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# Forecasting inflation through a bottom-up approach: How bottom is bottom?

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**Abstract**

The aim of this paper is to assess inflation forecast accuracy over the short-term horizon, using Consumer Price Index (CPI) disaggregated data, through a bottom-up approach. That is, aggregating forecasts is compared with aggregate forecasting. A new dimension to the question of to bottom-up or not is introduced by considering different levels of data disaggregation, namely a higher disaggregation level than the one considered up to now. This raises modelling issues that one has to cope with. In particular, it is suggested the use of a new strand of models, the Factor-Augmented SARIMA models. Considering as case-study the Portuguese one, we find an inverse relationship between the forecast horizon and the amount of information underlying the forecast, when minimizing the RMSFE.
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## 1. Introduction

In many countries, and especially in the European Union, the primary objective of monetary policy is price stability. For example, according to the European Central Bank (ECB), price stability is defined as "a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below " but "close to 2% over the medium term " (ECB, 2003a). Therefore, to ensure that this objective is attained, the monetary authority needs to be constantly

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monitoring and forecasting the evolution of prices. The existence of lags, caused by transmission mechanisms, and economic shocks, which endanger price stability, explains why inflation forecasting is regarded as a crucial tool for conducting monetary policy. Actually, Jean-Claude Trichet (ECB, 2003b) said that inflation forecasts are "useful, even indispensable, ingredients of monetary policy strategy".

Thus, forecasting inflation for the euro area as a whole is very important for monetary policy purposes. However, it is also relevant to forecast country level inflation. First of all, country level inflation forecasting contributes to a better understanding of the different transmission mechanisms in each country. Furthermore, Marcellino, Stock and Watson (2003) found evidence that forecasting inflation at the country level and then aggregating the forecasts increases accuracy against forecasting at the aggregate level. Finally, the usefulness of inflation forecasts is not restricted to monetary policy purposes. For example, improving short-term forecasting is also important because it allows to better anticipate near-term future developments, which enhances evaluation of current trends and improves the conjunctural assessment of central bankers. Moreover, inflation forecasts are also quite relevant in other areas, such as fiscal policy, wage bargaining and financial markets.

In this context, it is crucial to have more and more accurate inflation forecasts. One possible way of improving forecast accuracy is by considering more data, in particular, disaggregated one. Several studies have focused on whether using this kind of information increases forecasting accuracy. Actually, two strands of literature about the role of disaggregated information on improving forecast accuracy can be distinguished. One strand focus on using the forecasts of disaggregates to obtain the forecast for the aggregate — the bottom-up approach. Let $y_t$ be the variable of interest for forecasting. Suppose that this variable can be decomposed in n subcomponents, $y_{it}$ ($i=1, \ldots, n$), the disaggregated series. Then, $y_t = \sum_{i=1}^{n} \alpha_i y_{it}$, where $\alpha_i$ are the weights associated with each subcomponent. Instead of forecasting $y_t$ by fitting a model directly to this variable, the bottom-up approach advocates that one can obtain forecasts for the aggregate series by aggregating the forecasts of the disaggregated ones, $\widehat{y}_t = \sum_{i=1}^{n} \alpha_i \widehat{y}_{it}$. According to this approach, using disaggregated information can contribute to increase forecast accuracy, which means that aggregating the forecasts of disaggregated series can be better than forecasting the aggregate directly.

For example, Lütkepohl (1984a,b) argues that if the disaggregated data are generated by a known vector ARMA process then it is preferable to forecast the disaggregated variables first and then aggregate the forecasts, rather than forecast the aggregated time series directly. However, in practice, this is not always true, because of parameter and model uncertainty. Lütkepohl presents evidence that suggests that the forecasts from the aggregated process are superior to the aggregated forecasts from the disaggregated process for large lead times $h$ if the orders of the processes are unknown. So, does aggregation of disaggregated forecasts improve forecasting accuracy? The answer to this question is not clear-cut. One advantage of the bottom-up approach is the possibility of capturing idiosyncratic characteristics of each variable by modelling each one individually. However, disaggregated forecast inaccuracy might increase if models are misspecified. Also, what happens with forecast errors is not unambiguous. Forecast errors of the disaggregated variables might cancel out or not.

The second strand explores the possibility of condensing the large information set into a small number of variables, which retains the main features of the original dataset. This means that, for forecasting purposes, a large number of predictors is replaced by a reduced number of variables – diffusion indices, or dynamic common factors – without a significant loss of information (see Stock and Watson, 1998).

This paper tries to merge both strands (see also Marcellino et al., 2003). On one hand, dynamic common factors are introduced in the forecasting models, while, on the other hand, this is done for

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