A daily indicator of economic growth

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Introduction

- Decision-makers need to assess in real-time on a daily basis the current and future state of the economy.
- Economic perspective: a selection of the most relevant indicators is needed, together with a method to combine the various indicators into a summary measure.
- Statistical perspective: constructing and monitoring in real time a daily indicator is complicated by the unbalancedness of the data.
- Daily indicators of economic activity are usually not published, despite methods are available.
  - Two possible exceptions are the Eurocoin indicator and the Aruoba-Diebold-Scotti Business Conditions Index.
Aim of this paper

- We study alternative methods for constructing a daily indicator of growth that, drawing on a potentially large number of predictors available at the daily/monthly frequency:
  1. provides reliable predictions
  2. can be easily updated at the daily frequency
  3. gives interpretable and stable signals.

- We select three alternative methodologies from the large pool of available techniques:
  - Bridge equations
  - MIDAS approach, as introduced by Ghysels et al. (2004)
  - UMIDAS, linear variant to MIDAS introduced by Foroni, Marcellino and Schumacher (2013)

- As a target variable we adopt GDP, the key economic indicator of economic activity.
Summary of the methodology and results

- We start with a preliminary screening of the available indicators using single regressors, to select a limited number of variables that have information content for our forecast target.

- We then proceed by estimating multi-indicator models.

- Due to collinearity of the regressors, the coefficients have no clear interpretation.

- We turn to forecast pooling. Averaging the forecasts produced by single indicators provides accurate estimates of GDP growth.

- The performance of linear (bridge and UMIDAS) models is in line with that of MIDAS regressions.

- Our preferred specification for the daily indicator is then based on the UMIDAS approach, which seems strikes the best compromise between parsimony, simplicity and accuracy.
Methods

1. MIDAS (Ghysels et al. (2004)): the response to the higher-frequency explanatory variable is modelled using highly parsimonious distributed lag polynomials.

2. U-MIDAS (Foroni, Marcellino and Schumacher (2013)): MIDAS which does not resort to functional distributed lag polynomials.

3. Bridge equations: linear regressions that link ("bridge") high frequency variables to low frequency ones, providing some estimates of current and short-term developments in advance of the release.

   - In our context, we suggest to aggregate the daily indicators at the monthly frequency by averaging.
   - In order to forecast the missing observations of the monthly indicators which are then aggregated to obtain a quarterly value of $x_{itq}$, it is common practice to use autoregressive models.
Dataset 1

- **QUARTERLY DATA:**
  - Our only quarterly series is Euro Area GDP quarter on quarter growth rate, our forecast target.
  - We interpret such forecast as a daily indicator of overall economic conditions.
  - We assume that the quarterly variable is released on the 15th of each second month of the quarter after the one under analysis (e.g. on the 15th of May, we can see the advanced release of Q1).

- **MONTHLY DATA:**
  - As monthly explanatory variables, we use a set of indicators commonly recognized to have a good forecasting performance.
  - Examples: industrial production, construction production index, unemployment rate, retail trade, expectations on employment next month, and the economic sentiment indicator.
  - We fix a stylized release calendar, to replicate as closely as possible the real-time data flow.
Dataset II

- **DAILY DATA:**

  - 47 daily series including exchange rates, interest rates at different maturities, spreads and equity indexes.

1. The release calendar is extremely irregular, due to the presence of festive days and holidays.

   - We keep the values of the daily series constant over holidays (equivalent to saying that on Christmas day, when no new data are released, the forecast for GDP is unchanged with respect to the previous day).

2. The second issue relates to the irregular number of days in each month, from 28 to 31. We construct a stylized, fictitious, calendar in which we attribute 31 days to each month (equivalent to saying that February has 31 days but we only observe the first 28).
Dataset III

- We match the daily information with the available monthly indicators by keeping the monthly indicator constant in between releases.

3. Daily series are extremely volatile, so that we need a way to extract a reliable signal useful for forecasting GDP growth.

- We use moving averages of the daily series, such that each day we have the average of the previous 20 observations (good approximation of the number of working days in a month).

4. All the data are reduced to stationarity by an appropriate quarter on quarter transformation.
Dataset IV

- Sample starting in Q2-1999 and ending in Q2-2013.
- For each working day of the evaluation sample, we produce a prediction of quarter on quarter GDP.
- We use a recursive approach.
Indicator selection

- The best performing indicators change frequently over time with MIDAS/U-MIDAS models.

- Indicators appearing among the five best performing models:
  - Daily indicators: long-term interest rates, nominal exchange rate and interest rate spread (difference between the lowest and the highest yield, in 10 year bonds within the euro area).
  - Monthly indicators: Economic Sentiment Indicator, Employment expectations for the months ahead, Industrial Production Index.

- Differences in terms of predictive accuracy between MIDAS/U-MIDAS are not large.

- Focusing only on U-MIDAS models does not entail significant losses in terms of forecast accuracy.

- When using bridge models, the best daily indicators are rather stable across the days of the quarter and similar to those obtained on the basis of MIDAS/UMIDAS models.
We consider three monthly variables (the Industrial Production Index, the Economic Sentiment Indicator, the Employment Expectations index) together with three daily indicators (the 10 year interest rate on government bonds, the euro/US dollar exchange rate, and the 10 year lowest/highest yield spread).

We select four core indicators (IPI, ESI, 10y and USD).

We start our evaluation sample on 1st July, 2011.
UMIDAS model based on IP, ESI, 10y and USD in general produces lower RMSE than most of the underlying single indicator models.

Due to collinearity, there are substantial problems in the interpretation of its coefficients.

The weights of the indicators change on a daily basis during the quarter.
Best single indicators I

- We report the estimated coefficients (sums of the UMIDAS coefficients) of the 6 single indicator UMIDAS models.
- With the exception of the SPREAD, the coefficients are rather stable across quarters.
- The coefficients change within the quarter.
- All the coefficients have the proper sign from an economic point of view.
Pooling of selected single indicator UMIDAS I

- We assess whether combining the nowcasts based on the alternative daily and monthly indicators yields gains with respect to using single indicator models.
- We use inverse MSE weights for the combination:

\[ w_i = \left( \frac{1/MSE^i}{\sum_{i=1}^{n} 1/MSE^i} \right). \quad (1) \]

- We consider combining either all the 6 single indicator UMIDAS models, or only the 4 main ones (based on IP, ESI, 10y and USD).
- We identify a break in the intercept and dates it at 2008Q2. We insert an appropriate dummy in all the daily UMIDAS models.
In summary, the analysis supports the use of an inverted MSE combination of four single UMIDAS models (without AR and with a step dummy from 2008Q2), based on monthly IP and ESI and daily 10y and USD, to construct the daily indicator of economic conditions for the euro area.
Pooling of selected single indicator UMIDAS III
Pooling of selected single indicator UMIDAS IV
Pooling of selected single indicator bridge models I

- We repeat the same analysis conducted with U-MIDAS.
- With the exception of the 10 year yield and of the SPREAD, the coefficients are rather stable across quarters.
- The coefficients change within the quarter.
- All the coefficients except SPREAD have the proper sign from an economic point of view and have an evolution similar to the one observed in UMIDAS models.
- We consider combining either all the 6 single indicator bridge models, or only the 4 main ones.
Pooling of selected single indicator bridge models II

- Contrary to the UMIDAS case, the RMSE is rather stable in the first part of the quarter but slightly increasing from then onwards.

- RMSEs are overall comparable with those from the pooled UMIDAS model.

- The results are overall rather good, though the increasing pattern of the RMSE over time and the lack of interpretability of the spread coefficient support the use of the pooled UMIDAS.
Conclusions

- We have studied alternative methods to construct a daily indicator of growth.
- Our aim was to construct an indicator that (i) provides reliable predictions (i) can be easily updated at the daily frequency (iii) gives interpretable signals.
- We have selected a number of candidate predictors to be used in the composite indicator.
- Given the problematic results for the multi indicator models and the need to use all the best available information, we have combined the best performing single indicator UMIDAS and bridge models.
- The analysis supports the use of an inverted MSE combination of four single UMIDAS models (without AR and with a step dummy from 2008Q2), based on monthly IP and ESI and daily 10 year bond yield and exchange rate, to construct the daily indicator of economic conditions for the euro area.