The role of survey data in nowcasting euro-area GDP growth

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The role of survey data in nowcasting euro-area GDP growth – starting point

- Forecasting GDP: trade-off between precision of the signal of a predictor and its timeliness
- financial indicators: only indirectly related to real economy
- survey indicators: vaguely-defined concepts ("business situation") & direction of change only
- BUT: data are timely available
- AND: possible additional advantage beyond timeliness:
  - ✓ broader sectoral coverage (services: long delay of 'hard' data)
  - ✓ 'genuine' leading properties of expectations

Questions

- is it useful to include financial and survey data in a nowcast model or do they only introduce noise?
- is their value-added constant over time, or particularly pronounced at the beginning of the nowcasting quarter?
- is value-added only rooted in timely availability or genuine, i.e. would it continue to exist if real activity data were released as early as financial / survey data?
- did the Great recession make a difference (esp. concerning value of financial indicators)?

Tools

- comparison of GDP forecasts (in pseudo real-time) which differ in terms of input data categories
- We use factor models, in order to
  - ✓ derive general conclusions about merits of different data categories, as little as possible influenced by specific model choice
  - ✓ not depend on forecaster's skills in selecting meaningful predictors
  - ✓ compensate for deficiencies in single economic indicators (e.g. measurement errors) through extraction of information from many time-series

Set-up

- set of indicators consists of 111 time series from January 1997 to March 2014, corresponding to 69 quarterly observations (1997q1-2014q1).
- forecast horizon: 2007q1 to 2014q1 - entire financial and sovereign debt crisis, complementing earlier evidence
- allows explicit highlight on the crisis period of 2008/09
- 10 nowcasts for each quarter over the 4½ months between start of the quarter and publication of GDP flash
- → granular view on evolution of value added of different data sets over time

Set-up (cont'd)

- compare quality of nowcasts generated by factor models fed by different data categories (real, survey, financial)
- adaptive modelling approach: model specification and coefficients updated before every nowcast round; recursive forecasting scheme
- technically: blocking approach (from engineering literature)
- counterfactual exercise simulating immediate release of all predictors: "genuine" predictive power beyond timeliness?

Groundwork

- Preparation of customized dataset which represents realistic (pseudo real-time) data availability
- mixed-frequency problem plus ragged-edge problem (publication with time-lag); averaging of monthly variables not feasible in real-time
- blocking approach: splitting high frequency information into multiple low frequency series. At each point in time, partially available data is exploited, no need to forecast intra-quarterly missing information (as in standard bridging techniques).
- monthly observations of a given time-series are distributed into three quarterly series (e.g. three IP series: M1-IP, M2-IP and M3-IP)

Groundwork (cont'd)

- On each nowcasting day, dataset only includes variables with an observed value for reference quarter; all nowcasts exclusively based on actual monthly observations.
- Data transformations: trending series (e.g. IP, employment) are expressed as

$$\dot{x}_t^i = \frac{1}{3}\left[\frac{x_t^i}{\frac{1}{3}(x_{t-1}^1 + x_{t-1}^2 + x_{t-1}^3)} - 1\right]$$

- For non-stationary series without trend (e.g. interest rates, unemployment rates)

$$\ddot{x}_t^i = \frac{1}{3}\left[x_t^i - \frac{1}{3}(x_{t-1}^1 + x_{t-1}^2 + x_{t-1}^3)\right]$$

- Advantage: monthly components add up to quarterly aggregates

Four steps

1. conduct a factor analysis on the pseudo real-time dataset (from 1 to 10 factors, selection with AIC)
2. plug extracted factors into the regression equation

$$y_t = c + \sum_{j=1}^{K} \beta_j f_{jt} + \varepsilon_t$$

3. use estimated parameters and factors extracted from data at t+1 to compute a forecast for y at t+1

$$\hat{y}_{t+1} = \hat{c} + \sum_{j=1}^{\tilde{K}} \hat{\beta}_j \hat{f}_{jt+1}$$

4. compare nowcasting performance of different models at various points in time, using RMSE as forecast accuracy measure, AR(1) as benchmark

Closer look at data set

Table 1 – Composition of the panel of indicators

	by publication frequency:			
	F	Q	S	Total
daily	14	.	.	14 (13%)
monthly	18	34	45	97 (87%)
	by data transformation type:			
	F	Q	S	Total
no transformation	.	.	41	41 (37%)
first differences	15	2	.	17 (15%)
percentage changes	17	32	4	53 (48%)
	total:			
	F	Q	S	Total
	32 (29%)	34 (31%)	45 (40%)	111

Closer look at data set (cont'd)

30% financial indicators (F):

- interest rates & bond yields
- stock price & volatility indices
- nominal € X-rates, money supply
- loans to non-financial corporations
- commodity prices

30% quantitative real series (Q):

- IP in industry (incl. sub-sectors) & construction
- unemployment rate (incl. DE)
- core & overall inflation rates
- retail sales index & car registrations
- trade variables, REERs

40% survey variables (S):

- ESI
- confidence indices for INDU, SERV, RETA, BUIL, CONS
- all monthly balance-series from sector-specific surveys
- EU policy uncertainty index & components

Sequence of nowcasts/backcasts

- Nowcasts in principle on every day from day 1 of q to day 45 of q+1 (when Flash is released, i.e. already backcasts).
- But: to assess relative value-added of financial, survey and real data for nowcasting GDP, focus on a limited number of certain nowcasting dates suffices
- to make a difference, 'sufficient' new data has to be there: EA data releases relatively clustered at mid and end of month (unlike e.g. US)
- → 10 nowcasts per quarter, of which 3 conducted after the end of the reference quarter (i.e. effectively 'backcasts').

Table 2 – Availability of predictors throughout a given calendar quarter

Forecast date	Type of predictor	Available data referring to the predicted quarter…					
		…when Q(t-1) is predicted (**backcast**):			…when Q(t) is predicted (**nowcast**):		
		m1	m2	m3	m1	m2	m3
A. (month 1, 12th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP	**VIII**			**I**		
B. (month 1, 30th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP	**IX**			**II**		
C. (month 2, 12th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP	**X**			**III**		
D. (month 2, 15th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP				**IV**		
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A: First nowcast on 12th of month 1:

Available data:
daily predictors (DP: stock market data, nominal X-rates, etc.)

All other categories (MP1 to MP5): only releases for Q(t-1)

[can thus not be used for Q(t). However, indirect bearing on nowcast, since used to backcast Q(t-1) (GDP available neither for Q(t), nor for Q(t-1))
→ nowcast of Q(t) in situation A (and B and C) is two-step ahead forecast]

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B: Second nowcast on 30th of month 1:

Additional variables: monthly predictors (MP1) with releases for month 1 of Q(t):

Variables released at the end of the month to which they refer = **mainly survey series (EU BCS)**

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C: Third nowcast on 12th of month 2:

Additional variables:

month-2-versions of DP (blocking approach: separate M1-, M2- and M3-version of every variable) and

new MP2 basket, with values for month 1 just released:

Diverse, commodity prices to bond yields and economic policy uncertainty indicator

Table 2 – Availability of predictors throughout a given calendar quarter

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D: Three days later, 15th of month 2:

predictors remain the same

BUT: GDP figure of Q(t-1) has just been published

→ nowcast D is the first one-step ahead forecast.

Table 2 – Availability of predictors throughout a given calendar quarter

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G. (month 3, 30th)	DP, MP 1, MP 2, MP 3, MP 4, MP 5, GDP				VII		

E: 30th of month 2:

Additional variables:

month-2 version of MP1 variables (BCS), and

new MP3 basket, with values for month 1 just released:

e.g. unemployment rate, car registrations, monetary variables (inflation rates, money supply,…)

Table 2 – Availability of predictors throughout a given calendar quarter

Forecast date	Type of predictor	Available data referring to the predicted quarter…	
		…when Q(t-1) is predicted (**backcast**): m1 m2 m3	…when Q(t) is predicted (**nowcast**): m1 m2 m3
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B. (month 1, 30th)	DP, MP 1, MP 2, MP 3, MP 4, MP 5, GDP	IX	II
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F: 12th of month 3 (crucial)

Additional variables:

month-2-versions of MP2 and month-3-versions of DP and

new MP4 basket: month-1 versions of euro area IP and retail sales (high correlations with GDP)

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F. (month 3, 12th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP				VI		
G. (month 3, 30th)	DP MP 1 MP 2 MP 3 MP 4 MP 5 GDP				VII		

G: 30th of month 3 (last nowcasts during the reference quarter)

Additional variables:

month-3-version of MP1 (BCS)

Table 2 – Availability of predictors throughout a given calendar quarter

Forecast date	Type of predictor	Available data referring to the predicted quarter…					
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Last three exercises: backcasts (Q(t) has passed, but Flash GDP not yet released):

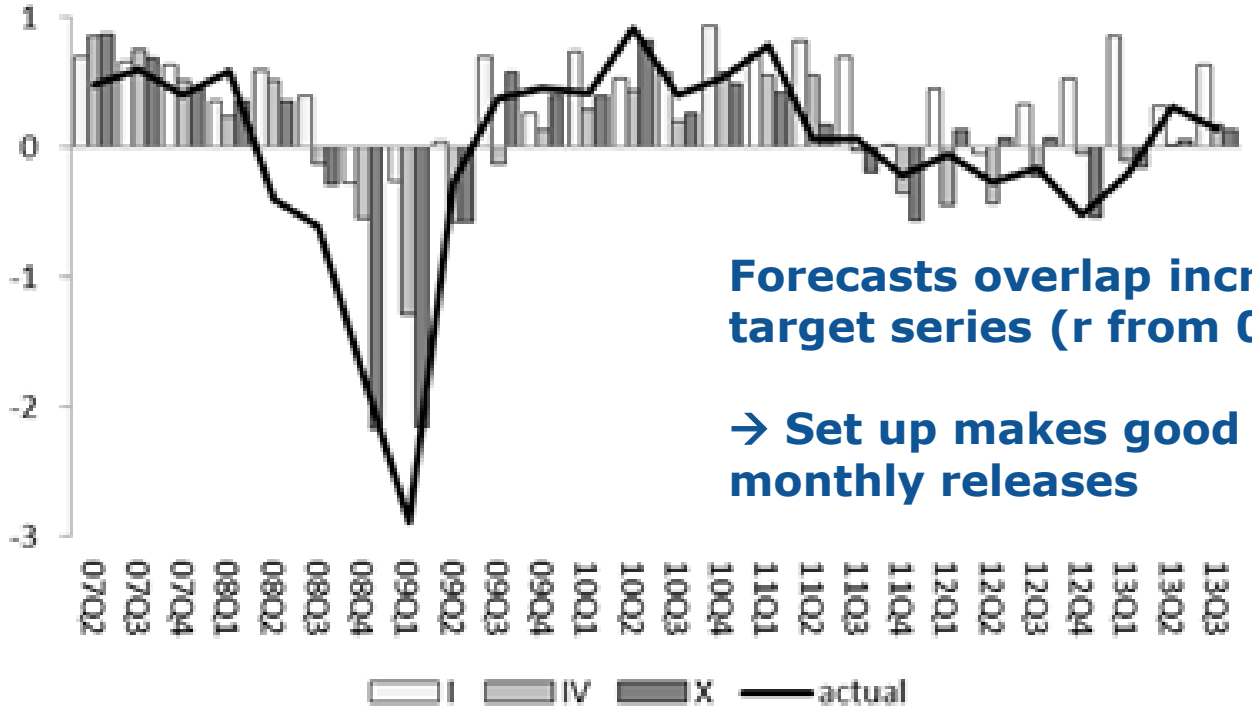
12th and 30th of the first month, and 12th of the second month of Q(t+1)

Relative abundance of data: month-2 and month-3 releases of MP2 to MP4, new data set MP5 (external trade data).

Very late prediction of GDP, (flash) release is impending, but backcast of Q(t) as **input for nowcast of Q(t+1)**, conducted on same day!

Assessing the information content of financial, survey and real activity data

Figure 1 – Out-of-sample forecasts from selected forecast rounds (FSQ)

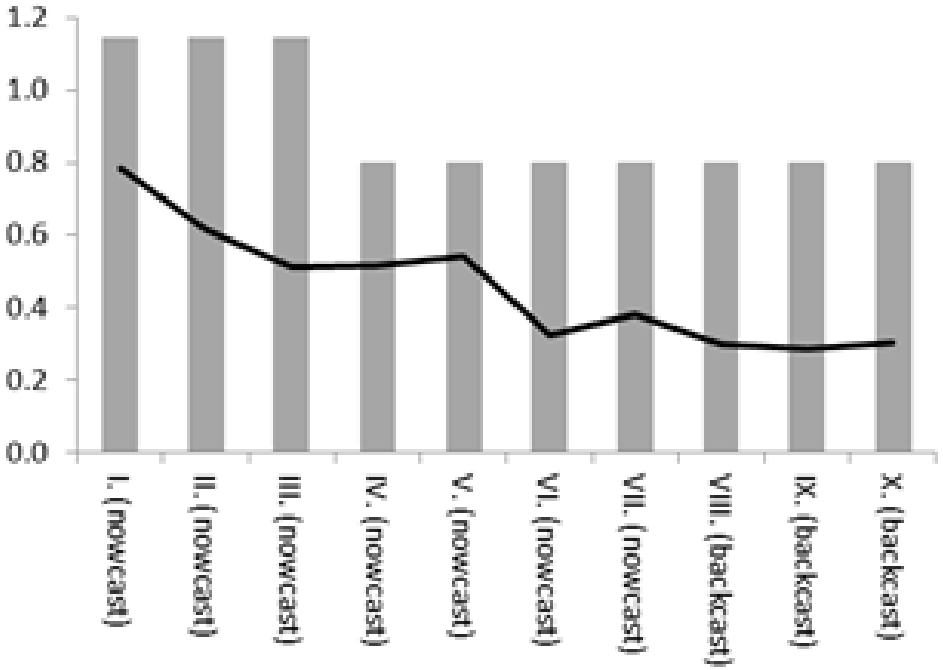


Forecasts overlap increasingly with target series (r from 0.68 to 0.92)

→ Set up makes good use of new monthly releases

Assessing the information content of financial, survey and real activity data

Figure 2 - RMSEs of FSQ and AR(1) in different nowcast rounds



FSQ model clearly and increasingly better than AR(1)

→ Adequacy of set of predictors

Evidence from models based on subsets of predictors

Forecast accuracy (2007q2–2013q3): RMSEs by model

			AR	FSQ	FQ	SQ	FS
Q(t)	m1	d12	1.14	0.78*	1.02	**1.20**	1.07
		d30	1.14	0.62*	**1.31**	1.29	1.03
	m2	d12	1.14	0.51*	**1.72**	1.54	1.18
		d15	0.80	0.51	**1.69**	1.56	0.94*
		d30	0.80	0.54*	**1.47**	1.35	1.01
	m3	d12	0.80	0.33*	1.80	1.12	**1.85**
		d30	0.80	0.38	1.44	0.79*	**1.59**
Q(t+1)	m1	d12	0.80	0.30	1.27	0.88*	**2.08**
		d30	0.80	0.29	1.25	0.96*	**2.17**
	m2	d12	0.80	0.30	1.09	0.74*	**2.05**

- * flags the best-performing model among FSQ, FQ, SQ, FS.
- Figures in bold highlight the worst-performing models among FQ, SQ, FS.
- RMSEs for AR and FSQ in levels.
- RMSEs of FQ, SQ and FS models expressed as fractions of FSQ RMSE.

- FQ model: financial and real data only (ex surveys)
- SQ model: survey and real data (ex financial)
- FS model: financial and survey data (ex real data)

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- SQ: financial data relevant for GDP nowcast in m1 and m2 (ratios > 1)
- 12th of m1: exclusion leads to RMSE increase by 20%.
- Dropping survey data (FQ) or real data (FS) leads to RMSE increase of only 2-7%
- 30th of m1 and whole m2: survey and financial data important (but dropping surveys leads to larger RMSE increase)
- From 30th of m3: model excl. financial data (SQ) better than full FSQ model → detrimental effect of fin. data in last 4 rounds

Evidence from models based on subsets of predictors

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- FQ: Survey data proves most important data category in second half of m1 and entire m2: dropping surveys results in RMSE increases of 31 to 72%
- removal of financial and real data implies smaller RMSE increase
- survey data remain to be important until end of forecast exercise, but:
- FS: real activity data become most relevant category from m3 onwards: omission drives up RMSE by up to 117% (plausible: 12th of m3 is IP release for m1)

Beyond timeliness - a counterfactual experiment

Re-run exercise with hypothetical dataset: all data available at the beginning (12th) of reference month (i.e. Jan. IP available on 12 January, instead of 12 March)

Counterfactual (2007q2–2013q3): RMSEs by model

			FSQ	FQ	SQ	FS
Q(t)	m1	d12	0.38*	1.35	1.02	**1.81**
	m2	d12	0.33	1.29	0.97*	**2.03**
		d15	0.32	1.31	0.95*	**1.86**
	m3	d12	0.30	1.09	0.74*	**2.05**

- * flags the best-performing model among FSQ, FQ, SQ, FS.
- Figures in bold highlight the worst-performing among FQ, SQ, FS.
- RMSEs of FSQ model reported in levels.
- RMSEs of FQ, SQ and FS models expressed as fractions of FSQ

- FS: real series are most important category (omission increases RMSE by 81 to 105%)
- SQ: financial data lose all significance: RMSE practically invariant to omission in m1 & 2; even markedly down with omission in m3 (RMSE ratio drops to 0.74).
- → benefits of financial data at the beginning of quarter mainly attributable to their timeliness.
- FQ: survey data relevant throughout entire exercise (ratios > 1) → survey data enhance nowcasting performance through more than just timeliness; complementary to real data

What are the sources of survey data's predictive power?

1. broader sectoral coverage than real series available before flash GDP estimate (service TO released more than 3 months after end of reference quarter) → under-representation of largest sector. Surveys can fill this gap
2. survey data include respondents' views on future developments (e.g. production expectations) → leading properties beneficial for early stages of nowcasting

(In m1 & 2, both sources potentially add value. In m3, forward-lookingness of survey data should be irrelevant in the counterfactual)

What are the sources of survey data's predictive power?

Counterfactual (2007q2–2013q3): RMSEs by model

			FQ	FSQ1	FSQ2
Q(t)	m1	d12	0.51	0.83	0.96
	m2	d12	0.42	0.91	0.97
		d15	0.42	0.90	0.88
	m3	d12	0.33	0.92	1.06

- RMSEs of FQ model reported in levels.
- RMSEs of FSQ1 and FSQ2 models expressed as fractions of the RMSEs of the FS model.

Counterfactual exercise for three different model set-ups:

- i) FQ model (financial and real data)
- ii) FQ plus forward-looking and services-related survey data (FSQ1)
- iii) FQ plus non-forward-looking and non-services-related survey data (FSQ2).

What are the sources of survey data's predictive power?

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	m3	d12	0.33	0.92	1.06

- RMSEs of FQ model reported in levels.
- RMSEs of FSQ1 and FSQ2 models expressed as fractions of the RMSEs of the FS model.

- FSQ1: ratios < 1: adding forward-looking and service-sector related questions drives down RMSE substantially throughout nowcast quarter, particularly in m1 (-17%).
- FSQ2: ratios around 1 or larger (except for m2), i.e. no impact
- → genuine forecasting power of survey data (i.e. beyond timeliness) appears due to forward-looking nature and coverage of services sector

A focus on the Great Recession period

Forecast accuracy (2008q1–2009q4): RMSEs by model

			FSQ	FQ	SQ	FS
Q(t)	m1	d12	1.19*	1.03	**1.32**	1.11
		d30	1.06*	1.17	**1.27**	1.04
	m2	d12	0.83*	1.56	**1.60**	1.22
		d15	0.84	1.49	**1.61**	0.92*
		d30	0.90*	**1.39**	1.38	1.03
	m3	d12	0.52*	1.71	1.06	**1.96**
		d30	0.60	1.35	0.75*	**1.68**
Q(t+1)	m1	d12	0.44	1.11	0.88*	**2.35**
		d30	0.41	1.09	0.94*	**2.44**
	m2	d12	0.45	1.02	0.68*	**2.27**

- * flags the best-performing model among FSQ, FQ, SQ, FS.
- Figures in bold highlight the worst-performing among FQ, SQ, FS.
- RMSEs of FQ, SQ and FS models expressed as fractions of FSQ

- FSQ: RMSEs have considerably increased
- Major conclusions remain valid:
- For virtually all stages of nowcasting exercise: best model contains survey and real data
- SQ: Financial data continues being irrelevant at the end of the nowcasting exercise (ratios <1).
- But: most relevant category throughout the first 1 ½ months.
- Only due to timeliness? →Counterfactual

A focus on the Great Recession period - Counterfactual

Counterfactual (2008q1–2009q4): RMSEs by model

			FSQ	FQ	SQ	FS
Q(t)	m1	d12	0.55*	1.35	1.11	**2.13**
	m2	d12	0.48	1.19	0.97*	**2.35**
		d15	0.48	1.17	0.90*	**2.07**
	m3	d12	0.45	1.02	0.68*	**2.27**

- * flags the best-performing model among FSQ, FQ, SQ, FS.
- Figures in bold highlight the worst-performing among FQ, SQ, FS.
- RMSEs of FQ, SQ and FS models expressed as fractions of FSQ

- Contrary to whole period: omission of financial data in m1 leads to increase of RMSE by 11%
- →beneficial effect of financial data during financial crisis is both due to timeliness *and* specific thematic relevance
- (Survey and real data turn out to be essential both in calm and turbulent times; real data continue being most important).

Summary

- timeliness often considered as the main/only "quality" of survey data
- our findings show that there is informational content even when timeliness is controlled for
- surveys are beneficial in GDP nowcasting also due to broad sectoral coverage and forward-looking nature
- Financial data turn out as irrelevant predictors across the full sample once timeliness is controlled for
- sub-sample analysis of Great Recession highlights the usefulness of financial data in times of financial turmoil

Thanks for your attention!

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