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A case study: the revisions and forecasts of Euro Area quarterly GDP

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ABSTRACT

In general, rational economic agents trade off the cost of waiting for the statistical agencies disseminate the final results of the relevant surveys before making a decision, on the one hand, and of making use of some model based predictions. Thus, from the viewpoint of agents, predictions and preliminary results from surveys often compete against each other. Comparing the loss attached to predictions, on the one hand, and to possible preliminary estimate from incomplete samples, on the other, provides a broad guidance in deciding if and when statistical agencies should release preliminary and final estimates. In this paper, the case of the dissemination of figures on quarterly GDP in the Euro Area is examined. The main conclusion is that the so called "flash estimates" actually provide valuable information to the users, while intermediate releases, published before three months from the end of the reference quarter can be substituted by model based estimation without any loss of accuracy.

KEYWORDS: Accuracy, Data Dissemination, Forecast, Preliminary Estimates, Timeliness.

J.E.L. CLASSIFICATION: C44, C49, C82, C83.

1 Introduction (*)

Rational economic agents base their decisions partly on statistical data describing the current state of the world. Nevertheless, generally they are not in the position to wait for the dissemination of the final results of the relevant surveys before making their decisions. In fact, timing matters in many decision processes, such as investment, consumption, coordination between supply and demand of non-storable goods and services, etc. Thus, the users of statistical data often have to make some model based guess about the final outcome of statistical surveys, usually referred to as "nowcasts". As a consequence, from the viewpoint of agents, predictions and preliminary results from surveys often compete against each other. This fact adds new elements to the long lasting debate on the trade-off between timeliness and accuracy of official statistics.

At time t+h, the predictions on the status of the relevant variables at time t can be based only on an information set, say Ω_{t+h}, smaller than the one possibly available by the end of the relevant surveys, at time t+H. Agents are aware to incur in a loss, say F(h), if they make decision at time t+h instead of waiting until t+H. Hopefully, the accuracy of nowcast likely improves as time goes by, so that F(h) decreases with h. On the other hand, collecting and elaborating data within a statistical survey takes time, thus the expected accuracy of possible preliminary sample estimates increases as data accumulate. As a consequence, the loss associated to the use of preliminary estimates based on the information set including only the data collected until t+h, is a decreasing function of h as well, say S(h). However, at time t+H, after data collection and elaboration have been completed, surveys hopefully provide results much more accurate than the best forecasts. Thus the advantage of using forecast, say F(h) – S(h), turns out to be a decreasing function of h as well.

As long as the statistics should meet users' needs, the comparison between F(h) and S(h) provides a broad guidance in deciding when and how preliminary and final estimates should be released. In fact, users would take advantage from the dissemination of preliminary data only if they provide better information compared to available forecasts, that is as far as $S(h) < F(h)$, otherwise they would continue using their forecasts. This approach have been developed by D'Elia (2010)

(*) The views expressed in the paper are those of the author and do not necessarily reflect views at Istat. The author gratefully acknowledges the valuable suggestions and criticisms come from some early readers of the paper. Of course, errors or omissions are the responsibility of the author.

The main aim of this paper is to apply this approach to the study of the dissemination of data on GDP in the Euro Area. In fact, the GDP is a key variable for policy makers' and economic agents' decisions. In particular, every error on the level and dynamics of GDP produces a direct loss due to under or overestimating the actual market size of national firms and indirect losses related to poor forecasts on future market dynamics. Thus, it is worth comparing the accuracy of forecasts, preliminary estimates and official data releases of GDP in a highly integrated market as the Euro Area.

2 The data

In Europe, the calendar for releasing quarterly national accounts is currently detailed by the EC Regulation N° 1392/2007. At the moment, each quarter the statistical agency of the European Commission (Eurostat) produces three releases of figures for the Euro Area GDP:

- a "flash estimate" at 45 days after the end of the reference quarter, which goes beyond the minimum requirements foreseen by the EC Regulations;
- a "first release" at 65 days after the end of the reference quarter, which includes also data on the main components of GDP from output and expenditure side;
- a "second release" at 105 days after the end of the reference quarter, including additional variables estimates and more detailed breakdown by industry, sectors, etc.

An intermediate release 75 days after the reference quarter provides an estimation of employment as well. In addition, later releases of quarterly GDP figures are disseminated after each revision of annual data. Of course, the dissemination policy of Eurostat has improved over time.

The different "vintages" of GDP figures are collected and published within the Real-Time DataBase (RTDB) project, coordinated by the Euro Area Business Cycle Network (EABCN), with the aim of providing the researchers and policy makers with timely and reliable information about the main economic indicators in the Euro Area (see Giannone *et al*., 2010). The dataset was constructed by retrieving data published since January 2001. In addition the vintages of time series of GDP and other main indicators were reconstructed back to 1999. All indicators in the dataset are reported according to the methodology adopted at the time of their publication. For example, the data on GDP at constant prices were replaced by chain indices in November 2005, and the definition of the Euro area is the one

holding at the time of each press release. At the moment, the data are disseminated by the ECB Statistical Data Warehouse on the website *http://sdw.ecb.europa.eu/browse.do?node=4843526*.

3 A naïve model to forecast and nowcast GDP

Exploiting the Real-Time database, it is possible to estimate the accuracy of preliminary statistical estimates of Euro Area GDP, comparing them to some ready available forecasts and nowcasts based on available data. In order to make the exercise more challenging, the forecasts made before the end of each reference quarter and the nowcasts based on preliminary estimates are simulated by using intentionally very simple time series models, estimated (inefficiently) by ordinary least squares on data actually available at the moment of each simulation. This procedures intends to mimic the actual behaviour of a unsophisticated user who exploits only official information readily available on GDP and disregards any other source of data, such as timely short term statistics, "soft data" on business and household confidence, possible private information, etc. Thus, in principle, the experiment is strongly biased toward supporting the actual data dissemination policy adopted by Eurostat, since subsequent official estimates potentially embody more information than that used by the factious (naïve) user considered in our simulation.

In particular, the forecast Y^*_t of the annual growth rate of GDP made before the end of the reference quarter t, is based on the following model

$$Y^*_t = c_{0,t,v} + a_{1,t,v}\, Y_{t-1,v} + a_{2,t,v}\, Y_{t-2,v} + a_{3,t,v}\, Y_{t-3,v} + u_{t,v} \qquad [1]$$

where $c_{0,t,v}$ and $a_{i,t,v}$ are parameters estimated by using only data belonging the vintage v available at time t-1, not including Y_t yet; $Y_{t-s,v}$ is the GDP growth rate released at time v, lagged by s quarters; $u_{t,v}$ is a random disturbance, not necessarily uncorrelated and homoscedastic. Even though the assumed characteristics of $u_{t,v}$ would require appropriate methods for estimating the parameters of [1] efficiently, our fictious user is supposed to use only ordinary least squares. This assumption makes the forecast even worse than the one possibly produced by the model [1].

When a new vintage of GDP figures, say $Y_{t,v}$, is released, an improved nowcast of GDP growth in the past quarter, say of Y^v_t, can be obtained by using the model

$$Y^v_t = k_{0,t,v} + b_{0,t,v}\, Y_{t,v} + b_{1,t,v}\, Y_{t-1,v} + b_{2,t,v}\, Y_{t-2,v} + b_{3,t,v}\, Y_{t-3,v} + v_{t,v} \qquad [2]$$

where the parameters $k_{0,t,v}$ and $b_{i,t,v}$ likely differ from the corresponding parameters $c_{0,t,v}$ and $a_{i,t,v}$ in [1]; also the properties of the stochastic term $v_{t,v}$ may differ from $u_{t,v}$. The rationale for [2] is that the revisions of GDP hardly are purely random and serially uncorrelated, so that there is a room for improving the accuracy of the official estimates by taking into account also the typical time series structure of revisions (see Fixler and Grimm, 2006, for the US GDP, Frale and Raponi, 2012, for the case of Italy).

4 The results

The results of the models [1] and [2] can be compared to the accuracy of official estimates of GDP, summarized in Table 1 for different vintages between 2001 and 2010. Since it is unlikely that an user is in the position to wait for the very definitive estimates of GDP, possibly available after a decade, here the benchmark for evaluating the potential loss of using preliminary data has been set to the figures released about one year after the end of the reference period, more precisely between 360 and 390 days after the quarter under examination.[1] As expected, the size of the deviation from the preliminary estimates and the benchmark improves almost regularly as the time goes by, reflecting the enhancement of the information set on which the GDP estimates are based. In particular the mean absolute error (MAE) of the very first estimates of annual growth rates is about 0.19 percentage points and its median is 0.16%, due to the effect of few large revisions in the series. In fact, excluding the 25% of best and worst performances respectively, the size of revisions ranges between 0.11% and 0.23%. The accuracy of estimates improves almost linearly with the dissemination delay from the end of the reference quarter, and the MAE falls below 0.1% after 5 months. In addition, the asymmetry in the distribution of revisions size reduces sharply even after a couple of months. Thus the complain of Mankiw and Shapiro (1986) and Croushore, and Stark (2005) about the noise introduced by the revisions of GDP in the US does not seem to apply to the Euro Area figure as well.

Also by interpolating the size of errors by vintage using a local first degree polynomial estimator, described by Fan (1992),[2] it turns out that the MAE reduces at each revision, and the dispersion around the MAE decreases as well, as reported in Figure 1. This non parametric approach has the advantage to provide an estimation for whatever vintage, even non existing actually. In particular, the error

[1] This choice limited the time span available for the estimation to 2010.

[2] For each vintage, the interpolation is based on a series of weighted least square estimators in which the observations close to the reference vintage are weighted by a "kernel function". The "bandwidth" of the weighted observations has been determined according to the formula proposed by Fan and Gijbels (1996).

associated to a virtual a statistical survey carried out just after the end of the reference quarter can be estimated of about 0.27 percentage points. Nevertheless, this value likely underestimates the true value, since it relies on the unrealistic assumption that sample information improves linearly as time passes by, that is hardly supported by the evidence on the actual data collection processes, that are characterised typically by a discontinuous reduction of the sample error size, just by the beginning of the survey and later when available information "concentrates".

Even taking in mind that an error size by 0.27 is a lower bound for an ideal release of GDP figures just by the end of the quarter, it can be compared to the performance of the model [1]. In addition, the curve of error size estimated non parametrically can be compared with the forecasts obtained by using the model [2] as the preliminary estimates are disseminated. As shown in Table 2, the comparison to the forecast available even before the end of the reference quarter is quite bit favourable to the first official estimates. In fact, the MAE of the naïve projections based on [1] is only 0.01 points above the MAE of a virtual survey based estimation carried out just by the end of the quarter, but is 0.1 points above the MAE of the first release of data. Noticeably, also the naïve projections show a dominance of few large errors, making the MAE significantly larger than the median absolute error, possibly related to some unpredictable shocks in the GDP dynamics hardly anticipated by a pure extrapolative model.

In any case, it seems that the preliminary official estimates of GDP released by Eurostat provide the users with valuable information about the dynamics of the economy, surely more accurate than a pure time series extrapolation of available data. Of course, more sophisticated users, exploiting a better information set could produce even better estimates than very preliminary figures. Nevertheless, the discrepancy between the MAE shown in the first row of table 1 and 2 respectively is large enough to expect that the contribution of non-sample information should be very large to overcome the actual performances of available preliminary estimates. It follows that, according to approach sketched in D'Elia (2010), the users likely would appreciate much more timely flash estimates of GDP from Eurostat, even though they were necessarily less accurate than the current ones.

The state of affairs changes dramatically after the release of the flash estimates. Since apparently the model [2] exploits more efficiently the information embodied in the past revision of the GDP figures, even a not very sophisticated and poorly informed user would be able to estimate GDP dynamics better than the next two or three release of official figures. In fact the MAE of the model [2] is about at par with the figures released between 111 and 150 days after the end of the quarter, that is about 3 months

after the flash estimates. In addition, the risk of very large error is quite limited, since in the 75% of the better cases the error size is less than 0.13%, that is almost the risk attached to official figures released about 6 month after the end of the reference quarter. Thus, the value of the figures released in the meanwhile is likely scarce for the users. In other words, the user would benefit from an improvement of the accuracy of the "first" and "second" releases, but not from a solely anticipation of their dissemination.

5 Conclusive remarks

To sum up, the approach proposed by D'Elia (2010) and the results shown in Figure 1, suggest to disseminate

- a very early estimate of GDP as soon as possible before the first release (possibly after a month);
- another release about 170 days after the end of the quarter and
- a second release 90 days after the previous one.

Noticeably, the threshold above were determined assuming that the typical user of data do not make use of very sophisticated forecasting methods and large information sets, and that after each nowcast, made when official data are disseminated, the nowcast is not improved further. Otherwise, the shorter lines in Figure 1 would be downward sloped, so that they cross the curve of the accuracy of official releases later than 170 and 260 days after the end of the reference quarter.

Indeed, if Eurostat would release the figures of Euro Area GDP more frequently, the users could make further nowcasts as well, assumedly improving the accuracy of the two nowcasts considered in this exercise. In case, the optimal limiting dissemination policy to meet the potential users' demand would be releasing data almost continuously over time, in order to enable the users to exploit the official data to improve their nowcasts as well. Nevertheless, this policy is unfeasible because it is too demanding both for Eurostat and for the users, who are likely "rationally inattentive" in order to balance the loss attached to deciding under imperfect information and the cost of improving their information set (see Sims, 2003).

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Table 1 – The accuracy of vintages of Euro Area GDP annual growth rate between 2001Q1 and 2010Q4
(distribution of absolute errors)

Days after the end of the reference quarter	25th centile	median	mean	75th centile
Less than 65	0.105	0.162	0.192	0.230
66 - 90	0.064	0.105	0.153	0.268
91 - 120	0.084	0.138	0.135	0.169
121 - 150	0.060	0.130	0.127	0.161
151 - 180	0.041	0.094	0.100	0.156
181 - 210	0.034	0.068	0.074	0.096
211 - 240	0.030	0.082	0.075	0.099
241 - 270	0.030	0.066	0.070	0.096
271 - 300	0.022	0.029	0.048	0.091
301 - 330	0.011	0.050	0.046	0.061
331 - 360	0.005	0.012	0.025	0.041
361 - 390	0.000	0.000	0.000	0.000

Source: Author's computation on ECB Statistical Data Warehouse.

Table 2 – The accuracy of forecast and nowcasts of Euro Area GDP annual growth rate between 2001Q1 and 2010Q4
(distribution of absolute errors)

	25th centile	median	mean	75th centile
Pure extrapolation one quarter ahead	0.091	0.202	0.283	0.374
Nowcast based on the flash estimate [(a)]	0.059	0.104	0.100	0.126
Nowcast based on the second release [(a)]	0.030	0.045	0.060	0.085

[(a)] *The sample had to be reduced to 2003Q1 - 2010Q4 to make the estimation of the models [1] and [2] feasible.*

Figure 1 – The accuracy of forecasts, nowcasts and official estimates