

Nowcasting Czech GDP in Real Time

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Outline

- 1 Motivation
- 2 Dynamic factor model
- 3 Real-time dataset
- 4 Real-time nowcasting exercise

Nowcasting

- GDP is the main measure of the state of the economy
- Problem: GDP is available only with a lag of roughly 70 days
- agents need to make decisions in real-time
- obtaining the accurate estimates of the current quarter is thus important
- CNB uses nowcasts as inputs to the G3 model
- CNB comments on the releases of GDP data (and the deviation of the CNB nowcast)

Issues when forecasting in real-time

- 1 Ragged ends
 - financial data and surveys are timely, hard data typically available only with a delay
- 2 Mixed frequencies
 - GDP quarterly, leading indicators monthly, financials daily
- 3 Curse of dimensionality
 - many potential indicators available, time series are short
- 4 Revisions
 - revisions to national accounts are sizeable, using revised data might understate forecast errors

We account for these issues by

- 1 estimating dynamic factor model (alleviates the curse of dimensionality)
- 2 casting the model into state-space framework (deals with ragged ends and mixed frequencies)
- 3 using multiple vintages of historical data to assess the performance of the model in real time

Specifically

- We use Banbura and Modugno (2013) version of DFM and apply it to Czech data.

Related Literature

- Nowcasting in real-time: Schumacher and Breitung (2008), Camacho and Perez-Quiros (2010), Banbura et al. (2012)
- Evidence on short-term forecasting Czech GDP: Arnostova et al. (2011), Havranek et al. (2012), Horvath (2012)

Contribution

- first to use Czech real-time data
- revisiting the discussion about the importance of various groups of variables
- nowcasting the expenditure components of GDP

Monthly dynamic factor model

$$x_t = \Lambda f_t + \varepsilon_t \quad (1)$$

$$f_t = A_1 f_{t-1} + \dots + A_p f_{t-p} + u_t, \quad (2)$$

Quarterly variables

- modeled by approximation of Mariano & Murasawa (2003)

$$y_t^Q \approx \frac{1}{3}(y_t + 2y_{t-1} + 3y_{t-2} + 2y_{t-3} + y_{t-4})$$

- observations assigned to the last month of the quarter, otherwise treated as missing

Estimation

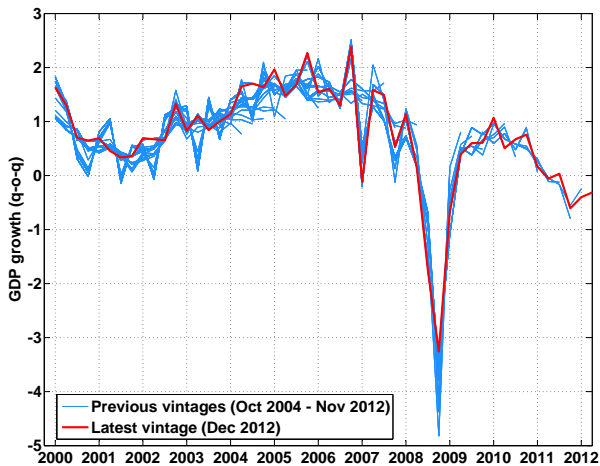
- model estimated by Expectation-Maximization algorithm
- iterations of two steps:
 - 1 estimate the expectation of log-likelihood conditional on previous iteration parameters
 - 2 re-estimate the parameters conditional on the likelihood from previous step
- initial parameters obtained by replacing missing observations by $N(0,1)$ draws and estimating principal components on the balanced sample.

Real-time dataset

- 99 monthly vintages - first October 2004, last December 2012
- most data start in January 2000
- data transformed to stationarity - mostly log-differences
- standardized to zero mean and unit variance
- 27 headline variables covering hard data, financial variables, confidence indicators and foreign environment

No.	Group	Variable	Revisions	Pub. Lag	Unb. Pat.	Source
1	Hard	Real GDP	Y	68 to 71	4,5,3-4,5,3	OECD
2	Hard	Industrial production index	Y	37 to 45	2-2	OECD
3	Hard	Construction output	Y	37 to 45	2-2	OECD
4	Hard	Retail Sales	Y	35 to 49	2-2	OECD
5	Hard	Unemployment rate	N	8 to 11	1-1	MLSA
6	Hard	CPI total	N	8 to 11	1-1	CZSO
7	Hard	Exports (current prices)	Y	35 to 39	2-2	OECD
8	Hard	Imports (current prices)	Y	35 to 39	2-2	OECD
9	Hard	Export price index	N	43 to 47	3-2	CZSO
10	Hard	Import price index	N	43 to 47	3-2	CZSO
11	Financials	CZK/EUR exchange rate	N	0	1-0	CNB
12	Financials	M2	Y	30 to 31	2-1	OECD
13	Financials	Credit	Y	30 to 31	2-1	CNB MB
14	Financials	PRIBOR 3M	N	0	1-0	CNB
15	Financials	PRIBOR 1Y	N	0	1-0	CNB
16	Financials	PX-50 stock index	N	0	1-0	PSE
17	Financials	Czech government bond yield (10Y)	N	0	1-0	CNB
18	Surveys	Consumers confidence indicator	N	-7 to -2	1-0	CZSO
19	Surveys	Industry confidence indicator	N	-7 to -2	1-0	CZSO
20	Surveys	Construction confidence indicator	N	-7 to -2	1-0	CZSO
21	Surveys	Trade confidence indicator	N	-7 to -2	1-0	CZSO
22	Surveys	Services confidence indicator	N	-7 to -2	1-0	CZSO
23	Exogenous	EURIBOR 3M	N	0	1-0	ECB
24	Exogenous	EURIBOR 1Y	N	0	1-0	ECB
25	Exogenous	Oil price (Brent)	N	0	1-0	Datastream
26	Exogenous	The Ifo business climate Germany	N	-10 to -4	1-0	IFO
27	Exogenous	Euro area business climate	Y	-4 to -1	1-0	EC
28	Exogenous	Germany exports	Y	40	2-2	OECD

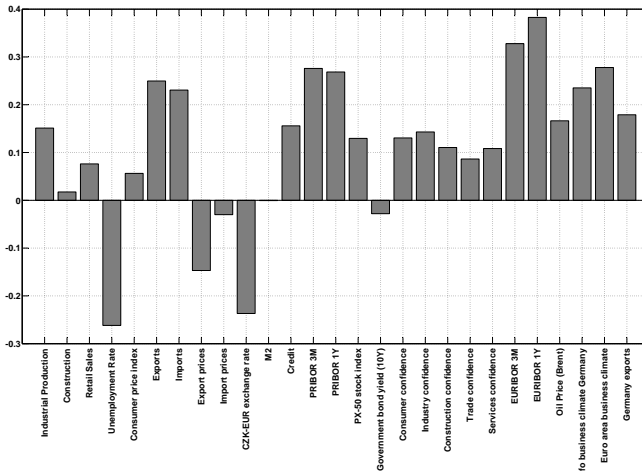
Vintages of Czech GDP growth



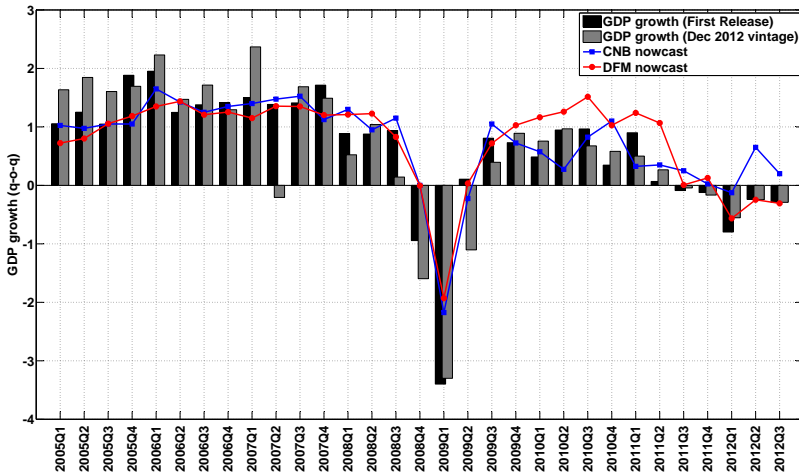
Design of the nowcasting exercise

- 31 nowcasting rounds (first nowcasted quarter: 2005Q1, last: 2012Q3)
- 14 nowcast updates, twice a month
- first nowcast update $Q(-1)M1$ mid, last nowcast update $Q(+1)M1$ end
- evaluated against first releases of GDP and against last available vintage
- parsimonious specification with one factor and two autoregressive lags

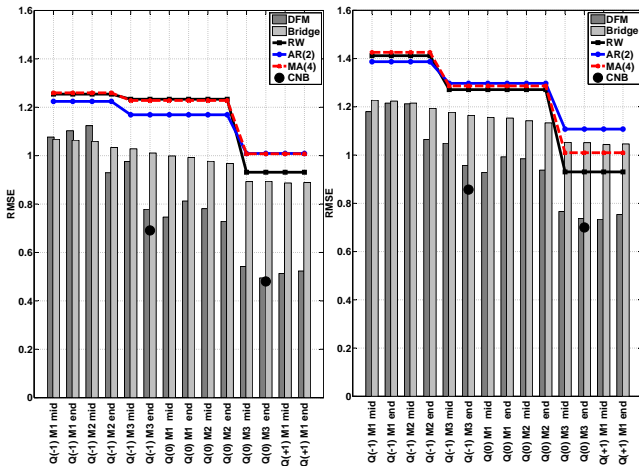
In-sample results: factor loadings



Nowcasting Czech GDP



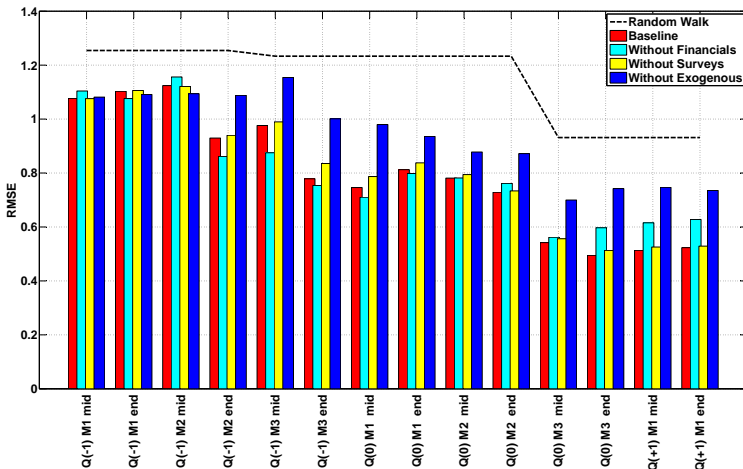
Out-of-sample performance



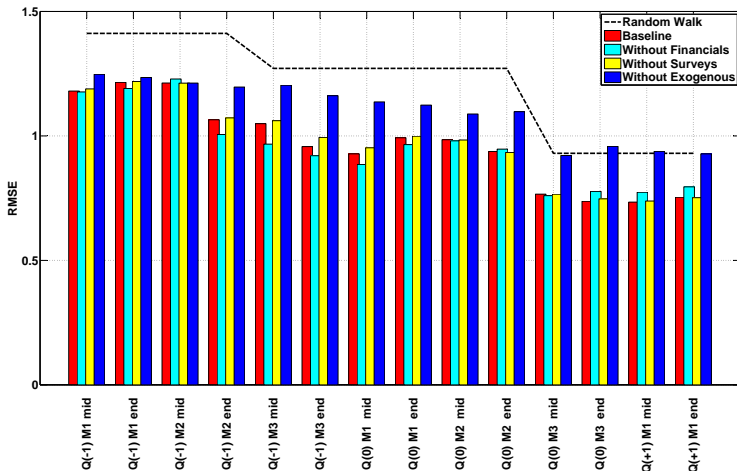
Out-of-sample performance: subsamples

	Full Sample (2005Q1-2012Q3)		Pre-Crisis (2005Q1-2008Q2)		Crisis (2008Q3-2012Q3)	
	Q(-1)M3 end	Q(0)M3 end	Q(-1)M3 end	Q(0)M3 end	Q(-1)M3 end	Q(0)M3 end
<i>Evaluated using first releases of GDP growth</i>						
Random Walk (absolute RMSE)	1.23	0.93	0.48	0.39	1.61	1.21
<i>RMSE relative to RW</i>						
Bridge	0.82	0.96	1.07	1.22	0.80	0.93
DFM	0.63	0.53	1.01	0.94	0.59	0.48
CNB	0.56	0.52	0.94	0.84	0.52	0.48
Combination CNB & DFM	0.54	0.47	0.91	0.86	0.51	0.42
<i>Evaluated using GDP growth in December 2012 vintage</i>						
Random Walk (absolute RMSE)	1.27	0.93	0.78	0.74	1.56	1.06
<i>RMSE relative to RW</i>						
Bridge	0.92	1.13	1.08	1.12	0.88	1.13
DFM	0.75	0.79	1.05	1.04	0.68	0.67
CNB	0.67	0.74	1.02	0.96	0.58	0.65
Combination CNB & DFM	0.68	0.74	1.01	0.99	0.58	0.61

What drives the performance of the model? (first releases)



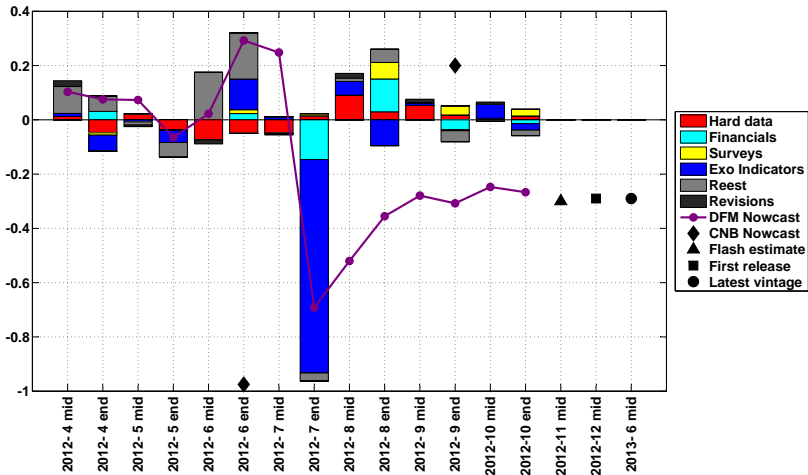
What drives the performance of the model? (Dec 2012 vintage)



News analysis

- allows to analyze the forecast updates that result from new data releases
- we decompose the forecast update in 3 parts
 - ① the effect of reestimation: $y' - y^0$
 - y^0 - old data, old unbalancedness pattern, old parameters
 - y' - old data, old unbalancedness pattern, new parameters
 - ② the effect of data revisions: $y'' - y'$
 - y'' - new data, old unbalancedness pattern, new parameters
 - ③ the news: $y^1 - y''$
 - y^1 - new data, new unbalancedness pattern, new parameters

Contribution of news to nowcast updates: 2012Q3



Nowcasting expenditure components of GDP: 2009Q1-2012Q3

	GDP	Consumption	GFCF	Gov. Cons.	Exports	Imports
<i>Evaluated using first releases of GDP growth</i>						
Random Walk (absolute RMSE)	1.19	1.01	6.12	2.07	4.86	5.15
<i>RMSE relative to RW</i>						
CNB	0.47	1.28	0.68	0.85	0.80	0.91
DFM	0.48	1.14	0.75	0.75	0.96	1.05
Combination CNB & DFM	0.42	1.10	0.68	0.66	0.75	0.83
<i>Evaluated using GDP growth in December 2012 vintage</i>						
Random Walk (absolute RMSE)	0.90	1.64	5.57	1.84	3.96	3.70
<i>RMSE relative to RW</i>						
CNB	0.62	0.80	0.63	0.95	0.89	1.04
DFM	0.69	0.78	0.74	0.86	0.90	1.12
Combination CNB & DFM	0.58	0.73	0.64	0.75	0.67	0.80

- DFM seem to nowcast consumption and gov. cons. better, adds value also for exports and imports
- of course, different sets of variables might be used depending on a component (e.g. based on an experience of relevant sectoral expert)

Summary

- we evaluated performance of medium-scale DFM model over 2005-2012 period
- performance of DFM model in real-time is comparable to judgemental nowcasts by CNB
- DFM seems to add valuable info in addition to CNB nowcasts
- the role of foreign data is crucial for the performance of the model
- DFM performance comparable for the expenditure components

Thank you for your attention!

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