Real-Time Data, Professional Forecasters and the Output Gap in an Estimated New Keynesian Model

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Real-Time Output Gap Uncertainty

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Introduction

- ► Following Croushore and Stark (2001) it has become standard to compare out-of-sample forecast performance of alternative macro models for the U.S. with real-time data.
- ➤ Since Orphanides (2001) and Orphanides and Van Norden (2002), it is well known that output gaps are measured with considerable error
 - important data revisions in GDP data
 - ▶ the presence of shock, parameter and model uncertainty when estimating potential output.
- Much less real-time data analysis has been done for the euro area.

Introduction: Contribution

This paper uses the real-time data base (RTDB) available from the ECB's Statistical Data Wharehouse and described in detail in Giannone, Henry, Lalik and Modugno (2010).

- ▶ We investigate the real-time forecasting performance of the model of Galí, Smets and Wouters (2012) since 2001 and compare it with two alternative non-structural models.
- ▶ The GSW model is very similar to the Smets and Wouters (2007) model. One difference is that it models labor supply decisions on the extensive margin (to work or not), rather than on the intensive margin (how much to work).
- We analyse to what extent the forecasts of euro area GDP growth, inflation and unemployment by professional forecasters (ECB's SPF) help improve the forecast performance of the DSGE model.

Introduction: Contribution

- Two cases for the introduction of SPF data:
 - "noise" interpretation: the mean SPF forecasts are assumed to be noisy indicators of the rational expectations forecasts implied by the DSGE model;
 - "news" interpretation: it is assumed that the forecasts reveal the presence of expected future shocks in line with those estimated over the past.

The noise interpretation can be seen as a variant of conditional forecasting with soft conditions, while the news interpretation involves hard conditions (Waggoner and Zha, 1999).

▶ We examine the implications for the uncertainty of the model-consistent output gap estimate. GSW model particularly suitable for studying the output gap since it includes unemployment as an observabel, allowing for a better discrimination of wage markup and labor supply shocks.

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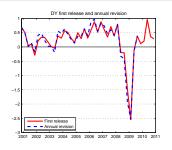
Conclusions

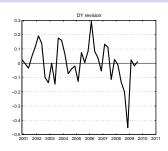
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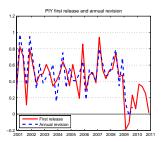
The Euro Area Real-Time Data Base

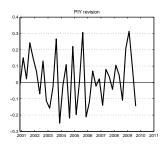
- ▶ We estimate the DSGE model using eight macroeconomic time series for the euro area: real GDP, private consumption, total investment, total employment, real wages, GDP deflator, the 3-month Euribor rate and unemployment.
- ▶ The RTDB vintages are provided on a monthly basis since January 2001 until March 2011.
- The vintages correspond to their publication in the ECB's Monthly Bulletin and contain both monthly and quarterly (and annual) data.
- ► Each vintage covers a common sample since the mid 1990's, and is linked to the AWM database updates.

Actuals - First Release Data and Annual Revisions









ECB Survey of Professional Forecasters

- ▶ The ECB SPF is conducted in the first month of each quarter since 1999Q1, directly after the first official estimate of HICP for the previous month; see Garcia (2003, ECB OP 8), and Bowles et al (2007, OP 59) for details.
- ► SPF covers annual real GDP growth, annual HICP, and the unemployment rate:
 - ► Individual forecasters' point forrecasts and "subjective distributions" through probabilities for fixed bins.
 - 1 and 2 year-ahead forecasts; current calender year, next calender year, (two calender years from now), and calender year "five" years into the future.
 - The number of respondents is quite high relative to, e.g., Consensus Economics.
- ▶ We use mean point forecasts for the 1-year and 2-year-ahead.

The RTDB and the SPF

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	Month 1		Month 2	Month 3
	1	\uparrow	↑	↑
	RTDB M1	SPF	RTDB M2	RTDB M3
Monthly	u_{m-2}	u_{m-2}	u_{m-2}	u_{m-2}
series	π_{m-2}	π_{m-1}	π_{m-2}	π_{m-2}
	r_{m-1}	r_{m-1}	r_{m-1}	r_{m-1}
Quarterly	y_{q-2}	y_{q-2}	y_{q-2}	y_{q-1}
series	c_{q-2}	c_{q-2}	c_{q-2}	c_{q-1}
	i_{q-2}	$\scriptstyle i_{q-2}$	i_{q-2}	i_{q-1}
	$p_{y,q-2}$	$p_{y,q-2}$	$p_{y,q-2}$	$p_{y,q-1}$
	e_{q-2}	e_{q-2}	e_{q-2}	e_{q-2}
	w_{q-2}	w_{q-2}	w_{q-2}	w_{q-2}
	u_{q-2}	u_{q-2}	u_{q-1}	u_{q-1}
	r_{q-1}	r_{q-1}	r_{q-1}	r_{q-1}

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Estimation Results - 1 (2)

- ▶ We estimate the GSW model for the euro area over the sample 1985Q1-2009Q4 (AWM update 16 combined with RTDB vintage 2010Q1). The period 1980Q1-1984Q4 is used as training sample.
- Compared with results for the US:
 - Average unemployment rate ($\bar{u} = 100(\mathcal{M}_w 1)/\varphi$, steady-state wage markup/labor supply elasticity) is higher in the euro area (9 vs. 5 percent).
 - ► The euro area economy appears to be much more sticky: estimated degree of price and wage indexation is relatively small in both areas, but the Calvo probabilities of unchanged wages and prices are higher in the euro area.
 - MP reaction coefficient on the output gap (r_y) is quite high for the euro area, while the coefficient on inflation is low.

Estimation Results - 2 (2)

- Overall, results for the euro area point to a less flexible economy with more persistence in the effects of various shocks on economic activity, prices and unemployment.
- Variance decompositions for euro area:
 - Output by demand shocks and productivity shocks (50-50) at 10Q horizon, by productivity (75) at 40Q horizon.
 - ▶ Inflation by price (wage) mark-up shocks.
 - ▶ Unemployment by demand (risk premium) and wage mark-up shocks, particularly at longer horizons.
- ➤ The "full-sample" estimation results are very similar when we re-estimate the model using the SPF forecasts as noisy indicators of the model-consistent expectations.

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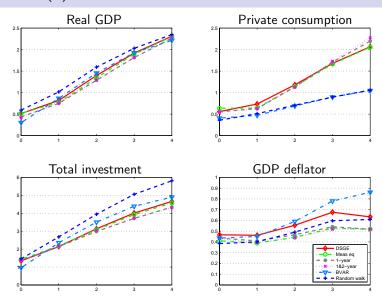
Real-Time Forecasting Performance

- ► Compare the real-time forecasting performance of the GSW models over 2001Q1-2010Q4 with 5 alternative models.
- ► The models are re-estimated annually starting with the 2001Q1 vintage (which is estimated until 2000Q4).
- "Nowcasts" are computed for variables with missing data, e.g., for 2000Q4 in the case of the 2001Q1 vintage, implemented through conditional forecasts (Waggoner-Zha) using data for the observed data in that period.
- ▶ One to four-step-ahead forecasts.
- ► Focus on forecasting annual rates for first differenced variables, with the annual revisions data as the actuals (ends in 2009Q3).

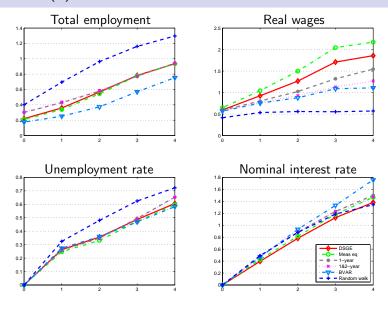
Alternative Models

- ► SPF data are used as conditioning information: hard conditions (1 and 1&2 year-ahead SPF forecasts), soft conditions (1 year-ahead SPF) yielding 3 alternative models.
- ► SPF data on annual real GDP growth concerns 3Q and 7Q ahead forecasts, while annual HICP and unemployment forecasts cover 4Q and 8Q ahead forecasts relative to the nowcast date.
- ▶ BVAR with a steady-state prior (Villani, 2009) and Minnesota-type prior on the VAR parameters (diffuse on covariances). Prior mean for first own lag is 0 for first differenced variables and unity for levels variables.
- Random-walk forecasts.

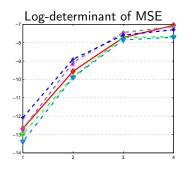
RMSE - 1 (2)

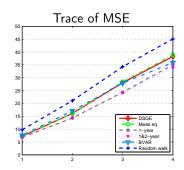


RMSE - 2 (2)



Multivariate Point Forecasts





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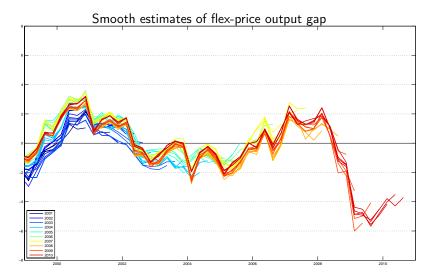
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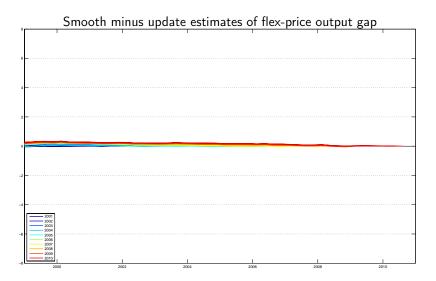
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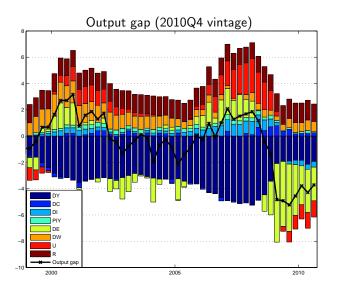
Real-Time Output Gap Estimation - 1 (2)



Real-Time Output Gap Estimation - 2 (2)



Obs Weight Decomposition - Koopman and Harvey (2003)



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Conclusions - 1 (2)

- ▶ Real-time forecasting: overall no model dominates when taking the multivariate point forecast statistics into account.
- Annual real GDP growth: all models perform similarly.
- Annual consumption and real wages: GSW model underperforms; systematically overpredicts real wage growth and private consumption
 - Consistent with Christoffel, Coenen and Warne (2011) for the New Area-Wide Model.
 - Models with a constant steady-state labor share and consumption-output ratio have a difficult time explaining the period with wage moderation.
- Adding the information from the SPF forecasts has only a limited effect on the forecasting performance of the DSGE model.

Conclusions - 2 (2)

- ▶ The output gap reached a maximal size of between 4 and 6 percent in the most recent recession, larger than the gap achieved in the early 1990s.
- ▶ There is quite a bit of uncertainty arising from the real-time nature of the data set used. Overall, this uncertainty is of the size of 1 to 2 percentage points.
- Most of the real-time putput gap uncertainty in the first half of the EMU period seems to be from revisions in the data, rather than updates because future information becomes available.

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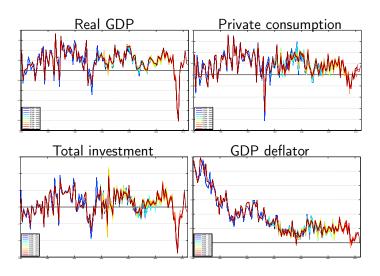
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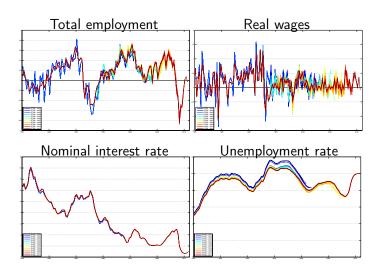
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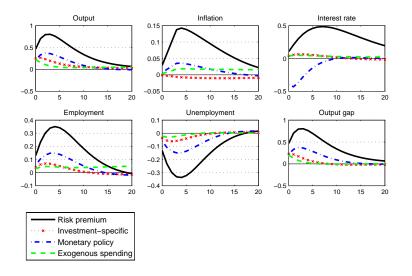
The Combined AWM-RTDB Vintages - 1 (2)



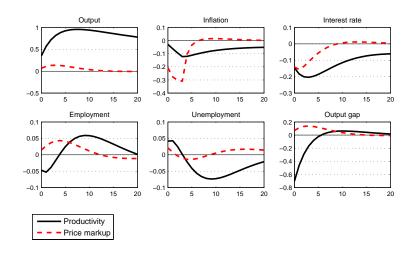
The Combined AWM-RTDB Vintages - 2 (2)



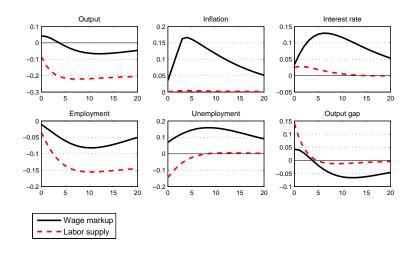
Impulse Responses - Demand Shocks



Impulse Responses - Supply Shocks



Impulse Responses - Labor Market Shocks



Simulation Smoother Estimate of Output Gap

