDER BOOK POSITION - GERMANY SADJ	BDEUSBOBQ
BD CONSTRUCTION SURVEY: PRICE EXPECTATIONS - GERMANY SADJ	BDEUSBPRQ
BD CONSUMER CONFIDENCE INDICATOR - GERMANY SADJ	BDEUSCCIQ
BD CONSUMER SURVEY: ECONOMIC SITUATION LAST 12 MTH-GERMANY SADJ	BDEUSCECQ
BD CONSUMER SURVEY: ECONOMIC SITUATION NEXT 12 MTH-GERMANY SADJ	BDEUSCEYQ
BD CONSUMER SURVEY: FINANCIAL SITUATION LAST 12 MTH-GERMANY SADJ	BDEUSCFNQ
BD CONSUMER SURVEY: FINANCIAL SITUATION NEXT 12 MTH-GERMANY SADJ	BDEUSCFYQ
BD CONSUMER SURVEY: MAJOR PURCH.OVER NEXT 12 MONTHS-GERMANY SADJ	BDEUSCPCQ
BD CONSUMER SURVEY: MAJOR PURCHASES AT PRESENT - GERMANY SADJ	BDEUSCMPQ
BD CONSUMER SURVEY: PRICES LAST 12 MONTHS - GERMANYSADJ	BDEUSCPRQ
BD CONSUMER SURVEY: PRICES NEXT 12 MONTHS - GERMANYSADJ	BDEUSCPYQ
BD CONSUMER SURVEY: SAVINGS AT PRESENT - GERMANY SADJ	BDEUSCSAQ
BD CONSUMER SURVEY: SAVINGS OVER NEXT 12 MONTHS - GERMANY SADJ	BDEUSCSYQ
BD CONSUMER SURVEY: STATEMENT ON FIN.SITUATION OF HOUSEHOLD SADJ	BDEUSCFHQ
BD CONSUMER SURVEY: UNEMPLOYMENT NEXT 12 MONTHS - GERMANY SADJ	BDEUSCUNQ
BD INDUSTRIAL CONFIDENCE INDICATOR - GERMANY SADJ	BDEUSICIQ
BD INDUSTRY SURVEY: EMP.EXPECTATIONS FOR MO.AHEAD -GERMANY SADJ	BDEUSIEMQ
BD INDUSTRY SURVEY: EXPORT ORDER BOOK POSITION - GERMANY SADJ	BDEUSIEBQ
BD INDUSTRY SURVEY: ORDER BOOK POSITION - GERMANY SADJ	BDEUSIOBQ
BD INDUSTRY SURVEY: PROD.EXPECTATION FOR MTH.AHEAD-GERMANY SADJ	BDEUSIPAQ
BD INDUSTRY SURVEY: PRODN. TRENDS IN RECENT MTH. - GERMANY SADJ	BDEUSIPRQ
BD INDUSTRY SURVEY: SELLING PRC.EXPECT.MTH. AHEAD -GERMANY SADJ	BDEUSISPQ
BD INDUSTRY SURVEY: STOCKS OF FINISHED GOODS - GERMANY SADJ	BDEUSIFPQ
BD RETAIL CONFIDENCE INDICATOR - GERMANY SADJ	BDEUSRCIQ
BD RETAIL SURVEY: CURRENT BUSINESS SITUATION - GERMANY SADJ	BDEUSRPBQ
BD RETAIL SURVEY: EMPLOYMENT - GERMANY SADJ	BDEUSREMQ
BD RETAIL SURVEY: FUTURE BUSINESS SITUATION - GERMANY SADJ	BDEUSREBQ
BD RETAIL SURVEY: ORDERS PLACED WITH SUPPLIERS - GERMANY SADJ	BDEUSROSQ
BD RETAIL SURVEY: STOCKS - GERMANY SADJ	BDEUSRSTQ

FRANCE

FR PRODUCTION OF TOTAL INDUSTRY (EXCLUDING CONSTRUCTION) VOLA	FROPRI35G
FR PRODUCTION IN TOTAL MANUFACTURING VOLA	FROPRI38G
FR PRODUCTION OF TOTAL MANUFACTURED CONSUMER GOODS VOLA	FROPRI49G
FR PRODUCTION OF TOTAL MANUFACTURED INTERMEDIATE GOODS VOLA	FROPRI61G
FR PRODUCTION OF TOTAL MANUFACTURED INVESTMENT GOODS VOLA	FROPRI70G
FR PRODUCTION OF TOTAL ENERGY VOLA	FROPRI44G
FR PRODUCTION IN TOTAL AGRICULTURE VOLA	FROPRI47G
FR PRODUCTION OF TOTAL CONSTRUCTION VOLA	FROPRI30G
FR PRODUCTION OF TOTAL VEHICLES VOLA	FROPRI58G
FR PERMITS ISSUED FOR DWELLINGS VOLA	FROODI15O
FR WORK STARTED FOR DWELLINGS VOLA	FROWSI41O
FR TOTAL RETAIL TRADE (VOLUME) VOLA	FROSLI15G
FR HOUSEHOLD CONSUMPTION - MANUFACTURED GOODS CONA	FRHCONMGD
FR HOUSEHOLD CONSUMPTION - MANUFACTURED GOODS, RETAIL GOODS CONA	FRHCONMCD
FR HOUSEHOLD CONSUMPTION - AUTOMOBILES CONA	FRHCONAUD
FR HOUSEHOLD CONSUMPTION - DURABLE GOODS CONA	FRHCONDGD
FR HOUSEHOLD CONSUMPTION - TEXTILES & LEATHER CONA	FRHCONTLD
FR HOUSEHOLD CONSUMPTION - OTHER MANUFACTURED GOODSCONA	FRHCONOTD
FR HOUSEHOLD CONSUMPTION - FURNITURE CONA	FRHCONFND
FR HOUSEHOLD CONSUMPTION - HOUSEHOLD APPLIANCES CONA	FRHCONHAD
FR HOUSEHOLD CONSUMPTION - ELECTRICAL GOODS CONA	FRHCONELD
FR PASSENGER CAR REGISTRATIONS SADJ	FROSLI12E
FR TOTAL CAR REGISTRATIONS VOLA	FROSLI05O
FR IMPORTS FOB CURA	FROXT009B
FR EXPORTS FOB CURA	FROXT003B
FR UNEMPLOYMENT VOLA	FROUN010O
FR NEW UNEMPLOYMENT CLAIMS SADJ	FROUN007G
FR UNEMPLOYMENT RATE (% OF TOTAL LABOUR FORCE) SADJ	FROUN015Q
FR NEW JOB VACANCIES FULL & PART-TIME REGISTERED DURING MONTH	FRVACTOTO
FR PPI - AGRICULTURAL GOODS NADJ	FROPP004F
FR PPI - INTERMEDIATE GOODS EXCLUDING ENERGY NADJ	FROPP065F
FR PPI - CHEMICALS NADJ	FROPP054F
FR PPI - METAL PRODUCTS NADJ	FROPP037F
FR PPI - MANUFACTURED PRODUCTS NADJ	FROPP017F
FR CPI NADJ	FROCP009F
FR CPI - FOOD NADJ	FROCP019F
FR CPI - ENERGY NADJ	FROCP041F
FR CPI - EXCLUDING FOOD & ENERGY NADJ	FROCP042F
FR CPI - RENT NADJ	FROCP054F
FR CPI - SERVICES EXCLUDING RENT NADJ	FROCP064F
FR MONEY SUPPLY - M1 (NATIONAL CONTRIBUTION TO M1) CURN	FRM1....A
FR MONEY SUPPLY - M2 (NATIONAL CONTRIBUTION TO M2) CURN	FRM2....A
FR MONEY SUPPLY - M3 (NATIONAL CONTRIBUTION TO M3) CURN	FRM3....A
FR PIBOR / EURIBOR - 3-MONTH (MTH.AVG.)	FRINTER3
FR YIELD 10-YEAR GOVERNMENT BENCHMARK BONDS NADJ	FROIR080R
FR SHARE PRICES - SBF 250 NADJ	FROSP001F
FR FRENCH FRANC TO US $	FRXRUSD.
UK MARKET PRICE - UK BRENT CURN	UKI76AAZA
FR ECONOMIC SENTIMENT INDICATOR - FRANCE SADJ	FREUSESIG
FR CONSTRUCTION CONFIDENCE INDICATOR - FRANCE SADJ	FREUSBCIQ
FR CONSTRUCTION SURVEY: ACT.COMPARED TO LAST MONTH - FRANCE SADJ	FREUSBACQ
FR CONSTRUCTION SURVEY: EMPLOYMENT EXPECTATIONS - FRANCE SADJ	FREUSBEMQ
FR CONSTRUCTION SURVEY: ORDER BOOK POSITION - FRANCE SADJ	FREUSBOBQ
FR CONSTRUCTION SURVEY: PRICE EXPECTATIONS - FRANCESADJ	FREUSBPRQ
FR CONSUMER CONFIDENCE INDICATOR - FRANCE SADJ	FREUSCCIQ
FR CONSUMER SURVEY: ECONOMIC SITUATION LAST 12 MTH.- FRANCE SADJ	FREUSCECQ
FR CONSUMER SURVEY: ECONOMIC SITUATION NEXT 12 MTH.- FRANCE SADJ	FREUSCEYQ
FR CONSUMER SURVEY: FINANCIAL SITUATION LAST 12 MTH- FRANCE SADJ	FREUSCFNQ
FR CONSUMER SURVEY: FINANCIAL SITUATION NEXT 12 MTH- FRANCE SADJ	FREUSCFYQ
FR CONSUMER SURVEY: MAJOR PURCH.OVER NEXT 12 MONTHS- FRANCE SADJ	FREUSCPCQ
FR CONSUMER SURVEY: MAJOR PURCHASES AT PRESENT - FRANCE SADJ	FREUSCMPQ
FR CONSUMER SURVEY: PRICES LAST 12 MONTHS - FRANCE SADJ	FREUSCPRQ
FR CONSUMER SURVEY: PRICES NEXT 12 MONTHS - FRANCE SADJ	FREUSCPYQ
FR CONSUMER SURVEY: SAVINGS AT PRESENT - FRANCE SADJ	FREUSCSAQ
FR CONSUMER SURVEY: SAVINGS OVER NEXT 12 MONTHS - FRANCE SADJ	FREUSCSYQ
FR CONSUMER SURVEY: STATEMENT ON FIN.SITUATION OF HOUSEHOLD SADJ	FREUSCFHQ
FR CONSUMER SURVEY: UNEMPLOYMENT NEXT 12 MONTHS - FRANCE SADJ	FREUSCUNQ
FR INDUSTRIAL CONFIDENCE INDICATOR - FRANCE SADJ	FREUSICIQ
FR INDUSTRY SURVEY: EMP.EXPECTATIONS FOR MO. AHEAD - FRANCE SADJ	FREUSIEMQ
FR INDUSTRY SURVEY: EXPORT ORDER BOOK POSITION - FRANCE SADJ	FREUSIEBQ
FR INDUSTRY SURVEY: ORDER BOOK POSITION - FRANCE SADJ	FREUSIOBQ
FR INDUSTRY SURVEY: PROD.EXPECTATION FOR MTH.AHEAD - FRANCE SADJ	FREUSIPAQ
FR INDUSTRY SURVEY: PRODN. TRENDS IN RECENT MTH. - FRANCE SADJ	FREUSIPRQ
FR INDUSTRY SURVEY: SELLING PRC.EXPECT. MTH. AHEAD - FRANCE SADJ	FREUSISPQ
FR INDUSTRY SURVEY: STOCKS OF FINISHED GOODS - FRANCE SADJ	FREUSIFPQ
FR RETAIL CONFIDENCE INDICATOR - FRANCE SADJ	FREUSRCIQ
FR RETAIL SURVEY: CURRENT BUSINESS SITUATION - FRANCE SADJ	FREUSRPBQ
FR RETAIL SURVEY: EMPLOYMENT - FRANCE SADJ	FREUSREMQ
FR RETAIL SURVEY: FUTURE BUSINESS SITUATION - FRANCE SADJ	FREUSREBQ
FR RETAIL SURVEY: ORDERS PLACED WITH SUPPLIERS - FRANCE SADJ	FREUSROSQ
FR RETAIL SURVEY: STOCKS - FRANCE SADJ	FREUSRSTQ

ITALY

IT PRODUCTION OF TOTAL INDUSTRY (EXCLUDING CONSTRUCTION) VOLA	ITOPRI35G
IT PRODUCTION OF TOTAL MANUFACTURED CONSUMER GOODS VOLA	ITOPRI49G
IT PRODUCTION OF TOTAL MANUFACTURED INTERMEDIATE GOODS VOLA	ITOPRI61G
IT PRODUCTION OF TOTAL MANUFACTURED INVESTMENT GOODS VOLA	ITOPRI70G
IT SALES OF TOTAL MANUFACTURED GOODS (VALUE) NADJ	ITOSLI09F
IT SALES OF TOTAL MANUFACTURED CONSUMER GOODS (VALUE) NADJ	ITOSLI61F
IT SALES OF MANUFACTURED INTERMEDIATE GOODS (VALUE)NADJ	ITOSLI64F
IT SALES OF MANUFACTURED INVESTMENT GOODS (VALUE) NADJ	ITOSLI65F
IT ORDERS FOR TOTAL MANUFACTURED GOODS (VALUE) SADJ	ITOODI32E
IT TOTAL RETAIL TRADE (VOLUME) VOLA	ITOSLI15G
IT TOTAL CAR REGISTRATIONS VOLA	ITOSLI05O
IT PASSENGER CAR REGISTRATIONS SADJ	ITOSLI12E
IT IMPORTS CIF CURA	ITOXT009B
IT EXPORTS FOB CURA	ITOXT003B
IT STANDARDIZED UNEMPLOYMENT RATE SADJ	ITOUN014Q
IT PPI NADJ	ITOPP019F
IT CPI NADJ	ITOCP009F
IT CPI - FOOD NADJ	ITOCP019F
IT CPI - ENERGY NADJ	ITOCP041F
IT CPI - EXCLUDING FOOD & ENERGY NADJ	ITOCP042F
IT CPI - SERVICES LESS HOUSING NADJ	ITOCP064F
IT CPI - HOUSING NADJ	ITOCP057F
IT EXPORT UNIT VALUE INDEX NADJ	ITEXPPRCF
IT MONEY SUPPLY: M1 - ITALIAN CONTRIBUTION TO THE EURO AREA CURN	ITM1....A
IT MONEY SUPPLY: M2 - ITALIAN CONTRIBUTION TO THE EURO AREA CURN	ITM2....A
IT MONEY SUPPLY: M3 - ITALIAN CONTRIBUTION TO THE EURO AREA CURN	ITM3....A
IT TREASURY BOND NET YIELD -SECONDARY MKT. (EP)	ITGBOND.
IT SHARE PRICES - ISE MIB STORICO NADJ	ITOSP001F
IT ITALIAN LIRE TO US $ (MTH.AVG.)	ITXRUSD.
UK MARKET PRICE - UK BRENT CURN	UKI76AAZA
IT ECONOMIC SENTIMENT INDICATOR - ITALY SADJ	ITEUSESIG
IT CONSTRUCTION CONFIDENCE INDICATOR - ITALY SADJ	ITEUSBCIQ
IT CONSTRUCTION SURVEY: ACT.COMPARED TO LAST MONTH - ITALY SADJ	ITEUSBACQ
IT CONSTRUCTION SURVEY: EMPLOYMENT EXPECTATIONS - ITALY SADJ	ITEUSBEMQ
IT CONSTRUCTION SURVEY: ORDER BOOK POSITION - ITALYSADJ	ITEUSBOBQ
IT CONSTRUCTION SURVEY: PRICE EXPECTATIONS - ITALY SADJ	ITEUSBPRQ
IT CONSUMER CONFIDENCE INDICATOR - ITALY SADJ	ITEUSCCIQ
IT CONSUMER SURVEY: ECONOMIC SITUATION LAST 12 MTH.- ITALY SADJ	ITEUSCECQ
IT CONSUMER SURVEY: ECONOMIC SITUATION NEXT 12 MTH.- ITALY SADJ	ITEUSCEYQ
IT CONSUMER SURVEY: FINANCIAL SITUATION LAST 12 MTH.- ITALY SADJ	ITEUSCFNQ
IT CONSUMER SURVEY: FINANCIAL SITUATION NEXT 12 MTH.- ITALY SADJ	ITEUSCFYQ
IT CONSUMER SURVEY: MAJOR PURCH.OVER NEXT 12 MONTHS- ITALY SADJ	ITEUSCPCQ
IT CONSUMER SURVEY: MAJOR PURCHASES AT PRESENT - ITALY SADJ	ITEUSCMPQ
IT CONSUMER SURVEY: PRICES LAST 12 MONTHS - ITALY SADJ	ITEUSCPRQ
IT CONSUMER SURVEY: PRICES NEXT 12 MONTHS - ITALY SADJ	ITEUSCPYQ
IT CONSUMER SURVEY: SAVINGS AT PRESENT - ITALY SADJ	ITEUSCSAQ
IT CONSUMER SURVEY: SAVINGS OVER NEXT 12 MONTHS - ITALY SADJ	ITEUSCSYQ
IT CONSUMER SURVEY: STATEMENT ON FIN.SITUATION OF HOUSEHOLD SADJ	ITEUSCFHQ
IT CONSUMER SURVEY: UNEMPLOYMENT NEXT 12 MONTHS - ITALY SADJ	ITEUSCUNQ
IT INDUSTRIAL CONFIDENCE INDICATOR - ITALY SADJ	ITEUSICIQ
IT INDUSTRY SURVEY: EMP. EXPECTATIONS FOR MO. AHEAD- ITALY SADJ	ITEUSIEMQ
IT INDUSTRY SURVEY: EXPORT ORDER BOOK POSITION - ITALY SADJ	ITEUSIEBQ
IT INDUSTRY SURVEY: ORDER BOOK POSITION - ITALY SADJ	ITEUSIOBQ
IT INDUSTRY SURVEY: PROD.EXPECTATION FOR MTH. AHEAD- ITALY SADJ	ITEUSIPAQ
IT INDUSTRY SURVEY: PRODN. TRENDS IN RECENT MTH. - ITALY SADJ	ITEUSIPRQ
IT INDUSTRY SURVEY: SELLING PRC. EXPECT. MTH. AHEAD- ITALY SADJ	ITEUSISPQ
IT INDUSTRY SURVEY: STOCKS OF FINISHED GOODS - ITALY SADJ	ITEUSIFPQ
IT RETAIL CONFIDENCE INDICATOR - ITALY SADJ	ITEUSRCIQ
IT RETAIL SURVEY: CURRENT BUSINESS SITUATION - ITALY SADJ	ITEUSRPBQ
IT RETAIL SURVEY: EMPLOYMENT - ITALY SADJ	ITEUSREMQ
IT RETAIL SURVEY: FUTURE BUSINESS SITUATION - ITALYSADJ	ITEUSREBQ
IT RETAIL SURVEY: ORDERS PLACED WITH SUPPLIERS - ITALY SADJ	ITEUSROSQ
IT RETAIL SURVEY: STOCKS - ITALY SADJ	ITEUSRSTQ

SPAIN

ES PRODUCTION OF TOTAL INDUSTRY (EXCLUDING CONSTRUCTION) VOLA	ESOPRI35G
ES PRODUCTION IN TOTAL MANUFACTURING VOLA	ESOPRI38G
ES PRODUCTION IN TOTAL MINING VOLN	ESOPRI36H
ES PRODUCTION OF TOTAL MANUFACTURED CONSUMER GOODS VOLN	ESOPRI49H
ES PRODUCTION OF TOTAL MANUFACTURED INTERMEDIATE GOODS VOLN	ESOPRI61H
ES PRODUCTION OF TOTAL MANUFACTURED INVESTMENT GOODS VOLN	ESOPRI70H
ES PRODUCTION OF CEMENT VOLA	ESOPRI01O
ES PRODUCTION OF ACCOMMODATION: NIGHTS IN HOTEL VOLA	ESOPRI21O
ES PASSENGER CAR REGISTRATIONS VOLA	ESOSLI12O
ES CONSUMPTION: PETROL - CARS (VOLA) VOLA	ESPCA313O
ES CONSUMPTION: DIESEL OIL (VOLA) VOLA	ESOIL562O
ES ELECTRICITY CONSUMPTION (VOLA) VOLA	ESECO312O

ES ELECTRICITY CONSUMPTION - INDUSTRIAL SECTOR (VOLA) VOLA	ESELE629G
ES CONSUMPTION: VISIBLE - CEMENT (VOLA) VOLA	ESCEM301O
ES IMPORTS CIF CURA	ESOXT009B
ES EXPORTS FOB CURA	ESOXT003B
ES STANDARDIZED UNEMPLOYMENT RATE SADJ	ESOUN014Q
ES PPI NADJ	ESOPP019F
ES PPI - AGRICULTURAL PRODUCTS NADJ	ESOPP004F
ES PPI - MANUFACTURING ALL ITEMS NADJ	ESOPP017F
ES PPI - INTERMEDIATE GOODS NADJ	ESOPP064F
ES PPI - CONSUMER GOODS NADJ	ESOPP062F
ES PPI - INVESTMENT GOODS NADJ	ESOPP068F
ES PPI - ENERGY NADJ	ESOPP022F
ES CPI NADJ	ESOCP009F
ES CPI - ENERGY NADJ	ESOCP041F
ES CPI - EXCLUDING FOOD & ENERGY NADJ	ESOCP042F
ES CPI - SERVICES EXCLUDING RENT NADJ	ESOCP064F
ES CPI - RENT NADJ	ESOCP057F
ES CONSTRUCTION COST INDEX NADJ	ESOOP005F
ES EXPORT UNIT VALUE INDEX NADJ	ESEXPPRCF
ES IMPORT UNIT VALUE INDEX NADJ	ESIMPPRCF
ES MONEY SUPPLY: M2 - SPANISH CONTRIBUTION TO EURO M2 CURN	ESM2....A
ES MONEY SUPPLY: M3 - SPANISH CONTRIBUTION TO EURO M3 CURN	ESM3....A
ES INTERBANK RATE - 3 MONTH (WEIGHTED AVERAGE, EP)	ESINTER3
ES YIELD 10-YEAR GOVERNMENT BONDS NADJ	ESOIR080R
ES SHARE PRICES - MSE GENERAL INDEX NADJ	ESOSP001F
ES SPANISH PESETAS TO US $ (MTH.AVG.)	ESXRUSD.
UK MARKET PRICE - UK BRENT CURN	UKI76AAZA
ES ECONOMIC SENTIMENT INDICATOR - SPAIN SADJ	ESEUSESIG
ES CONSTRUCTION CONFIDENCE INDICATOR - SPAIN SADJ	ESEUSBCIQ
ES CONSTRUCTION SURVEY: ACT.COMPARED TO LAST MONTH - SPAIN SADJ	ESEUSBACQ
ES CONSTRUCTION SURVEY: EMPLOYMENT EXPECTATIONS - SPAIN SADJ	ESEUSBEMQ
ES CONSTRUCTION SURVEY: ORDER BOOK POSITION - SPAINSADJ	ESEUSBOBQ
ES CONSTRUCTION SURVEY: PRICE EXPECTATIONS - SPAIN SADJ	ESEUSBPRQ
ES CONSUMER CONFIDENCE INDICATOR - SPAIN SADJ	ESEUSCCIQ
ES CONSUMER SURVEY: ECONOMIC SITUATION LAST 12 MTH.- SPAIN SADJ	ESEUSCECQ
ES CONSUMER SURVEY: ECONOMIC SITUATION NEXT 12 MTH.- SPAIN SADJ	ESEUSCEYQ
ES CONSUMER SURVEY: FINANCIAL SITUATION LAST 12 MTH.- SPAIN SADJ	ESEUSCFNQ
ES CONSUMER SURVEY: FINANCIAL SITUATION NEXT 12 MTH.- SPAIN SADJ	ESEUSCFYQ
ES CONSUMER SURVEY: MAJOR PURCH.OVER NEXT 12 MONTHS- SPAIN SADJ	ESEUSCPCQ
ES CONSUMER SURVEY: MAJOR PURCHASES AT PRESENT - SPAIN SADJ	ESEUSCMPQ
ES CONSUMER SURVEY: PRICES LAST 12 MONTHS - SPAIN SADJ	ESEUSCPRQ
ES CONSUMER SURVEY: PRICES NEXT 12 MONTHS - SPAIN SADJ	ESEUSCPYQ
ES CONSUMER SURVEY: SAVINGS AT PRESENT - SPAIN SADJ	ESEUSCSAQ
ES CONSUMER SURVEY: SAVINGS OVER NEXT 12 MONTHS - SPAIN SADJ	ESEUSCSYQ
ES CONSUMER SURVEY: STATEMENT ON FIN.SITUATION OF HOUSEHOLD SADJ	ESEUSCFHQ
ES CONSUMER SURVEY: UNEMPLOYMENT NEXT 12 MONTHS - SPAIN SADJ	ESEUSCUNQ
ES INDUSTRIAL CONFIDENCE INDICATOR - SPAIN SADJ	ESEUSICIQ
ES INDUSTRY SURVEY: EMP. EXPECTATIONS FOR MO. AHEAD- SPAIN SADJ	ESEUSIEMQ
ES INDUSTRY SURVEY: EXPORT ORDER BOOK POSITION - SPAIN SADJ	ESEUSIEBQ
ES INDUSTRY SURVEY: ORDER BOOK POSITION - SPAIN SADJ	ESEUSIOBQ
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