Money and monetary policy: The ECB experience 1999 - 2006

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Key Questions

1) How was monetary analysis conducted in practice? (Tools and evolution)

2) What has been the performance of monetary analysis in quantifying risks to price stability?

3) How has monetary analysis been used in monetary policy decisions?

Methodology of the paper

- **Narrative approach and quantitative real time assessment (real time forecasting evaluation):**

  - **Short sample problem**

    (about 8 years, 18 forecasting exercises, 18 interest rate changes)

  - **Models, quality of the signal and data change over time**

  - → **Rich real time database with different vintages of data and models**

Structure of the briefing for the Governing Council

- **Monetary analysis**

- **Quarterly Monetary Assessment (QMA)**

- **Economic analysis**

- **Macroeconomic projection exercise**
  - **Biannual conducted by Eurosystem staff, intermediate by ECB staff.**
  - **Based on structural macroeconometric models and expert judgement, up to a horizon of 9 quarters.**

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Monetary analysis: Overview of inputs and outputs in the QMA

- **Input**
  - Tools related to money demand framework

  - Broad monetary analysis including analysis of components and counterparts of M3 leading to a judgemental view

  - Bivariate forecasting models

- **Output**
  - M3 corrected for portfolio shifts and other factors

  - Excess liquidity measures

  - Quantitative assessment of risks to price stability based on inflation forecasts

  - Qualitative overall assessment of risks to price stability stemming from money

Monetary analysis: Money Demand

Reference value for annual M3 growth 4½%

(potential output 2-2½%, inflation below 2%, decline in velocity trend ½% to 1%)

Estimated money demand equations

Excess liquidity measures

Structural (money demand based) forecasts

Monetary analysis: Evolution

Challenges

- **Technical factors (e.g. introduction of remuneration of required reserves)**

- **Statistical problems (e.g. non-resident holdings of marketable instruments)**

- **Economic behaviour not captured by conventional determinants of money demand (e.g. portfolio shifts)**

Practical responses in real time

1) **Broadening of the monetary analysis and derivation of M3 corrected for judgmental factors**

2) **Stronger weight on reduced form equations for forecast**

3) **Freeze estimates of parameters of money demand equations, de-emphasise outcomes based on money demand models (excess liquidity measures derived from headline M3 and the reference value only used to provide risk scenarios, not central view)**

Real Time Response 1: Analysis of determinants of portfolio shifts

Analysis of broad set of indicators of portfolio shifts into money not captured by standard money demand models:

- Measures of uncertainty

- Measures of financial market volatility and risk aversion (capturing potential asymmetric effects)

- Quantitative indicators of portfolio decisions concerning domestic and foreign assets

➔ Derive levels of M3 free from money holdings stemming from temporary extraordinary portfolio decisions of economic agents and hence unlikely to be used for spending activities.

Real Time Response 1a: Real time versus ex post assessment of effects of portfolio shifts
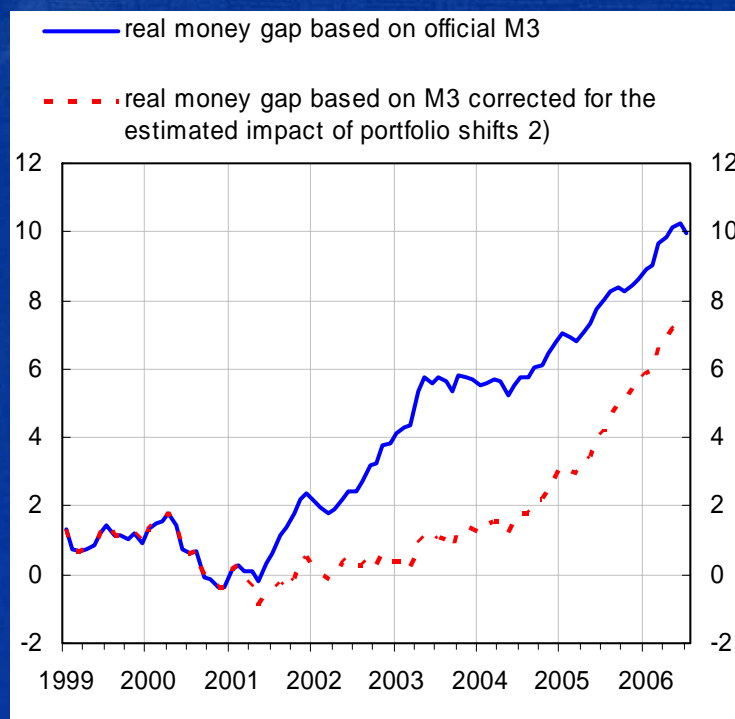
- **Different vintages of growth of M3 and M3 corrected**
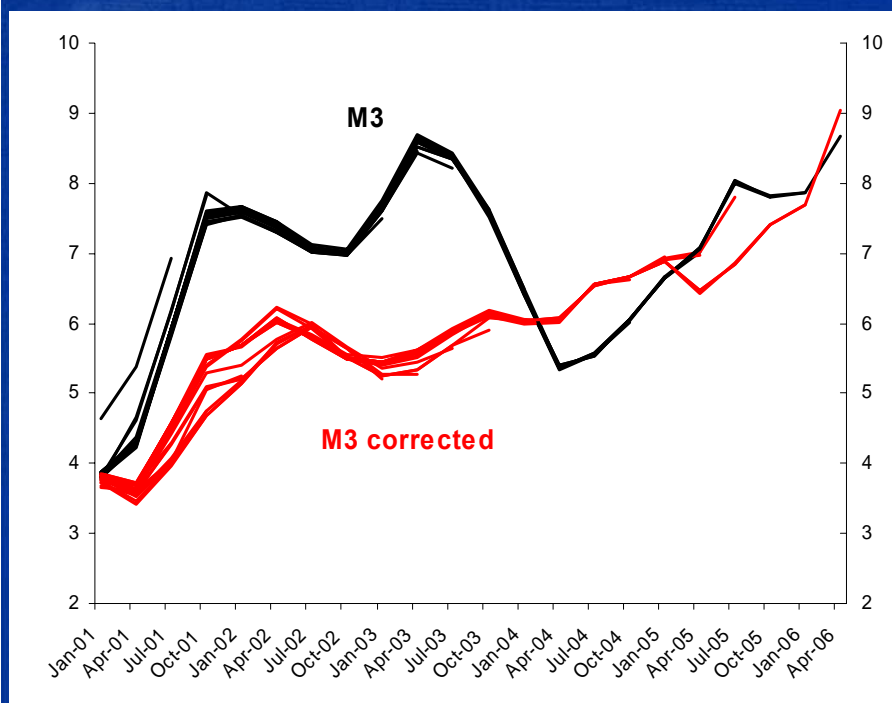
- **Ex post assessment does not differ significantly from assessment in real time**

Real Time Response 1b: Real time versus ex post assessment of effects of portfolio shifts

- **Real money gap of M3 and M3 corrected**

  real money gap based on official M3

  real money gap based on M3 corrected for the estimated impact of portfolio shifts 2)

- Judgmental analysis captured in real time shocks to money demand between 2001 and 2003 not captured by standard money demand models

- Between mid 2004 and today, the increase in the real money gap is not "corrected": analysis of the counterparts show liquidity pressures stemming from money creation via credit

- Open question: is the assessment since 2004 accurate?

Real Time Response 2: Bivariate Inflation Forecast (Nicoletti-Altimari, 2001)

$$\pi_{t+h} = a + b_0 \tilde{\pi}_t + b_1 \tilde{\pi}_{t-1} + \ldots + b_k \tilde{\pi}_{t-k} + c_0 x_t + c_1 x_{t-1} + \ldots + c_s x_{t-s} + \varepsilon_{t+h}$$
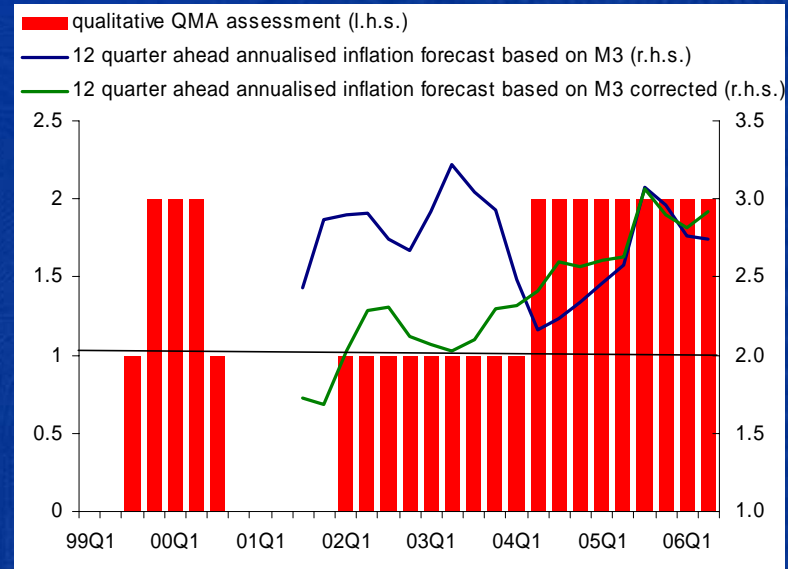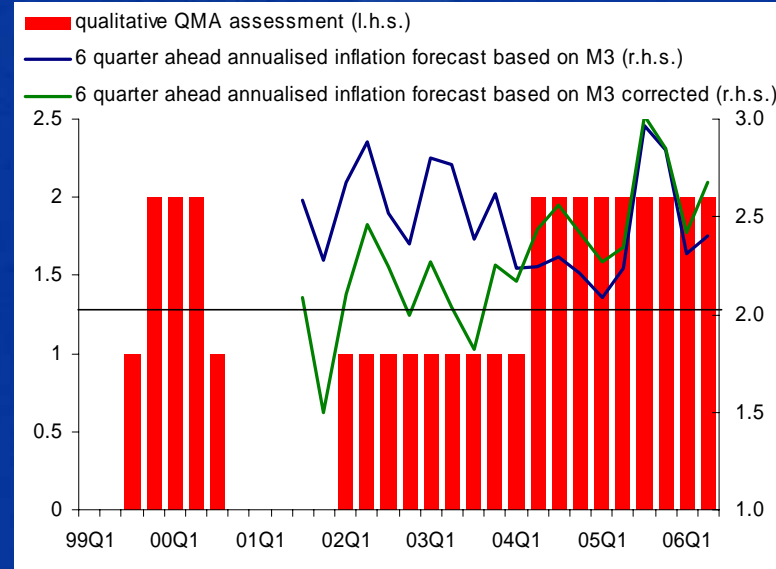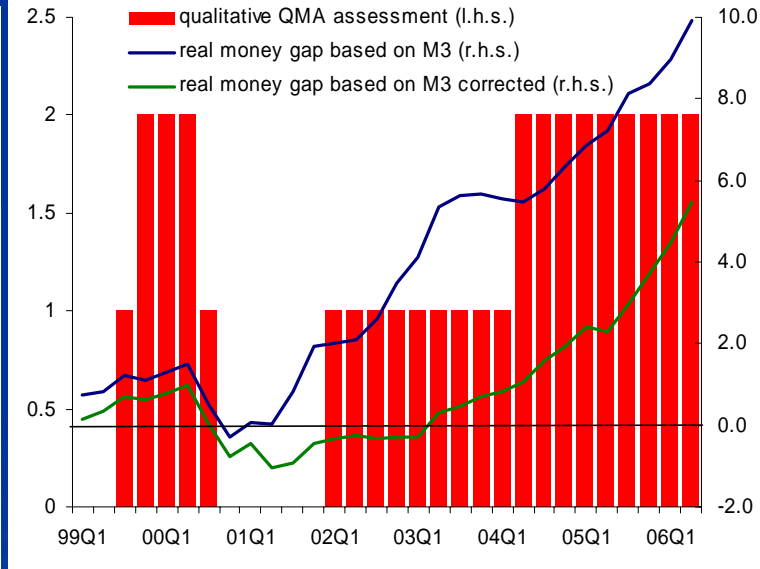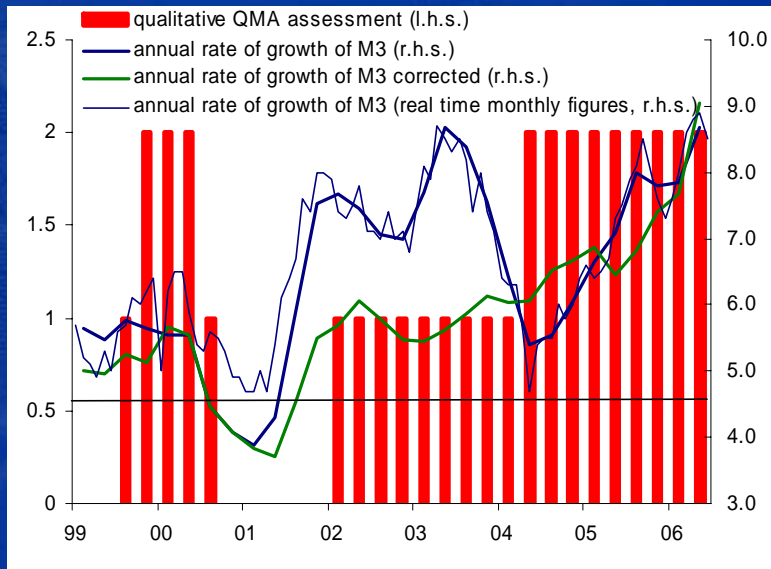
π_{t+h}: annualised h-period change in the HICP

$\tilde{\pi}_t$: two quarter moving average of the q-o-q change in HICP

x_t : four quarter moving average of the q-o-q change in M3 or M3 corrected

Monetary analysis: Summary indicators: 4 phases
coding from -2 (clear downward risks) to +2 (clear upward risks)

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Inflation forecasting evaluation
Target: annualised inflation over the next six quarters

- **Money based forecasts against two benchmarks: Economic Analysis projections and naïve forecasts**

	MSE relative to Naive	BIAS	Variance of forecast error
M3	1.86	0.28	0.11
M3 corrected	1.04	0.01	0.14
BMPE	2.40	-0.45	0.04
BMPE/M3	0.48	-0.08	0.04

Inflation forecast evaluation

- **BMPE projections biased downward**

- **M3 forecasts biased upward with similar size as BMPE**

- **The judgmental correction of M3 corrected the bias of the inflation forecast but it introduced volatility**

- **BMPE projections, M3 and M3 corr. based forecasts outperformed by naïve forecast**

- **The forecast combination BMPE/M3 is smooth and unbiased and then dominates in a MSE sense the M3 corrected inflation forecast and a naïve forecast**

Inflation forecast evaluation: further results

- **Formal test shows that inflation forecasts from M3 are not encompassed by the BMPE forecast (they add information)**

- **Several variables other than money produce (bivariate) upward biased forecasts and are not encompassed by the BMPE projections.**

- **However, the BMPE/M3 combination outperforms all the combinations of BMPE with alternative forecasts.**

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QMA and Introductory Statement: indicators

- **One measure of input from monetary analysis (QMA):**

  qualitative assessment of risks to price stability (seen before)

- **Two measures of output from the assessment of risks to price stability by the Governing Council (introductory statement):**

  assessment from monetary analysis and from economic analysis

Money and monetary policy: narrative approach

Qualitative input and output into/from the policy process

Legend:
- Input into the policy process: QMA qualitative assessment
- Output from policy process: Qualitative assessment monetary pillar from introductory statement
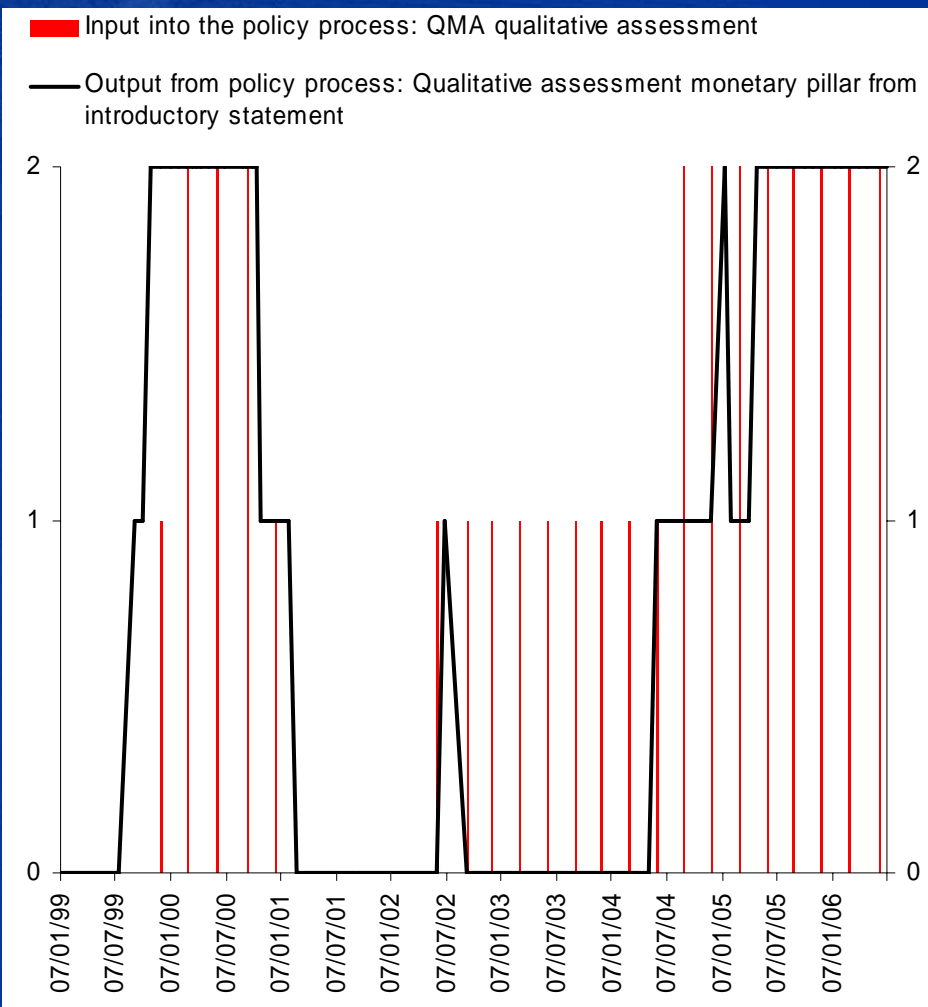
•**Overall, coincidence of QMA assessment and Introductory Statement assessment of risks to price stability stemming from monetary pillar.**
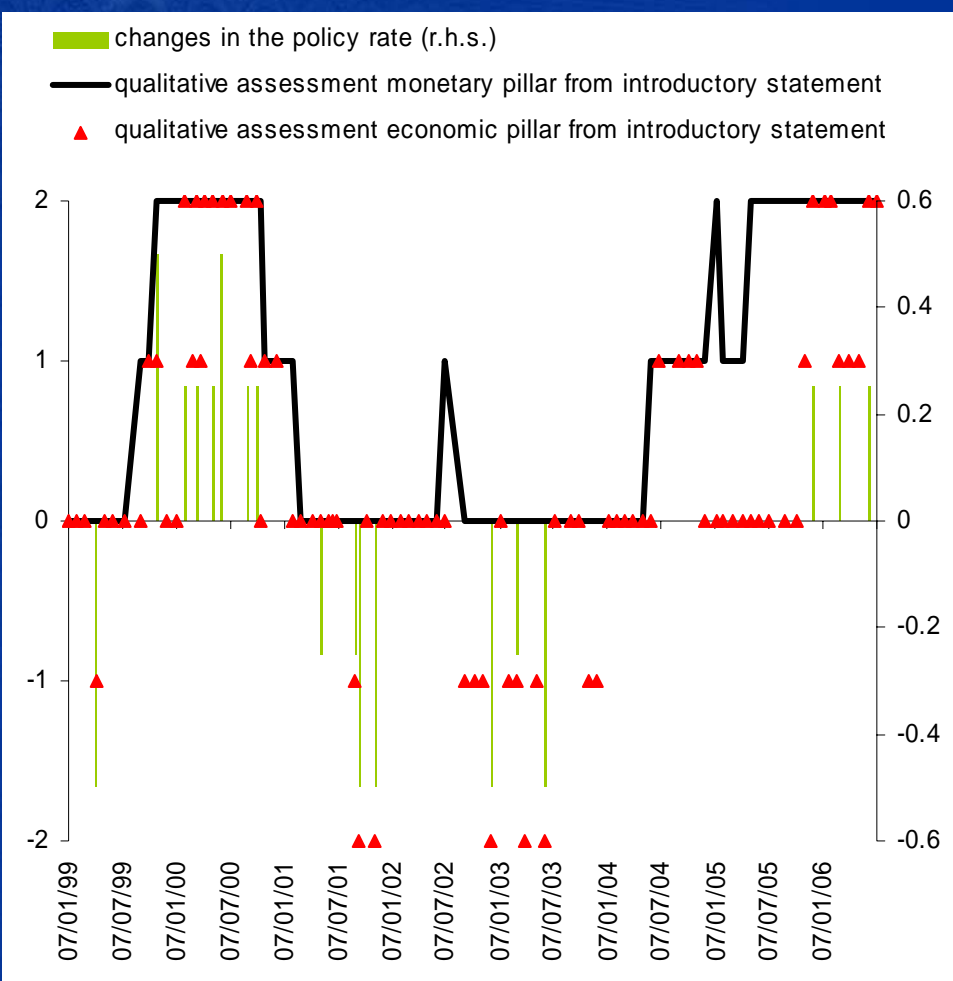
•**Exception: 2002-2004.**

  •**Portfolio shifts. Monetary analysis presented a benign scenario but upside risks.**

  •**Introductory statement did not take the upside risks assessment from the QMA into account.**

(coding of -2 hints at downward risks to price stability, coding of 2 indicates upward risks to price stability)

Money and monetary policy: narrative approach

Qualitative input and output into/from the policy process

Legend:
- changes in the policy rate (r.h.s.)
- qualitative assessment monetary pillar from introductory statement
- qualitative assessment economic pillar from introductory statement

- **High degree of correlation: difficult to identify role of two pillars in shaping interest rate decisions**

- **Indications from monetary pillar understated in 2002-2004 (portfolio shifts)**

- **Indications from monetary pillar for policy move in December 2005 very important.**

(coding of -2 hints at downward risks to price stability, coding of 2 indicates upward risks to price stability)

Summary and Conclusions

- Monetary analysis has evolved over time to cope with several challenges: data, institutions and portfolio shifts → tools have been developed to identify shifts in supply and demand of money in real time

- Money has provided a valuable input for the assessment of price stability, complementing the economic analysis assessment
  Challenges: signals not always easy to identify (signal from qualitative assessment sometime blurred, forecast excessively volatile)

- When signals from monetary analysis has differed from that of economic analysis, the economic analysis has played a larger role (2002-2004), but indication from monetary analysis motivated move in December 2005
  Challenge: communication

Background slides
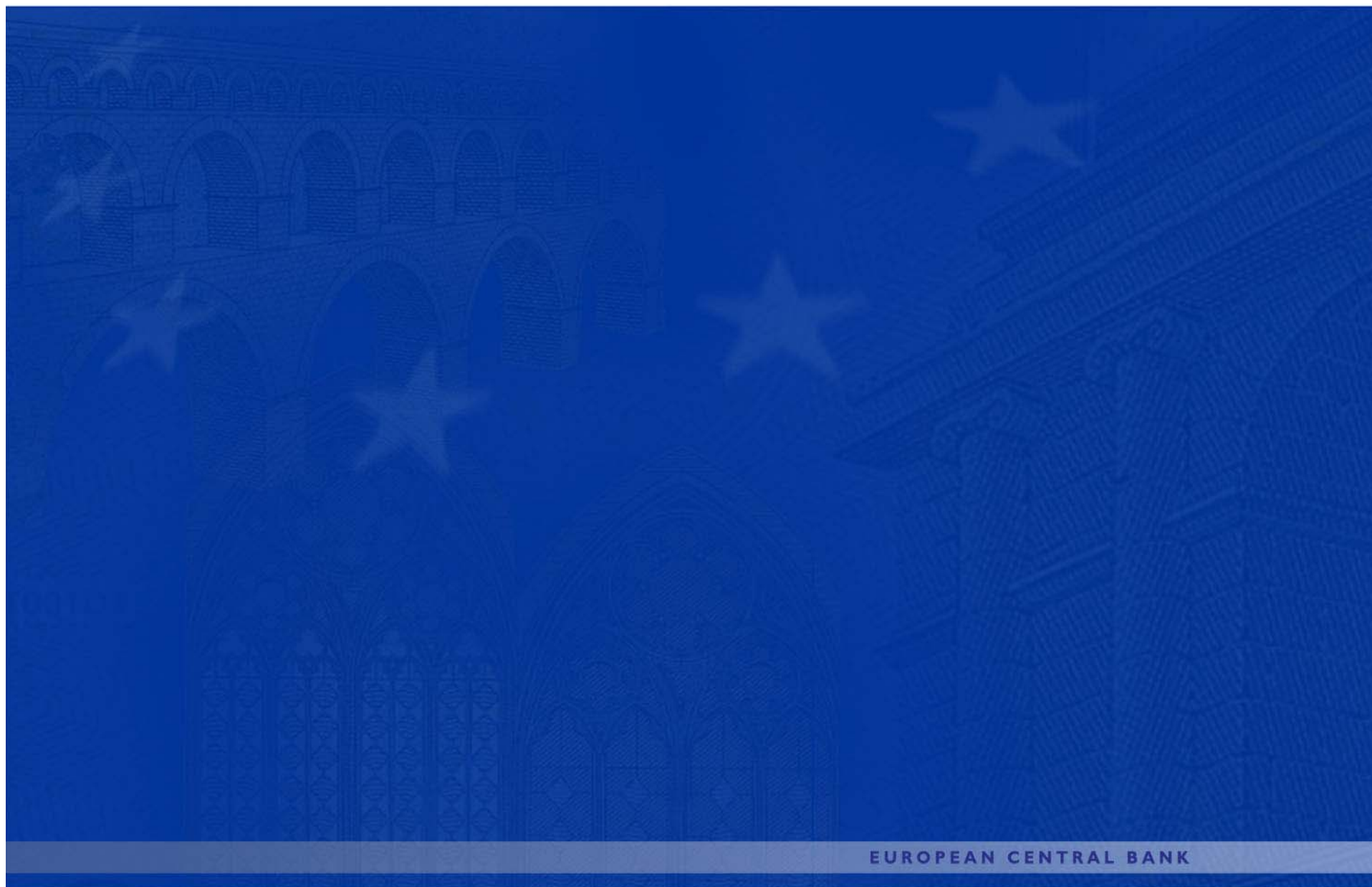
Background slide Forecast errors

- **Internal forecasts**

Model	MSFE	MSFE/RW	MSFE/AR	Bias	SD of fore.	Var. of f.e.	Bias²
AR	0.18	1.76	1.00	0.16	0.48	0.15	0.03
RW	0.10	1.00	0.57	0.12	0.25	0.09	0.01
1.9%	0.09	0.92	0.52	-0.27	0.00	0.02	0.07
BMPE	0.24	2.40	1.37	-0.45	0.20	0.04	0.20
M3	0.19	1.86	1.06	0.28	0.23	0.11	0.08
M3c	0.11	1.04	0.59	0.01	0.27	0.14	0.00
BMPE/M3	0.05	0.48	0.28	-0.08	0.10	0.04	0.01

$$\pi_{v,t+h} = a_v + b_v(L)\tilde{\pi}_{v,t} + c_v(L)x_{v,t} + \varepsilon_{v,t+h}$$

$with\ \pi_{v,t+h}$ equals the annualised h - period change in the HICP

$\tilde{\pi}_{v,t}$ equals the two quarter moving average of the q - o - q change in HICP

$x_{v,t}$ equals the four quarter moving average of the q - o - q change in money

Background slides: Forecast encompassing

- Is it possible to find a convex linear combination of the BMPE ($\pi^B_{v,t+h}$) and money ($\pi^M_{v,t+h}$) forecasts that significantly outperform the BMPE forecast (allowing for a bias term k)?

$$\pi_{t+h} - \pi^B_{v,t+h} = k + \lambda(\pi^M_{v,t+h} - \pi^B_{v,t+h}) + \eta_{t+h}$$

- Encompassing tests: results

Parameter	k	λ
M3	0.27*** (0.06)	0.24** (0.09)
M3 corrected	0.35*** (0.04)	0.22** (0.08)

Newey-West corrected standard errors in paranthesis. Three stars indicate that the coefficients are significant at 1% level, two stars at 5% level, one at 10% level

Background slide: Portfolio shifts I

- **Indicators to monitor and quantify portfolio shifts**

Group 1: Measures of uncertainty

- Consumer confidence
- Changes in unemployment

Group 2: Financial market indicators

- Exchange rate USD-euro
- DJ Eurostoxx index

- Implied stock market volatility
- Conditional correlation between stock and bond return
- Earnings yield premium
- Equity funds flows

Group 3: Monetary indicators

- Money market fund shares/units
- Loans to the private sector
- Net external assets
- Comparison US M2/ euro area M3
- Divisia M3 index

Group 4: Financial account/BOP indicators

- Monetary Presentation of BoP
- net external assets
- Net purchase of non-monetary securities

Monitoring tools:

- One-step-ahead forecast error for M3 from reg-ARIMA model
- Standard money demand model
- Liquidity preference shock derived from a small SVAR model

Background slide: Portfolio shifts II

- **reg-ARIMA time series model for the notional levels of M3**

$$\Delta\Delta^{12}(y_t - \sum_i \beta_i x_{it}) = (1 - \theta_1 L)(1 - \Theta L^{12})a_t$$

- **Estimates of the intervention variables**

Parameter	Estimate	t-value
Constant	-0.16	-1.7
Calendar Effect(Monday up to 1991)	1.4	4.4
Calendar Effect(Friday up to 1991)	-2.6	-9.2
Calendar Effect(Saturday up to 1991)	-1.1	-3.6
Calendar Effect(Friday from 1992)	-9.1	-3.8
Temporary change with decay factor 0.7 09/92 (ERM 2 crisis)	8.4	3.6
Temporary change with decay factor 0.7 03/93 (ERM 2 crisis)	9.0	3.8
Seasonal level shift 12/97	-8.0	-4.7
Seasonal level shift 04/98	3.4	2.1
Combination level shift and temp. change decay factor 0.2 01/99	4.8	4.0
Portfolio shift regressor phases 1 and 2	2.3	2.6
Portfolio shift regressor phases 3 and 4	2.6	3.3
Residual statistics	Value	S.E.
Skewness	0.25	0.15
Kurtosis	2.96	0.3

No signs of autocorrelation and non-linearities in residuals using the Ljung Box test statistics for residuals and squared residuals. Parameters in the Table are multiplied by 1000.

Background slide: Money demand stability

- **Recursive parameter estimates for long-run parameters of workhorse money demand equation as reported in the QMA 2001Q4**

Long-run income elasticity

Long-run semi-elasticity of interest rate spread