CAMP Forecasts 2013*

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Abstract

This note presents Centre for Applied Macro- and Petroleum Economics (CAMP) forecasts for key Norwegian macroeconomic variables for 2013. The forecasts are purely model based, i.e. they do not contain judgment from the authors. In this note we describe more closely how the forecasts are constructed.

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1 Introduction

This is the first set of forecasts for key Norwegian macroeconomic variables from the Centre for Applied Macro- and Petroleum Economics (CAMP). The forecasts presented here are the outcome of a new project that aims to build human knowledge of macroeconomic models and their forecast performance. The forecasts are purely model based, i.e. they do not contain judgment from the authors. In the future we will, however, use our judgement to continuously strive to build better and more accurate forecasting models.

Developing empirical models to forecast the behaviour of the economy is subject to many important decisions that can have a material impact on the output – e.g. forecasts – of the models. These decisions include the choice of the data set, the transformations applied to the data, the sample period used to estimate the parameters of the model, the choice of estimation techniques, the dynamic specification of the model, and so on.

A common research strategy is to make choices to test down to a single model specification. However, the model ultimately arrived at will most likely diverge from the true but unknown process that drives the behaviour of the economy. Settling on a single model also disregards all of the other possible models that might be nearly as good as (possibly even better than) the model that was ultimately chosen. If these other models have different implications, such as different forecasts, then one may mis-characterise the central location of the forecasts and also mis-characterise the uncertainty around the forecasts.

In recent years it has become increasingly common to adopt an alternative research strategy, which emphasises the use of combination methods (cf. selection) to reconcile competing forecasts. Rather than arrive at a single specification, one entertains a wide variety of models and then weights together the output from these models in a sensible manner, see e.g. Clark and McCracken (2008). By entertaining a variety of models one can develop a better appreciation of the range of views that could be supported by formal models, and a better appreciation of which outcomes are most likely.

In this paper we conduct out-of-sample forecasts of various core macroeconomic variables in Norway obtained from a spectrum of models.The forecasts presented in this note are purely model based. The methodology we employ is that of model combination. As such, the forecasting methodology is inspired by the work in Norges Bank and their system for averaging models (SAM). See e.g. Bjørnland et al. (2012). However, it should be noted that the system we employ is not the same as SAM. First, the scale of our forecasting system is much smaller, i.e. the model suit is much smaller than in SAM, and the types of models do also differ. Moreover, the method we use to construct combination weights differ. Finally, we will present forecast for nine macroeconomic variables, whereas SAM give forecast for GDP and inflation only.

In the forecasting literature model averaging has proven to be a useful tool for constructing forecasts that are robust to different loss functions, model specifications and irregularities in the underlying time series used in the analysis. We believe that also holds for our small scaled model combination system.

However, there are obvious extensions to our system that can be implemented and that would probably increase the accuracy of the forecasts. For example we do not entertain monthly information in any of our models. Had we incorporated monthly information, we would certainly have improved the forecast performance for the last quarter of 2012 but also for the year 2013 as a whole. In addition, none of our models contain surveys (expectation about future macroeconomic performance), that has often improved forecast accuracy. We plan to incorporate these extensions in the near future.

2 Forecasts for 2013

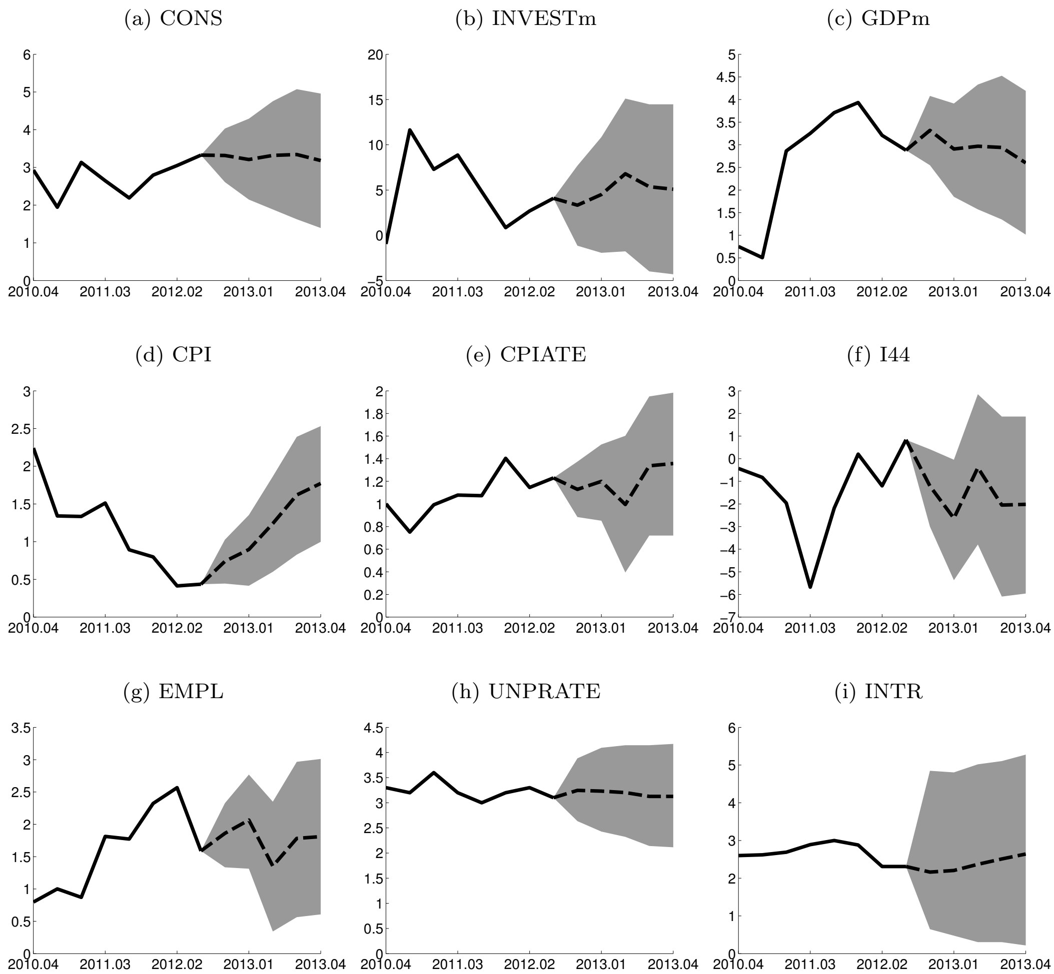
In this section we describe the CAMP forecasts. The forecasts are presented for the fourth quarter of 2012 until the end of 2013 of important macroeconomic variables, using our model averaging approach. Table 1 gives a summary in the form of quarterly and annual forecasts of the main variables and Figure 1 displays the forecasts.

Table 1: **Forecasts for 2013**

	2012	**2013**				
	Q4	Q1	Q2	Q3	Q4	**Average 2013**
CONS	3.32	3.21	3.32	3.34	3.18	**3.26**
INVESTm	3.32	4.50	6.80	5.36	5.08	**5.44**
GDPm	3.32	2.91	2.97	2.94	2.60	**2.85**
CPI	0.74	0.90	1.24	1.62	1.77	**1.38**
CPIATE	1.13	1.20	1.00	1.34	1.36	**1.22**
I44	-1.21	-2.64	-0.40	-2.05	-2.02	**-1.77**
EMPL	1.86	2.07	1.35	1.78	1.81	**1.75**
UNPRATE	3.25	3.23	3.20	3.13	3.13	**3.17**
INTR	2.16	2.21	2.37	2.51	2.64	**2.43**

Note: All quarterly forecasts are displayed as year on year changes, except INTR and UNPRATE that are in levels. In the last column we report yearly forecasts for 2013. CONS: personal consumption % growth, INVESTm: real investments mainland Norway % growth, GDPm: gross domestic product mainland Norway % growth, CPI: consumer price index % growth, CPIATE: consumer price index adjusted for taxes and energy % growth, I44: exchange rate import weighted % change, UNPRATE: unemployment rate %, EMPL: employmnet % growth, INTR: interest rate 3 month Nibor %.

Figure 1: **Forecasts**



Note: All forecasts are displayed as year on year changes, except INTR and UNPRATE that are in levels. The fancharts represent the 68 percent confidence bands. See Table 1 for details about the variable definitions.

3 Background

To provide the forecasts, we have developed a few models that produce sensible forecasts up to five quarters ahead. In particular, we entertain three different model classes in our analysis; factor augmented vector autoregressions (FAVARs), vector auto-regressions (VARs) and univariate autoregressive (AR) models. The models are estimated using both Bayesian and classical techniques.

In total we estimate five different models. Of these five models, three are FAVARs, one is a VAR(4) process and one is an AR(1) process (one AR(1) for each of the variables we are forecasting). The VAR and AR models are estimated using Bayesian techniques, with Minnesota style priors. The FAVARs are estimated using classical techniques. The three FAVARs are different with respect to the information set they utilize. Two of the FAVARs entertain a large domestic and international data set, while the third FAVAR model only entertain a domestic data set. All forecasts are produced as iterated forecasts.

In constructing the weights, we follow Bates and Granger (1969), who suggest combining models using weights derived from their sum of squared errors (SSE).[1] These weights will minimise a quadratic loss function based on forecast errors, provided the estimation errors of different models are actually uncorrelated.[2] Using inverse-SSE weights produces the same weights as those derived from the inverse of mean squared errors (MSEs) computed over some recent observed sample:

$$w_i = \frac{\frac{1}{MSE_i}}{\sum_{j=1}^{n} \frac{1}{MSE_j}} \tag{1}$$

In our current version of the system the weights are horizon, variable and model specific. For more details about the this type of methodology, please refer to e.g. Amisano and Geweke (2009), Kascha and Ravazzolo (2010), Bjørnland et al. (2011) and Aastveit et al. (2011).

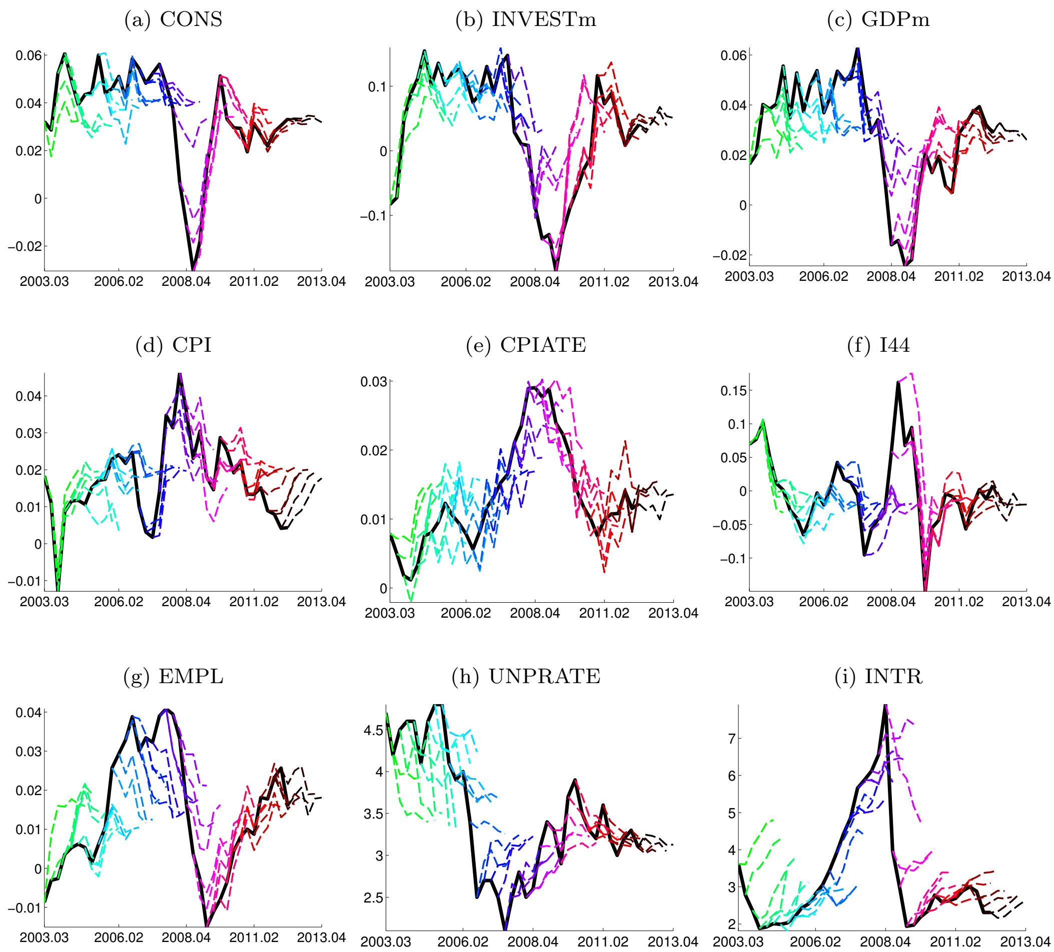
[1] We have also experienced with other ways to weight the models, such as combining the individual model densities using linear opinion pools. The weights attached to each model are then based on optimal log scoring. The forecasts from this scheme provide very similar forecast to what we present here using MSE weights.

[2] The estimation errors from our model suite may, however, not all be uncorrelated.

4 Evaluation of forecast

Figure 2 depicts the quasi real time out of sample forecasts for various horizons against the actual evolution of the variables. In particular, the Figure graphs the 1-5 step ahead forecasts (in color) based on the weighted model average constructed at each point in time and compares them to actual values (black line) for each variable. In Table Table 2 we then recursively evaluate quasi out-of-sample forecasts from 2003.03 to 2012.03.

Figure 2: **Forecast evaluation**



Note: All forecasts are displayed as year on year changes, except INTR and UNPRATE that are in levels. The graphs compare actual values (black line) with forecasts (hairy lines) given at different points in time. See Table 1 for details about the variable definitions.

Table 2 reports the root mean squared forecast error (RMSFE) of the five different models relative to the RMSFE of the combined forecast. A value higher than 1 indicates that the combined forecast has lower RMSFE than the individual model (perform better in a forecast competition). In 75 percent of the times, our combined model average outperforms any of the individual models in the model suite. Hence.combining forecasts improves forecast performance.

Table 2: **Relative RMSFE**

Horizon	M1	M2	M3	M4	M5
	CONS				
1	0.97	0.96	1.07	1.12	1.37
2	0.92	0.94	1.10	1.11	1.32
3	0.93	0.93	1.14	1.07	1.30
4	0.94	0.95	1.14	1.06	1.33
5	0.96	1.01	1.08	0.98	1.18
	INVESTm				
1	1.00	1.05	0.99	1.09	1.55
2	0.98	1.19	0.94	1.15	1.28
3	1.09	1.32	0.92	1.41	1.06
4	1.08	1.37	0.87	1.44	1.02
5	1.12	1.27	0.92	1.27	1.07
	GDPm				
1	1.01	1.01	1.00	1.14	1.11
2	1.01	1.07	1.02	1.18	0.95
3	0.96	1.08	1.01	1.19	0.93
4	1.00	1.13	1.06	1.20	0.90
5	1.05	1.15	1.11	1.09	0.84
	CPI				
1	1.03	1.02	1.03	1.02	1.02
2	1.00	1.02	1.04	1.01	1.10
3	1.02	1.06	1.05	0.99	1.09
4	1.08	1.13	1.07	0.98	1.05
5	1.01	1.05	1.01	0.91	0.96
	CPIATE				
1	1.01	1.05	1.04	1.00	1.03
2	1.20	1.26	1.19	0.96	1.00
3	1.12	1.19	1.18	1.00	0.98
4	1.31	1.32	1.35	1.02	0.90
5	1.41	1.42	1.48	1.12	0.83
	I44				
1	1.02	1.06	0.95	1.02	1.14
2	1.06	1.12	0.99	0.96	1.10
3	1.07	1.14	0.95	0.97	1.11
4	1.10	1.16	0.97	0.95	1.14
5	1.05	1.09	1.03	0.95	1.09
	EMPL				
1	1.27	1.21	1.20	1.16	0.98
2	1.14	1.26	1.14	1.18	0.99
3	1.08	1.29	1.06	1.13	1.04
4	1.01	1.27	1.00	1.06	1.04
5	0.96	1.20	0.99	1.03	1.07
	UNPRATE				
1	1.67	1.99	1.82	0.95	1.04
2	1.46	1.60	1.55	1.04	1.15
3	1.33	1.52	1.39	0.99	1.21
4	1.21	1.33	1.18	0.92	1.15
5	0.98	1.11	0.97	1.01	1.13
	INTR				
1	1.51	1.73	1.69	1.12	0.98
2	1.46	1.56	1.63	1.10	0.98
3	1.30	1.35	1.43	1.05	1.05
4	1.17	1.16	1.26	0.96	1.12
5	1.08	1.09	1.17	0.94	1.21

Note: The table reports the root mean squared forecast error (RMSFE) of the five different models relative to the RMSFE of the combined forecast. A value higher than 1 indicates that the combined forecast has lower RMSFE than the individual model. M1: international FAVAR, M2: international FAVAR, M3: domestic FAVAR, M4: AR(1), M5: VAR(4). Evaluation period: 2003.03 - 2012.03.

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5 Disclaimer and legal disclosures

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