UNIVERSITAT DE BARCELONA

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"Forecasting models currently applied to indicators computed on the basis of surveys results"

Tender ECFIN/2002/A3-01

FINAL REPORT

November 25th 2003

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This report is accompanied by a CD including data and programs used in the different sections and a CD user guide.

A. Introduction and objectives

1. **Business and consumer surveys** have become an **essential instrument of gathering economic information** in today's ever-changing environment. These surveys provide agents' perceptions and expectations of their environment. The rapid availability of the results and the wide range of variables covered make them very useful for decision-making. The incredible growth of business surveys since the early 1960s and the need to be carried out and presented in a comparable way lead to the implementation of the Joint Harmonised EU Programme by the Commission in 1961.

2. However, and despite an abundant and growing literature on the forecasting performance of survey indicators, **the usefulness of qualitative data for quantitative forecasting has not yet being fully exploited**.

3. The present report presents the **results** of the project "Forecasting models currently applied to indicators computed on the basis of surveys results". The report has been **updated** taking into account the comments by the Commission staff to some preliminary versions.

4. The project has **three different objectives**:

   a) **To compare different time series methods for short-run forecasting of Business and Consumer Surveys Indicators for the Euro area**. In this context, the effects of the **seasonal adjustment procedure** of original data are also analysed.
   b) To analyse the possibility of **forecasting some of the main quantitative macroeconomic variables** of the Euro area using the information given by the **Business and Consumer Surveys Indicators**.
   c) To provide a **methodological guide** for the monthly use of the models, the calculation of forecasts and the preparation of the basic results for a report on the outlook of the Euro area economy.

B. Forecasting Business and Consumer Surveys Indicators

B.1. Assessing the forecasting accuracy of different methods and models

5. The main objective in this section consists in **assessing alternative methods and models to forecast Business and Consumer Surveys Indicators for the Euro area aggregate**. This objective can be summarised in the two following questions: Is it possible to forecast qualitative indicators?, and, in such a case, which is the best procedure to do it?

6. In order to answer these questions, we have considered all the available information for the Business and Consumer Surveys Indicators for the Euro area. The analysed dataset includes 38 indicators (33 are monthly and 5 quarterly) and 6 composite indicators. The starting date of these indicators differs but most of them start in January 1985 (or in the first quarter of 1985). The last period included in the analysis is December 2002 (or the third-fourth quarter of 2002). More details on the dataset can be found in Annex 1.

7. At a first stage, we have considered **raw data** (in all cases, non seasonally adjusted levels of each category of the variables have been used) in order to test the forecast accuracy of **five different sets of models**: autoregressions (AR), ARIMA, Self-exciting threshold autoregressions (SETAR), Markov switching regime models (MK) and vector autoregressions (traditional VAR and also VAR models considering the joint evolution of different indicators). More details on these models can be found in Annex 2.

8. Next, we will consider the effects of **seasonal adjustment** procedures on forecast accuracy (section B.2) and the effects of **removing outliers** using Tramo/Seats on forecast accuracy (section B.3)

9. In order to evaluate the relative **forecasting accuracy** of the models, for each indicator to be forecasted all models were estimated until 2000.12 (or 2000.IV for quarterly indicators) and forecasts for 1,2,3,6 and 12 months (or 1,2,4 quarters)

ahead were computed. The specifications of the models are based on information up to 2000.12 or 2000.IV and, then, models are re-estimated in each month or quarter and forecasts are computed with these estimation results. Given the availability of actual values until 2002.12 or 2002.III or 2002.IV, forecast errors for each indicator and method can be computed in a recursive way (i.e., for the 1 month forecast horizon, 24 forecast errors can be computed for each indicator). In order to summarise this information, the Root Mean Square Error (RMSE) and Mean Absolute Percentual Error (MAPE) have been computed. Their values provide useful information in order to analyse the forecast accuracy of each method, so that the different methods can be ranked according to their values.

10. Before showing the results of this forecast competition, it is interesting to remark that the **statistical properties** of the Business and Consumer Surveys Indicators are substantially different to the ones of the main macroeconomic variables (GDP, CPI, Industrial Production, Industrial Producer Prices, etc.). In Annex 3.1, some descriptive statistics are shown for each considered indicator. It is worth noting that the variation coefficient shows extremely high values for some indicators. This fact can be interpreted as evidence of the **high volatility** of the indicators and, taking this into account, we would expect the forecast accuracy of the considered methods to be lower than that for other macroeconomic variables. Other interesting result is that if we look at the average values of the variation coefficient for categories (i.e, positive answers, negative answers, balance, etc), the highest value corresponds to the balance. A possible explanation of the higher variance of the balance is purely statistical. The variance of the balance can be decomposed as follows:

$$Var(b) = Var(p - m) = Var(p) + Var(m) - 2 \cdot Cov(p, m)$$

So, if the covariance between positive and negative answers is negative (they move in opposite directions), the variance of the balance would be higher than the variance of the other two components. In an 87% of cases, the sign of this covariance is negative, so the variance of the balance is higher (in most cases) than the other two components (Annex 3.2). But, is it significantly higher? To answer this question, we have applied a test of equality of variances between the balance and the other two components. **In a 76% of the cases, the null hypothesis of**

equality of variances is rejected. Additionally, we have computed some of the most commonly used methods to test the unit root hypothesis: the augmented Dickey and Fuller test, the Phillips and Perron test and the Kwiatkowski, Phillips, Schmidt and Yongcheol test. The Perron's test has also been adapted in order to allow for different types of structural changes: in the level (crash model) or in the slope (breaking trend). Since the variables under consideration can only take values between 0 and 100, a priori we would expect most of them to be I(0). The striking result is that **in many cases the variables are finally considered to be I(1)**, although some differences are observed among the conclusions of the different tests.

11. Regarding the results of the forecast competition, detailed results are shown in Annex 4. The main **conclusions** of this analysis can be summarised as follows:

- As expected, forecasts errors increase for longer horizons in most cases.
- In general, variables corresponding to questions with a higher number of possible answers (i.e, the ones from the Consumer surveys) are better forecasted than the rest.
- In most cases, the size of the errors is higher for the balance than for the components (this fact is related to the higher volatility of these variables).
- Something similar happens for most composite indicators (one notable exception is the Economic Sentiment Indicator).
- Regarding the forecast accuracy of the different methods, in most cases the univariate autoregressions are not outperformed by the rest of methods. In fact, only forecast errors from VAR and Markov models are lower than the ones from AR models in an important number of cases. It is also important to highlight that restricted VAR models usually work better than unrestricted VAR models and that errors displayed by VAR models consisting of different indicators are generally higher.
- Regarding the size of the forecast error, and taking into account than the considered variables (positive, neutral and negative answers but not the balance) can only take values between 0 and 100, even taking the best model the errors are quite high.

12. An additional aspect to be considered is related with the **balance forecasts**. As survey data are derived from qualitative questions and based on subjective evaluation, the results are usually presented in terms of balances, which show the difference between positive and negative percentages of answers. The balance is the information that analysts take into account and the one that is usually forecasted. But, **is it better to forecast the balance directly or to forecast negative and positive answers and then calculate the balance?** In order to answer this question we have replicated the previous forecasting competition now computing the balance from the forecasts of negative and positive answers using AR, ARIMA, TAR and VAR models. The results (in Annex 4.8) have shown that usually it is better to forecast the balance from the forecasts of positive and negative answers instead of doing it directly.

13. Apart from the analysis of the different answers, usually **composite indicators** are calculated from business surveys, for example, the Economic Sentiment Indicator is obtained weighting the answers to different questions of the survey. When looking at these aggregates, there are two possibilities: **to forecast them directly or to obtain the forecast weighting the forecasts for the different components.** Which approach provides better results? A similar exercise to the previous one has been carried out. The results using AR, ARIMA, TAR and VAR models (as shown below) provide similar conclusions to the analysis of the balance: it is better to forecast these indicators from the forecasts of the components than directly.

B.2. The effects of seasonality on data revision and on forecast accuracy

14. Seasonal adjustment methods are usually applied to these indicators. **How does the choice of Tramo/Seats (TS), X12, Dainties (DA) or Wavelets based method (WA) (see Annex 5.1) affect the values of the considered series?** Are they really different? We applied all these methods to obtain seasonally adjusted data (using TS, X12 and DA) and trend cycle estimation (using TS, X12 and WA) from some qualitative indicators (v1, v2, v3p, v3e, v3m, v3b, v4p, v4e, v4m, v4b). From these results (in Annex 5.2) we obtain two main conclusions:

- TS and X12 results are very similar but DA results (seasonal adjustment) and WA results (trend cycle-estimation) show great differences.
- Differences are more important on trend-cycle estimation than on seasonal adjustment.

15. **How does the choice of the seasonal adjustment method affect the revision of the series?** In order to evaluate these revisions, seasonally adjusted data and trend-cycle estimation can be computed in a recursive way adding one more observation from 2001.12 to 2002.12. The results (in Annex 5.2) show that:

- There are great differences in the size of revision among the different variables for every considered seasonal adjustment method.
- There is no relationship between the size of the revision in a given observation and the number of time periods between this observation and the last observation available.
- There are no revisions of seasonally adjusted data using DA method.
- TS revisions of seasonally adjusted data are greater than X12 revisions.
- Trend-cycle estimations using WA method show dramatic revisions.
- TS revisions of trend-cycle data are greater than X12 revisions.

16. The choice of a seasonal adjustment method can also affect forecasts. **Is it better to forecast raw data and then apply a seasonal adjustment method?** As pointed by Commission staff, the information from Business and Consumers Surveys has little seasonality, and, the results should not be very different. To confirm this idea, we have computed the Kruskal-Wallis test (see Annex 5.2 g) for all the qualitative variables in order to check the relevance of seasonality. In almost 87% of the cases, the null hypothesis of non-seasonality is not rejected, that is, most series do not present seasonal component. So, in our opinion, and although there have been a lot of contributions regarding this issue, too much attention has been given to this issue in the context of Business and Consumers Surveys.

B.3. The effects of removing outliers using Tramo/Seats on forecast accuracy

17. The presence of outliers can affect the results of the previous sections. One possibility consists in **using Tramo/Seats to remove outliers from original series**. Tramo/Seats uses an automatic procedure to detect and eliminate outliers from the considered series. Three different types of outliers are considered: Additive outliers (AO), Transitory changes (TC) and Level shifts (LS). In Annex 6.1, some **descriptive statistics** for the qualitative variables from the industrial survey and the balances for the other surveys are shown. From these statistics, some results can be highlighted:

- For some series, Tramo/Seats do not detect any outlier (i.e, the Economic Sentiment Indicator).
- In most cases, **the volatility has substantially decreased**, but in others the value of the variation coefficient has increased (although the standard deviation is lower, the value of the mean –which is clearly affected by the presence of extreme values- is even lower). As before, we have now computed the value of the covariance between positive and negative answers and we have tested if the variance of the balance is different from the one of positive or negative answers. As observed in Annex 6.2, in 95% of the cases (versus 87% when seasonality was not taken into account), the covariance is negative, so that **the null hypothesis of equality of variances between the balance and the other two components** (positive and negative answers**) is rejected in 82% of the cases** (versus 76%). Finally, the results on the unit root tests do not change at all when the outliers have been removed from the variables, so that the main results are maintained.

18. Using these data, we have repeated the forecast competition as in section B.1. The obtained results are shown in Annex 6.4 The main conclusions of this analysis can be summarised as follows:

- **RMSE values are equal or lower in nearly all variables** when using data where outliers have been removed using Tramo/Seats.

- However, there are differences in terms of models: while in **AR, ARIMA, TAR and Markov models the values of RMSE are clearly lower** than the ones for raw data, the results for VAR (unrestricted and restricted) are, some times, worse. Finally, the VAR models consisting of different indicators perform much better when outliers have been removed.
- When comparing **the RMSE for the balance computed from forecasts from positive and negative answers,** it is observed that the results **once the outliers are removed are**, in most cases, and for the models analysed (AR, ARIMA, TAR and VAR) **higher than for raw data**.
- Similarly, **when the composite indicators are computed from forecast from their components, the models** in the point above **perform worse after removing outliers**.

19. A practical issue when forecasting these series in real time is related on **the effects of incorporating new observations on outlier detection using Tramo/Seats**. In other words, it is necessary to remove the effects of outliers every time a new observation is available? To analyse this issue, we have followed a similar approach to that regarding the effects of seasonal adjustment procedures. In order to evaluate the effects of incorporating new observations, we have identified the time periods where an outlier is found in a recursive way adding one more observation from 2001.1 to 2002.12. The results of this analysis are shown in Annex 6.7.

20. From these results, some conclusions can be drawn:

- **The number and type of outliers clearly depends on the available sample**.
- Although there is some "persistence" in the moment and type of detected outliers, **there can be important changes in the results obtained using Tramo/Seats** once an additional observation is included (sometimes due to changes in the underlying model, but also to the own dynamic of the series).
- So, taking into account the results regarding the forecast accuracy of the different models, and although it increases the computational cost, **it seems important to apply the Tramo/Seats to remove the effects of outliers each time one additional observation is available**.

B.4. General comments on the results

21. In the next tables we present a summary of the recursive forecasts of the main indicators (Economic Sentiment, Industrial Confidence, Consumer Confidence, Construction Confidence, Retail Trade Confidence and Services Confidence Indicators) for the different models that have been implemented both through a direct computation method and through the forecasts from their components (indirect method). The tables presented are refered to raw data. For each indicator, the best model is indicated. Several conclusions can be pointed out:

- **Indirect methods seem to perform better than direct ones**.
- Among the **direct methods**, the **AR** model outperforms the rest of the models in almost all the cases. On the contrary, the TAR model is never cathegorised as the best one.
- Among the **indirect methods**, the **AR and VAR** models are the ones that obtain lower RMSE. Once again, the TAR model presents the highest values for the RMSE.

22. In addition to the previous comments to the tables, other conclusions arising from the analysis taken in the section can be summarised as follows:

- With respect to the **comparison of different seasonal adjustment methods**, TS and X12 results are very similar but DA results (seasonal adjustment) and WA results (trend cycle-estimation) show great differences. Differences are more important on trend-cycle estimation than on seasonal adjustment. There are great differences in the size of revision among the different variables for every considered seasonal adjustment method.
- **After removing outliers using TS** the forecast accuracy of the different methods is similar to the one observed with raw data. The number and type of outliers identified with TS clearly depends on the available sample. Although there is some "persistence" in the moment and type of detected outliers, there can be important changes in the results.

Average RMSE - Recursive forecasts from January 2001 to December 2002

Raw data

Economic Sentiment Indicator (v1)

	ESI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	***0.45****	0.77	1.02	1.51	1.52
	ARIMA	1.92	3.21	4.36	7.27	6.25
	TAR	4.65	7.14	9.33	15.07	20.51
	MK-TAR	0.61	0.75	1.19	2.20	6.12
indirect methods	AR	2.73	2.83	2.92	3.08	1.70
	ARIMA	0.46	***0.46****	***0.42****	***0.41****	***0.46****
	TAR	0.71	0.84	1.06	1.80	3.03
	MK-TAR	4.38	4.55	4.70	4.98	3.49

**** Best model***

Industrial Confidence Indicator (v2)

	ICI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	2.03	3.97	5.43	7.99	4.68
	ARIMA	10.54	21.70	29.85	40.20	39.19
	TAR	21.88	31.29	39.02	61.76	95.72
	MK-TAR	3.68	4.31	7.33	10.93	87.78
	VAR	3.39	5.63	6.90	12.25	17.82
indirect methods	AR	2.04	3.54	4.68	6.22	3.69
	ARIMA	2.21	4.14	5.52	7.60	7.97
	TAR	4.77	6.78	8.45	14.65	22.69
	VAR	***0.08****	***2.15****	***3.29****	***3.28****	***2.28****

**** Best model***

Consumer Confidence Indicator (v12)

	CCI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	***1.68****	***2.71****	***3.65****	5.49	3.77
	ARIMA	9.13	13.57	18.02	30.84	25.56
	TAR	14.31	18.75	23.70	39.32	47.02
	MK-TAR	2.68	4.42	6.77	10.38	90.78
	VAR	3.02	5.24	7.67	13.62	24.60
indirect methods	AR	1.78	2.79	3.69	5.64	***3.27****
	ARIMA	5.42	4.54	3.93	***3.00****	3.67
	TAR	6.09	6.54	7.14	9.22	11.99
	VAR	9.47	11.66	13.42	15.31	12.92

**** Best model***

Construction Confidence Indicator (v28)

	CCI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	2.01	2.36	2.38	2.97	***2.59****
	ARIMA	15.82	26.90	36.08	50.42	44.52
	TAR	26.32	38.53	50.42	73.45	100.06
	VAR	5.00	8.01	11.38	22.41	38.31
indirect methods	AR	1.97	***2.09****	***2.15****	***2.82****	2.88
	ARIMA	12.62	14.07	15.31	18.56	22.76
	TAR	13.06	14.62	16.96	25.21	32.69
	VAR	***0.07****	4.93	9.38	15.92	11.37

**** Best model***

Retail Trade Confidence Indicator (v33)

	RTCI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	2.59	3.08	3.32	4.68	8.04
	ARIMA	12.05	14.40	15.64	21.17	31.50
	TAR	17.73	24.04	26.92	39.67	59.06
	MK-TAR	2.56	3.63	***2.41****	4.15	***4.00****
	VAR	3.70	4.70	4.83	***4.00****	11.80
indirect methods	AR	***2.47****	3.17	3.50	5.13	8.82
	ARIMA	23.79	23.40	23.01	20.79	10.25
	TAR	29.27	32.48	34.80	40.68	40.94
	VAR	2.96	***2.72****	4.05	5.01	7.46

**** Best model***

Services Confidence Indicator (v39)

	SCI	1 month	2 months	3 months	6 months	12 months
direct methods	AR	5.44	10.31	15.51	26.48	43.33
	ARIMA	22.17	38.48	53.52	76.93	74.57
	TAR	56.92	76.78	86.97	126.94	182.96
	VAR	6.20	9.33	12.04	17.95	32.69
indirect methods	AR	5.61	9.94	13.97	20.49	35.87
	ARIMA	4.43	7.53	10.46	16.32	20.39
	TAR	12.00	16.22	18.57	25.46	41.09
	VAR	***0.69****	***2.34****	***7.59****	***14.37****	***18.90****

**** Best model***

C. Forecasting quantitative variables using information from Business and Consumer Surveys Indicators

C.1. Introduction

23. As previously mentioned in the first section of the report, our second objective is related with the possibility of **improving forecasts from main quantitative macroeconomic variables of the euro area using the information provided by Business and Consumer Surveys**. As pointed out by Pesaran (1987)[1], this type of data are less likely to be susceptible to sampling and measurement errors than surveys that require respondents to give point forecasts for the variables in question. One can think that the information provided by qualitative indicators could be useful to improve forecasts for quantitative variables due to two reasons:

a) First, statistical information from Business and Consumer Surveys is available much more in advance to quantitative statistics.
b) Second, and as it has been previously mentioned, these indicators are usually related with agents' expectations, so it is expected that they could be related with future developments of macroeconomic variables.

24. The strategy to **test if these indicators provide useful information to improve forecasts of the macroeconomic variables** has been the following:

a) First, macroeconomic variables that could be related with the information provided by Business and Consumer Surveys have been selected and **statistical information** for the longest time-span available has been collected from the Eurostat and the ECB databases. A list of the variables can be found in Annex 7.
b) Second, **five different sets of models** have been considered (AR, ARIMA, Self-exciting threshold autoregressions –SETAR-, Markov switching regime models and vector autoregressions –VAR-) to obtain forecasts for the different quantitative variables and the Root Mean Square Error (RMSE) and the Mean

[1] Pesaran, M. H. (1987), *The Limits to Rational Expectations*, Basil Blackwell, Oxford.

Absolute Percentual Error (MAPE) have been computed for different forecast horizons. The comparison of these values with the ones obtained with models where information from Business and Consumers Surveys has been considered would permit to assess whether these indicators permit to improve the forecasts or not.

c) Third, information from surveys are considered to forecast the quantitative variables using **three different types of models**:

i. Information on lagged selected indicators is introduced as explanatory variables in autoregressive and VAR models. For Markov Switching Regime models, the probability of changing regime now depends on information of the qualitative indicators instead of the own evolution of the series.

ii. Leading indicators models are constructed for each of the quantitative variables using information from Business and Consumer Surveys Indicators.

iii. One problem with survey data is that, in contrast to other statistical series, their results are weighted percentages of respondents expecting an economic variable to increase, decrease or remain constant. Therefore, the information refers to the direction of change but not to its magnitude. And this is the reason why we think that the considered list of qualitative indicators should be previously quantified in order to obtain more reliable forecasts of businessmen' opinions. The conversion of qualitative data into a quantitative measure of the expected rate of change provides more detailed information about agents' opinions and intentions. For this reason, a third strategy to improve quantitative forecasts from qualitative indicators would consist in quantifying the information provided by Business and Consumer Surveys. There have been different proposals in the literature on how to obtain these quantified series of expectations. In this sense, one common feature of all them is that they permit to obtain directly one-period forecasts. Another possibility consists in using the quantified series of expectations as explanatory variables of the related quantitative variable.

C.2. Benchmark models

25. The five proposed models would be applied to the quantitative variables measured in levels but also in growth rates. Two different definitions of growth rates have also been used: the monthly/quarterly growth rate and the year-on-year growth rate. These growth rates have also been calculated after removing outliers from original data using Tramo/Seats.

26. Using these three different data sets, five different sets of models have been considered (AR, ARIMA, SETAR, Markov switching regime models and VAR models) to obtain forecasts for the different quantitative variables. In order to evaluate the relative forecasting accuracy of the models, for each variable to be forecasted all models were estimated until 2000.12 (or 2000.III or IV for quarterly indicators) and forecasts for 1,2,3,6 and 12 months (or 1,2,4 quarters) ahead were computed. The specifications of the models are based on information up to 2000.12 or 2000.III or IV and, then, models are re-estimated in each month or quarter and forecasts are computed. Given the availability of actual values until 2002.12 or 2002.III or IV, forecast errors for each indicator and method can be computed in a recursive way (i.e., for the 1 month forecast horizon, 24 forecast errors can be computed for each indicator). In order to summarise this information, the Root Mean Squared Error (RMSE) and the Mean Absolut Percentual Error (MAPE) can be computed. Their values provide useful information in order to analyse the forecast accuracy of each method, so methods can be ranked according to their values.

27. As for the survey indicators, we have computed some descriptive statistics that can be found in Annex 8. From these results, it should be clearly expected than the forecast accuracy of the considered models for these variables would be better than for the survey indicators, given the lower variation coefficient when compared with the ones displayed by qualitative variables. The only exceptions are Savings rate (qv12) and the Change in inventories (qv19) which present very high variation coefficients. Additionally, the lower volatility observed by most variables is obtained not only for raw data but also for data after removing outliers. In the latter, the variation coefficient of the change in inventories reduces considerably.

28. The results (in Annex 9 for raw data, Annex 10 for growth rates from raw data, and Annex 11 for growth rates after removing outliers) show that:

- As expected, forecasts errors increase for longer horizons in most cases.
- Regarding the forecast accuracy of the different methods, and as in the analysis of qualitative indicators, in most cases the univariate autoregressions are not outperformed by the rest of methods. However, the performance of ARIMA, TAR and Markov models has substantially improved with respect of the analysis of the qualitative variables (being an exception the variables with high volatility such as the Change in inventories, qv19). In fact, in some cases, especially in the ARIMA models, they provide better results than the AR models. This result was not found in any case for the qualitative variables. On the other hand, the VAR models provide in most cases a worse performance than the AR.
- Regarding the size of the forecast error, the values of the MAPE are in nearly all cases lower than the 5% when looking at the best method. In fact, the only variable with higher errors is the change in inventories, which showed a very high volatility in the descriptive.
- When considering growth rates, the values of the RMSE for the different models for each variable are quite similar for the monthly/quarterly growth rates and the year-on-year growth rates. One interesting aspect is that when the growth rates are used, the RMSE is similar to the one with raw data for the forecast for 1 period ahead, but they are lower for higher horizons (6 and 12 months). This could be explained by the fact that when considering growth rates the trend is eliminated so that for certain periods the forecast can be more accurate. In general terms, the AR model is the only one that performs better in the case of growth rates than for raw data for most variables and for short horizons. The other models perform similarly.[2]
- Removing outliers seems to improve the results in all the models, but especially in the AR, ARIMA and TAR models.

[2] Despite the fact that the forecasts for the variables Savings rate (qv12), Changes in inventories (qv19) and Unemployment (qv20) are generally given in levels (and this is the way it is signalled in the Methodological guide provided in section D), we have preferred to use them also in growth rates in the tables of the forecasts with growth rates in order to obtain values that can be homogeneous and comparable with the forecasts of the rest of the variables.

C.3. "Augmented" autoregression, Markov switching regime and VAR models

29. One way to use the information of the qualitative indicators to improve the forecasts of the quantitative variables consists in **introducing selected indicators as explanatory variables in autoregressions and VAR models**. Recently, different works have estimated autoregressive and VAR models for some target variable (consumer spending, GNP), adding current and lagged values of a consumer confidence index to the models in order to test its significance and consider the extent of its effects. Their results are, however, contradictory and not quite satisfactory. However, the approach applied in this section is quite similar. For the case of Markov Switching Regime models, the probability of changing regime now depends on information of the qualitative indicators instead of the own evolution of the series.

30. Annex 12.2 shows the values of the **Root of the Mean Squared Error (RMSE)** obtained from recursive forecasts for 1,2,3,6 and 12 months during the period 2001.1-2002.12 including qualitative variables as explanatory variables in **augmented autoregressions and VAR models and the results for the "modified" Markov switching regime models**. The results show that:

- A result already pointed out when working with growth rates which is also obtained herein is that **forecasts errors do not always increase for longer horizons**.
- The values of the **RMSE for the Markov and VAR models for each variable are lower for the year-on-year growth rate than for the monthly/quarterly growth rate**.
- Regarding the forecast accuracy of the different methods, in most cases the **augmented autoregressions are not outperformed by the rest of methods**, being the modified Markov model the one displaying the higher RMSE.
- When removing outliers from data, the performance of augmented autoregressions improves in most cases, both for the year-to-year and monthly/quarterly growth rates. However, in the case of the modified Markov and augmented VAR models, this is not always the case. For some

variables the performance is better but for some others it worsens especially when the Markov models are used.

C.4. Leading indicators models

31. In spite of their well-known limitations pointed by the literature, **leading indicators** can also provide reliable forecasts of the analysed quantitative variables considering the whole set of information of Business and Consumer Surveys. Details on the chosen procedure can be found in Annex 13.1 whereas the description of the leading indicators models applied in this case and their selected variables are shown in Annex A13.2.

32. The results of the different models are shown in Annex 13.3. **In most cases, the values of RMSE for the different forecast horizons are higher than the ones from the benchmark models.** However, in some particular cases the leading indicator models clearly outperform the rest of models. The problem with these models is the excessively high variance of forecasts errors. It is also obtained that **the performance improves in most cases for growth rates of data** after removing outliers and for short horizons for the forecast (especially for 1 month or quarter).

C.5. Quantification of expectations

33. As it has been previously mentioned, one problem with survey data is that, in contrast to other statistical series, their results are weighted percentages of respondents expecting an economic variable to increase, decrease or remain constant. Therefore, the information refers to the direction of change but not to its magnitude. In the literature, **different methods** have been proposed in order to **convert qualitative data into a quantitative measure of agents' opinions and intentions**. In this section, six different possibilities are considered: the balance, the principal components based procedure, the Anderson procedure, the Carlson-Parkin and Augmented Carlson-Parkin methods and State-Space models (see Annexes 14

and 15 for details). The problem with this approach is that, although it is possible, only one-period forecasts can be directly computed from these methods.

34. Annex 14.2 shows the values of the **Root of the Mean Square Error** obtained from recursive forecasts for 1 month/quarter during the period 2001.1/I-2002.12/IV **for the analysed variables using the different considered quantification procedures**. It is obtained that the Carlson-Parkin method is the one with lower RMSE in most of the cases (especially when considering monthly/quarterly growth rates) followed and even in some cases surpassed by State-Space models. The result of this competition is consistent both in the cases when raw data is used and after removing outliers. However, the procedures perform slightly better when the outliers are removed.

35. The forecast for the quantitative variables is therefore made with AR and VAR models considering quantified indicators, in such a way that quantitative variables are given in growth rates (both monthly/quarterly and year-to-year) and qualitative variables are in levels. The results of the RMSE for both models are shown in Annex 14.3. **The AR models present lower RMSE when the year-on-year growth rate is used than with monthly growth rates**. However, **the opposite occurs with the quarterly growth rates, which present lower RMSE than the year-on-year growth rate**. Additionally, if we compare those results with the ones obtained with qualitative variables after removing outliers, it is concluded that in many cases the changes are little, but in any case **the second ones (after removing outliers) outperform the ones with raw data.** A final result is that the VAR model seems to perform better for the variables that have been computed than the AR models.

C.6. General comments on the results

36. The next tables present **a summary of the forecasting accuracy of different methods in the case of the quantitative variables**. We differentiate between the models that only consider the information included in each variable itself and the

models that include survey information so that comparisons among them can be established. The main conclusions can be stated as follows:

- **Among the methods that forecast the values of the variables according to their own information, the AR is the one presenting the lowest RMSE in almost all the cases**, followed by the VAR models. For a pair of variables the Markov models outperform the others, but this is never the case for the ARIMA and TAR models.
- **Among the methods that forecast the values of the variables including information from the survey, the Leading indicators model (2) and the AR** (both with and without quantification of the qualitative variables) **are the ones with are in most cases selected as the best ones**.
- When comparing the performance of the models that include information from the survey to the ones that do not, the conclusion seems to be that in many cases some models that include information from the survey obtain lower RMSE than the best model without survey information. Therefore, **the inclusion of indicators of the survey provides useful information to improve forecasts of the macroeconomic variables**.

37. In this sense, the obtained results confirm (and extend in a more systematic way[3]) the results of previous research that have considered information from Business and Consumer Surveys to explain the behaviour of macroeconomic variables. Among others, is it worth mentioning the works by Kauppi et al. (1996) and Bodo et al. (2000) for industrial production, Howrey (2001) and Forsells and Kenny (2002) for inflation, Sédillot and Pain (2003) for GDP and the more broad works by the Commission[4] and by the ECB[5].

[3] To our knowledge, no other work covers such a high number of macroeconomic variables and indicators (attention has been usually paid to industrial production, inflation and GDP). The number of econometric methods and models applied is also considerable higher than in previous research.
[4] For example, the BUSY and BUSY II models or the approach by Grasmann and Keereman (2001).
[5] Mourogone and Roma (2002) for GDP and Forsells and Kenny (2002).

References

Bodo, G., Golinelli, R. and Parigi, G. (2000): "Forecasting Industrial Production in the Euro Area," *Empirical Economics*, 25, 541-561.

Forsells, M. and Kenny, G. (2002): "The Rationality of Consumer's Inflation Expectations: Survey-based evidence for the Euro area", *ECB Working Paper 163*.

Grassmann, P. and Kleereman, F. (2001): "An indicator-based short-term forecast for quarterly GDP in the euro area", *Economic Paper* 154¸ European Commission.

Kauppi, E., Lassila, J. and Terasvirta, T. (1996): Short-Term forecasting of industrial production with business survey data: experience from Finaldn's great depression 1990-1993, *International* J*ournal of Forecasting*, 12, pp. 373-381.

Howrey, E. P. (2001): "The predictive power of the Index of Consumer Sentiment", *Brookings Papers on Economic Activity*, 1, 205-207.

Mourougane, A and Roma, M. (2002): "Can Confidence Indicators be Useful to Predict Short Term Real GDP Growth?", *ECB Working Paper*, 133.

qv1: HCPI. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	***0.25****	*0.40*	*0.47*	*0.40*	*0.45*
ARIMA	1.21	1.93	2.28	2.57	4.62
TAR	1.95	2.56	2.91	2.97	4.44
MK-TAR	na	na	na	na	na

Models with survey information	1 month	2 months	3 months	6 months	12 months
AR (+v18b)	0.26	0.40	0.48	0.48	***0.44****
AR (+v18 quantified)	0.28	***0.39****	***0.42****	**0.40**	0.56
MK-TAR(+v18b)	na	na	na	na	na
Leading indicators model 1	0.79	0.79	0.79	0.75	0.47
Leading indicators model 2	0.53	0.52	**0.47**	***0.40****	0.65

v14: Financial situation over next 12 months
v16: General economic situation over next 12 months
v18: Price trends over next 12 months
v19: Unemployment expectations over next 12 months
v23: Savings over next 12 months
v24: Statement on financial situation of household
b: balance

Monthly and quarterly models are compared separately
Italics: best model without survey information
Bold: Better forecast performance than best model without survey information
**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-total	***0.47****	***0.47****	*0.55*
VAR-consumption	0.51	0.66	0.94
VAR-savings	0.62	0.56	1.40

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-total (+ ESI)	0.48	0.49	***0.54****
VAR-consumption (+ CCI)	0.53	0.67	0.84
VAR-consumption (+v14b+v16b+v18b+v19b)	0.54	0.76	1.02
VAR-savings (+v23b+v24b)	0.63	0.69	1.02

VAR-total: HCPI+GDP+Unemployment
VAR-consumption: Consumption+HCPI+GDP+Unemployment+Interest rates
VAR-savings: Savings rate+GDP+HCPI+Interest rates

Monthly and quarterly models are compared separately
Italics: best model without survey information
Bold: Better forecast performance than best model without survey information
**** Best model***

qv2. Construction: Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	***1.15****	*1.37*	*1.46*	*1.64*	*1.99*
ARIMA	6.09	7.11	7.34	8.86	11.83
TAR	25.00	50.67	102.81	1478.52	596.14
MK-TAR	1.32	2.56	13.47	79.45	74.31

Models with survey information	1 month	2 month	3 month	4 month	5 month
AR (+v31b)	1.15	1.37	***1.45****	1.63	***1.90****
AR (+v31b quantified)	1.19	2.19	3.19	4.19	5.19
MK-TAR(+v31b)	na	na	na	na	na
Leading indicators model 1	2.71	2.92	3.41	3.38	2.49
Leading indicators model 2	1.28	***1.24****	1.60	***1.40****	2.76

v31: Employment expecteations for the months ahead

v32: Price expectations for the months ahead

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-construction	***2.28****	*3.61*	***3.04****

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-building a (+CCI)	2.30	***2.80****	3.99
VAR-building b (+v31b+v32b)	2.58	**3.56**	5.35

VAR-building: construction+Building permits index+construction work(other constructions)+
construction work(housing)

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv3: Building permits index. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	5.93	6.63	6.63	7.18	8.85
ARIMA	25.07	26.73	25.21	26.85	25.71
TAR	34.26	39.80	43.26	46.03	38.37
MK-TAR	*5.79*	*5.93*	*5.94*	*5.81*	*6.91*

Models with survey information	1 month	2 months	3 months	6 months	12 months
AR (+v29b)	6.40	6.99	7.09	7.96	9.53
AR (+v30b)	5.98	7.31	7.57	8.39	10.93
AR (+v29b+v30b)	6.60	7.65	7.81	8.81	10.36
AR (+v29b quantified)	**5.63**	5.99	6.04	***5.71****	***6.80****
AR (+v30b quantified)	***5.57****	***5.88****	***5.88****	5.85	**6.85**
MK-TAR(+v29b)	6.05	8.19	5.99	5.99	7.08
MK-TAR(+v30b)	na	na	na	na	na
Leading indicators model 1	6.82	7.40	6.63	6.92	7.44
Leading indicators model 2	6.35	7.01	7.20	9.29	**6.80**

v29: Trend of activity compared with preceding months

v30: Assessment of order books

v31: Employment expectations for the months ahead

v32: Price expectations for the months ahead

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-construction	*8.36*	*11.31*	*10.02*

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-building a (+CCI)	***6.85****	***6.80****	***9.63****
VAR-building b (+v31b+v32b)	**8.10**	**9.56**	19.24

VAR-building: construction+Building permits index+construction work(other constructions)+
construction work(housing)

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv4: Industry Production Index. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	*1.37*	*1.75*	*2.09*	*2.67*	*3.23*
ARIMA	7.40	8.89	10.33	13.37	14.65
TAR	14.43	15.54	21.26	31.70	39.37
MK-TAR	1.72	1.95	2.37	3.13	3.51

Models with survey information	1 month	2 months	3 months	6 months	12 months
AR (+v7b)	***1.35****	***1.46****	**1.51**	***1.51****	***1.61****
AR (+v7b quantified)	1.42	1.77	2.12	**2.60**	3.28
MK-TAR(+v7b)	1.84	2.10	2.16	3.09	3.54
Leading indicators model 1	1.64	**1.52**	***1.33****	2.81	**2.72**
Leading indicators model 2	2.22	2.35	2.45	6.79	**2.92**
VAR-industry 1b (+v7b quantified+v8b quantified)	1.38	**1.53**	**1.79**	**2.20**	**2.94**

v7: Production expectations for the onths ahead

v8: Selling price expectations for the months ahead

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-industry 1	1.88	3.14	4.73
VAR-industry 2	*1.61*	*2.46*	*2.81*

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-industry (+ICI)	**1.46**	***1.84****	***2.05****
VAR-industry 1b (+v7b+v8b)	***1.35****	**1.87**	**2.19**
VAR-industry 2 (+ICI)	1.87	**2.19**	**2.25**

VAR-industry and VAR-industry 1b: Industry production index+Industry producer price index

VAR-industry 2: Industry production index+Industry producer price index+ metal products and machinery

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv5: Industry Producer Price Index. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	*0.52*	*0.93*	*1.33*	*2.45*	*3.81*
ARIMA	1.96	3.35	4.33	7.84	13.28
TAR	5.21	7.19	8.93	14.97	22.88
MK-TAR	0.64	na	na	na	na

Models wth survey information	1 month	2 months	3 months	6 months	12 months
AR (+v8b)	**0.50**	**0.88**	**1.25**	**2.22**	**3.28**
AR (+v8b quantified)	**0.43**	**0.74**	**1.02**	**1.71**	**2.77**
MK-TAR(+v8b)	na	na	na	na	na
Leading indicators model 1	1.32	1.22	**1.19**	**1.80**	**3.02**
Leading indicators model 2	1.16	1.69	3.76	5.63	5.32
VAR-industry 1b (+v7b quantified+v8b quantified)	***0.40****	***0.67****	***0.92****	***1.56****	***2.61****

v7: Production expectations for the onths ahead

v8: Selling price expectations for the months ahead

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-industry 1	1.27	2.29	4.07
VAR-industry 2	***0.95****	*1.45*	***1.54****

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-industry (+ICI)	1.25	1.83	2.63
VAR-industry 1b (+v7b+v8b)	1.00	***1.41****	1.88
VAR-industry 2 (+ICI)	1.37	2.06	3.54

VAR-industry and VAR-industry 1b: Industry production index+Industry producer price index

VAR-industry 2: Industry production index+Industry producer price index+ metal products and machinery

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

Qv6: Number of new car registrations . Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	***5.22****	***5.29****	***5.68****	*6.87*	*5.70*
ARIMA	27.27	25.00	27.12	30.98	23.81
TAR	61.80	63.57	63.06	85.10	80.16
MK-TAR	7.52	18.01	8.30	9.47	9.87

	1 month	2 months	3 months	6 months	12 months
Leading indicators model 1	7.26	6.18	7.09	***6.29****	***5.27****
Leading indicators model 2	7.68	6.60	7.13	7.97	**5.40**

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v25b)	8.39	6.86	5.61
AR (+v25b quantified)	11.42	17.05	29.83
MK-TAR(+v25b)	na	na	na

v25: Intention ti buy a car within the next 2 years

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

Retail Deflated turnover index : Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	*1.12*	*1.12*	*1.15*	*1.23*	*1.97*
ARIMA	5.71	5.23	5.10	4.34	5.38
TAR	8.80	8.55	9.14	10.45	17.77
MK-TAR	8.80	8.55	9.14	10.45	17.77

Models with survey information	1 month	2 months	3 months	6 months	12 months
AR (+v34b)	1.32	1.33	1.35	**1.06**	**1.37**
AR (+v35b)	1.45	1.46	1.34	1.44	**1.93**
AR (+v36b)	1.44	1.36	1.34	1.50	2.24
AR (+v37b)	1.53	1.37	1.40	**1.21**	**1.69**
AR (+v34b +v35b +v36b +v37b)	1.97	2.26	2.44	1.95	**1.97**
AR (+v34b quantified)	1.52	1.46	1.46	1.72	2.44
AR (+v35b quantified)	1.39	1.39	1.38	1.68	2.40
AR (+v36b quantified)	1.37	1.38	1.37	1.71	2.40
AR (+v37b quantified)	1.43	1.43	1.44	1.80	2.53
MK-TAR(+v34b)	1.47	2.22	1.98	2.64	3.51
MK-TAR(+v35b)	na	na	na	na	na
MK-TAR(+v36b)	1.36	2.52	2.49	2.62	2.66
MK-TAR(+v37b)	na	na	na	na	na
Leading indicators model 1	***1.05****	***1.02****	***0.97****	***0.91****	***0.99****
Leading indicators model 2	**1.07**	**1.06**	**1.03**	**0.98**	2.73

v34: Present business situation

v35: Assessment of stocks

v36: Orders placed with suppliers

v37: Expected business situation

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv8: Industry Gross value added. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	*2.09*	*2.20*	*1.84*
ARIMA	7.20	9.13	11.55
TAR	11.03	11.51	12.63
MK-TAR	2.52	3.33	2.39

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+ICI)	**1.66**	***1.22****	***1.01****
MK-TAR(+ICI)	2.40	2.86	2.75
Leading indicators model 1	2.51	3.46	**1.32**
Leading indicators model 2	***1.29****	4.50	4.11

	1 quarter	2 quarters	4 quarters
VAR- supply	2.11	2.79	3.63

Models with survey information	1 quarter	2 quarters	4 quarters
VAR- supply (+ESI)	**1.35**	**1.46**	2.04

VAR-supply: Industry Gross value added+Construction+Wholesale and retail trade+ Financial intermediation

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv9: Construction Gross value added. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	*1.42*	*1.47*	***1.82****
ARIMA	4.39	4.70	4.67
TAR	4.74	5.70	7.76
MK-TAR	1.68	2.84	4.34

Models wth survey information	1 quarter	2 quarters	4 quarters
AR (+CCI)	2.64	3.17	2.49
MK-TAR(+CCI)	na	na	na
Leading indicators model 1	**1.25**	2.47	2.36
Leading indicators model 2	***0.82****	***1.24****	2.81

	1 quarter	2 quarters	4 quarters
VAR- supply	1.49	1.63	2.44

Models with survey information	1 quarter	2 quarters	4 quarters
VAR- supply (+ESI)	1.97	1.99	1.83

VAR-supply: Industry Gross value added+Construction+Wholesale and retail trade+Financial intermediation

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv10: Wholesale and retail trade & other Gross value added. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	*1.41*	*1.80*	2.62
ARIMA	4.82	6.53	8.72
TAR	6.52	8.25	10.56
MK-TAR	1.55	2.14	*2.55*

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v34b)	**1.38**	**1.70**	**2.33**
AR (+v34b quantified)	1.53	2.13	3.52
MK-TAR(+v34b)	na	na	na
Leading indicators model 1	2.43	2.30	***1.42****
Leading indicators model 2	1.82	1.94	3.62

v34: Present business situation

b: balance

	1 quarter	2 quarters	4 quarters
VAR- supply	1.43	1.90	2.98

Models with survey information	1 quarter	2 quarters	4 quarters
VAR- supply (+ESI)	***1.32****	***1.55****	**1.79**

VAR-supply: Industry Gross value added+Construction+Wholesale and retail trade+ Financial intermediation

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv11: Financial intermediation Gross value added. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	*0.88*	*1.29*	*2.18*
ARIMA	2.95	4.52	7.63
TAR	4.51	5.63	7.83
MK-TAR	na	na	na

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v13b)	0.92	1.34	**2.18**
AR (+v14b)	0.95	1.41	**2.16**
AR (+v13b +v14b)	0.98	1.50	2.19
AR (+v13b quantified)	0.97	1.48	2.52
AR (+v14b quantified)	0.96	1.47	2.51
MK-TAR(+v13b)	1.13	3.66	2.34
MK-TAR(+v14b)	***0.86****	3.31	**2.17**
Leading indicators model 1	1.06	***1.26****	***1.31****
Leading indicators model 2	1.12	1.59	2.83

	1 quarter	2 quarters	4 quarters
VAR- supply	0.93	1.93	2.45

Models with survey information	1 quarter	2 quarters	4 quarters
VAR- supply (+ESI)	0.90	**1.26**	**1.91**

VAR-supply: Industry Gross value added+Construction+Wholesale and retail trade+ Financial intermediation

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

v13: Financial situation over last 12 months

v14: Financial situation over next 12 months

b: balance

qv12: Savings rate . Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	***0.88****	***1.29****	***2.18****
ARIMA	2.95	4.52	7.63
TAR	4.51	5.63	7.83
MK-TAR	na	na	na

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v22b)	13.20	17.09	21.48
AR (+v23b)	12.11	11.84	10.45
AR (+v22 +v23b)	24.43	18.51	16.62
AR (+v22b quantified)	28.45	53.73	280.74
AR (+v23b quantified)	80.13	241.67	830.35
MK-TAR(+v22b)	na	na	na
MK-TAR(+v23b)	na	na	na
Leading indicators model 1	8.55	13.19	19.22
Leading indicators model 2	16.32	16.03	30.78

	1 quarter	2 quarters	4 quarters
VAR- savings	20.35	20.77	32.84

Models with survey information	1 quarter	2 quarters	4 quarters
VAR- savings (+v23b+v24b)	18.31	20.09	32.82

VAR-savings: HCPI+Savings rate+GDP+Interests rates

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

v22: Savings at present

v23: Savings over next 12 months

v24: Statement on financial situation of household

b: balance

qv13: Gross Domestic Product. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	1.14	*1.28*	*1.61*
ARIMA	4.04	5.28	7.02
TAR	13.36	12.37	8.12
MK-TAR	1.10	2.70	2.29

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+ESI)	**0.94**	**1.02**	**1.26**
AR (+v15b)	**1.07**	**1.19**	**1.51**
AR (+v16b)	**0.97**	**1.03**	**1.27**
AR (+ESI+v15b+v16b)	***0.86****	***0.89****	***1.14****
AR (+v15 quantified)	1.19	1.49	2.19
AR (+v16 quantified)	1.17	1.43	2.04
MK-TAR (+v1)	1.25	2.06	2.16
MK-TAR (+v15b)	na	na	na
MK-TAR (+v16b)	1.27	2.40	5.21
Leading indicators model 1	1.44	1.73	**1.16**
Leading indicators model 2	**1.01**	2.32	3.04

v14: Financial situation over next 12 months

v15: General economic situation over last 12 months

v16: General economic situation over next 12 months

v18: Price trends over next 12 months

v19: Unemployment expectations over next 12 months

v23: Savings over next 12 months

v24: Statement on financial situation of household

b: balance

	1 quarter	2 quarters	4 quarters
VAR-total	1.20	1.40	1.88
VAR-consumption	*1.07*	1.43	1.65
VAR-savings	2.37	3.11	4.33
VAR-exports	1.56	1.47	2.33

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-total (+ ESI)	1.19	**1.27**	**1.43**
VAR-exports (+v5b)	1.69	2.17	2.27
VAR-consumption (+ CCI)	1.24	1.50	**1.49**
VAR-consumption (+v14b+v16b+v18b+v19b)	1.32	1.87	2.42
VAR-savings (+v23b+v24b)	2.17	3.27	4.07

VAR-total: HCPI+GDP+Unemployment

VAR-consumption: Consumption+HCPI+GDP+Unemployment+Interest rates

VAR-savings: Savings rate+GDP+HCPI+Interest rates

VAR-exports: GDP+ Exports of goods+ Exchange rate

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv14: Gross fixed capital formation: construction work - other constructions . Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	*2.83*	*3.70*	*4.57*
ARIMA	8.10	10.82	11.61
TAR	11.61	14.90	18.29
MK-TAR	3.11	5.15	6.26

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v29b)	**2.77**	**2.27**	**2.42**
AR (+v30b)	**2.32**	***2.11****	***2.06****
AR (+v29b +v30b)	3.61	**3.44**	4.68
AR (+v29b quantified)	8.62	3.89	18.70
AR (+v30b quantified)	3.10	**3.18**	**3.18**
MK-TAR(+v29b)	na	na	na
MK-TAR(+v30b)	3.66	4.64	4.84
Leading indicators model 1	***2.04****	4.99	4.63
Leading indicators model 2	**2.59**	**2.50**	5.50

	1 quarter	2 quarters	4 quarters
VAR- construction	7.33	11.26	12.09

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-building a (+CCI)	6.52	9.78	10.73
VAR-building b (+v31b+v32b)	5.16	8.96	12.05

VAR-building: construction+Building permits index+construction work(other constructions)+ construction work(housing)

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

v29: Trend of activity compared with preceding months

v30: Assessment of order books

v31: Employment expectations for the months ahead

v32: Price expectations for the months ahead

b: balance

qv15: Gross fixed capital formation: metal products and machinery. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	3.29	5.61	11.55
ARIMA	8.53	14.26	27.12
TAR	15.07	22.35	31.63
MK-TAR	na	na	na

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v3b)	3.00	4.68	10.43
AR (+v7b)	2.63	4.33	9.55
AR (+v3b +v7b)	3.43	5.47	17.15
AR (+v3b quantified)	3.91	6.98	14.29
AR (+v7b quantified)	3.78	7.25	13.64
MK-TAR(+v3b)	3.93	5.21	9.25
MK-TAR(+v7b)	4.10	5.92	11.26
Leading indicators model 1	2.46	***2.02****	***3.26****
Leading indicators model 2	2.75	10.98	8.79

v3: Production trend observed in recent months

v7: Production expectations for the months ahead

b: balance

	1 quarter	2 quarters	4 quarters
VAR- industry 2	***1.44****	*2.42*	*3.41*

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-industry 2 (+ICI)	3.00	4.38	5.17

VAR-industry 2: Industry production index+Industry producer price index+metal products and machinery

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv16: Exports of goods . Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	2.69	*3.98*	*5.31*
ARIMA	8.78	14.34	20.91
TAR	21.81	30.46	38.67
MK-TAR	na	na	na

	1 quarter	2 quarters	4 quarters
VAR- exports	*2.44*	4.82	6.93

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+11b)	4.45	4.95	**5.01**
AR (+v5b)	4.66	6.75	5.53
AR (+v11b +v5b)	5.80	8.20	6.72
AR (+v11b quantified)	4.37	7.11	6.63
AR (+v5b quantified)	3.85	6.74	6.93
MK-TAR(+v11b)	3.20	5.59	8.11
MK-TAR(+v5b)	3.49	5.04	6.03
Leading indicators model 1	3.15	5.51	7.77
Leading indicators model 2	2.59	9.40	11.05

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-exports (+v5b)	***1.69****	***2.17****	***2.27****

VAR-exports: GDP+ Exports of goods+ Exchange rate

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

v5: Assessment of export order-book levels

v11: Export expectations for the months ahead

b: balance

qv17: Consumption. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	1.69	2.11	2.49
ARIMA	4.38	5.67	6.21
TAR	6.73	8.01	7.37
MK-TAR	1.68	2.72	3.39

	1 quarter	2 quarters	4 quarters
VAR- consumption	*1.61*	*1.87*	*2.01*

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v20b)	***1.42****	***1.45****	***1.52****
AR (+v20b quantified)	1.80	2.17	2.66
MK-TAR(+v20b)	1.67	4.69	2.66
Leading indicators model 1	1.64	**1.62**	**1.62**
Leading indicators model 2	1.64	2.05	2.91

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-consumption a (+ CCI)	1.77	2.02	2.02
VAR-consumption b (+v14b+v16b+v18b+v19b)	1.81	2.12	2.58

VAR-consumption: Consumption+HCPI+GDP+Unemployment+Interest rates

v14: Financial situation over next 12 months

v16: General economic situation over next 12 months

v18: Price trends over next 12 months

v19: Unemployment expectations over next 12 months

v20: Major purchases at present

b: balance

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv18: Gross fixed capital formation: construction work – housing. Year-on-year growth rates of raw data

Average RMSE - Recursive forecasts from 1st quarter 2001 to 4th quarter 2002

	1 quarter	2 quarters	4 quarters
AR	2.18	3.58	6.04
ARIMA	4.70	6.87	9.76
TAR	9.86	10.70	11.48
MK-TAR	***1.61****	***1.82****	***3.72****

	1 quarter	2 quarters	4 quarters
VAR- construction	5.70	6.21	6.98

Models with survey information	1 quarter	2 quarters	4 quarters
AR (+v26b)	6.42	6.90	8.92
AR (+v26b quantified)	68.92	322.83	4371.86
MK-TAR(+v26b)	na	na	na
Leading indicators model 1	2.79	2.85	3.95
Leading indicators model 2	2.73	2.53	6.41

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-building a (+CCI)	5.17	5.30	8.73
VAR-building b (+v31b+v32b)	4.50	3.71	8.32

VAR-building: construction+Building permits index+construction work(other constructions)+ construction work(housing)

v26: Purchase or build a home within the next 2 years

v31: Employment expectations for the months ahead

v32: Price expectations for the months ahead

b: balance

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

qv20: Unemployment rate. Year-on-year growth rates of raw data
Average RMSE - Recursive forecasts from January 2001 to December 2002 / 1st quarter 2001 to 4th quarter 2002

	1 month	2 months	3 months	6 months	12 months
AR	*1.56*	*2.63*	*3.58*	*6.22*	*10.84*
ARIMA	5.39	8.13	10.34	14.09	23.61
TAR	11.09	16.37	21.74	37.89	70.29
MK-TAR	na	na	na	na	na

Models with survey information	1 month	2 months	3 months	6 months	12 months
AR (+v19b)	1.66	2.82	3.82	6.29	**9.17**
AR (+v19b quantified)	***1.31****	***2.15****	***2.83****	**4.01**	**8.59**
MK-TAR(+v19b)	1.61	**2.23**	**3.13**	**3.88**	19.31
Leading indicators model 1	3.95	3.54	4.47	**4.71**	***5.68****
Leading indicators model 2	3.00	2.79	**3.07**	***2.77****	**8.83**

v14: Financial situation over next 12 months

v16: General economic situation over next 12 months

v18: Price trends over next 12 months

v19: Unemployment expectations over next 12 months

b: balance

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

	1 quarter	2 quarters	4 quarters
VAR-total	*2.90*	*5.16*	8.92
VAR-consumption	3.04	5.17	*7.99*

Models with survey information	1 quarter	2 quarters	4 quarters
VAR-total (+ESI)	3.04	**4.93***	**6.57**
VAR-consumption a (+ CCI)	3.25	5.36	**6.49**
VAR-consumption b (+v14b+v16b+v18b+v19b)	**2.71***	5.16	**6.48***

VAR-total: HCPI+GDP+Unemployment

VAR-consumption: Consumption+HCPI+GDP+Unemployment+Interest rates

Monthly and quarterly models are compared separately

Italics: best model without survey information

Bold: Better forecast performance than best model without survey information

**** Best model***

D. Methodological guide for the preparation of the basic results for a report on the outlook of the euro area economy

The objective of this section is to provide a methodological guide for a report on the outlook of the euro area economy. In particular, the methodological guide has been designed in order to establish the main guidelines to elaborate a quarterly report where the short term forecasts of the euro area economy evolution can be offered. In the methodological guide design we have taken into account some of the conclusions that have been obtained in the previous parts of the present report.

As pointed out by OECD (2003)[6], the potential users of the report can be divided into two categories: "those who intend to analyse the statistics in detail (economists, researches and other "analysts") and those who simply want to know the main results (politicians, business executives –personal who works in banks, financial institutions, etc.- and other "executives")".

The group formed by "analysts" are distinguished by the following aspects: they have time and knowledge to analyse the results in detail and they work in institutes and companies that have their own research department. So, they are a minor (but important) group of users of this kind of report.

On the other hand, the "executives" are a particularly important group of potential users, and they need that the results are presented in such a way that it is easy for them to read and understand it. Moreover, they usually do not have time to read an extensive report, so the results should be presented in a "simple" and summarised way. The results should be referred to the main confidence indicators and the main quantitative macroeconomic variables. According to this, the report should be brief (no more than three or four pages) and focused on summary tables and figures accompanied with "little" explanatory comments.

[6] OECD (2003): "Business Tendency Surveys. A Handbook", mimeo, 52-55. Available on http://www.ocde.org.

According to the main ideas given above, the methodological guide that we propose and in particular its contents have been designed on the assumption that the users of the report will be "executives" linked to the economy and with the analysis of its evolution without omitting those potential users who are more specialised in econometric methods.

Thus, the report should be characterised by the following aspects:

a. shortness (with the purpose that the users of the report can find the information that they need quickly)
b. the results must be showed mainly in figures and tables (with the purpose that it can be easily interpreted)
c. harshness in the forecast comments
d. run away from technical comments about the econometric methods used

Next, an example of the report is showed taking into account that the report was elaborated in December 2002.

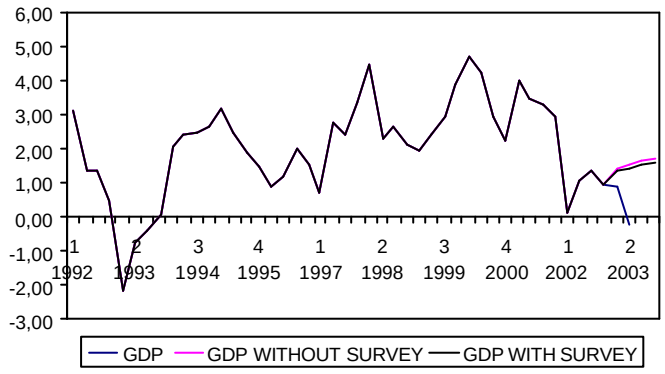
OUTLOOK OF THE EURO AREA ECONOMY USING INFORMATION FROM BUSINESS AND CONSUMER SURVEYS

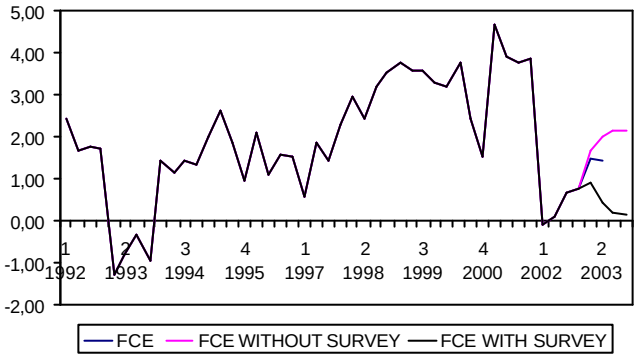
Month ?? 2003 – Report ??

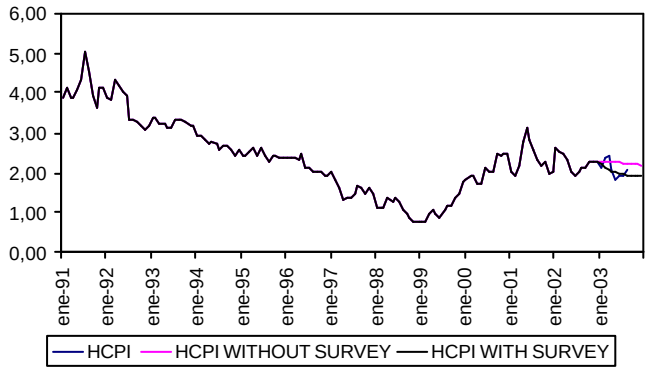
Statistical information available up to December 2002[7]
Forecasts for 2003

In summary …

- … A comment about the ESI evolution
- … A comment about the evolution of GDP, consumption, inflation and unemployment







[7] Data referring to January 2003 will be diffused on February 20, 2003. The next report (March 2003) will be scheduled on April 20, 2003.

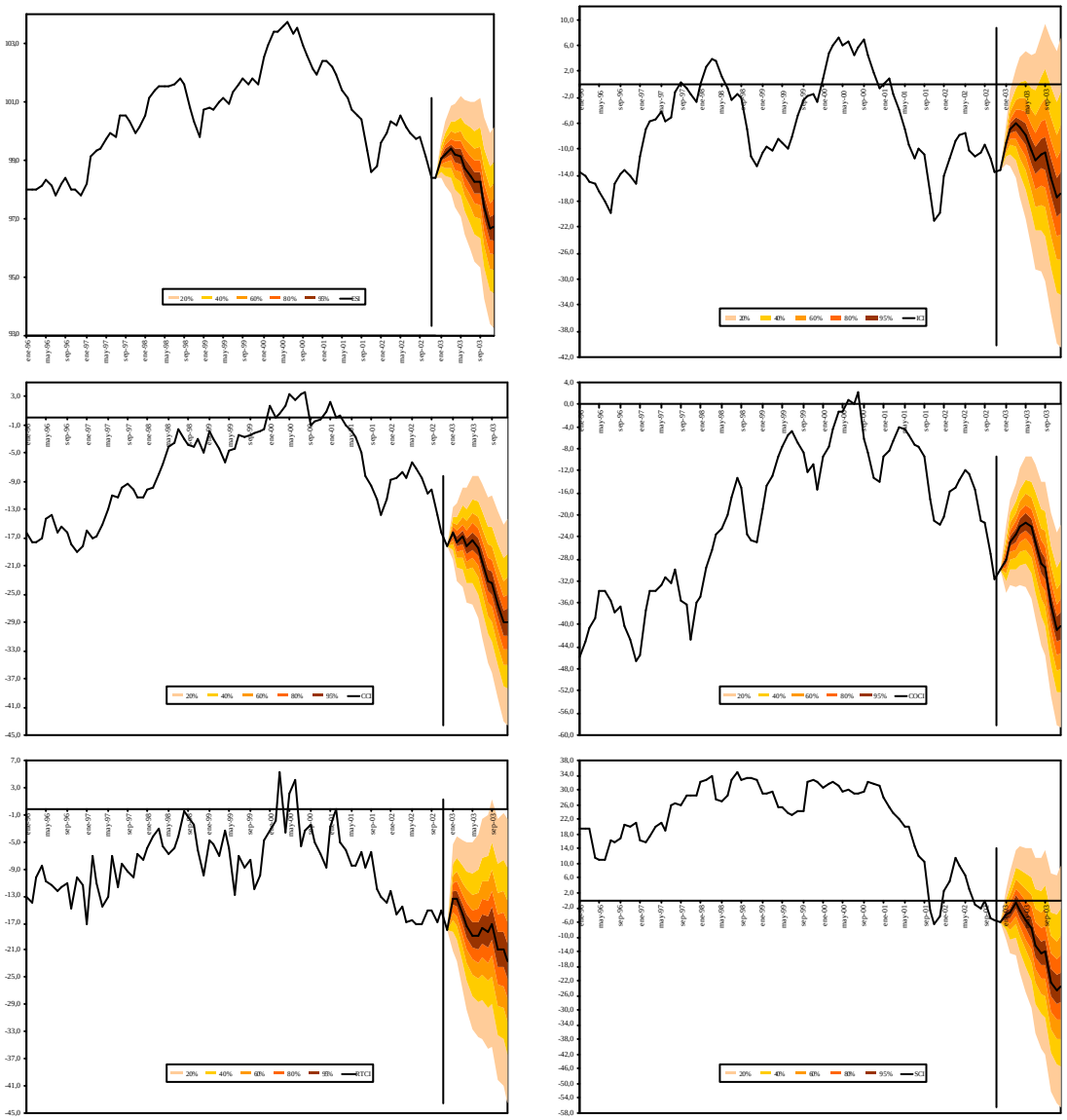
Part I. Business and Consumer indicators

Table 1. Forecasting business and consumer indicators for the Euro area Composite indicators

			2002		2003 (1)		
	Min.	Max (2)	June	December	March	June	December
ESI	95.20	103.70	100.10	98.40	99.36	98.75	96.71
ICI	-32.02	7.32	-10.20	-13.05	-6.06	-10.25	-16.67
CCI	-29.13	3.69	-7.04	-18.09	-16.92	-18.41	-28.93
COCI	-54.04	5.98	-12.48	-29.93	-23.72	-22.27	-40.21
RTCI	-21.64	7.52	-17.07	-17.84	-15.76	-18.86	-22.57
SCI	-6.32	34.74	3.04	-5.71	-0.61	-7.69	-23.75

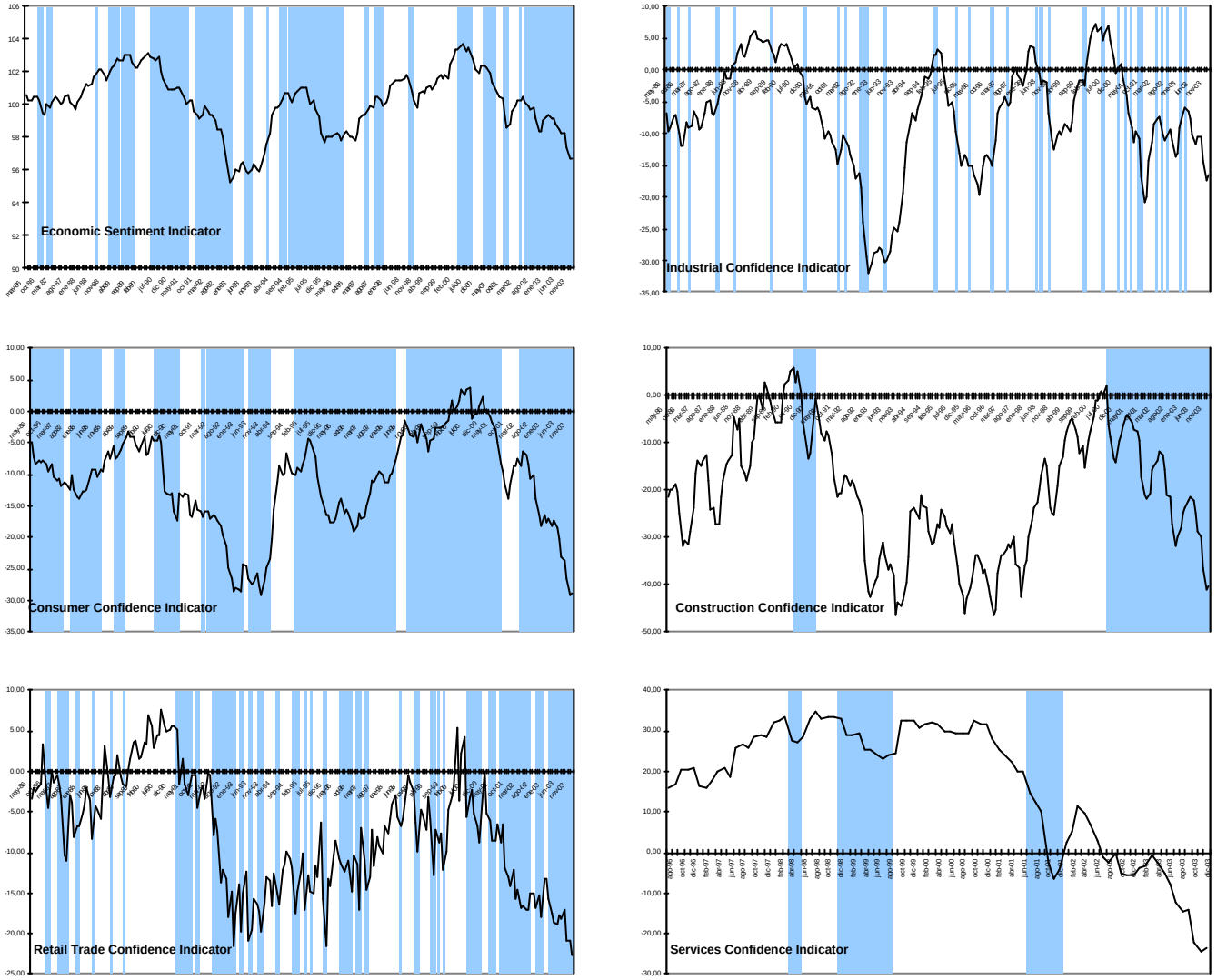
(1) Forecast obtained using information until December 2002.
(2) Extreme values of indicator since January 1985 –RTCI since January 1986 and SCI since April 1995- until December 2002.

Figure 1. Fan-chart



ESI: Economic Sentiment Indicator. ICI: Industrial Confidence Indicator. CCI: Consumer Confidence Indicator. COCI: Construction Confidence Indicator. RTCI: Retail Trade Confidence Indicator. SCI: Services Confidence Indicator.

Figure 2. Probability of recession



Part II. Quantitative macroeconomic variables

Table 2. Forecast of the main quantitative macroeconomic variables of the Euro area

			Year-on-year growth rates [1] 2002		Year-on-year growth rates [1,2] 2003		
	Year-on-year growth rates Min.	Max [3]	June / II	Dec / IV	March / I	June / II	Dec / IV
HCPI	0.78	5.05	1.93	2.28	2.26 (2.09)	2.24 (1.97)	2.21 (1.91)
IPRI	-4.15	6.62	-0.84	1.65	1.65 (1.54)	1.64 (1.53)	1.62 (1.36)
CEI	-7.60	4.67	-0.19	-0.58	-0.53 (-0.64)	-0.48 (-0.40)	-0.40 (-0.58)
UR	7.70	11.40	8.1	8.7	9.10 (9.34)	9.11 (9.48)	9.12 (9.77)
BPI	-16.58	26.16	-3.49	15.22	12.64 (11.42)	13.36 (13.76)	4.85 (7.95)
NCR	-28.33	22.63	-9.28	11.13	3.73 (-3.36)	3.74 (5.12)	0.66 (-0.02)
SR	0.06	0.09	0.06	0.07	0.07 (0.07)	0.07 (0.07)	0.07 (0.07)
GFCFCO	-8.00	8.47	0.46	-1.74	1.53 (1.92)	1.59 (0.33)	-0.08 (-2.55)
GFCFM	-12.20	11.78	-6.21	-1.65	2.92 (1.33)	4.49 (-0.61)	5.68 (0.14)
EG	-3.42	14.67	1.61	4.72	10.74 (11.46)	13.69 (14.65)	13.91 (13.82)
FCE	-1.28	4.70	0.11	0.76	1.67 (0.90)	2.03 (0.46)	2.18 (0.15)
GFCFCH	-5.84	7.88	-5.68	-4.08	-0.27 (3.26)	0.64 (4.64)	1.14 (6.36)
CI	-10.41	14.90	-4.60	-5.69	-0.78 (2.84)	2.32 (0.62)	5.29 (-0.45)
IPI	-7.35	7.29	-0.42	-0.57	0.71 (0.84)	0.77 (1.71)	1.81 (1.82)
RDTI	-2.91	6.04	-1.03	-1.57	-0.77 (-0.22)	0.53 (0.33)	1.62 (0.94)
IGVA	-7.08	7.33	1.70	1.73	3.33 (2.58)	2.89 (1.84)	3.52 (2.51)
CGVA	-6.86	7.27	-0.95	-1.87	-0.74 (0.23)	0.20 (0.75)	0.66 (-0.12)
WRTGVA	-2.12	6.67	1.32	1.61	2.22 (1.92)	2.54 (1.95)	2.85 (1.93)
FIGVA	0.43	5.29	1.50	0.43	1.44 (1.35)	1.63 (1.41)	2.00 (1.38)
GDP	-2.19	4.68	1.07	0.93	1.39 (1.34)	1.54 (1.44)	1.72 (1.58)

(1) Except for UR, SR and CI.

(2) Forecast obtained using information until December 2002 / 2002-IV. In brackets forecast using the information given by the business and consumer indicators.

(3) Extreme values of the monthly variable since January 1985 –HCPI since January 1990, CEI since January 1991, UR since January 1993 and RDTI since January 1994- until December 2002 and extreme values of the quarterly variable since 1991.I until 2002.IV.

HCPI: Harmonized Consumer Price Index. IPRI: Industry Producer Price Index. CEI: Construction – Number of Persons Employed Index. UR: Unemployment Rate. BPI: Building Permits Index – New Residencial Buildings. NCR: Number of Car Registrations. SR: Savings Rate. GFCFCO: Gross Fixed Capital Formation: Construction Work – Other Constructions. GFCFM: Gross Fixed Capital Formation: Metal Products and Machinery. EG: Exports of Goods. FCE: Final Consumption Expenditure: Household and NPISH. GFCFCH: Gross Fixed Capital Formation: Construction Work – Housing. CI: Changes in Inventories. IPI: Industrial Production Index. RDTI: Retail Deflacted Turnover Index. IGVA: Industry Gross Value Added. CGVA: Construction Gross Value Added. WRTGVA: Wholesale and Retail Trade and other Gross Value Added. FIGVA: Financial Intermediation Gross Value Added. GDP: Gross Domestic Product.

Part III. Ex-post forecast accuracy[8]

Table 3. Qualitative variables

	Month 2003	Forecast(1)	Real
ESI	September	98.24169	99.60
ICI	September	-10.53291	-8.40
CCI	September	-23.52452	-18.13
COCI	September	-29.73803	-22.36
RTCI	September	-16.97332	-10.07
SCI	September	-14.14292	6.67

(1) Forecast obtained using information until December 2002.

ESI: Economic Sentiment Indicator. ICI: Industrial Confidence Indicator. CCI: Consumer Confidence Indicator. COCI: Construction Confidence Indicator. RTCI: Retail Trade Confidence Indicator. SCI: Services Confidence Indicator.

Table 4. Quantitative variables

	2003	Forecast(1,2)		Real(1)
	Month / Quarter	Without indicator	With indicator	
HCPI	August	2.23	1.94	2.07
IPRI	August	1.63	1.51	1.45
CEI	June	-0.48	-0.40	0.15
UR	August	9.11	9.55	8.70
BPI	June	13.36	13.76	2.27
NCR	April	3.60	na	-5.69
SR	I	0.07	0.07	0.05
GFCFCO	II	1.59	0.33	-2.31
GFCFM	II	4.49	-0.61	-2.10
EG	II	13.69	14.65	-0.68
FCE	II	2.03	0.46	1.44
GFCFCH	II	0.64	4.64	0.90
CI	II	2.32	0.62	1.11
IPI	July	1.11	2.40	0.74
RDTI	July	0.29	0.02	-0.03
IGVA	II	2.89	1.84	-1.58
CGVA	II	0.20	0.75	-1.26
WRTGVA	II	2.54	1.95	0.41
FIGVA	II	1.63	1.41	0.12
GDP	II	1.54	1.44	-0.24

(1) Year-on-year growth rates except for UR, SR and CI.
(2) Forecast obtained using information until December 2002 / 2002-IV.

HCPI: Harmonized Consumer Price Index. IPRI: Industry Producer Price Index. CEI: Construction – Number of Persons Employed Index. UR: Unemployment Rate. BPI: Building Permits Index – New Residencial Buildings. NCR: Number of Car Registrations. SR: Savings Rate. GFCFCO: Gross Fixed Capital Formation: Construction Work – Other Constructions. GFCFM: Gross Fixed Capital Formation: Metal Products and Machinery. EG: Exports of Goods. FCE: Final Consumption Expenditure: Household and NPISH. GFCFCH: Gross Fixed Capital Formation: Construction Work – Housing. CI: Changes in Inventories. IPI: Industrial Production Index. RDTI: Retail Deflacted Turnover Index. IGVA: Industry Gross Value Added. CGVA: Construction Gross Value Added. WRTGVA: Wholesale and Retail Trade and other Gross Value Added. FIGVA: Financial Intermediation Gross Value Added. GDP: Gross Domestic Product.

8 The data considered in this part of the report should be elaborated with information from the previous one.

EXPLANATORY NOTES

Description of statistical sources: European Commission, Eurostat, European Central Bank

Forecasting models: Forecasts in this report have been obtained using the best econometric methods and models from a ex-post forecast accuracy comparison for the period January 2001 to December 2002.

FOR FURTHER INFORMATION ABOUT DATA AND THE REPORT CONTACT WITH:

???? (name, e-mail, phone, fax, address)

Business and consumers information on the web:

http://europa.eu.int/comm/economy_finance/index_en.htm

ANNEX 1. List of Business and Consumer Surveys Indicators for the Euro area

Code	Description	Freq.	First obs	Last obs	Obs.	Categories						
v1	**Economic Sentiment Indicator**	month	jan-85	dec-02	216							
v2	**Industrial Confidence Indicator (v7+v4-v6)/3**	month	jan-85	dec-02	216							
v3	Production trend observed in recent months	month	jan-85	dec-02	216	P	E	M				B
v4	Assessment of order-book levels	month	jan-85	dec-02	216	P	E	M				B
v5	Assessment of export order-book levels	month	jan-85	dec-02	216	P	E	M				B
v6	Assessment of stocks of finished products	month	jan-85	dec-02	216	P	E	M				B
v7	Production expectations for the months ahead	month	jan-85	dec-02	216	P	E	M				B
v8	Selling price expectations for the months ahead	month	jan-85	dec-02	216	P	E	M				B
v9	Employment expectations for the months ahead	month	jan-85	dec-02	216	P	E	M				B
v10	*New orders in recent months*	*quarter*	*1985-I*	*2002-IV*	72	P	E	M				B
v11	*Export expectations for the months ahead*	*quarter*	*1985-I*	*2002-IV*	72	P	E	M				B
v12	**Consumer Confidence Indicator (v14+v16-v19+v23)/4**	month	jan-85	dec-02	216							
v13	Financial situation over last 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v14	Financial situation over next 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v15	General economic situation over last 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v16	General economic situation over next 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v17	Price trends over last 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v18	Price trends over next 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v19	Unemployment expectations over next 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v20	Major purchases at present	month	jan-85	dec-02	216	PP	E	MM	N			B
v21	Major purchases over next 12 months	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v22	Savings at present	month	jan-85	dec-02	216	PP	P	M	MM	N		B
v23	Savings over next 12 months	month	jan-85	dec-02	216	PP	P	M	MM	N		B
v24	Statement on financial situation of household	month	jan-85	dec-02	216	PP	P	E	M	MM	N	B
v25	*Intention to buy a car within the next 2 years*	*quarter*	*1990-I*	*2002-IV*	52	PP	P	M	MM	N		B
v26	*Purchase or build a home within the next 2 years*	*quarter*	*1990-I*	*2002-IV*	52	PP	P	M	MM	N		B
v27	*Home improvements over the next 12 months*	*quarter*	*1990-I*	*2002-IV*	52	PP	P	M	MM	N		B

(Continues next page)

Code	Description	Freq.	First obs	Last obs	Obs	Categories			
v28	**Construction Confidence Indicator (v30+v31)/2**	month	jan-85	dec-02	216				
v29	Trend of activitiy compared with preceding months	month	jan-85	dec-02	216	P	E	M	B
v30	Assessment of order books	month	jan-85	dec-02	216	P	E	M	B
v31	Employment expectations for the months ahead	month	jan-85	dec-02	216	P	E	M	B
v32	Price expectations for the months ahead	month	jan-85	dec-02	216	P	E	M	B
v33	**Retail Trade Confidence Indicator (v34-v35+v37)/3**	month	jan-86	dec-02	204				
v34	Present business situation	month	jan-85	dec-02	216	P	E	M	B
v35	Assessment of stocks	month	jan-85	dec-02	216	P	E	M	B
v36	Orders placed with suppliers	month	feb-85	dec-02	215	P	E	M	B
v37	Expected business situation	month	jan-86	dec-02	204	P	E	M	B
v38	Employment	month	abr-85	dec-02	213	P	E	M	B
v39	**Services Confidence Indicator (v40+v41+v42)/3**	month	abr-95	dec-02	93				
v40	Assessment of business climate	month	abr-95	dec-02	93	P	E	M	B
v41	Evolution of demand in recent months	month	abr-95	dec-02	93	P	E	M	B
v42	Evolution of demand expected in the months ahead	month	abr-95	dec-02	93	P	E	M	B
v43	Evolution of employment in recent months	month	abr-95	dec-02	93	P	E	M	B
v44	Evolution of employment expected in the months ahead	month	jan-97	dec-02	72	P	E	M	B

ANNEX 2. Forecasting Methods for Business and Consumer Surveys Indicators

A2.1. Autoregressions

The widely known autoregressive model (also known as distributed-lags model) explains the behaviour of the endogenous variable as a linear combination of its own past values.

$$Y_t = f_1 Y_{t-1} + f_2 Y_{t-2} + ... + f_p Y_{t-p} + e_t$$

The key question is how to determine the number of lags that should be included in the model. For monthly data, we have considered different models with a minimum number of 1 lag up to a maximum of 24 (including all the intermediate lags), selecting that model with a lower value of the Akaike Information Criteria (AIC). For quarterly data, we have considered a maximum number of lags equals to 8.

A2.2. ARIMA models

Since the work by Box and Jenkins (1970), ARIMA models have been widely used and their forecast performance has also been confirmed.

The general expression of an ARIMA model is the following:

$$x_t^l = \frac{\Theta_s(L^s) q(L)}{\Phi_s(L^s) f(L) \Delta_s^D \Delta^d} e_t$$

$\Theta_s(L^s) = (1 - \Theta_s L^s - \Theta_{2s} L^{2s} - ... - \Theta_{Qs} L^{Qs})$ is a seasonal moving average polynomial,

$\Phi_s(L^s) = (1 - \Phi_s L^s - \Phi_{2s} L^{2s} - ... - \Phi_{Ps} L^{Ps})$ is a seasonal autoregressive polynomial,

$\theta(L) = (1 - \theta_1 L^1 - \theta_2 L^2 - ... - \theta_q L^q)$ is a regular moving average polynomial,

$\phi(L) = (1 - \phi_1 L^1 - \phi_2 L^2 - ... - \phi_p L^p)$ is a regular autoregressive polynomial,

λ is the value of the Box-Cox (1964) transformation, Δ_s^D is the seasonal difference operator,

Δ^d is the regular difference operator,
S is the periodicity of the considered time series, and
ε_t is the innovation which is assumed to behave as a white noise.

In order to use this kind of models with forecasting purposes it is necessary to identify the proper model (i.e., to give values to the order of the different polynomials, to the difference operator, etc.). For monthly data, we have considered models with up to 12 AR and MA terms (4 in the case of quarterly data) selecting the model with the lowest value of the AIC. The statistical goodness of the selected model has also been checked.

A2.3. TAR models

In the case of the ARIMA model the relationship between the current value of a variable and its lags is supposed to be linear and constant over time. However, when looking at real data it can be seen that expansions are more prolonged over time than recessions (Hansen, 1997). In fact, in the behaviour of most economic variables there seems to be a cyclical asymmetry that lineal models are not able to capture (Clements and Smith, 1999).

A Self-Excited Threshold Autoregressive model (SETAR) for the time series X_t can be summarised as follows:

$$\begin{aligned} &B(L)\cdot X_t + u_t && \text{if } X_{t-k} \leq X \\ &z(L)\cdot X_t + v_t && \text{if } X_{t-k} > X \end{aligned}$$

where u_t and v_t are white noises, B(L) and $z(L)$ are autoregressive polynomials, the value *k* is known as delay and the value *X* is known as threshold.

This two-regime self-exciting threshold autoregressive process is estimated using monthly and quarterly data for each indicator and the Monte Carlo procedure is used to generate multi-step forecasts.

The selected values of the delay are those minimising the sum of squared errors among values between 1 and 12 for monthly data and 1 and 4 for quarterly data. The values of the threshold are given by the variation of the analysed variable.

A2.4. Markov switching regime models

Threshold autoregressive models are perhaps the simplest generalization of linear autoregresions. In fact, these models were built on developments over traditional ARMA time series models. As an alternative to these models, time series regime-switching models assume that the distribution of the variable is known conditional on a particular regime or state occurring. When the economy changes from one regime to another, a substantial change occurs in the series. Hamilton (1989) presented the Markov regime-switching model in which the unobserved regime evolves over time as a 1st-order Markov process. The regime completely governs the dynamic behaviour of the series. This implies that once we condition on a particular regime occurring, and assume a particular parameterization of the model, we can write down the density of the variable of interest. However, as the regime is strictly unobservable, it is necessary to draw statistical inference regarding the likelihood of each regime occurring at any point in time. So, it is necessary to obtain the transition probabilities from one regime to the other.

There have been three different approaches to estimating these models (Potter, 1999). First, Hamilton (1989) developed a nonlinear filter to evaluate the likelihood function of the model and then directly maximized the likelihood function. Second, in a later article, Hamilton (1990) constructed an EM algorithm that is particularly useful for the case where all the parameters switch. Finally, Albert and Chib (1993) developed a Bayesian approach to estimation.

In this work, we employ a Markov-switching threshold autoregressive model (MK-TAR) where we allow for different regime-dependent intercepts, autoregressive parameters, and variances. The estimation of the models is carried out by maximum

likelihood using the Hamilton (1989) filter[9] together with the smoothing filter of Kim (1994).

Once we have estimated the probabilities of expansion and recession, we construct the following model for the time series X_t :

$$B(L)\cdot X_t + u_t \qquad \text{if } P[Expansion/X_{t-k}] \pounds P$$

$$z(L)\cdot X_t + v_t \qquad \text{if } P[Recession/X_{t-k}] > P$$

where, as in SETAR models, u_t and v_t are white noises, B(L) and $z(L)$ are autoregressive polynomials, the value k is known as delay and the value P is known as threshold[10]. The selected values of the delay are those minimising the sum of squared errors among values between 1 and 12 for monthly data and 1 and 4 for quarterly data. The values of the threshold are given by the variation of the probability.

A2.5. VAR models

In these models, each variable depends on a certain number of lags of the other variables under analysis (Sims, 1982). The idea is that the positive, neutral and negative answers to each question can be considered jointly. Moreover, as by definition the sum of the percentages of positive (P), neutral (E) and negative (M) answers would sum hundred, this restriction could also be introduced in the model improving its forecasting accuracy.

$$\begin{bmatrix} P_t \\ E_t \\ M_t \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix} \cdot \begin{bmatrix} P_{t-1} \\ E_{t-1} \\ M_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \cdot \begin{bmatrix} P_{t-p} \\ E_{t-p} \\ M_{t-p} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix}$$

[9] The Hamilton filter is an iterative procedure which provides estimates of the probability that a given state is prevailing at each point in time given its previous history. These estimates are dependent upon the parameter values given to the filter. Running the filter through the entire sample, provides a log likelihood value for the particular set of estimates used. This filter is then repeated to optimise the log likelihood to obtain the MLE estimates of the parameters. With the maximum likelihood parameters, the probability of state 0 at each point in time is calculated and these are the probabilities of recession and expansion.

[10] An alternative approach would have consisted in imposing the value of P and k instead of estimating them. These models are known as Markov Switching Autoregressive Models (MS-AR) and, in general, the values of P are 0.7 or 0.8 and the values of K, 0 or 1.

In order to use this kind of models with forecasting purposes it is necessary to identify the proper model (i.e, give values to the number of lags *p*). For monthly data, we have considered models with up to 24 lags (8 in the case of quarterly data) selecting the model with the lowest value of the AIC. The statistical goodness of the selected model has also been checked.

An alternative specification of VAR models would consist in considering the joint evolution of indicators (for example, trough a joint forecast for the evolution of demand and employment). The considered VAR models try to pick up, as far as possible, assumptions reflecting the dynamics of their behaviour from a theoretical point of view. In this sense, the VAR models including information from answers to different survey questions are the following:

VAR model	Considered indicators
Supply side	Industrial Confidence Indicator Consumer Confidence Indicator Construction Confidence Indicator Retail Trade Confidence Indicator Services Confidence Indicator
Industry	Production expectations for the months ahead Selling price expectations for the months ahead
Demand side	Price trends over next 12 months General economic situation over next 12 months Unemployment expectations over next 12 months Financial situation over next 12 months
Savings	Savings over next 12 months Statement on financial situation of household Major purchases over next 12 months
Building	Trend of activitiy compared with preceding months Employment expectations for the months ahead Price expectations for the months ahead
Retail Trade	Expected business situation Employment
Services	Evolution of demand expected in the months ahead Evolution of employment expected in the months ahead

References

Albert, J. and Chib, S. (1993): "Bayesian inference via Gibbs sampling of autoregressive time series subject to Markov mean and variance shifts", *Journal of Business and Economic Statistics*, 11, 1-15.

Box, G. i Cox, D. (1964): "An Analysis of Transformation", *Journal of the Royal Statistical Society Series B*, 26, 2.

Box, G. E. P. and Jenkins, G. M. (1970): *Time Series Analysis: Forecasting and Control*, Holden-Day, San Francisco.

Clements, M. and Smith, J. (1999): "A Monte Carlo Study of the Forecasting Performance of Empirical SETAR models", *Journal of Applied Econometrics*, 14, 123-141.

Hamilton, J. (1989): "A new approach to the economic analysis of nonstationary time series and the business cycle", *Econometrica*, 57, 357-384.

Hamilton, J. (1990): "Analysis of time series subject to changes in regime", *Journal of Econometrics*, 45, 39-70.

Hansen, B., (1997): Inference in threshold models, *mimeo*.

Kim, C. J. (1994): "Dynamic Linear Models with Markov-Switching", *Journal of Econometrics*, 60, 1–22.

Potter, S. (1999): *Nonlinear Time Series Modelling: An Introduction*, Federal Reserve Bank of New York, mimeo.

Sims, C. (1982): "Policy Analysis with Econometric Models", *Brookings Papers on Economic Activity*, 1, 107-164.

ANNEX 3. Some Statistics for the Business and Consumer Surveys Indicators and Methodological Issues

A3.1. Descriptive Statistics

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
V1	216	100.1625	3.3784	1.838	1.8351
V2	216	-7.1318	73.4308	8.5692	120.1544
V3p	216	17.8581	18.0743	4.2514	23.8065
V3e	216	64.1288	10.841	3.2926	5.1343
V3m	216	18.0145	37.114	6.0921	33.8179
V3b	216	-0.1564	99.5096	9.9754	6376.7302
V4p	216	11.9338	19.4515	4.4104	36.9571
V4e	216	59.6957	37.1868	6.0981	10.2153
V4m	216	28.3607	91.3903	9.5598	33.708
V4b	216	-16.4269	184.4613	13.5817	82.6794
V5p	216	11.6829	20.5652	4.5349	38.8166
V5e	216	57.6314	32.472	5.6984	9.8877
V5m	216	30.6882	77.3851	8.7969	28.6653
V5b	216	-19.0054	163.3955	12.7826	67.258
V6p	216	16.7807	13.5725	3.6841	21.9542
V6e	216	76.6071	7.9314	2.8163	3.6763
V6m	216	6.6102	3.2607	1.8057	27.3175
V6b	216	10.1705	25.7411	5.0736	49.8851
V7p	216	18.4887	17.4848	4.1815	22.6164
V7e	216	68.2208	11.6459	3.4126	5.0023
V7m	216	13.2867	26.5811	5.1557	38.8034
V7b	216	5.202	76.4798	8.7453	168.114
V8p	216	17.5023	52.4328	7.2411	41.3721
V8e	216	73.4859	32.7469	5.7225	7.7872
V8m	216	9.0118	11.4093	3.3778	37.4816
V8b	216	8.4905	94.8981	9.7416	114.7354
V9p	216	8.6228	10.0175	3.165	36.7056
V9e	216	69.3184	19.9164	4.4628	6.4381
V9m	216	22.0311	50.1258	7.08	32.1362
V9b	216	-13.4083	100.2314	10.0116	74.6667
V10p	72	22.7953	29.5095	5.4323	23.8307
V10e	72	56.8936	9.0064	3.0011	5.2749
V10m	72	20.3151	36.1671	6.0139	29.6031
V10b	72	2.4801	122.3853	11.0628	446.0552
V11p	72	18.5124	15.9941	3.9993	21.6032
v11e	72	68.691	5.7127	2.3901	3.4795
v11m	72	12.8068	16.8793	4.1084	32.0802
v11b	72	5.7056	60.027	7.7477	135.7923
V12	216	-10.7243	50.4053	7.0997	66.2017
V13pp	216	1.9708	0.1506	0.388	19.6895
V13p	216	10.6911	5.0477	2.2467	21.0147
V13e	216	60.7895	7.047	2.6546	4.3669
V13m	216	19.4832	12.1444	3.4849	17.8866
V13mm	216	6.0123	2.7836	1.6684	27.7499
V13n	216	1.0516	0.085	0.2916	27.7258
V13b	216	-8.44	22.3644	4.7291	56.0321

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
V14pp	216	1.696	0.1126	0.3355	19.7817
V14p	216	12.8892	4.375	2.0916	16.2278
V14e	216	63.9654	4.9936	2.2346	3.4935
V14m	216	13.0696	7.8131	2.7952	21.387
V14mm	216	2.9786	1.1734	1.0832	36.367
V14n	216	5.3925	0.4538	0.6737	12.4928
V14b	216	-1.3734	13.2784	3.644	265.3273
V15pp	216	1.6985	0.7584	0.8709	51.2719
V15p	216	13.9838	32.7637	5.724	40.9326
V15e	216	34.786	51.0234	7.1431	20.5343
V15m	216	30.4676	28.9397	5.3796	17.6566
V15mm	216	16.0634	75.2319	8.6736	53.9962
V15n	216	2.9783	0.3049	0.5522	18.5405
V15b	216	-22.6093	202.0896	14.2158	62.876
V16pp	216	1.3798	0.1745	0.4177	30.2724
V16p	216	17.3487	16.4774	4.0592	23.3979
V16e	216	40.1237	29.9664	5.4742	13.6432
V16m	216	24.5118	24.2167	4.921	20.0762
V16mm	216	8.4651	20.9411	4.5761	54.0587
V16n	216	8.1523	0.996	0.998	12.2422
V16b	216	-10.6692	75.67	8.6989	81.5323
V17pp	216	15.8956	60.315	7.7663	48.8579
V17p	216	33.1775	20.2486	4.4998	13.5629
V17e	216	29.477	27.9294	5.2848	17.9287
V17m	216	18.3204	45.3555	6.7346	36.7603
V17mm	216	1.4577	1.1501	1.0724	73.571
V17n	216	1.6706	0.1333	0.3651	21.8568
V17b	216	21.8687	176.8454	13.2983	60.8097
V18pp	216	14.9339	24.296	4.9291	33.0062
V18p	216	42.8009	21.4798	4.6346	10.8284
V18e	216	14.536	5.8607	2.4209	16.6545
V18m	216	20.2866	32.1783	5.6726	27.9622
V18mm	216	1.3944	0.3635	0.6029	43.2397
V18n	216	6.0528	0.5683	0.7538	12.4541
V18b	216	24.799	83.3874	9.1317	36.8227
V19pp	216	16.7537	74.7891	8.6481	51.619
V19p	216	33.912	28.8162	5.3681	15.8294
V19e	216	28.3522	37.9546	6.1607	21.7293
V19m	216	13.7782	37.5272	6.1259	44.4612
V19mm	216	1.2006	0.2773	0.5266	43.8643
V19n	216	6.0094	1.8711	1.3679	22.7619
V19b	216	25.6223	183.7338	13.5548	52.9025
V20pp	216	18.4149	16.7472	4.0923	22.223
V20e	216	40.6462	8.2389	2.8704	7.0618
V20mm	216	29.0914	35.7419	5.9784	20.5505
V20n	216	11.8541	5.4575	2.3361	19.7074
V20b	216	-10.6765	88.3503	9.3995	88.0388

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
V21pp	216	1.8199	0.1089	0.3299	18.1292
V21p	216	5.8325	0.7965	0.8925	15.3015
V21e	216	51.153	17.1178	4.1374	8.0882
V21m	216	10.9847	1.5089	1.2284	11.1827
V21mm	216	14.7881	2.7745	1.6657	11.2637
V21n	216	15.4301	8.9552	2.9925	19.3941
V21b	216	-15.547	5.7582	2.3996	15.4346
V22pp	216	43.2187	15.5863	3.9479	9.1348
V22p	216	26.3902	4.1127	2.028	7.6845
V22m	216	14.1421	1.0913	1.0447	7.3869
V22mm	216	10.6551	2.3843	1.5441	14.4919
V22n	216	5.5812	1.2819	1.1322	20.2864
V22b	216	38.69	23.8215	4.8807	12.6149
V23pp	216	18.4769	5.1525	2.2699	12.2851
V23p	216	28.1558	1.8753	1.3694	4.8638
V23m	216	21.4153	2.0374	1.4274	6.6653
V23mm	216	27.0817	4.5169	2.1253	7.8478
V23n	216	4.8768	1.4136	1.189	24.3799
V23b	216	-5.2358	21.883	4.6779	89.3444
V24pp	216	3.7894	0.1546	0.3932	10.3768
V24p	216	9.1706	3.8329	1.9578	21.3485
V24e	216	49.7099	2.9541	1.7187	3.4575
V24m	216	31.9503	5.5628	2.3586	7.382
V24mm	216	3.1625	0.3301	0.5745	18.1662
V24n	216	2.2229	0.2479	0.4979	22.4004
V24b	216	-10.7654	7.1597	2.6758	24.8551
v25pp	52	7.44	1.0719	1.0353	13.9159
v25p	52	12.9706	1.0686	1.0337	7.9699
v25m	52	14.5623	0.8667	0.9309	6.3929
v25mm	52	61.2467	4.1832	2.0453	3.3394
v25n	52	3.8008	1.8386	1.356	35.6757
v25b	52	-54.6026	9.6106	3.1001	5.6776
v26pp	52	2.6573	0.1496	0.3868	14.5577
v26p	52	4.5642	0.2542	0.5042	11.0465
v26m	52	7.2444	0.6419	0.8012	11.059
v26mm	52	83.7487	1.5548	1.2469	1.4889
v26n	52	1.8127	0.5416	0.7359	40.5974
v26b	52	-82.4314	1.7822	1.335	1.6195
v27pp	52	6.975	0.8498	0.9218	13.2163
v27p	52	8.5638	0.8973	0.9473	11.0612
v27m	52	14.5967	0.7624	0.8731	5.9817
v27mm	52	66.1844	3.4584	1.8597	2.8098
v27n	52	3.6913	1.4876	1.2197	33.0419
v27b	52	-62.2259	7.0705	2.659	4.2732
V28	216	-21.2394	186.8701	13.67	64.3617
V29p	216	18.8678	52.4836	7.2446	38.3964
V29e	216	54.1579	53.7583	7.332	13.5382
V29m	216	26.9817	144.6274	12.0261	44.5714
V29b	216	-8.1138	340.1953	18.4444	227.32

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
V30p	216	9.9975	21.6033	4.6479	46.491
V30e	216	49.705	41.9836	6.4795	13.0359
V30m	216	40.2843	105.3031	10.2617	25.4733
V30b	216	-30.2868	211.7244	14.5508	48.0432
V31p	216	10.9863	25.9507	5.0942	46.3684
V31e	216	65.838	47.4153	6.8859	10.4588
V31m	216	23.1743	99.6241	9.9812	43.0701
V31b	216	-12.1879	203.8097	14.2762	117.134
V32p	216	15.1253	60.6186	7.7858	51.4752
V32e	216	70.5993	39.6848	6.2996	8.923
V32m	216	14.2773	56.8908	7.5426	52.8293
V32b	216	0.848	195.3395	13.9764	1648.1412
V33	204	-6.9446	46.9522	6.8522	98.6695
V34p	216	25.1827	191.6298	13.843	54.9705
V34e	216	41.4236	442.2876	21.0306	50.7697
V34m	216	33.3862	112.1887	10.5919	31.7254
V34b	216	-8.2035	165.4672	12.8634	156.8035
V35p	216	29.9138	196.8648	14.0309	46.9043
V35e	216	56.3929	733.1112	27.076	48.0132
V35m	216	13.6689	175.0628	13.2311	96.7974
V35b	216	16.2449	10.7698	3.2817	20.2016
V36p	215	24.2684	181.2468	13.4628	55.4745
V36e	215	47.5477	615.7372	24.8141	52.1877
V36m	215	28.1998	161.2273	12.6975	45.0271
V36b	215	-3.9313	68.992	8.3061	211.2797
V37p	204	27.4412	162.806	12.7595	46.4977
V37e	204	47.6001	475.1047	21.7969	45.7917
V37m	204	24.9564	107.5468	10.3705	41.5544
V37b	204	2.4849	65.5031	8.0934	325.7093
V38p	213	18.2348	245.5616	15.6704	85.9366
V38e	213	62.778	965.7237	31.0761	49.5015
V38m	213	18.9887	249.1877	15.7857	83.132
V38b	213	-0.7538	24.0007	4.899	649.8705
V39	93	20.9895	120.586	10.9812	52.3175
V40p	93	33.6817	60.1925	7.7584	23.0344
V40e	93	52.7646	11.9537	3.4574	6.5525
V40m	93	13.5369	35.0846	5.9232	43.7562
V40b	93	20.1448	178.5948	13.3639	66.3393
V41p	93	35.2569	67.1723	8.1959	23.2462
V41e	93	46.2533	19.9228	4.4635	9.6501
V41m	93	18.4848	25.7894	5.0783	27.4729
V41b	93	16.772	166.0121	12.8846	76.8217
V42p	93	38.4152	44.1925	6.6477	17.305
V42e	93	49.2078	16.0926	4.0116	8.1523
V42m	93	12.3652	16.3724	4.0463	32.7232
V42b	93	26.05	105.1768	10.2556	39.3688
V43p	93	26.5186	49.2018	7.0144	26.4509
V43e	93	62.6226	29.3711	5.4195	8.6542
V43m	93	10.8534	6.3953	2.5289	23.3004
V43b	93	15.6652	81.9665	9.0535	57.7941

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
V44p	72	21.96	34.3977	5.865	26.7074
V44e	72	67.9626	20.6668	4.5461	6.6891
V44m	72	10.0681	14.4523	3.8016	37.7593
V44b	72	11.8919	77.1748	8.7849	73.8729

Summary statistics

Average Variation coef.	Monthly indicators	Quarterly indicators
pp	27.22	13.90
p	31.33	15.10
e	16.03	4.38
m	33.75	17.02
mm	33.76	2.55
n	19.52	36.44
b	348.47	118.68
i	67.26	

A3.2. Tests of equality of variance and analysis of the sign of the covariance between positive and negative answers

a) Summary of the results

Covariance	Negative sign	Positive sign	TOTAL
Month	28	5	33
Quarter	5	0	5
TOTAL	33	5	38

Covariance	Negative sign	Positive sign	TOTAL
Month	74%	13%	87%
Quarter	13%	0%	13%
TOTAL	87%	13%	100%

Statistic	Rejection of the Null (Null: equality of variance)	Non-rejection of the Null	TOTAL
Month	27	6	33
Quarter	2	3	5
TOTAL	29	9	38

Statistic	Rejection of the Null (Null: equality of variance)	Non-rejection of the Null	TOTAL
Month	71%	16%	87%
Quarter	5%	8%	13%
TOTAL	76%	24%	100%

b) Detailed results

	H	p-value	Decision	cov (p, m)
v3p	5.51	0.00	RH0	-22.26
v3e	9.18	0.00	RH0	
v3m	2.68	0.00	RH0	
v4p	9.48	0.00	RH0	-36.98
v4e	4.96	0.00	RH0	
v4m	2.02	0.00	RH0	
v5p	7.95	0.00	RH0	-32.87
v5e	5.03	0.00	RH0	
v5m	2.11	0.00	RH0	
v6p	1.90	0.00	RH0	-4.47
v6e	3.25	0.00	RH0	
v6m	7.89	0.00	RH0	
v7p	4.37	0.00	RH0	-16.28
v7e	6.57	0.00	RH0	
v7m	2.88	0.00	RH0	
v8p	1.81	0.00	RH0	-15.6
v8e	2.90	0.00	RH0	
v8m	8.32	0.00	RH0	
v9p	10.01	0.00	RH0	-20.14
v9e	5.03	0.00	RH0	
v9m	2.00	0.00	RH0	
v10p	4.15	0.00	RH0	-28.75
v10e	13.59	0.00	RH0	
v10m	3.38	0.00	RH0	
v11p	3.75	0.00	RH0	-13.77
v11e	10.51	0.00	RH0	
v11m	3.56	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v13pp	148.54	0.00	RH0	-2.4
v13p	4.43	0.00	RH0	
v13e	3.17	0.00	RH0	
v13m	1.84	0.00	RH0	
v13mm	26.62	0.00	RH0	
v13n	263.12	0.00	RH0	
v14pp	117.84	0.00	RH0	-1.63
v14p	3.03	0.00	RH0	
v14e	2.66	0.00	RH0	
v14m	1.70	0.00	RH0	
v14mm	28.14	0.00	RH0	
v14n	29.23	0.00	RH0	
v15pp	266.46	0.00	RH0	-9.25
v15p	6.17	0.00	RH0	
v15e	3.96	0.00	RH0	
v15m	6.98	0.00	RH0	
v15mm	210.38	0.00	RH0	
v15n	662.74	0.00	RH0	
v16pp	433.68	0.00	RH0	-5.16
v16p	4.59	0.00	RH0	
v16e	2.52	0.00	RH0	
v16m	3.12	0.00	RH0	
v16mm	63.47	0.00	RH0	
v16n	75.96	0.00	RH0	
v17pp	2.93	0.00	RH0	-28.71
v17p	8.73	0.00	RH0	
v17e	6.33	0.00	RH0	
v17m	3.90	0.00	RH0	
v17mm	134.32	0.00	RH0	
v17n	1326.27	0.00	RH0	
v18pp	3.43	0.00	RH0	-15.49
v18p	3.88	0.00	RH0	
v18e	14.23	0.00	RH0	
v18m	2.59	0.00	RH0	
v18mm	50.47	0.00	RH0	
v18n	146.75	0.00	RH0	
v19pp	2.46	0.00	RH0	-28.99
v19p	6.38	0.00	RH0	
v19e	4.84	0.00	RH0	
v19m	4.90	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v19mm	250.85	0.00	RH0	
v19n	98.19	0.00	RH0	
v20pp	5.28	0.00	RH0	-18.01
v20e	10.72	0.00	RH0	
v20mm	2.47	0.00	RH0	
v20n	16.19	0.00	RH0	
v21pp	52.89	0.00	RH0	-0.02
v21p	7.23	0.00	RH0	
v21e	0.34	1.00	Non RH0	
v21m	3.82	0.00	RH0	
v21mm	85.96	0.00	RH0	
v21n	0.64	1.00	Non RH0	
v22pp	1.53	0.00	RH0	-0.62
v22p	5.79	0.00	RH0	
v22e	233.39	0.00	RH0	
v22m	21.83	0.00	RH0	
v22mm	423.15	0.00	RH0	
v22n	18.58	0.00	RH0	
v23pp	4.24	0.00	RH0	-0.77
v23p	11.66	0.00	RH0	
v23e	13179.35	0.00	RH0	
v23m	10.74	0.00	RH0	
v23mm	147.14	0.00	RH0	
v23n	15.47	0.00	RH0	
v24pp	46.31	0.00	RH0	-1.07
v24p	1.87	0.00	RH0	
v24e	2.42	0.00	RH0	
v24m	1.29	0.03	RH0	
v24mm	1.87	0.00	RH0	
v24n	28.88	0.00	RH0	
v25pp	8.97	0.00	RH0	-0.01
v25p	8.99	0.00	RH0	
v25e	2110.50	0.00	RH0	
v25m	11.09	0.00	RH0	
v25mm	0.23	1.00	Non RH0	
v25n	5.23	0.00	RH0	
v26pp	11.91	0.00	RH0	-0.07
v26p	7.01	0.00	RH0	
v26e	193.70	0.00	RH0	
v26m	2.78	0.00	RH0	
v26mm	0.02	1.00	Non RH0	
v26n	3.29	0.00	RH0	
v27pp	8.32	0.00	RH0	-0.01
v27p	7.88	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v27e	1899.05	0.00	RH0	
v27m	9.27	0.00	RH0	
v27mm	0.14	1.00	Non RH0	
v27n	4.75	0.00	RH0	
v29p	6.48	0.00	RH0	-71.87
v29e	6.33	0.00	RH0	
v29m	2.35	0.00	RH0	
v30p	9.80	0.00	RH0	-42.61
v30e	5.04	0.00	RH0	
v30m	2.01	0.00	RH0	
v31p	7.85	0.00	RH0	-39.3
v31e	4.30	0.00	RH0	
v31m	2.05	0.00	RH0	
v32p	3.22	0.00	RH0	-39.1
v32e	4.92	0.00	RH0	
v32m	3.43	0.00	RH0	
v34p	0.86	0.86	Non RH0	69.5
v34e	0.37	1.00	Non RH0	
v34m	1.47	0.00	RH0	
v35p	0.05	1.00	Non RH0	181.42
v35e	0.01	1.00	Non RH0	
v35m	0.06	1.00	Non RH0	
v36p	0.38	1.00	Non RH0	137.38
v36e	0.11	1.00	Non RH0	
v36m	0.43	1.00	Non RH0	
v37p	0.40	1.00	Non RH0	102.93
v37e	0.14	1.00	Non RH0	
v37m	0.61	1.00	Non RH0	
v38p	0.10	1.00	Non RH0	236.48
v38e	0.02	1.00	Non RH0	
v38m	0.10	1.00	Non RH0	
v40p	2.97	0.00	RH0	-42.11
v40e	14.94	0.00	RH0	
v40m	5.09	0.00	RH0	
v41p	2.47	0.00	RH0	-36.92
v41e	8.33	0.00	RH0	
v41m	6.44	0.00	RH0	
v42p	2.38	0.00	RH0	-22.55
v42e	6.54	0.00	RH0	
v42m	6.42	0.00	RH0	
v43p	1.67	0.01	RH0	-13.33
v43e	2.79	0.00	RH0	
v43m	12.82	0.00	RH0	
v44p	2.24	0.00	RH0	-14.36
v44e	3.73	0.00	RH0	
v44m	5.34	0.00	RH0	

A3.3. Unit root tests

A3.3.1. Brief description of the tests

In the Box and Jenkins (1976) analysis the strategy for handling nonstationarities has been to differentiate the model until the autocorrelation function decays. We consider this is not a very satisfactory guide and so we prefer to use some testing procedures with statistical properties.

1) The augmented Dickey and Fuller test (ADF)

This test is based in the following model:

$$y_t = f\, y_{t-1} + \sum_{i=1}^{p} h_i y_{t-i} + u_t \qquad (1)$$

Assuming $u_t \sim N(0, s^2)$ Dickey and Fuller have shown that a t test for f=1 in (1) has the same limiting distribution under H_0 as a *t-test* for g=0 in an *AR*(1) process. Autocorrelated errors invalidate the use of the Dickey-Fuller test as it is based on the assumption that the errors are white noise. Essentially, we add lags of Δy_t to reduce y_t to a white noise. In order to test whether a series y_t is I(1), Dickey and Fuller advocate the following test regressions:

$$Dy_t = a\, y_{t-1} + \sum_{i=1}^{k} d_i Dy_{t-i} + u_t \qquad (2)$$

$$Dy_t = m + a\, y_{t-1} + \sum_{i=1}^{k} d_i Dy_{t-i} + u_t \qquad (3)$$

$$Dy_t = m + b\, t + a\, y_{t-1} + \sum_{i=1}^{k} d_i Dy_{t-i} + u_t \qquad (4)$$

where the order p is chosen large enough to ensure the residuals are empirically white noise. Each one of these regressions allows to test if y_t is a pure random walk (2), a random walk with drift (3) or a random walk with drift and linear time trend. We used an automatic data-based order selection.

2) The Phillips and Perron test (PP)

Phillips and Perron (1988) generalized the results of Dickey and Fuller (1979) to the case when u_t is serially correlated and possibly heteroskedastic as well. This test is based on a nonparametric approach with respect to nuisance parameters and allows for a very wide class of time series models in which there is a unit root.

The statistic used is a transformation of test statistic from the regressions (2), (3) and (4) which eliminate the nuisance parameter dependencies asymptotically.

3) The Kwiatkowski, Phillips, Schmidt and Yongcheol test (KPSS)

The KPSS test examines the serie y assuming it can be descomposed into the sum of a deterministic trend (xt), a random walk (r_t) and a stationary error (r_t):

$$y_t = xt + r_t + u_t$$

The test statistic is constructed based on the residuals from a least squares regression of y on a constant (and possibly a linear trend). If we denote the residuals as e_t, and define the partial sum process of the residuals as:

$$S_t = \sum_{t=1}^{T} e_t$$

then the test statistic is given by

$$LM = \sum_{t=1}^{T} S_t^2 / s_u^2$$

where s_u^2 is an estimate of the error variance from the least squares regression.

Kwiatkowski et al. (1992, p. 169) demonstrate that the sizes of the test depend on the sample size and the lag length used in the Newey-West (1987) adjustment (for serial correlation) to the covariance matrix (used to estimate s_u^2) but Septhon (1995) provide critical values based on response surface estimates. We used these critical values.

4) Unit roots with structural change

In performing unit root tests, special care must be taken if it is suspected that a structural change has occurred. Using Perron's test (Perron, 1989), the unit root hypothesis is examined allowing a possible one-time change in the level ("crash model") or in the slope of the trend function ("breaking trend").

As we do not know where is the (possible) structural change we have applied both tests using different hypothesis (structural change at 20% of data, 25% of data, etc., 80% of data) so we will know if we can reject I(1) hypothesis considering a structural change.

References

Box, G.E.P. and Jenkins, G.M. (1976): *Time Series Analysis: Forecasting and Control*. San Francisco: Holden-Day.

Dickey, D.A. and Fuller, W.A. (1979): "Distribution of the estimators for autoregressive time series with a unit root", *Journal of American Statistical Association* 74, 427-431.

Kwiatkowski, D.; Phillips, P.C.B.; Schmidt, P. and Yongcheol, S. (1992): "Testing the null hypothesis of stationary against the alternative of a unit root: how sure are we that economic time series have a unit root?", *Journal of Econometrics* 54, 159-178.

Perron, P. (1989): "The great crash, the oil price shock and the unit root hypothesis", *Econometrica* 57, 1361-1401.

Phillips, P.C.B. and Perron, P. (1988): "Testing for a unit root in time series regression", *Biometrika* 75, 335-346.

Sephton, P.S. (1995): "Response surface estimates of KPSS stationarity test", *Economics Letters* 47, 255-261.

A3.3.2. Results of the tests

a) Unit root tests without structural break

	ADF (lag selection)			PP (k=4)		PP (k=8)		KPSS (a)		KPSS (b)	
	Order	Determ.	Lag	Order	Determ.	Order	Determ.	Order	Determ.	Order	Determ.
v1	I(1)	μ	1	I(1)	μ	I(1)	μ	I(0)	μ	I(0)	τ
v2	I(0)		8	I(1)		I(0)	μ	I(0)	μ	I(0)	τ
v3p	I(0)		8	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v3e	I(1)	μ	2	I(1)	μ	I(0)	μ	I(1)	μ	I(1)	τ
v3m	I(0)	μ	8	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v3b	I(0)		8	I(0)		I(0)		I(0)	μ	I(0)	τ
v4p	I(1)	μ	7	I(1)		I(0)	μ	I(0)	μ	I(0)	τ
v4e	I(1)	μ	6	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v4m	I(0)	μ	6	I(1)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v4b	I(1)	μ	7	I(1)		I(0)	μ	I(0)	μ	I(0)	τ
v5p	I(0)	μ	6	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v5e	I(1)	μ	6	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v5m	I(1)	μ	3	I(1)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v5b	I(1)	μ	3	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v6p	I(0)	μ	6	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v6e	I(1)	μ	7	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v6m	I(1)	μ	6	I(1)	μ	I(1)	μ	I(0)	μ	I(0)	τ
v6b	I(0)	μ	5	I(1)		I(0)	μ	I(0)	μ	I(0)	τ
v7p	I(0)	μ	7	I(0)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v7e	I(1)	τ	4	I(0)	τ	I(0)	τ	I(1)	μ	I(1)	τ
v7m	I(0)	μ	2	I(0)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v7b	I(1)	μ	8	I(0)		I(0)		I(0)	μ	I(0)	τ
v8p	I(1)		8	I(0)	τ	I(0)	τ	I(1)	μ	I(0)	τ
v8e	I(1)	τ	8	I(0)	τ	I(0)	τ	I(1)	μ	I(0)	τ
v8m	I(1)	τ	6	I(1)	μ	I(0)	τ	I(1)	μ	I(0)	τ
v8b	I(0)	τ	3	I(0)	τ	I(1)	τ	I(1)	μ	I(0)	τ
v9p	I(1)	μ	3	I(1)		I(1)	μ	I(0)	μ	I(0)	τ
v9e	I(1)	μ	3	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v9m	I(1)	μ	3	I(1)		I(1)	μ	I(0)	μ	I(0)	τ
v9b	I(1)	μ	3	I(1)		I(1)	μ	I(0)	μ	I(0)	τ
v12	I(1)		6	I(1)		I(1)		I(0)	μ	I(1)	τ
v13pp	I(1)	μ	2	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v13p	I(1)		6	I(1)	τ	I(1)		I(0)	μ	I(1)	τ
v13e	I(1)		8	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v13m	I(1)		0	I(1)		I(1)	τ	I(0)	μ	I(1)	τ
v13mm	I(1)		6	I(1)		I(1)		I(0)	μ	I(1)	τ
v13n	I(1)	τ	5	I(0)	τ	I(1)	τ	I(1)	μ	I(0)	τ
v13b	I(1)		3	I(1)	τ	I(1)		I(0)	μ	I(1)	τ

	ADF (lag selection)			PP (k=4)		PP (k=8)		KPSS (a)		KPSS (b)	
	Order	Determ.	Lag	Order	Determ.	Order	Determ.	Order	Determ.	Order	Determ.
v14pp	I(1)	μ	8	I(1)	μ	I(1)	μ	I(1)	μ	I(0)	τ
v14p	I(1)		5	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v14e	I(1)		8	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v14m	I(1)	μ	0	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v14mm	I(1)		8	I(1)		I(1)		I(0)	μ	I(1)	τ
v14n	I(1)		8	I(0)	τ	I(1)		I(1)	μ	I(1)	τ
v14b	I(1)		0	I(1)		I(0)		I(0)	μ	I(1)	τ
v15pp	I(0)	μ	7	I(1)		I(0)	μ	I(0)	μ	I(0)	τ
v15p	I(1)	μ	6	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v15e	I(1)		3	I(1)		I(1)		I(0)	μ	I(1)	τ
v15m	I(1)	μ	7	I(1)		I(1)		I(0)	μ	I(0)	τ
v15mm	I(1)		6	I(1)		I(1)		I(0)	μ	I(1)	τ
v15n	I(1)	τ	2	I(1)	τ	I(1)		I(1)	μ	I(0)	τ
v15b	I(1)		3	I(1)		I(1)		I(0)	μ	I(1)	τ
v16pp	I(0)	μ	7	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v16p	I(1)	μ	4	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v16e	I(1)		8	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v16m	I(1)	μ	1	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v16mm	I(1)		7	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v16n	I(0)	τ	1	I(0)	τ	I(1)	τ	I(1)	μ	I(0)	τ
v16b	I(1)	μ	4	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v17pp	I(1)	τ	5	I(1)	τ	I(1)	τ	I(0)	μ	I(0)	τ
v17p	I(1)		3	I(1)		I(1)		I(0)	μ	I(1)	τ
v17e	I(1)		5	I(1)		I(1)		I(0)	μ	I(1)	τ
v17m	I(1)		8	I(1)		I(1)		I(0)	μ	I(0)	τ
v17mm	I(1)	μ	8	I(1)		I(1)	μ	I(0)	μ	I(0)	τ
v17n	I(1)	τ	7	I(1)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v17b	I(1)		8	I(1)	τ	I(1)		I(0)	μ	I(1)	τ
v18pp	I(1)	μ	4	I(1)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v18p	I(1)	μ	0	I(1)	μ	I(0)	μ	I(1)	μ	I(0)	τ
v18e	I(1)		2	I(1)		I(1)		I(0)	μ	I(1)	τ
v18m	I(1)	μ	8	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v18mm	I(1)	μ	1	I(1)	μ	I(1)	μ	I(1)	μ	I(0)	τ
v18n	I(1)	τ	7	I(0)	τ	I(0)	τ	I(1)	μ	I(0)	τ
v18b	I(1)		7	I(1)		I(1)	μ	I(0)	μ	I(1)	τ
v19pp	I(1)	μ	8	I(1)		I(1)		I(0)	μ	I(1)	τ
v19p	I(1)	μ	8	I(1)	μ	I(1)	μ	I(0)	μ	I(0)	τ
v19e	I(1)	μ	8	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v19m	I(1)	μ	2	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v19mm	I(1)	μ	6	I(1)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v19n	I(1)		1	I(1)		I(1)		I(1)	μ	I(1)	τ
v19b	I(1)	μ	8	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v20pp	I(1)		8	I(1)		I(1)		I(0)	μ	I(1)	τ
v20e	I(1)		8	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v20mm	I(1)		1	I(1)		I(1)		I(0)	μ	I(1)	τ
v20n	I(1)	τ	3	I(0)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v20b	I(1)		1	I(1)		I(1)		I(0)	μ	I(1)	τ

	ADF (lag selection)			PP (k=4)		PP (k=8)		KPSS (a)		KPSS (b)	
	Order	Determ.	Lag	Order	Determ.	Order	Determ.	Order	Determ.	Order	Determ.
v21pp	I(1)	μ	3	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v21p	I(1)		3	I(1)		I(1)		I(0)	μ	I(1)	τ
v21e	I(1)		1	I(1)		I(1)		I(1)	μ	I(0)	τ
v21m	I(1)	τ	4	I(1)	τ	I(1)	τ	I(0)	μ	I(0)	τ
v21mm	I(1)	μ	2	I(1)	μ	I(1)	τ	I(0)	μ	I(1)	τ
v21n	I(1)		8	I(1)	μ	I(1)		I(1)	μ	I(1)	τ
v21b	I(1)		2	I(1)		I(1)		I(0)	μ	I(1)	τ
v22pp	I(1)	μ	2	I(1)	μ	I(1)	μ	I(1)	μ	I(1)	τ
v22p	I(1)		5	I(1)		I(1)		I(1)	μ	I(1)	τ
v22m	I(1)	μ	2	I(1)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v22mm	I(1)		6	I(1)	τ	I(1)		I(1)	μ	I(1)	τ
v22n	I(1)	τ	2	I(1)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v22b	I(1)	τ	1	I(1)	τ	I(1)	μ	I(1)	μ	I(1)	τ
v23pp	I(1)	μ	4	I(1)	μ	I(1)	μ	I(1)	μ	I(0)	τ
v23p	I(1)	μ	7	I(1)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v23m	I(1)	τ	8	I(1)	τ	I(1)	τ	I(0)	μ	I(1)	τ
v23mm	I(1)		8	I(1)	μ	I(1)		I(1)	μ	I(1)	τ
v23n	I(1)	τ	4	I(1)	τ	I(1)		I(1)	μ	I(1)	τ
v23b	I(1)		7	I(1)		I(1)		I(1)	μ	I(1)	τ
v24pp	I(0)	μ	2	I(0)	μ	I(0)	μ	I(0)	μ	I(0)	τ
v24p	I(1)	τ	4	I(1)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v24e	I(1)	μ	2	I(1)	μ	I(1)		I(1)	μ	I(0)	τ
v24m	I(1)	τ	2	I(1)	τ	I(1)	τ	I(0)	μ	I(1)	τ
v24mm	I(1)	τ	4	I(1)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v24n	I(1)	μ	4	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v24b	I(1)	τ	1	I(1)	τ	I(1)	τ	I(1)	μ	I(1)	τ
v28	I(1)		8	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v29p	I(1)	μ	8	I(0)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v29e	I(0)	τ	5	I(0)	μ	I(0)	τ	I(0)	μ	I(0)	τ
v29m	I(0)	μ	8	I(0)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v29b	I(1)		8	I(0)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v30p	I(1)		5	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v30e	I(1)	μ	6	I(0)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v30m	I(1)		6	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v30b	I(1)		8	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v31p	I(1)		8	I(0)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v31e	I(1)	τ	8	I(0)	τ	I(1)	τ	I(0)	μ	I(0)	τ
v31m	I(1)		8	I(0)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v31b	I(1)		8	I(0)	μ	I(1)		I(0)	μ	I(1)	τ
v32p	I(1)		5	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v32e	I(1)		8	I(0)	μ	I(1)	μ	I(0)	μ	I(1)	τ
v32m	I(1)		8	I(1)	μ	I(1)		I(0)	μ	I(1)	τ
v32b	I(1)		5	I(1)		I(1)		I(0)	μ	I(1)	τ
v33	I(1)		8	I(1)		I(1)		I(1)	μ	I(0)	τ

	ADF (lag selection)			PP (k=4)		PP (k=8)		KPSS (a)		KPSS (b)	
	Order	Determ.	Lag	Order	Determ.	Order	Determ.	Order	Determ.	Order	Determ.
v34p	I(1)		3	I(1)		I(1)		I(1)	μ	I(1)	τ
v34e	I(1)	μ	3	I(1)	μ	I(1)	μ	I(1)	μ	I(1)	τ
v34m	I(1)	μ	2	I(1)	μ	I(0)	μ	I(1)	μ	I(1)	τ
v34b	I(1)	τ	2	I(1)	τ	I(1)	τ	I(0)	μ	I(0)	τ
v35p	I(1)		2	I(1)		I(0)		I(1)	μ	I(1)	τ
v35e	I(1)	μ	1	I(1)	μ	I(1)	μ	I(1)	μ	I(1)	τ
v35m	I(1)		1	I(1)		I(0)		I(1)	μ	I(1)	τ
v35b	I(0)	μ	8	I(0)	μ	I(0)	μ	I(0)	μ	I(1)	τ
v36p	I(1)		4	I(1)	τ	I(1)		I(1)	μ	I(1)	τ
v36e	I(1)	μ	2	I(1)	μ	I(1)	μ	I(1)	μ	I(1)	τ
v36m	I(1)	μ	6	I(1)	μ	I(0)	μ	I(1)	μ	I(1)	τ
v36b	I(1)	τ	7	I(0)		I(0)	τ	I(0)	μ	I(1)	τ
v37p	I(1)		8	I(1)		I(0)		I(1)	μ	I(1)	τ
v37e	I(1)	μ	3	I(1)		I(1)		I(1)	μ	I(1)	τ
v37m	I(1)		6	I(1)		I(1)		I(1)	μ	I(1)	τ
v37b	I(1)		8	I(0)		I(0)		I(0)	μ	I(0)	τ
v38p	I(1)		6	I(1)		I(0)		I(1)	μ	I(1)	τ
v38e	I(1)	μ	0	I(1)	μ	I(1)	μ	I(1)	μ	I(1)	τ
v38m	I(1)		2	I(1)		I(0)		I(1)	μ	I(1)	τ
v38b	I(1)		6	I(0)		I(0)		I(0)	μ	I(0)	τ

b) Unit root tests with structural break

	Crash model (a)		Crash model (b)		Breaking trend (a)		Breaking trend (b)	
	Order	Change	Order	Change	Order	Change	Order	Change
v1	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v2	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	65%
v3p	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	55%
v3e	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v3m	I(0)	70%	I(0)	70%	I(0)	65%	I(0)	65%
v3b	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v4p	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	65%
v4e	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	70%
v4m	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	65%
v4b	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	65%
v5p	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v5e	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v5m	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	70%
v5b	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v6p	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	70%
v6e	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	65%
v6m	I(0)	35%	I(0)	30%	I(0)	70%	I(0)	70%
v6b	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	70%
v7p	I(0)	60%	I(0)	70%	I(0)	60%	I(0)	65%
v7e	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v7m	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v7b	I(0)	60%	I(0)	65%	I(0)	60%	I(0)	65%
v8p	I(1)	30%	I(1)	30%	I(1)	60%	I(1)	60%
v8e	I(0)	45%	I(0)	45%	I(0)	30%	I(0)	30%
v8m	I(0)	70%	I(0)	65%	I(0)	50%	I(0)	65%
v8b	I(0)	70%	I(0)	70%	I(0)	60%	I(0)	60%
v9p	I(1)	60%	I(1)	70%	I(1)	60%	I(1)	70%
v9e	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v9m	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v9b	I(1)	60%	I(1)	65%	I(1)	60%	I(1)	65%
v12	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v13pp	I(1)	70%	I(1)	70%	I(1)	65%	I(1)	65%
v13p	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v13e	I(1)	65%	I(1)	70%	I(1)	65%	I(1)	70%
v13m	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v13mm	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v13n	I(0)	55%	I(0)	55%	I(0)	55%	I(0)	55%
v13b	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%

	Crash model (a)		Crash model (b)		Breaking trend (a)		Breaking trend (b)	
	Order	Change	Order	Change	Order	Change	Order	Change
v14pp	I(1)	65%	I(1)	65%	I(1)	30%	I(1)	65%
v14p	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v14e	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v14m	I(0)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v14mm	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v14n	I(0)	60%	I(1)	55%	I(0)	70%	I(0)	70%
v14b	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v15pp	I(0)	65%	I(0)	70%	I(0)	65%	I(0)	70%
v15p	I(0)	65%	I(1)	65%	I(0)	65%	I(1)	65%
v15e	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v15m	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v15mm	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v15n	I(0)	30%	I(0)	30%	I(0)	65%	I(0)	65%
v15b	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v16pp	I(0)	55%	I(0)	55%	I(0)	45%	I(0)	45%
v16p	I(1)	60%	I(1)	65%	I(1)	65%	I(1)	65%
v16e	I(0)	65%	I(0)	65%	I(0)	55%	I(1)	55%
v16m	I(1)	60%	I(1)	60%	I(1)	60%	I(1)	60%
v16mm	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v16n	I(0)	35%	I(0)	35%	I(0)	65%	I(0)	65%
v16b	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v17pp	I(1)	40%	I(1)	45%	I(1)	40%	I(1)	45%
v17p	I(1)	40%	I(1)	40%	I(1)	40%	I(1)	40%
v17e	I(1)	55%	I(1)	50%	I(1)	45%	I(1)	50%
v17m	I(1)	40%	I(1)	40%	I(1)	70%	I(1)	70%
v17mm	I(0)	40%	I(0)	40%	I(0)	70%	I(0)	70%
v17n	I(0)	55%	I(0)	55%	I(0)	70%	I(0)	70%
v17b	I(1)	40%	I(1)	40%	I(1)	40%	I(1)	45%
v18pp	I(1)	55%	I(1)	55%	I(0)	60%	I(0)	65%
v18p	I(0)	40%	I(0)	45%	I(0)	30%	I(0)	30%
v18e	I(1)	40%	I(1)	40%	I(1)	65%	I(0)	65%
v18m	I(1)	40%	I(1)	45%	I(1)	40%	I(1)	40%
v18mm	I(0)	40%	I(0)	40%	I(0)	40%	I(0)	45%
v18n	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v18b	I(1)	40%	I(1)	40%	I(1)	40%	I(1)	40%
v19pp	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v19p	I(1)	60%	I(1)	65%	I(1)	45%	I(1)	65%
v19e	I(0)	65%	I(0)	65%	I(0)	65%	I(0)	65%
v19m	I(1)	65%	I(1)	55%	I(1)	65%	I(1)	65%
v19mm	I(1)	65%	I(1)	70%	I(1)	45%	I(1)	45%
v19n	I(1)	65%	I(1)	70%	I(1)	70%	I(1)	70%
v19b	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%

	Crash model (a)		Crash model (b)		Breaking trend (a)		Breaking trend (b)	
	Order	Change	Order	Change	Order	Change	Order	Change
v20pp	I(1)	45%	I(1)	35%	I(1)	60%	I(1)	65%
v20e	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v20mm	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v20n	I(0)	40%	I(0)	35%	I(0)	70%	I(0)	70%
v20b	I(1)	60%	I(1)	65%	I(1)	60%	I(1)	65%
v21pp	I(1)	70%	I(1)	70%	I(1)	60%	I(1)	30%
v21p	I(1)	65%	I(1)	70%	I(1)	70%	I(1)	70%
v21e	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v21m	I(1)	65%	I(1)	70%	I(1)	30%	I(1)	30%
v21mm	I(0)	65%	I(1)	65%	I(1)	60%	I(1)	60%
v21n	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v21b	I(1)	65%	I(1)	65%	I(1)	60%	I(1)	60%
v22pp	I(0)	50%	I(0)	50%	I(0)	50%	I(0)	70%
v22p	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v22m	I(0)	40%	I(0)	45%	I(0)	70%	I(0)	70%
v22mm	I(0)	50%	I(0)	50%	I(0)	50%	I(0)	50%
v22n	I(0)	45%	I(0)	45%	I(0)	45%	I(0)	40%
v22b	I(0)	50%	I(0)	50%	I(0)	50%	I(0)	50%
v23pp	I(1)	30%	I(1)	35%	I(1)	65%	I(1)	65%
v23p	I(1)	70%	I(0)	70%	I(1)	70%	I(0)	70%
v23m	I(1)	50%	I(1)	50%	I(1)	70%	I(1)	70%
v23mm	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v23n	I(1)	60%	I(1)	35%	I(1)	60%	I(1)	55%
v23b	I(1)	60%	I(1)	70%	I(1)	60%	I(1)	65%
v24pp	I(0)	35%	I(0)	35%	I(0)	70%	I(0)	70%
v24p	I(1)	40%	I(1)	40%	I(1)	70%	I(1)	60%
v24e	I(1)	40%	I(1)	40%	I(1)	40%	I(1)	70%
v24m	I(1)	35%	I(1)	40%	I(1)	40%	I(1)	50%
v24mm	I(1)	40%	I(1)	40%	I(1)	50%	I(1)	70%
v24n	I(1)	40%	I(1)	40%	I(1)	70%	I(1)	60%
v24b	I(1)	35%	I(1)	35%	I(1)	40%	I(1)	40%
v28	I(1)	70%	I(1)	70%	I(1)	65%	I(1)	70%
v29p	I(0)	70%	I(1)	70%	I(0)	70%	I(1)	70%
v29e	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v29m	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v29b	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v30p	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v30e	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v30m	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v30b	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v31p	I(1)	65%	I(1)	70%	I(1)	65%	I(1)	70%
v31e	I(1)	60%	I(1)	70%	I(1)	60%	I(1)	70%
v31m	I(1)	70%	I(1)	70%	I(1)	65%	I(1)	70%
v31b	I(1)	70%	I(1)	70%	I(1)	65%	I(1)	70%

	Crash model (a)		Crash model (b)		Breaking trend (a)		Breaking trend (b)	
	Order	Change	Order	Change	Order	Change	Order	Change
v32p	I(1)	35%	I(1)	70%	I(1)	70%	I(1)	70%
v32e	I(0)	45%	I(0)	45%	I(0)	45%	I(0)	45%
v32m	I(1)	65%	I(1)	65%	I(1)	65%	I(1)	65%
v32b	I(1)	70%	I(1)	65%	I(1)	65%	I(1)	65%
v33	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v34p	I(0)	70%	I(0)	70%	I(0)	70%	I(0)	70%
v34e	I(0)	55%	I(0)	60%	I(0)	65%	I(0)	60%
v34m	I(0)	55%	I(0)	60%	I(1)	55%	I(0)	60%
v34b	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%
v35p	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v35e	I(0)	55%	I(0)	60%	I(0)	55%	I(0)	60%
v35m	I(0)	55%	I(0)	60%	I(0)	60%	I(0)	60%
v35b	I(0)	35%	I(0)	40%	I(0)	35%	I(0)	40%
v36p	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v36e	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v36m	I(0)	55%	I(0)	60%	I(0)	55%	I(0)	60%
v36b	I(0)	70%	I(0)	45%	I(1)	70%	I(1)	70%
v37p	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v37e	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v37m	I(0)	55%	I(0)	60%	I(0)	55%	I(0)	60%
v37b	I(1)	70%	I(1)	65%	I(1)	70%	I(1)	65%
v38p	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v38e	I(0)	60%	I(0)	60%	I(0)	60%	I(0)	60%
v38m	I(0)	55%	I(0)	60%	I(0)	60%	I(0)	60%
v38b	I(1)	70%	I(1)	70%	I(1)	70%	I(1)	70%

ANNEX 4. Detailed results of the forecast competition[11]

A4.1. RMSE for AR Models

AR	1 month	2 months	3 months	6 months	12 months
v1	0.45	0.77	1.02	1.51	1.52
v2	2.03	3.97	5.43	7.99	4.68
v3p	2.37	2.38	3.08	3.05	3.70
v3e	1.69	2.27	2.62	3.35	3.43
v3m	2.34	2.85	3.88	5.37	5.64
v3b	4.43	4.68	6.35	7.13	7.34
v4p	1.02	1.18	1.44	2.40	1.86
v4e	1.71	2.44	2.85	3.21	4.29
v4m	2.22	3.36	4.79	6.57	7.25
v4b	3.04	4.16	5.90	8.01	7.49
v5p	1.22	1.54	1.94	2.46	2.35
v5e	1.59	2.12	2.71	3.64	4.87
v5m	1.55	2.74	3.85	6.46	6.71
v5b	2.05	3.53	4.79	8.02	5.16
v6p	1.22	1.69	2.07	3.00	3.25
v6e	1.18	1.36	1.68	2.45	3.09
v6m	0.47	0.70	0.85	1.21	1.46
v6b	1.34	1.93	2.22	3.34	3.00
v7p	1.82	2.50	3.18	3.59	2.68
v7e	2.14	2.35	2.71	3.12	2.48
v7m	2.36	3.74	4.82	6.13	3.61
v7b	3.69	5.79	7.60	9.57	5.53
v8p	1.80	2.91	3.65	4.30	4.14
v8e	2.19	3.28	3.87	4.10	4.65
v8m	2.17	2.84	3.41	4.01	3.20
v8b	2.92	3.77	4.87	6.07	4.90
v9p	1.14	1.56	1.93	3.36	4.97
v9e	1.14	1.73	2.19	3.13	1.25
v9m	1.64	2.32	2.97	5.53	5.21
v9b	2.36	3.23	4.16	8.12	8.55
v12	1.68	2.71	3.65	5.49	3.77
v13pp	0.21	0.25	0.30	0.28	0.37
v13p	0.47	0.72	0.98	1.72	3.12
v13e	1.13	1.84	2.35	3.95	5.25
v13m	1.14	1.79	2.29	4.29	7.29
v13mm	0.45	0.66	0.87	1.48	2.24
v13n	0.18	0.23	0.26	0.32	0.39
v13b	1.05	1.78	2.50	4.63	8.27

[11] Tables only include the results for the RMSE for qualitative variables as we think that other statistics such as MAPE are not appropriate for this kind of variables as they can take near-to-zero values. However, results for MAPE have been also calculated and can be provided if requested.

AR	1 month	2 months	3 months	6 months	12 months
v14pp	0.29	0.31	0.29	0.25	0.28
v14p	0.67	0.84	0.99	1.37	2.16
v14e	1.00	1.17	1.31	1.71	2.44
v14m	0.80	1.14	1.30	1.66	1.46
v14mm	0.26	0.34	0.38	0.49	0.50
v14n	0.35	0.51	0.65	0.93	1.22
v14b	0.85	1.25	1.54	2.04	2.67
v15pp	0.31	0.36	0.47	0.80	1.17
v15p	1.31	1.80	2.22	3.79	4.88
v15e	1.53	2.39	2.84	4.93	8.95
v15m	1.48	2.05	2.60	4.43	7.82
v15mm	1.50	2.14	2.71	4.55	6.70
v15n	0.31	0.37	0.44	0.63	0.84
v15b	2.19	3.01	3.77	6.49	9.34
v16pp	0.20	0.27	0.30	0.31	0.35
v16p	1.60	2.20	2.84	3.69	2.40
v16e	1.76	2.91	3.76	5.91	5.06
v16m	2.22	3.49	4.57	6.45	3.79
v16mm	0.97	1.58	1.98	2.35	1.46
v16n	0.67	0.80	0.84	1.00	1.13
v16b	2.85	4.49	5.73	7.26	4.10
v17pp	3.22	5.60	8.00	11.96	15.81
v17p	0.97	0.77	0.85	0.85	1.32
v17e	1.76	3.07	4.28	7.22	9.27
v17m	1.69	2.66	3.36	4.65	6.91
v17mm	0.38	0.51	0.53	0.50	0.73
v17n	0.30	0.49	0.63	0.87	1.10
v17b	3.48	6.25	8.57	13.48	17.69
v18pp	2.37	3.68	4.53	6.56	7.14
v18p	2.06	2.70	2.93	4.26	6.97
v18e	1.45	2.23	2.97	5.02	7.45
v18m	2.37	3.60	4.04	6.07	9.42
v18mm	0.32	0.45	0.54	0.70	0.92
v18n	0.57	0.75	0.91	1.24	1.47
v18b	4.32	6.67	7.92	12.55	18.83
v19pp	1.71	2.70	3.66	5.87	4.21
v19p	2.63	4.10	5.32	9.55	9.56
v19e	2.26	3.69	4.93	7.68	6.16
v19m	1.76	2.91	3.90	6.93	7.23
v19mm	0.19	0.23	0.27	0.40	0.50
v19n	0.41	0.60	0.68	0.86	0.74
v19b	3.44	5.47	7.50	13.70	11.70
v20pp	1.55	2.28	2.77	4.03	6.30
v20e	1.05	1.51	1.74	1.86	2.46
v20mm	1.56	2.13	2.79	4.83	8.57
v20n	1.02	1.23	1.32	1.70	2.48
v20b	2.95	4.22	5.25	8.53	14.14

AR	1 month	2 months	3 months	6 months	12 months
V21pp	0.14	0.17	0.19	0.21	0.28
v21p	0.42	0.44	0.47	0.54	0.66
v21e	1.16	1.13	1.10	1.06	1.28
v21m	0.79	1.01	1.16	1.60	2.33
v21mm	0.69	0.79	0.86	1.06	1.43
v21n	0.58	0.71	0.77	1.00	1.43
v21b	0.77	1.08	1.36	1.85	2.99
v22pp	0.96	1.01	1.06	1.06	1.28
v22p	0.80	0.79	0.92	0.79	0.99
v22m	0.59	0.79	0.85	0.99	1.18
v22mm	0.75	1.02	1.09	1.04	1.42
v22n	0.34	0.49	0.59	0.98	1.57
v22b	1.71	2.08	2.07	1.90	1.96
v23pp	0.70	0.77	0.98	1.05	1.07
v23p	0.79	0.99	1.06	1.31	1.37
v23m	1.10	1.41	1.76	2.63	3.66
v23mm	1.20	1.58	1.59	1.95	2.39
v23n	0.31	0.41	0.49	0.77	1.29
v23b	1.93	2.51	2.92	3.18	5.10
v24pp	0.29	0.37	0.41	0.47	0.56
v24p	1.02	1.63	2.14	3.67	6.14
v24e	0.90	1.24	1.42	1.55	2.21
v24m	1.19	1.93	2.56	4.14	6.52
v24mm	0.31	0.50	0.62	0.94	1.26
v24n	0.34	0.41	0.48	0.56	0.60
v24b	1.19	1.91	2.54	4.42	7.63
v28	2.01	2.36	2.38	2.97	2.59
v29p	2.57	2.96	3.37	3.40	4.28
v29e	3.20	3.70	4.03	4.80	5.78
v29m	2.41	3.07	3.27	3.61	3.57
v29b	3.66	4.61	5.09	5.28	6.31
v30p	1.60	2.09	2.38	1.86	2.47
v30e	1.84	2.26	2.88	3.69	3.97
v30m	1.40	1.85	2.06	3.11	4.83
v30b	2.25	2.78	3.06	3.01	4.95
v31p	1.84	2.26	2.42	3.26	3.30
v31e	2.83	3.72	4.05	4.86	5.84
v31m	2.31	2.91	3.21	4.01	4.77
v31b	3.25	3.37	3.82	4.56	3.39
v32p	2.88	2.71	3.30	3.54	3.59
v32e	3.30	3.18	3.60	3.34	4.04
v32m	2.03	2.37	2.62	3.09	2.22
v32b	3.50	4.26	5.67	6.87	4.11
v33	2.59	3.08	3.32	4.68	8.04
v34p	2.66	3.42	3.43	4.28	7.13
v34e	3.22	3.73	4.02	4.55	5.86
v34m	3.18	3.65	3.90	5.40	7.97
v34b	5.19	6.30	6.22	8.61	13.88

AR	1 month	2 months	3 months	6 months	12 months
v35p	2.17	2.30	2.77	2.52	2.40
v35e	2.01	2.10	2.54	1.99	2.11
v35m	0.68	0.91	0.95	0.58	0.60
v35b	2.32	2.40	2.53	2.44	2.83
v36p	2.75	3.52	3.81	4.26	3.13
v36e	2.81	3.57	3.94	4.47	4.67
v36m	1.70	1.95	1.97	2.81	4.46
v36b	3.83	5.03	5.62	6.95	8.40
v37p	2.39	2.37	2.44	2.07	2.93
v37e	3.03	3.06	3.43	3.41	5.31
v37m	2.11	1.99	2.49	2.84	4.91
v37b	3.89	4.17	4.82	6.56	10.55
v38p	2.48	2.70	2.49	2.14	2.23
v38e	2.55	3.04	3.11	3.65	4.38
v38m	2.19	2.88	2.79	3.07	4.14
v38b	3.87	4.35	4.39	4.82	4.92
v39	5.44	10.31	15.51	26.48	43.33
v40p	4.90	7.32	8.85	12.76	22.16
v40e	4.58	5.18	5.07	5.59	6.97
v40m	3.42	6.24	8.84	14.11	16.65
v40b	7.32	12.49	16.72	23.86	30.56
v41p	4.99	7.41	9.27	12.27	16.81
v41e	4.64	6.36	7.55	7.93	8.77
v41m	3.99	6.15	8.17	9.29	10.85
v41b	8.35	12.86	16.40	21.82	28.00
v42p	4.59	7.88	11.00	14.88	13.12
v42e	3.28	4.67	5.58	9.91	12.64
v42m	4.32	7.55	9.93	11.08	9.57
v42b	8.37	15.60	24.13	37.94	97.93
v43p	3.52	5.17	6.97	9.55	16.76
v43e	3.63	4.82	6.04	6.81	10.79
v43m	1.76	2.55	3.23	4.15	3.82
v43b	4.69	7.09	9.90	13.64	16.54
v44p	3.54	5.97	8.23	10.73	12.43
v44e	2.17	2.80	3.24	3.87	5.71
v44m	1.95	3.10	4.32	5.86	4.12
v44b	5.00	8.70	12.88	18.30	17.33

AR	1 quarter	2 quarters	4 quarters
v10p	3.55	3.69	5.99
v10e	3.36	3.81	3.55
v10m	4.30	6.37	6.85
v10b	7.22	8.73	10.30
v11p	3.53	4.58	3.61
v11e	2.87	3.23	3.39
v11m	4.31	5.94	5.69
v11b	7.13	9.63	7.95
v25pp	0.73	0.56	0.85
v25p	0.90	0.76	0.77
v25m	0.70	1.11	1.76
v25mm	0.93	1.00	1.13
v25n	0.47	0.55	0.98
v25b	1.69	1.98	2.62
v26pp	0.50	0.42	0.41
v26p	0.85	0.39	0.52
v26m	0.52	0.80	0.92
v26mm	1.36	1.07	1.43
v26n	0.24	0.34	0.61
v26b	2.21	1.63	2.19
v27pp	0.60	0.72	0.57
v27p	0.55	0.66	0.54
v27m	0.92	1.41	1.92
v27mm	1.45	1.60	1.66
v27n	1.03	0.96	1.71
v27b	2.00	2.54	3.86

A4.2. RMSE for ARIMA Models

ARIMA	1 month	2 months	3 months	6 months	12 months
v1	1.92	3.21	4.36	7.27	6.25
v2	10.54	21.70	29.85	40.20	39.19
v3p	12.35	13.03	14.33	17.42	19.66
v3e	9.36	12.02	13.37	16.92	13.93
v3m	15.51	19.19	23.62	31.14	31.74
v3b	26.03	30.10	36.01	46.12	49.73
v4p	6.12	7.87	9.77	16.43	19.83
v4e	7.60	10.63	12.65	14.82	21.27
v4m	9.00	13.66	19.81	27.96	37.54
v4b	13.12	18.28	26.13	40.11	52.38
v5p	6.42	8.52	11.31	17.55	19.24
v5e	8.03	10.88	13.42	17.06	17.49
v5m	7.65	13.94	19.77	32.46	32.23
v5b	10.57	18.67	26.05	45.35	44.58
v6p	6.15	9.05	11.14	17.26	20.30
v6e	5.96	6.97	8.52	11.86	14.02
v6m	2.18	2.99	3.22	4.46	3.32
v6b	6.52	9.63	10.78	14.72	17.79
v7p	13.19	20.67	23.85	26.49	11.66
v7e	10.22	11.56	13.03	14.22	9.49
v7m	14.52	25.25	31.12	36.80	21.57
v7b	23.63	41.18	51.68	56.12	30.07
v8p	9.94	14.63	18.96	24.44	19.64
v8e	11.20	17.90	21.30	24.53	23.06
v8m	9.24	10.89	12.85	15.60	15.51
v8b	13.90	16.87	21.79	33.52	43.23
v9p	4.89	6.81	8.54	14.80	17.38
v9e	5.66	8.48	10.71	14.86	10.27
v9m	9.49	13.89	17.49	27.15	30.27
v9b	14.48	20.68	26.08	42.54	51.07
v12	9.13	13.57	18.02	30.84	25.56
v13pp	1.19	1.36	1.51	2.14	2.96
v13p	2.07	2.75	3.82	5.95	11.04
v13e	6.77	10.26	12.68	20.46	24.09
v13m	5.61	8.34	10.60	18.99	28.56
v13mm	2.34	3.21	3.87	6.80	10.68
v13n	0.80	0.90	0.94	1.05	1.12
v13b	4.90	7.93	11.12	19.54	32.15

ARIMA	1 month	2 months	3 months	6 months	12 months
v14pp	1.39	1.46	1.43	1.47	2.12
v14p	3.55	4.33	4.98	7.14	10.55
v14e	4.89	5.23	5.44	5.68	5.83
v14m	4.24	5.83	6.34	7.33	7.76
v14mm	1.36	1.71	1.81	2.31	2.81
v14n	1.54	1.68	1.74	1.99	2.05
v14b	4.20	6.13	7.43	9.55	12.86
v15pp	1.56	1.51	1.74	3.15	4.43
v15p	6.41	9.50	12.33	20.89	24.80
v15e	7.29	11.48	13.54	23.00	35.53
v15m	8.35	11.51	14.79	24.67	38.63
v15mm	7.05	9.46	11.94	20.37	32.56
v15n	1.42	1.62	1.87	2.61	2.96
v15b	12.05	16.40	21.43	40.53	62.18
v16pp	1.02	1.19	1.29	1.17	0.96
v16p	8.67	12.19	16.02	21.66	11.55
v16e	8.33	13.89	18.25	28.19	22.16
v16m	10.92	18.39	24.53	36.72	24.51
v16mm	4.76	7.81	10.11	12.57	5.59
v16n	3.07	3.44	3.18	3.17	2.64
v16b	13.56	21.58	28.01	38.85	21.71
v17pp	9.76	14.67	17.86	20.18	21.00
v17p	5.12	5.45	5.94	8.83	12.26
v17e	7.60	10.76	12.68	14.99	13.75
v17m	8.85	11.00	12.66	15.43	18.67
v17mm	1.75	2.08	2.47	2.71	3.44
v17n	1.02	1.02	1.04	1.15	1.45
v17b	16.33	23.26	27.60	35.36	40.83
v18pp	8.89	11.58	12.36	15.12	16.81
v18p	9.39	8.84	8.69	9.76	12.30
v18e	3.81	4.45	4.44	3.77	3.75
v18m	9.11	10.03	11.13	14.25	17.66
v18mm	1.71	1.59	1.74	1.91	2.69
v18n	2.14	2.38	2.53	2.72	2.71
v18b	16.71	18.09	17.65	20.93	31.50
v19pp	7.89	12.40	16.95	27.18	19.41
v19p	12.79	21.01	26.83	44.55	42.69
v19e	10.35	16.07	21.30	33.98	21.07
v19m	9.40	14.95	20.50	35.13	36.95
v19mm	1.60	2.08	2.23	3.46	4.06
v19n	2.16	2.89	3.26	3.97	2.73
v19b	17.12	27.79	38.48	65.57	53.00
v20pp	7.65	11.66	13.96	19.98	28.76
v20e	4.97	6.74	7.48	6.89	6.66
v20mm	8.27	11.35	14.30	23.81	38.76
v20n	4.93	5.59	5.91	7.11	8.84
v20b	13.87	19.53	24.10	40.22	66.40

ARIMA	1 month	2 months	3 months	6 months	12 months
v21pp	0.90	1.12	1.24	1.39	1.79
v21p	2.80	3.00	3.47	4.30	5.00
v21e	5.63	5.74	5.68	5.90	4.67
v21m	4.11	4.55	4.53	5.44	7.22
v21mm	3.66	4.36	4.90	5.55	5.83
v21n	3.61	4.18	4.81	6.43	9.01
v21b	4.02	5.41	5.96	7.00	11.53
v22pp	4.12	4.31	5.39	6.01	6.81
v22p	4.34	4.65	5.02	5.29	5.52
v22m	3.22	3.80	3.93	4.85	6.09
v22mm	3.71	4.66	4.62	3.96	3.00
v22n	1.70	1.83	1.83	2.23	1.64
v22b	7.72	9.43	10.11	11.14	11.71
v23pp	3.84	4.14	4.83	5.48	7.17
v23p	4.37	5.25	5.68	7.16	7.66
v23m	4.69	5.42	5.94	8.81	13.03
v23mm	6.57	8.19	8.33	9.50	8.27
v23n	1.40	1.58	1.73	2.05	3.13
v23b	10.53	13.21	15.20	18.74	24.58
v24pp	1.55	1.84	1.98	2.18	2.19
v24p	5.43	7.03	8.44	11.76	13.96
v24e	4.57	5.51	6.03	7.02	11.45
v24m	5.78	7.64	9.66	13.57	21.29
v24mm	1.18	1.41	1.34	1.68	2.39
v24n	1.65	1.84	2.09	2.76	3.41
v24b	6.54	8.87	10.63	15.50	20.92
v28	15.82	26.90	36.08	50.42	44.52
v29p	20.13	22.68	26.65	30.55	27.06
v29e	17.20	20.57	22.86	23.45	17.92
v29m	24.70	34.61	36.04	31.10	31.88
v29b	36.46	52.93	57.38	67.61	52.59
v30p	7.60	10.04	12.05	13.45	18.95
v30e	8.62	11.42	15.50	19.38	21.80
v30m	7.71	12.82	17.88	29.90	36.68
v30b	13.53	21.88	28.99	41.03	51.76
v31p	11.69	15.37	19.34	23.66	17.28
v31e	15.25	23.41	26.54	28.30	21.87
v31m	15.47	23.87	25.64	30.61	27.54
v31b	24.86	38.43	46.51	52.88	42.73
v32p	16.30	15.83	15.36	19.26	21.72
v32e	16.78	18.05	20.54	23.43	8.98
v32m	8.17	13.57	17.58	21.97	15.34
v32b	19.89	23.28	24.70	31.79	43.47
v33	12.05	14.40	15.64	21.17	31.50
v34p	13.66	16.16	16.01	12.59	16.37
v34e	15.06	18.68	20.31	23.21	28.32
v34m	16.49	18.88	20.55	28.24	42.72
v34b	26.11	30.95	29.21	40.27	55.78

ARIMA	1 month	2 months	3 months	6 months	12 months
v35p	10.63	11.17	12.87	12.06	14.03
v35e	10.59	11.26	13.67	13.55	19.47
v35m	3.87	5.20	5.86	6.13	8.27
v35b	10.82	11.10	11.20	9.72	9.99
v36p	11.18	13.14	13.52	14.14	11.49
v36e	13.73	17.66	20.40	24.44	29.08
v36m	8.88	10.95	12.32	17.03	27.73
v36b	16.44	21.44	23.32	26.19	33.52
v37p	13.43	13.26	13.06	10.04	7.60
v37e	16.15	15.30	18.07	21.36	34.40
v37m	10.12	9.97	13.13	18.64	30.34
v37b	18.11	19.44	20.62	25.42	35.81
v38p	12.13	13.73	12.38	10.58	9.64
v38e	14.22	16.22	16.87	22.44	29.64
v38m	10.44	14.22	14.47	18.30	24.29
v38b	16.55	19.50	19.15	22.40	27.28
v39	22.17	38.48	53.52	76.93	74.57
v40p	17.53	25.63	32.14	43.14	58.81
v40e	18.69	18.49	16.86	15.50	19.29
v40m	14.35	23.11	29.51	39.74	37.28
v40b	28.38	45.86	59.58	83.92	92.01
v41p	13.89	19.07	25.48	38.23	50.92
v41e	15.55	18.87	21.29	18.91	14.61
v41m	14.00	19.54	25.74	31.29	40.66
v41b	25.59	37.96	48.61	69.12	91.46
v42p	18.03	27.52	34.17	37.72	29.17
v42e	13.50	15.48	14.81	19.22	23.92
v42m	15.71	24.23	30.44	31.82	21.31
v42b	30.50	48.83	64.80	81.31	45.87
v43p	14.54	19.33	25.32	27.44	37.60
v43e	14.42	17.91	22.41	23.82	22.15
v43m	8.69	12.91	16.47	19.50	14.10
v43b	17.80	27.37	36.70	43.44	49.21
v44p	13.18	18.29	24.71	30.56	26.55
v44e	10.92	12.66	14.40	15.27	17.50
v44m	9.08	14.03	19.88	29.26	16.77
v44b	19.03	32.05	45.90	56.95	56.56

ARIMA	1 quarter	2 quarters	4 quarters
v10p	14.14	15.46	19.17
v10e	9.74	10.28	7.13
v10m	14.75	24.30	25.15
v10b	30.74	37.78	40.24
v11p	10.42	15.17	12.43
v11e	9.06	9.99	8.14
v11m	14.35	19.67	19.57
v11b	22.06	36.79	34.97
v25pp	2.00	1.74	2.43
v25p	2.62	2.65	2.46
v25m	1.57	2.00	2.90
v25mm	2.43	2.36	2.61
v25n	0.71	0.51	0.91
v25b	4.29	4.84	6.48
v26pp	1.40	1.38	1.59
v26p	2.83	1.98	2.38
v26m	1.45	2.29	2.29
v26mm	3.71	2.87	4.02
v26n	0.57	0.52	0.71
v26b	6.89	6.12	6.00
v27pp	1.96	2.44	2.50
v27p	1.48	2.05	2.27
v27m	3.00	4.10	5.08
v27mm	4.66	5.27	4.48
v27n	3.08	2.15	3.56
v27b	5.21	6.31	8.07

A4.3. RMSE for TAR Models

TAR	1 month	2 months	3 months	6 months	12 months
v1	4.65	7.14	9.33	15.07	20.51
v2	21.88	31.29	39.02	61.76	95.72
v3p	25.22	38.88	49.71	90.69	160.06
v3e	14.34	17.64	21.94	33.92	48.17
v3m	22.65	34.68	44.82	76.65	118.73
v3b	40.10	59.33	70.03	124.82	196.34
v4p	10.37	15.11	20.77	38.64	65.42
v4e	12.51	17.01	21.48	34.10	52.45
v4m	13.16	19.73	25.30	39.41	57.52
v4b	19.27	26.78	34.66	55.67	88.95
v5p	11.64	16.52	22.82	43.71	73.14
v5e	10.92	14.78	17.86	25.90	35.59
v5m	12.55	18.29	24.14	41.51	58.72
v5b	18.87	25.91	33.96	56.59	84.83
v6p	9.25	13.04	17.28	27.76	41.75
v6e	8.44	11.82	15.24	22.15	25.23
v6m	4.87	7.64	10.11	16.63	24.58
v6b	11.40	16.88	23.43	42.52	71.80
v7p	23.90	33.15	39.41	56.39	73.82
v7e	13.42	18.17	21.37	29.73	36.57
v7m	27.39	38.54	46.84	79.34	150.72
v7b	53.35	76.48	91.33	123.58	132.23
v8p	21.62	35.22	51.31	107.01	220.95
v8e	21.94	25.12	24.25	25.15	22.37
v8m	11.84	15.55	18.68	28.10	38.62
v8b	23.19	35.68	52.99	115.36	225.11
v12	14.31	18.75	23.70	39.32	47.02
v13pp	1.69	2.38	3.05	5.19	8.10
v13p	5.10	8.00	10.70	17.04	25.94
v13e	10.37	14.31	18.71	27.46	34.26
v13m	6.48	7.49	9.01	12.76	13.69
v13mm	2.77	3.37	4.05	5.84	8.64
v13n	1.66	2.96	4.65	11.80	38.46
v13b	6.42	7.63	9.56	13.68	19.56
v14pp	1.92	2.29	2.72	3.93	6.04
v14p	5.99	8.85	11.52	19.29	29.71
v14e	5.74	6.75	7.15	8.32	6.55
v14m	5.43	7.22	9.25	14.57	23.07

TAR	1 month	2 months	3 months	6 months	12 months
v14mm	1.74	2.19	2.79	5.10	9.86
v14n	2.70	4.46	6.46	12.99	22.59
v14b	6.49	8.82	10.92	19.10	27.08
v15pp	2.89	4.52	6.41	11.75	22.96
v15p	13.14	21.25	29.84	55.15	93.27
v15e	14.02	18.72	24.27	38.70	54.63
v15m	9.35	9.54	9.65	11.58	9.55
v15mm	9.12	9.20	10.04	15.46	28.89
v15n	2.27	3.32	4.59	8.16	13.38
v15b	15.58	14.16	15.25	18.55	25.01
v16pp	1.88	2.75	3.48	5.89	11.90
v16p	15.47	23.40	29.99	47.88	68.45
v16e	14.41	20.01	24.42	32.99	32.27
v16m	16.85	22.16	26.25	33.46	27.08
v16mm	7.07	10.89	14.49	27.87	55.54
v16n	5.02	6.63	8.18	13.26	16.21
v16b	21.90	31.51	39.43	63.44	87.00
v17pp	20.96	31.08	39.24	53.26	127.39
v17p	6.53	6.72	10.13	15.85	24.82
v17e	11.57	15.55	19.43	30.21	42.48
v17m	15.64	20.74	28.44	45.41	68.23
v17mm	3.71	5.78	9.49	21.95	57.39
v17n	1.28	1.65	2.09	3.29	4.43
v17b	28.64	37.28	46.35	46.40	61.82
v18pp	50.80	187.29	555.23	9840.45	2.32E+06
v18p	10.07	12.42	16.90	23.70	33.81
v18e	6.13	9.35	12.19	20.82	33.11
v18m	12.85	16.31	21.23	34.23	50.86
v18mm	2.29	3.42	4.88	8.91	17.72
v18n	4.85	5.22	5.36	7.35	9.16
v18b	18.89	17.10	19.44	20.43	25.51
v19pp	13.88	18.50	23.30	35.85	42.97
v19p	15.97	20.06	24.47	32.39	29.84
v19e	17.89	24.63	30.29	43.37	45.46
v19m	19.72	31.73	44.74	85.46	149.35
v19mm	5.55	7.06	6.42	12.85	17.13
v19n	4.88	8.88	12.77	23.75	48.47
v19b	27.51	38.73	48.87	78.19	107.20
v20pp	13.28	17.97	22.60	35.83	59.74
v20e	9.24	12.82	16.35	27.18	38.89
v20mm	9.35	10.28	11.89	15.37	17.52
v20n	157.70	2253.14	31261.98	3.96E+06	1.67E+10
v20b	3.76	4.62	5.59	10.23	16.79
v21pp	1.73	2.59	3.33	5.52	8.77
v21p	4.96	5.54	7.64	10.78	17.36
v21e	8.20	9.93	11.73	19.29	28.95
v21m	4.12	4.66	4.84	4.40	2.64

TAR	1 month	2 months	3 months	6 months	12 months
v21mm	3.61	4.35	5.25	8.71	12.73
v21n	17.65	21.70	22.74	57.95	137.26
v21b	3.77	4.70	5.52	10.15	16.86
v22pp	6.66	9.30	11.52	18.43	27.44
v22p	4.85	5.21	5.37	6.83	8.30
v22m	4.79	5.42	5.99	8.11	8.25
v22mm	5.62	6.83	8.33	12.87	22.54
v22n	2.58	3.51	4.18	6.76	11.05
v22b	11.94	15.75	18.93	27.86	38.12
v23pp	5.04	6.96	8.26	11.29	14.31
v23p	6.84	9.27	11.35	17.61	26.60
v23m	4.67	5.02	5.38	5.98	4.49
v23mm	8.74	10.42	12.15	17.21	25.70
v23n	3.07	4.47	5.69	10.24	17.91
v23b	14.57	18.77	24.52	34.50	47.00
v24pp	2.03	2.87	3.75	5.67	6.74
v24p	9.20	10.90	19.12	26.48	66.09
v24e	5.44	5.64	5.54	4.23	5.10
v24m	11.99	13.06	15.32	22.46	31.05
v24mm	2.42	2.65	2.69	4.55	6.92
v24n	8.08	13.34	29.97	129.28	5467.90
v24b	9.18	12.44	15.85	24.63	36.63
v28	26.32	38.53	50.42	73.45	100.06
v29p	38.51	59.61	73.36	98.58	82.83
v29e	24.84	25.56	25.15	20.25	20.77
v29m	51.21	84.09	117.53	180.36	260.23
v29b	84.10	124.19	158.52	213.41	187.32
v30p	13.62	21.77	30.09	55.19	108.81
v30e	15.61	24.74	32.40	51.06	73.43
v30m	14.87	23.07	31.56	52.14	67.33
v30b	23.00	34.94	46.71	71.41	86.76
v31p	20.18	33.03	47.34	89.24	134.48
v31e	27.17	36.41	44.43	58.19	73.95
v31m	32.75	51.88	67.19	109.73	170.23
v31b	44.74	65.57	87.94	133.35	142.40
v32p	23.07	34.68	49.79	91.70	182.20
v32e	20.14	25.10	31.18	40.21	45.79
v32m	15.94	24.27	31.85	59.70	109.75
v32b	31.48	46.71	63.06	102.21	164.88
v33	17.73	24.04	26.92	39.67	59.06
v34p	21.02	31.05	40.68	65.64	107.85
v34e	24.99	40.68	55.07	80.47	93.67
v34m	22.65	31.81	39.48	64.78	94.58
v34b	35.41	42.06	47.01	68.33	108.36
v35p	11.52	15.03	16.76	21.27	28.22
v35e	627.18	590.34	577.78	1831.90	3946.90
v35m	4.42	4.67	4.34	3.93	3.84
v35b	16.98	24.86	30.22	38.99	41.97

TAR	1 month	2 months	3 months	6 months	12 months
v36p	18.35	24.70	33.22	49.31	70.73
v36e	28.47	40.91	43.50	52.61	54.11
v36m	11.97	12.58	13.22	20.97	30.32
v36b	26.27	26.99	35.67	49.17	66.25
v37p	19.08	26.99	33.98	51.15	76.78
v37e	23.87	23.95	22.75	26.56	25.94
v37m	11.61	15.39	18.04	28.31	41.97
v37b	28.54	41.13	54.78	73.82	108.02
v38p	12.73	11.17	10.71	10.76	11.99
v38e	38.69	37.49	36.76	45.28	41.98
v38m	13.34	12.07	11.33	12.98	13.59
v38b	29.45	31.53	35.68	50.05	65.24
v39	56.92	76.78	86.97	126.94	182.96
v40p	26.56	35.00	46.06	54.18	73.18
v40e	20.07	24.37	24.39	33.80	35.16
v40m	46.91	144.31	342.08	1750.91	22235.30
v40b	53.28	73.03	89.52	100.05	123.66
v41p	38.36	48.37	50.91	82.75	106.95
v41e	16.63	19.08	20.93	20.21	22.22
v41m	45.82	188.95	199.86	407.01	217.37
v41b	69.11	89.18	96.85	147.36	208.36
v42p	29.61	38.20	45.56	56.03	56.71
v42e	10.56	10.54	9.63	7.27	9.67
v42m	60.03	325.48	328.33	199.14	140.34
v42b	50.93	66.42	78.70	90.19	80.17
v43p	55.17	61.41	62.70	84.71	91.66
v43e	15.79	25.80	35.55	51.08	25.63
v43m	11.93	15.18	16.95	18.37	8.94
v43b	45.65	81.63	118.92	156.90	93.16
v44p	24.87	38.13	48.22	55.66	63.73
v44e	19.02	19.90	21.95	20.18	22.29
v44m	13.62	17.82	21.55	23.26	8.39
v44b	54.14	71.39	77.33	80.38	73.35

TAR	1 quarter	2 quarters	4 quarters
v10p	24.60	22.03	38.52
v10e	13.29	16.84	26.84
v10m	22.79	30.86	36.30
v10b	46.17	61.59	67.32
v11p	18.72	22.42	31.76
v11e	11.48	12.33	13.07
v11m	22.33	31.08	33.66
v11b	40.47	44.85	39.48
v25pp	2.79	4.18	5.53
v25p	3.26	4.73	5.80
v25m	1.85	2.32	2.51
v25mm	3.52	3.04	4.52
v25n	2.04	3.07	6.06
v25b	6.75	4.72	5.60
v26pp	2.01	2.49	2.91
v26p	4.30	5.89	9.33
v26m	2.26	2.29	0.80
v26mm	2.97	2.36	3.69
v26n	0.97	1.21	1.48
v26b	4.71	3.75	3.55
v27pp	2.86	3.41	4.63
v27p	3.88	3.58	3.55
v27m	3.41	3.65	2.30
v27mm	7.10	5.94	6.25
v27n	3.63	5.66	10.42
v27b	4.30	4.80	6.22

A4.4. RMSE for MARKOV-TAR Models

MK-TAR	1 month	2 months	3 months	6 months	12 months
v1	0.61	0.75	1.19	2.20	6.12
v2	3.68	4.31	7.33	10.93	87.78
v3p	2.63	2.64	2.90	3.36	4.07
v3e	na	na	na	na	na
v3m	4.19	4.35	5.65	8.54	10.06
v3b	6.64	7.13	8.65	10.56	12.55
v4p	na	na	na	na	na
v4e	na	na	na	na	na
v4m	na	na	na	na	na
v4b	na	na	na	na	na
v5p	1.62	1.65	2.17	2.86	4.64
v5e	na	na	na	na	na
v5m	2.01	2.44	3.42	4.52	4.49
v5b	na	na	na	na	na
v6p	na	na	na	na	na
v6e	1.47	1.56	2.23	3.18	4.86
v6m	0.58	0.64	0.86	1.36	2.40
v6b	na	na	na	na	na
v7p	na	na	na	na	na
v7e	na	na	na	na	na
v7m	na	na	na	na	na
v7b	na	na	na	na	na
v8p	na	na	na	na	na
v8e	na	na	na	na	na
v8m	na	na	na	na	na
v8b	na	na	na	na	na
v9p	na	na	na	na	na
v9e	na	na	na	na	na
v9m	na	na	na	na	na
v9b	na	na	na	na	na
v12	2.68	4.42	6.77	10.38	90.78
v13pp	na	na	na	na	na
v13p	0.54	0.57	0.86	1.56	3.17
v13e	na	na	na	na	na
v13m	na	na	na	na	na
v13mm	0.70	0.79	1.12	1.58	2.24
v13n	0.19	0.20	0.42	0.35	0.41
v13b	1.52	1.61	2.94	3.46	7.66

MK-TAR	1 month	2 months	3 months	6 months	12 months
v14pp	na	na	na	na	na
v14p	0.70	0.94	1.19	1.60	2.63
v14e	na	na	na	na	na
v14m	na	na	na	na	na
v14mm	na	na	na	na	na
v14n	na	na	na	na	na
v14b	1.21	1.34	1.83	2.30	3.18
v15pp	0.37	0.78	0.98	3.72	13.26
v15p	na	na	na	na	na
v15e	na	na	na	na	na
v15m	2.08	2.06	3.66	5.37	19.74
v15mm	2.00	2.04	3.67	6.81	10.15
v15n	na	na	na	na	na
v15b	na	na	na	na	na
v16pp	na	na	na	na	na
v16p	na	na	na	na	na
v16e	2.43	2.88	4.28	7.14	9.17
v16m	na	na	na	na	na
v16mm	1.34	1.39	2.35	2.65	1.64
v16n	na	na	na	na	na
v16b	3.39	3.95	6.24	12.10	7.91
v17pp	na	na	na	na	na
v17p	1.17	1.26	1.38	1.68	2.55
v17e	2.35	2.95	5.51	7.01	13.79
v17m	2.02	3.26	4.86	7.96	30.49
v17mm	0.49	0.65	1.91	9.37	53.58
v17n	na	na	na	na	na
v17b	4.45	12.35	11.56	23.93	315.90
v18pp	na	na	na	na	na
v18p	2.14	2.98	3.25	5.51	8.18
v18e	na	na	na	na	na
v18m	na	na	na	na	na
v18mm	na	na	na	na	na
v18n	na	na	na	na	na
v18b	na	na	na	na	na
v19pp	2.69	3.24	5.15	6.70	8.62
v19p	na	na	na	na	na
v19e	na	na	na	na	na
v19m	na	na	na	na	na
v19mm	0.26	0.72	1.36	1.59	4.11
v19n	na	na	na	na	na
v19b	na	na	na	na	na
v20pp	na	na	na	na	na
v20e	na	na	na	na	na
v20mm	na	na	na	na	na
v20n	na	na	na	na	na
v20b	na	na	na	na	na

MK-TAR	1 month	2 months	3 months	6 months	12 months
v21pp	na	na	na	na	na
v21p	na	na	na	na	na
v21e	na	na	na	na	na
v21m	na	na	na	na	na
v21mm	na	na	na	na	na
v21n	na	na	na	na	na
v21b	na	na	na	na	na
v22pp	na	na	na	na	na
v22p	na	na	na	na	na
v22m	na	na	na	na	na
v22mm	na	na	na	na	na
v22n	na	na	na	na	na
v22b	na	na	na	na	na
v23pp	na	na	na	na	na
v23p	0.99	1.35	1.62	1.69	2.02
v23m	na	na	na	na	na
v23mm	na	na	na	na	na
v23n	0.38	0.38	0.43	0.57	1.06
v23b	2.17	2.56	3.28	3.75	5.87
v24pp	na	na	na	na	na
v24p	na	na	na	na	na
v24e	na	na	na	na	na
v24m	na	na	na	na	na
v24mm	na	na	na	na	na
v24n	na	na	na	na	na
v24b	na	na	na	na	na
v28	na	na	na	na	na
v29p	na	na	na	na	na
v29e	na	na	na	na	na
v29m	na	na	na	na	na
v29b	na	na	na	na	na
v30p	na	na	na	na	na
v30e	na	na	na	na	na
v30m	na	na	na	na	na
v30b	na	na	na	na	na
v31p	na	na	na	na	na
v31e	na	na	na	na	na
v31m	na	na	na	na	na
v31b	na	na	na	na	na
v32p	na	na	na	na	na
v32e	na	na	na	na	na
v32m	na	na	na	na	na
v32b	na	na	na	na	na
v33	2.56	3.63	2.41	4.15	4.00
v34p	na	na	na	na	na
v34e	na	na	na	na	na
v34m	na	na	na	na	na
v34b	na	na	na	na	na

MK-TAR	1 month	2 months	3 months	6 months	12 months
v35p	na	na	na	na	na
v35e	na	na	na	na	na
v35m	na	na	na	na	na
v35b	na	na	na	na	na
v36p	2.92	3.47	3.40	3.52	5.37
v36e	na	na	na	na	na
v36m	2.39	2.80	3.46	3.14	5.35
v36b	na	na	na	na	na
v37p	na	na	na	na	na
v37e	na	na	na	na	na
v37m	na	na	na	na	na
v37b	na	na	na	na	na
v38p	na	na	na	na	na
v38e	na	na	na	na	na
v38m	na	na	na	na	na
v38b	na	na	na	na	na
v39	na	na	na	na	na
v40p	3.77	13.19	15.77	35.93	29.79
v40e	na	na	na	na	na
v40m	na	na	na	na	na
v40b	6.03	16.30	26.87	65.49	116.23
v41p	na	na	na	na	na
v41e	na	na	na	na	na
v41m	na	na	na	na	na
v41b	na	na	na	na	na
v42p	na	na	na	na	na
v42e	na	na	na	na	na
v42m	na	na	na	na	na
v42b	na	na	na	na	na
v43p	2.68	5.74	10.18	42.29	359.10
v43e	na	na	na	na	na
v43m	na	na	na	na	na
v43b	na	na	na	na	na
v44p	na	na	na	na	na
v44e	na	na	na	na	na
v44m	na	na	na	na	na
v44b	na	na	na	na	na

MK-TAR	1 quarter	2 quarters	4 quarters
v10p	6.15	5.85	10.40
v10e	na	na	na
v10m	6.76	7.74	12.62
v10b	13.19	13.47	25.26
v11p	3.96	4.13	3.84
v11e	na	na	na
v11m	na	na	na
v11b	9.03	9.70	14.14
v25pp	na	na	na
v25p	0.96	1.29	1.00
v25m	na	na	na
v25mm	1.31	1.18	1.18
v25n	na	na	na
v25b	2.35	2.30	2.27
v26pp	na	na	na
v26p	na	na	na
v26m	0.72	0.94	1.22
v26mm	1.16	1.09	1.65
v26n	na	na	na
v26b	2.38	3.23	3.82
v27pp	na	na	na
v27p	na	na	na
v27m	na	na	na
v27mm	1.36	1.75	2.32
v27n	na	na	na
v27b	na	na	na

A4.5. RMSE for VAR Models (unrestricted)[12]

VAR		1 month	2 months	3 months	6 months	12 months
v3	p	2.34	2.40	2.80	3.36	3.82
	e	1.78	2.22	2.34	3.19	3.72
	m	3.04	3.79	4.50	6.05	7.05
	b	5.11	5.93	7.12	9.24	10.69
v4	p	1.31	1.76	2.30	4.03	5.73
	e	1.43	1.97	2.33	2.69	4.56
	m	1.87	2.89	4.05	6.35	10.05
	b	2.90	4.37	6.16	10.30	15.72
v5	p	1.23	1.83	2.36	3.95	4.99
	e	1.54	2.19	2.83	4.45	5.63
	m	1.54	2.81	3.95	6.70	7.98
	b	2.32	4.19	5.84	10.05	12.06
v6	p	1.17	1.67	2.06	3.12	3.63
	e	1.15	1.56	1.90	3.00	4.13
	m	0.55	0.84	1.02	1.42	1.56
	b	1.40	2.14	2.64	3.81	3.74
v7	p	2.72	4.03	4.56	4.64	3.02
	e	1.95	2.42	2.81	3.87	3.51
	m	3.16	5.15	6.28	7.51	4.46
	b	5.57	8.93	10.61	11.87	6.75
v8	p	2.31	3.55	4.56	5.78	4.75
	e	2.90	4.50	5.44	5.77	4.88
	m	1.94	2.45	2.86	3.47	3.58
	b	3.11	4.10	5.30	7.56	6.81
v9	p	1.17	1.65	2.09	3.57	5.05
	e	1.13	1.68	2.09	3.14	2.89
	m	1.91	2.82	3.57	6.04	7.54
	b	2.95	4.29	5.46	9.42	12.51
v13	p	0.62	1.04	1.42	2.52	4.37
	e	1.20	1.78	2.20	3.40	5.41
	m	1.36	2.19	2.93	5.30	9.42
	b	5.11	4.03	3.21	1.71	5.60
v14	p	0.86	1.14	1.40	1.85	2.59
	e	0.88	1.15	1.28	1.45	1.17
	m	0.80	1.23	1.47	1.92	2.01
	b	1.87	2.14	2.45	3.18	3.85
v15	p	1.56	2.41	3.37	6.38	10.34
	e	1.47	2.27	2.68	4.47	8.20
	m	2.38	3.77	5.07	9.57	17.78
	b	10.99	9.52	8.17	6.94	12.81
v16	p	1.87	2.75	3.60	4.55	2.88
	e	1.75	2.81	3.70	5.68	3.59
	m	2.98	4.96	6.71	9.92	5.43
	b	6.03	6.80	8.08	10.57	5.63

[12] The forecasts for the balance are calculated from forecasts from positive and negative answers.

VAR		1 month	2 months	3 months	6 months	12 months
v17	p	2.94	5.11	7.13	11.99	18.54
	e	1.58	2.74	3.88	6.65	9.42
	m	1.60	2.67	3.63	5.83	9.63
	b	11.89	11.08	10.61	10.02	14.24
v18	p	3.44	5.21	6.47	10.34	15.13
	e	1.61	2.28	2.97	4.67	6.52
	m	2.32	3.41	3.95	6.05	8.64
	b	11.73	13.38	14.83	20.01	27.79
v19	p	3.87	6.39	8.68	14.29	13.73
	e	2.27	3.65	4.78	7.24	5.60
	m	1.94	3.27	4.50	7.75	8.78
	b	10.62	11.44	12.87	17.93	16.02
v20	p	1.45	2.15	2.64	4.10	7.26
	e	1.06	1.36	1.43	1.02	2.21
	m	1.37	1.79	2.30	4.35	9.02
	b	2.62	3.72	4.74	8.40	16.23
v21	p	0.41	0.47	0.53	0.64	0.91
	e	1.00	1.19	1.38	1.78	2.94
	m	0.92	1.28	1.58	2.19	3.71
	b	2.80	2.37	2.08	1.21	0.98
v22	p	0.90	1.25	1.36	1.46	1.92
	e	0.34	0.48	0.58	0.94	1.51
	m	0.84	1.19	1.26	1.26	1.37
	b	6.23	6.33	6.31	5.85	4.87
v23	p	1.14	1.40	1.73	2.17	2.72
	e	0.31	0.41	0.48	0.72	1.21
	m	1.20	1.55	1.94	2.66	3.65
	b	3.87	4.38	4.89	5.91	7.02
v24	p	1.10	1.65	2.14	3.77	6.44
	e	0.81	1.04	1.16	1.11	1.68
	m	1.22	2.00	2.68	4.53	7.76
	b	9.24	10.39	11.46	14.51	19.30
v29	p	3.18	3.77	4.36	5.10	5.22
	e	3.68	5.53	6.73	7.07	5.86
	m	4.67	7.45	8.86	6.29	5.01
	b	7.08	10.41	12.22	9.00	8.39
v30	p	1.36	1.69	2.08	2.24	2.27
	e	1.63	2.22	2.88	4.25	4.76
	m	1.80	3.01	3.97	5.86	6.38
	b	2.73	4.34	5.64	7.79	8.30
v31	p	2.20	3.10	3.98	4.18	2.46
	e	3.07	4.55	5.53	7.74	7.34
	m	3.34	5.50	7.24	10.45	7.33
	b	4.76	7.69	10.30	13.92	8.11
v32	p	2.72	2.88	3.80	5.03	5.83
	e	3.25	3.50	4.12	4.15	3.53
	m	2.34	3.48	4.51	5.85	3.97
	b	3.89	5.34	7.26	10.10	9.33

VAR		1 month	2 months	3 months	6 months	12 months
v34	p	2.5	3.0	2.7	2.9	4.7
	e	2.7	3.2	3.6	3.5	4.2
	m	3.1	3.4	3.5	4.9	7.4
	b	4.9	5.5	5.1	7.2	11.6
v35	p	2.0	2.0	2.3	1.9	2.4
	e	2.2	2.2	2.6	1.9	2.4
	m	0.8	1.1	1.2	1.2	1.2
	b	2.2	2.3	2.5	2.6	3.0
v36	p	2.4	3.1	3.5	5.0	5.7
	e	2.6	3.0	3.2	3.7	2.8
	m	2.0	2.6	3.0	3.8	5.6
	b	3.6	4.8	5.6	8.1	10.9
v37	p	2.5	2.8	3.0	3.1	4.0
	e	3.0	3.2	3.8	3.4	5.3
	m	2.4	2.8	3.7	4.6	6.8
	b	4.0	4.7	5.5	7.0	9.8
v38	p	2.1	2.5	2.3	2.1	2.4
	e	2.5	3.3	3.3	3.8	4.3
	m	2.2	2.9	2.9	3.4	3.8
	b	3.5	4.2	4.0	4.0	4.7
v40	p	2.4	3.7	5.3	9.3	9.3
	e	2.1	2.1	1.6	1.1	1.5
	m	2.5	4.1	5.5	9.6	7.8
	b	4.5	7.5	10.7	18.9	17.2
v41	p	2.1	3.5	4.7	8.5	15.2
	e	2.5	3.5	4.4	5.1	8.8
	m	2.5	2.8	2.8	4.3	6.4
	b	3.8	5.2	6.4	12.4	21.6
v42	p	3.6	6.0	7.6	10.7	13.0
	e	2.3	3.5	4.4	6.5	8.1
	m	2.7	4.2	5.1	5.1	4.9
	b	5.9	9.8	12.2	15.5	17.9
v43	p	2.1	2.3	3.0	4.0	4.3
	e	1.9	2.5	2.8	2.9	0.6
	m	2.1	2.9	3.4	3.6	3.7
	b	3.7	4.6	5.7	7.1	8.0
v44	p	2.3	3.5	4.9	8.6	11.8
	e	2.5	3.5	4.6	5.7	7.5
	m	1.9	2.8	3.8	4.2	4.3
	b	3.3	5.2	7.4	12.2	16.1

VAR		1 quarter	2 quarters	4 quarters
v10	p	5.30	5.79	6.42
	e	2.79	3.69	3.52
	m	5.89	7.87	8.47
	b	10.87	13.32	14.62
v11	p	3.13	4.16	3.46
	e	2.95	3.53	3.96
	m	4.03	5.77	6.34
	b	6.62	9.44	9.44
v25	p	1.68	1.37	2.07
	e	0.45	0.53	0.96
	m	1.57	1.65	2.76
	b	2.71	1.72	3.10
v26	p	1.35	0.93	1.13
	e	0.24	0.33	0.59
	m	1.31	1.15	1.66
	b	2.48	1.14	1.39
v27	p	0.94	1.35	1.49
	e	1.08	1.08	1.90
	m	1.16	1.48	1.97
	b	2.92	2.89	3.15

A4.6. RMSE for VAR Models (restricted)[13]

rVAR		1 month	2 months	3 months	6 months	12 months
v3	p	2.52	2.49	3.28	3.89	3.05
	e	1.84	2.16	2.19	2.39	2.76
	m	2.57	2.72	3.71	5.14	4.20
	b	4.73	4.73	6.64	8.77	6.79
v4	p	1.06	1.39	1.88	3.08	2.76
	e	1.52	2.26	2.91	3.46	3.58
	m	1.96	2.99	4.25	6.13	5.81
	b	2.77	4.09	5.90	9.07	8.36
v5	p	1.19	1.54	2.05	3.23	1.84
	e	1.65	2.13	2.62	3.78	5.10
	m	1.51	2.54	3.40	5.72	4.54
	b	2.14	3.61	4.95	8.49	4.68
v6	p	1.21	1.69	2.12	3.16	3.67
	e	1.17	1.57	1.97	3.04	4.16
	m	0.51	0.81	1.00	1.41	1.55
	b	1.42	2.14	2.66	3.83	3.78
v7	p	1.87	2.66	3.51	4.13	2.22
	e	1.95	2.13	2.21	2.75	1.80
	m	2.27	3.61	4.82	6.50	3.16
	b	3.71	5.99	8.14	10.55	5.17
v8	p	2.62	4.49	5.52	6.31	3.36
	e	2.71	4.16	4.85	4.78	3.83
	m	1.96	2.32	2.62	3.16	2.36
	b	3.71	5.79	7.13	8.75	4.31
v9	p	1.14	1.56	1.93	3.37	4.97
	e	1.13	1.67	2.08	3.09	3.18
	m	1.84	2.68	3.37	5.77	7.67
	b	2.84	4.05	5.09	8.94	12.54
v13	p	0.63	1.05	1.43	2.52	4.37
	e	1.19	1.79	2.21	3.40	5.41
	m	1.36	2.20	2.95	5.30	9.43
	b	5.09	4.00	3.17	1.72	5.61
v14	p	0.86	1.16	1.42	1.88	2.60
	e	0.86	1.09	1.24	1.42	1.15
	m	0.82	1.24	1.49	1.96	2.03
	b	1.86	2.16	2.48	3.23	3.89
v15	p	1.53	2.31	2.88	4.62	6.02
	e	1.61	2.50	3.11	4.49	7.36
	m	2.48	4.12	5.32	8.41	13.24
	b	12.09	12.04	11.72	9.66	7.06
v16	p	1.71	2.44	3.06	3.85	2.46
	e	1.84	3.06	4.01	5.98	4.42
	m	3.06	5.04	6.69	9.64	6.27
	b	6.11	7.05	8.40	11.32	8.99

[13] Neutral answers are calculated as 100–positive answers–negative answers. The forecasts for the balance are calculated from forecasts from positive and negative answers.

rVAR		1 month	2 months	3 months	6 months	12 months
v17	p	3.17	5.80	7.79	11.41	14.82
	e	1.85	3.31	4.44	6.63	7.17
	m	1.76	2.98	3.85	5.26	8.43
	b	12.72	13.03	13.37	11.19	12.08
v18	p	4.32	6.67	7.90	12.48	18.82
	e	1.72	2.57	3.11	5.07	7.27
	m	2.92	4.34	4.99	7.56	11.60
	b	13.50	16.43	18.23	25.09	35.01
v19	p	4.41	7.38	10.22	20.56	24.19
	e	2.56	4.12	5.73	11.07	12.25
	m	2.41	4.12	5.56	10.87	15.02
	b	11.36	13.39	15.95	26.67	33.39
v20	p	1.71	2.54	3.06	4.44	7.56
	e	1.76	2.07	1.93	2.63	4.38
	m	2.06	2.92	3.45	6.19	11.76
	b	3.34	5.07	6.23	10.46	19.28
v21	p	0.42	0.47	0.53	0.61	0.90
	e	1.02	1.19	1.40	1.82	2.95
	m	0.93	1.29	1.59	2.23	3.72
	b	2.79	2.36	2.07	1.21	0.97
v22	p	0.93	1.34	1.49	1.73	2.31
	e	0.44	0.69	0.87	1.30	1.82
	m	0.84	1.18	1.25	1.25	1.39
	b	6.10	6.04	5.90	5.24	4.33
v23	p	1.15	1.40	1.71	2.11	2.64
	e	0.32	0.42	0.50	0.76	1.25
	m	1.20	1.55	1.93	2.61	3.59
	b	3.81	4.30	4.79	5.76	6.84
v24	p	1.10	1.65	2.14	3.77	6.44
	e	0.82	1.05	1.18	1.12	1.69
	m	1.23	2.02	2.70	4.55	7.76
	b	9.23	10.39	11.47	14.52	19.30
v29	p	2.52	2.68	2.92	3.03	4.00
	e	3.37	4.00	4.39	5.11	5.53
	m	3.04	3.95	4.28	4.04	4.03
	b	4.44	5.43	5.86	4.98	5.81
v30	p	1.56	1.94	2.18	1.42	2.42
	e	1.80	1.92	2.27	3.21	4.39
	m	1.85	2.07	2.51	3.53	6.10
	b	2.90	3.51	4.11	4.33	8.19
v31	p	1.96	2.34	2.66	3.58	3.67
	e	3.00	3.98	4.42	5.35	7.63
	m	2.68	3.67	4.39	6.52	7.67
	b	3.61	4.71	5.76	9.05	9.31
v32	p	3.11	3.48	4.13	4.97	6.36
	e	3.68	3.58	3.99	4.02	5.55
	m	2.08	2.44	2.85	3.23	2.50
	b	3.79	4.82	5.87	7.36	7.92

rVAR		1 month	2 months	3 months	6 months	12 months
v34	p	3.0964	3.9266	3.5221	3.9295	4.6441
	e	3.5235	4.0173	3.5798	4.3507	5.8258
	m	3.5758	4.2491	4.3632	6.2258	9.72
	b	5.6866	7.1412	7.0744	9.4535	14.062
v35	p	2.3613	2.5047	3.1857	2.298	2.6806
	e	3.0606	3.7577	5.0806	4.3641	3.6937
	m	1.3304	1.918	2.4524	2.5906	1.8749
	b	2.3006	2.3607	2.4926	2.1834	2.7648
v36	p	2.989	4.1115	4.8045	6.0623	4.6064
	e	3.3096	4.5984	5.2568	6.7728	2.8319
	m	2.1728	2.6042	2.6024	3.2396	3.1173
	b	4.0349	5.1171	5.6603	6.9675	7.3238
v37	p	2.2697	2.1571	2.2964	2.3593	2.6913
	e	3.1247	2.7168	3.5593	4.0167	6.4144
	m	2.8697	2.7819	3.3987	4.0311	6.1766
	b	4.1199	4.1654	4.5815	5.256	7.0241
v38	p	2.7523	3.0774	2.6645	2.9968	4.3993
	e	3.8223	4.5558	3.9148	5.8759	9.927
	m	2.6623	3.3778	3.2377	4.4039	6.4063
	b	3.8194	4.5491	4.4232	4.67	4.6217
v40	p	4.9184	6.7311	8.3155	12.7371	21.0003
	e	3.9762	4.1303	4.0151	3.4682	6.9658
	m	3.64	5.7776	7.7136	12.045	14.7885
	b	7.6864	11.8452	15.5294	24.5481	35.6474
v41	p	7.1701	11.9019	17.5862	24.6042	13.8709
	e	5.2009	6.8485	8.8537	12.74	7.8034
	m	5.7606	9.1809	12.6488	14.4519	10.2191
	b	11.9201	20.1269	29.3313	38.2926	23.0862
v42	p	4.3919	7.2903	10.15	17.0777	20.7084
	e	4.3513	7.014	9.2508	12.9107	14.531
	m	3.7468	5.4326	5.969	7.333	7.3377
	b	6.9158	10.7842	13.8569	22.9065	27.4768
v43	p	2.9241	3.9332	5.3376	7.5997	11.5732
	e	3.0749	3.9848	4.8896	6.8318	9.7976
	m	2.049	2.4207	3.0493	3.1963	3.7817
	b	4.0128	5.1865	7.1985	9.4522	14.1659
v44	p	3.8928	6.3201	8.4822	10.1327	10.5075
	e	2.7233	4.0525	4.9123	5.2147	8.0868
	m	2.3957	3.3514	4.5004	5.6763	3.5102
	b	5.8665	9.2762	12.665	15.5805	13.4279

rVAR		1 quarter	2 quarters	4 quarters
v10	p	4.45	5.45	6.57
	e	3.93	4.44	4.11
	m	4.29	6.22	6.47
	b	7.85	10.84	12.39
v11	p	3.90	4.77	3.35
	e	2.66	3.10	3.56
	m	4.29	5.56	5.22
	b	7.77	9.91	8.05
v25	p	1.67	1.37	2.03
	e	0.47	0.55	1.00
	m	1.57	1.65	2.77
	b	2.70	1.72	3.07
v26	p	1.36	0.93	1.10
	e	0.25	0.36	0.65
	m	1.32	1.19	1.70
	b	2.47	1.11	1.39
v27	p	0.94	1.41	1.46
	e	1.08	1.11	1.98
	m	1.16	1.48	1.89
	b	2.84	2.95	3.24

A4.7. RMSE for VAR Models of different indicators

VAR	***v2***	***v12***	***v28***	***v33***	***v39***
1 month	3.387	3.021	5.001	3.702	6.203
2 months	5.627	5.236	8.006	4.695	9.334
3 months	6.898	7.669	11.378	4.829	12.043
6 months	12.251	13.623	22.406	3.998	17.947
12 months	17.819	24.604	38.308	11.798	32.693

VAR	***v7b***	***v8b***
1 month	3.581	2.938
2 months	6.007	4.153
3 months	8.147	5.367
6 months	10.918	8.153
12 months	5.528	5.070

VAR	***v18b***	***v16b***	***v19b***	***v14b***
1 month	4.908	3.881	4.726	1.072
2 months	7.629	5.837	6.655	1.719
3 months	8.954	7.239	9.155	2.032
6 months	13.208	8.742	14.566	2.130
12 months	20.097	7.408	12.920	1.657

VAR	***v23b***	***v24b***	***v21b***
1 month	1.941	1.151	0.857
2 months	2.536	1.674	1.118
3 months	3.159	2.179	1.402
6 months	4.438	3.770	2.029
12 months	5.956	7.293	3.795

VAR	***v29b***	***v31b***	***v32b***
1 month	5.240	3.663	3.827
2 months	5.642	4.064	4.823
3 months	7.037	4.891	6.220
6 months	6.705	5.767	8.538
12 months	5.689	3.553	7.685

VAR	***v37b***	***v38b***
1 month	4.118	3.304
2 months	3.871	3.681
3 months	4.001	3.553
6 months	4.338	3.613
12 months	5.597	3.861

	v42b	***v44b***
1 month	10.063	6.982
2 months	20.597	13.553
3 months	32.514	21.136
6 months	61.747	45.214
12 months	122.424	45.701

A4.8. RMSE for the balance calculated from forecasts from positive and negative answers (indirect methods)

a) Autoregressive

AR	1 month	2 months	3 months	6 months	12 months
v3b	4.22	4.56	6.29	7.40	7.74
v4b	2.87	4.11	5.92	8.63	8.63
v5b	2.07	3.48	4.78	7.81	4.90
v6b	1.41	2.11	2.57	3.62	3.24
v7b	3.64	5.71	7.50	9.19	5.12
v8b	3.08	4.57	5.63	6.93	5.68
v9b	2.60	3.58	4.53	8.25	9.07
v13b	1.10	1.83	2.53	4.54	7.67
v14b	0.84	1.20	1.43	1.74	2.07
v15b	2.51	3.59	4.55	8.10	12.88
v16b	2.74	4.34	5.60	7.32	3.92
v17b	3.62	6.64	9.38	14.38	19.52
v18b	4.26	6.42	7.59	11.51	15.90
v19b	3.53	5.84	7.96	13.92	11.87
v20b	2.84	4.08	5.20	8.46	14.84
v21b	0.84	1.21	1.52	2.08	2.98
v22b	1.52	1.97	2.09	1.67	1.88
v23b	1.83	2.37	2.79	3.21	3.56
v24b	1.37	2.28	3.04	5.07	7.97
v29b	3.66	4.53	5.02	5.11	6.19
v30b	2.20	2.67	2.74	2.62	4.77
v31b	2.99	3.36	3.65	4.79	3.46
v32b	3.41	3.84	5.02	5.98	4.73
v34b	4.88	5.94	6.13	8.44	14.28
v35b	2.44	2.71	3.18	2.88	2.80
v36b	3.36	4.15	4.64	6.00	6.84
v37b	3.46	3.55	3.95	4.12	6.93
v38b	3.70	4.60	4.24	3.79	4.67
v40b	6.78	11.56	15.85	24.75	31.93
v41b	7.72	12.29	16.30	20.83	27.06
v42b	7.84	14.04	19.86	25.38	19.21
v43b	4.41	6.66	9.15	12.73	19.56
v44b	4.98	8.49	12.11	16.29	16.32

AR	1 quarter	2 quarters	4 quarters
v10b	6.70	8.80	10.72
v11b	7.06	9.52	7.89
v25b	2.00	1.77	2.64
v26b	2.19	1.59	2.26
v27b	1.69	2.25	2.21

b) ARIMA

ARIMA	1 month	2 months	3 months	6 months	12 months
v3b	5.22	6.19	7.80	10.88	13.96
v4b	2.70	3.99	5.85	9.64	15.28
v5b	2.30	4.08	5.95	10.83	13.62
v6b	1.43	2.21	2.77	4.62	6.09
v7b	5.03	9.20	11.36	14.17	8.87
v8b	2.77	3.69	4.70	7.30	7.92
v9b	2.68	3.95	5.10	8.98	12.71
v13b	1.11	1.76	2.40	4.60	9.08
v14b	0.97	1.36	1.59	2.13	3.56
v15b	2.50	3.52	4.64	8.92	17.16
v16b	2.81	4.65	6.29	9.39	6.17
v17b	3.10	4.39	5.44	7.36	10.21
v18b	3.55	3.99	4.05	5.32	7.95
v19b	3.53	6.00	8.40	15.40	16.94
v20b	2.98	4.44	5.70	9.68	18.68
v21b	1.03	1.33	1.58	2.16	3.36
v22b	1.42	1.70	1.96	2.21	2.80
v23b	2.11	2.57	2.96	4.17	6.48
v24b	1.26	1.69	2.14	3.36	5.79
v29b	7.60	10.71	11.81	12.33	12.96
v30b	2.64	4.26	5.78	9.45	15.29
v31b	4.59	6.88	8.49	11.37	12.09
v32b	3.83	4.93	5.62	7.73	10.03
v34b	5.10	5.75	6.16	8.16	15.06
v35b	2.47	2.78	3.28	3.03	3.02
v36b	3.23	3.89	4.33	5.88	9.79
v37b	3.63	3.71	4.24	5.13	8.41
v38b	3.58	4.59	4.32	4.26	6.24
v40b	5.65	9.27	12.46	18.48	26.28
v41b	4.68	7.11	9.77	15.20	24.76
v42b	5.91	9.82	13.15	15.56	13.14
v43b	3.90	5.58	7.65	9.56	13.74
v44b	4.04	6.29	9.20	13.39	11.73

ARIMA	1 quarter	2 quarters	4 quarters
v10b	9.02	14.55	19.66
v11b	8.15	12.34	13.95
v25b	1.83	1.80	3.02
v26b	2.21	1.96	3.32
v27b	2.16	3.00	3.90

c) TAR

TAR	1 month	2 months	3 months	6 months	12 months
v3b	6.54	7.89	8.07	11.41	15.87
v4b	4.00	5.50	6.84	10.30	14.56
v5b	4.05	5.47	7.13	11.59	14.47
v6b	2.13	2.72	3.47	4.93	6.39
v7b	9.32	12.00	13.30	18.03	25.57
v8b	4.20	6.03	8.68	19.94	52.09
V9b	na	na	na	na	na
v13b	1.49	1.85	2.29	3.31	5.02
v14b	1.21	1.37	1.51	1.45	1.17
v15b	3.60	4.08	4.97	7.41	11.86
v16b	4.38	5.86	6.88	9.27	7.54
v17b	5.79	7.73	9.96	10.72	25.23
V18b	na	na	na	na	na
v19b	6.16	8.38	10.39	16.58	17.84
v20b	10.23	10.76	11.11	12.41	16.81
v21b	0.85	0.83	0.80	0.74	1.38
v22b	2.13	2.38	2.47	2.48	2.63
v23b	2.40	2.76	2.97	2.89	3.59
v24b	1.37	1.52	1.92	3.21	10.55
v29b	13.19	15.70	17.36	21.99	50.13
v30b	4.15	5.40	6.51	7.59	12.18
v31b	7.89	10.91	13.21	15.33	11.49
v32b	4.97	6.05	7.40	10.74	21.20
v34b	6.23	6.51	5.94	7.06	7.72
v35b	2.74	3.44	3.74	4.82	7.17
v36b	4.66	4.77	5.60	7.65	12.28
v37b	4.31	4.95	5.16	6.22	10.38
v38b	4.49	3.90	3.66	4.31	6.11
V40b	na	na	na	na	na
v41b	12.43	42.49	46.00	109.76	88.44
v42b	14.94	70.35	74.14	53.70	51.87
v43b	11.83	13.40	13.77	19.08	25.93
v44b	7.08	10.20	12.83	15.08	16.64

TAR	1 quarter	2 quarters	4 quarters
v10b	12.80	13.84	14.98
v11b	11.85	12.96	11.64
v25b	1.32	2.43	2.90
v26b	2.04	1.93	2.58
v27b	2.35	1.96	2.22

d) VAR (restricted)

rVAR	1 month	2 months	3 months	6 months	12 months
v3b	5.11	5.93	7.12	9.24	10.69
v4b	2.90	4.37	6.16	10.30	15.72
v5b	2.32	4.19	5.84	10.05	12.06
v6b	1.40	2.14	2.64	3.81	3.74
v7b	5.57	8.93	10.61	11.87	6.75
v8b	3.11	4.10	5.30	7.56	6.81
v9b	2.95	4.29	5.46	9.42	12.51
v13b	5.11	4.03	3.21	1.71	5.60
v14b	1.87	2.14	2.45	3.18	3.85
v15b	10.99	9.52	8.17	6.94	12.81
v16b	6.03	6.80	8.08	10.57	5.63
v17b	11.89	11.08	10.61	10.02	14.24
v18b	11.73	13.38	14.83	20.01	27.79
v19b	10.62	11.44	12.87	17.93	16.02
v20b	2.62	3.72	4.74	8.40	16.23
v21b	2.80	2.37	2.08	1.21	0.98
v22b	6.23	6.33	6.31	5.85	4.87
v23b	3.87	4.38	4.89	5.91	7.02
v24b	9.24	10.39	11.46	14.51	19.30
v29b	7.08	10.41	12.22	9.00	8.39
v30b	2.73	4.34	5.64	7.79	8.30
v31b	4.76	7.69	10.30	13.92	8.11
v32b	3.89	5.34	7.26	10.10	9.33
v34b	4.93	5.54	5.09	7.23	11.56
v35b	2.18	2.30	2.49	2.58	2.96
v36b	3.60	4.76	5.58	8.09	10.93
v37b	3.97	4.67	5.54	7.04	9.83
v38b	3.46	4.21	4.04	4.04	4.66
v40b	4.45	7.45	10.67	18.87	17.17
v41b	3.77	5.23	6.37	12.45	21.65
v42b	5.93	9.77	12.20	15.49	17.89
v43b	3.72	4.63	5.74	7.06	7.99
v44b	3.32	5.22	7.40	12.24	16.15

rVAR	1 quarter	2 quarters	4 quarters
v10b	10.87	13.32	14.62
v11b	6.62	9.44	9.44
v25b	2.71	1.72	3.10
v26b	2.48	1.14	1.39
v27b	2.92	2.89	3.15

A4.9. RMSE for composite indicators calculated from forecasts from their components (indirect methods)

AR	1 month	2 months	3 months	6 months	12 months
v1	2.73	2.83	2.92	3.08	1.70
v2	2.04	3.54	4.68	6.22	3.69
v12	1.78	2.79	3.69	5.64	3.27
v28	1.97	2.09	2.15	2.82	2.88
v33	2.47	3.17	3.50	5.13	8.82
v39	5.61	9.94	13.97	20.49	35.87

ARIMA	1 month	2 months	3 months	6 months	12 months
v1	0.46	0.46	0.42	0.41	0.46
v2	2.21	4.14	5.52	7.60	7.97
v12	5.42	4.54	3.93	3.00	3.67
v28	12.62	14.07	15.31	18.56	22.76
v33	23.79	23.40	23.01	20.79	10.25
v39	4.43	7.53	10.46	16.32	20.39

TAR	1 month	2 months	3 months	6 months	12 months
v1	0.71	0.84	1.06	1.80	3.03
v2	4.77	6.78	8.45	14.65	22.69
v12	6.09	6.54	7.14	9.22	11.99
v28	13.06	14.62	16.96	25.21	32.69
v33	29.27	32.48	34.80	40.68	40.94
v39	12.00	16.22	18.57	25.46	41.09

VAR	1 month	2 months	3 months	6 months	12 months
v1	4.38	4.55	4.70	4.98	3.49
v2	0.08	2.15	3.29	3.28	2.28
v12	9.47	11.66	13.42	15.31	12.92
v28	0.07	4.93	9.38	15.92	11.37
v33	2.96	2.72	4.05	5.01	7.46
v39	0.69	2.34	7.59	14.37	18.90

ANNEX 5. Seasonal adjustment methods

A5.1. A brief description of considered seasonal adjustment methods

The problem of seasonal adjustment or trend-cycle estimations in econometrics has had a long history, and the techniques which can be applied have been evolving gradually over many years. The forces of evolution have been twofold. On the one hand is the gradual improvement in statistical and computational techniques. On the other hand are the methodological developments within the discipline of econometrics. The econometric approach to seasonal adjustment is based upon the notion that a time series is composed of several components of independent origin which are combined by addition or by multiplication. Usually, a multiplicative combination can be reduced to an additive one by taking logarithms.

The X12 seasonal adjustment method is an enhanced version of the X-11 variant of the Census Method 11 seasonal adjustment method. This procedure (which has two versions: multiplicative and additive) is the standard method used by the U.S. Bureau of Census to seasonally adjust publicly released data. It is based on the application of moving average filters and the X12 version includes controls for outliers using ARIMA models. For more details, see U.S. Census Bureau (2000).

The Tramo- Seats ("Time Series Regression with ARIMA Noise, Missing Observations and Outliers" and "Signal Extraction in ARIMA Time Series") procedure consists in the application of two interrelated programs developed by Gómez, Maravall and Caporello. The first program, Tramo, permits the automatic identification, estimation and forecasting of regression models with possibly nonstationary errors and any sequence of missing values. The program interpolates these values, identifies and corrects for several types of outliers, and estimates special effects such as Trading Day and Easter and, in general, intervention variable type of effects. The second program, Seats, permits the estimation of unobserved components in time series following an ARIMA model-based method. The trend, seasonal, irregular, and cyclical components are estimated and forecasted with signal extraction techniques applied to ARIMA models. The two programs are structured so as to be used together for automatic routine applications to a large number of series (as presently done at Eurostat). For more details, see Gómez and Maravall (1997).

Dainties is a seasonal adjustment method originally developed by Eurostat. The main advantage of this method is the absence of revisions when adding data at the end of the time series. It is based on the use of filters that are applied to the series in the same way as for the computation of weighted moving average with the objective of separating the series in three components (seasonal, trend and irregular) according to specific models. These models are based on three hypotheses: the trend can be represented by a cubic, the seasonal component by a stationary periodic series and the irregular component by a random series of sum zero. Using least squares, an optimum breakdown value that minimises the square of the irregular component is obtained and the Dainties filter is set up with this value. As a result, the filter permits to obtain directly the seasonal component in line with this model (see, European Commission, 2000).

Regarding the wavelets based approach, its starting point is related to the fact that the components of the time series can be regarded as Fourier combinations of trigonometrical functions (i.e. of sines and cosines) whose frequencies fall within specified ranges. Over the range of the frequencies that pertain to a particular component, on can define a spectral density function, which represents the squared amplitudes of the constituent trigonometrical functions.

In Fourier expansion context, the natural way to obtain seasonal adjusted series is based on invariant filters. An invariant filter can be thought of as an algorithm for processing a time series to get a more meaningful statistic. Most popular filters used in economic signal extraction are symmetric filters because, in some optimal sense (mean squared error), this is the best choice. But from the perspective of current analysis, we mustn't use symmetric filters because that produces important revisions at the end of the sample when we obtain more data.

Another disadvantage of Fourier expansion is that it has only frequency resolution and no time resolution. This means that although we might be able to determine all the frequencies present in a signal, we do not know when they are present. To overcome this problem, several solutions have been developed which are more or less able to represent a signal in the time and frequency domain at the same time. The wavelet analysis is probably the most recent solution to overcome these problems.

The wavelet representation can be used to separate unobserved components in a time series. For example, it can be used to remove some components as seasonal component or noise component.

In mathematics, it is often possible to approximate a complicated function as a linear combination of several simple expressions. One of the better-known examples is that of spectral, or Fourier, analysis where, by the spectral representation theorem, any covariance-stationary process X_t can be expressed as a linear combination of sine and cosine functions in the frequency domain. For example, the Fourier series of any real-valued function *f(x)* on the [0,1] interval is expressed as:

$$f(x) = a_0 + \sum_{k=1}^{\infty} a_k \cos(2pkx) + b_k \sin(2pkx) \qquad \text{(A5.1)}$$

where the parameters a_k , b_0 , and b_k , for k can be solved using least squares. However, few economic series follow the smooth cycles suggested by sine and cosine functions, thereby making Fourier analysis less appealing for economists. A recently developed alternative to Fourier transforms are *wavelet transform*s, where the same function *f(x)* can be expressed in the wavelet domain in the following manner:

$$f(x) = c_0 + \sum_{j=0}^{\infty} \sum_{k=0}^{2^j - 1} c_{jk} y(2^j x - k) \qquad \text{(A5.2)}$$

with $y(x)$ defined as:

$$y(x) = I_{[0,1/2)} - I_{[1/2,1)} \qquad \text{(A5.3)}$$

The group of functions $y_{jk}(x) = y(2^j x - k)$ are orthogonal and collectively form a basis in the space of all square-integrable functions $\mathbf{L^2}$ along the [0,1] interval. The index j is the dilation (or scaling) index, which compresses the function $y(x)$, and the index k is the transition index that shifts the function $y(x)$. More generally, any such basis in $L^2(R)$ is known as a wavelet, and (A5.3) is more commonly known as the Haar

wavelet. Several different wavelets have been proposed, which usually involve smoothing the step function (A5.3). The Daubechies (1988) wavelet is an example of such a smooth wavelet; and is commonly used in many applications outside economics, especially in signal processing. Several alternative wavelets are presented in, for example, Vidakovic (1999).

As noted by Jensen (1999), the strengths of wavelets lie in their ability to simultaneously localize a process in time and scale. They can zoom in on a process's behaviour at a point in time, which is a distinct advantage over Fourier analysis. Alternatively, wavelets can also zoom out to reveal any long and smooth features of a series. See Strang (1993) and Strichartz (1993) for more extensive expositions on wavelets.

Regarding the Business and Consumer Surveys Indicators, we propose a simple method for extracting a de-noised signal from these indicators. Our methodology is simple to calculate and can easily be implemented as it does not depend on a particular model selection criterion or parameter choices. The proposed method is based on a wavelet multi-scaling approach which decomposes the data into its low and high frequency components through the application of the discrete wavelet transform.

A signal expansion via some orthogonal wavelet basis can be interpreted as an aggregation of details across all scales, thus providing a reconstruction formula like (A5.1). The scalogram shows us how much variance can be assigned on different frequency band.

To obtain a de-noised signal we only need select the low-frequency bands of the scalogram. Let $\{h_l\} = \{h_0, ..., h_{L-1}\}$ denote the wavelet filter coefficients of the Daubechies wavelet family, and let $\{g_l\} = \{g_0, ..., g_{L-1}\}$ be the corresponding scaling filter coefficients, defined via the quadrature mirror relationship $g_m = (-1)^{m+1} h_{L-1-m}$.

The wavelet filter $\{h_l\}$ is associated with unit scale and the transfer function of a wavelets filter $H_k = \sum_{m=0}^{N-1} h_m e^{\frac{-2\pi imk}{N}}$ for $k = 0,..., N-1$, describes its band-pass nature. The wavelets filter $\{h_l\}$ approximates and ideal high-pass filter, the accuracy of the approximation increasing with the filter length L.

References

Daubechies, I. (1988): "Orthonormal Bases of Compactly Supported Wavelets", *Communications on Pure and Applied Mathematics*, 41, 909-996.

European Commission (2000): Joint harmonised EU programme of business and consumer surveys, *European Economy*, 4, part B.

Gómez, V. and Maravall, A. (1997): Programs TRAMO (Time Series Regression with ARIMA Noise, Missing Observations, and Outliers) and SEATS (Signal Extraction in ARIMA Time Series) Instructions for the User, mimeo.

Jensen, M. J. (1999): "Using wavelets to obtain a consistent ordinary least squares estimator of the long-memory parameter", *Journal of Forecasting*, 18, 1, 17-32.

Strang, G. (1993): "Wavelet transforms versus Fourier transforms", *Bulletin of the American Mathematics Society*, 28, 288-305.

Strichartz, R. (1993): "Wavelets and self-affine tilings", *Constructive Approx.*, 9, 327-346.

U.S. Census Bureau (2000): *X-12 ARIMA Reference Manual*, mimeo.

Vidakovic, B. (1999): *Statistical modelling by wavelets*, Wiley Series in Probability and Statistics, New York.

A5.2. Evaluation of the different seasonal adjustment methods

a) Mean squared error (MSE) between results from trend-cycle estimation

Trend-cycle estimation. MSE between methods. V1

	TS	X12	DA
TS	0.00	0.00	0.13
X12	0.00	0.00	0.14
DA	0.13	0.14	0.00

Trend-cycle estimation. MSE between methods. V2

	TS	X12	DA
TS	0.00	0.01	0.13
X12	0.01	0.00	0.15
DA	0.13	0.15	0.00

Trend-cycle estimation. MSE between methods. V3P

	TS	X12	DA
TS	0.00	0.01	0.15
X12	0.01	0.00	0.18
DA	0.15	0.18	0.00

Trend-cycle estimation. MSE between methods. V3E

	TS	X12	DA
TS	0.00	0.00	0.15
X12	0.00	0.00	0.16
DA	0.15	0.16	0.00

Trend-cycle estimation. MSE between methods. V3M

	TS	X12	DA
TS	0.00	0.01	0.23
X12	0.01	0.00	0.26
DA	0.23	0.26	0.00

Trend-cycle estimation. MSE between methods. V3B

	TS	X12	DA
TS	0.00	0.01	0.38
X12	0.01	0.00	0.44
DA	0.38	0.44	0.00

Trend-cycle estimation. MSE between methods. V4P

	TS	X12	DA
TS	0.00	0.01	0.14
X12	0.01	0.00	0.15
DA	0.14	0.15	0.00

Trend-cycle estimation. MSE between methods. V4E

	TS	X12	DA
TS	0.00	0.01	0.13
X12	0.01	0.00	0.15
DA	0.13	0.15	0.00

Trend-cycle estimation. MSE between methods. V4M

	TS	X12	DA
TS	0.00	0.01	0.14
X12	0.01	0.00	0.15
DA	0.14	0.15	0.00

Trend-cycle estimation. MSE between methods. V4B

	TS	X12	DA
TS	0.00	0.01	0.15
X12	0.01	0.00	0.15
DA	0.15	0.15	0.00

b) Mean squared error (MSE) between seasonally adjusted data.

Seasonal adjustment. MSE between methods. V1

	TS	X12	WAV
TS	0.00	0.01	0.35
X12	0.01	0.00	0.34
WAV	0.35	0.34	0.00

Seasonal adjustment. MSE between methods. V2

	TS	X12	WAV
TS	0.00	0.01	0.37
X12	0.01	0.00	0.35
WAV	0.37	0.35	0.00

Seasonal adjustment. MSE between methods. V3P

	TS	X12	WAV
TS	0.00	0.01	0.35
X12	0.35	0.00	0.35
WAV	0.35	0.35	0.00

Seasonal adjustment. MSE between methods. V3E

	TS	X12	WAV
TS	0.00	0.01	0.36
X12	0.01	0.00	0.34
WAV	0.36	0.34	0.00

Seasonal adjustment. MSE between methods. V3M

	TS	X12	WAV
TS	0.00	0.01	0.38
X12	0.01	0.00	0.36
WAV	0.38	0.36	0.00

Seasonal adjustment. MSE between methods. V3B

	TS	X12	WAV
TS	0.00	0.01	0.38
X12	0.01	0.00	0.36
WAV	0.38	0.36	0.00

Seasonal adjustment. MSE between methods. V4P

	TS	X12	WAV
TS	0.00	0.01	0.35
X12	0.01	0.00	0.35
WAV	0.35	0.35	0.00

Seasonal adjustment. MSE between methods. V4E

	TS	X12	WAV
TS	0.00	0.01	0.37
X12	0.01	0.00	0.35
WAV	0.37	0.35	0.00

Seasonal adjustment. MSE between methods. V4M

	TS	X12	WAV
TS	0.00	0.01	0.40
X12	0.01	0.00	0.36
WAV	0.36	0.36	0.00

Seasonal adjustment. MSE between methods. V4B

	TS	X12	WAV
TS	0.00	0.01	0.38
X12	0.01	0.00	0.38
WAV	0.38	0.38	0.00

c) Revisions of trend-cycle series

Mean absolute deviation. X12 method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0121	0.0112	0.0087	0.0085	0.0071	0.0063	0.0060	0.0044	0.0044	0.0042	0.0038	0.0018
V2	0.1078	0.0971	0.0882	0.0791	0.0701	0.0630	0.0537	0.0398	0.0412	0.0434	0.0309	0.0224
V3P	0.0335	0.0333	0.0317	0.0263	0.0332	0.0269	0.0311	0.0315	0.0307	0.0338	0.0133	0.0076
V3E	0.0250	0.0307	0.0441	0.0477	0.0292	0.0200	0.0210	0.0176	0.0121	0.0121	0.0095	0.0057
V3M	0.0378	0.0520	0.0541	0.0574	0.0613	0.0384	0.0199	0.0180	0.0167	0.0147	0.0077	0.0049
V3B	0.0582	0.0755	0.0878	0.0643	0.0891	0.0554	0.0473	0.0551	0.0627	0.0541	0.0323	0.0314
V4P	0.0310	0.0330	0.0322	0.0266	0.0200	0.0164	0.0133	0.0126	0.0118	0.0144	0.0176	0.0069
V4E	0.0299	0.0367	0.1329	0.1139	0.0357	0.0418	0.1329	0.0411	0.0278	0.1202	0.0219	0.0197
V4M	0.0703	0.0709	0.0602	0.0536	0.0517	0.0604	0.0484	0.0407	0.0247	0.0301	0.0171	0.0057
V4B	0.1013	0.0949	0.0843	0.0803	0.0775	0.0804	0.0546	0.0586	0.0315	0.0296	0.0257	0.0136
V3B*	0.0612	0.0747	0.0774	0.0737	0.0855	0.0429	0.0416	0.0401	0.0370	0.0387	0.0156	0.0098
V4B*	0.0912	0.0981	0.0952	0.0949	0.0705	0.0716	0.0627	0.0503	0.0342	0.0409	0.0245	0.0107

Mean squared error. X12 method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0018	0.0011	0.0004	0.0004	0.0003	0.0005	0.0004	0.0002	0.0002	0.0002	0.0001	0.0000
V2	0.1576	0.0822	0.0460	0.0369	0.0317	0.0399	0.0455	0.0113	0.0115	0.0135	0.0076	0.0047
V3P	0.0085	0.0080	0.0086	0.0080	0.0135	0.0058	0.0092	0.0097	0.0069	0.0098	0.0009	0.0006
V3E	0.0037	0.0081	0.0240	0.0424	0.0069	0.0022	0.0041	0.0026	0.0011	0.0014	0.0005	0.0002
V3M	0.0094	0.0260	0.0344	0.0558	0.0752	0.0172	0.0021	0.0042	0.0049	0.0031	0.0006	0.0003
V3B	0.0208	0.0448	0.0810	0.0383	0.1112	0.0178	0.0114	0.0399	0.0449	0.0247	0.0053	0.0051
V4P	0.0052	0.0063	0.0062	0.0031	0.0022	0.0013	0.0010	0.0009	0.0008	0.0013	0.0079	0.0006
V4E	0.0060	0.0140	0.0336	0.0221	0.0077	0.0106	0.0616	0.0284	0.0067	0.0346	0.0130	0.0062
V4M	0.0614	0.0690	0.0231	0.0160	0.0154	0.0543	0.0324	0.0135	0.0047	0.0234	0.0030	0.0004
V4B	0.1183	0.0819	0.0434	0.0374	0.0338	0.0768	0.0217	0.0229	0.0073	0.0088	0.0071	0.0015
V3B*	0.0217	0.0389	0.0523	0.0650	0.1245	0.0130	0.0129	0.0222	0.0170	0.0169	0.0013	0.0014
V4B*	0.0785	0.1205	0.0843	0.0694	0.0268	0.0532	0.0567	0.0227	0.0098	0.0350	0.0046	0.0008

Mean absolute deviation. TS method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0287	0.0095	0.0097	0.0097	0.0061	0.0073	0.0047	0.0245	0.0244	0.0243	0.0031	0.0245
V2	0.4733	0.1216	0.1225	0.1269	0.1099	0.1172	0.4910	0.4964	0.5048	0.4953	0.0217	0.0217
V3P	0.0530	0.0553	0.0455	0.0308	0.0342	0.0289	0.0198	0.0288	0.0170	0.0149	0.0230	0.0138
V3E	0.0324	0.0262	0.0310	0.0276	0.0300	0.0289	0.0173	0.0206	0.0266	0.0123	0.0126	0.0082
V3M	0.0725	0.0688	0.0668	0.0384	0.0435	0.0214	0.0134	0.0243	0.0176	0.0032	0.0189	0.0064
V3B	0.1161	0.1098	0.1171	0.0770	0.0889	0.0727	0.0523	0.0747	0.0326	0.0326	0.0447	0.0212
V4P	0.2321	0.0285	0.0254	0.0226	0.0164	0.2231	0.2219	0.0205	0.0247	0.0100	0.0181	0.1988
V4E	0.0084	0.0031	0.0025	0.0039	0.0056	0.0079	0.0024	0.0035	0.0035	0.0062	0.0025	0.0026
V4M	0.0114	0.0102	0.0053	0.0054	0.0064	0.0091	0.0058	0.0084	0.0058	0.0021	0.0008	0.0008
V4B	0.1501	0.1101	0.0876	0.1203	0.0827	0.1642	0.0656	0.1010	0.0936	0.0257	0.0349	0.0213
V3B*	0.1178	0.1166	0.1066	0.0620	0.0713	0.0392	0.0276	0.0435	0.0285	0.0162	0.0376	0.0171
V4B*	0.0358	0.0305	0.0319	0.0294	0.0334	0.0267	0.0200	0.0222	0.0291	0.0136	0.0123	0.0086

Mean squared error. TS method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0014	0.0002	0.0002	0.0002	0.0001	0.0001	0.0000	0.0009	0.0009	0.0009	0.0000	0.0009
V2	0.3593	0.0240	0.0242	0.0268	0.0193	0.0251	0.4055	0.4179	0.4401	0.4143	0.0009	0.0017
V3P	0.0054	0.0076	0.0060	0.0029	0.0066	0.0030	0.0017	0.0030	0.0006	0.0005	0.0031	0.0014
V3E	0.0019	0.0028	0.0073	0.0018	0.0037	0.0053	0.0006	0.0011	0.0048	0.0009	0.0009	0.0005
V3M	0.0069	0.0070	0.0125	0.0023	0.0064	0.0006	0.0003	0.0043	0.0019	0.0003	0.0007	0.0001
V3B	0.0208	0.0187	0.0307	0.0099	0.0311	0.0108	0.0047	0.0198	0.0036	0.0047	0.0094	0.0030
V4P	0.0859	0.0019	0.0011	0.0010	0.0004	0.0771	0.0766	0.0016	0.0027	0.0011	0.0017	0.0634
V4E	0.0024	0.0002	0.0001	0.0007	0.0017	0.0044	0.0003	0.0009	0.0004	0.0024	0.0003	0.0005
V4M	0.0025	0.0029	0.0003	0.0006	0.0011	0.0040	0.0004	0.0024	0.0024	0.0005	0.0000	0.0001
V4B	0.0339	0.0242	0.0120	0.0228	0.0111	0.0508	0.0075	0.0249	0.0309	0.0011	0.0049	0.0006
V3B*	0.0200	0.0246	0.0322	0.0073	0.0241	0.0040	0.0025	0.0127	0.0022	0.0007	0.0060	0.0017
V4B*	0.0033	0.0098	0.0096	0.0035	0.0080	0.0025	0.0011	0.0018	0.0123	0.0025	0.0007	0.0008

Mean absolute deviation. WA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.3979	0.3970	0.4547	0.4959	0.5186	0.5214	0.5008	0.4658	0.4127	0.3452	0.2690	0.1972
V2	2.2654	2.2668	2.6200	2.8713	3.0105	3.0358	2.9477	2.7600	2.4746	2.0985	1.6525	1.1801
V3P	1.0544	1.0543	1.2345	1.3641	1.4381	1.4584	1.4188	1.3347	1.1912	1.0169	0.8184	0.5845
V3E	0.5562	0.5687	0.6338	0.6772	0.7010	0.6979	0.6680	0.6150	0.5413	0.4526	0.3496	0.2553
V3M	1.5645	1.5779	1.8206	1.9931	2.0865	2.1088	2.0451	1.9102	1.7006	1.4457	1.1466	0.8192
V3B	2.5964	2.6095	3.0278	3.3287	3.4906	3.5350	3.4356	3.2180	2.8688	2.4391	1.9469	1.3890
V4P	1.0831	1.0872	1.2511	1.3677	1.4355	1.4519	1.4116	1.3188	1.1804	0.0078	0.8057	0.5952
V4E	1.2142	1.2237	1.3970	1.5183	1.5819	1.5875	1.5350	1.4273	1.2677	1.0660	0.8283	0.5742
V4M	2.2021	2.2162	2.5374	2.7652	2.8920	2.9154	2.8276	2.6403	2.3586	1.9987	1.5730	1.1176
V4B	3.2407	3.2598	3.7365	4.0775	4.2659	4.3025	4.1770	3.9057	3.4983	2.9781	2.3555	1.6960
V3B*	2.5991	2.6125	3.0351	3.3382	3.5021	3.5481	3.4488	3.2319	2.8830	2.4526	1.9586	1.3995
V4B*	2.6901	2.7170	3.1095	3.3860	3.5384	3.5601	3.4457	3.2083	2.8571	2.4121	1.8930	1.3399

Mean squared error. WA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.2268	0.2259	0.2987	0.3581	0.3951	0.4039	0.3795	0.3332	0.2671	0.1926	0.1214	0.0645
V2	8.5393	8.5298	11.4901	13.9066	15.3918	15.7469	14.9386	13.1502	10.5950	7.6479	4.7667	2.4161
V3P	1.8967	1.8927	2.6139	3.2088	3.5786	3.6988	3.5109	3.1061	2.4861	1.8113	1.1542	0.5844
V3E	0.5109	0.5560	0.6450	0.7106	0.7527	0.7342	0.6663	0.5624	0.4351	0.3055	0.1843	0.0941
V3M	3.9936	4.0653	5.3895	6.4753	7.1109	7.2822	6.8667	6.0061	4.7804	3.4587	2.1776	1.1032
V3B	11.1832	11.2649	15.2140	18.4709	20.4108	20.9988	19.8776	17.4651	13.9345	10.1050	6.3971	3.2356
V4P	1.9224	1.9311	2.5788	3.1065	3.4413	3.5413	3.3641	2.9507	2.3706	1.7194	1.0792	0.5592
V4E	2.3457	2.3835	3.0965	3.6628	4.0012	4.0638	3.8383	3.3583	2.6918	1.9417	1.2145	0.6263
V4M	7.9728	8.0602	10.5703	12.5865	13.8168	14.0876	13.2971	11.6351	9.3242	6.7326	4.2214	2.1724
V4B	17.3552	17.5202	23.0822	27.5936	30.3372	30.0007	29.3175	25.6624	20.5716	14.8805	9.3355	4.8196
V3B*	11.2291	11.3141	15.3099	18.6022	20.5677	21.1722	20.0372	17.6154	14.0611	10.2084	6.4638	3.2742
V4B*	11.9298	12.2008	15.7735	18.6037	20.3101	20.5953	19.3341	16.8306	13.4250	9.6587	6.0273	3.0919

d) Revisions of seasonally-adjusted series

Mean absolute deviation. TS method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0161	0.0117	0.0119	0.0117	0.0075	0.0077	0.0064	0.0174	0.0190	0.0199	0.0034	0.0194
V2	0.5344	0.0887	0.0856	0.0900	0.0715	0.0772	0.5541	0.5607	0.5678	0.5573	0.0237	0.0215
V3P	0.1359	0.1258	0.1017	0.0841	0.0877	0.0551	0.0411	0.0437	0.0276	0.0291	0.0305	0.0195
V3E	0.0537	0.0496	0.0503	0.0475	0.0493	0.0487	0.0345	0.0367	0.0387	0.0215	0.0147	0.0118
V3M	0.0955	0.0894	0.0838	0.0612	0.0595	0.0463	0.0407	0.0412	0.0211	0.0105	0.0232	0.0081
V3B	0.1872	0.1832	0.1823	0.1679	0.1640	0.1136	0.0990	0.1057	0.0564	0.0423	0.0500	0.0241
V4P	0.2737	0.0326	0.0301	0.0250	0.0221	0.2433	0.2427	0.0283	0.0297	0.0198	0.0202	0.2201
V4E	0.0151	0.0075	0.0036	0.0054	0.0074	0.0049	0.0052	0.0050	0.0052	0.0077	0.0035	0.0050
V4M												
V4B	0.1685	0.1291	0.1077	0.1373	0.1034	0.1812	0.0900	0.1198	0.0994	0.0341	0.0378	0.0217
V3B*	0.1992	0.1852	0.1599	0.1334	0.1351	0.0804	0.0676	0.0693	0.0413	0.0327	0.0447	0.0220
V4B*	0.0537	0.0496	0.0503	0.0475	0.0493	0.0487	0.0345	0.0367	0.0387	0.0215	0.0147	0.0118

Mean squared error. TS method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0005	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001	0.0005	0.0006	0.0006	0.0000	0.0006
V2	0.4401	0.0128	0.0121	0.0128	0.0086	0.0101	0.5093	0.5242	0.5449	0.5166	0.0012	0.0011
V3P	0.0340	0.0291	0.0206	0.0144	0.0151	0.0060	0.0040	0.0041	0.0027	0.0029	0.0022	0.0011
V3E	0.0057	0.0043	0.0045	0.0041	0.0045	0.0043	0.0027	0.0029	0.0031	0.0013	0.0004	0.0003
V3M	0.0124	0.0110	0.0096	0.0069	0.0066	0.0028	0.0024	0.0024	0.0008	0.0002	0.0010	0.0001
V3B	0.0677	0.0663	0.0657	0.0570	0.0545	0.0269	0.0208	0.0241	0.0070	0.0049	0.0048	0.0013
V4P	0.1207	0.0019	0.0015	0.0011	0.0008	0.0906	0.0902	0.0017	0.0021	0.0011	0.0012	0.0780
V4E	0.0010	0.0002	0.0001	0.0007	0.0009	0.0011	0.0001	0.0007	0.0002	0.0011	0.0001	0.0002
V4M												
V4B	0.0426	0.0287	0.0200	0.0320	0.0183	0.0573	0.0148	0.0266	0.0200	0.0019	0.0033	0.0007
V3B*	0.0708	0.0619	0.0470	0.0363	0.0370	0.0112	0.0086	0.0087	0.0039	0.0032	0.0041	0.0012
V4B*	0.0057	0.0043	0.0045	0.0041	0.0045	0.0043	0.0027	0.0029	0.0031	0.0013	0.0004	0.0003

Mean absolute deviation. X12 method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0123	0.0131	0.0114	0.0113	0.0094	0.0067	0.0069	0.0053	0.0049	0.0045	0.0043	0.0018
V2	0.0925	0.0903	0.0863	0.0807	0.0707	0.0604	0.0443	0.0378	0.0317	0.0330	0.0240	0.0207
V3P	0.0478	0.0480	0.0497	0.0429	0.0460	0.0328	0.0429	0.0395	0.0396	0.0411	0.0160	0.0106
V3E	0.0476	0.0505	0.0627	0.0550	0.0398	0.0343	0.0306	0.0248	0.0172	0.0159	0.0121	0.0070
V3M	0.0572	0.0659	0.0693	0.0563	0.0497	0.0416	0.0289	0.0199	0.0142	0.0141	0.0088	0.0059
V3B	0.0865	0.0984	0.1250	0.0883	0.0937	0.0773	0.0745	0.0715	0.0681	0.0620	0.0364	0.0348
V4P	0.0424	0.0432	0.0388	0.0351	0.0291	0.0270	0.0192	0.0177	0.0145	0.0153	0.0130	0.0046
V4E	0.0385	0.0374	0.0728	0.0520	0.0448	0.0545	0.0558	0.0363	0.0295	0.0320	0.0169	0.0182
V4M	0.0662	0.0619	0.0587	0.0579	0.0535	0.0498	0.0376	0.0418	0.0235	0.0157	0.0152	0.0051
V4B	0.0989	0.1007	0.0868	0.0899	0.0844	0.0702	0.0543	0.0586	0.0235	0.0219	0.0203	0.0109
V3B*	0.0812	0.0914	0.1014	0.0750	0.0736	0.0603	0.0559	0.0530	0.0456	0.0468	0.0180	0.0145
V4B*	0.1033	0.1004	0.1152	0.1073	0.0892	0.0821	0.0669	0.0616	0.0377	0.0301	0.0264	0.0115

Mean squared error. X12 method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0009	0.0009	0.0007	0.0006	0.0004	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0000
V2	0.0489	0.0448	0.0401	0.0369	0.0290	0.0193	0.0126	0.0094	0.0084	0.0061	0.0039	0.0025
V3P	0.0217	0.0221	0.0214	0.0185	0.0187	0.0112	0.0157	0.0128	0.0138	0.0159	0.0017	0.0012
V3E	0.0131	0.0145	0.0228	0.0162	0.0108	0.0078	0.0053	0.0035	0.0021	0.0018	0.0011	0.0004
V3M	0.0210	0.0267	0.0303	0.0180	0.0144	0.0093	0.0048	0.0033	0.0020	0.0017	0.0005	0.0002
V3B	0.0623	0.0737	0.1206	0.0495	0.0577	0.0372	0.0324	0.0297	0.0238	0.0192	0.0069	0.0064
V4P	0.0120	0.0120	0.0083	0.0077	0.0058	0.0062	0.0033	0.0033	0.0025	0.0026	0.0021	0.0001
V4E	0.0088	0.0096	0.0247	0.0131	0.0089	0.0132	0.0134	0.0071	0.0043	0.0057	0.0018	0.0031
V4M	0.0239	0.0225	0.0167	0.0168	0.0157	0.0150	0.0085	0.0146	0.0034	0.0015	0.0013	0.0002
V4B	0.0490	0.0498	0.0378	0.0396	0.0331	0.0242	0.0158	0.0245	0.0031	0.0024	0.0020	0.0005
V3B*	0.0542	0.0634	0.0728	0.0469	0.0439	0.0296	0.0280	0.0227	0.0215	0.0245	0.0019	0.0019
V4B*	0.0610	0.0626	0.0674	0.0554	0.0420	0.0344	0.0243	0.0277	0.0084	0.0054	0.0040	0.0011

Mean absolute deviation. DA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Mean squared error. DA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

e) Revisions of trend-cycle series (temporal analysis)

Mean absolute deviation. TS method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0204	0.4888	0.0492	0.0705	0.0289	0.0678	0.0756	0.0625	0.0656	0.1586	0.0569	0.0486
02/02	0.0222	0.1110	0.0776	0.0592	0.0759	0.0854	0.1113	0.0261	0.0776	0.1736	0.1320	0.1311
03/02	0.0207	0.2392	0.0934	0.1088	0.1622	0.2311	0.1485	0.0268	0.0367	0.0421	0.2224	0.1348
04/02	0.0167	0.4597	0.1026	0.0430	0.0425	0.1471	0.1439	0.0423	0.0389	0.0939	0.1209	0.0798
05/02	0.0238	0.5448	0.2219	0.0939	0.1335	0.3390	0.0843	0.0962	0.0614	0.1485	0.3363	0.1416
06/02	0.0201	0.7750	0.1747	0.1505	0.0473	0.1597	0.0593	0.1501	0.1575	0.2887	0.1943	0.0548
07/02	0.0258	0.4241	0.1774	0.0714	0.0881	0.2129	0.0458	0.0417	0.0416	0.0800	0.2600	0.0738
08/02	0.0391	0.3909	0.1452	0.1066	0.2280	0.4293	0.1743	0.0978	0.1440	0.3957	0.3583	0.2324
09/02	0.0569	0.2595	0.0983	0.2416	0.1912	0.3173	0.2829	0.0705	0.1818	0.5983	0.2505	0.4202
10/02	0.0182	0.1707	0.2054	0.2233	0.1369	0.4471	0.2971	0.2494	0.1101	0.1736	0.3366	0.3208
11/02	0.0495	0.0487	0.3192	0.1805	0.1071	0.5728	0.3085	0.1296	0.0346	0.4745	0.4220	0.1480
12/02	0.0587	0.4531	0.4569	0.2577	0.0323	0.7125	0.1092	0.3125	0.1116	0.0735	0.4892	0.3692

Mean squared error. TS method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0033	0.8348	0.0052	0.0227	0.0012	0.0108	0.0116	0.0392	0.0422	0.0837	0.0067	0.0067
02/02	0.0009	0.0313	0.0169	0.0148	0.0162	0.0292	0.0280	0.0042	0.0565	0.2062	0.0590	0.0915
03/02	0.0009	0.1449	0.0292	0.0789	0.1877	0.3333	0.0434	0.0022	0.0061	0.0030	0.3360	0.1253
04/02	0.0014	0.6093	0.0375	0.0049	0.0056	0.0677	0.0364	0.0058	0.0060	0.0272	0.0602	0.0188
05/02	0.0012	0.9789	0.1955	0.0254	0.1103	0.6895	0.0137	0.0497	0.0208	0.0657	0.5872	0.0714
06/02	0.0011	1.8054	0.0912	0.1003	0.0043	0.1059	0.0056	0.1350	0.1339	0.3331	0.1277	0.0046
07/02	0.0008	0.5311	0.0934	0.0083	0.0179	0.1241	0.0030	0.0043	0.0040	0.0147	0.1887	0.0138
08/02	0.0036	0.2866	0.0559	0.0208	0.2020	0.6647	0.0742	0.0300	0.0872	0.5734	0.4636	0.1333
09/02	0.0041	0.1762	0.0109	0.1273	0.1018	0.2332	0.1647	0.0082	0.1234	1.2891	0.0976	0.4901
10/02	0.0003	0.0792	0.0486	0.0922	0.0363	0.4027	0.1183	0.1583	0.0324	0.0508	0.1603	0.2303
11/02	0.0028	0.0025	0.1126	0.0364	0.0220	0.4780	0.1676	0.0258	0.0023	0.4160	0.2224	0.0226
12/02	0.0034	0.2053	0.2088	0.0664	0.0010	0.5077	0.0119	0.0976	0.0124	0.0054	0.2393	0.1363

Mean absolute deviation. X12 method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0457	0.4262	0.1166	0.0660	0.0993	0.1526	0.0696	0.2270	0.2829	0.3684	0.1762	0.2481
02/02	0.0330	0.3137	0.0726	0.1009	0.1493	0.2311	0.0751	0.2553	0.3307	0.3274	0.1834	0.3884
03/02	0.0137	0.1939	0.1217	0.1810	0.2123	0.4195	0.0830	0.1998	0.1525	0.1692	0.2657	0.3070
04/02	0.0146	0.0776	0.2028	0.2759	0.3218	0.4023	0.0387	0.1080	0.1010	0.1139	0.3469	0.3370
05/02	0.0295	0.2109	0.3386	0.1473	0.4051	0.5209	0.0400	0.2850	0.3000	0.3050	0.5457	0.3363
06/02	0.0447	0.4262	0.3107	0.1485	0.2384	0.3183	0.0238	0.3558	0.4034	0.4450	0.2530	0.3633
07/02	0.0430	0.4790	0.2832	0.1078	0.1426	0.4657	0.0422	0.4184	0.3515	0.2486	0.4061	0.4593
08/02	0.0349	0.1880	0.1971	0.1184	0.1553	0.4663	0.1476	0.4404	0.3092	0.3836	0.3454	0.4066
09/02	0.0222	0.1157	0.1465	0.1024	0.1985	0.5494	0.3008	0.5244	0.3110	0.3483	0.3449	0.3606
10/02	0.0251	0.2394	0.2277	0.1648	0.1842	0.4880	0.4833	0.5300	0.7206	0.4437	0.3900	0.8676
11/02	0.0414	0.1524	0.0691	0.0208	0.0750	0.2305	0.5419	0.7047	0.2862	0.4940	0.0725	0.2653
12/02	0.0118	0.6866	0.2588	0.0417	0.1710	0.5446	0.2951	0.8671	0.1747	0.4081	0.4298	0.2164

Mean squared error. X12 method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0093	0.8673	0.0235	0.0111	0.0246	0.0524	0.0127	0.0726	0.2789	0.6196	0.0595	0.2134
02/02	0.0071	0.3875	0.0097	0.0424	0.0585	0.1640	0.0193	0.0930	0.5354	0.4415	0.0788	0.5719
03/02	0.0006	0.1357	0.0326	0.1665	0.1426	0.5839	0.0425	0.0804	0.1108	0.1341	0.2464	0.3522
04/02	0.0004	0.0088	0.1062	0.3902	0.3599	0.4738	0.0036	0.0433	0.0216	0.0228	0.6532	0.4367
05/02	0.0013	0.0500	0.3068	0.0599	0.6371	0.9598	0.0053	0.1488	0.1854	0.2254	1.4790	0.2467
06/02	0.0038	0.2825	0.2384	0.0611	0.2162	0.2267	0.0010	0.1709	0.4897	0.8169	0.1812	0.3031
07/02	0.0033	0.6223	0.2365	0.0238	0.0400	0.4669	0.0026	0.3902	0.3907	0.1101	0.4627	0.5835
08/02	0.0027	0.0687	0.0832	0.0436	0.0387	0.3025	0.0273	0.4164	0.2064	0.3056	0.2062	0.4302
09/02	0.0008	0.0183	0.0415	0.0150	0.0692	0.5123	0.1190	0.5504	0.2283	0.1779	0.2021	0.3199
10/02	0.0010	0.1067	0.1361	0.0663	0.0731	0.6075	0.3496	0.3447	1.1952	0.3143	0.4028	1.8170
11/02	0.0027	0.0296	0.0048	0.0005	0.0066	0.0539	0.4529	0.5180	0.1257	0.3576	0.0067	0.1101
12/02	0.0001	0.4714	0.0670	0.0017	0.0292	0.2966	0.0871	0.7518	0.0305	0.1666	0.1848	0.0468

Mean absolute deviation. WA method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0572	0.6097	0.3442	0.3440	0.6479	0.9626	0.3728	0.2726	0.6139	0.9829	0.9921	0.9579
02/02	0.0505	0.6481	0.3629	0.3858	0.7110	0.0094	0.3928	0.3116	0.6668	1.0581	1.0425	1.0527
03/02	0.0449	0.6026	0.3219	0.3684	0.6775	0.9501	0.3771	0.3280	0.6442	1.0192	0.9790	1.0126
04/02	0.0399	0.5617	0.2864	0.3505	0.6450	0.9028	0.3669	0.3500	0.6408	0.9893	0.9267	0.9892
05/02	0.0350	0.5229	0.2738	0.3774	0.6495	0.8981	0.3471	0.3713	0.6180	0.9695	0.9233	0.9954
06/02	0.0321	0.4804	0.3010	0.3658	0.6467	0.9215	0.3372	0.3972	0.6299	0.9832	0.9477	0.9957
07/02	0.0293	0.4745	0.3228	0.3518	0.6506	0.9231	0.3415	0.4419	0.6713	0.0095	0.9447	0.0005
08/02	0.0290	0.4763	0.3052	0.3724	0.6705	0.9402	0.3394	0.4664	0.6984	0.9849	0.9623	0.9946
09/02	0.0300	0.4296	0.3227	0.3485	0.6770	0.9775	0.3233	0.4892	0.7174	0.9819	0.9997	0.9463
10/02	0.0357	0.4006	0.3192	0.3087	0.6330	0.9176	0.2688	0.5066	0.7020	0.9267	0.9523	0.8737
11/02	0.0468	0.4346	0.2154	0.2725	0.4916	0.6628	0.2052	0.4821	0.6499	0.8577	0.7070	0.7445
12/02	0.0812	0.3776	0.1764	0.1543	0.3307	0.4437	0.0337	0.5389	0.5675	0.6135	0.5070	0.4133

Mean squared error. WA method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0048	0.5027	0.1614	0.1738	0.6310	1.3206	0.1846	0.1050	0.5214	1.3089	1.3990	1.2645
02/02	0.0039	0.4950	0.1641	0.1990	0.6876	1.4055	0.1843	0.1189	0.5407	1.3379	1.4897	1.3595
03/02	0.0031	0.4247	0.1421	0.1791	0.6068	1.2324	0.1676	0.1292	0.5191	1.2570	1.3010	1.2756
04/02	0.0025	0.3733	0.1238	0.1586	0.5169	1.0410	0.1598	0.1398	0.5124	1.2122	1.1096	1.2116
05/02	0.0019	0.3335	0.1000	0.1752	0.5046	0.9494	0.1513	0.1505	0.5042	1.1945	1.0181	1.2371
06/02	0.0015	0.3036	0.1108	0.1540	0.5048	0.9885	0.1451	0.1686	0.5162	1.2011	1.0584	1.1900
07/02	0.0013	0.3038	0.1243	0.1351	0.4963	1.0377	0.1416	0.2015	0.5690	1.2613	1.0948	1.2125
08/02	0.0012	0.2866	0.1162	0.1512	0.5009	1.0270	0.1319	0.2225	0.5808	1.2612	1.0782	1.2657
09/02	0.0015	0.2363	0.1303	0.1304	0.4995	1.0819	0.1197	0.2437	0.5868	1.2499	1.1247	1.1883
10/02	0.0020	0.2165	0.1278	0.1010	0.4361	0.9622	0.0858	0.2618	0.5399	1.0461	1.0231	0.9902
11/02	0.0032	0.2322	0.0484	0.0832	0.2446	0.4405	0.0711	0.2367	0.4434	0.8763	0.4999	0.7285
12/02	0.0066	0.1426	0.0311	0.0238	0.1093	0.1969	0.0011	0.2905	0.3221	0.3763	0.2571	0.1708

f) Revisions of seasonally adjusted series (temporal analysis)

Mean absolute deviation. TS method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0093	0.4414	0.0436	0.0241	0.0225	0.0737	0.1106	0.0370	0.0000	0.1419	0.0562	0.0241
02/02	0.0129	0.0492	0.0392	0.0218	0.0411	0.0820	0.1332	0.0217	0.0000	0.1414	0.0645	0.0218
03/02	0.0141	0.1841	0.0209	0.0293	0.0440	0.1288	0.1821	0.0298	0.0000	0.0561	0.0534	0.0293
04/02	0.0314	0.4723	0.0432	0.0169	0.0289	0.1003	0.1321	0.0422	0.0000	0.0907	0.0663	0.0169
05/02	0.0319	0.4740	0.0614	0.0330	0.0208	0.1161	0.0470	0.0540	0.0000	0.1330	0.0735	0.0330
06/02	0.0345	0.7711	0.0450	0.0321	0.0346	0.0954	0.1032	0.0939	0.0000	0.2540	0.0704	0.0321
07/02	0.0244	0.3982	0.0377	0.0208	0.0287	0.1030	0.1070	0.0328	0.0000	0.1096	0.0637	0.0208
08/02	0.0394	0.4018	0.0361	0.0307	0.0372	0.1309	0.1540	0.0775	0.0000	0.2413	0.0712	0.0307
09/02	0.0421	0.1832	0.0263	0.0461	0.0412	0.1410	0.3158	0.0443	0.0000	0.3484	0.0675	0.0461
10/02	0.0297	0.1451	0.0451	0.0205	0.0747	0.1489	0.1374	0.1485	0.0000	0.1167	0.1112	0.0205
11/02	0.0154	0.0534	0.0677	0.0297	0.0149	0.1183	0.3927	0.0673	0.0000	0.3107	0.0726	0.0297
12/02	0.0130	0.1607	0.0707	0.0382	0.0057	0.1267	0.2079	0.1754	0.0000	0.0557	0.0650	0.0382

Mean squared error. TS method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0001	0.6767	0.0038	0.0011	0.0012	0.0111	0.0234	0.0123	0.0000	0.0448	0.0064	0.0011
02/02	0.0002	0.0048	0.0030	0.0008	0.0037	0.0159	0.0355	0.0017	0.0000	0.0866	0.0083	0.0008
03/02	0.0003	0.0834	0.0007	0.0024	0.0044	0.0275	0.0689	0.0028	0.0000	0.0044	0.0074	0.0024
04/02	0.0016	0.7903	0.0052	0.0006	0.0028	0.0300	0.0282	0.0064	0.0000	0.0179	0.0149	0.0006
05/02	0.0015	0.7713	0.0097	0.0016	0.0009	0.0411	0.0036	0.0149	0.0000	0.0440	0.0159	0.0016
06/02	0.0016	1.7221	0.0039	0.0019	0.0019	0.0188	0.0172	0.0429	0.0000	0.1735	0.0076	0.0019
07/02	0.0008	0.4549	0.0026	0.0007	0.0014	0.0156	0.0157	0.0019	0.0000	0.0283	0.0064	0.0007
08/02	0.0019	0.3263	0.0020	0.0015	0.0021	0.0241	0.0387	0.0135	0.0000	0.2005	0.0077	0.0015
09/02	0.0018	0.1274	0.0010	0.0029	0.0019	0.0259	0.1249	0.0028	0.0000	0.4287	0.0053	0.0029
10/02	0.0009	0.0506	0.0020	0.0007	0.0075	0.0266	0.0385	0.0489	0.0000	0.0213	0.0158	0.0007
11/02	0.0003	0.0053	0.0046	0.0015	0.0002	0.0140	0.1902	0.0082	0.0000	0.1722	0.0054	0.0015
12/02	0.0002	0.0258	0.0050	0.0015	0.0000	0.0160	0.0432	0.0308	0.0000	0.0031	0.0042	0.0015

Mean absolute deviation. X12 method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0136	0.0870	0.0752	0.0568	0.0584	0.1221	0.0318	0.0705	0.0893	0.0960	0.1252	0.1417
02/02	0.0077	0.0658	0.0365	0.0383	0.0702	0.0939	0.0338	0.0717	0.0784	0.1247	0.0907	0.0981
03/02	0.0073	0.0921	0.0519	0.0904	0.1016	0.2940	0.0319	0.1111	0.0641	0.0705	0.1228	0.1493
04/02	0.0103	0.0764	0.0921	0.0584	0.0816	0.1757	0.0256	0.0568	0.0476	0.0691	0.0865	0.0960
05/02	0.0116	0.1069	0.0483	0.0411	0.0477	0.1594	0.0229	0.0902	0.1229	0.1200	0.0794	0.1422
06/02	0.0125	0.1147	0.1556	0.0549	0.0544	0.0524	0.0207	0.0708	0.0878	0.0530	0.1865	0.1340
07/02	0.0234	0.1174	0.0927	0.0854	0.0619	0.1818	0.0442	0.0921	0.0571	0.1156	0.1407	0.1192
08/02	0.0109	0.0760	0.1052	0.0650	0.0658	0.1489	0.0412	0.0872	0.1930	0.2465	0.1385	0.2458
09/02	0.0098	0.0939	0.0677	0.0700	0.0275	0.1396	0.0156	0.2023	0.1594	0.0195	0.0769	0.2294
10/02	0.0074	0.1500	0.1202	0.0646	0.0506	0.1530	0.0696	0.1400	0.0720	0.0819	0.1520	0.1292
11/02	0.0142	0.0602	0.0426	0.0045	0.0278	0.0821	0.1825	0.1595	0.0862	0.1296	0.0497	0.0817
12/02	0.0225	0.2924	0.1070	0.0203	0.0905	0.1780	0.0689	0.4226	0.0287	0.1147	0.1975	0.0491

Mean squared error. X12 method

	V1	V2	V3P	V3E	V3M	V3B	V4P	V4E	V4M	V4B	V3B*	V4B*
01/02	0.0003	0.0140	0.0138	0.0060	0.0055	0.0289	0.0022	0.0085	0.0166	0.0168	0.0268	0.0335
02/02	0.0001	0.0071	0.0025	0.0036	0.0086	0.0268	0.0021	0.0124	0.0108	0.0346	0.0144	0.0164
03/02	0.0001	0.0132	0.0059	0.0301	0.0255	0.3186	0.0019	0.0209	0.0087	0.0074	0.0490	0.0566
04/02	0.0001	0.0095	0.0133	0.0122	0.0240	0.0492	0.0013	0.0040	0.0043	0.0078	0.0136	0.0199
05/02	0.0002	0.0143	0.0051	0.0022	0.0048	0.0398	0.0009	0.0127	0.0271	0.0271	0.0170	0.0265
06/02	0.0003	0.0198	0.0438	0.0046	0.0055	0.0043	0.0005	0.0140	0.0150	0.0045	0.0708	0.0337
07/02	0.0010	0.0188	0.0216	0.0095	0.0068	0.0417	0.0030	0.0149	0.0041	0.0221	0.0361	0.0212
08/02	0.0002	0.0076	0.0166	0.0072	0.0054	0.0299	0.0022	0.0090	0.1116	0.1639	0.0342	0.1701
09/02	0.0001	0.0143	0.0121	0.0062	0.0009	0.0293	0.0005	0.0465	0.0344	0.0008	0.0101	0.0694
10/02	0.0001	0.0295	0.0343	0.0089	0.0053	0.0519	0.0094	0.0231	0.0066	0.0074	0.0654	0.0271
11/02	0.0004	0.0069	0.0019	0.0000	0.0008	0.0073	0.0592	0.0259	0.0117	0.0281	0.0029	0.0109
12/02	0.0005	0.0855	0.0114	0.0004	0.0082	0.0317	0.0047	0.1786	0.0008	0.0132	0.0390	0.0024

Mean absolute deviation. DA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Mean squared error. DA method

	12 m.	11 m.	10 m.	9 m.	8 m.	7 m.	6 m.	5 m.	4 m.	3 m.	2 m.	1 m.
V1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4M	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V3B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
V4B*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

g) Forecasting raw-data or seasonally adjusted data? The Kruskal-Wallis test for detecting seasonality

g1) Summary of the results

KW	Rejection of the Null (Null: non-seasonality)	Non-rejection of the Null	TOTAL
Month	22	148	170
Quarter	4	22	26
TOTAL	26	170	196

KW	Rejection of the Null	Non-rejection of the Null	TOTAL
Month	11.22%	75.51%	86.73%
Quarter	2.04%	11.22%	13.27%
TOTAL	13.27%	86.73%	100.00%

g2) Detailed results

KW	H	p-value	Decision
v1	8.53	0.67	Non RH0
v2	7.50	0.76	Non RH0
v3p	29.54	0.00	RH0
v3e	18.75	0.07	Non RH0
v3m	25.21	0.01	RH0
v3b	26.71	0.01	RH0
v4p	2.79	0.99	Non RH0
v4e	1.42	1.00	Non RH0
v4m	1.01	1.00	Non RH0
v4b	1.64	1.00	Non RH0
v5p	2.07	1.00	Non RH0
v5e	1.96	1.00	Non RH0
v5m	1.61	1.00	Non RH0
v5b	2.02	1.00	Non RH0
v6p	2.05	1.00	Non RH0
v6e	3.53	0.98	Non RH0
v6m	4.10	0.97	Non RH0
v6b	2.71	0.99	Non RH0
v7p	67.23	0.00	RH0
v7e	18.53	0.07	Non RH0
v7m	39.18	0.00	RH0
v7b	57.03	0.00	RH0
v8p	55.60	0.00	RH0
v8e	128.82	0.00	RH0
v8m	9.48	0.58	Non RH0
v8b	21.34	0.03	RH0
v9p	4.60	0.95	Non RH0
v9e	4.70	0.94	Non RH0
v9m	3.46	0.98	Non RH0
v9b	3.32	0.99	Non RH0
v10p	20.25	0.00	RH0
v10e	15.04	0.00	RH0
v10m	10.84	0.01	RH0
v10b	14.03	0.00	RH0
v11p	7.20	0.07	Non RH0
v11e	4.84	0.18	Non RH0
v11m	3.83	0.28	Non RH0
v11b	5.23	0.16	Non RH0

KW	H	p-value	Decision
v12	6.22	0.86	Non RH0
v13pp	1.06	1.00	Non RH0
v13p	1.61	1.00	Non RH0
v13e	1.96	1.00	Non RH0
v13m	2.61	0.99	Non RH0
v13mm	0.95	1.00	Non RH0
v13n	6.18	0.86	Non RH0
v13b	1.51	1.00	Non RH0
v14pp	5.57	0.90	Non RH0
v14p	1.84	1.00	Non RH0
v14e	6.20	0.86	Non RH0
v14m	5.27	0.92	Non RH0
v14mm	2.09	1.00	Non RH0
v14n	4.40	0.96	Non RH0
v14b	3.20	0.99	Non RH0
v15pp	1.79	1.00	Non RH0
v15p	1.30	1.00	Non RH0
v15e	1.56	1.00	Non RH0
v15m	1.65	1.00	Non RH0
v15mm	1.69	1.00	Non RH0
v15n	10.73	0.47	Non RH0
v15b	1.27	1.00	Non RH0
v16pp	7.46	0.76	Non RH0
v16p	7.83	0.73	Non RH0
v16e	4.40	0.96	Non RH0
v16m	6.87	0.81	Non RH0
v16mm	6.52	0.84	Non RH0
v16n	12.26	0.34	Non RH0
v16b	8.25	0.69	Non RH0
v17pp	0.20	1.00	Non RH0
v17p	1.13	1.00	Non RH0
v17e	0.98	1.00	Non RH0
v17m	0.27	1.00	Non RH0
v17mm	1.06	1.00	Non RH0
v17n	8.96	0.63	Non RH0
v17b	0.54	1.00	Non RH0
v18pp	5.07	0.93	Non RH0
v18p	2.10	1.00	Non RH0
v18e	2.26	1.00	Non RH0
v18m	1.94	1.00	Non RH0
v18mm	1.83	1.00	Non RH0
v18n	18.25	0.08	Non RH0
v18b	2.74	0.99	Non RH0
v19pp	5.37	0.91	Non RH0
v19p	9.75	0.55	Non RH0
v19e	4.99	0.93	Non RH0
v19m	8.31	0.69	Non RH0

KW	H	p-value	Decision
v19mm	8.73	0.65	Non RH0
v19n	4.54	0.95	Non RH0
v19b	7.86	0.73	Non RH0
v20pp	4.52	0.95	Non RH0
v20e	8.64	0.65	Non RH0
v20mm	4.49	0.95	Non RH0
v20n	2.41	1.00	Non RH0
v20b	3.61	0.98	Non RH0
v21pp	9.27	0.60	Non RH0
v21p	0.72	1.00	Non RH0
v21e	1.30	1.00	Non RH0
v21m	3.32	0.99	Non RH0
v21mm	2.65	0.99	Non RH0
v21n	2.09	1.00	Non RH0
v21b	1.14	1.00	Non RH0
v22pp	0.50	1.00	Non RH0
v22p	1.77	1.00	Non RH0
v22m	3.69	0.98	Non RH0
v22mm	1.87	1.00	Non RH0
v22n	1.46	1.00	Non RH0
v22b	1.40	1.00	Non RH0
v23pp	1.82	1.00	Non RH0
v23p	2.51	1.00	Non RH0
v23m	5.97	0.88	Non RH0
v23mm	2.18	1.00	Non RH0
v23n	1.89	1.00	Non RH0
v23b	2.43	1.00	Non RH0
v24pp	6.16	0.86	Non RH0
v24p	3.42	0.98	Non RH0
v24e	2.97	0.99	Non RH0
v24m	1.88	1.00	Non RH0
v24mm	6.08	0.87	Non RH0
v24n	3.93	0.97	Non RH0
v24b	3.52	0.98	Non RH0
v25pp	2.25	0.52	Non RH0
v25p	2.53	0.47	Non RH0
v25m	0.16	0.98	Non RH0
v25mm	1.49	0.68	Non RH0
v25n	0.19	0.98	Non RH0
v25b	1.62	0.65	Non RH0
v26pp	0.46	0.93	Non RH0
v26p	0.34	0.95	Non RH0
v26m	0.67	0.88	Non RH0
v26mm	0.88	0.83	Non RH0
v26n	0.34	0.95	Non RH0
v26b	0.31	0.96	Non RH0
v27pp	0.64	0.89	Non RH0
v27p	0.42	0.94	Non RH0

KW	H	p-value	Decision
v27m	1.17	0.76	Non RH0
v27mm	0.57	0.90	Non RH0
v27n	1.52	0.68	Non RH0
v27b	0.21	0.98	Non RH0
v28	22.07	0.02	RH0
v29p	124.89	0.00	RH0
v29e	126.43	0.00	RH0
v29m	124.63	0.00	RH0
v29b	128.95	0.00	RH0
v30p	9.54	0.57	Non RH0
v30e	17.20	0.10	Non RH0
v30m	14.18	0.22	Non RH0
v30b	12.58	0.32	Non RH0
v31p	63.55	0.00	RH0
v31e	45.56	0.00	RH0
v31m	51.73	0.00	RH0
v31b	54.82	0.00	RH0
v32p	8.75	0.65	Non RH0
v32e	31.10	0.00	RH0
v32m	18.94	0.06	Non RH0
v32b	8.26	0.69	Non RH0
v33	6.96	0.80	Non RH0
v34p	0.62	1.00	Non RH0
v34e	0.60	1.00	Non RH0
v34m	1.34	1.00	Non RH0
v34b	1.20	1.00	Non RH0
v35p	7.27	0.78	Non RH0
v35e	2.06	1.00	Non RH0
v35m	6.93	0.80	Non RH0
v35b	39.12	0.00	RH0
v36p	4.23	0.96	Non RH0
v36e	1.12	1.00	Non RH0
v36m	7.40	0.77	Non RH0
v36b	22.47	0.02	RH0
v37p	3.93	0.97	Non RH0
v37e	1.48	1.00	Non RH0
v37m	3.03	0.99	Non RH0
v37b	9.70	0.56	Non RH0
v38p	7.32	0.77	Non RH0
v38e	5.45	0.91	Non RH0
v38m	11.85	0.38	Non RH0
v38b	31.07	0.00	RH0
v39	2.20	1.00	Non RH0
v40p	0.93	1.00	Non RH0
v40e	5.48	0.91	Non RH0
v40m	3.02	0.99	Non RH0
v40b	0.97	1.00	Non RH0
v41p	13.22	0.28	Non RH0

KW	H	p-value	Decision
v41e	12.27	0.34	Non RH0
v41m	13.85	0.24	Non RH0
v41b	13.36	0.27	Non RH0
v42p	6.93	0.81	Non RH0
v42e	5.55	0.90	Non RH0
v42m	10.81	0.46	Non RH0
v42b	7.97	0.72	Non RH0
v43p	2.69	0.99	Non RH0
v43e	2.37	1.00	Non RH0
v43m	9.56	0.57	Non RH0
v43b	3.11	0.99	Non RH0
v44p	8.19	0.70	Non RH0
v44e	3.25	0.99	Non RH0
v44m	15.24	0.17	Non RH0
v44b	10.54	0.48	Non RH0

ANNEX 6. The effects on removing outliers using Tramo/Seats

A6.1. Descriptive statistics

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
v1	216	100.1625	3.3784	1.838	1.8351
v2	216	-6.8289	71.4632	8.4536	123.7922
v3p	216	17.8581	18.0743	4.2514	23.8065
v3e	216	64.1288	10.841	3.2926	5.1343
v3m	216	17.4521	34.3229	5.8586	33.5694
v3b	216	-0.0329	98.332	9.9163	30115.0751
v4p	216	11.944	19.4805	4.4137	36.9531
v4e	216	63.0748	28.3333	5.3229	8.439
v4m	216	28.4332	92.0663	9.5951	33.7462
v4b	216	-16.4927	185.2419	13.6104	82.5236
v5p	216	9.2623	13.3449	3.6531	39.4401
v5e	216	57.6314	32.4553	5.697	9.8852
v5m	216	25.8555	54.9161	7.4105	28.6614
v5b	216	-19.0054	163.3955	12.7826	67.258
v6p	216	16.7894	13.4871	3.6725	21.8739
v6e	216	76.6071	7.9314	2.8163	3.6763
v6m	216	6.6169	3.238	1.7994	27.1944
v6b	216	10.1705	25.7411	5.0736	49.8851
v7p	216	18.4887	17.4848	4.1815	22.6164
v7e	216	71.0138	5.7477	2.3974	3.376
v7m	216	13.2731	27.9396	5.2858	39.8232
v7b	216	4.9258	80.6569	8.9809	182.3258
v8p	216	17.5023	52.4328	7.2411	41.3721
v8e	216	73.5227	32.7396	5.7219	7.7824
v8m	216	5.1455	3.517	1.8754	36.4462
v8b	216	8.7183	95.5444	9.7747	112.1167
v10p	72	22.7953	29.5095	5.4323	23.8307
v10e	72	56.8936	9.0064	3.0011	5.2749
v10m	72	20.3151	36.1671	6.0139	29.6031
v10b	72	2.4801	122.3853	11.0628	446.0552
v11p	72	18.5097	15.8412	3.9801	21.5028
v11e	72	68.775	5.1249	2.2638	3.2916
v11m	72	12.8068	16.8793	4.1084	32.0802
v11b	72	5.7056	60.027	7.7477	135.7923
v12	216	-8.0824	53.5806	7.3199	90.5655
v13b	216	-13.8079	15.5504	3.9434	28.559
v14b	216	-2.5008	12.0852	3.4764	139.0104
v15b	216	-14.9359	178.2328	13.3504	89.3843
v16b	216	6.9405	175.295	13.2399	190.7636
v17b	216	12.6443	134.2943	11.5885	91.6507
v18b	216	22.5985	86.8201	9.3177	41.2317
v19b	216	12.2562	234.775	15.3224	125.0171
v20b	216	-9.1626	78.0557	8.8349	96.4241
v21b	216	-15.5444	5.7571	2.3994	15.4358
v22b	216	46.4245	76.4109	8.7413	18.8291
v23b	216	-2.1243	32.8797	5.7341	269.9339

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
v24b	216	-9.0402	2.5468	1.5959	17.6531
v25b	52	-53.4618	13.3817	3.6581	6.8425
v26b	52	-82.6537	1.0823	1.0403	1.2587
v27b	52	-62.2032	6.5265	2.5547	4.107
v28	216	-21.2374	186.8537	13.6694	64.3651
v29b	216	-7.695	328.9937	18.1382	235.7153
v30b	216	-30.3272	210.7173	14.5161	47.865
v31b	216	-12.1879	203.8097	14.2762	117.134
v32b	216	0.727	194.0983	13.9319	1916.4706
v33	204	-6.9809	45.7466	6.7636	96.8871
v34b	216	-8.2035	165.4672	12.8634	156.8035
v35b	216	16.2109	10.4964	3.2398	19.9854
v36b	215	-3.9313	68.992	8.3061	211.2797
v37b	204	2.4268	65.5508	8.0963	333.6266
v38b	213	-2.5649	33.5825	5.795	225.9336
v39	93	22.9158	60.4939	7.7778	33.9407
v40b	93	38.3742	129.7877	11.3924	29.6878
v41b	93	18.1222	73.2596	8.5592	47.2303
v42b	93	35.0975	302.1894	17.3836	49.5294
v43b	93	-2.4749	98.9429	9.947	401.9175
v44b	72	-10.3718	138.1183	11.7524	113.3108

A6.2. Tests of equality of variance and analysis of the sign of the covariance between positive and negative answers

a) Summary of the results

Covariance	Negative sign	Positive sign	TOTAL
Month	32	1	33
Quarter	4	1	5
TOTAL	36	2	38

Covariance	Negative sign	Positive sign	TOTAL
Month	84%	3%	87%
Quarter	11%	3%	13%
TOTAL	95%	5%	100%

Statistic	Rejection of the Null (Null: Equality of variance)	Non-rejection of the Null	TOTAL
Month	29	4	33
Quarter	2	3	5
TOTAL	31	7	38

Statistic	Rejection of the Null (Null: Equality of variance)	Non-rejection of the Null	TOTAL
Month	76%	11%	87%
Quarter	5%	8%	13%
TOTAL	82%	18%	100%

b) Detailed results

		p-value	Decision	cov (p, m)
v3p	5.51	0.00	RH0	-22.26
v3e	9.18	0.00	RH0	
v3m	2.68	0.00	RH0	
v4p	9.51	0.00	RH0	-37.39
v4e	6.54	0.00	RH0	
v4m	2.01	0.00	RH0	
v5p	12.24	0.00	RH0	-21.19
v5e	5.03	0.00	RH0	
v5m	2.98	0.00	RH0	
v6p	1.91	0.00	RH0	-4.47
v6e	3.25	0.00	RH0	
v6m	7.95	0.00	RH0	
v7p	4.61	0.00	RH0	-16.62
v7e	14.03	0.00	RH0	
v7m	2.89	0.00	RH0	
v8p	1.82	0.00	RH0	-8.15
v8e	2.92	0.00	RH0	
v8m	27.17	0.00	RH0	
v9p	12.61	0.00	RH0	-20.81
v9e	79.92	0.00	RH0	
v9m	3.93	0.00	RH0	
v10p	4.15	0.00	RH0	-28.75
v10e	13.59	0.00	RH0	
v10m	3.38	0.00	RH0	
v11p	3.79	0.00	RH0	-13.69
v11e	11.71	0.00	RH0	
v11m	3.56	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v13pp	103.27	0.00	RH0	-0.87
v13p	3.79	0.00	RH0	
v13e	2.46	0.00	RH0	
v13m	2.14	0.00	RH0	
v13mm	25.16	0.00	RH0	
v13n	290.96	0.00	RH0	
v14pp	111.67	0.00	RH0	-1.18
v14p	2.76	0.00	RH0	
v14e	2.33	0.00	RH0	
v14m	2.38	0.00	RH0	
v14mm	35.39	0.00	RH0	
v14n	26.49	0.00	RH0	
v15pp	234.19	0.00	RH0	-7.17
v15p	6.74	0.00	RH0	
v15e	3.34	0.00	RH0	
v15m	8.17	0.00	RH0	
v15mm	177.71	0.00	RH0	
v15n	643.75	0.00	RH0	
v16pp	7.37	0.00	RH0	-19.02
v16p	7.37	0.00	RH0	
v16e	7.31	0.00	RH0	
v16m	4.73	0.00	RH0	
v16mm	143.74	0.00	RH0	
v16n	81.89	0.00	RH0	
v17pp	7.03	0.00	RH0	-17.8
v17p	6.93	0.00	RH0	
v17e	6.90	0.00	RH0	
v17m	3.64	0.00	RH0	
v17mm	71.12	0.00	RH0	
v17n	1156.28	0.00	RH0	
v18pp	10.42	0.00	RH0	-9.08
v18p	4.05	0.00	RH0	
v18e	22.23	0.00	RH0	
v18m	2.97	0.00	RH0	
v18mm	38.29	0.00	RH0	
v18n	250.74	0.00	RH0	
v19pp	6.16	0.00	RH0	-23.08
v19p	8.15	0.00	RH0	
v19e	6.19	0.00	RH0	
v19m	6.15	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v19mm	322.56	0.00	RH0	
v19n	125.48	0.00	RH0	
v20pp	10.23	0.00	RH0	-10.64
v20e	9.33	0.00	RH0	
v20mm	2.72	0.00	RH0	
v20n	46.55	0.00	RH0	
v21pp	21.43	0.00	RH0	-0.03
v21p	3.96	0.00	RH0	
v21e	3.80	0.00	RH0	
v21m	6.14	0.00	RH0	
v21mm	74.09	0.00	RH0	
v21n	4.84	0.00	RH0	
v22pp	4.89	0.00	RH0	-0.62
v22p	18.81	0.00	RH0	
v22e	71.02	0.00	RH0	
v22m	70.55	0.00	RH0	
v22mm	913.54	0.00	RH0	
v22n	59.61	0.00	RH0	
v23pp	6.35	0.00	RH0	-0.24
v23p	13.95	0.00	RH0	
v23e	6.90	0.00	RH0	
v23m	18.48	0.00	RH0	
v23mm	512.30	0.00	RH0	
v23n	59.59	0.00	RH0	
v24pp	13.21	0.00	RH0	-0.47
v24p	3.41	0.00	RH0	
v24e	0.95	0.64	Non RH0	
v24m	0.75	0.98	Non RH0	
v24mm	0.63	1.00	Non RH0	
v24n	15.74	0.00	RH0	
v25pp	12.48	0.00	RH0	-0.01
v25p	12.52	0.00	RH0	
v25e	6.95	0.00	RH0	
v25m	15.44	0.00	RH0	
v25mm	0.33	1.00	Non RH0	
v25n	7.22	0.00	RH0	
v26pp	8.66	0.00	RH0	-0.06
v26p	6.33	0.00	RH0	
v26e	13.36	0.00	RH0	
v26m	1.76	0.02	RH0	
v26mm	0.01	1.00	Non RH0	
v26n	1.56	0.06	RH0	
v27pp	8.08	0.00	RH0	0.00
v27p	7.27	0.00	RH0	

	H	p-value	Decision	cov (p, m)
v27e	85.64	0.00	RH0	
v27m	8.56	0.00	RH0	
v27mm	0.13	1.00	Non RH0	
v27n	4.50	0.00	RH0	
v29p	6.56	0.00	RH0	-70.88
v29e	7.28	0.00	RH0	
v29m	2.27	0.00	RH0	
v30p	11.73	0.00	RH0	-29.74
v30e	5.02	0.00	RH0	
v30m	2.29	0.00	RH0	
v31p	7.74	0.00	RH0	-40.2
v31e	4.26	0.00	RH0	
v31m	2.05	0.00	RH0	
v32p	3.20	0.00	RH0	-46.25
v32e	3.63	0.00	RH0	
v32m	2.67	0.00	RH0	
v34p	3.17	0.00	RH0	-21.91
v34e	8.97	0.00	RH0	
v34m	5.99	0.00	RH0	
v35p	1.87	0.00	RH0	-4.23
v35e	1.73	0.00	RH0	
v35m	0.18	1.00	Non RH0	
v36p	2.44	0.00	RH0	-15.24
v36e	2.08	0.00	RH0	
v36m	3.91	0.00	RH0	
v37p	1.48	0.00	RH0	-21.6
v37e	2.79	0.00	RH0	
v37m	2.27	0.00	RH0	
v38p	0.17	1.00	Non RH0	25.42
v38e	4.65	0.00	RH0	
v38m	4.30	0.00	RH0	
v40p	4.59	0.00	RH0	-2.53
v40e	6.50	0.00	RH0	
v40m	19.17	0.00	RH0	
v41p	1.08	0.36	Non RH0	-45.44
v41e	2.76	0.00	RH0	
v41m	1.03	0.44	Non RH0	
v42p	2.19	0.00	RH0	-118.81
v42e	34.09	0.00	RH0	
v42m	2.78	0.00	RH0	
v43p	2.03	0.00	RH0	-0.76
v43e	10.74	0.00	RH0	
v43m	33.74	0.00	RH0	
v44p	3.47	0.00	RH0	-7.30
v44e	7.00	0.00	RH0	
v44m	24.33	0.00	RH0	

A6.3. Unit Roots

The results obtained herein are the same as in Annex 3.3.2.

A6.4. The effects on forecasting accuracy

A6.4.1 RMSE for AR Models

AR	1 month	2 months	3 months	6 months	12 months
v1	0.45	0.77	1.02	1.51	1.52
v2	1.79	3.03	4.24	7.17	5.33
v3p	2.37	2.38	3.08	3.05	3.70
v3e	1.69	2.27	2.62	3.35	3.43
v3m	2.07	2.50	3.28	4.14	3.39
v3b	4.50	4.69	6.38	7.05	7.15
v4p	1.02	1.14	1.48	2.64	3.21
v4e	1.66	2.31	2.67	2.90	3.70
v4m	1.82	2.76	4.15	6.91	6.66
v4b	1.76	2.92	4.13	8.31	6.03
v5p	0.78	1.11	1.48	2.50	3.16
v5e	1.61	2.13	2.72	3.67	4.94
v5m	1.30	2.30	3.23	5.42	5.78
v5b	2.05	3.53	4.79	8.02	5.16
v6p	1.20	1.69	2.11	3.08	3.39
v6e	1.18	1.36	1.68	2.45	3.09
v6m	0.47	0.70	0.84	1.19	1.43
v6b	1.34	1.93	2.22	3.34	3.00
v7p	1.82	2.50	3.18	3.59	2.68
v7e	2.27	2.73	3.10	3.68	2.82
v7m	2.53	4.14	5.12	7.27	4.38
v7b	3.10	4.92	6.14	8.51	6.25
v8p	1.80	2.91	3.65	4.30	4.14
v8e	1.81	3.02	3.69	3.93	4.47
v8m	1.08	1.50	1.83	2.27	1.86
v8b	2.66	3.82	5.03	6.12	4.73

AR	1 quarter	2 quarters	4 quarters
v10p	2.68	2.73	4.10
v10e	2.86	3.45	3.47
v10m	3.39	4.71	6.44
v10b	5.63	6.64	8.97
v11p	2.51	2.89	2.52
v11e	1.22	1.76	1.62
v11m	3.39	4.64	5.84
v11b	6.23	7.86	8.17

A6.4.2 RMSE for ARIMA Models

ARIMA	1 month	2 months	3 months	6 months	12 months
v1	1.92	3.21	4.36	7.27	6.25
v2	10.55	18.52	24.67	33.51	31.34
v3p	12.35	13.03	14.33	17.42	19.66
v3e	9.36	12.02	13.37	16.92	13.93
v3m	14.43	19.41	22.74	26.76	18.97
v3b	26.09	30.17	35.98	46.14	49.58
v4p	6.12	7.85	9.71	16.29	19.61
v4e	8.42	11.74	13.66	15.33	18.34
v4m	8.95	12.56	18.97	30.07	24.09
v4b	10.52	16.57	23.42	45.67	57.83
v5p	3.80	5.24	6.88	10.96	11.70
v5e	8.18	10.59	13.52	17.41	18.49
v5m	6.21	10.84	15.16	24.51	12.67
v5b	10.57	18.67	26.05	45.35	44.58
v6p	5.75	7.13	8.14	12.46	13.70
v6e	5.96	6.97	8.52	11.86	14.02
v6m	2.02	2.84	3.16	4.25	3.12
v6b	6.52	9.63	10.78	14.72	17.79
v7p	13.19	20.67	23.85	26.49	11.66
v7e	9.74	11.54	13.01	14.65	9.90
v7m	16.13	27.40	32.48	42.65	26.57
v7b	20.96	39.61	49.97	56.36	40.81
v8p	9.94	14.63	18.96	24.44	19.64
v8e	9.54	15.63	20.80	23.66	22.55
v8m	4.34	5.92	8.03	9.34	7.90
v8b	12.62	16.18	20.70	32.12	43.78

ARIMA	1 quarter	2 quarters	4 quarters
v10p	14.14	15.46	19.17
v10e	9.74	10.28	7.13
v10m	14.75	24.30	25.15
v10b	30.74	37.78	40.24
v11p	8.30	12.37	10.99
v11e	4.61	5.64	4.31
v11m	14.35	19.67	19.57
v11b	22.06	36.79	34.97

A6.4.3 RMSE for TAR Models

TAR	1 month	2 months	3 months	6 months	12 months
v1	4.51	6.72	8.73	14.25	20.04
v2	18.45	27.10	36.25	64.72	114.63
v3p	21.58	22.91	23.37	36.91	55.56
v3e	14.36	17.62	21.84	34.08	48.14
v3m	22.80	36.18	49.10	90.38	149.46
v3b	39.82	58.39	69.24	125.90	202.44
v4p	10.57	14.98	19.80	36.77	67.16
v4e	12.49	16.87	21.09	33.15	51.13
v4m	12.79	18.96	25.47	41.73	64.41
v4b	18.59	25.38	34.55	60.66	94.35
v5p	7.38	10.18	14.10	27.37	48.88
v5e	11.06	14.88	18.16	25.95	34.94
v5m	10.54	15.21	20.08	34.97	50.99
v5b	18.88	25.97	34.05	56.53	84.64
v6p	8.70	11.65	14.78	24.64	44.42
v6e	8.43	11.84	15.17	22.19	25.29
v6m	4.78	7.51	10.06	16.72	25.51
v6b	11.34	16.96	23.34	42.56	71.62
v7p	24.37	32.32	39.17	61.68	92.14
v7e	13.09	17.26	20.02	26.73	29.61
v7m	29.60	41.97	52.48	94.38	189.18
v7b	50.28	72.24	84.02	126.56	140.06
v8p	20.60	32.75	46.14	85.88	148.04
V8e	20.45	23.43	21.99	21.36	20.18
V8m	6.37	8.44	10.94	16.39	22.72
V8b	22.71	35.33	54.26	117.46	235.21

TAR	1 quarter	2 quarters	4 quarters
v10p	24.65	21.94	38.54
v10e	13.37	16.82	26.94
v10m	22.80	30.63	36.35
v10b	45.78	61.94	66.97
v11p	17.22	20.65	30.43
v11e	6.97	7.93	9.24
v11m	22.12	31.12	34.05
v11b	40.55	44.62	39.41

A6.4.4 RMSE for MARKOV Models

MK_TAR	1 month	2 months	3 months	6 months	12 months
v1	0.61	0.75	1.20	2.20	6.15
v2	2.99	3.43	6.40	9.89	72.60
v3p	2.62	2.65	2.90	3.36	4.04
v3e	na	na	na	na	na
v3m	na	na	na	na	na
v3b	6.54	7.46	8.83	10.71	12.90
v4p	1.42	1.53	2.22	3.32	5.27
v4e	na	na	na	na	na
v4m	na	na	na	na	na
v4b	na	na	na	na	na
v5p	na	na	na	na	na
v5e	1.94	2.67	3.70	3.44	5.20
v5m	na	na	na	na	na
v5b	na	na	na	na	na
v6p	na	na	na	na	na
v6e	1.47	1.56	2.21	3.18	4.86
v6m	0.68	0.63	0.81	0.94	0.66
v6b	na	na	na	na	na
v7p	na	na	na	na	na
v7e	na	na	na	na	na
v7m	na	na	na	na	na
v7b	na	na	na	na	na
v8p	na	na	na	na	na
v8e	na	na	na	na	na
v8m	na	na	na	na	na
v8b	na	na	na	na	na

MK_TAR	1 quarter	2 quarters	4 quarters
v10p	6.10	5.85	10.38
v10e	na	na	na
v10m	6.73	7.65	12.68
v10b	13.21	13.25	25.28
v11p	na	na	na
v11e	na	na	na
v11m	na	na	na
v11b	9.11	9.73	14.23

A6.4.5 RMSE for VAR Models (unrestricted)

VAR		1 month	2 months	3 months	6 months	12 months
v3	p	2.76	2.60	3.47	4.36	6.84
	e	2.06	2.45	2.70	2.36	4.22
	m	2.47	3.36	4.61	6.28	11.51
	b	6.09	5.80	7.58	8.90	15.23
v4	p	1.27	1.72	2.26	4.05	5.77
	e	1.44	1.96	2.33	2.54	3.86
	m	1.70	2.81	4.09	7.15	10.11
	b	2.76	4.46	6.33	11.41	15.72
v5	p	0.84	1.28	1.74	3.00	3.95
	e	1.67	2.40	3.14	4.89	6.16
	m	1.26	2.30	3.23	5.44	6.44
	b	2.57	3.74	5.07	8.74	10.87
v6	p	1.19	1.69	2.11	3.16	3.69
	e	1.14	1.55	1.94	3.02	4.16
	m	0.51	0.80	0.99	1.39	1.54
	b	1.41	2.14	2.65	3.83	3.79
v7	p	2.38	4.11	5.56	6.33	2.92
	e	2.57	2.74	2.74	3.39	2.15
	m	3.24	5.66	7.21	10.19	4.85
	b	6.39	9.23	11.71	15.35	10.97
v8	p	2.23	3.53	4.55	5.85	4.74
	e	2.45	4.16	5.24	5.82	4.85
	m	1.00	1.33	1.54	1.92	2.03
	b	5.89	7.19	8.13	10.25	10.28

VAR		1 quarter	2 quarters	4 quarters
v10	p	5.30	5.79	6.42
	e	2.79	3.69	3.52
	m	5.89	7.87	8.47
	b	10.87	13.32	14.62
v11	p	5.09	7.21	5.31
	e	4.06	3.77	2.64
	m	7.71	11.09	8.51
	b	12.25	18.03	13.70

A6.4.6 RMSE for VAR Models (restricted) [14]

rVAR		1 month	2 months	3 months	6 months	12 months
v3	p	2.64	2.52	3.32	3.79	3.20
	e	4.15	4.19	3.98	3.36	2.99
	m	2.57	2.89	3.66	4.83	4.31
	b	6.90	6.85	8.25	9.58	8.20
v4	p	0.99	1.14	1.64	3.01	2.42
	e	5.96	6.12	6.29	6.49	6.89
	m	1.64	2.55	3.79	6.48	5.58
	b	2.31	3.47	5.01	9.38	7.95
v5	p	0.78	1.04	1.37	2.43	1.97
	e	7.57	7.46	7.42	6.98	5.20
	m	1.16	2.05	2.85	4.91	5.00
	b	2.53	3.46	4.52	7.90	6.90
v6	p	1.21	1.69	2.12	3.17	3.69
	e	1.16	1.57	1.96	3.04	4.17
	m	0.51	0.80	0.98	1.39	1.54
	b	1.42	2.14	2.65	3.84	3.80
v7	p	2.03	2.71	3.31	4.34	2.57
	e	5.82	5.84	5.69	5.44	5.55
	m	2.54	4.04	4.89	7.00	3.54
	b	6.51	7.66	8.81	11.62	5.95
v8	p	2.90	5.08	6.60	8.46	4.98
	e	3.88	3.83	4.21	4.70	1.59
	m	0.94	1.28	1.51	2.11	1.64
	b	6.57	9.09	10.86	13.83	10.80

rVAR		1 quarter	2 quarters	4 quarters
v10	p	4.45	5.45	6.57
	e	3.93	4.44	4.11
	m	4.29	6.22	6.47
	b	7.85	10.84	12.39
v11	p	3.66	4.57	3.39
	e	1.82	2.32	2.69
	m	4.40	5.78	5.59
	b	7.69	10.11	8.55

[14] Neutral answers are calculated as 100–positive answers–negative answers. The forecasts for the balance are calculated from forecasts from positive and negative answers.

A6.4.7 RMSE for VAR Models of different indicators

VAR	***v2***	***v12***	***v28***	***v33***	***v39***
1 month	2.861	2.025	5.068	3.947	5.049
2 months	4.872	2.594	8.659	4.719	7.612
3 months	6.141	3.544	12.085	4.764	10.809
6 months	10.204	7.657	16.689	6.088	14.458
12 months	7.533	12.189	24.131	3.918	13.490

VAR	***v7b***	***v8b***
1 month	3.236	2.608
2 months	5.212	3.799
3 months	6.725	4.959
6 months	10.348	6.911
12 months	7.206	5.135

VAR	***v18b***	***v16b***	***v19b***	***v14b***
1 month	2.243	2.928	4.228	0.996
2 months	3.574	5.202	6.619	1.572
3 months	4.422	7.136	9.546	1.985
6 months	4.557	10.917	16.029	2.445
12 months	3.901	7.564	12.552	1.861

VAR	***v23b***	***v24b***	***v21b***
1 month	1.530	0.714	0.831
2 months	1.910	0.892	1.223
3 months	2.024	0.927	1.555
6 months	2.696	0.961	2.223
12 months	2.517	1.395	3.541

VAR	***v29b***	***v31b***	***v32b***
1 month	4.709	3.470	3.163
2 months	5.270	2.989	3.690
3 months	6.781	4.094	4.955
6 months	6.355	4.829	6.552
12 months	5.465	3.772	6.409

VAR	***v37b***	***v38b***
1 month	4.806	4.004
2 months	4.389	4.948
3 months	4.830	5.504
6 months	5.975	8.128
12 months	15.094	14.680

VAR	***v42b***	***v44b***
1 month	4.763	5.400
2 months	8.995	9.093
3 months	12.804	14.131
6 months	26.520	36.266
12 months	50.099	53.487

A6.5. RMSE for the balance from forecasts from positive and negative answers

AR	1 month	2 months	3 months	6 months	12 months
v3b	6.18	6.48	7.78	8.39	8.24
v4b	2.37	3.41	4.99	9.13	9.04
v5b	2.58	3.60	4.78	7.94	7.72
v6b	1.41	2.11	2.60	3.70	3.40
v7b	6.30	7.25	8.14	10.09	6.61
v8b	5.71	6.96	7.68	9.11	9.13

AR	1 quarter	2 quarters	4 quarters
v10b	6.70	8.80	10.72
v11b	6.67	9.15	7.76

ARIMA	1 month	2 months	3 months	6 months	12 months
v3b	7.15	8.23	9.34	11.45	13.62
v4b	2.51	3.56	5.20	9.56	11.71
v5b	2.66	3.74	4.98	8.51	8.14
v6b	1.32	1.82	2.14	3.61	4.28
v7b	6.51	9.37	11.02	14.72	10.54
v8b	4.30	4.98	5.31	6.97	8.04

ARIMA	1 quarter	2 quarters	4 quarters
v10b	9.02	14.55	19.66
v11b	7.57	11.68	13.55

TAR	1 month	2 months	3 months	6 months	12 months
v3b	7.73	7.33	7.25	11.30	22.40
v4b	4.18	5.54	7.16	11.45	15.91
v5b	3.65	4.59	5.82	9.23	10.43
v6b	2.07	2.57	3.14	4.35	6.79
v7b	10.07	12.09	13.66	19.01	28.31
v8b	6.70	9.09	11.83	20.83	40.71

TAR	1 quarter	2 quarters	4 quarters
v10b	12.82	13.76	15.11
v11b	11.58	13.13	12.11

VAR	1 month	2 months	3 months	6 months	12 months
v3b	6.09	5.80	7.58	8.90	15.23
v4b	2.76	4.46	6.33	11.41	15.72
v5b	2.57	3.74	5.07	8.74	10.87
v6b	1.41	2.14	2.65	3.83	3.79
v7b	6.39	9.23	11.71	15.35	10.97
v8b	5.89	7.19	8.13	10.25	10.28

VAR	1 quarter	2 quarters	4 quarters
v10b	10.87	13.32	14.62
v11b	12.25	18.03	13.70

A6.6. RMSE for composite indicators calculated from forecasts from their components (indirect methods)

AR	1 month	2 months	3 months	6 months	12 months
v1	2.83	2.94	3.04	3.22	1.84
v2	5.08	5.45	5.90	7.06	6.04

ARIMA	1 month	2 months	3 months	6 months	12 months
v1	0.47	0.44	0.41	0.40	0.48
v2	5.49	6.48	7.61	10.00	11.47

TAR	1 month	2 months	3 months	6 months	12 months
v1	0.77	0.85	1.04	1.61	2.34
v2	7.33	9.36	11.25	17.24	24.12

VAR	1 month	2 months	3 months	6 months	12 months
v1	4.56	4.73	4.89	5.19	3.67
v2	5.32	5.49	4.10	2.76	7.73

A6.7. The effects of incorporating new observations on outlier detection using Tramo/Seats

With the aim of analysing the effects of incorporating new observations on outlier detection using Tramo/Seats, we have followed a similar approach to that regarding the effects of seasonal adjustment procedures.

In order to evaluate the effects of incorporating new observations, we have identified the time periods where an outlier is found in a recursive way adding one more observation from 2001.1 to 2002.12. The results of this analysis are shown in the following tables for some selected variables: v2, v3b, v3m, v3e, v8b, v8m, v8e.

These tables should be interpreted as follows: the number and type of detected outliers when adding a new observation are shown in columns, while in rows, the moment of time for each outlier can be found.

v2	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
01-87																			AO	AO				
10-89																			AO	AO				
07-96	AO	AO	AO	AO	AO	AO	AO		AO			AO												AO
06-00	AO	AO	AO	AO	AO	AO	AO		AO			AO												AO
10-01													LS	LS	LS	LS	LS	LS				LS	LS	
11-01																		TC						
12-01												AO												
01-02																			LS	LS				

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

v3b[15]	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
03-91							TC	TC	TC					TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
05-97														LS										

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

[15] No outlier is detected for v3p.

v3m	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
03-91																			TC		TC	TC	TC	TC
07-96					AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO
05-00																			AO		AO	AO	AO	AO
05-01																			LS		LS	LS	LS	LS

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

v3e	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
02-91															TC									
11-92	LS		LS					LS							LS									

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

v8b	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
07-85	LS																							
01-88	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
02-93								TC										TC						TC
01-97	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO		AO
06-01																		AO						
07-01																								AO

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

v8m[16]	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
07-85		LS	LS	LS		LS			LS	LS	LS		LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS	LS
03-86												TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
05-86																			AO					
09-87																			AO					
01-88	AO	AO	AO	AO	TC	AO		AO	AO	AO	AO	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
11-88							TC						TC	TC	TC	TC	TC	TC	TC	TC	LS	TC	TC	TC
03-89																AO			TC	AO				
05-90																			TC					
01-93	AO											AO												
10-98	AO																							
03-99	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO												
01-00	AO	AO			AO				AO			AO												
02-00			AO	AO		AO				AO	AO								AO					
07-01							AO	AO	AO	AO	AO	AO				AO			AO	AO	AO	AO	AO	AO

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

v8e	jan-01	feb-01	mar-01	apr-01	may-01	jun-01	jul-01	aug-01	set-01	oct-01	nov-01	des-01	jan-02	feb-02	mar-02	apr-02	may-02	jun-02	jul-02	aug-02	set-02	oct-02	nov-02	des-02
03-99	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO	AO												AO	AO
12-01																							AO	AO

AO: Additive Outlier, TC: Transitory Change, LS: Level shift.

[16] No outlier is detected for v8p.

ANNEX 7. List of considered quantitative variables

Code	Description	Freq.	First obs.	Last obs.	Obs.	Eurostat-Code
qv1	Harmonized consumer price index	month	jan-90	dec-02	156	CPHI: CP-HI00 HICP
qv2	Construction - number of persons employed index	month	jan-91	dec-02	144	ISBU_M: IS-EPI
qv3	Building permits index - New residential buildings	month	jan-85	dec-02	216	ISBU_M: IS-PEI
qv4	Industry Production index	month	jan-85	dec-02	216	ISIN_M: IS-IP
qv5	Industry Producer price index	month	jan-85	dec-02	216	ISIN_M: IS-PPI
qv6	Number of new car registrations	month	jan-85	dec-02	216	ISOT_M: IS-CAR
qv7	Retail Deflated turnover index	month	jan-94	dec-02	108	ISRT_M:IS-DIT-T
qv8	*Industry Gross value added*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAAG_Q: NA-B1G-KP-MIO-EUR*
qv9	*Construction Gross value added*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAAG_Q: NA-B1G-KP-MIO-EUR*
qv10	*Wholesale and retail trade & other Gross value added*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAAG_Q: NA-B1G-KP-MIO-EUR*
qv11	*Financial intermediation Gross value added*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAAG_Q: NA-B1G-KP-MIO-EUR*
qv12	*Savings rate*	*quarter*	*1991-I*	*2002-III*	*47*	*NAIA_Q: NA-B8G/ NAIA_Q: NA-B6G*
qv13	*Gross domestic product*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAMA_Q: NA-B1GM*
qv14	*Gross fixed capital formation: construction work - other constructions*	*quarter*	*1991-I*	*2002-III*	*47*	*NAMA_Q: NA-P51-FB*
qv15	*Gross fixed capital formation: metal products and machinery*	*quarter*	*1991-I*	*2002-III*	*47*	*NAMA_Q: NA-P51-MET*
qv16	*Exports of goods*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAMA_Q: NA-P61*
qv17	*Final consumption expenditure: household and NPISH*	*quarter*	*1991-I*	*2002-IV*	*48*	*NAMA_Q:NA-P31_S14_S15*
qv18	*Gross fixed capital formation: construction work - housing*	*quarter*	*1991-I*	*2002-III*	*47*	*NAMA_Q:NA-P51-FA*
qv19	*Changes in inventories*	*quarter*	*1991-I*	*2002-IV*	*48*	*ECB Data set*
Qv20	Unemployment	month	jan-93	2002-IV	120	LM-UN-T-TOT

ANNEX 8. Descriptive Statistics for the quantitative variables

A.8.1. Raw data

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
qv1	156	98.5	64.894	8.0557	8.1784
qv2	144	100.9661	13.315	3.649	3.6141
qv3	216	86.975	203.7597	14.2744	16.4121
qv4	216	100.2466	168.7801	12.9915	12.9596
qv5	216	95.8162	58.3006	7.6355	7.9689
qv6	216	112.6073	380.0628	19.4952	17.3126
qv7	108	105.1111	127.3947	11.2869	10.7381
qv8	48	306210.446	515682343	22708.6403	7.416
qv9	48	75199.5467	16951113.6	4117.173	5.475
qv10	48	274790.166	845528295	29077.9692	10.5819
qv11	48	335548.343	1428381081	37793.9292	11.2633
qv12	47	33414.8302	5.25E+10	229080.018	685.5639
qv13	48	1365549.36	2.68E+10	163683.16	11.9866
qv14	47	93760.0831	1.46E+10	120670.646	128.7015
qv15	47	82005.9987	322558486	17959.9133	21.9007
qv16	48	348767.107	9089991278	95341.4458	27.3367
qv17	48	766599.574	1.58E+10	125662.101	16.3921
qv18	47	75956.4006	159714953	12637.8382	16.6383
qv19	48	1.4665	30.269	5.5017	375.1506
qv20	120	9.7867	1.2823	1.1324	11.5708

A.8.2. After removing outliers

Code	Observations	Mean	Variance	Std. Deviation	Variation Coef.
qv1	156	98.5006	65.3164	8.0819	8.2049
qv2	144	107.4933	7.7663	2.7868	2.5925
qv3	216	86.938	197.2263	14.0437	16.1537
qv4	216	100.259	168.5317	12.982	12.9484
qv5	216	95.9024	60.48	7.7769	8.1092
qv6	216	129.555	732.9768	27.0735	20.8973
qv7	108	104.9436	126.0431	11.2269	10.698
qv8	48	306939.061	476871402	21837.3854	7.1146
qv9	48	75086.2457	14744982.8	3839.9196	5.114
qv10	48	272038.589	619227241	24884.277	9.1473
qv11	48	335137.285	1383620924	37197.0553	11.0991
qv12	47	33356.1246	5.23E+10	228677.5524	685.5639
qv13	48	1354893.86	4.92E+10	221784.1598	16.3691
qv14	47	84856.5431	3856681508	62102.186	73.1849
qv15	47	101787.673	1.55E+10	124377.5577	122.1931
qv16	48	348766.721	9090260732	95342.8588	27.3371
qv17	48	787145.235	1.70E+10	130242.6761	16.5462
qv18	47	76055.5113	159537859	12630.8297	16.6074
qv19	48	2.5136	38.9829	6.2436	248.3904
qv20	120	9.7867	1.2823	1.1324	11.5708

ANNEX 9. Detailed results of the benchmark models[17]

A9.1 MAPE for AR models

AR	1 month	2 months	3 months	6 months	12 months
qv1	0.23	0.35	0.42	0.56	0.98
qv2	0.86	1.62	2.13	3.07	3.41
qv3	4.23	4.79	4.79	4.90	5.72
qv4	1.30	1.63	2.02	2.53	2.90
qv5	0.22	0.37	0.53	0.94	2.16
qv6	5.09	5.17	5.50	7.08	5.88
qv7	0.99	0.97	0.96	0.78	0.91
qv20	1.79	3.17	4.18	5.64	9.23

AR	1 quarter	2 quarters	4 quarters
qv8	1.97	2.43	2.77
qv9	1.75	1.78	1.93
qv10	1.44	2.56	5.84
qv11	0.64	1.25	3.26
qv12	5.68	9.86	14.83
qv13	1.11	1.72	3.60
qv14	2.66	4.09	2.97
qv15	2.14	4.30	9.42
qv16	2.39	4.01	6.95
qv17	1.41	2.21	3.88
qv18	1.63	2.53	4.26
qv19	215.46	126.77	132.96

[17] Results for MAPE are shown instead of RMSE as for quantitative variables it provides a good idea of the forecast error without taking into account the measure unit of the variable. As qualitative variables can take 100 as a maximum value, MAPE from this annex can be compared, although cautiously, with RMSE in Annex 5.

A9.2 MAPE for ARIMA models

ARIMA	1 month	2 months	3 months	6 months	12 months
qv1	0.20	0.32	0.36	0.42	0.36
qv2	0.76	1.40	1.72	2.58	1.41
qv3	7.38	7.82	7.69	9.21	10.34
qv4	5.10	4.99	3.79	4.60	4.39
qv5	0.25	0.44	0.66	1.09	1.70
qv6	11.73	13.77	14.75	21.12	9.39
qv7	5.62	5.91	5.83	6.56	5.40
qv20	1.17	2.02	2.47	3.69	6.49

ARIMA	1 quarter	2 quarters	4 quarters
qv8	2.34	2.35	1.87
qv9	4.38	3.91	2.41
qv10	1.83	3.12	1.99
qv11	0.52	0.66	1.30
qv12	5.13	7.78	11.49
qv13	0.70	0.93	0.99
qv14	6.57	7.72	5.10
qv15	6.72	7.85	9.03
qv16	3.58	3.15	3.14
qv17	1.62	2.62	1.71
qv18	5.76	5.09	9.09
qv19	202.66	96.49	79.55

A9.3 MAPE for TAR models

TAR	1 month	2 months	3 months	6 months	12 months
qv1	0.28	0.31	0.37	0.37	0.57
qv2	1.63	2.10	2.46	3.82	8.11
qv3	10.29	10.55	12.92	21.62	50.56
qv4	7.22	6.39	6.63	8.76	8.15
qv5	0.58	0.84	1.06	1.82	2.83
qv6	16.11	16.45	21.62	29.96	40.96
qv7	26.79	29.54	78.44	146.10	1168.74
qv20	5.11	6.43	11.34	28.06	78.83

TAR	1 quarter	2 quarters	4 quarters
qv8	9.65	26.14	55.90
qv9	5.21	4.45	4.56
qv10	2.03	2.98	7.21
qv11	1.07	1.42	2.25
qv12	14.02	21.30	31.56
qv13	1.66	1.99	2.52
qv14	4.77	5.85	9.24
qv15	17.06	30.39	62.18
qv16	7.12	9.21	9.25
qv17	2.41	3.91	5.71
qv18	8.47	8.65	8.48
qv19	134.52	78.43	103.58

A9.4 MAPE for MARKOV models

MK_TAR	1 month	2 months	3 months	6 months	12 months
qv1	na	na	na	na	na
qv2	1.01	1.33	2.03	9.74	148.01
qv3	8.41	7.74	8.46	9.50	10.50
qv4	7.14	8.02	7.68	10.59	8.97
qv5	na	na	na	na	na
qv6	na	na	na	na	na
qv7	7.27	6.34	6.34	7.17	9.23
qv20	1.83	3.21	6.12	19.75	173.42

MK-TAR	1 quarter	2 quarters	4 quarters
qv8	3.83	5.41	5.91
qv9	5.51	4.30	4.71
qv10	2.05	2.15	3.25
qv11	na	na	na
qv12	na	na	na
qv13	2.06	2.54	2.13
qv14	6.88	7.03	5.97
qv15	na	na	na
qv16	na	na	na
qv17	2.70	3.18	3.22
qv18	5.82	6.15	5.55
qv19*	3.08	4.40	6.30

*RMSE. Change in inventories.

A9.5 MAPE for VAR models

A9.5.1 Description of the VAR models

The VAR models that have been specified tries to pick up, as far as possible, the classical Economic Theory assumptions in order to reflect the economic dynamic. In this sense, the VAR models that have been estimated could be defined as "total of the economy", "supply", "industry", "construction" and, by the demand side, "exports", "consumption" and "saving". In concrete, the considered quantitative VAR models have been the following:

VAR model	Considered quantitative variables
Total of the economy	Harmonized consumer price index Gross domestic product Unemployment rate
Supply	Industry Gross value added Construction Gross value added Wholesale and retail trade & other Gross value added Financial intermediation Gross value added
Industry (a)	Industry Production index Industry Producer price index
Industry (c)	Industry Production index Industry Producer price index Gross fixed capital formation: metal products and machinery
Construction (a)	Construction - number of persons employed index Building permits index - New residential buildings Gross fixed capital formation: construction work - other constructions Gross fixed capital formation: construction work – housing Interest rates
Exports	Gross domestic product Exports of goods Exchange rates
Consumption (a)	Harmonized consumer price index Gross domestic product Final consumption expenditure: household and NPISH Unemployment rate Interest rates
Saving	Harmonized consumer price index Savings rate Gross domestic product Interest rates

A9.5.2 Description of additional exogenous quantitative variables

Code	Description	Freq.	First obs.	Last obs.	Obs.	Eurostat-Code
qv21	Interest rates	month	jan-90	dec-02	156	MF-3MI-RT 3-month interest rates (average)
qv22	Exchange rate	month	jan-93	dec-02	120	MF-NEXRT-I Nominal effective exchange rates (average)

A9.5.3 Detailed results

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.472	1.324	3.868
2 quarters	0.476	1.589	6.203
4 quarters	0.702	1.949	9.227

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	2.241	2.365	2.578	0.803
2 quarters	2.645	2.718	3.604	1.351
4 quarters	3.537	5.271	4.223	2.549

Industry 1	***qv4***	***qv5***
1 quarter	2.074	0.595
2 quarters	2.838	1.116
4 quarters	3.969	2.547

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.960	1.419	2.733
2 quarters	2.903	3.917	4.862
4 quarters	4.665	9.846	6.953

Building	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.549	7.799	4.206	4.833	11.007
2 quarters	3.753	6.479	5.939	7.830	22.554
4 quarters	5.807	7.873	6.245	9.295	41.994

Exports	***qv16***	***qv13***	***qv22***
1 quarter	6.585	1.750	9.631
2 quarters	7.245	2.983	11.579
4 quarters	14.123	5.442	14.363

Comsumption	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	1.320	1.240	0.537	3.465	22.695
2 quarters	1.631	1.575	0.292	6.368	32.368
4 quarters	2.059	1.625	0.725	6.315	58.927

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	2.471	1.533	0.478	10.093
2 quarters	3.108	1.477	0.373	18.075
4 quarters	5.010	3.397	0.671	16.985

ANNEX 10. Detailed results of the benchmark models using growth rates from raw data

A10.1 RMSE for AR models

a) Monthly/quarterly growth rates

AR	1 month	2 months	3 months	6 months	12 months
qv1	0.27	0.24	0.25	0.22	0.21
qv2	1.42	1.00	0.94	0.79	0.74
qv3	5.67	6.36	6.72	7.45	6.69
qv4	1.35	1.32	1.31	1.25	1.25
qv5	0.30	0.30	0.30	0.32	0.22
qv6	6.21	7.44	7.07	7.57	7.62
qv7	1.33	1.82	1.78	1.59	1.45
qv20	1.79	1.89	1.82	1.69	1.70

AR	1 quarter	2 quarters	4 quarters
qv8	2.16	1.90	2.21
qv9	1.49	1.52	1.80
qv10	1.42	1.26	1.50
qv11	0.87	1.03	1.30
qv12	5.91	4.67	4.27
qv13	1.10	1.07	1.23
qv14	2.99	3.04	2.81
qv15	2.84	2.61	3.33
qv16	2.35	2.27	2.47
qv17	1.62	1.47	1.79
qv18	2.42	2.04	2.03

b) year-on-year growth rates

AR	1 month	2 months	3 months	6 months	12 months
qv1	0.25	0.40	0.47	0.40	0.45
qv2	1.15	1.37	1.46	1.64	1.99
qv3	5.93	6.63	6.63	7.18	8.85
qv4	1.37	1.75	2.09	2.67	3.23
qv5	0.52	0.93	1.33	2.45	3.81
qv6	5.22	5.29	5.68	6.87	5.70
qv7	1.12	1.12	1.15	1.23	1.97
qv20	1.56	2.63	3.58	6.22	10.84

AR	1 quarter	2 quarters	4 quarters
qv8	2.09	2.20	1.84
qv9	1.42	1.47	1.82
qv10	1.41	1.80	2.62
qv11	0.88	1.29	2.18
qv12	7.24	10.45	16.10
qv13	1.14	1.28	1.61
qv14	2.83	3.70	4.57
qv15	3.29	5.61	11.55
qv16	2.69	3.98	5.31
qv17	1.69	2.11	2.49
qv18	2.18	3.58	6.04

A10.2 RMSE for ARIMA models

a) Monthly/quarterly growth rates

ARIMA	1 month	2 months	3 months	6 months	12 months
qv1	1.37	1.39	1.33	1.24	1.17
qv2	6.32	4.95	3.69	3.24	3.45
qv3	42.16	41.71	47.71	41.61	24.59
qv4	47.45	51.82	50.21	50.82	32.08
qv5	1.70	1.77	1.77	1.84	2.07
qv6	61.91	82.62	69.30	59.93	38.18
qv7	36.02	30.34	29.56	32.66	17.83
qv20	7.13	6.86	6.74	6.83	6.10

ARIMA	1 quarter	2 quarters	4 quarters
qv8	7.36	5.60	3.90
qv9	4.28	3.34	2.87
qv10	5.10	3.23	2.73
qv11	3.00	2.63	2.28
qv12	17.01	16.99	9.90
qv13	3.64	2.72	2.40
qv14	6.82	6.20	6.12
qv15	6.99	7.40	5.73
qv16	9.01	9.46	5.72
qv17	4.06	3.31	3.04
qv18	3.17	3.28	3.13

b) year-on-year growth rates

ARIMA	1 month	2 months	3 months	6 months	12 months
qv1	1.21	1.93	2.28	2.57	4.62
qv2	6.09	7.11	7.34	8.86	11.83
qv3	25.07	26.73	25.21	26.85	25.71
qv4	7.40	8.89	10.33	13.37	14.65
qv5	1.96	3.35	4.33	7.84	13.28
qv6	27.27	25.00	27.12	30.98	23.81
qv7	5.71	5.23	5.10	4.34	5.38
qv20	5.39	8.13	10.34	14.09	23.61

ARIMA	1 quarter	2 quarters	4 quarters
qv8	7.20	9.13	11.55
qv9	4.39	4.70	4.67
qv10	4.82	6.53	8.72
qv11	2.95	4.52	7.63
qv12	17.80	25.30	33.02
qv13	4.04	5.28	7.02
qv14	8.10	10.82	11.61
qv15	8.53	14.26	27.12
qv16	8.78	14.34	20.91
qv17	4.38	5.67	6.21
qv18	4.70	6.87	9.76

A10.3 RMSE for TAR models

a) Monthly/quarterly growth rates

TAR	1 month	2 months	3 months	6 months	12 months
qv1	1.52	1.48	1.51	1.47	1.42
qv2	15.74	15.64	15.62	27.49	93.57
qv3	89.96	85.73	83.14	77.40	71.20
qv4	84.47	84.34	84.14	82.47	60.27
qv5	2.72	2.89	2.96	3.51	5.19
qv6	175.62	166.05	152.23	137.98	130.59
qv7	75.10	70.61	72.45	73.11	143.88
qv20	12.06	12.09	11.88	11.29	9.87

TAR	1 quarter	2 quarters	4 quarters
qv8	27.90	25.12	23.68
qv9	37.67	39.11	29.58
qv10	19.12	18.63	13.30
qv11	6.72	6.10	5.74
qv12	27.22	34.10	23.80
qv13	13.36	12.37	8.12
qv14	46.29	45.58	35.72
qv15	76.04	64.21	55.49
qv16	34.53	30.85	27.74
qv17	17.42	16.25	14.14
qv18	37.29	37.32	27.31

b) Year-on-year growth rates

TAR	1 month	2 months	3 months	6 months	12 months
qv1	1.95	2.56	2.91	2.97	4.44
qv2	25.00	50.67	102.81	1478.52	596.14
qv3	34.26	39.80	43.26	46.03	38.37
qv4	14.43	15.54	21.26	31.70	39.37
qv5	5.21	7.19	8.93	14.97	22.88
qv6	61.80	63.57	63.06	85.10	80.16
qv7	8.80	8.55	9.14	10.45	17.77
qv20	11.09	16.37	21.74	37.89	70.29

TAR	1 quarter	2 quarters	4 quarters
qv8	11.03	11.51	12.63
qv9	4.74	5.70	7.76
qv10	6.52	8.25	10.56
qv11	4.51	5.63	7.83
qv12	20.01	26.22	35.65
qv13	5.10	6.56	8.60
qv14	11.61	14.90	18.29
qv15	15.07	22.35	31.63
qv16	21.81	30.46	38.67
qv17	6.73	8.01	7.37
qv18	9.86	10.70	11.48

A10.4 RMSE for MARKOV models

a) Monthly/quarterly growth rates

MK-TAR	1 month	2 months	3 months	6 months	12 months
qv1	na	na	na	na	na
qv2	1.37	1.63	1.50	2.27	2.56
qv3	na	na	na	na	na
qv4	na	na	na	na	na
qv5	na	na	na	na	na
qv6	na	na	na	na	na
qv7	na	na	na	na	na
qv20	na	na	na	na	na

MK-TAR	1 quarter	2 quarters	4 quarters
qv8	8.73	8.75	11.61
qv9	11.71	12.17	10.33
qv10	5.08	4.99	5.03
qv11	na	na	na
qv12	7.65	12.05	13.41
qv13	3.91	4.00	4.21
qv14	14.39	14.25	14.34
qv15	25.31	26.89	26.24
qv16	na	na	na
qv17	5.52	5.49	8.95
qv18	12.46	12.17	10.94

b) Year-on-year growth rates

MK-TAR	1 month	2 months	3 months	6 months	12 months
qv1	na	na	na	na	na
qv2	1.32	2.56	13.47	79.45	74.31
qv3	5.79	5.93	5.94	5.81	6.91
qv4	1.72	1.95	2.37	3.13	3.51
qv5	0.64	na	na	na	na
qv6	7.52	18.01	8.30	9.47	9.87
qv7	1.48	1.48	2.11	3.06	4.22
qv20	na	na	na	na	na

MK-TAR	1 quarter	2 quarters	4 quarters
qv8	2.52	3.33	2.39
qv9	1.68	2.84	4.34
qv10	1.55	2.14	2.55
qv11	na	na	na
qv12	na	na	na
qv13	1.10	2.70	2.29
qv14	3.11	5.15	6.26
qv15	na	na	na
qv16	na	na	na
qv17	1.68	2.72	3.39
qv18	1.61	1.82	3.72

A10.5 RMSE for VAR models

a) Year-on-year growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.469	1.199	2.902
2 quarters	0.466	1.399	5.157
4 quarters	0.548	1.875	8.920

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	2.112	1.485	1.431	0.928
2 quarters	2.794	1.629	1.902	1.393
4 quarters	3.631	2.436	2.980	2.452

Industry 1	***qv4***	***qv5***
1 quarter	1.875	1.274
2 quarters	3.135	2.294
4 quarters	4.727	4.074

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.605	0.945	1.443
2 quarters	2.458	1.448	2.424
4 quarters	2.811	1.536	3.407

Building	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.278	8.362	5.703	7.329	18.963
2 quarters	3.613	11.313	6.209	11.257	35.745
4 quarters	3.037	10.018	6.977	12.085	43.122

Exports	***qv16***	***qv13***	***qv22***
1 quarter	2.443	1.564	7.734
2 quarters	4.822	1.467	11.392
4 quarters	6.929	2.325	13.370

Consumption	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	1.615	1.068	0.505	3.043	18.305
2 quarters	1.866	1.429	0.662	5.170	29.234
4 quarters	2.010	1.651	0.937	7.985	39.310

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	20.350	2.370	0.618	23.547
2 quarters	20.767	3.112	0.559	33.289
4 quarters	32.840	4.325	1.401	66.330

b) Monthly/quarterly growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.419	1.082	3.906
2 quarters	0.443	1.512	3.792
4 quarters	0.313	2.109	4.707

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	2.715	1.917	1.458	0.815
2 quarters	2.503	2.876	1.146	0.682
4 quarters	2.172	3.103	1.344	0.925

Industry 1	***qv4***	***qv5***
1 quarter	3.015	0.655
2 quarters	1.876	0.702
4 quarters	1.507	0.659

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.468	0.761	3.892
2 quarters	1.501	0.745	3.237
4 quarters	1.574	0.752	2.235

Building	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.616	3.598	5.157	7.415	11.734
2 quarters	1.055	5.331	4.296	5.442	11.824
4 quarters	1.842	6.788	2.508	4.203	8.604

Exports	***qv16***	***qv13***	***qv22***
1 quarter	2.624	1.181	4.779
2 quarters	2.929	1.122	3.104
4 quarters	2.107	0.664	3.758

Consumption	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	2.584	1.591	0.383	3.673	8.890
2 quarters	3.519	2.346	0.414	3.756	8.063
4 quarters	2.731	1.945	0.349	4.187	9.021

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	12.151	1.491	0.608	16.562
2 quarters	11.290	1.653	0.518	18.173
4 quarters	7.497	1.722	0.397	10.022

ANNEX 11. Detailed results of the benchmark models using growth rates after removing outliers from data using Tramo/Seats

A11.1. RMSE for AR models

a) Monthly/quarterly growth rates

AR	1 month	2 months	3 months	6 months	12 months
qv1	0.22	0.23	0.24	0.23	0.21
qv2	0.66	0.82	0.83	0.68	0.78
qv3	5.01	5.51	5.66	6.19	4.62
qv4	1.32	1.33	1.32	1.27	1.22
qv5	0.28	0.30	0.30	0.32	0.22
qv6	4.80	5.59	5.68	6.43	5.32
qv7	1.33	1.77	1.76	1.47	1.30
qv20	1.79	1.89	1.82	1.69	1.70

AR	1 quarter	2 quarters	4 quarters
qv8	1.78	1.23	1.50
qv9	1.43	1.32	1.59
qv10	0.84	0.48	0.55
qv11	0.91	1.05	1.02
qv12	6.81	6.68	6.88
qv13	0.40	0.52	0.49
qv14	1.34	1.54	1.38
qv15	2.84	2.61	3.33
qv16	2.35	2.27	2.47
qv17	0.59	0.63	0.60
qv18	1.91	2.01	2.21

b) Year-on-year growth rates

AR	1 month	2 months	3 months	6 months	12 months
qv1	0.20	0.32	0.39	0.39	0.45
qv2	0.29	0.53	0.72	1.17	2.22
qv3	4.59	5.39	5.52	6.40	7.86
qv4	1.35	1.69	2.05	2.61	3.19
qv5	0.52	0.95	1.40	2.65	4.41
qv6	4.94	5.27	5.78	7.39	8.18
qv7	1.24	1.17	1.18	1.20	1.78
qv20	1.56	2.63	3.58	6.22	10.84

AR	1 quarter	2 quarters	4 quarters
qv8	1.79	1.75	1.71
qv9	1.43	1.37	2.05
qv10	0.28	0.47	0.90
qv11	0.53	0.67	0.88
qv12	8.50	12.73	17.95
qv13	0.35	0.19	0.25
qv14	2.00	3.38	7.45
qv15	3.29	5.61	11.55
qv16	2.69	3.98	5.31
qv17	0.44	0.59	0.56
qv18	1.83	2.83	5.28

A11.2. RMSE for ARIMA models

a) Monthly/quarterly growth rates

ARIMA	1 month	2 months	3 months	6 months	12 months
qv1	1.07	1.13	1.06	1.02	0.84
qv2	1.00	1.33	1.21	1.16	1.00
qv3	36.58	38.53	42.51	37.84	22.71
qv4	7.38	7.13	7.14	6.46	4.57
qv5	1.38	1.39	1.38	1.74	1.99
qv6	71.37	64.28	67.35	77.30	45.90
qv7	32.61	34.62	31.15	27.46	17.70
qv20	7.13	6.86	6.74	6.83	6.10

ARIMA	1 quarter	2 quarters	4 quarters
qv8	5.66	5.22	3.80
qv9	3.81	3.06	2.33
qv10	1.16	1.35	1.11
qv11	1.84	1.52	1.72
qv12	18.77	17.33	14.81
qv13	1.32	1.31	1.01
qv14	2.26	1.96	1.43
qv15	6.99	7.40	5.73
qv16	10.97	9.81	4.39
qv17	1.66	1.15	0.76
qv18	3.59	3.50	2.75

b) Year-on-year growth rates

ARIMA	1 month	2 months	3 months	6 months	12 months
qv1	1.14	1.81	1.98	2.33	2.60
qv2	1.21	2.36	3.16	5.83	10.07
qv3	21.59	24.38	24.72	26.51	24.56
qv4	7.30	8.56	10.11	12.49	14.90
qv5	1.64	2.72	3.64	8.02	13.16
qv6	25.22	25.96	25.16	28.80	18.33
qv7	5.70	5.29	5.24	4.46	5.86
qv20	5.39	8.13	10.34	14.09	23.61

ARIMA	1 quarter	2 quarters	4 quarters
qv8	5.74	6.82	9.57
qv9	3.94	3.74	5.37
qv10	1.07	2.06	3.14
qv11	1.71	2.90	5.33
qv12	15.75	14.93	16.81
qv13	1.68	2.33	4.03
qv14	4.04	4.28	3.52
qv15	8.53	14.26	27.12
qv16	8.78	14.34	20.91
qv17	1.38	1.84	1.43
qv18	4.74	6.27	9.02

A11.3. RMSE for TAR models

a) Monthly/quarterly growth rates

TAR	1 month	2 months	3 months	6 months	12 months
qv1	1.54	1.56	1.52	1.51	1.23
qv2	5.66	7.04	7.52	6.02	3.14
qv3	88.28	83.57	79.51	75.18	67.02
qv4	84.26	84.06	83.86	82.07	59.60
qv5	2.72	2.89	3.00	3.57	5.06
qv6	159.59	152.79	139.81	130.32	108.30
qv7	69.90	63.04	63.13	71.46	146.66
qv20	12.06	12.09	11.88	11.29	9.87

TAR	1 quarter	2 quarters	4 quarters
qv8	29.56	26.40	24.82
qv9	36.24	34.65	26.73
qv10	18.22	16.56	12.90
qv11	8.46	7.33	6.63
qv12	22.71	19.05	19.47
qv13	15.76	14.17	11.68
qv14	47.43	45.10	35.68
qv15	76.08	64.32	55.50
qv16	n/a	n/a	n/a
qv17	19.11	17.10	14.58
qv18	33.92	33.42	25.04

b) Year-on-year growth rates

TAR	1 month	2 months	3 months	6 months	12 months
qv1	1.91	2.70	3.34	4.66	7.15
qv2	2.60	4.25	5.77	9.96	17.30
qv3	30.88	33.14	42.65	58.61	88.21
qv4	11.18	16.44	20.29	33.06	43.87
qv5	4.86	6.79	8.55	14.59	21.00
qv6	42.93	52.91	59.61	85.02	95.11
qv7	9.51	9.04	9.51	11.65	18.24
qv20	11.09	16.37	21.74	37.89	70.29

TAR	1 quarter	2 quarters	4 quarters
qv8	9.18	14.27	21.31
qv9	5.75	7.62	11.97
qv10	1.47	2.41	3.54
qv11	3.82	3.97	5.47
qv12	20.65	41.13	82.28
qv13	1.94	3.75	5.20
qv14	9.22	7.31	13.17
qv15	15.08	22.35	31.35
qv16	21.77	30.37	38.76
qv17	2.86	3.24	2.83
qv18	3.78	3.93	4.59

A11.4. RMSE for MARKOV models

a) Monthly/quarterly growth rates

MK-TAR	1 month	2 months	3 months	6 months	12 months
qv1	na	na	na	na	na
qv2	na	na	na	na	na
qv3	na	na	na	na	na
qv4	na	na	na	na	na
qv5	na	na	na	na	na
qv6	na	na	na	na	na
qv7	na	na	na	na	na
qv20	na	na	na	na	na

MK-TAR	1 quarter	2 quarters	4 quarters
qv8	8.81	8.50	13.98
qv9	11.71	11.66	11.59
qv10	na	na	na
qv11	2.77	2.35	2.63
qv12	na	na	na
qv13	na	na	na
qv14	16.14	16.22	13.52
qv15	25.30	26.91	26.14
qv16	na	na	na
qv17	6.28	5.95	5.37
qv18	11.28	12.19	11.29

b) Year-on-year growth rates

MK-TAR	1 month	2 months	3 months	6 months	12 months
qv1	na	na	na	na	na
qv2	0.43	0.58	1.31	3.16	61.26
qv3	5.47	5.62	5.80	5.73	6.50
qv4	1.57	1.95	2.61	3.17	4.10
qv5	na	na	na	na	na
qv6	na	na	na	na	na
qv7	na	na	na	na	na
qv20	na	na	na	na	na

MK-TAR	1 quarter	2 quarters	4 quarters
qv8	1.48	1.75	4.07
qv9	na	na	na
qv10	na	na	na
qv11	na	na	na
qv12	5.88	8.14	7.55
qv13	na	na	na
qv14	3.11	5.15	6.26
qv15	na	na	na
qv16	na	na	na
qv17	na	na	na
qv18	na	na	na

A11.5. RMSE for VAR models

a) Monthly/quarterly growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.353	0.849	3.174
2 quarters	0.391	1.096	4.088
4 quarters	0.312	1.281	4.654

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	3.304	2.981	1.553	0.538
2 quarters	3.066	2.339	1.248	0.735
4 quarters	1.075	3.141	1.238	0.728

Industry 1	***qv4***	***qv5***
1 quarter	3.093	0.571
2 quarters	1.827	0.752
4 quarters	1.402	0.720

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.643	0.673	3.959
2 quarters	1.431	0.743	3.186
4 quarters	1.434	0.845	2.230

Building	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	0.861	5.857	1.905	2.486	9.356
2 quarters	0.716	6.122	2.581	2.517	9.893
4 quarters	0.726	5.416	2.451	1.047	9.212

Exports	***qv16***	***qv13***	***qv22***
1 quarter	3.004	0.831	4.614
2 quarters	3.601	0.853	3.499
4 quarters	2.395	1.130	2.791

Consumption	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	2.573	1.173	0.290	3.156	8.430
2 quarters	3.088	1.763	0.343	3.689	8.920
4 quarters	1.773	0.741	0.281	3.767	9.651

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	8.351	1.107	0.510	7.068
2 quarters	8.700	1.380	0.428	7.103
4 quarters	9.363	1.335	0.422	7.157

b) Year-on-year growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.400	0.397	3.208
2 quarters	0.499	0.336	5.243
4 quarters	0.730	0.476	7.386

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	1.729	1.504	0.288	0.558
2 quarters	2.279	1.831	0.477	0.682
4 quarters	2.910	2.818	0.928	1.342

Industry 1	***qv4***	***qv5***
1 quarter	1.845	1.344
2 quarters	2.742	2.540
4 quarters	4.808	4.878

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.681	0.855	1.410
2 quarters	2.616	1.511	2.408
4 quarters	3.189	1.657	3.278

Building	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	1.048	4.570	2.643	1.496	5.639
2 quarters	1.393	5.382	4.662	1.823	7.970
4 quarters	2.354	7.053	6.887	2.642	16.109

Exports	***qv16***	***qv13***	***qv22***
1 quarter	4.049	0.585	8.422
2 quarters	6.170	0.635	10.695
4 quarters	10.319	0.957	12.604

Consumption	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	0.532	0.490	0.410	3.403	12.071
2 quarters	0.888	0.781	0.547	5.534	20.844
4 quarters	1.121	1.043	0.744	7.892	21.771

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	9.022	0.656	0.466	6.276
2 quarters	7.625	0.755	0.534	13.201
4 quarters	9.708	0.751	0.764	12.444

ANNEX 12. Augmented autoregression, Markov and VAR models

A12.1. Equivalence table between QV and V for AR, Markov and VAR models

	quantitatives					qualitatives			
Total	***qv1***	***qv13***	***qv20***			***v1***			
Supply	***qv8***	***qv9***	***qv10***	***qv11***		***v1***			
Industry	***qv4***	***qv5***				***v2***			
Industry 1b	***qv4***	***qv5***				***v7b***	***v8b***		
Industry 2	***qv4***	***qv5***	***qv15***			***v2***			
Building a	***qv2***	***qv3***	***qv14***	***qv18***	***qv21***	***v28***			
Building b	***qv2***	***qv3***	***qv14***	***qv18***	***qv21***	***v31b***	***v32b***		
Exports	***qv13***	***qv16***	***qv22***			***v5b***			
Consumption a	***qv1***	***qv13***	***qv17***	***qv20***	***qv21***	***v12***			
Consumption b	***qv1***	***qv13***	***qv17***	***qv20***	***qv21***	***v14b***	***v16v***	***v18b***	***v19b***
Savings	***qv1***	***qv12***	***qv13***	***qv21***		***v23b***	***v24b***		

A12.2. Forecast competition for raw data

A12.2.1. AR models

a) Monthly/quarterly growth rates

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.28	0.25	0.26	0.24	0.22
qv2	v31	1.26	0.75	0.74	0.63	0.65
qv3a	v29	6.01	6.61	7.02	7.51	6.52
qv3b	v30	5.79	5.87	6.24	6.73	6.12
qv3ab	v29-v30	6.19	6.26	6.68	6.93	6.09
qv4	v7	1.19	1.29	1.18	1.17	0.98
qv5	v8	0.29	0.30	0.29	0.31	0.23
qv7a	v34	1.73	1.99	2.10	1.94	1.18
qv7b	v35	1.67	2.16	2.19	1.84	1.67
qv7c	v36	1.59	1.89	1.91	1.78	1.96
qv7d	v37	1.79	2.14	2.12	1.82	1.94
qv7ad	v34-v37	5.38	3.59	3.60	3.19	3.63
qv20	v19	1.74	1.69	1.66	1.31	1.54

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	10.26	10.66	6.98
qv8	v2	1.48	1.56	1.53
qv9	v28	1.80	1.81	1.80
qv10	v34	1.51	1.20	1.38
qv11a	v13	1.07	1.15	1.37
qv11b	v14	1.01	1.10	1.31
qv11ab	v13-v14	1.03	1.06	1.31
qv12a	v22	9.28	10.35	7.82
qv12b	v23	9.69	12.60	11.30
qv12ab	v22-v23	13.49	14.34	15.12
qv13a	v1	1.07	1.33	1.10
qv13b	v15	1.11	1.49	1.36
qv13c	v16	1.12	1.10	0.98
qv13ac	v1,v15-v16	1.17	1.68	1.85
qv14a	v29	3.47	4.20	3.54
qv14b	v30	2.52	2.87	2.46
qv14ab	v29-v30	4.67	4.50	5.42
qv15a	v3	2.77	2.65	3.15
qv15b	v7	2.33	2.44	3.13
qv15ab	v3-v7	3.58	2.42	4.49
qv16a	v11	3.94	3.33	4.02
qv16b	v5	3.64	2.44	2.34
qv16ab	v11,v5	4.64	4.77	5.07
qv17	v20	1.47	1.70	2.01
qv18	v26	6.87	7.18	8.57
qv19*	v6	3.20	2.47	2.14

* changes in inventories

b) Year-on-year growth rates

AR	Exog	1 month	2 months	3 months	6 months	12 months
Qv1	v18	0.26	0.40	0.48	0.48	0.44
Qv2	v31	1.15	1.37	1.45	1.63	1.90
Qv3a	v29	6.40	6.99	7.09	7.96	9.53
Qv3b	v30	5.98	7.31	7.57	8.39	10.93
Qv3ab	v29-v30	6.60	7.65	7.81	8.81	10.36
Qv4	v7	1.35	1.46	1.51	1.51	1.61
Qv5	v8	0.50	0.88	1.25	2.22	3.28
Qv7a	v34	1.32	1.33	1.35	1.06	1.37
Qv7b	v35	1.45	1.46	1.34	1.44	1.93
Qv7c	v36	1.44	1.36	1.34	1.50	2.24
Qv7d	v37	1.53	1.37	1.40	1.21	1.69
Qv7ad	v34-v37	1.97	2.26	2.44	1.95	1.97
Qv20	v19	1.66	2.82	3.82	6.29	9.17

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	8.39	6.86	5.61
qv8	v2	1.66	1.22	1.01
qv9	v28	2.64	3.17	2.49
qv10	v34	1.38	1.70	2.33
qv11a	v13	0.92	1.34	2.18
qv11b	v14	0.95	1.41	2.16
qv11ab	v13-v14	0.98	1.50	2.19
qv12a	v22	13.20	17.09	21.48
qv12b	v23	12.11	11.84	10.45
qv12ab	v22-v23	24.43	18.51	16.62
qv13a	v1	0.94	1.02	1.26
qv13b	v15	1.07	1.19	1.51
qv13c	v16	0.97	1.03	1.27
qv13ac	v1,v15-v16	0.86	0.89	1.14
qv14a	v29	2.77	2.27	2.42
qv14b	v30	2.32	2.11	2.06
qv14ab	v29-v30	3.61	3.44	4.68
qv15a	v3	3.00	4.68	10.43
qv15b	v7	2.63	4.33	9.55
qv15ab	v3-v7	3.43	5.47	17.15
qv16a	v11	4.45	4.95	5.01
qv16b	v5	4.66	6.75	5.53
qv16ab	v11,v5	5.80	8.20	6.72
qv17	v20	1.42	1.45	1.52
qv18	v26	6.42	6.90	8.92

A12.2.2. Markov models

a) Monthly/quarterly growth rates

MK-TAR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	na	na	na	na	na
qv2	v31	na	na	na	na	na
qv3a	v29	14.84	14.49	16.01	14.72	13.60
qv3b	v30	na	na	na	na	na
qv4	v7	16.74	16.80	17.66	18.26	16.30
qv5	v8	0.34	0.38	0.38	0.70	0.59
qv7a	v34	na	na	na	na	na
qv7b	v35	18.70	15.64	22.57	25.28	38.16
qv7c	v36	na	na	na	na	na
qv7d	v37	18.88	15.75	21.59	21.30	47.42
qv20	v19	1.95	2.57	2.12	2.88	2.40

MK-TAR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	19.16	17.22	27.43
qv8	v2	8.63	9.07	12.12
qv9	v28	12.06	13.00	15.65
qv10	v34	5.55	6.91	4.39
qv11a	v13	2.44	2.34	2.41
qv11b	v14	2.40	4.26	2.38
qv12a	v22	na	na	na
qv12b	v23	na	na	na
qv13a	v1	4.06	4.11	4.01
qv13b	v15	3.97	4.08	4.54
qv13c	v16	4.30	3.82	4.21
qv14a	v29	na	na	na
qv14b	v30	14.63	14.75	11.75
qv15a	v3	25.60	25.20	26.46
qv15b	v7	26.02	26.10	31.42
qv16a	v11	9.78	5.44	5.34
qv16b	v5	9.29	7.83	11.12
qv17	v20	5.42	4.56	5.66
qv18	v26	na	na	na
qv19*	v6	3.25	4.63	7.71

* changes in inventories

b) Year-on-year growth rates

MK-TAR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	na	na	na	na	na
qv2	v31	na	na	na	na	na
qv3a	v29	6.05	8.19	5.99	5.99	7.08
qv3b	v30	na	na	na	na	na
qv4	v7	1.84	2.10	2.16	3.09	3.54
qv5	v8	na	na	na	na	na
qv7a	v34	1.47	2.22	1.98	2.64	3.51
qv7b	v35	na	na	na	na	na
qv7c	v36	1.36	2.52	2.49	2.62	2.66
qv7d	v37	na	na	na	na	na
qv20	v19	1.61	2.23	3.13	3.88	19.31

MK-TAR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	na	na	na
qv8	v2	2.40	2.86	2.75
qv9	v28	na	na	na
qv10	v34	na	na	na
qv11a	v13	1.13	3.66	2.34
qv11b	v14	0.86	3.31	2.17
qv12a	v22	na	na	na
qv12b	v23	na	na	na
qv13a	v1	1.25	2.06	2.16
qv13b	v15	na	na	na
qv13c	v16	1.27	2.40	5.21
qv14a	v29	na	na	na
qv14b	v30	3.66	4.64	4.84
qv15a	v3	3.93	5.21	9.25
qv15b	v7	4.10	5.92	11.26
qv16a	v11	3.20	5.59	8.11
qv16b	v5	3.49	5.04	6.03
qv17	v20	1.67	4.69	2.66
qv18	v26	na	na	na

A12.2.3. VAR models

a) Monthly/quarterly growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.421	1.260	3.404
2 quarters	0.447	1.560	2.581
4 quarters	0.262	1.709	3.608

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	2.564	2.087	1.285	0.777
2 quarters	2.474	2.937	1.173	0.697
4 quarters	2.169	3.607	1.563	0.988

Industry 1	***qv4***	***qv5***
1 quarter	2.488	0.632
2 quarters	1.391	0.641
4 quarters	1.427	0.581

Industry 1b	***qv4***	***qv5***
1 quarter	3.994	0.593
2 quarters	6.427	0.576
4 quarters	6.956	0.539

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.917	0.708	4.918
2 quarters	1.731	0.683	5.729
4 quarters	1.486	0.644	2.458

Building a	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.023	4.575	4.976	7.000	12.134
2 quarters	0.930	6.339	4.406	5.123	10.687
4 quarters	1.367	5.261	2.631	5.518	12.213

Building B	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.793	3.442	4.698	5.645	13.392
2 quarters	2.112	4.183	4.225	4.172	10.562
4 quarters	1.557	5.017	4.371	5.092	9.010

Exports	***qv16***	***qv13***	***qv22***
1 quarter	3.446	1.388	5.033
2 quarters	4.089	1.782	3.977
4 quarters	3.235	1.090	4.202

Consumption a	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	2.394	1.572	0.396	3.312	8.838
2 quarters	3.034	2.286	0.445	2.937	8.362
4 quarters	2.038	1.437	0.304	2.718	7.893

Consumption b	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	3.306	2.415	0.356	3.772	9.840
2 quarters	2.529	2.531	0.495	3.626	10.801
4 quarters	2.882	2.606	0.270	3.050	12.449

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	11.535	1.486	0.657	18.043
2 quarters	9.628	1.679	0.544	19.858
4 quarters	10.709	1.877	0.580	22.885

b) Year-on-year growth rates.

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.484	1.185	3.041
2 quarters	0.487	1.273	4.928
4 quarters	0.542	1.435	6.571

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	1.351	1.966	1.319	0.899
2 quarters	1.459	1.985	1.549	1.262
4 quarters	2.036	1.829	1.793	1.915

Industry 1	***qv4***	***qv5***
1 quarter	1.458	1.248
2 quarters	1.836	1.827
4 quarters	2.053	2.628

Industry 1b	***qv4***	***qv5***
1 quarter	1.349	1.002
2 quarters	1.870	1.413
4 quarters	2.192	1.878

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.874	1.371	3.004
2 quarters	2.186	2.058	4.376
4 quarters	2.248	3.539	5.174

Building a	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.301	6.850	5.170	6.516	16.016
2 quarters	2.795	6.798	5.296	9.779	26.473
4 quarters	3.994	9.635	8.734	10.726	20.485

Building B	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	2.579	8.101	4.500	5.158	29.431
2 quarters	3.565	9.561	3.708	8.955	45.046
4 quarters	5.351	19.240	8.324	12.051	82.390

Exports	***qv16***	***qv13***	***qv22***
1 quarter	3.582	1.693	6.825
2 quarters	4.453	2.173	10.438
4 quarters	6.575	2.270	14.665

Consumption a	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	1.767	1.236	0.526	3.253	15.947
2 quarters	2.019	1.499	0.672	5.363	24.117
4 quarters	2.022	1.486	0.841	6.489	32.947

Consumption b	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	1.808	1.318	0.543	2.707	13.747
2 quarters	2.124	1.866	0.757	5.161	27.987
4 quarters	2.577	2.425	1.025	6.483	58.297

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	18.311	2.169	0.627	24.512
2 quarters	20.093	3.266	0.687	41.993
4 quarters	32.818	4.066	1.022	70.561

A12.3. Forecast competition after removing outliers from data.

A12.3.1. AR models

a) Monthly/quarterly growth rates.

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.23	0.24	0.24	0.22	0.22
qv2	v31	0.62	0.70	0.69	0.66	0.70
qv3a	v29	5.24	5.72	5.91	6.31	4.73
qv3b	v30	5.41	5.90	5.90	6.38	5.81
qv3ab	v29-v30	5.79	6.33	6.38	6.88	6.35
qv4	v7	1.01	1.17	1.19	1.24	1.18
qv5	v8	0.28	0.29	0.29	0.31	0.23
qv7a	v34	1.16	1.34	1.33	1.26	1.30
qv7b	v35	1.59	1.97	2.03	1.83	1.55
qv7c	v36	1.60	1.85	1.87	1.79	1.96
qv7d	v37	1.55	1.92	1.96	2.05	2.48
qv7ad	v34-v37	6.44	3.41	3.44	3.07	2.47
qv20	v19	1.70	1.62	1.61	1.64	1.86

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	4.04	5.26	5.77
qv8	v2	1.67	1.48	1.76
qv9	v28	1.57	1.52	1.81
qv10	v34	0.90	0.65	0.59
qv11a	v13	1.13	1.15	1.05
qv11b	v14	1.10	1.09	1.00
qv11ab	v13-v14	1.11	1.07	1.01
qv12a	v22	8.32	7.33	6.49
qv12b	v23	8.51	9.64	12.23
qv12ab	v22-v23	12.75	13.62	18.69
qv13a	v1	1.35	1.37	0.66
qv13b	v15	1.67	1.75	0.92
qv13c	v16	1.60	1.65	0.96
qv13ac	v1,v15-v16	2.47	1.86	1.21
qv14a	v29	1.44	1.55	1.75
qv14b	v30	0.67	0.76	0.37
qv14ab	v29-v30	0.92	1.00	0.89
qv15a	v3	2.74	2.63	3.15
qv15b	v7	2.28	2.46	3.34
qv15ab	v3-v7	3.03	1.99	2.55
qv16a	v11	3.94	3.33	4.02
qv16b	v5	3.64	2.44	2.34
qv16ab	v11,v5	4.64	4.77	5.07
qv17	v20	0.83	0.74	0.68
qv18	v26	2.73	2.35	2.76
qv19*	v6	3.11	2.07	2.59

* changes in inventories

b) Year-on-year growth rates.

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.20	0.33	0.41	0.43	0.55
qv2	v31	0.33	0.60	0.82	1.34	2.26
qv3a	v29	4.84	5.60	5.79	6.87	8.53
qv3b	v30	4.93	6.04	6.43	7.66	10.22
qv3ab	v29-v30	5.47	6.47	6.80	8.35	9.82
qv4	v7	1.31	1.52	1.64	1.46	1.23
qv5	v8	0.50	0.89	1.30	2.39	3.80
qv7a	v34	1.26	1.27	1.28	1.00	1.48
qv7b	v35	1.31	1.30	1.30	1.18	1.56
qv7c	v36	1.34	1.33	1.32	1.34	1.49
qv7d	v37	1.21	1.20	1.19	1.02	1.15
qv7ad	v34-v37	2.03	2.03	2.05	2.29	3.49
qv20	v19	1.67	2.84	3.83	6.25	8.92

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	4.53	4.61	5.74
qv8	v2	1.66	1.47	1.79
qv9	v28	1.42	1.68	2.60
qv10	v34	0.27	0.44	0.78
qv11a	v13	0.49	0.58	0.92
qv11b	v14	0.63	0.83	1.22
qv11ab	v13-v14	0.64	0.88	1.23
qv12a	v22	14.15	21.63	19.93
qv12b	v23	8.72	10.23	10.57
qv12ab	v22-v23	23.30	28.95	21.13
qv13a	v1	0.39	0.35	0.42
qv13b	v15	0.41	0.40	0.56
qv13c	v16	0.41	0.37	0.52
qv13ac	v1,v15-v16	0.35	0.44	0.66
qv14a	v29	1.23	1.84	2.45
qv14b	v30	0.99	1.37	2.06
qv14ab	v29-v30	1.04	1.43	2.08
qv15a	v3	3.00	4.68	10.43
qv15b	v7	2.54	4.23	9.72
qv15ab	v3-v7	2.69	4.68	13.23
qv16a	v11	4.45	4.95	5.01
qv16b	v5	4.66	6.75	5.53
qv16ab	v11,v5	5.80	8.20	6.72
qv17	v20	0.45	0.49	0.35
qv18	v26	2.59	3.74	7.06

A12.3.2. Markov models

a) Monthly/quarterly growth rates

MK-TAR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.28	0.91	1.48	4.64	6.57
qv2	v31	na	na	na	na	na
qv3a	v29	14.73	14.27	14.77	na	na
qv3b	v30	na	na	na	na	na
qv4	v7	16.71	17.05	17.43	18.31	16.65
qv5	v8	0.30	0.36	0.38	0.49	0.36
qv7a	v34	na	na	na	na	na
qv7b	v35	18.60	15.53	22.02	21.53	20.85
qv7c	v36	na	na	na	na	na
qv7d	v37	na	na	na	na	na
qv20	v19	1.88	3.07	3.62	2.62	2.32

MK-TAR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	22.42	22.04	26.80
qv8	v2	8.94	11.97	11.31
qv9	v28	na	na	na
qv10	v34	6.16	6.01	5.81
qv11a	v13	2.93	2.64	2.87
qv11b	v14	2.80	2.50	2.62
qv12a	v22	7.36	7.61	6.84
qv12b	v23	6.49	6.14	7.45
qv13a	v1	4.97	4.86	4.30
qv13b	v15	4.97	4.65	4.55
qv13c	v16	na	na	na
qv14a	v29	na	na	na
qv14b	v30	15.98	16.61	18.02
qv15a	v3	25.34	24.90	24.75
qv15b	v7	26.23	24.46	26.65
qv16a	v11	9.77	5.44	5.39
qv16b	v5	9.37	7.84	11.06
qv17	v20	6.29	5.99	5.80
qv18	v26	na	na	na
qv19*	v6	3.29	4.68	7.80

* changes in inventories

b) Year-on-year growth rates

MK-TAR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	Na	na	na	na	na
qv2	v31	Na	na	na	na	na
qv3a	v29	6.17	6.01	6.74	10.61	10.65
qv3b	v30	Na	na	na	na	na
qv4	v7	1.49	1.82	2.55	2.67	4.04
qv5	v8	0.59	0.98	1.51	2.56	7.07
qv7a	v34	1.54	3.12	2.43	3.23	3.43
qv7b	v35	na	na	na	na	na
qv7c	v36	na	na	na	na	na
qv7d	v37	na	na	na	na	na
qv20	v19	1.66	2.01	2.86	3.63	12.43

MK-TAR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	na	na	na
qv8	v2	1.68	3.57	4.48
qv9	v28	1.15	1.87	2.66
qv10	v34	na	na	na
qv11a	v13	0.69	1.30	1.36
qv11b	v14	0.73	0.68	1.24
qv12a	v22	6.23	11.00	13.59
qv12b	v23	5.66	8.07	11.55
qv13a	v1	0.23	0.29	1.70
qv13b	v15	0.31	0.27	0.67
qv13c	v16	0.34	0.29	0.66
qv14a	v29	na	na	na
qv14b	v30	1.06	1.92	3.49
qv15a	v3	3.87	5.35	11.39
qv15b	v7	4.19	5.74	11.14
qv16a	v11	4.04	4.45	4.15
qv16b	v5	3.81	4.28	6.28
qv17	v20	0.74	1.30	na
qv18	v26	na	na	na

A12.3.3. VAR models

a) Monthly/quarterly growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.336	0.661	2.777
2 quarters	0.386	1.003	2.825
4 quarters	0.262	0.988	3.520

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	3.376	2.665	1.280	0.545
2 quarters	3.187	2.542	1.426	0.800
4 quarters	0.957	2.980	1.077	0.712

Industry 1	***qv4***	***qv5***
1 quarter	3.410	0.542
2 quarters	1.631	0.676
4 quarters	1.650	0.629

Industry 1b	***qv4***	***qv5***
1 quarter	4.236	0.524
2 quarters	6.495	0.633
4 quarters	6.977	0.612

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	1.978	0.644	5.093
2 quarters	1.864	0.712	5.477
4 quarters	1.159	0.728	2.640

Building a	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	0.727	4.296	2.155	2.231	8.780
2 quarters	0.719	3.567	1.562	1.319	10.192
4 quarters	0.285	4.601	1.053	0.801	8.868

Building B	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	0.706	4.441	2.135	2.250	8.907
2 quarters	0.614	4.030	1.468	1.425	10.142
4 quarters	0.241	4.429	1.128	0.784	8.785

Exports	***qv16***	***qv13***	***qv22***
1 quarter	3.362	0.882	4.366
2 quarters	2.530	0.956	3.230
4 quarters	4.018	1.059	4.158

Consumption a	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	2.005	1.003	0.301	2.861	8.473
2 quarters	2.621	1.726	0.360	3.120	8.970
4 quarters	1.263	0.434	0.265	2.286	8.529

Consumption b	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	2.444	1.195	0.269	2.766	8.929
2 quarters	2.513	1.659	0.390	3.241	10.245
4 quarters	1.457	0.656	0.305	3.793	8.802

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	8.876	0.998	0.463	8.365
2 quarters	9.402	1.036	0.461	8.530
4 quarters	9.299	1.078	0.426	8.682

b) Year-on-year growth rates

Total	***qv1***	***qv13***	***qv20***
1 quarter	0.405	0.373	2.966
2 quarters	0.466	0.413	4.839
4 quarters	0.778	0.444	6.576

Supply	***qv8***	***qv9***	***qv10***	***qv11***
1 quarter	1.261	1.617	0.218	0.567
2 quarters	1.150	1.853	0.292	0.696
4 quarters	1.327	2.135	0.425	1.134

Industry 1	***qv4***	***qv5***
1 quarter	1.847	1.453
2 quarters	2.494	2.359
4 quarters	2.978	3.629

Industry 1b	***qv4***	***qv5***
1 quarter	1.370	1.057
2 quarters	1.812	1.565
4 quarters	1.999	1.989

Industry 2	***qv4***	***qv5***	***qv15***
1 quarter	2.392	1.631	3.381
2 quarters	3.082	2.672	5.225
4 quarters	3.383	4.585	6.284

Building a	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	1.074	4.645	2.590	1.708	5.405
2 quarters	1.553	5.331	4.626	2.156	6.915
4 quarters	2.488	6.928	6.616	3.181	11.897

Building B	***qv2***	***qv3***	***qv18***	***qv14***	***qv21***
1 quarter	1.163	5.032	2.637	1.893	4.810
2 quarters	1.741	7.076	4.624	2.396	5.182
4 quarters	2.705	8.504	6.275	3.242	6.714

Exports	***qv16***	***qv13***	***qv22***
1 quarter	3.838	0.765	6.553
2 quarters	4.778	0.863	10.152
4 quarters	5.470	0.648	10.378

Consumption a	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	0.648	0.389	0.407	3.242	12.250
2 quarters	0.967	0.652	0.486	5.189	20.573
4 quarters	1.112	0.936	0.706	6.702	22.520

Consumption b	***qv17***	***qv13***	***qv1***	***qv20***	***qv21***
1 quarter	0.575	0.557	0.453	2.478	10.966
2 quarters	0.790	0.922	0.588	4.633	19.323
4 quarters	0.748	0.900	0.749	8.300	35.230

Savings	***qv12***	***qv13***	***qv1***	***qv21***
1 quarter	9.991	0.635	0.534	7.578
2 quarters	10.474	1.021	0.727	18.819
4 quarters	15.142	0.815	1.583	45.984

ANNEX 13. Leading indicators models

A13.1. Brief description of the considered methodology

According to Clements and Hendry (1998), p. 207 "an indicator is any variable believed informative about another variable of interest". In this context, a leading indicator is any variable whose outcome is known in advance of a related variable which is desired to forecast. Usually, there are several leading indicators for every variable to be forecasted and, for this reason, composite leading indicators are constructed. A composite leading index is a combination (e.g. a weighted average) of this set of simple leading indicators. Composite leading indicators are useful to provide estimates of the current state and short-term forecasts of the analysed economy. The main advantage of composite leading indicators in relation to other methods is that it is not necessary to obtain forecasts for exogenous variables as their lagged values are known in advance. Of course, leading indicators will only provide reasonably accurate short term forecasts. However, we extend the analysis up to two years as an additional benchmark for the results using other procedures.

The procedure for the selection of the simple leading indicators for each endogenous variable is based on the bilateral correlations between different lags of each of the variables in the Business and Consumer Surveys Indicators and the endogenous variable. The simple leading indicators have been chosen among those with highest values of the correlation coefficient. The length of the lead has been determined by cross-correlation analysis. In this sense, as an automatic identification procedure, different values of the bilateral correlation coefficient have been explored as a limit for a variable to be considered as a leading indicator. These values range from zero (all explanatory variables would be considered as leading indicators) to 0.8 (only variables with a strong correlation with the endogenous would be considered). Eventually we fixed this limit at 0.5.

As there could be several simple leading indicators for every endogenous variable and the available sample is quite short, it is necessary to reduce the dimensionality of the exogenous variables matrix before using this information set to obtain the desired forecasts. It is also necessary to eliminate from this set of simple leading indicators, the

part of their behaviour attributable to noise which would not be useful to forecast the endogenous variables (the noise would be higher with lower values of the correlation coefficient). With this aim, we extracted the principal components of the regressors. The idea is that the first principal components capture the commonalities in the set of simple leading indicators (the relevant information to forecast the endogenous variables). After experimenting with different values, we retain as many components as necessary to explain 70% of the total variance of the simple leading indicators.

Once the simple leading indicators have been selected and have been summarised in a few components (in most cases, the number of considered components ranges from one to three), these components are used as explanatory variables in the forecasting equations.

References

Clements, M. and Hendry, D. (1998): *Forecasting economic time series*, Cambridge University Press, Cambridge.

A13.2. Description of the leading indicators models

	Obs		Factors	Selected variables (lags)
qv1	92	1 month	2	v8(1), v16(2)
		2 months	2	v16(2), v22(3), d_v4(3), d_v6(3), d_v15(3)
		3 months	3	v17(6), v22(3), v24(6), v30(6), v32(6), v34(6), v36(6), d_v4(3), d_v6(3), d_v15(3)
		6 months	3	v16(8), v19(8), v21(12), v22(12), v29(8), v30(8), v31(10), v32(9), v38(8), d_v18(6), d_v20(11), d_v22(11)
		12 months	6	v7(24), v13(21), v14(20), v15(19), v16(19), v19(19), v20(22), v21(23), v22(15), v23(20), v24(19), v29(19), v30(19), v31(22), v32(20), v34(22), v35(24), v36(15), v37(16), v38(21), v40(24), v43(20), d_v3(15), d_v5(24), d_v7(24), d_v15(23), d_v19(17), d_v20(24), d_v21(20), d_v29(24), d_v30(24), d_v35(22), d_v42(18)
qv2	92	1 month	2	v44(2), d_v3(1), d_v22(2), d_v23(2)
		2 months	2	v13(2), v14(2), v15(2), v20(2), v21(2), v23(2), v30(2), d_v17(2), d_v29(2), d_v31(2), d_v38(2), d_v41(2)
		3 months	1	d_v23(3)
		6 months	1	v29(10)
		12 months	4	v7(13), v29(23), v31(24), v35(22), v41(20), d_v7(13), d_v18(20), d_v19(14), d_v24(24), d_v31(14), d_v42(24)
qv3	92	1 month	1	v16(2), v19(2), v22(2), v23(2)
		2 months	1	v14(3), v16(4), v19(4), v22(3), v23(3)
		3 months	2	v5(6), v14(6), v15(6), v16(6), v19(6), v22(6), v23(3), d_v6(6)
		6 months	2	v3(11), v5(11), v7(12), v14(11), v15(9), v16(12), v19(10), v22(11), v23(9), d_v4(12), d_v5(12), d_v6(11), d_v7(12), d_v14(12), d_v15(12), d_v16(12), d_v18(9), d_v19(11), d_v20(11), d_v21(12), d_v22(12), d_v23(12), d_v24(9), d_v31(11)
		12 months	3	v4(24), v8(13), v13(24), v14(23), v15(22), v16(22), v19(23), v20(22), v21(17), v22(21), v23(23), v24(19), v30(15), v31(16), v32(17), v34(20), v36(14), v37(20), v38(22), v40(22), v41(22), v42(24), v43(24), v44(13), d_v4(13), d_v6(18), d_v16(20), d_v21(21), d_v22(24), d_v29(19), d_v30(23), d_v32(20), d_v35(20), d_v36(20), d_v37(22), d_v40(22), d_v42(24)
qv4	203	1 month	2	v7(1), v40(2), v41(1), v42(2), v43(2), v44(2), d_v3(2), d_v5(2), d_v7(1), d_v15(2), d_v16(1), d_v20(2), d_v21(2), d_v22(2), d_v23(2), d_v24(2), d_v31(1)
		2 months	2	v40(2), v42(2), v43(3), v44(3), d_v3(2), d_v5(2), d_v15(3), d_v20(2), d_v21(2), d_v22(4), d_v23(3), d_v24(2)
		3 months	1	v43(3), v44(3), d_v15(3), d_v22(4), d_v23(3)
		6 months	1	v17(12), v18(12)
		12 months	3	v8(17), v13(24), v14(24), v15(24), v16(24), v19(24), v22(24), v24(24), v30(24), v34(24), v37(24), v38(24), v43(23), d_v7(19), d_v13(14), d_v16(24), d_v19(14), d_v21(16), d_v22(14), d_v34(12), d_v36(23), d_v37(12), d_v38(19), d_v41(16)

qv5	203	1 month	2	v23(1), v41(1), d_v3(1)
		2 months	2	v41(3), v42(3), d_v3(3)
		3 months	3	v20(6), v21(6), v24(6), v41(3), v42(3), d_v3(3)
		6 months	3	v20(12), v21(8), v22(12), v24(6), v29(9), v35(9)
		12 months	3	v15(24), v17(24), v20(24), v22(17), v40(20), v44(22)
qv6	92	1 month	2	v8(2), d_v19(2), d_v41(2)
		2 months	2	v3(2), v18(4), d_v21(2), d_v22(2), d_v24(2), d_v30(2), d_v31(4)
		3 months	1	v23(5), v24(6), v30(6), v32(6)
		6 months	1	d_v32(7)
		12 months	2	v4(24), v13(23), v14(24), v15(24), v16(24), v17(19), v18(14), v19(24), v20(18), v21(20), v22(23), v23(23), v24(19), v30(22), v31(14), v32(14), v34(22), v36(24), v37(24), v38(24), v40(24), v41(21), v42(24), v43(24), d_v6(16), d_v8(23), d_v14(24), d_v15(24), d_v18(24), d_v20(24), d_v23(18), d_v29(19), d_v30(23), d_v31(20), d_v38(12), d_v41(16), d_v42(21)
qv7	108	1 month	1	v14(1), v23(1), d_v23(2)
		2 months	2	v24(2), v34(2), d_v8(4), d_v13(2), d_v21(4), d_v23(2)
		3 months	1	d_v4(6), d_v5(6), d_v6(5), d_v7(5), d_v14(5), d_v15(6), d_v19(6), d_v20(6), d_v21(6), d_v22(6), d_v23(5)
		6 months	2	v17(9), v18(11), v21(8), v34(10), d_v15(12)
		12 months	1	v18(15), d_v15(12)
qv20	120	1 month	2	v7(1), v37(1), v44(2), d_v22(2)
		2 months	3	v29(3), v35(2), v41(3), d_v6(2), d_v30(2)
		3 months	2	v36(6), d_v3(5), d_v23(3)
		6 months	3	v29(10), v35(11), v36(6), v38(10), v44(11), d_v3(12), d_v20(12)
		12 months	3	v35(22), v44(23), d_v3(24), d_v14(20), d_v20(24), d_v22(14), d_v23(14)
qv8	48	1 quarter	2	v29(2), v40(2), d_v4(2), d_v5(1), d_v23(2), d_v29(2), d_v32(2)
		2 quarters	4	v10(3), v29(3), v35(3), v41(2), v44(2), d_v6(3), d_v7(3), d_v8(3), d_v22(4), d_v23(4), d_v24(3), d_v26(3), d_v27(2), d_v34(3), d_v40(2), d_v41(3), d_v42(3)
		4 quarters	2	v8(5), d_v3(7), d_v4(7), d_v5(7), d_v11(5)
qv9	30	1 quarter	2	v13(2), v14(2), v15(2), v16(2), v19(2), v20(2), v23(2), v24(2), v25(2), v26(1), v27(1), v30(2), v31(2), d_v25(2), d_v29(2), d_v31(1)
		2 quarters	2	v13(3), v14(4), v15(4), v16(4), v17(4), v19(3), v20(3), v21(4), v22(4), v23(4), v24(2), v25(2), v26(2), v27(2), v30(2), v31(3), v34(4), v36(4), v37(4), v38(4), v40(4), v41(4), v42(4), v44(3), d_v6(4), d_v8(3), d_v10(4), d_v11(4), d_v13(4), d_v14(4), d_v15(4), d_v18(4), d_v19(4), d_v20(4), d_v21(4), d_v23(4), d_v24(4), d_v25(4), d_v26(4), d_v29(4), d_v30(4), d_v31(4), d_v42(4)
		4 quarters	2	v8(4), v17(4), d_v29(7)

qv10	30	1 quarter	2	v3(2), v4(1), v5(2), v6(2), v7(2), v10(2), v11(2), v13(1), v14(1), v15(1), v16(1), v17(2), v20(1), v21(1), v22(1), v23(2), v27(1), v29(2), v37(1), v38(2), d_v6(2), d_v7(2), d_v8(2), d_v13(2), d_v15(2), d_v16(2), d_v18(2), d_v19(2), d_v20(2), d_v21(2), d_v22(2), d_v23(2), d_v24(2), d_v25(2), d_v26(2), d_v27(2)
		2 quarters	3	v4(2), v6(2), v10(2), v16(2), v17(4), v22(4), v23(2), v29(3), v38(2), v40(3), v41(2), v42(2), d_v11(3), d_v13(4), d_v14(4), d_v15(2), d_v18(4), d_v19(4), d_v21(4), d_v23(4), d_v24(3), d_v25(3), d_v27(4), d_v29(4), d_v30(4), d_v31(4)
		4 quarters	2	v8(7), v17(5), v18(7), v22(8), d v15(4), d v27(6), d v30(6)
qv11	47	1 quarter	2	v13(2), v14(2), v15(1), v18(2), v19(2), v20(2), v21(1), v23(2), v24(2), v25(2), v26(2), v27(2), v30(2), v32(1), d v7(1), d v17(2), d v25(2), d v31(2), d v34(2), d v38(2), d v41(2)
		2 quarters	3	v10(4), v29(4), v35(4), v41(3), v43(4), v44(3), d_v6(4), d_v7(3), d_v8(3), d_v10(2), d_v24(4), d v26(3), d v27(3), d v34(3), d v36(4), d v40(2), d v41(4), d v42(4)
		4 quarters	2	v3(5), v6(5), v7(4), v10(5), v11(4), v16(5), v17(4), v18(7), v38(5), d_v6(4), d_v7(5), d_v8(5), d_v14(5), d_v15(5), d_v16(5), d_v18(5), d_v19(4), d_v20(5), d_v21(4), d_v22(5), d_v23(6), d_v24(5), d v25(6), d v26(5), d v27(6), d v29(8), d v30(6), d v31(7), d v32(8)
qv12	48	1 quarter	1	v44(1), d v18(1), d v27(1), d v31(1)
		2 quarters	1	d v19(2)
		4 quarters	1	v13(5), v15(6), v24(4), v25(5), v27(5), v30(5), v31(5), v32(5), d_v4(8), d_v6(6), d_v10(7), d_v15(7), d_v16(6), d_v20(7), d_v21(6), d_v24(8), d_v25(8), d_v26(8)
qv13	30	1 quarter	3	v18(1), v26(2), v35(2), d_v7(1), d_v10(1), d_v17(2), d_v25(2), d_v31(1), d_v32(2), d_v34(2), d_v36(2)
		2 quarters	2	v8(4), v17(3), v18(2), d_v13(2), d_v15(3), d_v20(2), d_v21(2), d_v23(2), d_v24(2), d_v25(2), d v30(4)
		4 quarters	3	v10(8), v29(8), v35(8), v41(7), v42(8), v44(7), d_v6(8), d_v7(7), d_v13(5), d_v15(5), d_v22(6), d v23(5), d v24(4), d v27(7), d v34(4), d v41(4), d v42(8)
qv14	29	1 quarter	2	v15(1), v16(1), v17(2), v19(1), v20(2), v26(1), v27(1), v38(2), d_v6(2), d_v15(2), d_v19(2), d_v20(2), d v21(2), d v24(2), d v25(2), d v26(1)
		2 quarters	2	v14(3), v15(4), v16(4), v17(4), v19(2), v20(2), v21(3), v22(3), v23(3), v24(2), v25(3), v29(2), v31(3), v34(3), v35(4), v36(4), v37(4), v38(3), v40(4), v41(4), v42(4), v44(3), d_v6(3), d_v8(3), d_v10(3), d_v11(4), d_v13(4), d_v14(4), d_v15(4), d_v18(4), d_v19(4), d_v20(4), d_v21(4), d_v23(4), d_v24(4), d_v25(4), d_v26(4), d_v29(4), d_v30(3), d_v31(3), d_v40(4), d_v41(2), d_v42(4)
		4 quarters	2	v17(4), v22(8), d v15(7), d v18(6), d v19(4), d v20(4), d v22(5), d v27(5), d v29(6), d v32(5)

qv15	47	1 quarter	3	v3(1), v6(1), v10(1), v11(1), v18(2), v25(1), v27(1), v42(1), d_v3(1), d_v7(1), d_v8(1), d_v13(1), d_v18(1), d_v23(1), d_v25(2), d_v31(1)
		2 quarters	2	v17(3), v18(3), d_v11(4), d_v19(2), d_v20(2), d_v23(2), d_v32(2)
		4 quarters	2	v8(7), v32(7), d_v11(6), d_v29(6)
qv16	48	1 quarter	3	v29(2), v41(2), v44(2), d_v8(2), d_v24(2), d_v27(2), d_v34(2), d_v36(2), d_v37(2), d_v40(1), d_v41(2), d_v42(2)
		2 quarters	4	v10(3), v29(2), v35(3), v41(2), v42(3), v44(2), d_v6(3), d_v8(2), d_v22(4), d_v23(4), d_v24(3), d_v26(3), d_v27(2), d_v30(3), d_v34(3), d_v36(4), d_v40(2), d_v41(3), d_v42(3)
		4 quarters	3	v29(6), v35(7), d_v6(7), d_v7(6), d_v22(4), d_v23(4), d_v25(8), d_v30(7), d_v34(6), d_v36(4), d_v40(5)
qv17	48	1 quarter	2	v13(2), v17(2), v20(2), v21(1), v23(2), v25(2), v27(2), d_v15(2), d_v17(2), d_v20(2), d_v21(2), d_v22(2)
		2 quarters	2	v13(3), v17(3), v20(2), v21(4), v23(4), v25(2), v27(2), v34(4), d_v15(4), d_v17(2), d_v20(2), d_v21(2), d_v22(3)
		4 quarters	2	v3(7), v4(5), v5(6), v6(6), v7(7), v8(7), v10(7), v11(7), v13(8), v14(8), v15(8), v16(8), v18(6), v19(8), v21(8), v23(8), v24(8), v25(8), v26(8), v27(8), v30(8), v32(8), v34(8), v35(4), v36(8), v37(4), v41(8), v43(8), v44(7), d_v3(7), d_v4(7), d_v5(7), d_v6(7), d_v7(7), d_v8(7), d_v10(7), d_v11(4), d_v13(4), d_v14(4), d_v15(5), d_v17(5), d_v18(4), d_v19(4), d_v20(4), d_v22(5), d_v23(4), d_v32(6), d_v34(5), d_v35(8), d_v37(4), d_v38(7), d_v40(5), d_v41(8), d_v42(5)
qv18	29	1 quarter	2	v8(2), v11(2), v17(2), v35(1), v44(2), d_v3(2), d_v4(2), d_v5(2), d_v6(2), d_v32(1), d_v34(1), d_v38(1), d_v40(1)
		2 quarters	2	v8(3), v11(2), v17(3), v18(3), v21(4), v31(3), v35(4), v38(3), v40(4), v44(2), d_v3(2), d_v4(2), d_v5(2), d_v6(3), d_v8(3), d_v10(3), d_v11(4), d_v14(4), d_v18(4), d_v19(4), d_v20(4), d_v29(4), d_v30(4), d_v35(4)
		4 quarters	2	v3(7), v4(6), v5(7), v6(7), v7(7), v8(8), v10(7), v11(7), v13(4), v14(4), v15(4), v16(5), v17(4), v19(4), v20(4), v21(4), v22(4), v23(4), v25(4), v26(4), v27(4), v34(5), v35(4), v36(4), v37(5), v38(5), v40(5), v41(5), v42(5), v43(4), d_v3(7), d_v7(8), d_v11(6), d_v13(7), d_v14(6), d_v15(7), d_v16(6), d_v18(4), d_v19(5), d_v20(4), d_v21(7), d_v22(7), d_v23(7), d_v24(5), d_v25(4), d_v26(5), d_v27(6), d_v29(4), d_v30(4), d_v31(6), d_v34(6), d_v35(5), d_v36(6), d_v37(5), d_v40(5), d_v41(8), d_v42(4)
qv19	30	1 quarter	1	d_v3(2)
		2 quarters	1	d_v3(2)
		4 quarters	2	v7(8), v29(7), v41(6), d_v3(8), d_v13(8), d_v14(8), d_v15(8), d_v18(8), d_v19(8), d_v24(6), d_v27(6), d_v29(8), d_v30(8), d_v31(8), d_v40(6), d_v41(7), d_v42(7)

A13.3. Forecast accuracy of leading indicators models. RMSE

A13.3.1. Leading indicators for raw data

a) Monthly/quarterly growth rates

RMSE Model 1

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	1	0.3	0.7	0.28	0.26	0.25	0.23	0.21
qv2	1	0.5	0.7	1.08	0.98	1.15	0.71	1.23
qv3	1	0.2	0.7	10.04	10.37	11.17	10.69	9.63
qv4	1	0.2	0.7	9.52	9.59	10.35	6.42	9.26
qv5	1	0.2	0.7	0.30	0.28	0.30	0.35	0.21
qv6	1	0.2	0.7	19.07	16.10	16.95	15.33	23.01
qv7	1	0.3	0.7	11.53	10.13	10.06	10.61	12.67
qv20	1	0.4	0.7	1.39	1.49	1.72	1.79	1.87

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	1	0.5	0.7	2.12	2.56	2.93
qv9	1	0.5	0.7	4.15	4.28	4.29
qv10	1	0.5	0.7	1.93	2.59	2.65
qv11	1	0.5	0.7	1.35	1.04	1.66
qv12	1	0.2	0.7	10.68	11.58	10.00
qv13	1	0.5	0.7	2.51	1.48	1.59
qv14	1	0.5	0.7	5.80	3.44	2.84
qv15	1	0.5	0.7	16.53	7.81	6.34
qv16	1	0.5	0.7	2.15	2.61	4.60
qv17	1	0.5	0.7	2.66	1.65	2.55
qv18	1	0.5	0.7	3.30	4.55	7.50
qv19***	1	0.4	0.7	3.40	2.77	1.95

* minimal correlation with endogenous variable to select a qualitative indicator
** proportion of total variance explained by selected factors
*** changes in inventories

RMSE Model 2

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	2	0.3	0.7	0.31	0.28	0.28	0.21	0.19
qv2	2	0.5	0.7	1.28	1.09	1.13	0.73	0.71
qv3	2	0.3	0.7	11.16	11.46	12.27	11.47	12.12
qv4	2	0.3	0.7	9.76	10.21	11.87	9.76	11.59
qv5	2	0.4	0.7	0.33	0.32	0.35	0.45	0.46
qv6	2	0.3	0.7	19.86	16.91	17.23	19.12	25.72
qv7	2	0.3	0.7	11.59	10.11	10.49	9.23	12.72
qv20	2	0.4	0.7	1.50	1.28	2.03	1.92	1.88

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	2	0.5	0.7	1.76	1.98	2.31
qv9	2	0.5	0.7	4.46	5.17	2.73
qv10	2	0.5	0.7	2.20	1.21	1.23
qv11	2	0.5	0.7	1.01	1.08	0.99
qv12	2	0.5	0.7	11.41	21.72	9.95
qv13	2	0.5	0.7	7.81	3.86	0.16
qv14	2	0.5	0.7	6.46	6.86	4.43
qv15	2	0.5	0.7	8.09	5.91	4.85
qv16	2	0.5	0.7	3.22	2.38	2.74
qv17	2	0.5	0.7	2.90	1.51	2.76
qv18	2	0.5	0.7	4.29	7.95	3.77
qv19***	2	0.5	0.7	2.86	2.38	1.73

* minimal correlation with endogenous variable to select a qualitative indicator
** proportion of total variance explained by selected factors
*** changes in inventories

b) Year-on-year growth rates

RMSE Model 1

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	1	0.5	0.7	0.79	0.79	0.79	0.75	0.47
qv2	1	0.5	0.7	2.71	2.92	3.41	3.38	2.49
qv3	1	0.3	0.7	6.82	7.40	6.63	6.92	7.44
qv4	1	0.5	0.7	1.64	1.52	1.33	2.81	2.72
qv5	1	0.4	0.7	1.32	1.22	1.19	1.80	3.02
qv6	1	0.3	0.7	7.26	6.18	7.09	6.29	5.27
qv7	1	0.5	0.7	1.05	1.02	0.97	0.91	0.99
qv20	1	0.5	0.7	3.95	3.54	4.47	4.71	5.68

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	1	0.5	0.7	2.51	3.46	1.32
qv9	1	0.5	0.7	1.25	2.47	2.36
qv10	1	0.5	0.7	2.43	2.30	1.42
qv11	1	0.5	0.7	1.06	1.26	1.31
qv12	1	0.5	0.7	8.55	13.19	19.22
qv13	1	0.5	0.7	1.44	1.73	1.16
qv14	1	0.5	0.7	2.04	4.99	4.63
qv15	1	0.5	0.7	2.46	2.02	3.26
qv16	1	0.5	0.7	3.15	5.51	7.77
qv17	1	0.5	0.7	1.64	1.62	1.62
qv18	1	0.5	0.7	2.79	2.85	3.95

RMSE Model 2

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	2	0.5	0.7	0.53	0.52	0.47	0.40	0.65
qv2	2	0.5	0.7	1.28	1.24	1.60	1.40	2.76
qv3	2	0.3	0.7	6.35	7.01	7.20	9.29	6.80
qv4	2	0.5	0.7	2.22	2.35	2.45	6.79	2.92
qv5	2	0.5	0.7	1.16	1.69	3.76	5.63	5.32
qv6	2	0.5	0.7	7.68	6.60	7.13	7.97	5.40
qv7	2	0.5	0.7	1.07	1.06	1.03	0.98	2.73
qv20	2	0.5	0.7	3.00	2.79	3.07	2.77	8.83

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	2	0.5	0.7	1.29	4.50	4.11
qv9	2	0.5	0.7	0.82	1.24	2.81
qv10	2	0.5	0.7	1.82	1.94	3.62
qv11	2	0.5	0.7	1.12	1.59	2.83
qv12	2	0.5	0.7	16.32	16.03	30.78
qv13	2	0.5	0.7	1.01	2.32	3.04
qv14	2	0.5	0.7	2.59	2.50	5.50
qv15	2	0.5	0.7	2.75	10.98	8.79
qv16	2	0.5	0.7	2.59	9.40	11.05
qv17	2	0.5	0.7	1.64	2.05	2.91
qv18	2	0.5	0.7	2.73	2.53	6.41

* minimal correlation with endogenous variable to select a qualitative indicator
** proportion of total variance explained by selected factors

A13.3.2. Growth rates after removing outliers using Tramo/Seats

a) Monthly/quarterly growth rates

RMSE Model 1

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	1	0.3	0.7	0.24	0.26	0.25	0.22	0.21
qv2	1	0.4	0.7	0.44	0.58	0.79	0.87	0.99
qv3	1	0.2	0.7	9.87	9.94	10.80	12.38	10.18
qv4	1	0.2	0.7	8.94	9.31	9.91	7.43	7.42
qv5	1	0.3	0.7	0.36	0.32	0.33	0.47	0.28
qv6	1	0.3	0.7	16.84	16.49	16.57	13.68	14.60
qv7	1	0.3	0.7	11.13	9.99	9.80	12.23	14.07
qv20	1	0.4	0.7	1.39	1.47	1.67	1.74	1.77

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	1	0.5	0.7	1.15	2.36	2.80
qv9	1	0.5	0.7	3.27	4.06	2.54
qv10	1	0.5	0.7	2.03	1.10	1.34
qv11	1	0.5	0.7	1.46	0.90	1.67
qv12	1	0.4	0.7	13.62	10.23	12.39
qv13	1	0.5	0.7	1.79	1.43	1.16
qv14	1	0.5	0.7	5.30	4.27	1.92
qv15	1	0.5	0.7	11.03	7.80	5.43
qv16	1	0.5	0.7	2.60	2.45	4.77
qv17	1	0.5	0.7	3.14	1.53	1.73
qv18	1	0.5	0.7	3.10	6.13	7.87
qv19***	1	0.3	0.7	3.24	2.44	2.05

* minimal correlation with endogenous variable to select a qualitative indicator
** proportion of total variance explained by selected factors
*** changes in inventories

RMSE Model 2

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	2	0.3	0.7	0.26	0.26	0.25	0.22	0.25
qv2	2	0.5	0.7	0.46	0.63	0.81	0.84	0.59
qv3	2	0.3	0.7	11.01	10.71	12.04	12.51	9.91
qv4	2	0.3	0.7	10.32	9.14	9.42	7.22	8.93
qv5	2	0.5	0.7	0.36	0.38	0.37	0.48	0.65
qv6	2	0.3	0.7	16.28	15.76	16.29	16.00	15.10
qv7	2	0.3	0.7	11.14	9.97	11.70	11.26	12.03
qv20	2	0.5	0.7	1.41	1.50	2.30	1.83	1.90

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	2	0.5	0.7	1.85	2.27	2.64
qv9	2	0.5	0.7	3.05	4.26	2.84
qv10	2	0.5	0.7	2.03	1.55	0.95
qv11	2	0.5	0.7	1.04	0.80	0.70
qv12	2	0.5	0.7	9.39	11.76	10.84
qv13	2	0.5	0.7	1.86	1.49	1.27
qv14	2	0.5	0.7	4.74	3.86	2.52
qv15	2	0.5	0.7	10.32	7.12	4.62
qv16	2	0.5	0.7	2.01	2.62	3.23
qv17	2	0.5	0.7	2.83	1.44	1.81
qv18	2	0.5	0.7	3.31	5.70	4.29
qv19***	2	0.5	0.7	2.85	2.44	3.01

* minimal correlation with endogenous variable to select a qualitative indicator
** proportion of total variance explained by selected factors
*** changes in inventories

b) Year-on-year growth rates

RMSE Model 1

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	1	0.5	0.7	0.77	0.85	0.64	0.87	1.41
qv2	1	0.5	0.7	0.89	1.08	1.14	0.99	1.64
qv3	1	0.3	0.7	5.80	5.82	5.69	4.77	7.55
qv4	1	0.5	0.7	1.53	1.41	1.30	5.13	4.98
qv5	1	0.4	0.7	1.69	1.42	1.46	2.68	2.68
qv6	1	0.3	0.7	6.67	6.78	6.16	6.55	5.86
qv7	1	0.5	0.7	1.40	1.03	0.91	0.91	2.40
qv20	1	0.5	0.7	4.96	5.55	5.42	6.07	8.86

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	1	0.5	0.7	1.37	2.86	1.25
qv9	1	0.5	0.7	1.01	1.70	2.88
qv10	1	0.5	0.7	0.23	0.91	0.78
qv11	1	0.5	0.7	1.03	1.06	0.30
qv12	1	0.5	0.7	6.69	11.28	7.08
qv13	1	0.5	0.7	0.54	0.46	0.42
qv14	1	0.5	0.7	0.52	1.22	0.70
qv15	1	0.5	0.7	3.33	7.81	11.17
qv16	1	0.5	0.7	3.34	5.51	4.44
qv17	1	0.5	0.7	0.77	0.57	0.85
qv18	1	0.5	0.7	3.52	3.23	3.50

RMSE Model 2

Variable	Model	Correlation*	Inertia**	1 month	2 months	3 months	6 months	12 months
qv1	2	0.5	0.7	0.33	0.33	0.47	0.60	0.64
qv2	2	0.5	0.7	0.70	0.57	0.84	1.37	4.11
qv3	2	0.5	0.7	7.45	6.09	5.97	9.99	9.35
qv4	2	0.5	0.7	2.05	2.23	2.50	6.31	2.42
qv5	2	0.5	0.7	1.84	1.98	3.46	3.73	5.43
qv6	2	0.5	0.7	4.92	6.47	6.34	7.02	3.71
qv7	2	0.5	0.7	1.12	0.91	0.99	0.93	2.73
qv20	2	0.5	0.7	3.86	3.96	2.94	4.08	8.47

Variable	Model	Correlation*	Inertia**	1 quarter	2 quarters	4 quarters
qv8	2	0.5	0.7	1.47	4.28	4.07
qv9	2	0.5	0.7	1.00	0.99	5.41
qv10	2	0.5	0.7	0.41	0.52	1.20
qv11	2	0.5	0.7	0.79	1.61	0.94
qv12	2	0.5	0.7	10.80	14.67	20.91
qv13	2	0.5	0.7	0.47	0.71	2.60
qv14	2	0.5	0.7	1.38	1.12	5.26
qv15	2	0.5	0.7	2.23	11.00	9.27
qv16	2	0.5	0.7	2.72	7.97	9.54
qv17	2	0.5	0.7	1.14	1.37	0.60
qv18	2	0.5	0.7	3.94	3.18	2.16

* minimal correlation with endogenous variable to select a qualitative indicator

** proportion of total variance explained by selected factors

ANNEX 14. Quantification methods

A14.1. Description of the methods

Assuming that the percentage change expected remains constant in time for the categories expecting an increase and a decrease of the variable, Anderson (1951) defined the balance statistic as a measure of the average changes expected in the variable. Ever since, the balance statistic has been widely used as a short-term forecast as well as for the construction of several economic indicators.

There have been a variety of quantification methods proposed in the literature. These methods are based on the assumption that respondents base their answer on a subjective probability distribution defined over future changes in the variable and conditional to the information available up that moment, which has the same form for all agents. Differences between methods have usually been related to theoretical considerations regarding rationality tests rather than based on their forecasting ability.

The accuracy of the balance statistic as a means for extracting the maximum degree of information from survey data on the direction of change has been widely studied since the introduction of this new source of information in Europe by the *IFO-Institut für Wirtschaftsforschung* at the beginning of the fifties, for example by Anderson (1951, 1952), Theil (1952, 1955), Anderson, Bauer and Fels (1954), De Menil and Bhalla (1975) and Defris and Williams (1979). This line of research has led some authors to look for alternative procedures and statistics oriented towards the conversion of qualitative data into quantitative series of expectations.

While most of the emphasis was given to the justification of the balance statistic within a theoretical framework and the evaluation of its performance as predictor of inflation and economic activity, as well as to the analysis of the rationality and the formation of expectations (i.e. Papadia, 1983), some other studies have been more empirically oriented. The fact that business and consumer surveys seem to be a valuable tool for anticipating economic activity has given rise to a line of research more focused on the construction of indexes and indicators of activity with survey data.

In spite of the valuable information contained in the balance statistic, our experience with this type of data has led us to find some limitations of the balance statistic as a forecasting measure. Some of these shortcomings concerning the degree of response, the relative importance of each category for every question, etc. depend to a large extent on the specific features of the survey under consideration. Some other problems, such as the volatility and the escalation of the series, are related to the nature of the data on the direction of change.

For this reason, we have considered other possibilities of "quantifying" the information from business and consumer surveys. A first possibility consists in summarising all the possible answers contained in the business and consumer surveys in an indicator that also takes account of the percentage of "stable" answers. This indicator can be constructed using a principal component analysis (PCA) of all the answers for each question, which shows the linear combination of the three/five/six percentages that captures the most variability between the successive surveys.

But, the strong correlation of the balance statistic with the percentage changes of its corresponding quantitative index of reference found by Anderson (1952) opened the door for the quantification of ordinal responses using more complex methods. Theil (1952) suggested a theoretical framework, later referred as the subjective probability approach, to convert qualitative responses of the direction of change into quantitative expectations, $\bar{x}_{t+1}^{e}$. The basic idea behind the method is that there is some indifference interval around zero within which respondents report "no change", whereas outside they report a change in the variable.

Let x_{t+1} be the percentage change of the variable from period t to period $t+1$ and $\bar{x}_{t+1}^{e}$ its expectation conditional on the respondent's information set. Hence, an expected increase is reported if $\bar{x}_{t+1}^{e} > a_t^{t+1}$ with a relative frequency A_t^{t+1} and an expected decrease $\bar{x}_{t+1}^{e} < b_t^{t+1}$ with a relative frequency B_t^{t+1}. Assuming the standard normal distribution one can derive:

$$\bar{x}^{e}_{t+1} = \hat{d} g_t^{t+1} \qquad \text{where } g_t^{t+1} = \frac{b_t^{t+1} + a_t^{t+1}}{b_t^{t+1} - a_t^{t+1}} \text{ and } \begin{cases} b_t^{t+1} = \Phi^{-1}\left(B_t^{t+1}\right) = \dfrac{-d - \bar{x}^{e}_{t+1}}{s^{e}_{t+1}} \\ a_t^{t+1} = \Phi^{-1}\left(1 - A_t^{t+1}\right) = \dfrac{d - \bar{x}^{e}_{t+1}}{s^{e}_{t+1}} \end{cases}$$

where Φ^{-1} stands for the inverse of the cumulative standard normal distribution. As pointed out by Zimmermann (1999), the logistic and the scaled-t have also been used in the literature, usually leading to very similar results. Since the limit of the interval of indifference d is unknown, Carlson and Parkin (1975) used the following method of escalation:

$$\hat{d} = \frac{\sum_{t=1}^{n} x_{t+1}}{\sum_{t=1}^{n} g_t^{t+1}}$$

This method was first applied by Carlson and Parkin (1975) and widely employed in the literature ever since. Recent contributions have relaxed the assumption of a symmetric indifference interval and the unbiasedness condition introduced by Carlson-Parkin escalating procedure:

$$\bar{x}^{e}_{t+1} = \hat{d}_b e_t^{t+1} + \hat{d}_a f_t^{t+1} \quad \text{where } e_t^{t+1} = \frac{b_t^{t+1}}{b_t^{t+1} - a_t^{t+1}} \text{ and } f_t^{t+1} = \frac{a_t^{t+1}}{b_t^{t+1} - a_t^{t+1}}$$

As parameters d_b and d_a are unknown they have to be estimated usually by the following OLS regression $x_t = d_b e_t^{t-1} + d_a f_t^{t-1} + u_t$. This alternative procedure implies that the aggregate distribution and the indifference intervals for both expectations and realizations are the same. As it happened with Carlson-Parkin method, this may cause problems when using the derived data for testing the rationality of expectations.

Recent econometric techniques have been incorporated in the methodology in order to overcome some of its shortcomings, basically the restrictive assumptions on which it is based. As a result, new methods have been suggested and applied with the aim of obtaining accurate series of expectations. Recent papers have focused in the possibility

of using State-Space models to estimate series of expectations and to forecast reference quantitative variables. For example, Seitz (1988) applied the time-varying parameter model of Cooley and Prescott (1976) and used the Kalman filter to derive a dynamic and asymmetric indifference interval.

Our proposal consists in using a State-Space model where the Kalman filter is used to estimate time varying and asymmetric indifference intervals that can be used to obtain series of expectations but also to forecast reference quantitative.

By relaxing the assumption that thresholds $d_{a,t+1}$ and $d_{b,t+1}$ are symmetric and are fixed across time, the asymmetric Carlson-Parkin conversion equation turns into:

$$\bar{x}^{e}_{t+1} = \hat{d}_{a,t+1} e_t^{t+1} - \hat{d}_{b,t+1} f_t^{t+1} \quad \text{where} \quad e_t^{t+1} = \frac{b_t^{t+1}}{b_t^{t+1} - a_t^{t+1}} \text{ and } f_t^{t+1} = \frac{a_t^{t+1}}{b_t^{t+1} - a_t^{t+1}}$$

Instead of using the Cooley and Prescott time-varying parameter model and regressing the outturn on retrospective survey responses in order to obtain estimates of $\bar{x}^{e}_{t+1}$ as done by Seitz (1988), we purpose a more general state-space representation for the threshold parameters that would include Seitz's method as a particular case:

$$\bar{x}_t = d_{a,t} e_{t-1}^{t} - d_{b,t} f_t^{t+1} + u_t \qquad u_t \sim N\left(0, s_u^2\right)$$

$$\begin{cases} d_{a,t} = a\, d_{a,t-1} + v_t \\ d_{b,t} = b\, d_{b,t-1} + w_t \end{cases}$$

where a and b are the autoregressive parameters and v_t and w_t are two independent and normally distributed disturbances with mean zero and variance s_v^2 and s_w^2, respectively. The relationship between x_t and the response thresholds is linear and it is expressed in the measurement equation. The unknown state is supposed to vary in time according to the linear transition equation. In order to estimate the variances and the autoregressive parameters and derive estimates of x^{e}_{t+1} the Kalman filter is used.

This generalization of the probability approach introduces a more flexible representation, allowing for asymmetric and dynamic response thresholds generated by a first-order Markov process. Additionally, estimates of $\bar{x}^{e}_{t+1}$ can be derived by means of just survey responses about expectations, without the need of perceptions about past changes of the variable.

We also purpose a particular case of this general model where threshold parameters follow a random walk instead of an autoregressive process. Therefore, a and b are supposed to be zero and the state-space representation of the model is:

$$\bar{x}_t = d_{a,t} e^{t}_{t-1} - d_{b,t} f^{t+1}_{t} + u_t \qquad u_t \sim N\left(0, s^{2}_{u}\right)$$

$$\begin{cases} d_{a,t} = d_{a,t-1} + v_t \\ d_{b,t} = d_{b,t-1} + w_t \end{cases}$$

When initialising the Kalman filter two options have been considered. First, we have supposed that the initial conditions of the filter are obtained by regressing $\bar{x}_t$ on e^{t+1}_{t} and f^{t+1}_{t} in the first fourth of the sample. We have also supposed that both initial conditions are equal to zero. As a result, we end up with four different state-space representations:

SS1: autoregressive process with initial conditions estimated by OLS regression.
SS2: random walk process with initial conditions estimated by OLS regression.
SS3: random walk process with null initial conditions.
SS4: autoregressive process with null initial conditions.

More details on the specification, the estimation procedure and how obtain one period forecasts can be found in Annex 11.

References:

Anderson, O. (1951): "Konjunkturtest und Statistik", *Allgemeines Statistical Archives*, 35, 209-20.

Anderson, O. (1952): "The business test of the IFO-Institute for economic research, Munich, and its theoretical model", *Revue de l'Institut International de Statistique*, 20, 1-17.

Anderson, O., Bauer, R. K. and Fels, E. (1954): *On the accuracy of short-term entrepreneurial expectations*, Paper read at the Montreal Meeting of the American Statistical Association.

Carlson, J. A. and Parkin, M. (1975): "Inflation expectations", *Economica*, 42, 123-38.

Cooley, T. F. and Prescott, E. C. (1976): "Estimation in the presence of stochastic parameter variation", *Econometrica*, 44, 167-84.

De Menil, G. and Bhalla, S. (1975): "Direct measurement of popular price expectations", *American Economic Review*, 65, 169-80.

Defris, L. V. and Williams, R. A. (1979): "Quantitative versus qualitative measures of price expectations", *Economics Letters*, 2, 169-73.

Papadia, F. (1983): "Inflationary Expectations in the European Economic Communities Countries", *Empirical Economics*, 8, 187-202.

Seitz, H. (1988): "The estimation of inflation forecasts from business survey data", *Applied Economics*, 20, 427-438.

Theil, H. (1952): "On the time shape of economic microvariables and the Munich business test", *Revue de l'Institut International de Statistique*, 20, 105-120.

Theil, H. (1955): "Recent experiences with the Munich business test: an expository article", *Econometrica*, 23, 184-192.

Zimmermann, K. F. (1999): "Analysis of Business Surveys", in Pesaran, M. H. and Schmidt, P. (eds.), *Handbook of Applied Econometrics*. Volume II: Microeconomics, Blackwell Publishers, Oxford.

A14.2. Comparison of quantification procedures.

a) Raw data

a.1) Monthly/quarterly growth rates

RMSE (1 month)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V7 (qv4)	13.60	10.50	1.56	1.42	1.65	-	10.47	10.41	-
V8 (qv5)	5.70	1.03	0.08	0.07	0.08	0.36	0.60	0.36	0.35
V18 (qv1)	25.73	1.15	0.21	0.21	0.21	0.27	0.28	0.27	0.28
V19 (qv20)	21.17	2.84	0.30	0.18	0.32	1.70	1.66	1.71	1.70
V29 (qv3)	14.93	9.48	1.34	1.03	1.24	15.42	9.66	9.49	15.38
V30 (qv3)	23.92	9.49	0.62	0.54	0.57	13.90	9.47	9.45	15.82
V31 (qv2)	11.56	1.83	0.42	0.03	0.32	1.75	1.72	1.72	1.75
V34 (qv7)	19.93	11.33	0.93	1.44	0.98	-	11.27	11.26	18.70
V35 (qv7)	20.19	11.32	0.80	1.06	1.00	-	11.28	11.28	19.01
V36 (qv7)	16.83	11.37	1.07	1.96	1.11	-	11.38	11.26	18.24
V37 (qv7)	13.49	11.34	0.80	3.78	0.89	-	11.39	11.26	19.11

RMSE (1 quarter)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V3 (qv15)	20.05	17.00	2.78	17.98	2.89	26.77	13.65	13.62	-
V5 (qv16)	18.81	6.94	1.91	1.57	2.33	-	6.04	6.07	10.97
V6 (qv19*)	11.11	3.58	102.87	38.11	92.52	3.40	2.98	2.84	-
V7 (qv15)	16.69	17.39	3.65	4.49	3.67	25.68	13.60	13.60	-
V11 (qv16)	11.14	6.49	2.22	2.19	2.22	9.27	5.43	5.95	9.70
V13 (qv11)	9.19	1.99	0.81	0.65	0.83	1.87	1.32	1.33	-
V14 (qv11)	3.00	2.16	0.87	0.66	0.89	2.31	1.33	1.33	2.56
V15 (qv13)	21.74	3.09	0.56	0.49	0.67	4.63	2.22	2.23	4.97
V16 (qv13)	10.94	3.06	0.54	0.50	0.63	4.46	2.23	2.22	-
V20 (qv17)	12.49	3.38	0.54	0.63	0.61	5.55	2.98	2.95	6.24
V22 (qv12)	41.43	7.90	0.66	0.22	0.38	8.12	6.09	5.91	7.95
V23 (qv12)	8.25	7.86	0.57	0.16	0.54	8.14	6.09	5.91	7.80
V25 (qv6)	57.39	14.43	0.76	0.72	1.39	16.91	15.65	15.37	15.20
V26 (qv18)	83.83	9.52	1.16	1.10	1.15	10.90	6.54	6.45	10.88
V29 (qv14)	23.42	11.14	3.12	0.65	3.62	11.23	6.90	7.19	15.96
V30 (qv14)	31.29	11.62	1.20	0.55	0.87	15.10	7.86	7.53	-
V30 (qv15)	34.23	17.26	5.02	1.39	4.51	28.53	14.50	13.61	26.75
V34 (qv10)	13.36	4.36	0.90	0.99	0.88	-	3.16	3.20	5.74

* Changes in inventories

a.2) Year-on-year growth rates

RMSE (1 month)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V7 (qv4)	7.44	2.01	2.70	3.46	2.70	-	1.50	1.51	1.51
V8 (qv5)	4.32	2.49	0.81	0.91	0.85	0.57	0.60	0.58	-
V18 (qv1)	23.77	2.35	2.48	2.49	2.49	0.27	0.27	0.27	0.27
V19 (qv20)	19.44	6.45	5.36	2.68	5.68	1.33	1.35	1.37	1.37
V29 (qv3)	12.96	6.93	1.76	2.98	2.04	5.94	5.66	5.58	5.76
V30 (qv3)	20.87	6.56	2.33	1.46	2.48	5.86	5.74	5.46	5.76
V31 (qv2)	12.35	1.84	1.47	0.16	1.37	1.17	1.16	1.15	1.17
V34 (qv7)	16.84	1.86	1.58	2.33	1.59	-	1.17	1.17	-
V35 (qv7)	16.70	1.87	1.64	1.75	1.61	-	1.13	1.16	-
V36 (qv7)	12.07	2.01	1.22	3.26	1.38	-	1.14	1.17	1.49
V37 (qv7)	7.00	1.97	1.22	6.18	1.39	-	1.13	1.15	-

RMSE (1 quarter)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V3 (qv15)	5.91	7.37	3.91	21.40	4.00	3.38	2.84	2.82	2.70
V5 (qv16)	37.16	24.28	6.32	5.67	7.75	2.54	2.66	2.76	2.62
V6 (qv19*)	13.07	4.66	312.52	96.85	276.26	3.54	2.79	2.85	3.31
V7 (qv15)	7.02	7.31	4.55	5.26	4.57	3.89	3.73	3.43	3.40
V11 (qv16)	4.86	7.73	6.29	8.46	6.45	2.94	2.38	2.70	2.92
V13 (qv11)	11.26	4.09	3.66	2.52	3.69	0.92	0.94	0.93	0.92
V14 (qv11)	3.46	4.31	3.66	2.65	3.73	0.90	0.90	0.90	0.89
V15 (qv13)	22.85	3.37	2.37	1.64	2.63	1.45	1.37	1.35	1.44
V16 (qv13)	11.62	3.40	2.10	1.72	2.46	1.25	1.21	1.24	1.13
V20 (qv17)	12.52	3.42	2.15	1.92	2.40	2.02	1.76	1.90	1.98
V22 (qv12)	45.00	10.07	3.05	0.93	3.05	5.17	6.20	5.23	4.80
V23 (qv12)	11.26	9.81	1.71	0.68	1.63	6.95	5.57	6.00	-
V25 (qv6)	55.78	6.61	1.19	0.25	1.96	-	4.81	4.88	4.91
V26 (qv18)	83.05	3.38	2.12	2.12	2.20	1.31	1.35	1.39	1.31
V29 (qv14)	15.63	3.83	1.21	0.29	1.23	2.79	3.17	3.03	2.82
V30 (qv14)	29.17	4.18	3.59	0.22	3.51	2.82	2.49	2.84	2.32
V30 (qv15)	32.51	7.03	6.94	1.66	6.28	2.99	3.24	2.97	3.07
V34 (qv10)	14.48	4.80	2.71	3.07	2.87	1.87	1.84	1.78	1.84

* Changes in inventories

b) After removing outliers

b.1) Monthly/quarterly growth rates

RMSE (1 month)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V7 (qv4)	14.22	10.55	1.77	1.47	1.82	-	10.39	10.36	-
V8 (qv5)	7.73	0.98	0.08	0.07	0.08	-	0.31	0.30	-
V18 (qv1)	17.93	0.85	0.19	0.19	0.20	-	0.22	0.22	-
V19 (qv20)	15.62	2.89	0.30	0.18	0.33	1.70	1.68	1.73	1.70
V29 (qv3)	14.79	8.87	1.24	0.91	1.14	-	9.01	8.89	13.88
V30 (qv3)	30.05	8.88	0.66	0.65	0.67	13.77	8.88	8.85	12.79
V31 (qv2)	11.61	1.34	0.40	0.05	0.33	0.83	0.77	0.78	0.83
V34 (qv7)	31.29	11.23	0.93	1.36	1.35	-	11.35	11.26	-
V35 (qv7)	42.96	11.27	0.81	0.83	0.64	-	11.20	11.28	-
V36 (qv7)	31.26	11.49	1.14	3.04	0.99	-	11.42	11.26	-
V37 (qv7)	19.49	11.38	0.84	1.43	0.96	-	11.38	11.26	-

RMSE (1 quarter)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V3 (qv15)	19.50	17.02	2.10	16.04	2.40	25.29	13.62	13.61	-
V5 (qv16)	18.12	6.90	1.90	1.61	2.34	10.90	6.01	6.07	11.13
V6 (qv19*)	11.11	3.58	106.72	38.06	95.07	2.92	2.94	2.84	3.37
V7 (qv15)	16.88	17.43	3.67	4.77	3.71	25.76	13.81	13.61	27.12
V11 (qv16)	11.07	6.46	2.29	2.16	2.29	9.41	5.51	5.95	10.88
V13 (qv11)	7.29	2.34	0.78	0.65	0.81	1.88	1.53	1.53	-
V14 (qv11)	3.39	2.43	0.85	5.59	0.87	2.71	1.54	1.53	2.85
V15 (qv13)	13.43	3.29	0.55	0.53	0.61	-	2.68	2.68	-
V16 (qv13)	27.73	3.25	0.50	0.65	0.58	4.96	2.68	2.67	5.24
V20 (qv17)	8.42	3.46	0.45	0.28	0.50	-	3.50	3.43	6.37
V22 (qv12)	43.40	6.77	0.51	0.27	0.32	4.15	4.69	4.60	4.26
V23 (qv12)	7.14	6.73	0.55	0.14	0.51	-	4.79	4.63	-
V25 (qv6)	55.95	14.45	1.06	1.09	1.09	16.79	15.75	15.15	15.53
V26 (qv18)	83.72	7.80	1.16	1.04	1.13	10.85	6.55	6.45	10.88
V29 (qv14)	21.98	9.54	2.85	0.54	3.35	9.30	8.20	8.57	18.67
V30 (qv14)	34.74	9.98	0.70	0.65	0.56	15.07	8.71	8.60	14.89
V30 (qv15)	38.46	17.21	4.74	1.85	3.91	27.86	14.21	13.61	26.58
V34 (qv10)	25.21	4.18	0.82	0.55	0.75	7.12	3.67	3.67	6.99

* Changes in inventories

b.2) Year-on-year growth rates

RMSE (1 month)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V7 (qv4)	7.81	2.01	2.73	3.60	2.73	1.48	1.51	1.49	1.49
V8 (qv5)	5.97	2.79	0.82	0.88	0.85	0.55	0.58	0.56	-
V18 (qv1)	15.89	1.80	2.21	2.29	2.31	0.20	0.19	0.19	0.20
V19 (qv20)	13.92	6.44	5.36	2.60	5.86	-	1.33	1.34	1.33
V29 (qv3)	13.10	6.64	1.75	2.88	2.03	5.68	5.53	5.21	5.50
V30 (qv3)	27.01	6.38	2.52	1.93	2.21	5.13	5.21	4.94	5.09
V31 (qv2)	12.04	1.94	1.41	0.26	1.36	0.33	0.32	0.32	-
V34 (qv7)	29.51	1.71	1.76	2.44	1.73	1.17	1.19	1.17	1.18
V35 (qv7)	41.24	1.89	1.95	1.57	1.92	1.13	1.16	1.14	-
V36 (qv7)	28.96	2.40	1.30	5.98	1.86	1.29	1.32	1.22	1.22
V37 (qv7)	15.74	2.05	1.49	2.57	1.75	1.29	1.22	1.12	1.13

RMSE (1 quarter)	BAL	1st PC	Anderson	C-P	AC-P	SS1	SS2	SS3	SS4
V3 (qv15)	5.57	7.30	4.03	18.93	4.23	3.64	3.25	2.94	2.86
V5 (qv16)	37.19	24.17	6.18	5.82	7.74	2.65	2.60	2.79	2.68
V6 (qv19*)	13.08	4.66	346.05	129.16	305.58	3.32	2.79	2.88	3.33
V7 (qv15)	7.13	7.46	4.68	5.56	4.72	3.83	3.70	3.43	3.46
V11 (qv16)	4.87	7.71	6.23	8.32	6.40	2.97	2.43	2.69	2.92
V13 (qv11)	9.25	4.44	3.41	2.50	3.53	0.38	0.42	0.47	0.43
V14 (qv11)	1.97	4.54	3.54	22.25	3.61	0.46	0.49	0.52	0.47
V15 (qv13)	14.19	3.48	2.25	1.78	2.42	0.45	0.37	0.39	0.38
V16 (qv13)	25.63	3.56	2.12	2.24	2.13	0.45	0.46	0.41	0.44
V20 (qv17)	7.93	3.33	2.63	0.90	2.73	0.56	0.56	0.56	0.56
V22 (qv12)	46.88	8.78	3.01	0.94	2.76	5.91	6.25	5.71	5.87
V23 (qv12)	10.11	8.41	1.59	0.50	1.52	6.42	6.16	6.04	-
V25 (qv6)	54.55	6.03	2.13	1.96	1.73	4.57	5.02	4.46	4.60
V26 (qv18)	82.94	2.41	2.13	2.10	2.22	1.29	1.30	1.29	1.29
V29 (qv14)	15.06	3.17	0.81	0.08	0.70	1.29	1.32	1.33	1.28
V30 (qv14)	33.35	3.33	2.23	0.10	1.56	0.84	0.85	0.92	0.89
V30 (qv15)	37.05	6.87	6.08	2.20	4.76	2.96	3.34	2.96	3.01
V34 (qv10)	26.99	3.49	2.35	1.64	2.33	0.67	0.69	0.68	0.67

* Changes in inventories

A14.3. Forecast competition with quantified indicators

A14.3.1. Quantitative variable in growth rates and Qualitative variables in levels using AR and VAR models

a) Monthly/quarterly growth rates

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.30	0.28	0.26	0.23	0.20
qv2	v31	1.47	1.30	1.11	0.97	0.78
qv3a	v29	8.65	9.50	9.65	10.28	9.60
qv3b	v30	8.80	9.69	9.95	10.50	9.38
qv4	v7	8.21	10.01	10.72	12.30	11.15
qv5	v8	0.29	0.29	0.27	0.27	0.26
qv7a	v34	9.81	9.96	10.15	10.57	12.54
qv7b	v35	9.82	10.00	9.89	10.72	12.70
qv7c	v36	9.52	10.22	10.26	10.57	12.39
qv7d	v37	9.05	9.88	10.15	10.86	12.96
qv20	v19	2.01	2.17	2.19	2.23	2.43

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	10.62	9.89	11.52
qv10	v34	2.17	1.45	1.45
qv11a	v13	0.91	1.08	1.34
qv11b	v14	0.95	1.07	1.32
qv12a	v22	27.40	50.61	78.29
qv12b	v23	6.39	5.24	3.09
qv13b	v15	1.24	1.14	1.33
qv13c	v16	1.26	1.19	1.37
qv14	v29	2.39	2.67	3.00
qv14	v30a	4.16	5.30	4.92
qv15	v7	3.91	4.13	2.86
qv15a	v30b	3.52	3.10	2.90
qv15b	v3	3.84	4.09	2.38
qv16a	v11	3.95	2.77	2.13
qv16b	v5	3.66	2.85	2.66
qv17	v20	1.80	1.71	1.84
qv18	v26	4.79	3.31	3.16
qv19*	v6	4.27	2.51	5.98

* Changes in inventories

VAR_3b (industry 1b)

		qv4	***qv5***
industry 1b	1 month	7.1613	0.2754
	2 months	9.3091	0.2879
	3 months	9.2115	0.2869
	6 months	7.8181	0.2943
	12 months	7.2467	0.2712

b) Year-on-year growth rates

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.28	0.39	0.42	0.40	0.56
qv2	v31	1.19	1.47	1.60	1.89	2.51
qv3a	v29	5.63	5.99	6.04	5.71	6.80
qv3b	v30	5.57	5.88	5.88	5.85	6.85
qv4	v7	1.42	1.77	2.12	2.60	3.28
qv5	v8	0.43	0.74	1.02	1.71	2.77
qv7a	v34	1.52	1.46	1.46	1.72	2.44
qv7b	v35	1.39	1.39	1.38	1.68	2.40
qv7c	v36	1.37	1.38	1.37	1.71	2.40
qv7d	v37	1.43	1.43	1.44	1.80	2.53
qv20	v19	1.31	2.15	2.83	4.01	8.59

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	11.42	17.05	29.83
qv10	v34	1.53	2.13	3.52
qv11a	v13	0.97	1.48	2.52
qv11b	v14	0.96	1.47	2.51
qv12a	v22	28.45	53.73	280.74
qv12b	v23	80.13	241.67	830.35
qv13b	v15	1.19	1.49	2.19
qv13c	v16	1.17	1.43	2.04
qv14	v29	8.62	3.89	18.70
qv14	v30a	3.10	3.18	3.18
qv15	v7	3.78	7.25	13.64
qv15a	v30b	3.73	7.23	13.80
qv15b	v3	3.91	6.98	14.29
qv16a	v11	4.37	7.11	6.63
qv16b	v5	3.85	6.74	6.93
qv17	v20	1.80	2.17	2.66
qv18	v26	68.92	322.83	4371.86
qv19*	v6	8.91	12.25	16.43

* Changes in inventories

VAR_3b (industry 1b)

		qv4	***qv5***
industry 1b	1 month	1.3794	0.4048
	2 months	1.532	0.6713
	3 months	1.7948	0.9207
	6 months	2.1988	1.5621
	12 months	2.9351	2.6068

A14.3.2. Quantitative variable in growth rates and Qualitative variables in levels after removing outliers using AR and VAR models

a) Monthly/quarterly growth rates

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.25	0.25	0.25	0.24	0.21
qv2	v31	0.56	0.75	0.81	0.88	0.68
qv3a	v29	8.50	9.27	9.42	10.20	9.65
qv3b	v30	8.59	9.36	9.65	10.40	9.24
qv4	v7	8.15	9.96	10.67	12.42	11.67
qv5	v8	0.27	0.29	0.28	0.28	0.27
qv7a	v34	10.45	9.80	9.99	10.41	12.01
qv7b	v35	9.15	10.01	10.18	10.62	12.59
qv7c	v36	9.53	9.96	10.12	10.46	12.36
qv7d	v37	9.47	10.06	10.21	10.66	12.61
qv20	v19	2.01	2.17	2.19	2.23	2.43

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	8.11	6.26	7.15
qv10	v34	0.51	0.42	0.48
qv11a	v13	0.90	1.10	0.91
qv11b	v14	0.98	1.10	0.91
qv12a	v22	11.65	9.08	15.30
qv12b	v23	6.58	6.83	6.92
qv13b	v15	0.64	0.66	0.77
qv13c	v16	0.68	0.61	0.68
qv14	v29	1.95	1.91	1.72
qv14	v30a	1.63	1.76	1.62
qv15	v7	3.71	3.94	2.86
qv15a	v30b	3.74	3.23	2.88
qv15b	v3	3.93	4.00	2.67
qv16a	v11	4.05	2.84	2.03
qv16b	v5	3.58	2.73	2.59
qv17	v20	0.67	0.75	0.60
qv18	v26	1.95	2.05	2.31
qv19*	v6	4.98	2.31	7.33

* Changes in inventories

VAR_3b (industria 1b)

		qv4	***qv5***
industria 1b	1 month	8.22	0.2734
	2 months	11.2739	0.2932
	3 months	11.1035	0.2974
	6 months	9.0941	0.326
	12 months	7.9567	0.2866

b) Year-on-year growth rates

AR	exog	1 month	2 months	3 months	6 months	12 months
qv1	v18	0.23	0.37	0.44	0.56	0.81
qv2	v31	0.31	0.56	0.76	1.15	2.10
qv3a	v29	4.90	5.34	5.20	5.38	6.37
qv3b	v30	4.91	5.35	5.21	5.50	6.45
qv4	v7	1.41	1.75	2.10	2.57	3.25
qv5	v8	0.44	0.76	1.10	1.97	3.06
qv7a	v34	1.46	1.45	1.43	1.77	2.46
qv7b	v35	1.32	1.33	1.29	1.66	2.34
qv7c	v36	1.45	1.50	1.48	1.89	2.55
qv7d	v37	1.48	1.51	1.48	1.90	2.64
qv20	v19	1.31	2.15	2.83	4.01	8.59

AR	exog	1 quarter	2 quarters	4 quarters
qv6	v25	10.62	16.01	21.23
qv10	v34	0.23	0.36	0.55
qv11a	v13	0.68	0.97	1.51
qv11b	v14	0.68	0.94	1.43
qv12a	v22	27.43	104.63	1492.97
qv12b	v23	27.43	104.63	1492.97
qv13b	v15	0.46	0.54	0.98
qv13c	v16	0.46	0.54	0.98
qv14	v29	3.17	5.54	13.10
qv14	v30a	2.71	5.33	14.06
qv15	v7	3.78	7.25	13.64
qv15a	v30b	3.73	7.23	13.80
qv15b	v3	3.84	7.12	13.98
qv16a	v11	4.37	7.08	6.62
qv16b	v5	3.85	6.74	6.93
qv17	v20	0.57	0.94	1.25
qv18	v26	2.07	3.37	5.44
qv19*	v6	44.71	29.02	32.61

* Changes in inventories

VAR_3b (industria 1b)

		qv4	***qv5***
industria 1b	1 month	1.3787	0.4047
	2 months	1.562	0.6909
	3 months	1.9027	1.001
	6 months	2.4413	1.8053
	12 months	3.4424	2.8442

ANNEX 15. State-Space models and the Kalman filter

Many conventional dynamic models can be easily written in a State-Space form. The State-Space form offers a more flexible way of treating the identification and estimation of dynamic models and this is the reason why State-Space models have been widely used by economists in the last years (see Harvey, 1982 and 1987).

A state space model consists of two equations: the measurement equation and the transition equation. The measurement equation relates a $nx1$ vector Y_t with a_t, a $mx1$ vector of unobservable variables through the following expression:

$$Y_t = Z_t \cdot a_t + d_t + e_t, \qquad \text{(A11.1)}$$

where Z_t is a nxm matrix, d_t is a $nx1$ vector of exogenous variables and e_t is a $nx1$ vector of serially uncorrelated disturbances with zero mean and known covariance matrix: H_t: $e_t \sim Niid(0_{nx1}, H_{nxn})$.

Although, in general, the elements of a_t are not observable, it is assumed that their behaviour can be estimated by a first-order Markov process:

$$a_t = T_t \cdot a_{t-1} + c_t + R_t \cdot q_t, \qquad \text{(A11.2)}$$

where T_t is a mxm matrix, c_t is an $mx1$ vector of exogenous variables which influence a_t, R_t is an mxg matrix and q_t is a $gx1$ vector of serially uncorrelated disturbances with zero mean and covariance matrix Q_t: $q_t \sim Niid(0_{mx1}, Q_{mxm})$.

Equation (A11.2) is known as a transition equation or system equation and together with equation (A11.1) they form the state space model.

Z_t, d_t, H_t, T_t, c_t, R_t and Q_t are known as hyperparameters and the specification of the State-Space model is completed by two further assumptions concerning the initial state vector values and the covariance matrix of the disturbances:

$$\begin{aligned} E(a_0) &= a_0; \\ \text{var}(a_0) &= P_0; \end{aligned} \qquad \text{(A11.3)}$$

$$E(e_t \cdot q_s') = 0 \quad s,t = 1,...,T; \qquad \text{(A11.4)}$$

$$\begin{aligned} E(e_t \cdot a_0) &= 0 \quad t = 1,...,T; \\ E(q_t \cdot a_0) &= 0 \quad t = 1,...,T. \end{aligned} \qquad \text{(A11.5)}$$

The Kalman filter is a recursive procedure for computing the optimal estimates of the state vector at time *t*, using the information available at time *t*-1, and updating these estimates as additional information becomes available. This filter, originally proposed by Kalman (1960) and Kalman and Bucy (1961), is proposed by two sets of equations which are applied sequentially:

Stage One: First we must obtain the optimal predictor of the next observation of the state vector (time *t*) using all the available information (until *t*-1). Let a_{t-1} denote the optimal estimator of a_{t-1} based on the observations up to and including Y_{t-1}, the *mxm* estimation error covariance matrix P_{t-1} associated to this estimator is given by:

$$P_{t-1} = E[(a_{t-1} - a_{t-1}) \cdot (a_{t-1} - a_{t-1})'] . \qquad \text{(A11.6)}$$

Once a_{t-1} and P_{t-1} are known, the optimal estimator of a_t restricted to these values is given by:

$$a_{t/t-1} = a_t / a_{t-1} = E(a_t / a_{t-1}) = E(T_t \cdot a_{t-1} + c_t + R_t \cdot q_t) = T_t \cdot a_{t-1} + c_t , \qquad \text{(A11.7)}$$

with a covariance matrix of the estimation errors equals to:

$$P_{t/t-1} = E[(a_t - a_t / a_{t-1}) \cdot (a_t - a_t / a_{t-1})'] = T_t \cdot P_{t-1} \cdot T_t' + R_t \cdot Q_t \cdot R_t' . \qquad \text{(A11.8)}$$

Stage Two: Next we must update the predictor of a_t, $a_{t/t-1}$ incorporating the additional information available at time *t*:

$$a_t = a_{t/t} = a_{t/t-1} + P_{t/t-1} \cdot Z_t' \cdot F_t^{-1} \cdot \left(Y_t - Z_t \cdot a_{t/t-1} - d_t\right); \quad \text{(A11.9)}$$

$$P_t = P_{t/t-1} - P_{t/t-1} \cdot Z_t' \cdot F_t^{-1} \cdot Z_t \cdot P_{t/t-1}; \quad \text{(A11.10)}$$

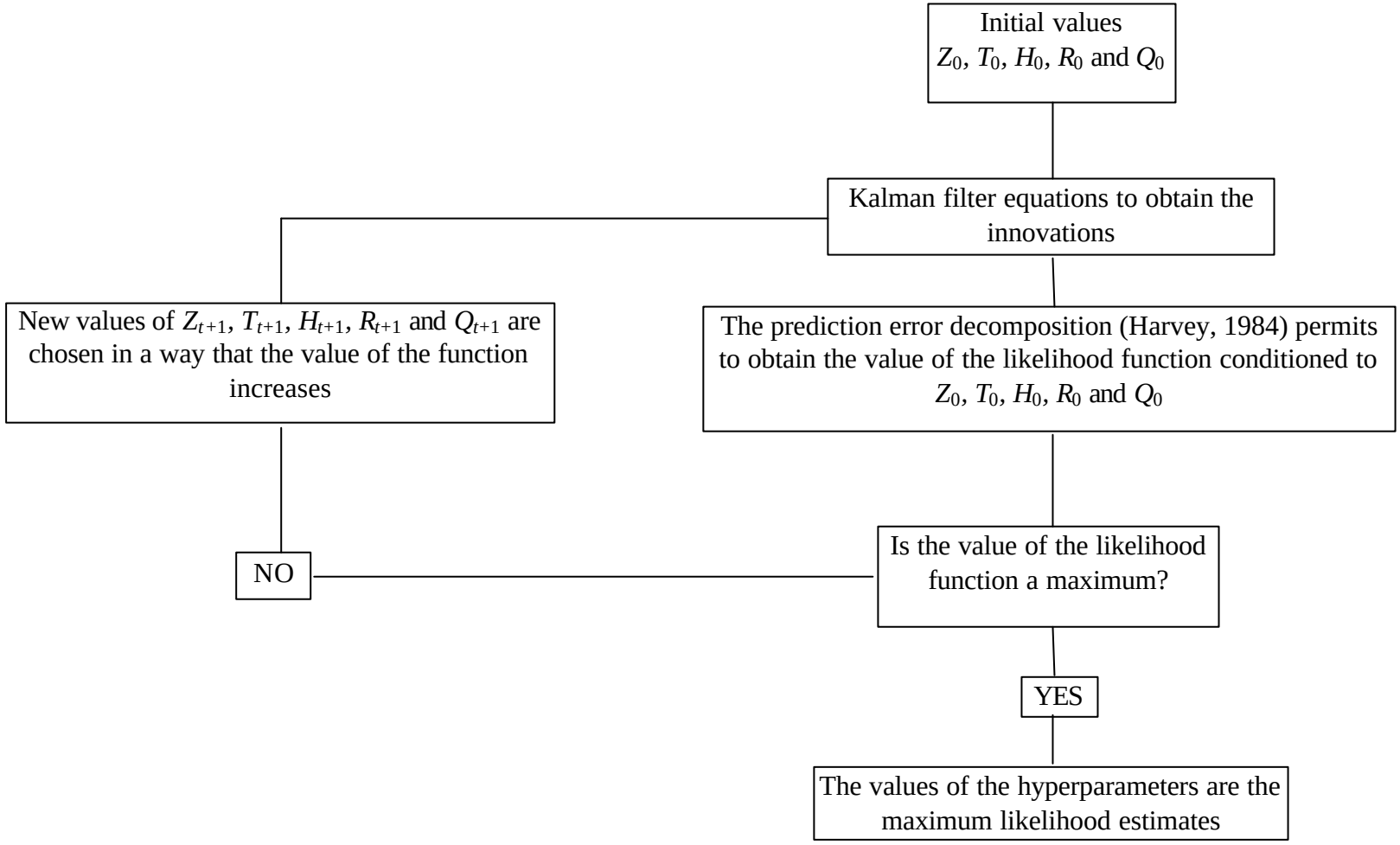
$$F_t = Z_t \cdot P_{t/t-1} \cdot Z_t' + H_t. \quad \text{(A11.11)}$$

The Kalman filter equations can only be applied if the initial values of the state vector a_0, its associated estimation error covariance matrix P_0 and the values of the hyperparameters are known. If these values are not known, they must be estimated before applying the Kalman filter. In this sense, the classical theory of maximum likelihood estimation can be adapted to obtain estimates of the hyperparameters. The procedure is summarised in the figure in the next page.

To solve the problem of the initialisation of the Kalman filter, two procedures exist depending whether the state vector is stationary or not. A State-Space model is stationary if the given values of the matrix T_t in equation (A11.2) are within the unit circle and there are enough observations of the considered system to affirm that the model has reached stationarity. In this situation, the initial values of the state vector can be estimated from the unconditional mean of the considered process. Following Harvey (1984), these values can be obtained using the first available m observations to estimate the equation (A11.1) using OLS and, next, initialising the Kalman filter at time $m+1$. The main disadvantage of this method is that when the number of available observations is small, the degrees of freedom of the system is very limited. Another alternative consists of considering the initial values as unknown hyperparameters and estimating them by maximum likelihood (Rosenberg, 1973).

However, when the model is not stationary, the initial conditions are not well defined and the previous solutions can not be applied. The most usual solution in this case consists of treating the initial conditions as diffuse, introducing complementary equations to the usual Kalman filter. In the literature, different ways of introducing these equations have been proposed (for example, Harvey and Phillips, 1979; Anderson and Moore, 1979; Kitagawa and Gersch, 1984; Ansley and Kohn, 1989, de Jong, 1991), but none are completely satisfactory.

Maximum likelihood estimation procedure of the unknown hyperparameters



Adapted from Cuthberson *et al.* (1992, p. 214)

References:

Anderson, B. and J. Moore (1979): *Optimal Filtering*, Prentice-Hall, Englewoods Cliffs.

Ansley, C. and R. Kohn (1989): "Filtering and smoothing in state-space models with partially diffuse initial conditions", *Journal of Time Series Analysis*, 11, 275-93.

Cuthberson, K., S. Hall and M. Taylor (1992): *Applied Econometric Techniques*, Phillip Allan, New York.

de Jong, P. (1991): The diffuse Kalman filter, *The Annals of Statistics*, 19, 1073-83.

Hackl, P. and A. Westlund (1996): "Demand for international telecomunication: Time-varying price elasticity", *Journal of Econometrics*, 70, 243-60.

Harvey, A. (1982): "The Kalman filter and its applications in Econometrics and time series analysis", *Methods of Operational Research*, 44, 3-18.

Harvey, A. (1987): "Applications of the Kalman filter in Econometrics", in T. Bewley (ed.) *Advances in Econometrics*: Fifth World Congress, Econometric Society Monograph 13, Cambridge University Press, Cambridge.

Harvey, A. and G. Phillips (1979): "Maximum likelihood estimation of regression models with autoregressive-moving average disturbances", *Biometrika*, 66, 69-58.

Kalman, R. (1960): "A new approach to linear filtering and prediction problems", *Transactions ASME, Journal of Basic Engineering*, 82, 35-45.

Kalman, R. and R. Bucy (1961): "New results in linear filtering and prediction theory", *Transactions ASME, Journal of Basic Engineering*, 83, 95-108.

Kitagawa, G. and W. Gersch (1984): "A smoothness prior-state space modeling of time series with trend and seasonality", *Journal of the American Statistical Association*, 82, 1032-63.

Rosenberg, B. (1973): "Random coefficient models: The analysis of a cross section of Time Series by stochastically convergent parameter regression", *Annals of Economic and Social Measurement*, 2, 399-427.

ANNEX 16. Brief summary of implemented models for qualitative and quantitative variables

a) Non adjusted data

	Non adjusted variables										
	Direct methods							Indirect methods			
	Univariate				Multivariate						
					Categories		Indicators				
					Unrestricted	Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR
Monthly											
v1	*	*	*	*				*	*	*	*
v2	*	*	*	*			*	*	*	*	*
v3p	*	*	*	*	*	*					
v3e	*	*	*	*	*	*					
v3m	*	*	*	*	*	*					
v3b	*	*	*	*	*	*		*	*	*	*
v4p	*	*	*	*	*	*					
v4e	*	*	*	*	*	*					
v4m	*	*	*	*	*	*					
v4b	*	*	*	*	*	*		*	*	*	*
v5p	*	*	*	*	*	*					
v5e	*	*	*	*	*	*					
v5m	*	*	*	*	*	*					
v5b	*	*	*	*	*	*		*	*	*	*
v6p	*	*	*	*	*	*					
v6e	*	*	*	*	*	*					
v6m	*	*	*	*	*	*					
v6b	*	*	*	*	*	*		*	*	*	*
v7p	*	*	*	*	*	*					
v7e	*	*	*	*	*	*					
v7m	*	*	*	*	*	*					
v7b	*	*	*	*	*	*	*	*	*	*	*
v8p	*	*	*	*	*	*					
v8e	*	*	*	*	*	*					
v8m	*	*	*	*	*	*					
v8b	*	*	*	*	*	*	*	*	*	*	*
v9p	*	*	*	*	*	*					
v9e	*	*	*	*	*	*					
v9m	*	*	*	*	*	*					
v9b	*	*	*	*	*	*		*	*	*	*
v12	*	*	*	*			*	*	*	*	*
v13pp	*	*	*	*							
v13p	*	*	*	*	*	*					
v13e	*	*	*	*	*	*					
v13m	*	*	*	*	*	*					
v13mm	*	*	*	*							
v13n	*	*	*	*							
v13b	*	*	*	*	*	*		*	*	*	*

	Non adjusted variables											
	Direct methods							Indirect methods				
	Univariate				Multivariate							
					Categories		Indicators					
					Unrestricted	Restricted						
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR
v14pp	*	*	*	*							
v14p	*	*	*	*	*	*					
v14e	*	*	*	*	*	*					
v14m	*	*	*	*	*	*					
v14mm	*	*	*	*							
v14n	*	*	*	*							
v14b	*	*	*	*	*	*	*	*	*	*	*
v15pp	*	*	*	*							
v15p	*	*	*	*	*	*					
v15e	*	*	*	*	*	*					
v15m	*	*	*	*	*	*					
v15mm	*	*	*	*							
v15n	*	*	*	*							
v15b	*	*	*	*	*	*		*	*	*	*
v16pp	*	*	*	*							
v16p	*	*	*	*	*	*					
v16e	*	*	*	*	*	*					
v16m	*	*	*	*	*	*					
v16mm	*	*	*	*							
v16n	*	*	*	*							
v16b	*	*	*	*	*	*	*	*	*	*	*
v17pp	*	*	*	*							
v17p	*	*	*	*	*	*					
v17e	*	*	*	*	*	*					
v17m	*	*	*	*	*	*					
v17mm	*	*	*	*							
v17n	*	*	*	*							
v17b	*	*	*	*	*	*		*	*	*	*
v18pp	*	*	*	*							
v18p	*	*	*	*	*	*					
v18e	*	*	*	*	*	*					
v18m	*	*	*	*	*	*					
v18mm	*	*	*	*							
v18n	*	*	*	*							
v18b	*	*	*	*	*	*	*	*	*	*	*
v19pp	*	*	*	*							
v19p	*	*	*	*	*	*					
v19e	*	*	*	*	*	*					

	Non adjusted variables											
	Direct methods							Indirect methods			
	Univariate				Multivariate						
					Categories		Indicators				
					Unrestricted	Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR
v19m	*	*	*	*	*	*					
v19mm	*	*	*	*							
v19n	*	*	*	*							
v19b	*	*	*	*	*	*	*	*	*	*	*
v20pp	*	*	*	*	*	*					
v20e	*	*	*	*	*	*					
v20mm	*	*	*	*	*	*					
v20n	*	*	*	*							
v20b	*	*	*	*	*	*		*	*	*	*
v21pp	*	*	*	*							
v21p	*	*	*	*	*	*					
v21e	*	*	*	*	*	*					
v21m	*	*	*	*	*	*					
v21mm	*	*	*	*							
v21n	*	*	*	*							
v21b	*	*	*	*	*	*	*	*	*	*	*
v22pp	*	*	*	*							
v22p	*	*	*	*	*	*					
v22m	*	*	*	*	*	*					
v22mm	*	*	*	*							
v22n	*	*	*	*	*	*					
v22b	*	*	*	*	*	*		*	*	*	*
v23pp	*	*	*	*							
v23p	*	*	*	*	*	*					
v23m	*	*	*	*	*	*					
v23mm	*	*	*	*							
v23n	*	*	*	*	*	*					
v23b	*	*	*	*	*	*	*	*	*	*	*
v24pp	*	*	*	*							
v24p	*	*	*	*	*	*					
v24e	*	*	*	*	*	*					
v24m	*	*	*	*	*	*					
v24mm	*	*	*	*							
v24n	*	*	*	*							
v24b	*	*	*	*	*	*	*	*	*	*	*
v28	*	*	*	*			*	*	*	*	*
v29p	*	*	*	*	*	*					
v29e	*	*	*	*	*	*					

	Non adjusted variables											
	Direct methods								Indirect methods			
	Univariate				Multivariate							
					Categories			Indicators				
					Unrestricted		Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR		VAR	VAR	AR	ARIMA	TAR	VAR
v29m	*	*	*	*	*		*					
v29b	*	*	*	*	*		*	*	*	*	*	*
v30p	*	*	*	*	*		*					
v30e	*	*	*	*	*		*					
v30m	*	*	*	*	*		*					
v30b	*	*	*	*	*		*		*	*	*	*
v31p	*	*	*	*	*		*					
v31e	*	*	*	*	*		*					
v31m	*	*	*	*	*		*					
v31b	*	*	*	*	*		*	*	*	*	*	*
v32p	*	*	*	*	*		*					
v32e	*	*	*	*	*		*					
v32m	*	*	*	*	*		*					
v32b	*	*	*	*	*		*	*	*	*	*	*
v33	*	*	*	*				*	*	*	*	*
v34p	*	*	*	*	*		*					
v34e	*	*	*	*	*		*					
v34m	*	*	*	*	*		*					
v34b	*	*	*	*	*		*		*	*	*	*
v35p	*	*	*	*	*		*					
v35e	*	*	*	*	*		*					
v35m	*	*	*	*	*		*					
v35b	*	*	*	*	*		*		*	*	*	*
v36p	*	*	*	*	*		*					
v36e	*	*	*	*	*		*					
v36m	*	*	*	*	*		*					
v36b	*	*	*	*	*		*		*	*	*	*
v37p	*	*	*	*	*		*					
v37e	*	*	*	*	*		*					
v37m	*	*	*	*	*		*					
v37b	*	*	*	*	*		*	*	*	*	*	*
v38p	*	*	*	*	*		*					
v38e	*	*	*	*	*		*					
v38m	*	*	*	*	*		*					
v38b	*	*	*	*	*		*	*	*	*	*	*
v39	*	*	*	*				*	*	*	*	*
v40p	*	*	*	*	*		*					
v40e	*	*	*	*	*		*					

	Non adjusted variables										
	Direct methods							Indirect methods			
	Univariate				Multivariate						
					Categories		Indicators				
					Unrestricted	Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR
v40m	*	*	*	*	*	*					
v40b	*	*	*	*	*	*		*	*	*	*
v41p	*	*	*	*	*	*					
v41e	*	*	*	*	*	*					
v41m	*	*	*	*	*	*					
v41b	*	*	*	*	*	*		*	*	*	*
v42p	*	*	*	*	*	*					
v42e	*	*	*	*	*	*					
v42m	*	*	*	*	*	*					
v42b	*	*	*	*	*	*	*	*	*	*	*
v43p	*	*	*	*	*	*					
v43e	*	*	*	*	*	*					
v43m	*	*	*	*	*	*					
v43b	*	*	*	*	*	*		*	*	*	*
v44p	*	*	*	*	*	*					
v44e	*	*	*	*	*	*					
v44m	*	*	*	*	*	*					
v44b	*	*	*	*	*	*	*	*	*	*	*
Quarterly											
v10p	*	*	*	*	*	*					
v10e	*	*	*	*	*	*					
v10m	*	*	*	*	*	*					
v10b	*	*	*	*	*	*		*	*	*	*
v11p	*	*	*	*	*	*					
v11e	*	*	*	*	*	*					
v11m	*	*	*	*	*	*					
v11b	*	*	*	*	*	*		*	*	*	*
v25pp	*	*	*	*							
v25p	*	*	*	*	*	*					
v25m	*	*	*	*	*	*					
v25mm	*	*	*	*							
v25n	*	*	*	*	*	*					
v25b	*	*	*	*	*	*		*	*	*	*
v26pp	*	*	*	*							
v26p	*	*	*	*	*	*					
v26m	*	*	*	*	*	*					
v26mm	*	*	*	*							
v26n	*	*	*	*	*	*					
v26b	*	*	*	*	*	*		*	*	*	*
v27pp	*	*	*	*							
v27p	*	*	*	*	*	*					
v27m	*	*	*	*	*	*					
v27mm	*	*	*	*							
v27n	*	*	*	*	*	*					
v27b	*	*	*	*	*	*		*	*	*	*

b) Adjusted data

	Adjusted variables										
	Direct methods							Indirect methods			
	Univariate				Multivariate						
					Categories		Indicators				
					Unrestricted	Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR
Monthly											
v1	*	*	*	*				*	*	*	*
v2	*	*	*	*			*	*	*	*	*
v3p	*	*	*	*	*	*					
v3e	*	*	*	*	*	*					
v3m	*	*	*	*	*	*					
v3b	*	*	*	*	*	*		*	*	*	*
v4p	*	*	*	*	*	*					
v4e	*	*	*	*	*	*					
v4m	*	*	*	*	*	*					
v4b	*	*	*	*	*	*		*	*	*	*
v5p	*	*	*	*	*	*					
v5e	*	*	*	*	*	*					
v5m	*	*	*	*	*	*					
v5b	*	*	*	*	*	*		*	*	*	*
v6p	*	*	*	*	*	*					
v6e	*	*	*	*	*	*					
v6m	*	*	*	*	*	*					
v6b	*	*	*	*	*	*		*	*	*	*
v7p	*	*	*	*	*	*					
v7e	*	*	*	*	*	*					
v7m	*	*	*	*	*	*					
v7b	*	*	*	*	*	*	*	*	*	*	*
v8p	*	*	*	*	*	*					
v8e	*	*	*	*	*	*					
v8m	*	*	*	*	*	*					
v8b	*	*	*	*	*	*	*	*	*	*	*
v9p											
v9e											
v9m											
v9b											
v12							*				
v13pp											
v13p											
v13e											
v13m											
v13mm											
v13n											
v13b											

	Adjusted variables											
	Direct methods								Indirect methods			
	Univariate				Multivariate							
					Categories			Indicators				
					Unrestricted		Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR		VAR	VAR	AR	ARIMA	TAR	VAR
v14pp												
v14p												
v14e												
v14m												
v14mm												
v14n												
v14b								*				
v15pp												
v15p												
v15e												
v15m												
v15mm												
v15n												
v15b												
v16pp												
v16p												
v16e												
v16m												
v16mm												
v16n												
v16b								*				
v17pp												
v17p												
v17e												
v17m												
v17mm												
v17n												
v17b												
v18pp												
v18p												
v18e												
v18m												
v18mm												
v18n												
v18b								*				
v19pp												
v19p												
v19e												

	Adjusted variables											
	Direct methods								Indirect methods			
	Univariate				Multivariate							
					Categories			Indicators				
					Unrestricted		Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR		VAR	VAR	AR	ARIMA	TAR	VAR
v19m												
v19mm												
v19n												
v19b								*				
v20pp												
v20e												
v20mm												
v20n												
v20b												
v21pp												
v21p												
v21e												
v21m												
v21mm												
v21n												
v21b								*				
v22pp												
v22p												
v22m												
v22mm												
v22n												
v22b												
v23pp												
v23p												
v23m												
v23mm												
v23n												
v23b								*				
v24pp												
v24p												
v24e												
v24m												
v24mm												
v24n												
v24b								*				
v28								*				
v29p												
v29e												

	Adjusted variables											
	Direct methods								Indirect methods			
	Univariate				Multivariate							
					Categories			Indicators				
					Unrestricted		Restricted					
Variable	AR	ARIMA	TAR	Markov	VAR		VAR	VAR	AR	ARIMA	TAR	VAR
v29m												
v29b								*				
v30p												
v30e												
v30m												
v30b												
v31p												
v31e												
v31m												
v31b								*				
v32p												
v32e												
v32m												
v32b								*				
v33								*				
v34p												
v34e												
v34m												
v34b												
v35p												
v35e												
v35m												
v35b												
v36p												
v36e												
v36m												
v36b												
v37p												
v37e												
v37m												
v37b								*				
v38p												
v38e												
v38m												
v38b								*				
v39								*				
v40p												
v40e												

	Adjusted variables											
	Direct methods							Indirect methods				
	Univariate				Multivariate							
					Categories		Indicators					
					Unrestricted	Restricted						
Variable	AR	ARIMA	TAR	Markov	VAR	VAR	VAR	AR	ARIMA	TAR	VAR	
v40m												
v40b												
v41p												
v41e												
v41m												
v41b												
v42p												
v42e												
v42m												
v42b							*					
v43p												
v43e												
v43m												
v43b												
v44p												
v44e												
v44m												
v44b							*					
Quarterly												
v10p	*	*	*	*	*	*						
v10e	*	*	*	*	*	*						
v10m	*	*	*	*	*	*						
v10b	*	*	*	*	*	*						
v11p	*	*	*	*	*	*						
v11e	*	*	*	*	*	*						
v11m	*	*	*	*	*	*						
v11b	*	*	*	*	*	*						
v25pp												
v25p												
v25m												
v25mm												
v25n												
v25b												
v26pp												
v26p												
v26m												
v26mm												
v26n												
v26b												
v27pp												
v27p												
v27m												
v27mm												
v27n												
v27b												

ANNEX 17. Table of correspondance between survey indicators and quantitative macroeconomic variables

Survey		Macroeconomic variables
Economic Sentiment Indicator	**v1**	gv13
Industrial Confidence Indicator	**v2**	
Production trend observed in recent months	v3	gv4 gv8 gv13 gv19
Assessment of order-book levels	v4	gv4 gv8 gv13 gv19
Assessment of export order-book levels	v5	gv4 gv8 gv13 gv16
Assessment of stocks of finished products	v6	gv4 gv8 gv13 gv19
Production expectations for the months ahead	v7	gv4 gv8 gv13 gv19
Selling price expectations for the months ahead	v8	gv1 gv5
Employment expectations for the months ahead	v9	gv4 gv8 gv13 gv20
New orders in recent months	v10	gv4 gv8 gv15
Export expectations for the months ahead	v11	gv4 gv8 gv13 gv16
Consumer Confidence Indicator	**v12**	gv13 gv17
Financial situation over last 12 months	v13	gv6 gv13 gv17
Financial situation over next 12 months	v14	gv6 gv13 gv17
General economic situation over last 12 months	v15	gv6 gv13 gv17
General economic situation over next 12 months	v16	gv6 gv13 gv17
Price trends over last 12 months	v17	gv1
Price trends over next 12 months	v18	gv1
Unemployment expectations over next 12 months	v19	gv13 gv17 gv20
Major purchases at present	v20	gv13 gv17
Major purchases over next 12 months	v21	gv13 gv17
Savings at present	v22	gv12
Savings over next 12 months	v23	gv12
Statement on financial situation of household	v24	gv12
Intention to buy a car within the next 2 years	v25	gv6
Purchase or build a home within the next 2 years	v26	gv18
Home improvements over the next 12 months	v27	gv18
Construction Confidence Indicator	**v28**	gv3 gv9 gv13 gv14 gv18
Trend of activitiy compared with preceding months	v29	gv3 gv9 gv13 gv14 gv18
Assessment of order books	v30	gv3 gv9 gv13 gv14 gv18
Employment expectations for the months ahead	v31	gv2 gv20
Price expectations for the months ahead	v32	gv1
Retail Trade Confidence Indicator	**v33**	gv10 gv13
Present business situation	v34	gv10 gv13
Assessment of stocks	v35	gv10 gv19
Orders placed with suppliers	v36	gv10 gv19
Expected business situation	v37	gv10 gv13
Employment	v38	gv20
Services Confidence Indicator	**v39**	gv10 gv11 gv13
Assessment of business climate	v40	gv10 gv11 gv13
Evolution of demand in recent months	v41	gv10 gv11 gv13
Evolution of demand expected in the months ahead	v42	gv10 gv11 gv13
Evolution of employment in recent months	v43	gv20
Evolution of employment expected in the months ahead	v44	gv20

Harmonized consumer price index	gv1
Construction - number of persons employed index	gv2
Building permits index - New residential buildings	gv3
Industry Production index	gv4
Industry Producer price index	gv5
Number of new car registrations	gv6
Retail Deflated turnover index	gv7
Industry Gross value added	gv8
Construction Gross value added	gv9
Wholesale and retail trade & other Gross value added	gv10
Financial intermediation Gross value added	gv11
Savings rate	gv12
Gross domestic product	gv13
Gross fixed capital formation: construction work - other constructions	gv14
Gross fixed capital formation: metal products and machinery	gv15
Exports of goods	gv16
Final consumption expenditure: household and NPISH	gv17
Gross fixed capital formation: construction work - housing	gv18
Changes in inventories	gv19
Unemployment	gv20

ANNEX 18. Estimation results and diagnostics for the best model for the main indicators

Endogenous variable: V1

V1 =f(V4B, V6B, V7B, V14B, V16B, V19B, V23B, V30B, V31B, V34B, V35B, V37B)

V4B
model: ARIMA(1,1,1)

	Coefficient	t-student
AR1	0.87894348	14.5894
MA1	0.61592926	
Mean	0.12969731	0.29597

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	18
Log likelihood	-398.680008
Akaike AIC	803.360015
Error variance	3.859455935
SBC	813.116835
Standard error	1.964549805
Adjusted SSE	727.094261
SSE	725.5777157

V6B
model: ARIMA(5,1,12)

	Coefficient	t-student
AR1	0.85783189	0.79909
AR2	-0.46804469	-0.39192
AR3	0.57971243	0.73421
AR4	0.1036196	0.13109
AR5	-0.10303305	-0.14069
MA1	0.88295042	
MA2	-0.52686271	
MA3	0.35931645	
MA4	0.14553422	
MA5	-0.24246944	
MA6	0.24606746	
MA7	0.06227977	
MA8	-0.05346975	
MA9	-0.00162877	
MA10	0.16417639	
MA11	-0.12951762	
MA12	0.09362357	
Mean	-0.01734233	-0.14728

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	5
Log likelihood	307.48605
Akaike AIC	650.972101
Error variance	1.599798915
SBC	709.513022
Standard error	1.264831576
Adjusted SSE	279.8197314
SSE	276.7652123

V7B
model: ARIMA(1,1,8)

	Coefficient	t-student
AR1	0.91402212	6.84573
MA1	0.70575026	
MA2	0.21189115	
MA3	0.07391869	
MA4	-0.05332356	
MA5	-0.00615017	
MA6	0.09009484	
MA7	-0.08145956	
MA8	0.05927822	
Mean	0.01940056	0.22603

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	5
Log likelihood	-529.18578
Akaike AIC	1078.371561
Error variance	15.56620961
SBC	1110.894295
Standard error	3.945403605
Adjusted SSE	2851.523583
SSE	2817.483988

Endogenous variable: V1

V1 =f(V4B, V6B, V7B, V14B, V16B, V19B, V23B, V30B, V31B, V34B, V35B, V37B)

V14B
model: ARIMA(11,1,12)

	Coefficient	t-student
AR1	-0.75282899	-0.26419
AR2	-0.09247768	-0.04185
AR3	0.41667102	0.45343
AR4	0.07518443	0.04998
AR5	-0.20909722	-0.30609
AR6	-0.36641891	-0.35207
AR7	-0.4878007	-0.54319
AR8	-0.67156993	-0.55938
AR9	-0.08763484	-0.05736
AR10	0.28142577	0.38402
AR11	0.0338268	0.0253
MA1	-0.76111129	
MA2	-0.03370804	
MA3	0.38893729	
MA4	-0.03491948	
MA5	-0.36799132	
MA6	-0.29024823	
MA7	-0.36100568	
MA8	-0.58376055	
MA9	-0.33370254	
MA10	-0.02728318	
MA11	-0.06043442	
MA12	-0.05882679	
Mean	0.04854212	0.61481

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	6
Log likelihood	-244.383366
Akaike AIC	536.766733
Error variance	0.826699855
SBC	614.821295
Standard error	0.909230364
Adjusted SSE	144.5151709
SSE	138.0588758

V16B
model: ARIMA(11,1,7)

	Coefficient	t-student
AR1	0.12855395	0.25013
AR2	-0.11343243	-0.42751
AR3	-0.30339033	-0.89881
AR4	0.18941061	0.52758
AR5	-0.25882443	-0.75045
AR6	0.00186438	0.00472
AR7	-0.41101621	-1.34846
AR8	0.04818108	0.39398
AR9	-0.1036952	-0.93794
AR10	0.06424336	0.55963
AR11	0.13864004	1.13471
MA1	0.04056756	
MA2	-0.05522554	
MA3	-0.33921864	
MA4	0.00777633	
MA5	-0.27502287	
MA6	0.09756672	
MA7	-0.37590143	
Mean	0.04430846	0.1925

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	33
Log likelihood	-453.910161
Akaike AIC	945.820321
Error variance	7.466419645
SBC	1007.613516
Standard error	2.732475003
Adjusted SSE	1296.446498
SSE	1284.224179

V19B
model: ARIMA(6,1,5)

	Coefficient	t-student
AR1	0.76497918	0.4177
AR2	0.38636983	0.32104
AR3	-0.39484761	-0.49796
AR4	0.29267978	0.36412
AR5	-0.15282562	-0.16094
AR6	0.07028503	0.2047
MA1	0.65681701	
MA2	0.35272058	
MA3	-0.38611936	
MA4	0.3500208	
MA5	0.02656086	
Mean	-0.12267882	-0.59348

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	6
Log likelihood	-478.594972
Akaike AIC	981.189944
Error variance	9.30682245
SBC	1020.217225
Standard error	3.050708516
Adjusted SSE	1678.846174
SSE	1665.921219

Endogenous variable: V1

V1 =f(V4B, V6B, V7B, V14B, V16B, V19B, V23B, V30B, V31B, V34B, V35B, V37B)

V14B
model: ARIMA(11,1,12)

	Coefficient	t-student
AR1	-0.75282899	-0.26419
AR2	-0.09247768	-0.04185
AR3	0.41667102	0.45343
AR4	0.07518443	0.04998
AR5	-0.20909722	-0.30609
AR6	-0.36641891	-0.35207
AR7	-0.4878007	-0.54319
AR8	-0.67156993	-0.55938
AR9	-0.08763484	-0.05736
AR10	0.28142577	0.38402
AR11	0.0338268	0.0253
MA1	-0.76111129	
MA2	-0.03370804	
MA3	0.38893729	
MA4	-0.03491948	
MA5	-0.36799132	
MA6	-0.29024823	
MA7	-0.36100568	
MA8	-0.58376055	
MA9	-0.33370254	
MA10	-0.02728318	
MA11	-0.06043442	
MA12	-0.05882679	
Mean	0.04854212	0.61481
Sample	1985:1-2000:12	
Included observations	191	
Iterations until convergence	6	
Log likelihood	-244.383366	
Akaike AIC	536.766733	
Error variance	0.826699855	
SBC	614.821295	
Standard error	0.909230364	
Adjusted SSE	144.5151709	
SSE	138.0588758	

V16B
model: ARIMA(11,1,7)

	Coefficient	t-student
AR1	0.12855395	0.25013
AR2	-0.11343243	-0.42751
AR3	-0.30339033	-0.89881
AR4	0.18941061	0.52758
AR5	-0.25882443	-0.75045
AR6	0.00186438	0.00472
AR7	-0.41101621	-1.34846
AR8	0.04818108	0.39398
AR9	-0.1036952	-0.93794
AR10	0.06424336	0.55963
AR11	0.13864004	1.13471
MA1	0.04056756	
MA2	-0.05522554	
MA3	-0.33921864	
MA4	0.00777633	
MA5	-0.27502287	
MA6	0.09756672	
MA7	-0.37590143	
Mean	0.04430846	0.1925
Sample	1985:1-2000:12	
Included observations	191	
Iterations until convergence	33	
Log likelihood	-453.910161	
Akaike AIC	945.820321	
Error variance	7.466419645	
SBC	1007.613516	
Standard error	2.732475003	
Adjusted SSE	1296.446498	
SSE	1284.224179	

V19B
model: ARIMA(6,1,5)

	Coefficient	t-student
AR1	0.76497918	0.4177
AR2	0.38636983	0.32104
AR3	-0.39484761	-0.49796
AR4	0.29267978	0.36412
AR5	-0.15282562	-0.16094
AR6	0.07028503	0.2047
MA1	0.65681701	
MA2	0.35272058	
MA3	-0.38611936	
MA4	0.3500208	
MA5	0.02656086	
Mean	-0.12267882	-0.59348
Sample	1985:1-2000:12	
Included observations	191	
Iterations until convergence	6	
Log likelihood	-478.594972	
Akaike AIC	981.189944	
Error variance	9.30682245	
SBC	1020.217225	
Standard error	3.050708516	
Adjusted SSE	1678.846174	
SSE	1665.921219	

Endogenous variable: V1

V1 =f(V4B, V6B, V7B, V14B, V16B, V19B, V23B, V30B, V31B, V34B, V35B, V37B)

V23B
model: ARIMA(10,1,11)

	Coefficient	t-student
AR1	1.18607376	3.45357
AR2	-1.05545502	-2.01826
AR3	0.81401737	1.53419
AR4	-0.50221629	-0.97731
AR5	0.13936398	0.2729
AR6	-0.16927014	-0.33316
AR7	0.34734844	0.6883
AR8	-0.43417913	-0.84196
AR9	-0.04908338	-0.10148
AR10	0.12256921	0.40664
MA1	1.56927163	
MA2	-1.40015274	
MA3	1.10408243	
MA4	-0.74226639	
MA5	0.18154301	
MA6	-0.04314296	
MA7	0.05903858	
MA8	-0.07981653	
MA9	-0.34469067	
MA10	0.53576181	
MA11	-0.31161056	
Mean	0.08050919	1.05176

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	5
Log likelihood	-327.127698
Akaike AIC	698.255396
Error variance	1.97684145
SBC	769.805412
Standard error	1.406001938
Adjusted SSE	343.7165323
SSE	334.0862051

V30B
model: ARIMA(2,1,1)

	Coefficient	t-student
AR1	1.03929803	6.58934
AR2	-0.04546018	-0.61818
MA1	0.99999977	
Mean	0.24193757	0.85141

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	6
Log likelihood	-516.968879
Akaike AIC	1041.937757
Error variance	13.38366028
SBC	1054.946851
Standard error	3.658368527
Adjusted SSE	2509.109153
SSE	2502.744472

V31B
model: ARIMA(4,1,4)

	Coefficient	t-student
AR1	0.48879493	0.66087
AR2	0.64241507	2.25786
AR3	0.42363979	1.29225
AR4	-0.57087608	-0.93213
MA1	0.38929282	
MA2	0.82340103	
MA3	0.50641855	
MA4	-0.71911242	
Mean	0.12164596	0.20958

Sample	1985:1-2000:12
Included observations	191
Iterations until convergence	6
Log likelihood	-597.406446
Akaike AIC	1212.812893
Error variance	31.72163623
SBC	1242.083354
Standard error	5.632196395
Adjusted SSE	5825.273587
SSE	5773.337794

Endogenous variable: V2 =(V4B-V6B+V7B)/3

VAR

	V4B		*V6B*		*V7B*	
Explanatory variables	Coefficient	t-student	Coefficient	t-student	Coefficient	t-student
C	0.127606	0.13232	-1.072648	-1.74408	2.64672	1.917
V4B(-1)	0.910626	10.2787	-0.223255	-3.95143	0.394183	3.10783
V4B(-2)	0.031547	0.27779	0.135596	1.87224	-0.21122	-1.29914
V4B(-3)	0.276731	2.40908	-0.124154	-1.69478	0.05903	0.35895
V4B(-4)	-0.223933	-1.92121	0.08708	1.17147	-0.144542	-0.86619
V4B(-5)	-9.32E-05	-0.00082	-0.047988	-0.66017	0.007393	0.0453
V4B(-6)	-0.043996	-0.39194	0.030968	0.4326	-0.076732	-0.47748
V4B(-7)	-0.058912	-0.50673	0.065075	0.87769	0.086772	0.52133
V4B(-8)	0.075254	0.64065	0.061365	0.81917	-0.148068	-0.88048
V4B(-9)	0.006807	0.05763	-0.027437	-0.36428	0.354245	2.0951
V4B(-10)	0.001136	0.00961	-0.048887	-0.64829	0.186233	1.10013
V4B(-11)	-0.143423	-1.23757	0.054089	0.73184	-0.486262	-2.93077
V4B(-12)	0.234718	2.00089	-0.094343	-1.26108	-0.239076	-1.42356
V4B(-13)	-0.065651	-0.7452	0.004701	0.08368	0.340055	2.69616
V6B(-1)	-0.053312	-0.3908	0.490667	5.63989	-0.131257	-0.67206
V6B(-2)	0.017868	0.1183	0.102652	1.06575	-0.264094	-1.22138
V6B(-3)	-0.255138	-1.68019	0.260617	2.69117	0.133738	0.61518
V6B(-4)	0.248255	1.60878	-0.031981	-0.32497	0.295478	1.33748
V6B(-5)	-0.068807	-0.44063	0.07428	0.74588	0.014712	0.0658
V6B(-6)	-0.032713	-0.21633	-0.219701	-2.27824	-0.193204	-0.89246
V6B(-7)	0.065275	0.43659	-0.053168	-0.55762	-0.038524	-0.17998
V6B(-8)	0.136489	0.92923	0.149591	1.59693	-0.087753	-0.4173
V6B(-9)	-0.28007	-1.85961	0.178888	1.86249	0.107574	0.49891
V6B(-10)	0.239725	1.56634	-0.185531	-1.90084	0.526221	2.40161
V6B(-11)	0.099792	0.63301	0.123605	1.22945	0.019817	0.0878
V6B(-12)	-0.21901	-1.41016	0.002857	0.02885	-0.346393	-1.55789
V6B(-13)	0.108607	0.81801	-0.083408	-0.98506	0.034614	0.1821
V7B(-1)	0.197793	3.47225	-0.095291	-2.62307	0.901952	11.0598
V7B(-2)	-0.044252	-0.60302	0.050916	1.08794	-0.113647	-1.08172
V7B(-3)	0.002656	0.03738	0.042905	0.94674	-0.169782	-1.66884
V7B(-4)	-0.060047	-0.85205	0.037303	0.82998	0.033998	0.33697
V7B(-5)	0.019704	0.28293	-0.039478	-0.88884	0.19158	1.92143
V7B(-6)	-0.084319	-1.21457	0.067097	1.51551	-0.247777	-2.49299
V7B(-7)	0.120843	1.70425	-0.070138	-1.55105	0.114851	1.13139
V7B(-8)	-0.200421	-2.83874	0.050235	1.1157	-0.03514	-0.34766
V7B(-9)	0.034395	0.47965	0.010175	0.22249	-0.199047	-1.93886
V7B(-10)	0.046759	0.64085	0.01221	0.2624	0.072184	0.69102
V7B(-11)	0.065125	0.8911	-0.009197	-0.19731	0.285151	2.72528
V7B(-12)	-0.110006	-1.54458	0.027867	0.61353	0.273902	2.68628
V7B(-13)	-0.017252	-0.29305	0.090502	2.41062	-0.353026	-4.18872
Sample(adjusted):			1986:02-2000:12			
Included observations:			179			
R-squared	0.991323		0.974398		0.952915	
Adj. R-squared	0.988889		0.967215		0.939704	
Sum sq. resids	329.1853		133.8834		674.7083	
S.E. equation	1.538909		0.981422		2.203183	
F-statistic	407.1963		135.6504		72.13136	
Log likelihood	-308.5165		-227.9977		-372.7471	
Akaike AIC	3.894039		2.994388		4.611699	
Schwarz SC	4.606304		3.706653		5.323964	
Mean dependent	-15.84128		9.815922		5.755978	
S.D. dependent	14.59921		5.420265		8.972384	
Determinant Residual Covariance			4.449742			
Log Likelihood			-895.5797			
Akaike Information Criteria			11.34726			
Schwarz Criteria			13.48405			

Endogenous variable: V12

Autoregression

Explanatory variables	Coefficient	t-student
C	-0.598132	-2.2165
V12(-1)	1.061313	14.2074
V12(-2)	-0.062988	-0.57888
V12(-3)	0.086247	0.79284
V12(-4)	-0.009886	-0.08907
V12(-5)	-0.139293	-1.24219
V12(-6)	-0.070815	-0.63152
V12(-7)	0.063489	0.56561
V12(-8)	0.077434	0.68835
V12(-9)	-0.048418	-0.4306
V12(-10)	0.054433	0.48497
V12(-11)	0.041504	0.3704
V12(-12)	0.094824	0.83317
V12(-13)	-0.201598	-2.59156
Sample(adjusted):	1986:02-2000:12	
Included observations:	179	
R-squared	0.954335	
Adj. R-squared	0.950737	
Sum sq. resids	446.5682	
S.E. equation	1.645136	
F-statistic	265.2522	
Log likelihood	-335.8115	
Akaike AIC	3.908508	
Schwarz SC	4.157801	
Mean dependent	-10.84411	
S.D. dependent	7.412123	

Endogenous variable: V28 =(V30B+V31B)/2

Autoregression V30B

Explanatory variables	Coefficient	t-student
C	-1.04933	-1.30518
V30B(-1)	0.751082	9.09683
V30B(-2)	0.175442	1.6918
V30B(-3)	-0.047592	-0.45377
V30B(-4)	0.124182	1.17404
V30B(-5)	-0.089182	-0.83119
V30B(-6)	0.082794	0.77181
V30B(-7)	0.116382	1.09573
V30B(-8)	-0.161639	-1.52462
V30B(-9)	0.071878	0.67416
V30B(-10)	0.116962	1.10419
V30B(-11)	0.021753	0.20467
V30B(-12)	0.073892	0.69625
V30B(-13)	-0.023257	-0.21874
V30B(-14)	-0.194448	-1.82791
V30B(-15)	0.083213	0.77134
V30B(-16)	-0.096691	-0.90056
V30B(-17)	-0.240242	-2.23706
V30B(-18)	0.117622	1.08046
V30B(-19)	-0.051149	-0.46768
V30B(-20)	-0.0251	-0.23096
V30B(-21)	0.100261	0.92403
V30B(-22)	-0.044929	-0.41486
V30B(-23)	0.101233	1.2009
Sample(adjusted):	1986:12-2000:12	
Included observations:	169	
R-squared	0.953484	
Adj. R-squared	0.946105	
Sum sq. resids	1589.483	
S.E. equation	3.310884	
F-statistic	129.226	
Log likelihood	-429.1875	
Akaike AIC	5.363166	
Schwarz SC	5.807649	
Mean dependent	-29.21893	
S.D. dependent	14.26171	

Autoregression V31B

Explanatory variables	Coefficient	t-student
C	-0.774154	-1.87428
V31B(-1)	0.78452	10.4518
V31B(-2)	0.209857	2.20635
V31B(-3)	-0.112906	-1.19823
V31B(-4)	0.041794	0.44602
V31B(-5)	0.004102	0.0441
V31B(-6)	0.000221	0.00238
V31B(-7)	-0.007469	-0.08017
V31B(-8)	-0.052403	-0.56269
V31B(-9)	-0.047562	-0.51064
V31B(-10)	0.176563	1.90257
V31B(-11)	0.142887	1.53416
V31B(-12)	0.289424	3.09925
V31B(-13)	-0.23336	-2.42713
V31B(-14)	-0.25498	-3.39249
Sample(adjusted):	1986:03-2002:12	
Included observations:	178	
R-squared	0.942576	
Adj. R-squared	0.937644	
Sum sq. resids	2168.596	
S.E. equation	3.647502	
F-statistic	191.1095	
Log likelihood	-475.0757	
Akaike AIC	5.506468	
Schwarz SC	5.774596	
Mean dependent	-11.75174	
S.D. dependent	14.60683	

Endogenous variable: V33 =(V34B-V35B+V37B)/3

Autoregression V34B

Explanatory variables	Coefficient	t-student
C	-0.471083	-1.01274
V34B(-1)	0.527455	6.7625
V34B(-2)	0.059829	0.67716
V34B(-3)	0.294059	3.36604
V34B(-4)	0.135898	1.5344
V34B(-5)	-0.032299	-0.3625
V34B(-6)	-0.024463	-0.27518
V34B(-7)	0.014392	0.16037
V34B(-8)	0.013263	0.1475
V34B(-9)	-0.006245	-0.06982
V34B(-10)	0.023207	0.25591
V34B(-11)	0.066364	0.7315
V34B(-12)	-0.247764	-2.76047
V34B(-13)	0.180432	2.03139
V34B(-14)	0.04675	0.51879
V34B(-15)	-0.110989	-1.41264

Sample(adjusted):	1986:04-2000:12
Included observations:	177
R-squared	0.847037
Adj. R-squared	0.832785
Sum sq. resids	4373.229
S.E. equation	5.211805
F-statistic	59.43601
Log likelihood	-534.9811
Akaike AIC	6.225775
Schwarz SC	6.512885
Mean dependent	-6.356554
S.D. dependent	12.74533

Autoregression V35B

Explanatory variables	Coefficient	t-student
C	3.947856	2.35996
V35B(-1)	0.469015	6.07391
V35B(-2)	0.008936	0.10425
V35B(-3)	0.146779	1.73326
V35B(-4)	-0.041663	-0.49104
V35B(-5)	0.057614	0.68043
V35B(-6)	0.050612	0.60316
V35B(-7)	-0.020304	-0.24229
V35B(-8)	0.036143	0.42951
V35B(-9)	-0.194078	-2.30658
V35B(-10)	0.052681	0.61584
V35B(-11)	0.133554	1.56023
V35B(-12)	0.21053	2.47957
V35B(-13)	0.004491	0.05213
V35B(-14)	-0.163083	-2.11535

Sample(adjusted):	1986:03-2000:12
Included observations:	178
R-squared	0.425186
Adj. R-squared	0.375816
Sum sq. resids	1103.609
S.E. equation	2.602039
F-statistic	8.612153
Log likelihood	-414.9567
Akaike AIC	4.830974
Schwarz SC	5.099102
Mean dependent	15.89494
S.D. dependent	3.293498

Autoregression V37B

Explanatory variables	Coefficient	t-student
C	0.38496	0.98585
V37B(-1)	0.519991	6.77181
V37B(-2)	-0.01727	-0.19916
V37B(-3)	0.301316	3.49275
V37B(-4)	0.006625	0.07514
V37B(-5)	0.095506	1.08572
V37B(-6)	0.171989	1.94558
V37B(-7)	-0.10359	-1.1946
V37B(-8)	0.126182	1.46312
V37B(-9)	-0.249955	-3.30874

Sample(adjusted):	1986:10-2000:12
Included observations:	171
R-squared	0.668918
Adj. R-squared	0.65041
Sum sq. resids	3514.827
S.E. equation	4.67239
F-statistic	36.14272
Log likelihood	-501.112
Akaike AIC	5.977918
Schwarz SC	6.161641
Mean dependent	2.811111
S.D. dependent	7.902415

Endogenous variable: V39 =(V40B+V41B+V42B)/3

VAR

	V40B		*V41B*		*V42B*	
Explanatory variables	Coefficient	t-student	Coefficient	t-student	Coefficient	t-student
C	-21.98582	-2.35816	-19.92689	-1.75227	12.69202	1.83843
V40B(-1)	0.774972	4.04352	-0.310071	-1.32637	0.140001	0.98649
V40B(-2)	-0.175242	-0.71847	0.135022	0.45384	-0.042114	-0.23318
V40B(-3)	-0.315257	-1.27124	0.082989	0.27436	-0.148239	-0.80726
V40B(-4)	0.373826	1.51973	-0.290091	-0.96685	0.24348	1.33674
V40B(-5)	-0.174825	-0.71202	0.237364	0.79256	0.025795	0.14187
V40B(-6)	0.262938	1.07133	-0.38596	-1.28926	0.334138	1.83857
V40B(-7)	-0.548093	-2.21275	-0.097816	-0.32376	-0.167409	-0.91273
V40B(-8)	-0.014527	-0.06179	0.046337	0.16159	-0.12179	-0.69959
V40B(-9)	-0.016247	-0.06505	-0.254398	-0.83509	0.182234	0.98539
V40B(-10)	-0.285822	-1.36558	0.163383	0.63997	-0.075223	-0.48536
V41B(-1)	0.073819	0.48044	0.843696	4.50175	0.128205	1.12683
V41B(-2)	-0.204871	-0.99649	-0.144957	-0.57804	-0.078114	-0.5131
V41B(-3)	0.308386	1.47919	-0.237161	-0.93262	0.177247	1.14814
V41B(-4)	-0.319962	-1.52293	0.181892	0.70978	-0.063692	-0.4094
V41B(-5)	0.111854	0.51385	0.056787	0.21388	-0.033496	-0.20781
V41B(-6)	-0.008252	-0.03766	-0.417009	-1.56042	-0.23468	-1.44653
V41B(-7)	-0.012747	-0.05418	0.338186	1.17847	0.227845	1.30786
V41B(-8)	0.113585	0.53502	-0.179861	-0.69457	-0.00392	-0.02493
V41B(-9)	-0.02587	-0.11534	0.140559	0.51378	0.111889	0.67369
V41B(-10)	0.037463	0.21024	-0.202486	-0.93161	-0.112194	-0.85028
V42B(-1)	0.540762	2.30712	0.630999	2.2071	0.658353	3.79322
V42B(-2)	0.035535	0.15702	-0.168338	-0.60982	0.026023	0.15529
V42B(-3)	0.38427	1.70124	1.004445	3.64575	-0.292534	-1.74901
V42B(-4)	-0.036278	-0.13595	-0.343756	-1.05611	0.038037	0.19249
V42B(-5)	0.281665	1.28702	-0.010541	-0.03949	0.053208	0.32833
V42B(-6)	-0.03323	-0.14856	-0.078721	-0.28853	-0.373882	-2.25732
V42B(-7)	0.229535	0.92309	0.439435	1.44884	0.106952	0.58086
V42B(-8)	0.059039	0.2247	-0.289253	-0.90253	0.007907	0.04064
V42B(-9)	-0.138574	-0.52752	0.495907	1.54772	-0.038162	-0.19619
V42B(-10)	0.337941	1.49607	0.082107	0.298	-0.028528	-0.17055
Sample(adjusted):			1996:02-2000:12			
Included observations:			59			
R-squared	0.925307		0.861725		0.92677	
Adj. R-squared	0.845278		0.713573		0.84831	
Sum sq. resids	388.4668		577.955		213.0012	
S.E. equation	3.724757		4.543264		2.758113	
F-statistic	11.56222		5.816507		11.81195	
Log likelihood	-139.3151		-151.0351		-121.5883	
Akaike AIC	5.773395		6.170683		5.172485	
Schwarz SC	6.864982		7.26227		6.264072	
Mean dependent	25.99915		23.06288		29.2261	
S.D. dependent	9.469397		8.489095		7.081633	
Determinant Residual Covariance			188.5299			
Log Likelihood			-405.7102			
Akaike Information Criteria			16.90543			
Schwarz Criteria			20.18019			

Endogenous variable: QV1 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	0.066748	1.14282
QV1(-1)	0.912918	7.11767
QV1(-2)	406.0958	0.55168
QV1(-3)	-882.9849	-1.21981
QV1(-4)	-1063.05	-1.46293
QV1(-5)	653.8479	0.88001
QV1(-6)	189.9822	0.2651
QV1(-7)	594.419	0.85039
QV1(-8)	796.9544	1.16366
Q_V18(-1)	-405.9816	-0.55156
Q_V18(-2)	883.0679	1.21997
Q_V18(-3)	1062.976	1.46281
Q_V18(-4)	-654.0587	-0.88027
Q_V18(-5)	-189.8409	-0.2649
Q_V18(-6)	-594.2603	-0.85012
Q_V18(-7)	-797.0095	-1.16371
Q_V18(-8)	-0.105146	-0.72468
Sample(adjusted):	1994:09-2000:12	
Included observations	76	
R-squared	0.946609	
Adj. R-squared	0.93213	
Sum sq. resids	1.366157	
S.E. equation	0.152168	
F-statistic	65.37791	
Log likelihood	44.87248	
Akaike AIC	-0.733486	
Schwarz SC	-0.212138	
Mean dependent	1.794488	
S.D. dependent	0.584096	

Endogenous variable: QV2 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	0.71234	2.61408
QV2(-1)	1.57	10.6225
QV2(-2)	-0.996956	-3.4498
QV2(-3)	0.378496	1.11326
QV2(-4)	0.266993	0.81192
QV2(-5)	-0.614802	-2.29122
QV2(-6)	0.666024	2.91391
QV2(-7)	-0.865846	-3.857
QV2(-8)	0.557329	2.34496
QV2(-9)	-0.0806	-0.32718
QV2(-10)	-0.220277	-0.92771
QV2(-11)	0.470947	2.20015
QV2(-12)	-0.842964	-4.97185
QV2(-13)	0.738415	4.10394
QV2(-14)	-0.224626	-1.04399
QV2(-15)	-0.237585	-1.07075
QV2(-16)	0.577902	2.79616
QV2(-17)	-0.707515	-3.54097
QV2(-18)	0.637596	3.00054
QV2(-19)	-0.38147	-1.66105
QV2(-20)	-0.110359	-0.47645
QV2(-21)	0.376449	1.80372
QV2(-22)	-0.328151	-1.7583
QV2(-23)	0.163752	1.01066
QV2(-24)	-0.012071	-0.14029
V31B(-1)	0.034959	2.27767
V31B(-2)	-0.028439	-1.51161
V31B(-3)	-0.002143	-0.11686
V31B(-4)	0.03444	1.89296
V31B(-5)	-0.047295	-2.57027
V31B(-6)	0.006494	0.34743
V31B(-7)	0.022502	1.1716
V31B(-8)	-0.012519	-0.7047
V31B(-9)	0.030715	1.81102
V31B(-10)	0.01928	1.08775
V31B(-11)	-0.020968	-1.19176
V31B(-12)	0.005591	0.33288
V31B(-13)	-0.051371	-2.9941
V31B(-14)	0.047787	2.59551
V31B(-15)	-0.001808	-0.09167
V31B(-16)	-0.020314	-1.07792
V31B(-17)	0.045126	2.41845
V31B(-18)	-0.021198	-1.12738
V31B(-19)	0.017913	0.94392
V31B(-20)	-0.017028	-0.89098
V31B(-21)	-0.032478	-1.65355
V31B(-22)	0.010777	0.53639
V31B(-23)	0.005748	0.28311
V31B(-24)	0.008831	0.53844
Sample(adjusted):	1994:01 2000:12	
Included observations:	84	
R-squared	0.988586	
Adj. R-squared	0.972932	
Sum sq. resids	4.298561	
S.E. equation	0.350451	
F-statistic	63.15228	
Log likelihood	5.655701	
Akaike AIC	1.032007	
Schwarz SC	2.449984	
Mean dependent	0.389355	
S.D. dependent	2.130083	

Endogenous variable: QV3 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	0.185113	0.29928
QV3(-1)	0.605435	6.00357
QV3(-2)	-0.138227	-0.38729
QV3(-3)	0.162738	0.44988
QV3(-4)	-0.255283	-0.71404
QV3(-5)	0.237209	0.66605
QV3(-6)	-0.292447	-0.82597
QV3(-7)	0.117835	0.33158
QV3(-8)	0.879439	2.51444
QV3(-9)	0.351595	1.00696
QV3(-10)	-0.086624	-0.24695
QV3(-11)	-0.612128	-1.73463
QV3(-12)	-0.071747	-0.19689
QV3(-13)	1.235308	3.38343
Q_V30(-1)	0.316741	0.3467
Q_V30(-2)	0.010834	0.01108
Q_V30(-3)	0.349669	0.36196
Q_V30(-4)	-0.700321	-0.72646
Q_V30(-5)	1.340796	1.38952
Q_V30(-6)	-1.318485	-1.37077
Q_V30(-7)	-1.820259	-1.92308
Q_V30(-8)	0.573083	0.59796
Q_V30(-9)	0.619462	0.64954
Q_V30(-10)	1.498104	1.54383
Q_V30(-11)	-1.710983	-1.72072
Q_V30(-12)	-1.905487	-1.91033
Q_V30(-13)	1.435706	2.55174
Sample(adjusted):	1991:05-2000:12	
Included observations:	116	
R-squared	0.658818	
Adj. R-squared	0.559147	
Sum sq. resids	2683.682	
S.E. equation	5.491241	
F-statistic	6.60993	
Log likelihood	-346.7954	
Akaike AIC	6.444749	
Schwarz SC	7.085671	
Mean dependent	2.324901	
S.D. dependent	8.270348	

Endogenous variable: QV4 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	0.238397	1.88941
QV4(-1)	0.167281	1.88796
QV4(-2)	0.144294	1.61169
QV4(-3)	0.210893	2.3466
QV4(-4)	0.049603	0.53794
QV4(-5)	0.109454	1.22895
QV4(-6)	0.081686	0.96533
QV4(-7)	-0.005967	-0.07037
QV4(-8)	0.022282	0.26295
QV4(-9)	-0.10799	-1.32008
QV4(-10)	0.076658	0.92955
QV4(-11)	0.005919	0.0727
QV4(-12)	-0.214167	-2.58144
QV4(-13)	0.198961	2.30298
QV4(-14)	-0.075775	-0.85911
QV4(-15)	0.154189	1.76341
QV4(-16)	0.018617	0.22002
QV4(-17)	0.10822	1.38725
V7B(-1)	0.129243	3.36208
V7B(-2)	0.070173	1.35347
V7B(-3)	-0.039965	-0.76294
V7B(-4)	-0.005451	-0.10509
V7B(-5)	-0.015807	-0.31579
V7B(-6)	0.054799	1.17407
V7B(-7)	-0.028153	-0.60972
V7B(-8)	-0.026313	-0.57597
V7B(-9)	-0.045536	-1.01714
V7B(-10)	0.027431	0.60818
V7B(-11)	0.019416	0.43124
V7B(-12)	-0.056963	-1.26199
V7B(-13)	-0.098725	-2.01702
V7B(-14)	-0.012051	-0.23263
V7B(-15)	-0.03768	-0.7225
V7B(-16)	0.125709	2.40261
V7B(-17)	-0.088968	-2.06492
Sample(adjusted):	1987:06-2000:12	
Included observations:	163	
R-squared	0.924155	
Adj. R-squared	0.904009	
Sum sq. resids	130.3885	
S.E. equation	1.009287	
F-statistic	45.87231	
Log likelihood	-213.0936	
Akaike AIC	3.044093	
Schwarz SC	3.708395	
Mean dependent	2.341615	
S.D. dependent	3.257612	

Endogenous variable: QV5 year-on-year growth rates

Augmented VAR

	QV4		*QV5*	
Explanatory variables	Coefficient	t-student	Coefficient	t-student
C	0.456298	1.87803	0.063912	1.19019
QV4(-1)	0.475732	3.62836	0.056566	1.95199
QV4(-2)	-0.906664	-1.82439	0.07001	0.6374
QV4(-3)	0.838888	1.73307	0.108649	1.01558
QV4(-4)	-0.195863	-0.38861	0.087996	0.78994
QV4(-5)	-0.37455	-0.73146	-0.080811	-0.71404
QV4(-6)	-0.062355	-0.12373	0.094187	0.84558
QV4(-7)	-0.501926	-0.93721	-0.071721	-0.60592
QV4(-8)	0.876353	1.58854	-0.016816	-0.13792
QV4(-9)	-0.325287	-0.57254	-0.099752	-0.79439
QV4(-10)	-0.427724	-0.82109	-0.077827	-0.67597
QV4(-11)	0.296788	0.57607	0.042046	0.36926
QV5(-1)	-0.50503	-0.90973	1.29565	10.5599
QV5(-2)	-1113.376	-0.24401	-1001.512	-0.99312
QV5(-3)	-196.3664	-0.04355	1366.179	1.37097
QV5(-4)	3683.198	0.83091	-30.82417	-0.03146
QV5(-5)	1495.732	0.33522	-1100.893	-1.11632
QV5(-6)	-4219.748	-0.90876	-769.8961	-0.75018
QV5(-7)	3200.902	0.68382	1142.525	1.10436
QV5(-8)	-3540.089	-0.77096	-175.6587	-0.17309
QV5(-9)	-4698.749	-1.00641	-1051.309	-1.01882
QV5(-10)	4944.178	1.02921	101.9826	0.09605
QV5(-11)	3249.353	0.6803	-579.9826	-0.5494
Q_V7(-1)	2.031486	2.5736	-0.096852	-0.55515
Q_V7(-2)	-1.741079	-1.99228	-0.154441	-0.7996
Q_V7(-3)	0.925634	0.99272	-0.140443	-0.68149
Q_V7(-4)	0.355025	0.37164	0.128722	0.60966
Q_V7(-5)	-0.312042	-0.33546	-0.16788	-0.81658
Q_V7(-6)	0.642246	0.6569	0.176574	0.81714
Q_V7(-7)	-1.717956	-1.65147	-0.058577	-0.25478
Q_V7(-8)	0.976568	0.89684	0.225089	0.93527
Q_V7(-9)	0.608991	0.59057	0.079667	0.34955
Q_V7(-10)	-0.846302	-0.8505	-0.043915	-0.19968
Q_V7(-11)	0.270334	0.78862	-0.060836	-0.80297
Q_V8(-1)	1114.219	0.24419	1001.28	0.99285
Q_V8(-2)	195.9103	0.04345	-1365.979	-1.37073
Q_V8(-3)	-3682.815	-0.8308	30.71541	0.03135
Q_V8(-4)	-1495.873	-0.33524	1100.629	1.11604
Q_V8(-5)	4219.842	0.90876	769.9065	0.75018
Q_V8(-6)	-3201.56	-0.68394	-1142.539	-1.10435
Q_V8(-7)	3539.776	0.77088	175.844	0.17327
Q_V8(-8)	4699.612	1.00659	1051.169	1.01868
Q_V8(-9)	-4944.264	-1.02922	-101.6763	-0.09576
Q_V8(-10)	-3248.887	-0.68019	579.4382	0.54888
Q_V8(-11)	-0.676874	-1.24154	0.256096	2.12534
Sample(adjusted):	1991:03 2000:12			
Included observations:	118			
R-squared	0.932673		0.989062	
Adj. R-squared	0.892092		0.982469	
Sum sq. resids	101.3093		4.948793	
S.E. equation	1.178049		0.260368	
F-statistic	22.9831		150.022	
Log likelihood	-158.4369		19.68617	
Akaike AIC	3.448082		0.429048	
Schwarz SC	4.504699		1.485665	
Mean dependent	1.856464		1.488813	
S.D. dependent	3.586215		1.96647	
Determinant Residual Covariance	3.61E-13			
Log Likelihood	1020.549			
Akaike Information Criteria	-14.24659			
Schwarz Criteria	-10.02012			

Endogenous variable: QV6 year-on-year growth rates

Autoregression

Explanatory variables	Coefficient	t-student
C	0.119164	0.18801
QV6(-1)	0.229496	2.79772
QV6(-2)	0.14648	1.75499
QV6(-3)	0.300567	3.63758
QV6(-4)	0.024538	0.28584
QV6(-5)	0.144632	1.68915
QV6(-6)	0.071819	0.88182
QV6(-7)	0.007056	0.08666
QV6(-8)	-0.009821	-0.12006
QV6(-9)	0.057199	0.69831
QV6(-10)	-0.09083	-1.10734
QV6(-11)	-0.087948	-1.0652
QV6(-12)	-0.375858	-4.54947
QV6(-13)	0.05056	0.57732
QV6(-14)	0.111393	1.27447
QV6(-15)	0.18896	2.23907
QV6(-16)	-0.128457	-1.52065
QV6(-17)	0.164248	1.97706
Sample(adjusted):	1987:06-2000:12	
Included observations:	163	
R-squared	0.482684	
Adj. R-squared	0.422033	
Sum sq. resids	7799.062	
S.E. equation	7.333937	
F-statistic	7.958411	
Log likelihood	-546.5297	
Akaike AIC	6.926744	
Schwarz SC	7.268386	
Mean dependent	1.780117	
S.D. dependent	9.646856	

Endogenous variable: QV7 year-on-year growth rates

Leading indicators

Indicators selected with correlation above:	0.50	
Number of factors:	1	
Total variance explained by selected factor(s):	*Factor 1*	84.15%

Explanatory variables	Coefficient	t-student
C	1.70	10.23
Factor 1	1.01	6.07
Included observations:		68
R-squared:		0.36

Factor = f(d_v4(-3), d_v22(-4), d_v23(-2))

Factor 1 = 0.353 * d_v4(-3) + 0.3765 * d_v22(-4) + 0.3625 * d_v23(-2)

Communalities

Variable(-lag)	Extraction
d_v4(-3)	0.788
d_v22(-4)	0.896
d_v23(-2)	0.831

d_ : Variable in differences

Endogenous variable: QV8 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	0.548178	0.20864
QV8(-1)	0.082752	0.31963
QV8(-2)	0.073879	0.28546
QV8(-3)	0.090966	0.37829
QV8(-4)	-0.265498	-1.04346
QV8(-5)	0.221575	0.82805
QV8(-6)	0.312775	1.06784
V2(-1)	0.304047	1.834
V2(-2)	-0.056346	-0.24829
V2(-3)	-0.011502	-0.05716
V2(-4)	-0.098812	-0.55241
V2(-5)	-0.189962	-0.9787
V2(-6)	0.037573	0.28347
Sample(adjusted):	1993:3-2000:4	
Included observations:	30	
R-squared	0.790897	
Adj. R-squared	0.643294	
Sum sq. resids	45.09091	
S.E. equation	1.628621	
F-statistic	5.358291	
Log likelihood	-48.6804	
Akaike AIC	4.112027	
Schwarz SC	4.719212	
Mean dependent	2.236686	
S.D. dependent	2.726873	

Endogenous variable: QV9 year-on-year growth rates

Leading indicators

Indicators selected with correlation above:	0.50	
Number of factors:	2	
Total variance explained by selected factor(s):	*Factor 1*	69.11%
	Factor 2	13.28%
	Total	82.39%

Explanatory variables	Coefficient	t-student
C	1.19	2.51
Factor 1	1.95	3.78
Factor 2	-0.85	-1.01
Included observations:		14
R-squared:		0.59

Factors = ***f(v13(-2), v14(-3), v15(-2), v16(-2), v17(-4), v19(-3), v20(-2), v21(-4), v22(-3), v23(-2), v24(-2), v25(-3), v30(-2), v31(-3), v35(-4), v36(-4), v38(-3), v40(-4), d_v11(-4), d_v14(-4), d_v18(-4), d_v19(-4), d_v20(-4), d_v23(-4), d_v24(-3), d_v25(-3), d_v29(-4), d_v30(-4), d_v31(-4))***

Factor 1 = 0.0564 * v13(-2) + 0.0566 * v14(-3) + 0.0559 * v15(-2) + 0.0518 * v16(-2) - 0.0225 * v17(-4) - 0.0507 * v19(-3) + 0.0578 * v20(-2) + 0.0509 * v21(-4) - 0.0254 * v22(-3) + 0.0563 * v23(-2) - 0.0195 * v24(-2) + 0.0492 * v25(-3) + 0.0527 * v30(-2) + 0.048 * v31(-3) - 0.0235 * v35(-4) + 0.0352 * v36(-4) + 0.0434 * v38(-3) + 0.0476 * v40(-4) + 0.0489 * d_v11(-4) + 0.0434 * d_v14(-4) - 0.0489 * d_v18(-4) + 0.0322 * d_v19(-4) + 0.0353 * d_v20(-4) - 0.0326 * d_v23(-4) + 0.006 * d_v24(-3) + 0.0436 * d_v25(-3) + 0.0541 * d_v29(-4) + 0.0565 * d_v30(-4) + 0.0529 * d_v31(-4)

Factor 2 = 0.0361 * v13(-2) + 0.0417 * v14(-3) + 0.044 * v15(-2) + 0.0452 * v16(-2) + 0.1365 * v17(-4) - 0.0831 * v19(-3) - 0.0011 * v20(-2) + 0.0676 * v21(-4) + 0.1338 * v22(-3) + 0.0184 * v23(-2) + 0.1388 * v24(-2) - 0.0162 * v25(-3) + 0.0632 * v30(-2) + 0.0745 * v31(-3) + 0.0067 * v35(-4) + 0.0721 * v36(-4) + 0.072 * v38(-3) + 0.0362 * v40(-4) - 0.0779 * d_v11(-4) - 0.0601 * d_v14(-4) + 0.0166 * d_v18(-4) - 0.131 * d_v19(-4) - 0.0545 * d_v20(-4) + 0.0984 * d_v23(-4) - 0.1527 * d_v24(-3) - 0.0756 * d_v25(-3) - 0.0299 * d_v29(-4) - 0.0266 * d_v30(-4) + 0.0364 * d_v31(-4)

Communalities

Variable(-lag)	Extraction
v13(-2)	0.940
v14(-3)	0.961
v15(-2)	0.946
v16(-2)	0.826
v17(-4)	0.802
v19(-3)	0.967
v20(-2)	0.935
v21(-4)	0.888
v22(-3)	0.815
v23(-2)	0.901
v24(-2)	0.791
v25(-3)	0.690
v30(-2)	0.920
v31(-3)	0.842
v35(-4)	0.156

Communalities

Variable(-lag)	Extraction
v36(-4)	0.531
v38(-3)	0.711
v40(-4)	0.681
d_v11(-4)	0.885
d_v14(-4)	0.657
d_v18(-4)	0.682
d_v19(-4)	0.900
d_v20(-4)	0.455
d_v23(-4)	0.642
d_v24(-3)	0.838
d_v25(-3)	0.735
d_v29(-4)	0.852
d_v30(-4)	0.922
d_v31(-4)	0.833

d_ : Variable in differences

Endogenous variable: QV10 year-on-year growth rates

Augmented VAR

	QV8		*QV9*		*QV10*		*QV11*	
Explanatory variables	Coefficient	t-student	Coefficient	t-student	Coefficient	t-student	Coefficient	t-student
C	-43.82982	-0.10961	-206.8989	-1.02794	-105.9637	-1.14366	105.2323	0.77652
QV8(-1)	0.441533	0.38442	1.160804	2.00786	-0.455352	-1.71101	0.298672	0.76729
QV8(-2)	-0.150023	-0.14802	0.131868	0.25848	-0.145142	-0.61803	0.046632	0.13576
QV8(-3)	0.583634	0.76809	-0.544571	-1.42384	0.111236	0.63181	0.186984	0.72611
QV8(-4)	-1.017807	-1.47533	-0.349811	-1.00738	-0.147782	-0.92451	-0.263605	-1.12747
QV8(-5)	0.51533	0.99853	-0.417228	-1.60614	0.038193	0.31939	0.217252	1.24213
QV9(-1)	0.360331	0.90513	0.247573	1.23552	0.072752	0.78871	0.220573	1.63489
QV9(-2)	-0.456239	-1.28312	0.034313	0.19172	-0.109404	-1.32793	-0.004272	-0.03545
QV9(-3)	0.250496	0.33217	-0.183571	-0.48361	-0.191382	-1.09528	0.217931	0.85272
QV9(-4)	0.383442	1.02358	0.031899	0.16917	0.119498	1.37673	0.189216	1.49041
QV9(-5)	-0.28549	-0.65773	-0.832067	-3.80847	-0.070638	-0.70236	-0.122497	-0.83274
QV10(-1)	0.071537	0.03981	-0.938767	-1.0378	-0.010601	-0.02546	0.300416	0.49326
QV10(-2)	1.081054	1.03068	-0.425466	-0.80589	0.755717	3.10958	0.303704	0.85439
QV10(-3)	-0.525076	-0.47525	2.146409	3.85965	0.431049	1.68381	-0.02486	-0.06639
QV10(-4)	-1.12539	-1.25044	-0.032017	-0.07068	-0.658979	-3.16009	-0.116327	-0.38139
QV10(-5)	-0.116265	-0.05102	0.155713	0.13575	-0.701595	-1.32874	0.253662	0.32845
QV11(-1)	-0.802896	-0.24348	-1.700757	-1.02465	1.599409	2.09327	-0.017087	-0.01529
QV11(-2)	0.237819	0.08673	1.164664	0.84388	-1.479408	-2.32861	0.134618	0.14487
QV11(-3)	-1.863098	-0.57489	-2.453585	-1.50414	-1.09161	-1.45374	-0.354787	-0.32303
QV11(-4)	3.315683	0.98185	-3.22991	-1.90019	0.35839	0.45803	0.674996	0.58979
QV11(-5)	-0.899181	-0.36942	3.916019	3.19631	1.327068	2.35303	0.035619	0.04318
V1(-1)	-0.039164	-0.01092	-2.137346	-1.1835	0.441353	0.5309	-1.150817	-0.94643
V1(-2)	0.505945	0.44991	0.817862	1.4449	0.395475	1.51777	0.050238	0.13182
V1(-3)	-0.22436	-0.13254	0.610339	0.71632	0.333856	0.85119	-0.388949	-0.67799
V1(-4)	0.448062	0.41457	0.399946	0.73518	0.195323	0.77997	-0.030482	-0.08322
V1(-5)	-0.222124	-0.12006	2.454912	2.63616	-0.284477	-0.66361	0.460948	0.73516
Sample(adjusted):				1993:2 2000:4				
Included observations:				31				
R-squared	0.934643		0.979229		0.989254		0.935943	
Adj. R-squared	0.607856		0.875376		0.935527		0.615659	
Sum sq. resids	17.60253		4.459684		0.945023		2.021719	
S.E. equation	1.876301		0.944424		0.434747		0.63588	
F-statistic	2.860097		9.428989		18.4124		2.922228	
Log likelihood	-35.21495		-13.934		10.11616		-1.671485	
Akaike AIC	3.949352		2.576387		1.024764		1.785257	
Schwarz SC	5.152051		3.779086		2.227463		2.987956	
Mean dependent	1.996417		0.133788		2.784966		3.259117	
S.D. dependent	2.99626		2.675265		1.71217		1.025692	
Determinant Residual Covariance				2.17E-10				
Log Likelihood				124.9286				
Akaike Information Criteria				0.327185				
Schwarz Criteria				6.34068				

Endogenous variable: QV11 year-on-year growth rates

Leading indicators

Indicators selected with correlation above:	0.50	
Number of factors:	1	
Total variance explained by selected factor(s):	*Factor 1*	71.52%

Explanatory variables	Coefficient	t-student
C	3.21	29.13
Factor 1	0.84	7.44
Included observations:		32
R-squared:		0.65

Factor = ***f(v3(-4), v4(-2), v5(-3), v6(-4), v7(-4), v10(-4), v11(-4), v13(-2), v14(-3), v15(-3), v16(-4), v17(-4), v18(-4), v19(-4), v20(-2), v25(-2), v30(-2), d_v6(-4), d_v7(-4), d_v8(-4), d_v15(-4), d_v16(-4), d_v18(-4), d_v19(-4), d_v20(-3), d_v21(-4), d_v23(-4), d_v24(-4), d_v25(-4), d_v26(-4), d_v27(-4), d_v30(-4))***

Factor 1 = 0.0393 * v3(-4) + 0.0398 * v4(-2) + 0.04 * v5(-3) - 0.0392 * v6(-4) + 0.0377 * v7(-4) + 0.0365 * v10(-4) + 0.0369 * v11(-4) + 0.0383 * v13(-2) + 0.0416 * v14(-3) + 0.0416 * v15(-3) + 0.0405 * v16(-4) - 0.0348 * v17(-4) - 0.0344 * v18(-4) - 0.0387 * v19(-4) + 0.0331 * v20(-2) + 0.0279 * v25(-2) + 0.0316 * v30(-2) + 0.0408 * d_v6(-4) + 0.0388 * d_v7(-4) + 0.0388 * d_v8(-4) + 0.0385 * d_v15(-4) + 0.0365 * d_v16(-4) + 0.0411 * d_v18(-4) - 0.0386 * d_v19(-4) + 0.0312 * d_v20(-3) + 0.0302 * d_v21(-4) + 0.0363 * d_v23(-4) + 0.0427 * d_v24(-4) + 0.0415 * d_v25(-4) + 0.0416 * d_v26(-4) + 0.0353 * d_v27(-4) + 0.028 * d_v30(-4)

Communalities	
Variable(-lag)	Extraction
v3(-4)	0.768
v4(-2)	0.785
v5(-3)	0.792
v6(-4)	0.761
v7(-4)	0.706
v10(-4)	0.662
v11(-4)	0.675
v13(-2)	0.730
v14(-3)	0.859
v15(-3)	0.859
v16(-4)	0.813
v17(-4)	0.600
v18(-4)	0.589
v19(-4)	0.743
v20(-2)	0.545
v25(-2)	0.385

Communalities	
Variable(-lag)	Extraction
v30(-2)	0.496
d_v6(-4)	0.827
d_v7(-4)	0.749
d_v8(-4)	0.746
d_v15(-4)	0.736
d_v16(-4)	0.663
d_v18(-4)	0.837
d_v19(-4)	0.742
d_v20(-3)	0.484
d_v21(-4)	0.452
d_v23(-4)	0.655
d_v24(-4)	0.904
d_v25(-4)	0.855
d_v26(-4)	0.860
d_v27(-4)	0.617
d_v30(-4)	0.389

d_ : Variable in differences

Endogenous variable: QV12 year-on-year growth rates

Autoregression

Explanatory variables	Coefficient	t-student
C	1.18636	0.84695
QV12(-1)	0.401016	2.18403
QV12(-2)	0.125817	0.69144
QV12(-3)	0.23501	1.30582
QV12(-4)	-0.408182	-2.09676
QV12(-5)	-0.087366	-0.46364
Sample(adjusted):	1993:2-2000:4	
Included observations:	31	
R-squared	0.434586	
Adj. R-squared	0.321503	
Sum sq. resids	1479.164	
S.E. equation	7.69198	
F-statistic	3.843071	
Log likelihood	-103.8984	
Akaike AIC	7.090219	
Schwarz SC	7.367765	
Mean dependent	2.053013	
S.D. dependent	9.338219	

Endogenous variable: QV13 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	-136.1032	-1.21674
QV13(-1)	0.077653	0.35229
QV13(-2)	-0.454644	-1.74908
QV13(-3)	-0.499433	-1.63614
QV13(-4)	-0.794588	-3.32612
V1(-1)	0.652736	1.41023
V1(-2)	0.254472	0.49136
V1(-3)	0.655487	1.18724
V1(-4)	-0.146727	-0.32102
V15B(-1)	0.170526	1.81176
V15B(-2)	-0.022797	-0.15639
V15B(-3)	-0.012895	-0.09752
V15B(-4)	-0.124085	-1.93165
V16B(-1)	-0.137645	-1.38904
V16B(-2)	-0.061878	-0.58108
V16B(-3)	-0.043169	-0.48319
V16B(-4)	0.19025	2.62113
Sample(adjusted):	1993:1-2000:4	
Included observations:	32	
R-squared	0.896691	
Adj. R-squared	0.786494	
Sum sq. resids	6.787214	
S.E. equation	0.672667	
F-statistic	8.137189	
Log likelihood	-20.59491	
Akaike AIC	2.349682	
Schwarz SC	3.128354	
Mean dependent	2.087627	
S.D. dependent	1.455778	

Endogenous variable: QV14 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	6.715042	1.62616
QV14(-1)	0.14185	0.65556
QV14(-2)	-0.092556	-0.42698
QV14(-3)	0.064159	0.27804
QV14(-4)	-0.291956	-1.24803
V30B(-1)	0.21813	1.77655
V30B(-2)	0.004843	0.02936
V30B(-3)	0.075287	0.48121
V30B(-4)	-0.096044	-0.74977
Sample(adjusted):	1993:1-2000:4	
Included observations:	32	
R-squared	0.613033	
Adj. R-squared	0.478435	
Sum sq. resids	168.1044	
S.E. equation	2.703496	
F-statistic	4.55457	
Log likelihood	-71.94762	
Akaike AIC	5.059227	
Schwarz SC	5.471465	
Mean dependent	-0.396476	
S.D. dependent	3.743447	

Endogenous variable: QV15 year-on-year growth rates

Leading indicators

Indicators selected with correlation above:	0.50	
Number of factors:	2	
Total variance explained by selected factor(s):	*Factor 1*	63.79%
	Factor 2	12.72%
	Total	76.51%

Explanatory variables	Coefficient	t-student
C	3.35	5.38
Factor 1	4.60	6.17
Factor 2	1.48	1.58
Included observations:		31
R-squared:		0.74

Factors = ***f(v17(-3), v18(-3), d_v11(-4), d_v19(-2), d_v20(-2), d_v23(-2), d_v32(-2))***

Factor 1 = -0.2095 * v17(-3) - 0.214 * v18(-3) - 0.1428 * d_v11(-4) - 0.2097 * d_v19(-2) + 0.2227 * d_v20(-2) + 0.1801 * d_v23(-2) + 0.0838 * d_v32(-2)

Factor 2 = -0.1982 * v17(-3) - 0.2288 * v18(-3) + 0.534 * d_v11(-4) + 0.2322 * d_v19(-2) - 0.0906 * d_v20(-2) + 0.0136 * d_v23(-2) + 0.6221 * d_v32(-2)

Communalities

Variable(-lag)	Extraction
v17(-3)	0.800
v18(-3)	0.852
d_v11(-4)	0.763
d_v19(-2)	0.823
d_v20(-2)	0.851
d_v23(-2)	0.549
d_v32(-2)	0.686

d_ : Variable in differences

Endogenous variable: QV16 year-on-year growth rates

Augmented VAR

	QV13		*QV16*		*QV22*	
Explanatory variables	Coefficient	t-student	Coefficient	t-student	Coefficient	t-student
C	4.789074	0.4104	-8.29849	-0.25871	18.6525	0.42252
QV13(-1)	1.184011	1.33805	2.140466	0.87997	0.433777	0.12958
QV13(-2)	-0.053097	0.08687	-0.157477	-0.09372	2.688273	1.16254
QV13(-3)	-0.661417	-0.5822	-0.625622	-0.20033	-4.750537	-1.10531
QV13(-4)	-0.116797	-0.16937	0.680152	0.3588	-2.272691	-0.87114
QV16(-1)	-0.382746	-2.47987	-0.566656	-1.33561	-0.909757	-1.55807
QV16(-2)	0.027227	0.09016	0.09878	0.119	-0.339453	-0.29713
QV16(-3)	-0.034503	-0.24467	0.525865	1.35655	0.649963	1.21828
QV16(-4)	0.057301	0.16134	0.374009	0.38308	0.060784	0.04524
QV22(-1)	-0.04846	-0.42112	-0.317987	-1.00527	0.970742	2.22985
QV22(-2)	-0.079281	-0.51762	-0.236596	-0.56194	-0.165649	-0.28587
QV22(-3)	0.213506	1.43159	0.562712	1.37258	0.07255	0.12858
QV22(-4)	-0.13143	-1.57803	-0.316675	-1.38319	-0.123258	-0.39118
V5B(-1)	0.092794	0.41653	0.171457	0.27998	0.244007	0.28952
V5B(-2)	0.068783	0.52748	-0.051628	-0.14403	0.237255	0.48093
V5B(-3)	-0.052795	-0.25351	-0.370767	-0.64766	0.040357	0.05122
V5B(-4)	-0.057897	-0.9125	-0.289495	-1.65983	-0.100383	-0.4182
Sample(adjusted):			1995:1-2000:4			
Included observations:			24			
R-squared	0.871269		0.948961		0.967457	
Adj. R-squared	0.577025		0.8323		0.893074	
Sum sq. resids	3.116325		23.54809		44.60248	
S.E. equation	0.667225		1.834125		2.524239	
F-statistic	2.961047		8.134377		13.00643	
Log likelihood	-9.55773		-33.82641		-41.49135	
Akaike AIC	2.213144		4.235535		4.874279	
Schwarz SC	3.047599		5.069989		5.708734	
Mean dependent	2.526185		8.117457		1.113777	
S.D. dependent	1.025924		4.478812		7.719508	
Determinant Residual Covariance			3.291574			
Log Likelihood (d.f. adjusted)			-150.5145			
Akaike Information Criteria			18.20954			
Schwarz Criteria			21.54736			

Endogenous variable: QV17 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	3.263759	1.85569
QV17(-1)	-0.182177	-0.3569
QV17(-2)	-0.269347	-0.50623
QV17(-3)	-0.231009	-0.50573
QV17(-4)	-0.052725	-0.14694
QV17(-5)	0.243487	0.74759
QV17(-6)	-0.158822	-0.67081
QV17(-7)	0.168005	0.81207
QV17(-8)	-0.000737	-0.00282
V20B(-1)	-0.068825	-0.85789
V20B(-2)	0.19731	1.46315
V20B(-3)	-0.042309	-0.24861
V20B(-4)	0.098087	0.80703
V20B(-5)	0.080977	0.92345
V20B(-6)	-0.168653	-1.88462
V20B(-7)	0.06452	0.41232
V20B(-8)	-0.124082	-1.35791

Sample(adjusted):	1994:1-2000:4
Included observations:	28
R-squared	0.868305
Adj. R-squared	0.676749
Sum sq. resids	3.239212
S.E. equation	0.542654
F-statistic	4.532907
Log likelihood	-9.534037
Akaike AIC	1.895288
Schwarz SC	2.704127
Mean dependent	2.201445
S.D. dependent	0.954451

Endogenous variable: QV18 year-on-year growth rates

Markov - TAR

Global OLS Estimation, Without threshold
Dependent Variable: QV18
Heteroskedasticity correction Used

Explanatory variables	Coefficient	t-statistics
C	1.4983578	2.47200329
QV18(-1)	0.39246743	1.8923792
QV18(-2)	-0.01452288	-0.08991908
QV18(-3)	0.05673786	0.5023485
QV18(-4)	-0.34408405	-2.39250856
Observations	23	
Degrees of Freedom	18	
Sum of Squared Errors	109.6199	
Residual Variance	6.08999	
R-squared	0.32947	
Heteroskedasticity Test (P-val	0.60419	

Threshold Variable:	*Probability of changing regin*
Threshold Estimate	0.912
Delay	4
Joint R-Squared	0.54049

OLS Estimation, Regime 1 - Probability <= 0.912
Dependent Variable: QV18
Heteroskedasticity correction Used

Explanatory variables	Coefficient	t-statistics
C	2.9381757	11.0088519
QV18(-1)	0.38126928	4.54802987
QV18(-2)	-0.18217269	-1.50430923
QV18(-3)	0.19513698	1.35970172
QV18(-4)	-0.564854	-3.74598868
Observations	10	
Degrees of Freedom	5	
Sum of Squared Errors	9.70761	
Residual Variance	1.94152	
R-squared	0.7301	

OLS Estimation, Regime 2 - Probability > 0.912
Dependent Variable: QV18
Heteroskedasticity correction Used

Explanatory variables	Coefficient	t-statistics
C	-0.49202765	-0.34828833
QV18(-1)	0.23625918	1.31491873
QV18(-2)	0.22005764	1.08263609
QV18(-3)	0.38183846	1.77800513
QV18(-4)	-0.41877005	-2.53863835
Observations	13	
Degrees of Freedom	8	
Sum of Squared Errors	65.4152	
Residual Variance	8.1769	
R-squared	0.37294	

Endogenous variable: QV20 year-on-year growth rates

Augmented autoregression

Explanatory variables	Coefficient	t-student
C	-0.437271	-2.18044
QV20(-1)	1.066342	5.60907
QV20(-2)	-0.284941	-0.90407
QV20(-3)	0.267584	0.85124
QV20(-4)	-0.286452	-1.04229
QV20(-5)	0.630494	2.37235
QV20(-6)	-0.545252	-1.84523
QV20(-7)	0.013481	0.04338
QV20(-8)	0.101795	0.51744
Q_V19(-1)	0.028222	0.22404
Q_V19(-2)	0.047076	0.31301
Q_V19(-3)	-0.076519	-0.47194
Q_V19(-4)	-0.028431	-0.18031
Q_V19(-5)	0.120423	0.77107
Q_V19(-6)	-0.044329	-0.28049
Q_V19(-7)	-0.031246	-0.22234
Q_V19(-8)	0.038119	0.33072
Sample(adjusted):	1996:12-2000:12	
Included observations:	49	
R-squared	0.982352	
Adj. R-squared	0.973529	
Sum sq. resids	14.92	
S.E. equation	0.682825	
F-statistic	111.3295	
Log likelihood	-40.3946	
Akaike AIC	2.342637	
Schwarz SC	2.998983	
Mean dependent	-6.015543	
S.D. dependent	4.196819	