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Modelling industrial new orders

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ABSTRACT

This article models industrial new orders across the European Union (EU) countries for various breakdowns. A common modelling framework exploits soft (business opinion surveys) as well as hard data (industrial turnover). The estimates show for about 200 cases that the model determinants significantly help in explaining new orders' monthly growth rates. An alternative estimation method, different model specifications and out-of-sample and real-time forecasting all show that the model results are robust. We present real-time outcomes of a European Central Bank (ECB) indicator on industrial new orders at an aggregated euro area level. This indicator is largely based on national new orders data and on estimates yielded by the model for those countries that no longer report new orders at the national level. Finally, we demonstrate the leading content of the ECB indicator on euro area new orders for industrial production.

1. Introduction

This study models industrial new orders for EU countries for various breakdowns: total, total excluding heavy transport equipment, the main industrial groupings, and domestic and non-domestic. The model deploys various data sources. In particular, we use surveys from the European Commission's DG ECFIN business survey in manufacturing as well as from *Markit* amongst Purchasing Managers (PMI), Eurostat's official statistics on industrial turnover, and variables aimed at improving the model dynamics.

The reason for this modelling exercise was to fill a data gap on industrial new orders that emerged following the decision to terminate the collection of data on industrial new orders by Eurostat, the Statistical Office of the EU, at the end of May 2012, i.e. final reporting period is March 2012 (Eurostat, 2012). The Eurostat collection of the industrial new orders variables stopped in the context of prioritisation in the development and production of statistics in the light of reduced resources and with the objective of reducing the burden on the European Statistical System. Another reason mentioned by the European Statistical System Committee was that industrial new orders were intended to serve as a leading indicator of future production, but that the predictive capacity of new orders has proven to be limited. The latter reason is in our view from a theoretical point of view weak, because there is, by nature, a lead time between the placement of an order and the production of the product. The lead time, however, typically varies across types of products. The lead time is limited for non-durable consumer goods, whereas it can be quite high for certain capital goods, e.g. airplanes.

Following the discontinuation of statistics on industrial new orders by Eurostat, our study introduces the ECB indicator on industrial new orders at an aggregated euro area level. This indicator is compiled from a mixture of national data, consisting of (1) hard statistics on new orders for those countries that have decided to continue the collection of industrial new orders statistics at a national level; and (2) new orders estimates obtained from the modelling framework presented in this article. Correspondingly, the euro area aggregate series consist of official hard data formerly collected by Eurostat (up to March 2012); and from April 2012 onwards, aggregates obtained from the combination of national data and the outcome of the estimation framework, using Eurostat's turnover country weights with a base year 2010. Despite the discontinuation at euro area aggregate level, a large number of EU countries continues the new orders data collection at a national level, reflecting the importance of industrial new orders statistics for conjunctural analysis in those countries. These countries transmit monthly the nationally collected data to the ECB. The transmitted time series are preferably seasonally and working-day adjusted, and expressed in terms of indices (from 2013 onwards base year 2010). Ireland, France, Cyprus, Luxembourg, Malta and Slovenia (euro area), and Denmark, Latvia, Lithuania and the United Kingdom (non-euro area) have officially discontinued the data collection at time of preparing this article. All other EU countries continued with the collection at the national level.

New orders are widely monitored by analysts and policy makers across the globe, despite the fact that Eurostat discontinued the provision of euro area industrial new orders statistics, because new orders have historically shown to empirically anticipate business cycle turning points. There is a long-standing tradition of new orders leading industrial production (Alexander and Stekler, 1959). More recent evidence

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supporting the leading properties of new orders is provided by Döpke et al. (1994) for Germany and by García-Ferrer and Bujosa-Brun (2000) for France and Spain. Furthermore, new orders in manufacturing (specifically, the nondefense capital goods excluding aircraft orders sub-category) have historically exhibited high correlation with the cyclical components of the business cycle in the U.S. (Stock and Watson, 1999). Consistently, manufacturing new orders in capital goods have served as inputs to the Conference Board's Leading Economic Index for both the U.S. and the euro area. New orders are also amongst the leading series used for the widely monitored OECD's composite leading indicator.

Notwithstanding the importance of new orders for conjunctural analysis, little literature exists that explicitly models industrial new orders and thereby could underpin our modelling exercise. We are aware of only a few studies that focus on modelling industrial new orders. Nicholson and Tebbutt (1979) draw upon early investment theories to model new orders received from the private industrial sector. They also appreciate that new orders for non-residential construction work lead the UK construction industry activity. Other studies focus on the link between business sentiment surveys and the business cycle. For example, Klein and Moore (1981) find that entrepreneur surveys on new orders are relevant for an assessment of the UK business cycle in addition to the traditional quantitative time series. More recent research concludes that business tendency surveys are able to predict the Italian business cycle, and hence are useful for forecasting the Italian real economy in the short run (Cesaroni, 2011). Etter and Graff (2003) model new orders for Switzerland using business surveys. They find that the OLS-generated estimates predict levels, turning points, peaks and troughs of their reference series very closely throughout the whole estimation period. Finally, in reaction to the ensued discontinuation of euro area new orders statistics, the European Commission (2011) analyses the relevance of EC business survey in manufacturing to the discontinued series, concluding that surveys contain relevant information for assessing the latter.

To the best of our knowledge, our study is the first to model industrial new orders by deploying qualitative and quantitative data. Given the lack of formal academic consideration as well as the small number of observations available for industrial new orders for EU countries (in some cases starting in 2003 and ending in 2012) the model is constructed by diagnostically building up on its simplest versions. Several criteria to accept the final model version are applied. Apart from statistical criteria (not only t-statistics, but also the white noise property of the model residuals), restrictions accounting for plausible economic properties (e.g. it is implausible for new orders to consistently grow faster than sales) are also considered.

The main finding of our work is that the model designed tellingly enlightens industrial new orders month-on-month (hereafter m-o-m) growth rates, which significantly benefit from the selected model determinants across all cases. In particular, turnover and surveys on new orders matter for monthly new order growth. At the euro area aggregate level, the model explains about 50% of the variation in total new orders m-o-m growth rate. The explanatory power varies for the other breakdowns of new orders considered at the euro area aggregate level between around 30% (capital goods) and 70% (intermediate goods). These are promising outcomes for the inherently noisy monthly growth rates in industrial new orders. The robustness of our model is analysed in various ways (including an alternative estimation method and different model specifications), confirming that it provides statistically as well as economically reliable outcomes, even out-of-sample and in real time.

The outline of this paper is as follows. Section 2 describes the model and its determinants and Section 3 the data. Section 4 presents the estimation results of our model including out-of-sample forecasts and explores a couple of estimation and modelling alternatives. Section 5 introduces the real-time outcome of the ECB indicator on euro area industrial new orders as well as scrutinises its forecasting properties in real time. Section 6 reports results about new orders leading production. Section 7 concludes.

2. Model

Our study pioneers modelling industrial new orders as far as scale (euro area aggregate as well as all EU countries), scope (totals, totals excluding heavy transport equipment as well as all breakdowns across main industrial groupings and origins of demand), and by deploying a broad mix of qualitative and quantitative data. Given the novelty of our modelling exercise, and due to the lack of a commonly agreed theoretical and empirical framework it could fall back on, the model determinants are drawn not only from business surveys on new orders, but also from hard data. Emphasis is thus put on ensuring that the information from a broad mixture of data sources is exploited, which should help in enhancing the robustness of the model-based proxy for new orders. The empirical framework is constructed by empirically building upon its simplest versions. The specific-to-general modelling strategy as far as the selection of explanatory variables is also sustained on the grounds of superior efficiency in terms of ex-ante forecasting performance in small samples (Herwartz, 2010).

We consider three cohorts of model determinants of m-o-m growth in new orders (NO): (i) (qualitative) surveys, (ii) (quantitative) hard data, and (iii) variables to improve the model dynamics, as summarised in Table 1.

The first cohort of model determinants is qualitative data sources. We consider not only DG ECFIN monthly surveys in manufacturing on managers' assessment of the current level of order books (stock concept) to be *above normal/normal for the season/below normal*, but also Purchasing Managers' responses on total orders (flow concept) being *higher/lower/same than one month ago*. Both survey series are included in the model, with ECFIN survey as the headline survey indicator, because it is, in contrast to the PMI, available for all EU countries. To line up with the PMI survey series, which, from the conceptual point of view are preferred because they explicitly relate to new orders m-o-m growth rates, the ECFIN surveys are transformed into third differences, i.e. the 3-month change. Furthermore, only the information entrenched in the PMI that is not already included in the ECFIN series is taken into account. Each survey time series is contained in the model in terms of its level as well as the first difference in order to "let the data speak" whether only levels – as expected from the conceptual point of view for the PMI – or also the change – as more are expected for the ECFIN series on order book levels – matters for monthly growth in new orders.

Second, building the model empirically, from its simplest versions relying only on surveys, we find that adding quantitative statistics on

Table 1
Overview of model determinants for euro area industrial new orders m-o-m growth.

Surveys	
$\Delta_3 ECFIN$	3-month change in managers' assessment of the current level of order books levels
$\Delta\Delta_3 ECFIN$	3-month change in managers' assessment of the current level of order books levels (1st difference)
μ_t^{PMI}	Purchasing manager new orders index (PMI)
$\mu_t^{\Delta PMI}$	Purchasing manager new orders index (PMI) (1st difference)
Hard data	
TO m-o-m growth	Industrial turnover index in manufacturing (corresponds to market sales of goods or services)
TO_{t-1} m-o-m growth	Industrial turnover index in manufacturing (1 period lagged)
NO_{t-1}/TO_{t-1}	New orders to industrial turnover ratio (1 period lagged)
Variables that improve dynamics	
NO_{t-1} m-o-m growth	Lagged dependent variable (by 1 period)
NO_{t-2} m-o-m growth	Lagged dependent variable (by 2 periods)