COMISEF Computational Optimization Methods in Statistics, Econometrics and Finance

- Marie Curie Research and Training Network funded by the EU Commission through MRTN-CT-2006-034270 -

COMISEF WORKING PAPERS SERIES

WPS-025 27/01/2010

The Response of Retail Interest Rates to Factor Forecasts of Money Market Rates in Major European Economies

A. Banerjee
V. Bystrov
P. Mizen

The Response of Retail Interest Rates to Factor Forecasts of Money Market Rates in Major European Economies

Anindya Banerjee [*], Victor Bystrov [†§] and Paul Mizen [‡]

This draft: January 2010

Abstract

The recent financial crisis has underlined that banks no longer simply accumulate deposits and lend a fraction to their clients. Instead they use interbank markets and structured finance to increase their loan book. This has implications for the understanding of interest rate pass through since a large number of interest rates and macro variables influence the retail rates they set on loans and deposits. This paper uses Stock-Watson factor forecasts to predict market interest rates which are then used as the basis for setting retail rates. We find a significant role for forecasts of future interest rates in determining short- and long-run pass through, and we argue that models which do not include future rates are misspecified.

Keywords: forecasting, factor models, interest rate pass-through

JEL: C32, C53, E43, E47

[*] Professor of Econometrics, University of Birmingham, a.banerjee@bham.ac.uk

[†] Assistant Professor, University of Lodz, emfvib@uni.lodz.pl

[‡] Professor of Monetary Economics, University of Nottingham, paul.mizen@nottingham.ac.uk

[§] The author gratefully acknowledges financial support from the EU Commission through MRTN-CT-2006-034270 COMISEF.

1 Introduction

The financial crisis has focused attention on the inter-bank market for wholesale funding, which saw a decline in the volume of lending and an increase in spreads over the implied official rates at comparable maturities during the period 2007 - 2009. Although the financial crisis brought to an end a period when banks borrowed funds to support loan growth, the wholesale money market is important because banks had, in previous years, relied heavily on these markets to provide funding for their retail products. Llewellyn (2009) notes that between 1998 and 2008 the top US banks reduced their deposit to asset ratios from 45 percent to 36 percent, demonstrating a tendency to increase their borrowing from wholesale markets to fund lending rather than to rely on their own deposit base. These banks also held fewer liquid assets since they had access to money markets and could obtain funds from the rapidly growing securitised product market. The growth of the market for residential mortgage backed securities (RMBS), asset backed securities (ABS) and collateralised debt obligations (CDOs) and their related products provided access to resources to further expand their lending activities. This tendency to expand the loan book using access to interbank markets is also seen for banks in the euroarea. Miles (2009) reports that the gap between bank loans and deposits in millions of euros has risen from EUR1 billion in 1998 to almost EUR 3.5 bn in 2008. The growth in securitisation of mortgages, loans and other products has occured more recently, but is substantial nonetheless.

Greater reliance on wholesale markets is not a recent phenomenon. Banks substantially changed their funding model a decade before the financial crisis emerged (Borio, 2008, Mizen, 2008, and Llewellyn, 2009) and they were much more reliant on a range of funding options from wholesale markets to structured products up until the point that the financial crisis occurred. This introduces a much wider array of relevant market interest rates to the pricing of loans, mortgages and deposit products than has been considered in most models of interest rate pass through.

The changing nature of bank funding brought into focus through the financial crisis requires us to ask a number of important questions about the relationship between interest rates in wholesale and retail markets. For example, in the light of the recent widening of spreads we might ask 'How closely did retail rates follow wholesale rates prior to the crisis in the major euro area countries, and elsewhere?' and 'How much does the recent emergence of spreads reflect an attempt by banks to widen their margins, or expectations of future rate rises from current low levels?' We can also ask some questions about the evidence of pass through at the country level, for example, 'Does the evidence calculated at the national level match the evidence at the aggregate level of the euro area?' and 'Was the euro area experience of pass-through dynamic similar or different to the United Kingdom?.

Most empirical studies have concentrated on the relationship between current retail rates, current wholesale rates and lagged terms in these rates, individually, modelling dynamic adjustment around the one-period lag of a linear long-run relationship. The implicit assumption is that the retail rate has a unique contemporaneous relationship with a single, current wholesale rate representing the cost of funds, and any dynamic adjustment is backward looking. This ignores any projection, or forecast, of rates that might be undertaken by banks, and neglects a large amount of information available in the plethora of interest rates and macroeconomic data that is likely to be relevant to retail interest rate setting. We therefore argue that such models are inconsistent with the behaviour of financial markets and lag behind the practice of banks in the decade before the financial crisis.

We contribute to the literature by emphasizing that financial institutions seek to anticipate the direction of future rates and use projections to determine whether they should change retail rates in response to changes to interest rates in the wholesale markets. We provide a simple theoretical argument for introducing expectations of future wholesale rates into retail rate setting decisions, and demonstrate that a model that excludes forecasts would be misspecified. We implement our forward-looking framework by allowing retail rates to depend on current and lagged changes of retail and market rates, a long-run relationship in levels, and forecasts of wholesale rates several months ahead.

In order to generate these forecasts of wholesale rates with relevant maturities at different horizons, we investigate the performance of autoregressive and a wide variety of dynamic factor models. The factor forecasts are based on a range of information, including interest rates at various maturities, swap rates and macroeconomic variables that might influence the path of monetary policy. We utilise rich datasets, for four of the largest economies of the euro area (France, Germany, Italy and Spain) as well as for the aggregate euro area and the United Kingdom. The categories of variables used in the forecasting exercise match broadly the categories considered by Stock and Watson (2002, 2003) in estimating their forecasting models for macroeconomic variables in the United States, and include production indicators, earnings, unemployment, price indices, monetary indicators, exchange rates, and commodity prices, but we augment this data with the interest rates and yields in money and bond markets.* A principal components method is used to extract factors which explain wholesale rates, and these are then used to determine retail rates offered to households and firms. We evaluate sixteen forecasting models and choose the superior forecasting model based on a minimum mean square forecast error criterion for many wholesale rates, forecast horizons and countries, which can then explain different retail rates. Our sample of monthly data runs from January 1991 to June 2007. The only other paper that has followed a similar dynamic factor approach to modelling retail interest rates is Barbier de la Serre et al (2008), which restricts its attention to France using data from January 2003 to July 2007.

We find a significant role for expectations of future interest rates in determining short- and long-run pass through, and we argue that models which do not include future rates are misspecified. Several extensions of this work are also proposed, such as comparing the efficacy of forecasts of interest rates derived from our framework with market forward rates, and implementing forecasting using real-time data in order to take full account of the revisions of the dataset.

The paper is organised as follows. The next section provides a brief literature review. Section 3 provides a theoretical basis for including forecasts of future market rates, section 4 gives an outline of our econometric methodology, and Section 5 gives our data sources. Section 6 reports the results and the final section concludes.

2 Background

The conventional basis for thinking about the interest rate setting behaviour of banks has been the banking firm model based on the Monti-Klein framework (c.f. Monti, 1971, Klein, 1971). It supposes that banks only engage in 'originate and hold' behaviour, using their own deposits as the basis for their own lending, and assumes that all loans are held to maturity. The markup (markdown) of loans (deposits) over a risk free rate is then a function of market power, and loan rates and deposit rates take a positive or negative markup over the contemporaneous risk free rate i.e. the official rate or a wholesale rate. Banks have no alternative source of funds because

*We recognise the greater financial sophistication of borrowing and lending *between banks* by considering EURIBOR and LIBOR rates with maturities up to a year, yields on medium term bonds from 2 to 10 years maturity and longer term bonds up to 30 years to maturity, swap rates from 2 to 10 years, commercial paper rates and treasury bill rates up to a year to maturity.

there is no market for interbank lending in this model. Clearly this does not correspond to the actual behaviour of banks over the last decade or more.

Evidence on interest rate pass through has been founded on this model to answer questions about the adjustment speed of interest rates, the degree of linearity or nonlinearity in the response of retail rates to market rates and financial market integration, competition and efficiency. These studies use time series of weighted averaged interest rates by broad product category such as deposits, loans and mortgages, or individual rates for identifiable banks, products, and tiers within countries. Some papers have used the official refinancing rate as the benchmark, others have used a closely related short-term wholesale money market rate such as a EURIBOR rate. As better definition of the rates on different products has been possible, first through the national retail interest rate (NRIR) series and later through the money and financial institutions interest rate (MIR) statistics, authors have selected the market rate to match more closely the maturity of the retail rate. This is justified by appealing to a 'cost of funds' argument, which states that the marginal cost of funds is best captured by the rate on the market rate with the closest maturity to the retail product. A similar, and related argument, for this approach is that the monetary or financial institution will try to avoid mismatch in assets and liabilities by funding a loan with market finance at a similar maturity e.g. a money market instrument or bond issue, and therefore the rate or yield on that instrument gives the benchmark rate. This is fine in theory, but in practice there are problems as noted by Sander and Kleimeier (2004) and Sorensen and Werner (2005). First, since the 'most appropriate' market rate is not always chosen by maturity matching but by a pre-selection method using the correlation between the retail rate in question and alternative market rates, the method can overstate the extent of pass through since the highest correlation delivers the highest pass through coefficient among the options available. Second, it is not always possible to find a close match between retail and wholesale rates because the retail rate categories can be quite coarse - a problem that was particularly acute with the NRIR database, but is less serious for the MIR database. Besides, market rates exist only at certain maturities. Sorensen and Werner (2005) overcame some of these problems by using higher definition MIR data, by creating synthetic market rates from the existing actual market rates at given maturities and by selecting benchmark rates using correlations within pre-defined maturity bands appropriate for the retail rate in question. Their work represents one of the most sophisticated approaches to the issue of benchmark rate selection and is one that we follow in this paper, using their data series for some countries.

Barbier de la Serre et al (2008) recognise that hedging and securitisation through the markets are not captured in this 'cost of funds' approach, even when it is done in a very sophisticated way. There is a vast array of variables (interest rates and macroeconomic data) that indicate the direction of future monetary policy that can influence the setting of retail rates. Some of these variables are future-dated expected short-term rates. They make use of common factors to explain omitted variables in the relationship between the retail rate and the market rate in France from January 2003 to July 2007. We follow a similar stratey for four euro area countries, the euro area as a whole and the United Kingdom.

Early approaches to pass through such as the Monti-Klein model assumed perfectly competitive financial markets in theoretical frameworks which imply pass through should be full, symmetric and relatively swift to changes in official rates, but few studies found this to be the case. The literature introduced a number of modifications to the original framework, which reflected more realistic features of financial markets, including imperfect competition, asymmetric information, and switching costs. These have resulted in models that imply that full pass-through is a long-run phenomenon, with deviations from this 'equilibrium' occuring in the short-run.[†]

[†]de Bondt et al. 2005 provide a systematic summary of short-run and long-run pass through estimates from the literature (1994-2004) in Table 1 of their paper. In most cases the long run pass through, for the majority of

Empirically these were reflected in asymmetric and non-linear adjustment (c.f. Heffernan (1997), Hofmann and Mizen (2004), Sander and Kleimeier (2004), de Graeve et al. (2007), and Fuertes et al. (2008)) in response to official rate changes. Studies of time series of weighted averaged interest rates and panel of data for individual financial institutions interest rates have found strong evidence for nonlinearity and heterogeneity as financial institutions negotiate imperfections in financial markets, switching and menu costs.

Other papers have focused on the efficiency of financial markets. Kuttner (2001), Bernoth and von Hagen (2004) and Sander and Kleimeier (2006) have used futures prices to make allowance for anticipated and unanticipated monetary policy changes on the adjustment of retail rates. Sander and Kleimeier (2006) show there is a greater response to anticipated monetary policy changes measured by interest rate futures than to unanticipated changes.

Another branch of the literature has compared the retail rate setting behaviour of banks in different euroarea countries in response to a common monetary policy action, and these include Mojon (2000), Erhmann et al (2001), Erhmann and Worms (2001), Worms (2001), Weth (2002), Sander and Kleimeier (2004, 2006). They consider whether convergence in financial markets has occurred as economic reform has taken place through a common monetary policy and due to competition between banks across the euroarea. The majority view is that, at the micro level, pass through is strongly influenced by banks' financial characteristics and the banking industry structure in each country and this dominates the influence of monetary union or competitive forces across the euro area as a whole. Bondt et al. (2002), Bondt (2005), Kok-Sorrenson and Werner (2005), Sander and Kleimeier (2004, 2006) show that the degree of pass through continues to be substantially different across the euro area despite a common monetary policy.

3 Theoretical basis for a forward-looking model

Using a simple model based on the Ball and Mankiw (1994) to introduce fixed menu costs, C, of changing interest rates, Hofmann and Mizen (2004) showed that there would be an incentive for financial institutions not to adjust retail interest rates rates, rr_{t+i}, in response to observed changes in market rates, mr_{t+i}. If the required adjustment to rates in the context of a two-period model were to lie within some interval $(rr_t - mr_t) \in \left[-\sqrt{\frac{C}{2}} + \frac{E_t mr_{t+2} - mr_{t+1}}{2}, \sqrt{\frac{C}{2}} + \frac{E_t mr_{t+2} - mr_{t+1}}{2}\right]$.

In this paper we generalise the result above in order to emphasise the importance of forward-looking behaviour and forecasts of future interest rates. The model has many periods, and if at any point in time the retail interest rate is changed, the financial intermediary incurs a fixed cost, C, of making the change. Therefore our model has a significant difference compared to the Ball-Mankiw (B-M) model. In B-M the financial intermediary can make changes to rates costlessly in even periods, but incurs a fixed cost C when making a price change in an odd period. In our model the financial intermediary sets the price (the retail rate) and incurs a cost of changing it once set. We make this alteration for two reasons, first, it is realiastic to assume that reseting the retail rate incurs a cost to the financial intermediary (the fixed cost of informing the borrowers of rate changes either by letter or advertisement) at any time that the change is made, and second, where the retail product is arranged through a contract in the financial markets the cost of altering the arrangement will involve a fixed fee. An examples of the second type includes fixed rate mortgages that exchange fixed payments for variable interest through swap markets, it is for this reason that financial intermediaries impose penalties for early repayment to cover their costs if swap contracts need to be altered.

Wholesale rates represent the cost of additional funds for the financial intermediary, assuming that deposits have been fully used to provide existing loans, and at the point in time that the

countries and for the euroarea as a whole, is 100 percent, or very close to that figure.

retail rate is posted it attempts to forecast future wholesale rates in order to set the retail rate at a level that represents the average cost of new funds for the period of the loan. Hence the optimal retail rate set at the beginning of the period for an H-period retail product e.g. a 30 year mortgage is then given by:

$$rr_t^* = \frac{\sum_{h=0}^{H-1} E_{t-1} mr_{t+h}}{H}, \tag{1}$$

where $E_{t-1}mr_{t+h}$ is the future expected (forecast) wholesale rate based on information known at $t-1$. This determines the ex ante optimal retail rate, but ignores the effects of shocks to the interest rate. Once we allow for shocks to cause the actual future rate to deviate from the expected future rate then there will be conditions in which it is optimal to reset interest rates, incurring a fixed cost of doing so.

At any point in time an innovation, ε_{t+h+1} could cause the wholesale rate to deviate from its expected value i.e.

$$mr_{t+h+1} = E_{t-1}mr_{t+h} + \varepsilon_{t+h+1}$$

where $\varepsilon_{t+h+1}$is a shock which is normally distributed with zero mean and constant variance. If a shock occurs in period $j+1$ then the financial institution could reset the rate for an H-period retail product to:

$$rr_{t+j}^* = \frac{\sum_{h=0}^{H-1} E_{t+j} mr_{t+h+j}}{H}$$

at a cost, C. There is only an incentive for the bank to adjust its retail rates in any period if the loss of not adjusting is higher than the menu cost, but this depends how large is the difference between the retail rate and the newly preferred level for retail rates, based on its knowledge of shocks to market rates, its view about future markett rates and the cost of adjustment:

The loss function the financial intermediary minimises in each period j is

$$\begin{aligned} & E_{t+j}\left[\sum_{j=0}^{J-1}\sum_{h=0}^{H-1}\left(rr_{t+j}^* - mr_{t+h+j}\right)^2\right] \\ = \; & H(rr_{t+j}^* - rr_{t+j+1}^* - rr_{t+j+2}^* - rr_{t+j+3}^* - ...) > C \end{aligned}$$

Where this can be rearranged to yield:

$$\left[\left(rr_{t+j}^* - \frac{E_{t+j}\sum_{j=0}^{J-1}\sum_{h=0}^{H-1}(mr_{t+h+j})}{H}\right) - \frac{E_{t+j}\sum_{j=1}^{J-1}\sum_{h=0}^{H-1}(mr_{t+h+j+1} - \sum_{j=0}^{J-1}\sum_{h=0}^{H-1} mr_{t+h+j})}{H}\right]^2 > \frac{C}{H}$$

The first term is the deviation from long-run equilibrium, the second term represents the average expected change in the wholesale rates H periods into the future for each time period j. The firm will not adjust if:

$$\left(rr^*_{t+j} - \frac{E_{t+j} \sum\limits_{j=0}^{J-1} \sum\limits_{h=0}^{H-1} (mr_{t+h+j})}{H} \right) \in \left[-\sqrt{\frac{C}{H}} + Z, \sqrt{\frac{C}{H}} + Z \right],$$

where $Z = \frac{1}{H} \left[E_{t+j} \sum\limits_{j=1}^{J-1} \sum\limits_{h=0}^{H-1} (mr_{t+h+j+1} - \sum\limits_{j=0}^{J-1} \sum\limits_{h=0}^{H-1} mr_{t+h+j}) \right]$. The point we wish to emphasise with this model is that the decision to make a change to retail rates is determined by considering expected changes to future market rates. Only if the expected change in market rates falls outside of the range will the financial institution incur the cost of making adjustment, C.

4 Econometric Methodology

4.1 The Conventional View

The conventional model of interest rate pass through adopted by the literature uses a general to specific model selection criterion across all the different retail and market rates to provide the short and long-run estimates of pass through is the following equation:

$$\Delta rr_t = \mu + \phi_0 \Delta mr_t + \sum_{k=1}^{K} \phi_k \Delta mr_{t-k} + \sum_{l=1}^{L} \varphi_l \Delta rr_{t-l} + u_t,$$

where Δrr_{t+l} denotes the first difference of the retail rate in question, Δmr_{t+k} is the current and lagged first difference of the wholesale rate. In some cases the model is estimated in levels not first differences. The long-run pass through in the absence of a cointegrating relationship is defined as

$$\beta = \frac{\sum_{k=0}^{K} \phi_i}{1 - \sum_{l=1}^{L} \varphi_l}.$$

The computation of the long-run pass through is based on the assumption that there is no cointegrating relationship between rr_t and mr_t, but many studies such as de Bondt et al. (2002), de Bondt (2005), Kok-Sorrenson and Werner (2005) and Sander and Kleimeier (2002, 2004, 2006) find that there is a cointegrating relationship between rr_t and mr_t. In this case the model is amended to introduce an error correction term:

$$\Delta rr_t = \mu' + \phi'_0 \Delta mr_t + \sum_{k=1}^{K} \phi'_k \Delta mr_{t-k} + \sum_{l=1}^{L} \varphi'_l \Delta rr_{t-l} + \alpha'(rr_{t-1} - \beta'_0 - \beta'_1 mr_{t-1}) + u'_t.$$

The long-run is defined as the estimate of the coefficient β'_1in the cointegrating relationship.

4.2 Our Approach

Based on our theoretical analysis in the previous section we modify the basic dynamic relationship used by the literature, and we do so because we recognise that the long-run equilibrium relationship between the retail rate and the market rate involves future as well as current values of mr_t. Consider our definition of the equilibrium retail rate, rr^*_t, which is a weighted average of current and future market rates over H periods, based on equation (1),

$$rr_t^* = \frac{1}{H}\sum_{h=0}^{H-1} E_{t-1} mr_{t+h}.$$

It is easy to see by rearrangement that

$$rr_t^* = \frac{1}{H} mr_t + \frac{1}{H}\sum_{h=1}^{H-1} E_{t-1} mr_{t+h} = mr_t + \frac{1}{H}\sum_{h=1}^{H-1} E_{t-1}[mr_{t+h} - mr_t].$$

Then the empirical dynamic relationship for the actual retail rate, rr_t, can be written as

$$\begin{aligned} \Delta rr_t &= \mu'' + \phi_0'' \Delta mr_t + \sum_{k=1}^{K} \phi_k'' \Delta mr_{t-k} + \sum_{l=1}^{L} \varphi_l'' \Delta rr_{t-l} \\ &\quad + \alpha''(rr_{t-1} - \beta_0'' - \beta_1'' mr_{t-1}) + \sum_{h=1}^{H-1} \psi_h'' \Delta^h \widehat{mr}_{t+h} + u_t'', \end{aligned} \quad (2)$$

where $\sum_{h=1}^{H-1} \psi_h'' \Delta^h \widehat{mr}_{t+i}$ is an estimate of the expectations term $\frac{1}{H}\sum_{h=1}^{H-1} E_{t-1}[mr_{t+h} - mr_t]$. Note that the long-run equilibrium is defined in terms of a relationship between rr_t and mr_t, which can be compared directly to conventional measures of the long-run, but if our model is correct the conventional dynamic model will be misspecified because it omits the future expected changes in market rates, and the estimated coefficients in that model will be biased. To introduce forward-looking terms we need to consider a means to generate forecasts of the future expected market rates, and our next two sub-sections explain how we will do this.

4.3 Stock-Watson Methodology

Following Stock and Watson (2002) we take a scalar series, y_{t+1}, and we use the N-dimensional multiple time series of predictor variables, X_t, observed over the period $t = 1, 2, ..., T$ to make forecasts. Both $y_{t+1}$and Z_t are zero mean series. It is assumed that (X_t, y_{t+1}) has a dynamic factor model representation with $\overline{r}$ common factors f_t,

$$\begin{aligned} y_{t+1} &= \beta(L) f_t + \gamma(L) y_t + \epsilon_{t+1} \\ X_{it} &= \lambda_i(L) f_t + e_{it} \end{aligned}$$

for $i = 1, ..., N$ and where $e_t = (e_{it,} e_{2t}, ..., e_{Nt})'$ is defined as the $N \times 1$ idiosyncratic disturbance and $\beta(L)$ and $\lambda_i(L)$ are polynomials in the lag operator L with non-negative powers. It is assumed that $E(\epsilon_{t+1} \mid f_t, y_t, f_{t-1}, y_{t-1}, X_{t-1}, ...) = 0$.

If the lag polynomials $\beta(L), \gamma(L)$ and $\lambda_i(L)$ are all modelled as finite orders of at most q, which permits the model to be written as:

$$\begin{aligned} y_{t+1} &= \beta' F_t + \gamma(L) y_t + \epsilon_{t+1} \\ X_t &= \Lambda f_t + e_t \end{aligned}$$

where $F_t = (f_t', ..., f_{t-q}')'$ is an $r \times 1$ matrix, $r = (q+1)\overline{r}$, and the i^{th} row of Λ, is $(\lambda_{i0,}.., \lambda_{iq})$, and $\beta = (\beta_{0,}..., \beta_q)'$. This representation can be estimated using the principal components method.

4.4 Constructing Forecasts

Following Banerjee et al. (2005, 2006), all our forecasting models are specified and estimated as a linear projection of an h-step-ahead variable, y_{t+h}, onto t-dated predictors, which may include lagged transformed values (denoted y_t) of x_t, the series we wish to forecast i.e. wholesale interest rates. More precisely, the forecasting models all have the form,

$$y_{t+h} = \mu + \alpha(L)y_t + \beta(L)'Z_t + \epsilon^h_{t+h},$$

where $\alpha(L)$ is a scaler lag polynomial, $\beta(L)$ is a vector lag polynomial, μ is a constant, Z_t is a vector of predictor variables. Marcellino, Stock and Watson (2006) present a comparison of this h-step projection method with the more standard approach of specifying a model for y_t and then solving it forward to obtain a forecast for y_{t+h}.

The construction of y_{t+h} depends on whether the series is modelled as I(0) or I(1) 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, $y_{t+h} = x_{t+h}$ in the I(0) case and $y_t = x_t$, while in the I(1) case, $y^h_{t+h} = \sum_{s=t+1}^{t+h} \Delta x_{t+h}$ so that $y^h_{t+h} = x_{t+h} - x_t$ and $y_t = x_t - x_{t-1}$. In words, the forecasts are for the growth in the series x between time period $t$and $t+h$. This is a convenient formulation because, given that its lags are known when forecasting, the unknown component of y^h_{t+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 (MSFE) from models for second-differenced variables directly comparable with, for example, those from models for first differences only. The MSFE 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 the section below. In all our empirical examples below we test and confirm whether the variable of interest is I(0) or I(1) and apply the forecasting method above accordingly. Hence the chosen model for h-step ahead forecasting is

$$\Delta^h y_{t+h} = \alpha + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{j=1}^{q} \gamma'_j Z_{t-j} + e^h_{t+h}, \tag{3}$$

4.5 Forecasting Models

The various forecasting models we compare differ in their choice of Z_t in equation (3), and here we briefly list the forecasting models and their main characteristics:

a) Autoregressive forecast (ar(aic)). 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 AIC, starting with a maximum of p lags. While this model is very simple, in that it excludes Z_t from the forecast equation, the resulting forecasts are typically rather accurate, see e. g. Marcellino et al. (2003) and Marcellino (2006).

b) Factor-based forecasts. We compare the properties of the autoregressive forecasts with a competing class of methods based on factors. These forecasts define Z_t in (3) to be the estimated factors from a dynamic factor model, the so-called diffusion indexes, along the lines of Stock and Watson (2002b), to which we refer for addition details. While other methods are available for factor extraction, see e.g. Forni, Lippi, Hallin and Reichlin (2000, 2005) and Kapetanios and Marcellino (2009), or for forecasting in the presence of many predictors, see e.g. the review in Stock and Watson (2006), Stock and Watson's (2002) approach using the principal components from a larger set of information variables, X_t, as the factors has performed well in a variety of empirical forecasting applications.

c) AR and factor-based forecasts. A set of forecasts where the autoregressive terms and the factors are used to form a forecast may outperform forecasts formed using autoregressive or factors separately.

The choice of the number of factors is chosen by one of two methods: AIC criteria or by imposing a fixed number of factors, $\bar{r}$, where $\bar{r}$ lies in the range 1 to 6. Factor lags are included in one forecasting model in place of autoregressive terms.

4.6 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. In the empirical examples, the models are first estimated on an initial data span, for example from (3), and the corresponding h-step-ahead forecast is computed. Every period, (i.e. for every augmentation of the sample) for all model estimations, standardization of the data, calculation of the estimated factors, etc., is repeated until the end of the data span.

The forecasting performance of the various methods described is examined by comparing their simulated out-of-sample MSFE (the sum of the squared forecast errors, given by recursive augmentation, divided by the number of forecast comparisons possible) and choosing the forecast model for the wholesale rate that produces the lowest MSFE. It could be the case that it is the autoregressive model which produces the lowest MSFE, in which case it is the forecasts generated from an AR model which are used in the estimated pass-through equation, but our experience in practice is that this is rarely the case, and in most comparisons a factor forecast or combined AR and factor forecast has a superior MSFE.

4.7 Application of the Methodology

In order to construct the best-performing model for judging pass-through, we first construct forecasts of all the wholesale rates (this will differ from country to country) using the Stock-Watson factor methods described above. Factors are extracted from a data set, which is fully described for each country in Appendix 1. Under some technical assumptions (restrictions on moments and stationarity conditions), the column space spanned by the dynamic factors can be estimated consistently by the principal components of the $T \times T$ covariance matrix of the matrix denoted X, where X is an $N \times T$ matrix of variables, where N is large (of the order of 30 or more or larger). The factors can be considered as an exhaustive summary of the information contained in a large dataset.

These factors are then used to form forecasts of the wholesale rate. We primarily consider four different factor-based forecasts in the empirical applications. First, in addition to the current and lagged y_t up to 6 factors are included in the model (fac(aic)+ar), with the AIC criterion used to choose the number of factors and the lag length of y_t. Second, up to 6 factors and up to 3 factor lags are included (fac+faclags(aic)) and selection of the number of factors and factor lags is again by AIC. Third, up to 6 factors but not their lags are included (fac(aic)). Fourth, we consider factor forecasts based on a fixed number of factors (fac(1)+ar to fac(6)+ar) with current and lagged y_t (chosen by AIC). Finally we also consider forecasts using a fixed number of factors from 1 to 6, but without current and lagged y_t, The selection of the best forecasting model for the wholesale rates is then determined by the minimum mean square forecast error criterion described above for each wholesale rate in each country. This is then used for forecasting the wholesale rate.

Having obtained our best forecasts of wholesale rates we use these in combination with the retail rates to estimate the pass-through equations in each country. The first step identifies a wholesale rate at a proximal rate of maturity with the relevant retail rate. That is, the selection of the wholesale rate at an appropriate maturity for the retail rate, in order to determine pass-through. For example, mortgage loans to households are matched in each country with a ten year bond rates, which appears a reasonable choice given the long term maturity of mortgage instruments. The model specification is determined by eliminating the insignificant variables subject to the diagnostic statistics remaining acceptable in the following equation, which was estimated for $h = 1, 3, 6, 12$:

$$\Delta rr_t = \mu + \Delta mr_t + \alpha rr_{t-1} + \gamma mr_{t-1} + \sum_{k=1}^{K} \phi_k'' \Delta mr_{t-k} + \sum_{l=1}^{L} \varphi_l'' \Delta rr_{t-l} + \psi_h \Delta^h \widehat{mr}_{t+h} + u_t \quad (4)$$

where Δrr_{t+l} denotes the first difference of the retail rate in question, Δmr_{t-k} is the current and lagged first difference of the wholesale rate, Δmr_{t+h} is its h -step-ahead forecast. If rr_t and mr_t are cointegrated, t-statistics for α and γ are asymptotically normally distributed, and the long run pass-through coefficient is $\beta = -\gamma/\alpha$. We use AIC to select the best model across $h = 1, 3, 6, 12$.

5 Data

Our data comprise variables at a monthly frequency from January 1991 to June 2007 for Germany, Italy, Spain and the United Kingdom, and from June 1991 to June 2007 for France because swap rates were not available before June 1991. Data for the euroarea run from the introduction of the currency in January 1999 to December 2008.

We make use of monthly data on interest rates from the harmonised monetary and financial institutions' interest rate (MIR) dataset, January 2003 - June 2007, for euroarea countries, which is then spliced to the non-harmonised national retail interest rate (NRIR) data to provide a sufficient sample for estimation back to January 1991 (June 1991 for France). Harmonised data from the MIR dataset offers 31 interest rates for euroarea countries, but only extends backwards to January 2003. The NRIR dataset offers fewer interest rates but has a considerably longer time series for each rate in euroarea countries. For the purpose of this study, the MIR series are aggregated into the more coarsely defined NRIR categories using new business volumes as weights, which is a modified approach to aggregation compared to the methods employed in Kok-Sørensen and Werner (2006).[‡] There are six categories of retail interest rates generated by this method, including mortgage rates, short-term loans to enterprises, long-term loans to

[‡]We are grateful to Christopher Kok-Sørensen and Thomas Werner for providing their dataset. They explain in correspondence with the authors that '... the difference between the [former method] and the new data set is that in the former when deriving the weights (in order to aggregate the MIR categories to the less detailed NRIR categories) we used a combination of new business (NB) volumes and outstanding amounts (OA). The OA volumes we applied in order to create back series of the country-specific market rates, based on the notion that OA better reflected maturity structures of loans granted/deposits taken before January 2003 (a period for which we have no NB volume data).

However, the problem with this approach is that it is difficult to match the breakdown by initial rate of fixation in the NB series with the breakdown by original maturity in the OA series. In countries where the correspondence between the two types of breakdown is weak, the pass-through results became biased.'

enterprises, time deposit and current account rates, and consumer loans to households, but not all these series are collected for all countries and years. For the United Kingdom we extract comparable retail rates from the Bank of England online database. We investigate the first five series in this paper. Graphs of our retail rates over the sample 1995 - 2009 are given in Figure A1 (see Appendix), where we can see evidence of three complete cycles in euroarea interest rates, and five cycles in UK rates.

The wholesale rates used to indicate the cost of funds for these retail products include euroarea overnight rates (EONIA), EURIBOR rates from 1 to 12 month maturity, interest rate swap rates from 2 to 10 year maturity, and bond yields from 2 to 20 years' maturity. These data are matched using the closest available data for the United Kingdom from the Bank of England, where we use the sterling overnight rate (SONIA), LIBOR from 1 week to 12 month maturity, commercial paper rates from 2 to 6 month maturity, swap rates for 2-10 years maturity and a 20 year government bond yield. Figure A2 (see Appendix) provides an illustration of the different money market (wholesale) rates.

To generate forecasts for the wholesale rates of interest we use a range of variables based on the series used by Stock and Watson (2002). Out of a total of 60 variables listed, there are 37 variables for France, 39 variables for Germany, 35 variables for Italy, 32 variables for Spain, and 34 variables for the United Kingdom, which are listed in Appendix Table A1. The data include economic variables such as industrial production, employment and earnings, prices and monetary aggregates, exchange rates, commodity prices and the market interest rates described above. The sources of these data are the International Financial Statistics database complied by the IMF, Datastream, the European Central Bank and the Bank of England.

6 Results

6.1 Preliminary issues relating to stationarity

We first consider the time series properties of the retail and wholesale rates using unit root tests based on the augmented Dickey-Fuller (ADF) test, and the test for stationarity using Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test. These are reported in panels A and B of Table 1. The results of the ADF tests do not reject the null of non-stationarity in any of the cases for Germany and the United Kingdom, while for France, Italy, Spain they do not reject in the majority of cases but do reject isolated rates. The KPSS results present a more consistent outcome, since for all rates in all countries they reject the null of stationarity at the one percent level but occasionally at the 5 per cent level of significance.

In order to examine pass through we need to match the retail rates with an appropriate market rate. We use our judgment using the typical maturity of the retail product to foind a similar maturity market rate. For current accounts we use a 6-month interbank rate; for time deposits and short-term loans to enterprises we use a 12-month interbank rate; for medium to long-term loans to enterprises we use a 3-year bond or swap rate, and for mortgages we use a 10-year bond rate. To predict the future values of these selected market rates we will extract factors from a wide information set which can then be used to predict the future value and horizons 1, 3, 6 and12 months ahead.

Table 1: Unit root tests for retail and wholesale interest rates

Panel A: ADF tests, values of test statistics

H_0 : Unit Root

	Germany	France	Italy	Spain	Euro Area	UK
Interbank Rate, 6 Months	-	-	-1.37	-2.16	-2.29	-1.96
Interbank Rate, 12 Months	-2.29	-2.53	-1.45	-2.22	-2.61*	-2.25
Bond/Swap Rate, 3 Years	-2.28	-2.28	-2.28	-2.28	-2.28	-2.76*
Bond Rate, 10 Years	-1.72	-1.72	-1.72	-1.72	-1.72	-2.32
Current Account Deposits	-	-	-1.51	-2.81*	-2.22	-2.41
Time Deposits	-2.13	-2.07	-2.93**	-1.79	-2.46	-2.03
Short-Term Loans to Enterprises	-2.12	-3.16**	-1.41	-1.79	-2.94**	-1.74
Long-Term Loans to Enterprises	-1.47	-3.05**	-3.13	-2.18	-2.14	-1.19
Mortgage Loans	-1.76	-	-2.80*	-2.16	-2.45	-2.21

Panel B: KPSS tests, values of test statistics

H_0 : Stationarity

	Germany	France	Italy	Spain	Euro Area	UK
Interbank Rate, 6 Months	-	-	1.20***	1.16***	0.48**	0.87***
Interbank Rate, 12 Months	0.93***	0.64**	1.19***	1.18***	0.48**	0.96***
Bond/Swap Rate, 3 Years	1.16***	1.16***	1.16***	1.16***	1.16***	1.26***
Bond Rate, 10 Years	1.26***	-	1.26***	1.26***	1.26***	1.27***
Current Account Deposits	-	-	1.24***	1.18***	0.74***	0.55**
Time Deposits	0.98***	0.65**	0.84***	1.20***	0.53**	0.76***
Short-Term Loans to Enterprises	0.77***	0.71**	1.23***	1.18***	0.88***	0.96***
Long-Term Loans to Enterprises	0.54**	0.72**	0.85***	1.18***	0.64**	1.03***
Mortgage Loans	1.19***	-	0.89***	1.23***	0.97***	1.03***

Note:

*	H_0 is rejected at the 10 % significance level
**	H_0 is rejected at the 5 % significance level
* * *	H_0 is rejected at the 1 % significance level

6.2 Factor Extraction

In order to produce forecasts using the Stock-Watson methodology we need first to extract factors from the wide information sets for each country. The variables in our dataset are listed in the Appendix Table A1.

Initial estimation of factors and forecasting models is undertaken on the sample June 1991 to December 1994 for France, Germany, Italy and Spain; for June 1999 to December 2002 for the euro area, and June 1993 to December 1999 for the United Kingdom, which allows scope for lags. Using these data we extract six factors. Figure A3 (see Appendix) reports the factor loadings for the first four factors for each country or region against the economic and financial variables, which are recorded by their line numbers in Table A1 on the horizontal axes. The first 17 lines refer to economic variables, lines 18-39 refer to short term market interest rates of up to 12 month maturity, and lines 40 - 60 refer to medium and long term swap rates, spreads and government bond yields of 2-20 years to maturity. There is evidence that the factors pick up different information, since the first and second factors load on to interest rates for all four euro-area countries (Germany, France, Italy and Spain) and the UK, while the third and fourth factors load more heavily onto economic variables, with little if any weight on interest rates.

6.3 Forecast Evaluation

We turn now to the evaluation of forecast performance of models including and excluding factors to predict future market rates. A summary of the best forecasts is given in Table 2, but the detailed comparison of the forecast performance relative to an autoregressive benchmark model with lags selected by AIC is given in the Appendix Table A2. Appendix 2 reports the comparison of forecast performances for each money market rate with maturity of 12 months, 3 years and 10 years separately for each country where the relative size of the RMSE is compared to the AR case. The top of the table records the normalised AR model chosen by AIC, and this is compared to a model with AR and factors both chosen by AIC, a model with factors and lagged factors and a model just with factors both chosen by AIC. The next twelve lines provide comparisons with a model with a fixed number of factor (up to six) with AR chosen by AIC criteria and without. There are separate tables for each of the forecast horizons 1, 3, 6 and 12 months ahead. The preferred minimum RMSE forecast is underlined in each column of the four tables, and from this information the summary of preferred forecasts is generated. The final line in each column records the actual RMSE for the AR case.

Our preferred (minimum RMSE) forecast for each wholesale interest rate differs in terms of the precise number of factors and lags with the horizon and the country under consideration, but in every case, for all wholesale rates in all countries, factor models are selected in preference to the benchmark AR model. The improvement in the RMSE compared to the AR benchmark is between 0 and 38. This finding suggests that the use of broader information in the form of a wide range of interbank rates, bonds rates and swap rates as well as macroeconomic information that can assist in the prediction of the direction of future market interest rates since including factors with this information helps to improve the forecast performance.

Table 2: Best forecasts of wholesale rates

Instrument	Horizon	Germany	France	Italy	Spain	Euro Area	UK
6 Months	1 Month	-	-	ar(aic)	fac(1)+ar	fac(5)	fac(2)+ar
	3 Months	-	-	fac(1)	fac(1)+ar	fac(5)	fac(2)+ar
	6 Months	-	-	fac(1)	fac(1)	fac(aic)	fac(6)
	12 Months	-	-	fac(1)	fac(aic)	ar(aic)	fac(6)
12 Months	1 Month	fac(2)+ar	fac(4)	fac(1)	fac(5)+ar	fac(aic)+ar	fac(2)+ar
	3 Months	fac(5)	fac(4)	fac(1)	fac(1)+ar	fac(aic)+ar	fac(2)+ar
	6 Months	fac(aic)	fac(6)	fac(1)	fac(1)	fac(aic)	fac(6)
	12 Months	fac(6)	fac(5)	fac(1)	fac(1)	ar(aic)	fac(6)+ar
3 Years	1 Month	fac(2)	fac(4)	fac(1)	fac(6)	fac(2)+ar	fac(3)+ar
	3 Months	fac(1)	fac(4)	fac(1)	fac(4)	fac(2)	fac(6)
	6 Months	fac(3)	fac(6)	fac(3)	fac(4)	fac(aic)+ar	fac(6)
	12 Months	fac(1)	fac(5)	fac(3)	fac(4)	ar(aic)	ar(aic)
10 Years	1 Month	fac(2)	-	fac(1)	fac(3)+ar	fac(1)	fac(5)
	3 Months	fac(2)	-	fac(3)	fac(1)	fac(2)+ar	fac(3)
	6 Months	fac(2)	-	fac(3)	fac(1)	fac(aic)+ar	fac(3)
	12 Months	fac(1)+ar	-	fac(1)+ar	fac(2)+ar	ar(aic)	fac(3)

Note:

ar(aic)	is autoregressive model with the number of lags selected by AIC
fac(k)	is factor model with k factors (k=1,2,3,4,5,6)
fac(aic)	is factor model with the number of factors selected by AIC
fac(k)+ar	is factor model with k factors and autoregressive lags
fac(aic)+ar	is factor model with the number of factors selected by AIC and autoregressive lags

6.4 Pass through with/without forecasts of future market rates

Having selected our preferred forecasting model we use the forecasts to provide future values of the relevant wholesale rate for each of the retail rates, using different models for each forecast horizon, and we then use a general to specific method to eliminate the variables with insignificant coefficients. The pass through equation is estimated using a sample from January 1995 to June 2007 for France, Germany, Italy and Spain, January 1999 to June 2007 for the United Kingdom and January 2003 to December 2008 for the euro area. Due to the potential problem of multicollinearity, our model selection algorithm includes the forecast of the future dated market rate at the horizon that minimises the Akaike Information Criterion. Lag selection is carried out through an automated general-to-specific procedure. A Wald test is applied to test the joint significance of a group of lags with individual t-statistics below 1.96 at each step of the procedure and if the null of zero valued coefficients is not rejected at the 5 per cent level these lags are excluded from the model. An LM test for serial correlation of residuals is performed at each step with a significance level of 5 per cent. If the null of no serial correlation is rejected, the procedure returns to the previous step.

Table 3A in Appendix reports the results and diagnostic statistics for dynamic models. Two models are reported for each retail interest rate for each country. First we report the dynamic model the long-run pass-through estimate and the diagnostic statistics for the selected pass through equation *including* forecasts of future wholesale rates, then similar details are reported for the selected pass through equation *excluding* forecasts of future wholesale rates. These are reported for dynamic adjustment models of retail rates on current accounts, time deposits, short-term loans to enterprises, long-term loans to enterprises, and mortgage loans for Germany, France, Italy, Spain, the United Kingdom and the euro area.

The first observation we make is that forecasts of future market rates are significant in the dynamic pass through equations for 14 out of 17 cases among the major euro area countries, with ten of the coefficients on the forecasts are significant at the one percent level and the remaining four are found to be significant at the 5 percent level. In the five cases examined for the United Kingdom forecasts two coefficients on forecasts are significant for the short-term and the long-term loans to enterprises, but not for current accounts, time deposits or mortgages. Summarized results concerning the significance of forecasts are reported in Table 3.

Table 3: t-statistics for forecasts in dynamic pass-through models

Retail Instrument	Germany	France	Italy	Spain	Euro Area	UK
Current Account Deposits	-	-	4.31***	1.21	8.43***	0.63
Time Deposits	-2.10**	-2.18**	4.81***	4.02***	2.23**	-1.28
Short-Term Loans to Enterprises	5.51***	2.82***	3.89***	3.19***	3.33***	-4.54***
Long-Term Loans to to Enterprises	6.54***	2.47**	3.49***	2.31**	-1.24	-3.64***
Mortgage Loans	1.44	-	4.49***	0.91	1.32	1.03

Note: t-statistics are computed using HAC standard errors

Comparing the models with and without the forecasts of market rates we find that the information criteria (AIC and BIC) show the model with forecasts dominates the model without forecasts (there is a lower value for the information criterion) in the majority of cases (see Appendix Table A3). The summary of long run pass-through estimates in models with/without forecasts are reported in Table 4. It shows that in majority of cases the long-run pass through estimate is higher in the model with forecasts than in the model without them, suggesting that models that exclude forecasts of market rates are prone to understate the degree of interest rate pass through in the euro area and the United Kingdom.

Table 4: Long run pass-through coefficients in models with/without forecasts

Retail Instrument	Model	Germany	France	Italy	Spain	Euro Area	UK
Current Account Deposits	With Forecast	-	-	0.592	0.431	0.330	0.359
	Without Forecast	-	-	0.601	0.449	0.284	0.357
Time Deposits	With Forecast	0.883	0.925	0.806	0.844	0.862	0.907
	Without Forecast	0.903	0.935	0.779	0.821	0.830	0.919
Short-Term Loans to Enterprises	With Forecast	0.726	1.200	1.020	0.925	1.340	0.951
	Without Forecast	0.641	1.060	1.010	0.900	1.200	0.879
Long-Term Loans to Enterprises	With Forecast	0.832	1.460	1.010	0.799	1.420	0.798
	Without Forecast	0.696	1.340	0.998	0.713	1.440	0.793
Mortgage Loans	With Forecast	1.380	-	1.110	1.120	2.120	1.220
	Without Forecast	1.220	-	1.040	1.030	1.960	1.210

The long run pass through coefficient gives the central bank an indication of the extent to which changes in the appropriate market rate are transmitted to the retail rates offered to households and firms. If following changes to official interest rates the adjustment to market rates is lower, then monetary policy has less impact on household and firm behaviour through the interest rate channel of monetary transmission. Our results show that ignoring the impact of forecasts by neglecting the role of forward-looking behaviour on the part of financial institutions, tends to lower the estimated impact of policy through the interest channel.

There is some heterogeneity adjustment of different retail rates in response to changes in market rates. The pass through for current accounts and time deposits lie below unity, while pass through for short-term and longer term loans to enterprises lie close to unity, and the pass through for mortgages lies well above unity. An estimate of the long run pass through coefficient that lies below unity implies there is not full adjustment to changes in market rates even in the long run, while an estimate above unity implies that there is more than one hundred percent adjustment to retail rates.

One influence over the difference in the response to market rates may lie in the maturity of the retail products for which we are considering adjustment of the retail rates. The rates that adjust less than one hundred percent in the long run have mostly short and medium-long term maturities between 1 month and 3-5 years. Mortgage products have a much longer term to maturity than the other retail products offered by financial institutions, even compared to medium and long term loans to enterprises, and may be influenced by market rates with maturities longer than the 10-year bond since mortgages are often granted for 20-25 years. Consistent data on long term bonds can only be obtained for maturities up to 10 years in the euroarea, although yields for longer maturity bonds are available in the United Kingdom. It is conceivable that our pass through estimate is greater than unity because we are using a shorter maturity market rate than is desirable. It is a feature of all the estimates of long run pass through for mortgages at the country level, that the coefficient is greater than one.

Another influence is the nature of the retail product. Consumers seldomly change their bank accounts, and this may mean that banks have greater market power and less effective competition once they have attracted a customer to deposit funds with their institution. Firms may be more inclined to seek out competitive rates for loans and this may be responsible for the higher degree of long-run pass through. Mortgage rates offer incomplete information on the costs of obtaining a long term loan for house purchase. Bundled with the interest rate are periods of fixation, reversion rates for interest rates after the fixed rate period, application fees and other costs associated with the loan. Mortgage interest rates may not fully reflect adjustment to current or future rates if other less visible elements of the package can be adjusted instead.

7 Conclusions

Models of pass through have typically been backward looking and ignore future dated information. It is possible to allow for expected values of future market rates to introduce future dated information, and to handle large datasets with many financial and economic variables that may influence forecasts of market rates by using dynamic factor models. Our results are based on a new approach to interest rate pass through that allows for future dated information and the large datasets that could affect expectations of market rates. We find that forecasts are significant in the estimation of dynamic adjustment in the euro area, but not in the UK.The estimated long run pass through from these models is greater than from models than ignore future dated information. Potentially backward looking models have understated the impact of policy on retail interest rates faced by households and firms.

8 References

Ball, L. and Mankiw, G.N. (1994) 'Asymmetric price adjustment and economic fluctuations' Economic Journal 104, 247-61

Banerjee, A., Masten, I. and Marcellino, M. (2005) 'Leading indicators for euro area inflation and GDP growth', Oxford Bulletin of Economics and Statistics 67, 785-813

Banerjee, A., Masten, I. and M. Marcellino (2006) 'Forecasting macroeconomic variables for the accession countries", in Artis, M., Banerjee, A. and Marcellino, M. (eds.), The European Enlargement: Prospects and Challenges, Cambridge: Cambridge University Press

Banerjee, A., Marcellino, M. and I. Masten (2008) 'Forecasting macroeconomic variables using diffusion indexes in short samples with structural change", CEPR Working Papers, No 6706

Berbier de la Serre, A., Frappa, S., Montornes, J., and Murez, M. (2008) 'Bank interest rates pass-through: new evidence from French panel data', Banque de France mimeo

Bernoth, K. and von Hagen, J. (2004) 'The Euribor futures market efficiency and the impact of ECB policy announcements', International Finance 7:1, 1-24

Bondt, G. de (2002) 'Retail bank pass through : new evidence at the euro area level', ECB Working Papers, No 136

Bondt, G. de (2002) 'Interest rate pass through in the euro area', German Economic Review 6, 37-78

Bondt, G. de, Mojon, B. and Valla, N. (2005) 'Term structure and the sluggishness of retail bank interest rates in the euro area countries', ECB Working Papers, No 518

Borio, C. (2008) 'The financial turmoil of 2007-?: a preliminary assessment and some policy considerations, BIS Working Papers, No. 251

De Graeve, F., De Jonghe, O. and R. Vander Vennet (2007) 'Competition, transmission and bank pricing policies: Evidence from Belgian loan and deposit markets', Journal of Banking and Finance, Volume 31, Issue 1, January 2007, 259-278

Erhmann, M., Gambacorta, L., Pagés J., Sevestre, P. and Worms,A. (2001) 'Financial systems and the role of banks in monetary policy transmission in the euro area' ECB Working Papers, No 105

Erhmann, M. and Worms, A. (2001), 'Interbank lending and monetary policy transmission - evidence for Germany', ECB Working Papers, No 73

Forni, M., Hallin, M., Lippi, M., and L. Reichlin (2000) 'The generalized dynamic factor model: identification and estimation', The Review of Economics and Statistics, 82, 4, 540-554

Forni, M., Hallin, M., Lippi, M., and L. Reichlin (2005) 'The generalized dynamic factor model: one-sided estimation and forecasting', Journal of the American Statistical Association, 100, 830-840

Fuertes, A-M., Heffernan, S. and Kalotychou, E. (2008) 'How do UK banks react to changing central bank rates?' CASS Business School mimeo

Gambacorta, L. (2008) 'How do banks set interest rates?', European Economic Review 52, 792-819

Heffernan, S. (1997) 'Modelling British interest rate adjustment: an error correction approach', Economica, 64, 211-231

Hofmann, B. and Mizen, P. (2004) 'Interest rate pass through in the monetary transmission mechanism: UK banks' and building societies' retail rates', Economica, 71, 99-125

Kapetanios, G. and M. Marcellino(2009) 'A parametric estimation method for dynamic factor models of large dimensions' Journal of Time Series Analysis, 2009, Volume 30, Issue 2, pages 208-238

Kleimeier, S. and Sander, H. (2006) 'Expected versus unexpected monetary policy impulses and interest rate pass through in euro-zone retail banking markets', Journal of Banking and Finance 30, 1839-70

Klein, M.A. (1971) 'A theory of the banking firm' Journal of Money, Credit, and Banking 3, 205-218

Kok-Sorensen, C. and Werner, T. (2006) 'Bank interest rate pass through in the euro area', ECB Working Papers, No 580

Kuttner, K. (2001) 'Monetary policy surprises and interest rates: evidence from the Fed funds futures market', Journal of Monetary Economics 47, 523-44

Llewellyn, D. T. (2009) 'Financial innovation and the economics of banking and the financial system, Anderloni, L., Llewellyn, D. T. and R. H. Schmidt (eds.), Financial Innovation and Retail and Corporate Banking, 1-40, Edward Elgar Publishing Limited

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

Marcellino, M., M., Stock, J.H. and M. W. Watson (2006) 'A Comparison of direct and iterated multistep AR methods for forecasting macroeconomic time series', CEPR Discussion Papers, No 4976

Miles, D. (2009) 'Government and the financial sector', in Chote, R., Emmerson, C., Miles, D. and J. Shaw (eds.), IFS Green Budget, 151-166, The Institute for Fiscal Studies, London

Mizen, P.D. (2008) FRB St Louis Economic Review, September

Mojon, B. (2000), 'Financial structure and the interest rate channel of ECB monetary policy', ECB Working Papers, No 40

Monti, M. (1971) 'A theoretical model of bank behaviour and its implications for monetary policy', L'Industria, 2, 165-191

Piazzesi, M. and Swanson, E.T. (2008) 'Futures prices as risk-adjusted forecasts of monetary policy', Journal of Monetary Economics 55, 677-91

Sander, H. and S. Kleimeier (2004) 'Convergence in euro-zone retail banking? What interest rate pass-through tells us about monetary policy transmission, competition and integration', Journal of International Money and Finance 23, 461-492

Stock, J.H. and M. W. Watson (2002) 'Macroeconomic forecasting using diffusion indexes', Journal of Business and Economic Statistics 20, 147-162.

Stock, J.H. and M. W. Watson, (2003) 'Forecasting output and inflation: the role of asset prices', Journal of Economic Literature, Volume 41, Issue 3, 788-829

Stock, J.H. and M. W. Watson (2006) 'Macroeconomic forecasting using many predictors', in Graham, E., Granger, C. and A. Timmerman (eds.), Handbook of Economic Forecasting, North Holland

Weth, M. (2002) 'The pass-through from market interest rates to bank lending rates in Germany' Deutsche Bundesbank, Economic Research Centre Discussion Paper No. 11/02.

Worms, A. (2001) 'The reaction of bank lending to monetary policy measures in Germany', ECB Working Papers, No 96

Appendix

Table A1: Data Description

N	Name	Germany	France	Italy	Spain	Euro Area	UK
1	Industrial Production Index	IFS	IFS	IFS	IFS	IFS	IFS
2	Real Earnings	IFS	IFS	IFS	IFS	-	IFS
3	Consumer Price Index	IFS	IFS	IFS	IFS	IFS	IFS
4	Producer Price Index	IFS	IFS	IFS	IFS	IFS	IFS
5	Monetary Aggregate M1	-	IFS	IFS	IFS	-	IFS
6	Monetary Aggregate M2	IFS	IFS	IFS	IFS	IFS	IFS
7	Monetary Aggregate M3	IFS	IFS	IFS	IFS	IFS	-
8	Monetary Aggregate M4	-	-	-	-	-	IFS
9	Nominal Equilibrium Exchange Rate	IFS	IFS	IFS	IFS	IFS	IFS
10	Real Equilibrium Exchange Rate	IFS	IFS	IFS	IFS	IFS	IFS
11	Stock Price Index	IFS	IFS	IFS	IFS	ECB	IFS
12	Price of Gold, USD/Troy Ounce	IFS	IFS	IFS	IFS	IFS	IFS
13	Price of Silver, USD/Troy Ounce	IFS	IFS	IFS	IFS	IFS	IFS
14	Price of Petroleum, USD/Barrel	IFS	IFS	IFS	IFS	IFS	IFS
15	Non-Fuel Primary Commodities Price Index	IFS	IFS	IFS	IFS	IFS	IFS
16	Unemployment Rate	IFS	IFS	IFS	IFS	IFS	IFS
17	Employment	IFS	-	-	-	-	IFS
18	Interbank Interest Rate, Overnight	DS	DS	DS	DS	ECB	BoE
19	Interbank Interest Rate, 1 Week	-	-	-	-	-	BoE
20	Interbank Interest Rate, 1 Month	DS	DS	DS	DS	ECB	BoE
21	Interbank Interest Rate, 2 Months	DS	-	-	-	-	-
22	Interbank Interest Rate, 3 Months	DS	DS	DS	DS	ECB	BoE
23	Interbank Interest Rate, 4 Months	DS	-	-	-	-	-
24	Interbank Interest Rate, 5 Months	DS	-	-	-	-	-
25	Interbank Interest Rate, 6 Months	DS	DS	DS	DS	ECB	BoE
26	Interbank Interest Rate, 7 Months	DS	-	-	-	-	-
27	Interbank Interest Rate, 8 Months	DS	-	-	-	-	-
28	Interbank Interest Rate, 9 Months	DS	-	-	-	-	-
29	Interbank Interest Rate, 10 Months	DS	-	-	-	-	-
30	Interbank Interest Rate, 11 Months	DS	-	-	-	-	-
31	Interbank Interest Rate, 12 Months	DS	DS	DS	DS	ECB	BoE
32	Commercial Paper Rate, 1 Month	-	-	-	-	-	BoE
33	Commercial Paper Rate, 2 Months	-	-	-	-	-	BoE
34	Commercial Paper Rate, 3 Months	-	-	-	-	-	BoE
35	Commercial Paper Rate, 6 Months	-	-	-	-	-	BoE
36	Treasury Bill Rate ,1 Month	-	DS	-	-	-	-
37	Treasury Bill Rate ,3 Months	-	DS	DS	-	-	DS
38	Treasury Bill Rate ,6 Months	-	DS	DS	-	-	-
39	Treasury Bill Rate ,12 Months	-	DS	DS	-	-	-
40	Interest Rate Swap Rate, 2 Years	DS	DS	DS	DS	-	BoE
41	Interest Rate Swap Rate, 3 Years	DS	DS	DS	DS	-	BoE
42	Interest Rate Swap Rate, 4 Years	DS	DS	DS	DS	-	BoE
43	Interest Rate Swap Rate, 5 Years	DS	DS	DS	DS	-	BoE
44	Interest Rate Swap Rate, 7 Years	DS	DS	DS	DS	-	BoE
45	Interest Rate Swap Rate, 10 Years	DS	DS	DS	DS	-	BoE
46	Spread, 6-Month and 2-Year Rates	-	-	-	-	ECB	-
47	Spread, 6-Month and 3-Year Rates	-	-	-	-	ECB	-
48	Spread, 6-Month and 5-Year Rates	-	-	-	-	ECB	-
49	Spread, 6-Month and 7-Year Rates	-	-	-	-	ECB	-
50	Spread, 6-Month and 10-Year Rates	-	-	-	-	ECB	-
51	Government Bond Yield, 2 Years	ECB	ECB	ECB	ECB	ECB	-
52	Government Bond Yield, 3 Years	ECB	ECB	ECB	ECB	ECB	-
53	Government Bond Yield, 5 Years	ECB	ECB	ECB	ECB	ECB	BoE
54	Government Bond Yield, 7 Years	ECB	ECB	ECB	ECB	ECB	-
55	Government Bond Yield, 10 Years	ECB	ECB	ECB	ECB	ECB	BoE
56	Government Bond Yield, 20 Years	-	-	-	-	-	BoE
57	Government Bond Yield Spot, 2 Years	-	-	-	DS	-	-
58	Government Bond Yield Spot, 3 Years	-	-	-	DS	-	-
59	Government Bond Yield Spot, 5 Years	-	-	-	DS	-	-
60	Government Bond Yield Spot, 10 Years	-	-	-	DS	-	-

Sources of Data:

BoE	Bank of England
DS	DataStream
ECB	European Central Bank
IFS	International Financial Statistics, IMF

Table A2: Forecast Performance

Germany:

	Money Market Rate		
	12 Months	3 Years	10 Years
Forecast Method	Relative Mean Square Error		
1 Month Ahead Forecast			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.95 (0.07)	0.94 (0.08)	0.92 (0.05)
Factors + Factor Lags (AIC)	0.97 (0.03)	0.89 (0.05)	0.94 (0.08)
Factors (AIC)	0.93 (0.06)	0.88 (0.05)	0.97 (0.08)
1 Factor + AR (AIC)	0.92 (0.03)	0.97 (0.05)	0.94 (0.05)
2 Factors + AR (AIC)	0.90 (0.06)	0.92 (0.07)	0.91 (0.05)
3 Factors + AR (AIC)	0.91 (0.06)	0.94 (0.08)	0.93 (0.06)
4 Factors + AR (AIC)	0.95 (0.09)	0.99 (0.12)	0.96 (0.07)
5 Factors + AR (AIC)	0.94 (0.09)	1.00 (0.13)	0.96 (0.08)
6 Factors + AR (AIC)	0.99 (0.13)	1.01 (0.14)	0.98 (0.09)
1 Factor	0.94 (0.03)	0.90 (0.05)	0.95 (0.08)
2 Factors	0.93 (0.05)	0.87 (0.05)	0.89 (0.08)
3 Factors	0.94 (0.05)	0.90 (0.06)	0.92 (0.08)
4 Factors	0.96 (0.08)	0.93 (0.08)	0.94 (0.08)
5 Factors	0.92 (0.09)	0.93 (0.09)	0.96 (0.08)
6 Factors	0.92 (0.10)	0.95 (0.11)	0.97 (0.09)
RMSFE for AR (AIC)	0.177	0.208	0.179
3 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.87 (0.12)	0.94 (0.09)	0.88 (0.08)
Factors + Factor Lags (AIC)	0.99 (0.07)	0.92 (0.07)	0.86 (0.08)
Factors (AIC)	0.88 (0.10)	0.93 (0.09)	0.86 (0.08)
1 Factor + AR (AIC)	0.96 (0.03)	0.94 (0.06)	0.87 (0.06)
2 Factors + AR (AIC)	0.93 (0.05)	0.93 (0.07)	0.85 (0.08)
3 Factors + AR (AIC)	0.90 (0.06)	0.93 (0.07)	0.88 (0.08)
4 Factors + AR (AIC)	0.87 (0.12)	0.91 (0.10)	0.92 (0.08)
5 Factors + AR (AIC)	0.85 (0.12)	0.93 (0.10)	0.93 (0.08)
6 Factors + AR (AIC)	0.86 (0.12)	0.93 (0.10)	0.97 (0.09)
1 Factor	0.95 (0.04)	0.89 (0.07)	0.84 (0.09)
2 Factors	0.94 (0.06)	0.91 (0.07)	0.81 (0.08)
3 Factors	0.93 (0.07)	0.91 (0.08)	0.84 (0.08)
4 Factors	0.90 (0.09)	0.93 (0.09)	0.91 (0.08)
5 Factors	0.85 (0.11)	0.92 (0.09)	0.91 (0.08)
6 Factors	0.86 (0.11)	0.92 (0.09)	0.92 (0.08)
RMSFE for AR (AIC)	0.396	0.442	0.384
6 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.93 (0.09)	1.01 (0.10)	0.96 (0.11)
Factors + Factor Lags (AIC)	1.03 (0.05)	1.00 (0.10)	0.89 (0.14)
Factors (AIC)	0.90 (0.10)	1.00 (0.08)	0.87 (0.11)
1 Factor + AR (AIC)	0.92 (0.04)	0.96 (0.09)	0.92 (0.11)
2 Factors + AR (AIC)	0.95 (0.05)	0.97 (0.07)	0.93 (0.09)
3 Factors + AR (AIC)	0.95 (0.05)	0.97 (0.06)	0.87 (0.10)
4 Factors + AR (AIC)	1.00 (0.08)	0.99 (0.10)	0.89 (0.10)
5 Factors + AR (AIC)	0.95 (0.10)	0.98 (0.11)	1.12 (0.16)
6 Factors + AR (AIC)	0.96 (0.10)	1.01 (0.11)	1.17 (0.17)
1 Factor	0.92 (0.04)	0.93 (0.09)	0.88 (0.14)
2 Factors	0.92 (0.05)	0.94 (0.08)	0.87 (0.11)
3 Factors	0.91 (0.06)	0.93 (0.07)	0.88 (0.11)
4 Factors	0.97 (0.08)	0.98 (0.09)	0.92 (0.12)
5 Factors	0.92 (0.10)	0.99 (0.09)	0.95 (0.13)
6 Factors	0.94 (0.10)	1.01 (0.09)	0.96 (0.12)
RMSFE for AR (AIC)	0.709	0.728	0.614

12 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.93 (0.11)	0.83 (0.15)	0.96 (0.11)
Factors + Factor Lags (AIC)	1.02 (0.04)	0.88 (0.09)	0.79 (0.12)
Factors (AIC)	0.92 (0.11)	0.83 (0.15)	0.96 (0.11)
1 Factor + AR (AIC)	0.93 (0.05)	0.78 (0.11)	0.79 (0.12)
2 Factors + AR (AIC)	0.92 (0.06)	0.79 (0.12)	0.82 (0.12)
3 Factors + AR (AIC)	0.90 (0.10)	0.82 (0.14)	0.92 (0.11)
4 Factors + AR (AIC)	0.92 (0.11)	0.83 (0.15)	0.99 (0.11)
5 Factors + AR (AIC)	0.89 (0.13)	0.88 (0.14)	1.06 (0.12)
6 Factors + AR (AIC)	0.88 (0.13)	0.87 (0.14)	1.06 (0.11)
1 Factor	0.93 (0.05)	0.78 (0.11)	0.81 (0.12)
2 Factors	0.92 (0.06)	0.79 (0.12)	0.83 (0.12)
3 Factors	0.90 (0.10)	0.82 (0.14)	0.92 (0.11)
4 Factors	0.91 (0.11)	0.83 (0.15)	0.94 (0.11)
5 Factors	0.89 (0.13)	0.88 (0.14)	1.03 (0.11)
6 Factors	0.88 (0.13)	0.87 (0.14)	1.03 (0.10)
RMSFE for AR (AIC)	1.265	1.250	1.003

France:

	Money Market Rate		
	12 Months	3 Years	10 Years
Method	Relative Mean Square Error		
1 Month Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.02 (0.17)	0.77 (0.09)	0.81 (0.09)
Factors + Factor Lags (AIC)	1.02 (0.17)	0.79 (0.09)	0.80 (0.10)
Factors (AIC)	1.02 (0.17)	0.79 (0.09)	0.80 (0.10)
1 Factor + AR (AIC)	0.94 (0.03)	0.90 (0.05)	0.80 (0.08)
2 Factors + AR (AIC)	0.96 (0.04)	0.94 (0.07)	0.81 (0.08)
3 Factors + AR (AIC)	1.06 (0.08)	0.85 (0.07)	0.78 (0.09)
4 Factors + AR (AIC)	0.92 (0.07)	0.80 (0.10)	0.76 (0.10)
5 Factors + AR (AIC)	0.95 (0.10)	0.74 (0.10)	0.77 (0.09)
6 Factors + AR (AIC)	0.91 (0.19)	0.75 (0.11)	0.76 (0.10)
1 Factor	0.94 (0.03)	0.90 (0.05)	0.80 (0.08)
2 Factors	0.96 (0.04)	0.91 (0.05)	0.82 (0.08)
3 Factors	0.97 (0.05)	0.85 (0.07)	0.80 (0.09)
4 Factors	0.89 (0.08)	0.75 (0.09)	0.76 (0.10)
5 Factors	0.94 (0.10)	0.76 (0.10)	0.72 (0.10)
6 Factors	0.91 (0.19)	0.77 (0.11)	0.70 (0.10)
RMSFE for AR (AIC)	0.226	0.204	0.179
3 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.85 (0.12)	0.88 (0.11)	0.87 (0.08)
Factors + Factor Lags (AIC)	0.81 (0.12)	0.88 (0.11)	0.85 (0.08)
Factors (AIC)	0.81 (0.12)	0.88 (0.11)	0.85 (0.08)
1 Factor + AR (AIC)	0.84 (0.08)	0.86 (0.10)	0.85 (0.07)
2 Factors + AR (AIC)	0.81 (0.09)	0.90 (0.09)	0.87 (0.08)
3 Factors + AR (AIC)	0.83 (0.10)	0.90 (0.09)	0.88 (0.08)
4 Factors + AR (AIC)	0.74 (0.11)	0.85 (0.12)	0.89 (0.09)
5 Factors + AR (AIC)	0.81 (0.13)	0.89 (0.13)	0.92 (0.08)
6 Factors + AR (AIC)	0.90 (0.15)	0.89 (0.14)	0.96 (0.09)
1 Factor	0.81 (0.08)	0.86 (0.10)	0.84 (0.07)
2 Factors	0.81 (0.09)	0.90 (0.09)	0.85 (0.08)
3 Factors	0.83 (0.10)	0.90 (0.09)	0.86 (0.08)
4 Factors	0.74 (0.11)	0.84 (0.11)	0.86 (0.08)
5 Factors	0.78 (0.13)	0.89 (0.13)	0.90 (0.08)
6 Factors	0.79 (0.13)	0.90 (0.14)	0.92 (0.09)
RMSFE for AR (AIC)	0.476	0.454	0.387

6 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.85 (0.18)	0.93 (0.12)	0.95 (0.07)
Factors + Factor Lags (AIC)	0.86 (0.17)	0.92 (0.11)	0.95 (0.07)
Factors (AIC)	0.86 (0.17)	0.92 (0.11)	0.95 (0.07)
1 Factor + AR (AIC)	0.92 (0.12)	0.84 (0.09)	0.92 (0.07)
2 Factors + AR (AIC)	0.92 (0.11)	0.90 (0.08)	0.93 (0.07)
3 Factors + AR (AIC)	0.92 (0.11)	0.89 (0.08)	0.94 (0.07)
4 Factors + AR (AIC)	0.86 (0.14)	0.86 (0.11)	0.95 (0.07)
5 Factors + AR (AIC)	0.84 (0.17)	0.85 (0.13)	1.04 (0.10)
6 Factors + AR (AIC)	0.85 (0.18)	0.83 (0.13)	1.04 (0.11)
1 Factor	0.88 (0.10)	0.84 (0.09)	0.92 (0.07)
2 Factors	0.92 (0.11)	0.87 (0.08)	0.93 (0.07)
3 Factors	0.92 (0.11)	0.87 (0.08)	0.94 (0.07)
4 Factors	0.86 (0.14)	0.83 (0.11)	0.95 (0.07)
5 Factors	0.83 (0.17)	0.84 (0.13)	1.03 (0.10)
6 Factors	0.80 (0.17)	0.81 (0.13)	1.03 (0.11)
RMSFE for AR (AIC)	0.763	0.764	0.608
12 Months Ahead Forecasts			
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.87 (0.21)	0.84 (0.11)	0.83 (0.10)
Factors + Factor Lags (AIC)	0.87 (0.21)	0.84 (0.10)	0.76 (0.12)
Factors (AIC)	0.87 (0.21)	0.84 (0.10)	0.76 (0.12)
1 Factor + AR (AIC)	0.97 (0.05)	0.79 (0.11)	0.72 (0.14)
2 Factors + AR (AIC)	0.96 (0.08)	0.82 (0.11)	0.88 (0.11)
3 Factors + AR (AIC)	0.97 (0.08)	0.81 (0.11)	0.89 (0.12)
4 Factors + AR (AIC)	0.88 (0.15)	0.77 (0.16)	0.88 (0.13)
5 Factors + AR (AIC)	0.88 (0.23)	0.75 (0.20)	0.94 (0.13)
6 Factors + AR (AIC)	0.89 (0.23)	0.76 (0.20)	0.95 (0.13)
1 Factor	0.95 (0.05)	0.79 (0.11)	0.74 (0.14)
2 Factors	0.96 (0.08)	0.80 (0.11)	0.74 (0.14)
3 Factors	0.97 (0.08)	0.80 (0.11)	0.76 (0.14)
4 Factors	0.88 (0.15)	0.77 (0.16)	0.79 (0.14)
5 Factors	0.84 (0.22)	0.75 (0.19)	0.85 (0.15)
6 Factors	0.84 (0.23)	0.76 (0.20)	0.87 (0.15)
RMSFE for AR (AIC)	1.292	1.272	1.031

Italy:

	Money Market Rate			
	6 Months	12 Months	3 Years	10 Years
Method	Relative Mean Square Error			
1 Month Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.07 (0.03)	1.14 (0.10)	1.00 (0.09)	0.86 (0.09)
Factors + Factor Lags (AIC)	1.07 (0.03)	1.14 (0.10)	1.00 (0.09)	0.85 (0.09)
Factors (AIC)	1.07 (0.03)	1.14 (0.10)	1.00 (0.09)	0.85 (0.09)
1 Factor + AR (AIC)	1.04 (0.05)	0.99 (0.03)	0.94 (0.05)	0.81 (0.08)
2 Factors + AR (AIC)	1.19 (0.17)	1.10 (0.10)	0.99 (0.09)	0.82 (0.08)
3 Factors + AR (AIC)	1.22 (0.16)	1.15 (0.11)	0.99 (0.08)	0.81 (0.08)
4 Factors + AR (AIC)	1.43 (0.27)	1.17 (0.12)	0.97 (0.08)	0.87 (0.09)
5 Factors + AR (AIC)	1.48 (0.30)	1.20 (0.14)	1.00 (0.10)	0.87 (0.09)
6 Factors + AR (AIC)	1.56 (0.32)	1.23 (0.15)	1.02 (0.09)	0.88 (0.10)
1 Factor	1.04 (0.05)	0.99 (0.03)	0.94 (0.05)	0.81 (0.08)
2 Factors	1.13 (0.12)	1.10 (0.10)	0.99 (0.09)	0.82 (0.08)
3 Factors	1.14 (0.12)	1.15 (0.11)	0.96 (0.08)	0.81 (0.08)
4 Factors	1.16 (0.13)	1.17 (0.12)	0.97 (0.08)	0.87 (0.09)
5 Factors	1.31 (0.19)	1.20 (0.14)	0.98 (0.08)	0.87 (0.09)
6 Factors	1.35 (0.20)	1.23 (0.15)	0.99 (0.08)	0.87 (0.09)
RMSFE for AR (AIC)	0.243	0.268	0.208	0.179

3 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.00 (0.03)	0.99 (0.02)	0.93 (0.06)	0.88 (0.09)
Factors + Factor Lags (AIC)	1.00 (0.03)	0.99 (0.02)	0.93 (0.08)	0.87 (0.08)
Factors (AIC)	1.00 (0.03)	0.99 (0.02)	0.93 (0.08)	0.87 (0.08)
1 Factor + AR (AIC)	0.94 (0.06)	0.95 (0.05)	0.96 (0.08)	0.85 (0.08)
2 Factors + AR (AIC)	0.96 (0.06)	0.96 (0.05)	0.99 (0.08)	0.85 (0.08)
3 Factors + AR (AIC)	1.05 (0.10)	0.98 (0.06)	0.96 (0.06)	0.83 (0.08)
4 Factors + AR (AIC)	1.05 (0.11)	0.99 (0.09)	1.02 (0.08)	0.91 (0.08)
5 Factors + AR (AIC)	1.25 (0.24)	1.07 (0.11)	0.99 (0.07)	0.92 (0.07)
6 Factors + AR (AIC)	1.25 (0.23)	1.09 (0.12)	1.00 (0.07)	0.93 (0.07)
1 Factor	0.94 (0.06)	0.95 (0.05)	0.93 (0.08)	0.82 (0.08)
2 Factors	0.96 (0.06)	0.96 (0.05)	0.96 (0.08)	0.82 (0.08)
3 Factors	1.05 (0.10)	0.98 (0.06)	0.93 (0.07)	0.80 (0.08)
4 Factors	1.05 (0.11)	0.99 (0.09)	0.97 (0.08)	0.91 (0.08)
5 Factors	1.25 (0.24)	1.07 (0.11)	0.98 (0.07)	0.91 (0.07)
6 Factors	1.25 (0.23)	1.09 (0.12)	0.99 (0.07)	0.92 (0.07)
RMSFE for AR (AIC)	0.468	0.505	0.442	0.384
6 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.99 (0.05)	0.96 (0.05)	0.91 (0.08)	0.82 (0.14)
Factors + Factor Lags (AIC)	0.99 (0.05)	0.96 (0.05)	0.95 (0.10)	0.82 (0.14)
Factors (AIC)	0.99 (0.05)	0.96 (0.05)	0.95 (0.10)	0.82 (0.14)
1 Factor + AR (AIC)	0.90 (0.09)	0.91 (0.07)	0.92 (0.09)	0.82 (0.14)
2 Factors + AR (AIC)	0.94 (0.09)	0.93 (0.07)	0.95 (0.09)	0.84 (0.14)
3 Factors + AR (AIC)	1.03 (0.11)	0.97 (0.08)	0.90 (0.08)	0.80 (0.11)
4 Factors + AR (AIC)	1.01 (0.14)	0.97 (0.12)	0.92 (0.08)	0.88 (0.10)
5 Factors + AR (AIC)	1.16 (0.20)	1.06 (0.14)	0.93 (0.09)	0.89 (0.09)
6 Factors + AR (AIC)	1.25 (0.25)	1.14 (0.14)	0.95 (0.09)	0.89 (0.10)
1 Factor	0.90 (0.09)	0.91 (0.07)	0.92 (0.09)	0.82 (0.14)
2 Factors	0.93 (0.09)	0.93 (0.07)	0.95 (0.09)	0.84 (0.14)
3 Factors	1.02 (0.11)	0.97 (0.08)	0.90 (0.08)	0.80 (0.11)
4 Factors	1.01 (0.14)	0.97 (0.12)	0.92 (0.08)	0.88 (0.10)
5 Factors	1.16 (0.20)	1.06 (0.14)	0.93 (0.09)	0.89 (0.09)
6 Factors	1.25 (0.25)	1.14 (0.14)	0.95 (0.09)	0.89 (0.10)
RMSFE for AR (AIC)	0.814	0.871	0.728	0.614
12 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.98 (0.04)	1.01 (0.03)	0.81 (0.09)	0.80 (0.11)
Factors + Factor Lags (AIC)	0.98 (0.04)	1.01 (0.03)	0.81 (0.09)	0.80 (0.11)
Factors (AIC)	0.98 (0.04)	1.01 (0.03)	0.81 (0.09)	0.80 (0.11)
1 Factor + AR (AIC)	0.92 (0.07)	0.95 (0.05)	0.81 (0.09)	0.75 (0.13)
2 Factors + AR (AIC)	0.94 (0.07)	0.97 (0.05)	0.82 (0.09)	0.76 (0.13)
3 Factors + AR (AIC)	1.08 (0.13)	1.04 (0.10)	0.78 (0.10)	0.78 (0.11)
4 Factors + AR (AIC)	1.02 (0.15)	1.01 (0.12)	0.78 (0.10)	0.78 (0.11)
5 Factors + AR (AIC)	1.21 (0.25)	1.14 (0.18)	0.78 (0.12)	0.88 (0.10)
6 Factors + AR (AIC)	1.23 (0.23)	1.16 (0.16)	0.79 (0.12)	0.92 (0.10)
1 Factor	0.92 (0.07)	0.95 (0.05)	0.81 (0.09)	0.77 (0.13)
2 Factors	0.93 (0.07)	0.97 (0.05)	0.82 (0.09)	0.78 (0.12)
3 Factors	1.06 (0.13)	1.04 (0.10)	0.78 (0.10)	0.79 (0.11)
4 Factors	1.02 (0.15)	1.01 (0.12)	0.78 (0.10)	0.79 (0.11)
5 Factors	1.21 (0.25)	1.14 (0.18)	0.78 (0.12)	0.83 (0.10)
6 Factors	1.23 (0.23)	1.16 (0.16)	0.79 (0.12)	0.85 (0.09)
RMSFE for AR (AIC)	1.464	1.523	1.250	1.003

Spain:

	Money Market Rate			
	6 Months	12 Months	3 Years	10 Years
Method	Relative Mean Square Error			
1 Month Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.03 (0.06)	0.92 (0.06)	0.90 (0.06)	0.80 (0.10)
Factors + Factor Lags (AIC)	1.03 (0.06)	0.92 (0.06)	0.89 (0.05)	0.82 (0.09)
Factors (AIC)	1.03 (0.06)	0.92 (0.06)	0.89 (0.05)	0.82 (0.09)
1 Factor + AR (AIC)	1.01 (0.06)	0.89 (0.06)	0.89 (0.05)	0.83 (0.08)
2 Factors + AR (AIC)	0.97 (0.07)	0.90 (0.07)	0.89 (0.05)	0.82 (0.08)
3 Factors + AR (AIC)	1.02 (0.07)	0.92 (0.07)	0.88 (0.05)	0.80 (0.09)
4 Factors + AR (AIC)	1.08 (0.10)	0.93 (0.08)	0.94 (0.08)	0.81 (0.09)
5 Factors + AR (AIC)	1.00 (0.10)	0.86 (0.08)	0.94 (0.09)	0.83 (0.10)
6 Factors + AR (AIC)	1.26 (0.20)	0.87 (0.09)	0.88 (0.10)	0.80 (0.10)
1 Factor	1.01 (0.06)	0.89 (0.06)	0.89 (0.05)	0.83 (0.08)
2 Factors	1.01 (0.07)	0.90 (0.07)	0.89 (0.05)	0.84 (0.08)
3 Factors	1.05 (0.07)	0.92 (0.07)	0.88 (0.05)	0.82 (0.09)
4 Factors	1.05 (0.10)	0.92 (0.08)	0.89 (0.06)	0.84 (0.09)
5 Factors	1.00 (0.10)	0.86 (0.08)	0.88 (0.07)	0.81 (0.10)
6 Factors	1.03 (0.12)	0.87 (0.09)	0.86 (0.08)	0.80 (0.10)
RMSFE for AR (AIC)	0.203	0.232	0.208	0.179
3 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.97 (0.12)	0.83 (0.11)	0.88 (0.07)	0.85 (0.08)
Factors + Factor Lags (AIC)	1.09 (0.14)	0.88 (0.13)	0.87 (0.07)	0.85 (0.08)
Factors (AIC)	1.09 (0.14)	0.88 (0.13)	0.87 (0.07)	0.85 (0.08)
1 Factor + AR (AIC)	0.92 (0.10)	0.83 (0.11)	0.93 (0.06)	0.81 (0.07)
2 Factors + AR (AIC)	0.93 (0.12)	0.85 (0.12)	0.92 (0.07)	0.85 (0.07)
3 Factors + AR (AIC)	0.93 (0.13)	0.88 (0.12)	0.89 (0.07)	0.83 (0.07)
4 Factors + AR (AIC)	0.98 (0.16)	0.93 (0.13)	0.90 (0.09)	0.89 (0.09)
5 Factors + AR (AIC)	1.00 (0.17)	0.94 (0.14)	0.90 (0.10)	0.85 (0.10)
6 Factors + AR (AIC)	1.04 (0.20)	1.09 (0.20)	0.94 (0.12)	0.90 (0.11)
1 Factor	1.01 (0.10)	0.86 (0.13)	0.90 (0.07)	0.81 (0.07)
2 Factors	1.08 (0.13)	0.90 (0.14)	0.92 (0.07)	0.84 (0.07)
3 Factors	1.11 (0.14)	0.90 (0.14)	0.89 (0.07)	0.82 (0.07)
4 Factors	1.17 (0.18)	0.92 (0.14)	0.86 (0.08)	0.87 (0.09)
5 Factors	1.13 (0.17)	0.90 (0.15)	0.87 (0.09)	0.84 (0.10)
6 Factors	1.15 (0.21)	0.97 (0.18)	0.91 (0.11)	0.90 (0.11)
RMSFE for AR (AIC)	0.382	0.453	0.442	0.384
6 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.84 (0.11)	0.92 (0.12)	0.92 (0.10)	0.84 (0.13)
Factors + Factor Lags (AIC)	0.85 (0.11)	0.92 (0.12)	0.99 (0.13)	0.84 (0.14)
Factors (AIC)	0.85 (0.11)	0.92 (0.12)	0.99 (0.13)	0.84 (0.14)
1 Factor + AR (AIC)	0.80 (0.11)	0.90 (0.12)	0.92 (0.09)	0.82 (0.13)
2 Factors + AR (AIC)	0.85 (0.11)	0.92 (0.12)	0.93 (0.08)	0.84 (0.12)
3 Factors + AR (AIC)	0.87 (0.11)	0.93 (0.12)	0.93 (0.08)	0.84 (0.12)
4 Factors + AR (AIC)	0.86 (0.13)	1.02 (0.14)	0.89 (0.09)	0.88 (0.11)
5 Factors + AR (AIC)	0.85 (0.14)	0.93 (0.13)	0.95 (0.10)	0.90 (0.13)
6 Factors + AR (AIC)	0.89 (0.15)	1.03 (0.18)	1.00 (0.11)	0.99 (0.12)
1 Factor	0.78 (0.11)	0.85 (0.11)	0.92 (0.09)	0.82 (0.13)
2 Factors	0.85 (0.11)	0.92 (0.12)	0.93 (0.08)	0.84 (0.12)
3 Factors	0.87 (0.11)	0.93 (0.12)	0.93 (0.08)	0.84 (0.12)
4 Factors	0.89 (0.13)	0.93 (0.13)	0.88 (0.09)	0.88 (0.11)
5 Factors	0.85 (0.14)	0.93 (0.13)	0.94 (0.10)	0.90 (0.13)
6 Factors	0.89 (0.15)	1.03 (0.18)	0.99 (0.11)	0.99 (0.12)
RMSFE for AR (AIC)	0.779	0.808	0.728	0.614

12 Months Ahead Forecasts

AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.78 (0.17)	0.77 (0.13)	0.76 (0.10)	0.78 (0.12)
Factors + Factor Lags (AIC)	0.78 (0.17)	0.77 (0.13)	0.76 (0.10)	0.79 (0.11)
Factors (AIC)	0.78 (0.17)	0.77 (0.13)	0.76 (0.10)	0.79 (0.11)
1 Factor + AR (AIC)	0.84 (0.14)	0.80 (0.11)	0.84 (0.08)	0.76 (0.12)
2 Factors + AR (AIC)	0.81 (0.16)	0.77 (0.13)	0.80 (0.09)	0.75 (0.13)
3 Factors + AR (AIC)	0.86 (0.13)	0.79 (0.12)	0.80 (0.09)	0.76 (0.13)
4 Factors + AR (AIC)	0.82 (0.16)	0.79 (0.14)	0.74 (0.13)	0.82 (0.10)
5 Factors + AR (AIC)	0.91 (0.16)	0.91 (0.14)	0.85 (0.11)	0.94 (0.10)
6 Factors + AR (AIC)	0.91 (0.21)	0.90 (0.17)	0.80 (0.11)	0.82 (0.11)
1 Factor	0.80 (0.13)	0.79 (0.10)	0.83 (0.08)	0.78 (0.12)
2 Factors	0.81 (0.16)	0.77 (0.13)	0.80 (0.09)	0.77 (0.13)
3 Factors	0.86 (0.13)	0.79 (0.12)	0.80 (0.09)	0.77 (0.13)
4 Factors	0.82 (0.16)	0.79 (0.14)	0.74 (0.13)	0.82 (0.10)
5 Factors	0.91 (0.16)	0.91 (0.14)	0.85 (0.11)	0.94 (0.10)
6 Factors	0.91 (0.21)	0.90 (0.17)	0.80 (0.11)	0.82 (0.11)
RMSFE for AR (AIC)	1.394	1.513	1.250	1.003

Euro Area:

	Money Market Rate			
	6 Months	12 Months	3 Years	10 Years
Forecast Method	Relative Mean Square Error			
1 Month Ahead Forecast				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.75 (0.25)	0.77 (0.20)	1.04 (0.03)	1.00 (0.05)
Factors + Factor Lags (AIC)	0.69 (0.32)	0.79 (0.19)	0.99 (0.04)	0.93 (0.04)
Factors (AIC)	0.64 (0.33)	0.79 (0.18)	0.99 (0.04)	0.98 (0.06)
1 Factor + AR (AIC)	0.88 (0.14)	0.82 (0.17)	1.00 (0.04)	0.90 (0.04)
2 Factors + AR (AIC)	0.83 (0.18)	0.85 (0.14)	0.92 (0.07)	0.91 (0.04)
3 Factors + AR (AIC)	0.67 (0.31)	0.80 (0.18)	0.96 (0.03)	0.96 (0.04)
4 Factors + AR (AIC)	0.71 (0.30)	0.86 (0.17)	1.03 (0.05)	0.96 (0.06)
5 Factors + AR (AIC)	0.64 (0.35)	0.81 (0.20)	1.05 (0.06)	0.95 (0.06)
6 Factors + AR (AIC)	0.69 (0.31)	0.93 (0.16)	1.05 (0.08)	0.90 (0.08)
1 Factor	0.75 (0.27)	0.79 (0.19)	1.03 (0.06)	0.89 (0.04)
2 Factors	0.79 (0.22)	0.85 (0.14)	0.95 (0.03)	0.91 (0.04)
3 Factors	0.63 (0.33)	0.79 (0.19)	0.99 (0.04)	0.95 (0.03)
4 Factors	0.66 (0.32)	0.85 (0.14)	1.03 (0.04)	0.95 (0.05)
5 Factors	0.62 (0.35)	0.83 (0.17)	1.03 (0.04)	0.95 (0.06)
6 Factors	0.67 (0.32)	0.83 (0.19)	1.03 (0.07)	0.89 (0.08)
RMSFE for AR (AIC)	0.154	0.161	0.190	0.160
3 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.72 (0.32)	0.84 (0.23)	1.09 (0.22)	1.03 (0.08)
Factors + Factor Lags (AIC)	0.74 (0.32)	0.96 (0.08)	1.01 (0.03)	1.00 (0.00)
Factors (AIC)	0.72 (0.32)	0.79 (0.26)	1.06 (0.06)	1.05 (0.04)
1 Factor + AR (AIC)	0.95 (0.11)	0.96 (0.08)	1.00 (0.02)	0.99 (0.03)
2 Factors + AR (AIC)	0.96 (0.11)	0.92 (0.13)	0.93 (0.05)	0.93 (0.08)
3 Factors + AR (AIC)	0.94 (0.12)	0.87 (0.16)	1.06 (0.08)	0.95 (0.09)
4 Factors + AR (AIC)	0.96 (0.12)	0.96 (0.13)	1.21 (0.23)	1.05 (0.09)
5 Factors + AR (AIC)	0.72 (0.32)	0.84 (0.26)	1.17 (0.24)	1.03 (0.09)
6 Factors + AR (AIC)	0.74 (0.32)	0.89 (0.22)	1.18 (0.24)	1.02 (0.11)
1 Factor	0.93 (0.13)	0.96 (0.08)	1.03 (0.06)	0.99 (0.03)
2 Factors	0.96 (0.10)	0.93 (0.12)	0.92 (0.05)	0.95 (0.04)
3 Factors	0.88 (0.16)	0.88 (0.15)	0.93 (0.06)	0.96 (0.05)
4 Factors	0.90 (0.14)	0.95 (0.13)	1.03 (0.07)	1.05 (0.08)
5 Factors	0.72 (0.32)	0.84 (0.26)	1.00 (0.11)	1.06 (0.09)
6 Factors	0.74 (0.32)	0.85 (0.25)	1.01 (0.11)	1.06 (0.09)
RMSFE for AR (AIC)	0.346	0.380	0.450	0.308

6 Months Ahead Forecast				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.82 (0.16)	0.92 (0.11)	1.02 (0.01)	1.19 (0.21)
Factors + Factor Lags (AIC)	0.93 (0.12)	1.04 (0.05)	0.84 (0.13)	1.00 (0.00)
Factors (AIC)	0.82 (0.16)	0.92 (0.11)	0.99 (0.06)	1.04 (0.03)
1 Factor + AR (AIC)	1.14 (0.22)	1.04 (0.05)	0.93 (0.05)	1.03 (0.02)
2 Factors + AR (AIC)	1.15 (0.23)	1.04 (0.05)	0.94 (0.04)	1.03 (0.02)
3 Factors + AR (AIC)	1.08 (0.21)	0.98 (0.04)	1.04 (0.06)	1.04 (0.03)
4 Factors + AR (AIC)	1.00 (0.12)	1.07 (0.10)	1.11 (0.10)	1.16 (0.11)
5 Factors + AR (AIC)	0.85 (0.16)	0.96 (0.14)	1.09 (0.10)	1.16 (0.12)
6 Factors + AR (AIC)	0.87 (0.19)	1.07 (0.10)	1.29 (0.28)	1.35 (0.30)
1 Factor	1.11 (0.18)	1.04 (0.05)	0.93 (0.05)	1.03 (0.02)
2 Factors	1.10 (0.17)	1.04 (0.05)	0.94 (0.04)	1.03 (0.02)
3 Factors	0.99 (0.15)	0.98 (0.04)	0.94 (0.04)	1.03 (0.03)
4 Factors	1.00 (0.12)	1.07 (0.10)	1.10 (0.10)	1.16 (0.10)
5 Factors	0.83 (0.17)	0.96 (0.14)	1.06 (0.11)	1.15 (0.12)
6 Factors	0.88 (0.17)	1.07 (0.17)	1.20 (0.21)	1.24 (0.18)
RMSFE for AR (AIC)	0.508	0.565	0.621	0.423
12 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.43 (0.18)	1.43 (0.22)	1.24 (0.16)	1.22 (0.15)
Factors + Factor Lags (AIC)	1.08 (0.08)	1.06 (0.06)	1.00 (0.00)	1.00 (0.00)
Factors (AIC)	1.08 (0.08)	1.08 (0.07)	1.07 (0.04)	1.04 (0.07)
1 Factor + AR (AIC)	1.44 (0.18)	1.43 (0.22)	1.01 (0.06)	1.01 (0.01)
2 Factors + AR (AIC)	1.50 (0.21)	1.44 (0.23)	1.01 (0.06)	1.05 (0.04)
3 Factors + AR (AIC)	1.47 (0.19)	1.43 (0.24)	1.08 (0.08)	1.28 (0.18)
4 Factors + AR (AIC)	1.49 (0.20)	1.50 (0.27)	1.41 (0.27)	1.35 (0.27)
5 Factors + AR (AIC)	1.43 (0.19)	1.45 (0.25)	1.46 (0.29)	1.35 (0.30)
6 Factors + AR (AIC)	1.54 (0.27)	1.51 (0.28)	1.43 (0.21)	1.35 (0.28)
1 Factor	1.08 (0.08)	1.06 (0.06)	1.01 (0.06)	1.01 (0.01)
2 Factors	1.08 (0.08)	1.06 (0.06)	1.01 (0.06)	1.01 (0.01)
3 Factors	1.07 (0.08)	1.10 (0.07)	1.05 (0.06)	1.02 (0.03)
4 Factors	1.27 (0.17)	1.37 (0.20)	1.35 (0.20)	1.22 (0.19)
5 Factors	1.29 (0.17)	1.40 (0.22)	1.40 (0.25)	1.27 (0.27)
6 Factors	1.32 (0.16)	1.40 (0.18)	1.40 (0.18)	1.25 (0.24)
RMSFE for AR (AIC)	0.782	0.818	0.770	0.575

United Kingdom:

	Money Market Rate			
	6 Months	12 Months	3 Years	10 Years
Method	Relative Mean Square Error			
1 Month Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.00 (0.00)	0.98 (0.07)	0.97 (0.10)	1.05 (0.06)
Factors + Factor Lags (AIC)	1.20 (0.13)	1.16 (0.07)	0.98 (0.04)	1.02 (0.09)
Factors (AIC)	1.20 (0.13)	1.16 (0.07)	0.98 (0.04)	1.02 (0.09)
1 Factor + AR (AIC)	1.02 (0.02)	0.96 (0.04)	1.00 (0.08)	1.04 (0.07)
2 Factors + AR (AIC)	0.98 (0.05)	0.91 (0.08)	0.95 (0.10)	1.05 (0.10)
3 Factors + AR (AIC)	1.03 (0.00)	0.96 (0.08)	0.91 (0.09)	1.00 (0.10)
4 Factors + AR (AIC)	1.05 (0.07)	0.99 (0.09)	0.91 (0.09)	0.96 (0.10)
5 Factors + AR (AIC)	1.10 (0.07)	1.02 (0.08)	0.91 (0.09)	1.02 (0.09)
6 Factors + AR (AIC)	1.13 (0.13)	1.05 (0.09)	0.92 (0.10)	0.96 (0.09)
1 Factor	1.12 (0.09)	1.14 (0.07)	0.98 (0.03)	1.03 (0.08)
2 Factors	1.22 (0.11)	1.15 (0.07)	0.94 (0.05)	1.02 (0.11)
3 Factors	1.20 (0.13)	1.22 (0.13)	0.97 (0.06)	0.99 (0.10)
4 Factors	1.22 (0.13)	1.25 (0.14)	0.97 (0.06)	0.96 (0.10)
5 Factors	1.23 (0.14)	1.25 (0.14)	1.01 (0.07)	0.95 (0.10)
6 Factors	1.23 (0.15)	1.20 (0.13)	1.02 (0.09)	0.95 (0.10)
RMSFE for AR (AIC)	0.114	0.146	0.248	0.165

3 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	1.00 (0.00)	1.00 (0.05)	0.97 (0.08)	1.04 (0.13)
Factors + Factor Lags (AIC)	1.13 (0.12)	1.02 (0.05)	0.97 (0.08)	1.04 (0.13)
Factors (AIC)	1.13 (0.12)	1.02 (0.05)	0.97 (0.08)	1.04 (0.13)
1 Factor + AR (AIC)	1.01 (0.01)	0.96 (0.04)	0.98 (0.08)	0.96 (0.04)
2 Factors + AR (AIC)	0.98 (0.05)	0.95 (0.07)	0.97 (0.08)	1.02 (0.14)
3 Factors + AR (AIC)	1.14 (0.12)	1.00 (0.07)	0.98 (0.08)	0.93 (0.11)
4 Factors + AR (AIC)	1.14 (0.12)	1.00 (0.07)	0.99 (0.08)	0.95 (0.10)
5 Factors + AR (AIC)	1.11 (0.12)	1.00 (0.07)	1.00 (0.09)	1.06 (0.16)
6 Factors + AR (AIC)	1.12 (0.13)	1.02 (0.08)	0.93 (0.10)	0.98 (0.12)
1 Factor	1.05 (0.08)	1.02 (0.05)	0.98 (0.03)	0.95 (0.09)
2 Factors	1.08 (0.07)	1.01 (0.07)	0.97 (0.08)	1.01 (0.14)
3 Factors	1.13 (0.12)	1.08 (0.10)	0.98 (0.08)	0.93 (0.11)
4 Factors	1.13 (0.12)	1.09 (0.10)	0.99 (0.08)	0.95 (0.10)
5 Factors	1.12 (0.12)	1.08 (0.11)	0.98 (0.08)	0.98 (0.14)
6 Factors	1.12 (0.13)	1.05 (0.12)	0.91 (0.10)	0.96 (0.13)
RMSFE for AR (AIC)	0.298	0.386	0.459	0.321
6 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.94 (0.08)	1.14 (0.20)	0.96 (0.11)	0.95 (0.13)
Factors + Factor Lags (AIC)	0.94 (0.08)	1.07 (0.21)	0.96 (0.11)	0.95 (0.13)
Factors (AIC)	0.94 (0.08)	1.07 (0.21)	0.96 (0.11)	0.95 (0.13)
1 Factor + AR (AIC)	0.94 (0.08)	1.01 (0.18)	1.02 (0.09)	0.99 (0.09)
2 Factors + AR (AIC)	0.94 (0.09)	1.06 (0.19)	1.03 (0.14)	1.11 (0.16)
3 Factors + AR (AIC)	0.99 (0.12)	1.06 (0.15)	0.94 (0.14)	0.91 (0.15)
4 Factors + AR (AIC)	0.99 (0.12)	1.06 (0.15)	0.94 (0.14)	0.93 (0.15)
5 Factors + AR (AIC)	0.94 (0.14)	1.03 (0.18)	0.93 (0.16)	0.95 (0.17)
6 Factors + AR (AIC)	0.93 (0.13)	1.03 (0.18)	0.93 (0.17)	0.92 (0.17)
1 Factor	0.94 (0.08)	1.01 (0.18)	1.00 (0.09)	0.95 (0.07)
2 Factors	0.94 (0.09)	1.03 (0.21)	1.03 (0.14)	1.09 (0.16)
3 Factors	0.99 (0.12)	1.04 (0.20)	0.94 (0.14)	0.91 (0.15)
4 Factors	0.99 (0.12)	1.05 (0.20)	0.94 (0.14)	0.93 (0.15)
5 Factors	0.94 (0.14)	1.01 (0.22)	0.89 (0.16)	0.95 (0.17)
6 Factors	0.93 (0.13)	0.99 (0.21)	0.87 (0.16)	0.92 (0.17)
RMSFE for AR (AIC)	0.552	0.632	0.679	0.456
12 Months Ahead Forecasts				
AR (AIC)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
Factors (AIC) + AR (AIC)	0.83 (0.14)	0.95 (0.15)	1.29 (0.20)	0.88 (0.10)
Factors + Factor Lags (AIC)	0.83 (0.14)	0.85 (0.18)	1.29 (0.20)	0.88 (0.10)
Factors (AIC)	0.83 (0.14)	0.85 (0.18)	1.29 (0.20)	0.88 (0.10)
1 Factor + AR (AIC)	0.83 (0.13)	0.91 (0.18)	1.26 (0.25)	0.92 (0.07)
2 Factors + AR (AIC)	0.81 (0.15)	0.85 (0.22)	1.26 (0.30)	1.03 (0.13)
3 Factors + AR (AIC)	0.83 (0.11)	0.89 (0.18)	1.29 (0.20)	0.86 (0.12)
4 Factors + AR (AIC)	0.83 (0.12)	0.88 (0.18)	1.29 (0.20)	0.87 (0.11)
5 Factors + AR (AIC)	0.78 (0.16)	0.78 (0.21)	1.23 (0.19)	0.88 (0.11)
6 Factors + AR (AIC)	0.77 (0.16)	0.76 (0.21)	1.24 (0.19)	0.90 (0.11)
1 Factor	0.83 (0.13)	0.80 (0.22)	1.23 (0.29)	1.00 (0.07)
2 Factors	0.81 (0.15)	0.79 (0.23)	1.24 (0.29)	1.01 (0.14)
3 Factors	0.83 (0.11)	0.82 (0.19)	1.29 (0.20)	0.86 (0.12)
4 Factors	0.83 (0.12)	0.81 (0.19)	1.29 (0.20)	0.87 (0.11)
5 Factors	0.78 (0.16)	0.77 (0.21)	1.23 (0.19)	0.88 (0.11)
6 Factors	0.77 (0.16)	0.77 (0.21)	1.24 (0.19)	0.90 (0.11)
RMSFE for AR (AIC)	0.988	1.110	0.873	0.615

Table A3: Dynamic Pass-Through Models

Germany: Time Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.296 (0.029)	-0.286 (0.029)
mr_{t-1}	0.261 (0.025)	0.258 (0.025)
Δmr_t	0.254 (0.039)	0.209 (0.028)
Δmr_{t-3}	-0.087 (0.030)	-0.086 (0.026)
Δmr_{t-12}	0.104 (0.023)	0.085 (0.025)
$\Delta^6 \widehat{mr}_{t+6\|t}$	-0.063 (0.030)	-
Pass-through Coefficient	0.883 (0.012)	0.903 (0.006)
LM Test for Serial Correlation, p-value	0.094	0.103
Log-Likelihood	254.69	252.53
AIC	-0.989	-0.970
BIC	-0.853	-0.857

Germany: Short-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.120 (0.053)	0.073 (0.057)
rr_{t-1}	-0.050 (0.018)	-0.043 (0.020)
mr_{t-1}	0.036 (0.011)	0.027 (0.013)
Δmr_{t-4}	0.081 (0.030)	0.113 (0.040)
Δmr_{t-5}	0.119 (0.037)	0.143 (0.042)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.332 (0.061)	-
Pass-through Coefficient	0.726 (0.206)	0.641 (0.258)
LM Test for Serial Correlation, p-value	0.067	0.176
Log-Likelihood	210.660	197.620
AIC	-0.284	-0.092
BIC	-0.148	0.022

Germany: Long-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.301 (0.131)	0.315 (0.136)
rr_{t-1}	-0.116 (0.051)	-0.131 (0.054)
mr_{t-1}	0.097 (0.037)	0.091(0.039)
Δmr_{t-1}	0.267 (0.050)	0.315 (0.068)
Δrr_{t-8}	-0.173 (0.078)	-0.146 (0.076)
Δmr_{t-11}	0.099 (0.055)	0.041 (0.056)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.242 (0.037)	-
Pass-through Coefficient	0.832 (0.101)	0.696 (0.073)
LM Test for Serial Correlation, p-value	0.281	0.434
Log-Likelihood	149.540	132.610
AIC	0.029	0.338
BIC	0.208	0.492

Germany: Mortgage Loans

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.026 (0.014)	-0.038 (0.011)
mr_{t-1}	0.036 (0.015)	0.046 (0.013)
Δmr_t	0.425 (0.072)	0.496 (0.062)
Δrr_{t-1}	0.246 (0.057)	0.246 (0.053)
Δmr_{t-1}	0.222 (0.047)	0.203 (0.048)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.075 (0.052)	-
Pass-through Coefficient	1.380 (0.204)	1.220 (0.042)
LM Test for Serial Correlation, p-value	0.847	0.761
Log-Likelihood	211.080	210.120
AIC	-0.291	-0.292
BIC	-0.155	-0.178

France: Time Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.231 (0.034)	-0.234 (0.035)
mr_{t-1}	0.214 (0.032)	0.218 (0.033)
Δmr_t	0.454 (0.067)	0.388 (0.051)
Δrr_{t-1}	0.172 (0.043)	0.199 (0.046)
Δmr_{t-2}	-0.145 (0.037)	-0.139 (0.032)
Δrr_{t-4}	0.083 (0.025)	0.066 (0.022)
Δrr_{t-7}	0.078 (0.038)	0.071 (0.041)
Δmr_{t-12}	0.069 (0.022)	0.062 (0.026)
$\Delta^1 \widehat{mr}_{t+1\|t}$	-0.161 (0.074)	-
Pass-through Coefficient	0.925 (0.009)	0.935 (0.008)
LM Test for Serial Correlation, p-value	0.496	0.343
Log-Likelihood	213.45	210.770
AIC	-0.281	-0.254
BIC	-0.077	-0.073

France: Short-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.060 (0.025)	-0.072 (0.026)
mr_{t-1}	0.072 (0.029)	0.076 (0.029)
Δrr_{t-1}	-0.135 (0.048)	-0.111 (0.052)
Δrr_{t-3}	0.263 (0.129)	0.265 (0.130)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.195 (0.069)	-
Pass-through Coefficient	1.200 (0.091)	1.060 (0.066)
LM Test for Serial Correlation, p-value	0.993	0.992
Log-Likelihood	102.42	98.764
AIC	1.432	1.474
BIC	1.545	1.564

France: Long-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.048 (0.016)	-0.053 (0.014)
mr_{t-1}	0.069 (0.024)	0.071 (0.021)
Δrr_{t-1}	-0.245 (0.064)	-0.225 (0.056)
Δmr_{t-1}	0.179 (0.068)	0.209 (0.074)
Δrr_{t-2}	-0.118 (0.068)	-0.147 (0.047)
Δrr_{t-3}	0.306 (0.104)	0.313 (0.106)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.136 (0.055)	-
Pass-through Coefficient	1.460 (0.086)	1.340 (0.073)
LM Test for Serial Correlation, p-value	0.290	0.396
Log-Likelihood	129.920	127.360
AIC	1.024	1.048
BIC	1.182	1.185

Italy: Current Account Deposits

	Model with forecasts	Model without forecasts
intercept	-0.068 (0.023)	-0.118 (0.028)
rr_{t-1}	-0.127 (0.023)	-0.149 (0.025)
mr_{t-1}	0.075 (0.014)	0.090 (0.016)
Δrr_{t-1}	0.195 (0.090)	0.244 (0.085)
Δrr_{t-2}	-0.279 (0.085)	-0.240 (0.070)
Δrr_{t-3}	0.376 (0.090)	0.394 (0.092)
Δrr_{t-4}	-0.244 (0.087)	-0.235 (0.081)
Δmr_{t-9}	0.059 (0.025)	0.055 (0.028)
$\Delta^1 \widehat{mr}_{t+1\|t}$	0.654 (0.151)	-
Pass-through Coefficient	0.592 (0.029)	0.601 (0.029)
LM Test for Serial Correlation, p-value	0.345	0.150
Log-Likelihood	235.480	229.12
AIC	-0.633	-0.547
BIC	-0.430	-0.366

Italy: Time Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.233 (0.022)	-0.223 (0.024)
mr_{t-1}	0.188 (0.019)	0.173 (0.019)
Δmr_{t-2}	0.079 (0.031)	0.086 (0.032)
Δmr_{t-8}	-0.048 (0.022)	-0.037 (0.019)
Δrr_{t-9}	0.164 (0.053)	0.186 (0.032)
Δmr_{t-12}	-0.058 (0.025)	-0.045 (0.021)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.077 (0.016)	-
Pass-through Coefficient	0.806 (0.016)	0.779 (0.010)
LM Test for Serial Correlation, p-value	0.200	0.154
Log-Likelihood	214.710	211.850
AIC	-0.333	-0.303
BIC	-0.175	-0.167

Italy: Short-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.164 (0.021)	0.153 (0.021)
rr_{t-1}	-0.130 (0.017)	-0.144 (0.016)
mr_{t-1}	0.133 (0.017)	0.145 (0.018)
Δmr_{t-2}	0.079 (0.028)	0.073 (0.034)
Δmr_{t-4}	0.066 (0.027)	0.055 (0.023)
Δrr_{t-6}	0.118 (0.058)	0.105 (0.059)
Δrr_{t-11}	-0.138 (0.053)	-0.093 (0.072)
Δrr_{t-12}	0.132 (0.050)	0.115 (0.066)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.210 (0.054)	-
Pass-through Coefficient	1.020 (0.029)	1.010 (0.028)
LM Test for Serial Correlation, p-value	0.192	0.092
Log-Likelihood	215.29	208.48
AIC	-0.310	-0.217
BIC	-0.107	-0.036

Italy: Long-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.442 (0.059)	0.352 (0.052)
rr_{t-1}	-0.262 (0.032)	-0.285 (0.032)
mr_{t-1}	0.265 (0.037)	0.284 (0.037)
Δrr_{t-1}	-0.230 (0.059)	-0.197 (0.048)
Δrr_{t-11}	-0.142 (0.053)	-0.081 (0.049)
Δrr_{t-12}	0.159 (0.072)	0.171 (0.079)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.363 (0.104)	-
Pass-through Coefficient	1.010 (0.035)	0.998 (0.032)
LM Test for Serial Correlation, p-value	0.067	0.125
Log-Likelihood	87.169	82.325
AIC	1.708	1.769
BIC	1.866	1.905

Italy: Mortgage Loans

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.072 (0.011)	-0.069 (0.012)
mr_{t-1}	0.080 (0.011)	0.072 (0.014)
Δmr_t	-0.124 (0.051)	0.034 (0.044)
Δrr_{t-1}	-0.196 (0.066)	-0.197 (0.067)
Δrr_{t-3}	0.176 (0.066)	0.232 (0.080)
Δrr_{t-7}	0.211 (0.064)	0.177 (0.070)
Δmr_{t-7}	0.075 (0.037)	0.090 (0.039)
Δrr_{t-9}	-0.178 (0.057)	-0.214 (0.052)
Δrr_{t-10}	-0.111 (0.052)	-0.150 (0.059)
Δrr_{t-12}	0.315 (0.073)	0.449 (0.081)
Δmr_{t-12}	0.089 (0.044)	0.096 (0.045)
$\Delta^1 \widehat{mr}_{t+1\|t}$	0.728 (0.162)	
Pass-through Coefficient	1.110 (0.031)	1.040 (0.035)
LM Test for Serial Correlation, p-value	0.342	0.019
Log-Likelihood	160.600	150.390
AIC	0.613	0.760
BIC	0.884	1.009

Spain: Current Account Deposits

	Model with forecasts	Model without forecasts
intercept	-0.057 (0.016)	-0.055 (0.016)
rr_{t-1}	-0.100 (0.018)	-0.102 (0.018)
mr_{t-1}	0.044 (0.009)	0.046 (0.008)
Δmr_t	0.117 (0.026)	0.109 (0.023)
Δmr_{t-4}	0.065 (0.027)	0.066 (0.023)
Δmr_t	0.092 (0.040)	0.089 (0.040)
$\Delta^1 \widehat{mr}_{t+1\|t}$	-0.091 (0.075)	-
Pass-through Coefficient	0.441 (0.031)	0.449 (0.027)
LM Test for Serial Correlation, p-value	0.029	0.021
Log-Likelihood	256.730	256.230
AIC	-1.005	-1.013
BIC	-0.847	-0.878

Spain: Time Deposits

	Model with forecasts	Model without forecasts
intercept	0.052 (0.018)	0.043 (0.022)
rr_{t-1}	-0.265 (0.062)	-0.409 (0.037)
mr_{t-1}	0.223 (0.052)	0.336 (0.034)
Δmr_{t-2}	-0.139 (0.054)	0.014 (0.037)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.346 (0.086)	-
Pass-through Coefficient	0.844 (0.022)	0.821 (0.016)
LM Test for Serial Correlation, p-value	0.038	0.998
Log-Likelihood	190.420	181.210
AIC	0.024	0.155
BIC	0.137	0.246

Spain: Short Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.703 (0.108)	0.724 (0.108)
rr_{t-1}	-0.521 (0.082)	-0.572 (0.081)
mr_{t-1}	0.482 (0.074)	0.515 (0.076)
Δmr_{t-1}	-0.770 (0.149)	-0.429 (0.132)
Δrr_{t-2}	-0.611 (0.155)	-0.222 (0.099)
Δmr_{t-7}	-0.279 (0.079)	-0.234 (0.080)
Δmr_{t-12}	0.112 (0.054)	0.149 (0.055)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.695 (0.218)	
Pass-through Coefficient	0.925 (0.022)	0.900 (0.021)
LM Test for Serial Correlation, p-value	0.198	0.461
Log-Likelihood	118.440	111.150
AIC	1.223	1.324
BIC	1.405	1.482

Spain: Long-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.171 (0.055)	0.189 (0.059)
rr_{t-1}	-0.109 (0.019)	-0.118 (0.019)
mr_{t-1}	0.087 (0.026)	0.084 (0.028)
Δrr_{t-1}	-0.250 (0.057)	-0.298 (0.058)
Δrr_{t-2}	-0.113 (0.067)	0.119 (0.058)
Δrr_{t-3}	-0.146 (0.066)	-0.153 (0.069)
Δmr_{t-3}	0.150 (0.074)	0.174 (0.069)
Δrr_{t-4}	-0.182 (0.070)	-0.174 (0.069)
Δrr_{t-5}	-0.360 (0.086)	-0.333 (0.088)
Δmr_{t-5}	0.447 (0.103)	0.440 (0.113)
Δmr_{t-10}	0.220 (0.073)	0.208 (0.074)
Δmr_{t-11}	0.234 (0.067)	0.231 (0.071)
Δrr_{t-12}	0.289 (0.061)	0.302 (0.064)
Δmr_{t-13}	0.195 (0.059)	0.212 (0.061)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.134 (0.058)	-
Pass-through Coefficient	0.799 (0.148)	0.713 (0.151)
LM Test for Serial Correlation, p-value	0.123	0.118
Log-Likelihood	123.960	121.350
AIC	1.225	1.251
BIC	1.566	1.569

Spain: Mortgage Loans

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.021 (0.009)	-0.022 (0.008)
mr_{t-1}	0.024 (0.008)	0.023 (0.009)
Δrr_{t-1}	0.565 (0.064)	0.566 (0.060)
Δmr_{t-1}	0.093 (0.036)	0.100 (0.029)
Δmr_{t-2}	0.103 (0.041)	0.101 (0.038)
Δrr_{t-4}	0.146 (0.053)	0.152 (0.050)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.041 (0.045)	-
Pass-through Coefficient	1.120 (0.149)	1.030 (0.061)
LM Test for Serial Correlation, p-value	0.278	0.268
Log-Likelihood	227.510	226.960
AIC	-0.538	-0.545
BIC	-0.379	-0.409

Euro Area: Current Account Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.069 (0.031)	-0.030 (0.037)
mr_{t-1}	0.023 (0.010)	0.008 (0.013)
Δmr_{t-1}	0.085 (0.018)	0.170 (0.031)
Δmr_{t-5}	0.040 (0.019)	0.013 (0.019)
Δrr_{t-6}	0.242 (0.122)	0.497 (0.210)
Δrr_{t-7}	0.356 (0.134)	0.599 (0.213)
Δrr_{t-8}	-0.243 (0.077)	-0.315 (0.096)
Δmr_{t-8}	-0.082 (0.017)	-0.124 (0.036)
$\Delta^1 \widehat{mr}_{t+1\|t}$	0.118 (0.014)	-
Pass-through Coefficient	0.330 (0.012)	0.284 (0.082)
LM Test for Serial Correlation, p-value	0.702	0.563
Log-Likelihood	198.42	178.79
AIC	-4.181	-3.549
BIC	-3.864	-3.268

Euro Area: Short-Term Time Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.097 (0.037)	-0.112 (0.038)
mr_{t-1}	0.083 (0.032)	0.093 (0.032)
Δmr_{t}	0.439 (0.084)	0.566 (0.065)
Δrr_{t-3}	0.238 (0.120)	0.241 (0.121)
Δmr_{t-5}	0.162 (0.072)	0.169 (0.071)
Δmr_{t-6}	-0.191 (0.070)	-0.225 (0.077)
Δmr_{t-7}	0.088 (0.054)	0.141 (0.048)
Δmr_{t-9}	-0.200 (0.071)	-0.104 (0.066)
Δmr_{t-10}	0.167 (0.073)	0.141 (0.058)
Δrr_{t-11}	-0.268 (0.057)	-0.256 (0.102)
Δmr_{t-12}	0.281 (0.057)	0.315 (0.055)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.127 (0.057)	-
Pass-through Coefficient	0.862 (0.030)	0.830 (0.026)
LM Test for Serial Correlation, p-value	0.639	0.986
Log-Likelihood	125.780	122.640
AIC	-1.617	-1.545
BIC	-1.195	-1.158

Euro Area: Short-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.016 (0.005)	-0.013 (0.005)
mr_{t-1}	0.021 (0.008)	0.015 (0.006)
Δmr_{t-1}	0.307 (0.051)	0.404 (0.049)
Δmr_{t-9}	0.198 (0.088)	0.223 (0.076)
$\Delta^1 \widehat{mr}_{t+1\|t}$	0.160 (0.048)	-
Pass-through Coefficient	1.340 (0.141)	1.200 (0.146)
LM Test for Serial Correlation, p-value	0.451	0.555
Log-Likelihood	111.420	109.060
AIC	-1.368	-1.322
BIC	-1.192	-1.181

Euro Area: Medium to Long-Term Loans to Enterprises

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.139 (0.026)	-0.137 (0.029)
mr_{t-1}	0.197 (0.018)	0.185 (0.017)
Δmr_t	0.065 (0.03)	0.071 (0.023)
Δrr_{t-1}	-0.345 (0.069)	-0.340 (0.067)
Δrr_{t-2}	-0.270 (0.077)	-0.266 (0.072)
Δrr_{t-5}	-0.238 (0.079)	-0.268 (0.079)
Δmr_{t-8}	-0.092 (0.034)	-0.096 (0.036)
Δrr_{t-9}	-0.178 (0.063)	-0.192 (0.061)
Δmr_{t-9}	0.088 (0.036)	0.089 (0.036)
Δrr_{t-11}	-0.180 (0.069)	-0.214 (0.061)
Δmr_{t-11}	0.085 (0.033)	0.084 (0.031)
Δrr_{t-12}	0.191 (0.128)	0.160 (0.067)
$\Delta^6 \widehat{mr}_{t+6\|t}$	-0.159 (0.128)	-
Pass-through Coefficient	1.420 (0.024)	1.440 (0.012)
LM Test for Serial Correlation, p-value	0.506	0.556
Log-Likelihood	139.260	138.57
AIC	-2.040	-2.051
BIC	-1.583	-1.628

Euro Area: Mortgage Loans

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.047 (0.016)	-0.059 (0.011)
mr_{t-1}	0.100 (0.028)	0.116 (0.020)
Δmr_t	0.122 (0.044)	0.117 (0.039)
Δrr_{t-1}	-0.344 (0.055)	-0.320 (0.044)
Δrr_{t-2}	-0.298 (0.058)	-0.277 (0.053)
Δmr_{t-2}	0.133 (0.050)	0.121 (0.053)
Δrr_{t-3}	-0.278 (0.059)	-0.252 (0.060)
Δrr_{t-4}	-0.330 (0.049)	-0.307 (0.047)
Δrr_{t-5}	-0.190 (0.038)	-0.175 (0.033)
Δmr_{t-5}	0.178 (0.060)	0.174 (0.057)
Δmr_{t-6}	-0.149 (0.047)	-0.152 (0.050)
Δrr_{t-8}	-0.076 (0.033)	-0.070 (0.033)
Δmr_{t-10}	0.230 (0.047)	0.234 (0.050)
Δrr_{t-11}	-0.165 (0.049)	-0.153 (0.043)
Δrr_{t-12}	0.445 (0.055)	0.461 (0.049)
$\Delta^{12} \widehat{mr}_{t+12\|t}$	0.136 (0.103)	-
Pass-through Coefficient	2.12 (0.171)	1.96 (0.037)
LM Test for Serial Correlation, p-value	0.741	0.737
Log-Likelihood	119.68	119.23
AIC	-1.275	-1.294
BIC	-0.712	-0.765

United Kingdom: Instant Access Deposits

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.102 (0.027)	-0.101 (0.023)
mr_{t-1}	0.037 (0.009)	0.036 (0.008)
Δrr_{t-1}	-0.235 (0.082)	-0.234 (0.070)
Δmr_{t-2}	0.337 (0.050)	0.346 (0.043)
Δmr_{t-4}	0.162 (0.058)	0.163 (0.06)
Δmr_{t-6}	0.231 (0.062)	0.232 (0.062)
Δrr_{t-7}	0.215 (0.078)	0.212 (0.084)
Δrr_{t-8}	-0.249 (0.071)	-0.253 (0.067)
Δmr_{t-8}	0.124 (0.060)	0.133 (0.052)
Δmr_{t-12}	0.144 (0.051)	0.143 (0.053)
$\Delta^6 \widehat{mr}_{t+6\|t}$	0.012 (0.019)	-
Pass-through Coefficient	0.359 (0.014)	0.357 (0.013)
LM Test for Serial Correlation, p-value	0.882	0.873
Log-Likelihood	168.620	168.430
AIC	-0.891	-0.910
BIC	-0.585	-0.630

United Kingdom: Time Deposits

	Model with forecasts	Model without forecasts
intercept	-0.302 (0.054)	-0.305 (0.059)
rr_{t-1}	-0.212 (0.027)	-0.206 (0.028)
mr_{t-1}	0.192 (0.025)	0.189 (0.026)
Δrr_{t-6}	0.255 (0.066)	0.241 (0.064)
Δrr_{t-11}	0.158 (0.071)	0.148 (0.074)
Δrr_{t-12}	-0.174 (0.080)	-0.165 (0.076)
$\Delta^3 \widehat{mr}_{t+3\|t}$	-0.041 (0.032)	-
Pass-through Coefficient	0.907 (0.039)	0.919 (0.047)
LM Test for Serial Correlation, p-value	0.710	0.742
Log-Likelihood	146.950	146.390
AIC	-0.494	-0.504
BIC	-0.298	-0.336

United Kingdom: Short Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.558 (0.169)	0.835 (0.187)
rr_{t-1}	-0.266 (0.060)	-0.326 (0.057)
mr_{t-1}	0.253 (0.060)	0.286 (0.055)
Δmr_t	0.262 (0.100)	0.088 (0.102)
Δmr_{t-2}	-0.382 (0.130)	-0.320 (0.150)
Δmr_{t-8}	-0.216 (0.065)	-0.145 (0.084)
Δmr_{t-9}	0.227 (0.077)	0.208 (0.074)
$\Delta^{12} \widehat{mr}_{t+12\|t}$	-0.177 (0.039)	-
Pass-through Coefficient	0.951 (0.072)	0.879 (0.070)
LM Test for Serial Correlation, p-value	0.388	0.554
Log-Likelihood	109.230	97.896
AIC	0.376	0.608
BIC	0.600	0.803

United Kingdom: Long Term Loans to Enterprises

	Model with forecasts	Model without forecasts
intercept	0.165 (0.064)	0.217 (0.065)
rr_{t-1}	-0.078 (0.019)	-0.096 (0.020)
mr_{t-1}	0.062 (0.016)	0.077 (0.018)
Δmr_t	0.124 (0.034)	0.094 (0.035)
Δrr_{t-1}	0.281 (0.102)	0.288 (0.129)
Δmr_{t-3}	0.064 (0.030)	0.062 (0.034)
Δrr_{t-8}	0.185 (0.072)	0.207 (0.072)
Δmr_{t-11}	0.084 (0.033)	0.089 (0.037)
$\Delta^6 \widehat{mr}_{t+36\|t}$	-0.080 (0.022)	-
Pass-through Coefficient	0.798 (0.101)	0.793 (0.087)
LM Test for Serial Correlation, p-value	0.317	0.618
Log-Likelihood	168.670	163.39
AIC	-0.937	-0.841
BIC	-0.685	-0.617

United Kingdom: Mortgage Loans

	Model with forecasts	Model without forecasts
rr_{t-1}	-0.139 (0.059)	-0.141 (0.063)
mr_{t-1}	0.170 (0.072)	0.171 (0.075)
Δmr_t	0.579 (0.077)	0.609 (0.078)
Δrr_{t-1}	0.225 (0.092)	0.212 (0.098)
Δrr_{t-11}	0.126 (0.060)	0.143 (0.057)
$\Delta^3 \widehat{mr}_{t+3\|t}$	0.086 (0.083)	-
Pass-through Coefficient	1.220 (0.018)	1.210 (0.016)
LM Test for Serial Correlation, p-value	0.962	0.953
Log-Likelihood	111.760	111.380
AIC	0.274	0.260
BIC	0.442	0.399

Figure A1: Dynamics of Retail Rates

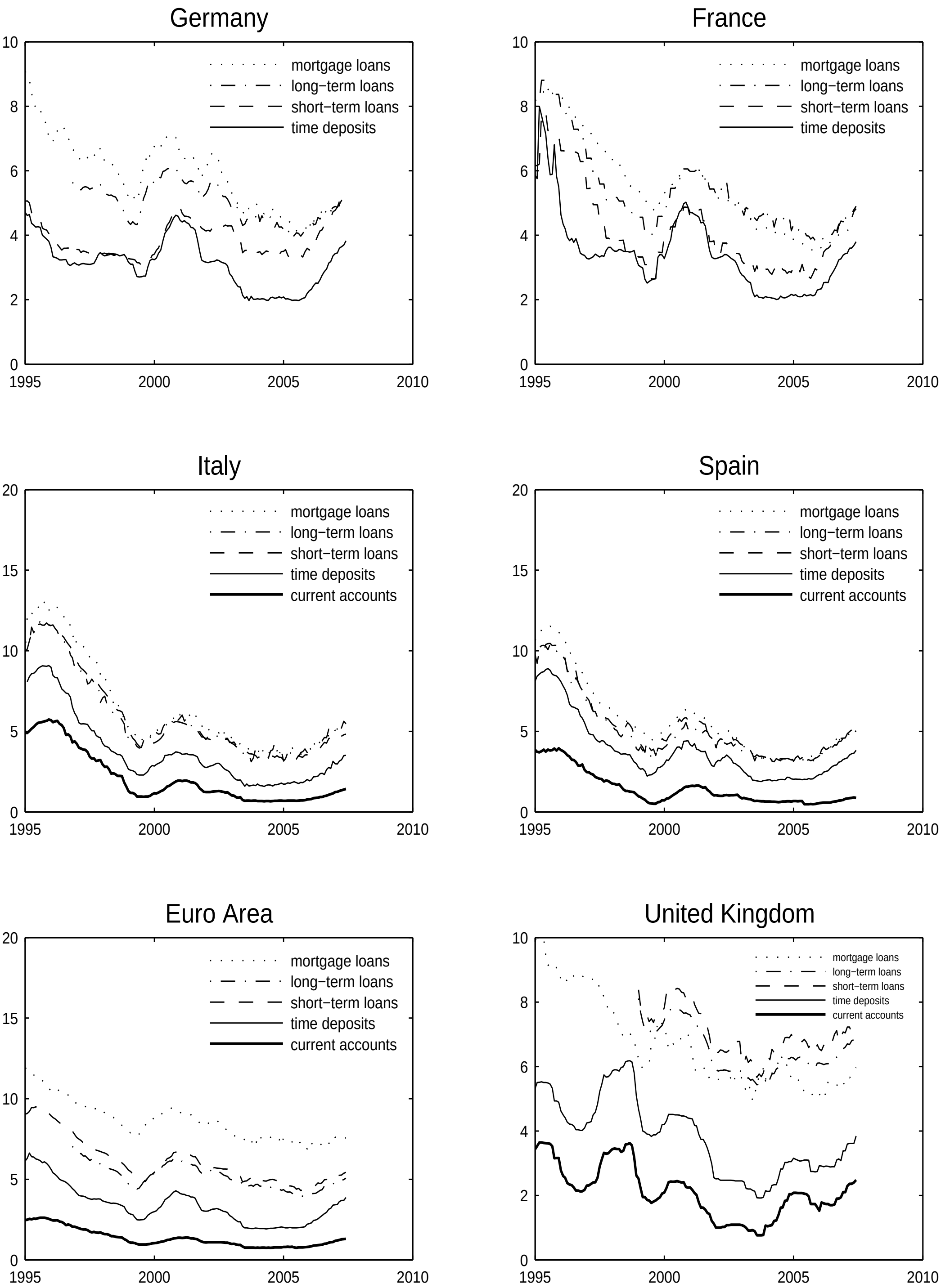


Figure A2 : Dynamics of Wholesale Rates

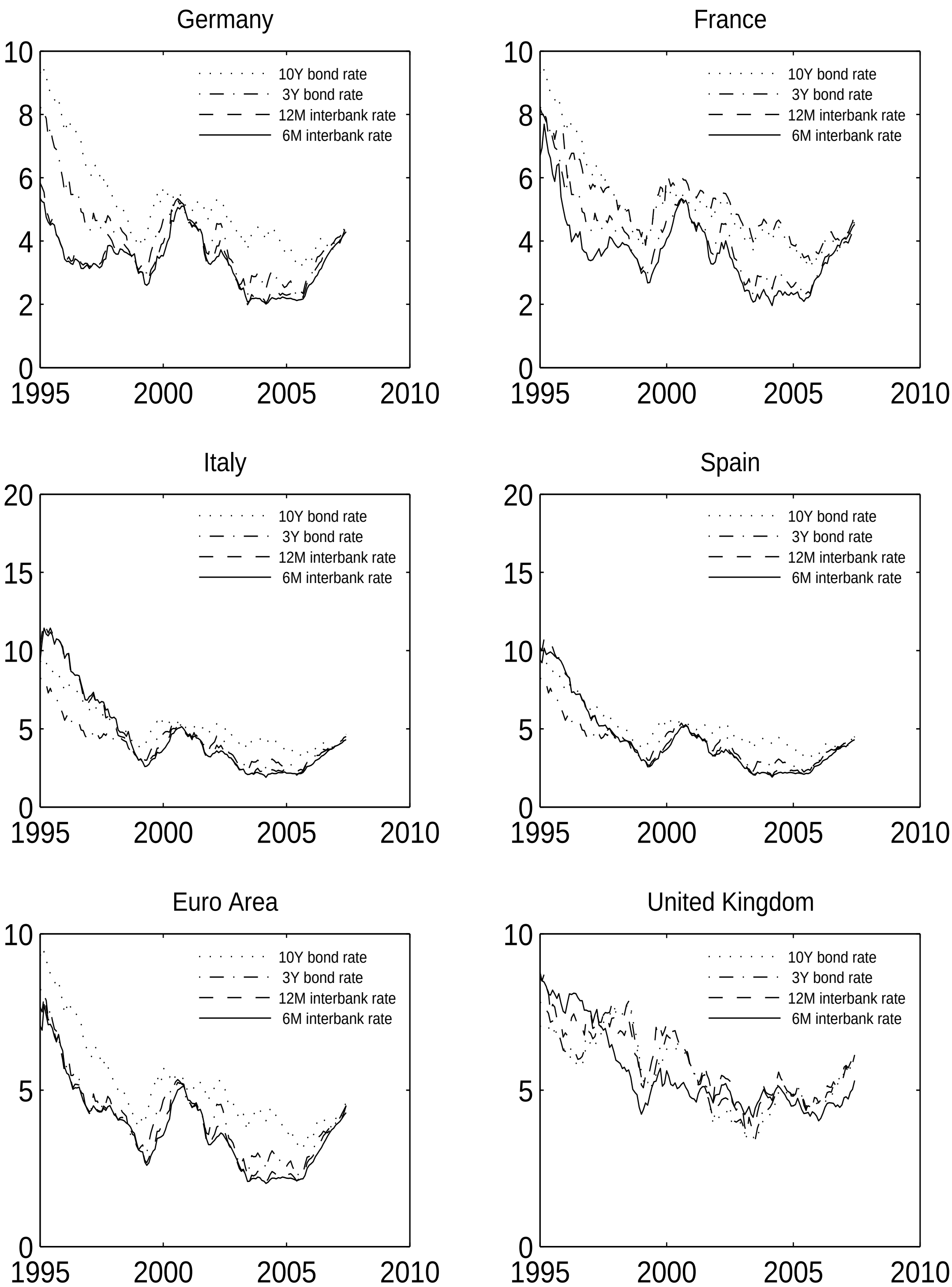
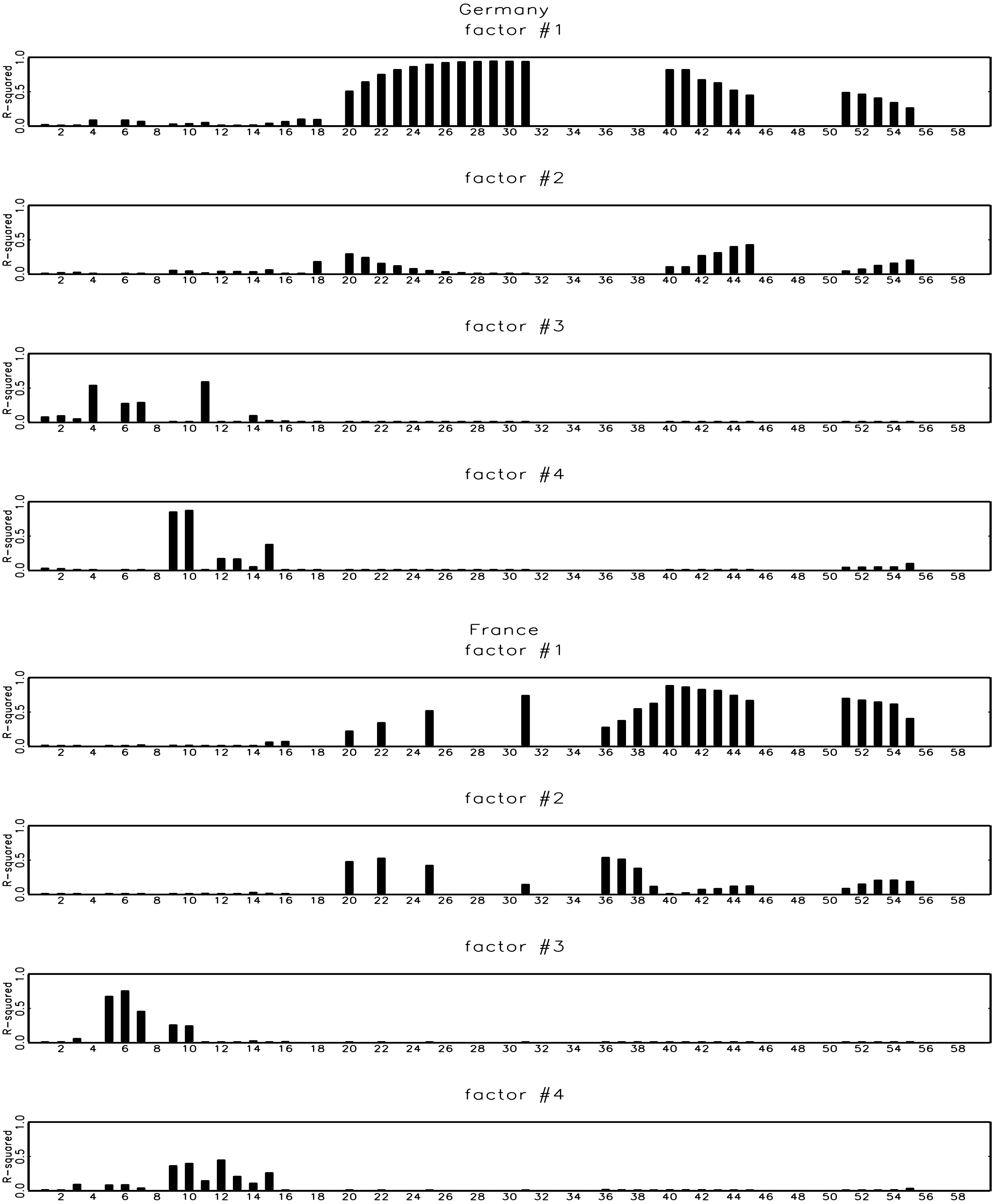
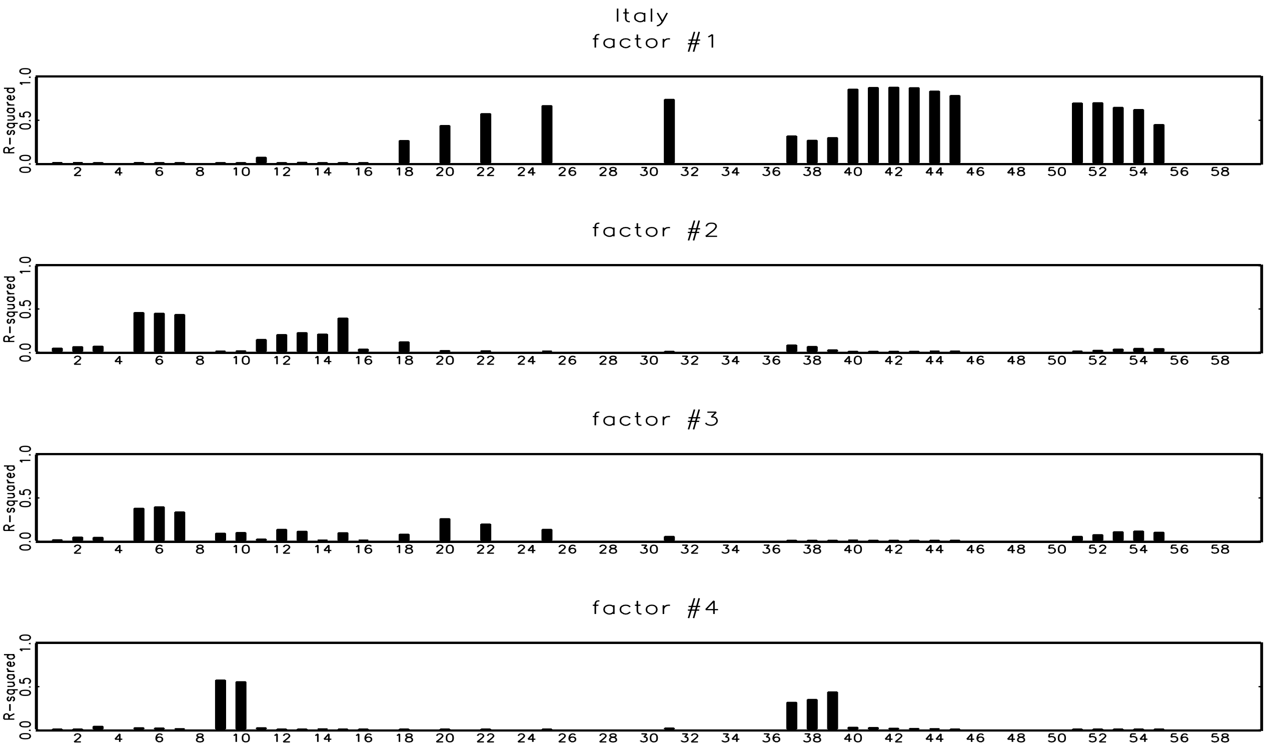
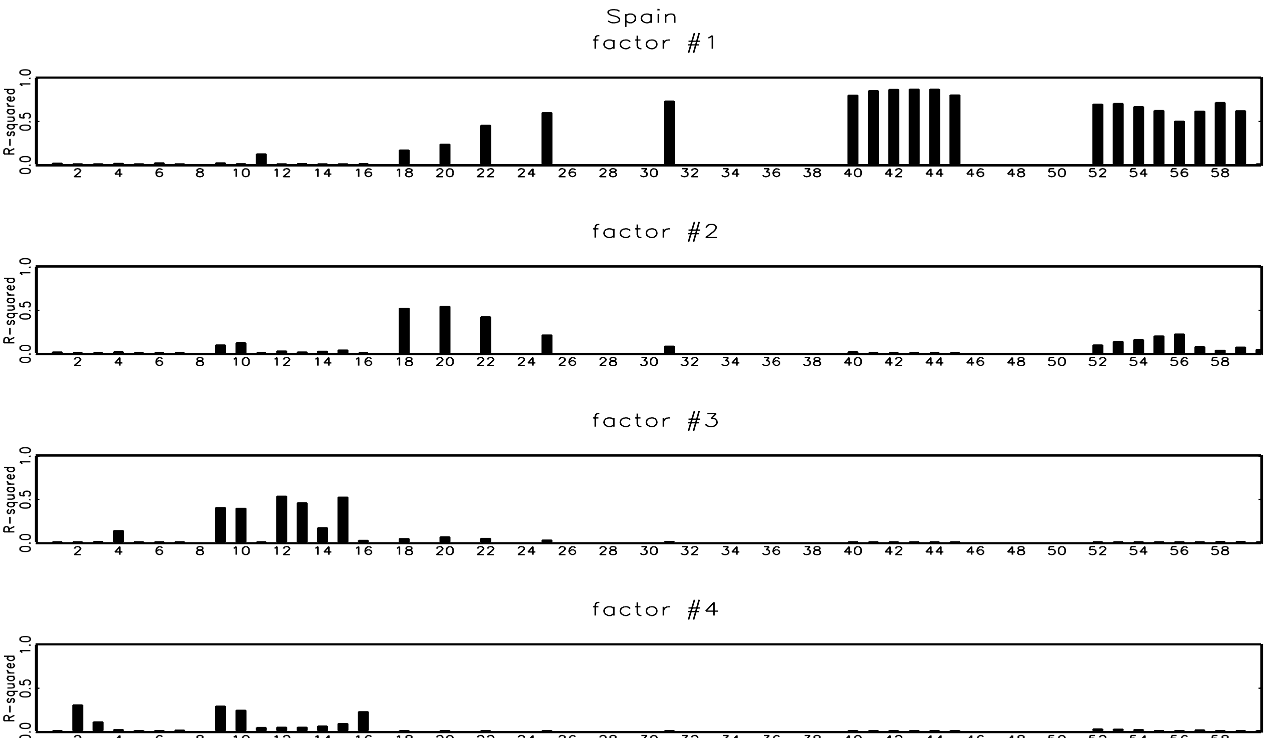
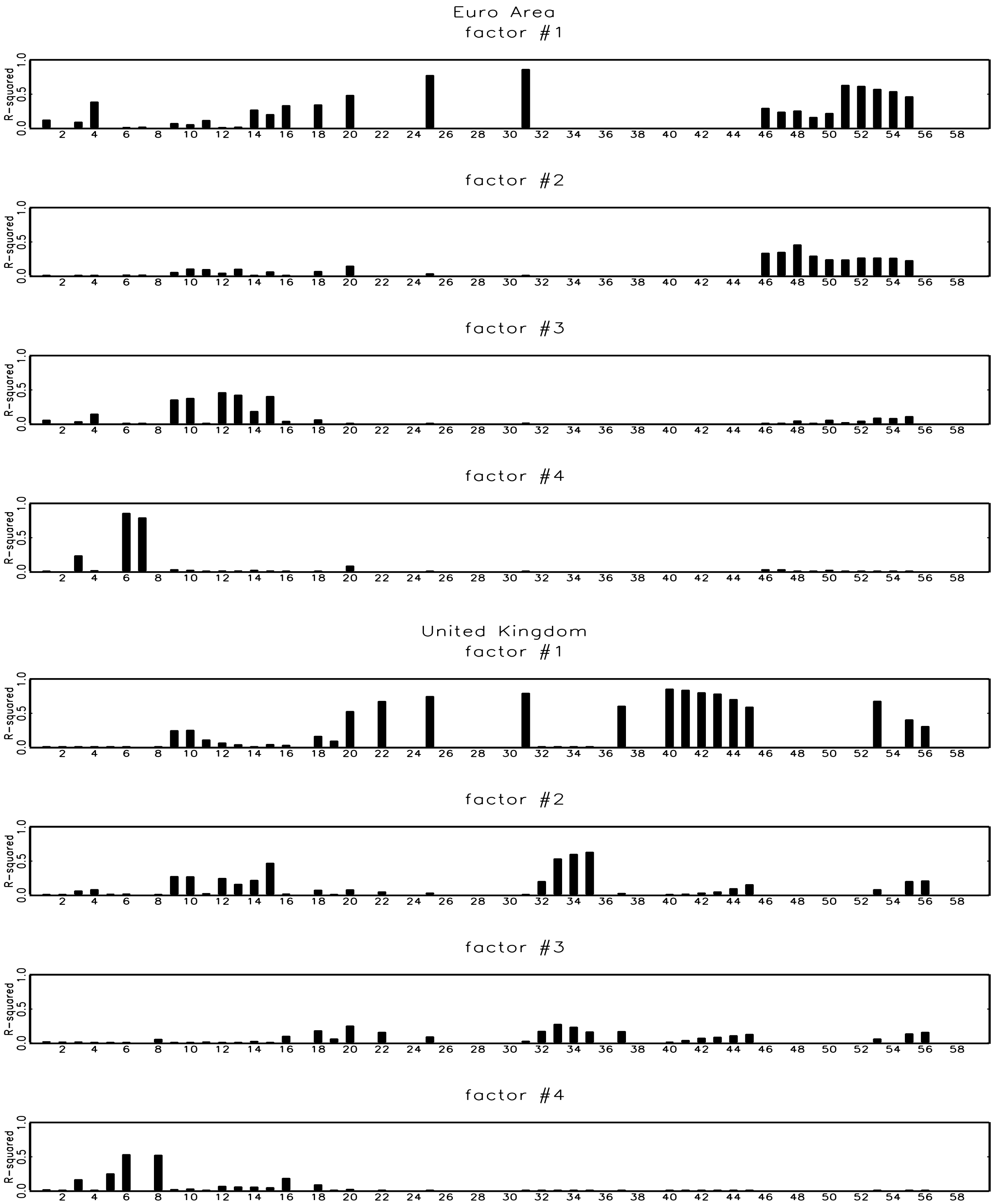


Figure A3: Factor Loadings




Italy
factor #1
factor #2
factor #3
factor #4
R-squared
0.0 0.5 1.0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58


Spain
factor #1
factor #2
factor #3
factor #4
R-squared
0.0 0.5 1.0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58


Euro Area
factor #1
factor #2
factor #3
factor #4
United Kingdom
factor #1
factor #2
factor #3
factor #4
R-squared
0.0 0.5 1.0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58