EUROPEAN CENTRAL BANK
EUROSYSTEM

OCCASIONAL PAPER SERIES
NO 149 / JUNE 2013

INTRODUCING THE ECB INDICATOR ON EURO AREA INDUSTRIAL NEW ORDERS

By Gabe J. de Bondt,
Heinz C. Dieden,
Sona Muzikarova
and Istvan Vincze

EUROPEAN CENTRAL BANK

EUROSYSTEM

OCCASIONAL PAPER SERIES

NO 149 / JUNE 2013

INTRODUCING THE ECB INDICATOR ON EURO AREA INDUSTRIAL NEW ORDERS

by Gabe J. de Bondt, Heinz C. Dieden, Sona Muzikarova and Istvan Vincze[1]

In 2013 all ECB publications feature a motif taken from the €5 banknote.

This paper can be downloaded without charge from http://www.ecb.europa.eu or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=2264195.

1 *The authors would like to acknowledge the contributions of Iskra Pavlova and Diane Kostroch (made during their traineeships at DG-Statistics) and are grateful for the comments of the Working Groups on General Economic Statistics (WGGES) and on Forecasting (WGF) and for the input from Giordano Zevi (Banca d'Italia) and from Brian Schaitkin and Ataman Ozyildirim from the Conference Board staff. Furthermore, the work has benefited from feedback from Hans-Joachim Klöckers, Bettina Landau, Julian Morgan, Gabriel Quirós and Daniela Schackis. Any errors or omissions are exclusively the responsibility of the authors.*

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Internet
http://www.ecb.europa.eu

Fax
+49 69 1344 6000

Information on all of the papers published in the ECB Occasional Paper Series can be found on the ECB's website, http://www.ecb.europa.eu/pub/scientific/ops/date/html/index.en.html. Unless otherwise indicated, hard copies can be obtained or subscribed to free of charge, stock permitting, by contacting info@ecb.europa.eu

ISSN 1607-1484 (print)
ISSN 1725-6534 (online)
EU catalogue number QB-AQ-13-016-EN-C (print)
EU catalogue number QB-AQ-13-016-EN-N (online)

CONTENTS

ABSTRACT

Following the discontinuation of the official statistics on industrial new orders by Eurostat in mid-2012, this paper introduces the ECB indicator on euro area industrial new orders, which aims to fill the new statistical gaps for euro area total new orders as well as for various breakdowns. Despite the discontinuation of the data collection at European level, a large number of euro area countries are expected to continue with the data collection nationally. For those countries which have discontinued the collection of national data, model-estimates are used in calculating the ECB indicator on euro area industrial new orders. New orders are modelled across EU countries using "soft" data (business opinion surveys) as well as "hard" data (industrial turnover) and applying a common modelling framework. The model determinants significantly explain the monthly growth rates in new orders across approximately 200 estimated equations. Various tests show that the estimates are robust. This paper demonstrates that, besides the leading information content of industrial new orders for euro area industrial production, the monitoring of the ECB indicator on new orders is useful for cross-checking developments in industrial production in real time.

JEL codes: C22, C52, E32.

Keywords: Industrial new orders, leading indicators, real-time analysis, euro area, ECB indicator.

NON-TECHNICAL SUMMARY

Following the discontinuation of the official statistics on industrial new orders by Eurostat (the last observation period being March 2012), this paper presents the ECB indicator on euro area industrial new orders. Despite the discontinuation at European level, a large number of euro area countries continue with the data collection at national level, reflecting the importance of new orders statistics for their national conjunctural analyses. The ECB, in close cooperation with national central banks (NCBs) and national statistical institutes (NSIs), has established regular monthly data transmissions of national data on industrial new orders to the ECB. In order to derive estimates for the discontinued national data, a common modelling framework has been applied to the individual EU countries.

The ECB indicator on euro area industrial new orders is compiled from national data as a weighted average; the weighting scheme previously used by Eurostat is applied with 2005 as the base year until the end of 2012; from 2013 onwards, industrial turnover-based weights are applied with 2010 as the base year. Most national data are made available to the ECB in a seasonally adjusted and working-day adjusted format; in cases in which only non-adjusted national data are available, the adjustments are made by the ECB. For the aggregation of euro area results, official national data are taken into account for those NSIs that have decided to continue the collection of data on industrial new orders, whereas for those countries that have discontinued the data collection, model estimates as derived from the estimation framework are used. 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. The ECB indicator on industrial new orders is calculated once the incoming national data coverage reaches a euro area threshold of 60%, which is typically achieved at around $t+55$ days (i.e. the last week of the month referring to the data from two months ago). For countries that provide their national data *after* the euro area database has been updated for a new monthly observation, the estimates obtained from the estimation framework are overwritten by the official national data and euro area aggregates are re-calculated accordingly.

The release of the ECB indicator on euro area industrial new orders contains total new orders, total new orders excluding heavy transport equipment, as well as breakdowns by main industrial groupings (capital goods, intermediate goods and consumer goods further divided into durable and non-durable consumer goods) and by origin of orders (domestic and non-domestic, with the latter further divided into euro area and non-euro area). These series are sourced as "ECB experimental statistics based on national data" and are available in the Statistical Data Warehouse (SDW). The ECB indicator on total euro area new orders will also be reported in the Statistical Annex of the ECB Monthly Bulletin (Table 5.2.4) and the ECB Statistical Pocket Book (Table 3.3).

The significance of modelling industrial new orders stems from their empirically upheld tendency to historically anticipate (turning points in) business cycles. Moreover, there is a long-standing tradition of new orders leading industrial production. This is why industrial new orders are among the leading series used for the widely monitored OECD Composite Leading Indicators and the Conference Board Leading Economic Indices.

Notwithstanding the link between industrial new orders and industrial production, as well as the empirical evidence that the former lead business cycle turning points, little formal academic consideration has been given to modelling new orders. This study therefore pioneers modelling new orders in manufacturing in terms of scale (the model includes the euro area aggregate and

all individual EU countries) and scope (in addition to total new orders and orders excluding heavy transport equipment, breakdowns across main industrial groupings and source of origin are provided), and by deploying a broad mix of qualitative as well as quantitative data. The model determinants are selected not only from the European Commission/DG ECFIN's harmonised business surveys in manufacturing (also referred to as "EC surveys") and Markit's Purchasing Managers Index (PMI), but also from official statistics on industrial turnover. Emphasis is thus placed on ensuring that information from a broad range of sources is exploited, which helps enhancing the robustness of the model-based proxy for industrial new orders.

Given the lack of formal academic attention given to the subject, as well as the short sample periods of data available for new orders across the EU (in some cases starting in 2003 and ending in 2012), an agnostic modelling approach is considered preferable. Several criteria are applied before the final model version is accepted. Apart from statistical criteria (not only t-statistics, but also the white noise property of the model residuals), restrictions accounting for plausible economic properties are also taken into account (e.g. it is implausible that industrial new orders can consistently grow faster than sales).

The estimation results show for all countries that the model determinants significantly help in explaining the month-on-month growth rates of industrial new orders. This applies in particular to turnover and surveys on new orders, and less so to the lagged monthly growth in new orders. Moreover, the model yields uncorrelated residuals at the euro area aggregate and country level. At the euro area aggregate level, the model explains about 50% of the variation in the month-on-month growth rates of total industrial new orders, with a corresponding standard error of regression of around 1.6 percentage points. The explanatory power for the remaining euro area aggregate breakdowns varies between around 30% (capital goods) and 70% (intermediate goods). These are promising outcomes for the inherently noisy monthly growth rates in industrial new orders, which can be revised substantially in real time. Consistently, the correlation between the in-sample estimated euro area total new order index and the actual new order index stands at 99%.

A different method estimating an alternative frequency (three-month-on-three-month growth rates), alternative model specifications, and out-of-sample and real-time forecasts all show that the estimates are robust. The model estimates do not improve in a statistical and/or economic way by system estimation (seemingly unrelated regression), by simplifying the way in which both surveys on industrial new orders are incorporated in the model, or by adding a foreign indicator at the euro area aggregate or country level. Moving from the inherently noisy month-on-month growth rates to the three-month-on-three-month frequency confirms the explanatory power of the model determinants, as they explain slightly above 90% of new orders growth, albeit at the cost of incorrect behaviour of the model residuals. Likewise, dynamic out-of-sample forecasts over a ten-year period show that the model framework is able to explain 97% of the variation in total industrial new order indices, only a minor deterioration compared to the in-sample fit at 98% over the same period. Additionally, a real-time forecasting exercise starting in 2009 shows the model-based real-time outcome at index level to be closer to the final official release than the index derived from the cumulated first official releases of the monthly growth rate.

This paper analyses whether the new ECB indicator on euro area industrial new orders leads euro area industrial production. The results, which are robust across various new orders subgroupings, as well as two different empirical methods (i.e. Granger causality tests and impulse responses from a bivariate vector autoregressive model), indeed show that euro area new orders lead production, while the average lead time varies.

Besides the leading information of new orders for production, monitoring the former is also useful in cross-checking developments in industrial production in real time. This is particularly appealing during periods of heightened uncertainty about the reliability of production data, as illustrated by two real-time examples (the 2008/09 recession and the 2011/12 recession). Another contribution data on industrial new orders make to the conjunctural analysis of the euro area economy is that – unlike production data – they provide information on the origins of demand, i.e. domestic or foreign.

I INTRODUCTION

This paper introduces the ECB indicator on euro area industrial new orders, which combines official statistics with model-generated estimates. The focus is on industrial new orders because this short-term business cycle indicator is no longer released by Eurostat. The importance of modelling industrial new orders in particular lies in the fact that they have shown to historically anticipate business cycle turning points. There is a long-standing tradition of industrial new orders leading industrial production. For example, Alexander and Stekler (1959) show that new orders in durable goods lead industrial production by six months. More recent evidence of new orders leading the business cycle in manufacturing in Germany is provided by Döpke, Krämer and Langfeldt (1994). New orders have also proved particularly valuable in providing early signals of the sharpness of the downturn in the European context (see, e.g., García-Ferrer and Bujosa-Brun, 2000). Owing to their implied leading properties, industrial new orders are among the leading series used for the widely monitored OECD Composite Leading Indicator. 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 United States (Stock and Watson, 1999). Consistently, manufacturing new orders in capital goods have served as inputs to the Conference Board Leading Economic Index for both the US and the euro area. In line with that evidence, industrial new orders are deployed for conjunctural analysis in central banking. For a general description of the usefulness of new orders for economic analysis, see ECB (2003).

Notwithstanding the clear link between new orders and industrial production, as well as the empirical evidence that the former correctly pre-empts business cycle turning points, there is little formal academic literature which explicitly deals with modelling industrial new orders and which could therefore constitute a relevant underpinning for the modelling exercise in this paper. Recent academic debate revolves around forecasting and nowcasting properties of the existing leading indicators, as well as the relationships between them. Older studies, furthermore, analyse new orders in rather particular contexts; Nicholson and Tebbutt (1979), for example, focus on the United Kingdom industrial housing cycle. To the best of the authors' knowledge, this study is the first one to deploy a mix of qualitative and quantitative data in order to model industrial new orders.

The outline of this paper is as follows. Section 2 reviews the limited academic work conducted on modelling new orders and presents the model and its determinants. Section 3 describes the variety, nature, availability, and sources of data used in the empirical model. Section 4 presents the OLS estimation results for the euro area (the "direct" approach) in terms of monthly growth rates and index levels. Section 5 checks the robustness of the basic model and explores a couple of estimation and modelling alternatives, as well as the model's forecasting performance out-of-sample and in real time. Section 6 identifies the potential uses of the new ECB indicator on euro area industrial new orders for policy application. Section 7 concludes. Annex I reports the euro area aggregate and euro area country-level estimation results for total new orders and total new orders (excluding heavy transport equipment). More detailed estimation results for all the main industrial groupings and breakdowns by origin of demand for the set of euro area and non-euro area EU countries are available upon request (see Table A.1 in Annex I). Annex II details the results of various robustness checks.

2 MODEL

This section reviews the academic literature available on the subject, describes the conceptual rationale underlying the selection of the model determinants and introduces the model specification to be estimated for industrial new orders at the euro area aggregate level and country level. The model and methodology are agnostic, as no standardised theoretical approach to modelling new orders that could serve as guidance for the modelling framework is available.

2.1 LITERATURE

Only a few studies focusing on modelling industrial new orders exist. Nicholson and Tebbutt (1979) draw upon early investment theories to model new orders received from the private industrial sector. They also find that new orders for non-residential construction work lead United Kingdom 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, in addition to the traditional quantitative time series, are relevant for assessing the United Kingdom business cycle. More recent research concludes that business tendency surveys are able to predict the Italian business cycle, and are therefore useful for forecasting the Italian real economy in the short run (Cesaroni, 2011). For Switzerland, Etter and Graff (2003) model new orders using business surveys. They find that the OLS-generated estimates predict the levels, turning points, peaks and troughs of their reference series very closely throughout the whole estimation period. Finally, in reaction to the discontinuation of euro area new orders statistics, the European Commission (2011) analyses the relevance of EC business surveys in manufacturing to the discontinued series, concluding that the surveys contain relevant information for assessing the latter.

This study pioneers modelling new orders in manufacturing in terms of scale (it includes the euro area aggregate as well as all individual EU countries), scope (in addition to the total new orders and orders (excluding heavy transport equipment) subcategories, breakdowns across all the main industrial groupings are provided) and source (information on the origin (domestic or non-domestic) of orders is provided), and by deploying a broad mix of qualitative and quantitative data. Given the novelty of the modelling exercise and, consequently, the lack of a commonly agreed theoretical and empirical framework it could fall back on, the model determinants are selected not only on the basis of business surveys on new orders but also hard data. Emphasis is thus placed on ensuring that information from a broad mixture of data sources is exploited, which is expected to enhance the robustness of the model-based proxy for new orders. Moreover, the modelling framework is constructed agnostically, by empirically building upon its simplest versions. The agnostic 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).

2.2 DETERMINANTS

Table 1 summarises three groups of model determinants used to explain industrial new orders (NO): (1) (qualitative) surveys, (2) (quantitative) hard data, and (3) variables to improve the model dynamics.

First, qualitative data sources are considered; the European Commission/DG ECFIN's 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*, with no reference to monthly

Table 1 Model determinants

Variable	Macroeconomic determinant
Surveys	
$\Delta_3 ECFIN$	Three-month change in managers' assessment of the current level of orders books
$\Delta\Delta_3 ECFIN$	Three-month change in managers' assessment of the current level of orders books (1st difference)
PMI residuals	Manufacturing PMI new orders index
ΔPMI residuals	Manufacturing PMI new orders index (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)

changes, and purchasing managers' responses on total orders (flow concept) being *higher/lower/the same* with respect to one month ago (hereafter referred to as PMI). Both survey series are included in the model, with the EC survey as the headline survey indicator, because it is, in contrast to the PMI, available for all EU countries. Only the information entrenched in the PMI that is not already included in the EC survey series is fitted. Moreover, both survey time series are contained in the model in terms of their level as well as first difference in order to "let the data speak" as to whether only surveys in levels (as expected from the conceptual point of view for the PMI) or also the first difference in the surveys (as expected for the EC survey series on order book levels) matter for monthly growth in new orders.

Second, building the model empirically, from its simplest versions relying only on surveys, reveals that adding quantitative statistics on sales advances the model meaningfully. The addition of sales relates to the economic accounting definition of orders, i.e. the change in order book levels results from new orders minus sales and cancelled orders.

$$\Delta \text{ Order books} = \text{new orders} - \text{sales} - \text{cancelled orders} \quad (1)$$

The identity implies that the model-based proxy for new orders should additionally contain an expression representing sales and cancelled orders. There are no data on cancelled orders available, but Eurostat's index on industrial turnover (TO) can be exploited to represent sales. In addition, the model is enhanced by including an industrial turnover month-on-month growth rate lagged by one period. This addition has a positive consequence at the country level, because some countries release turnover data late. In this way the turnover growth at time *(t-1)* serves in the real-time application of the model as a proxy for sales at time *t*, reverting to the basic model, once turnover for the current reference period is released later in time. The last quantitative term to complement the model is the one-period lagged new orders/total turnover ratio (NO/TO), which represents a long-run equilibrium relation between new orders and sales.

The final group of determinants augments the model with the dependent variable lagged by one and two periods, respectively, in order to introduce more dynamics into the model and mitigate the temporal/spatial dependence of the error term. Empirical results show that the addition of the two lagged dependent variables generally suffices to facilitate uncorrelated residuals.

2.3 MODEL SPECIFICATION

The basic empirical model to estimate the monthly growth rate of industrial new orders (NO m-o-m growth) for the euro area aggregate and euro area/EU countries individually reads as follows:

$$\text{NO m-o-m growth}_t = \beta_0 + \beta_1\Delta_3\ \text{ECFIN}_t + \beta_2\Delta\Delta_3\ \text{ECFIN}_t + \beta_3\mu_t^{PMI} + \beta_4\mu_t^{\Delta PMI} + \beta_5\ \text{TO m-o-m growth}_t + \beta_6\ \text{TO m-o-m growth}_{t-1} + \beta_7\ \text{NO}_{t-1} / \text{TO}_{t-1} + \beta_8\ \text{NO m-o-m growth}_{t-1} + \beta_9\ \text{NO m-o-m growth}_{t-2} + \varepsilon_t \quad (2)$$

The PMI residual terms are derived from extra regressions in the following fashion:

$$\text{PMI}_t = \beta_0 + \beta_1(\Delta_3\text{ECFIN}_t) + \mu_t^{PMI} + \varepsilon_t \quad (3)$$

$$\Delta\ \text{PMI}_t = \beta_0 + \beta_1(\Delta\Delta_3\text{ECFIN}_t) + \mu_t^{\Delta PMI} + \varepsilon_t \quad (4)$$

Equation 2 represents the basic model for modelling euro area industrial new orders, whilst equations 3 and 4 serve as intermediate regressions from which the PMI residual terms are extracted and plugged into the basic model (equation 2). The PMI residual terms potentially capture all extra information absent from the EC surveys. This arrangement, of course, rests on the assumption that PMI and EC surveys do not encompass identical information. All right-hand-side variables – with the exception of the lagged dependent terms and the one-period lagged new order/turnover ratio term (NO/TO) – are expected to exhibit a positive relationship with industrial new orders.

Additional restricted specifications are tested on the basis of the freely estimated basic model results at the euro area aggregate and country level. The coefficient restrictions imposed in each case are tailored to each country's data availability, as well as its individual performance under free estimation, i.e. right-hand-side variables shown to have little explanatory power are eliminated. In addition, other coefficients are constrained to ensure the economic viability of their magnitudes vis-à-vis the monthly growth rate of new orders, e.g. new orders growth should not exceed sales growth *($\beta_6 = 1 - \beta_5$)*.

3 DATA

This section explores the definitions and sources of the data, summarizes data availability across countries and data subcategories, and graphically depicts for the euro area the main model determinants of industrial new orders.

3.1 INDUSTRIAL NEW ORDERS

Despite the discontinuation of data collection at the European level, many EU countries continue to collect the statistics on industrial new orders at the national level,[2] reflecting the importance of industrial new orders statistics for their national conjunctural analyses. Every month, immediately after the national release, these countries transmit the nationally collected data to the ECB,[3] which then updates the national series formerly received from Eurostat with the incoming observations from national sources.

The national series requested for transmission specifically refer to total industrial new orders for manufacturing, industrial new orders for manufacturing (excluding heavy transport equipment), total domestic, total non-domestic (further broken down into euro area and non-euro area) industrial new orders, and as well as the main industrial groupings (MIG): intermediate goods, capital goods, and consumer goods (further broken down into non-durable consumer goods and durable consumer goods).

The main target of the estimation exercise is to deliver euro area aggregate industrial new order estimates at a monthly frequency, seasonally and working-day adjusted. The general approach adopted to meet this target is two-fold. To obtain the estimated values for the discontinued series, the euro area aggregate data are directly deployed (the "direct" approach). At the same time, an "indirect" approach is taken by using the country-level data for estimation and subsequent euro area aggregation.[4]

3.2 OPINION SURVEY DATA

The European Commission/DG ECFIN[5] opinion surveys in manufacturing measure order book levels, which can be related to new incoming orders, completions of orders or cancellations. An increase in the indicator signals that enterprises' stock of orders is larger than normal, which could hint at a comparatively higher order intake. The EC survey question on manufacturing orders reads:

- Do you consider your current overall order books to be *above normal/normal for the season/ below normal*?

2 According to information received from national central banks and national statistical institutes, the following EU countries have already discontinued data collection at the national level: Ireland, France, Cyprus, Luxembourg, Malta, Slovenia (euro area), and Denmark, Latvia, Lithuania and the United Kingdom (non-euro area). All other EU countries will continue collection at the national level, at least for the time being, and subsequently transfer the national series to the ECB for aggregation with the model-generated estimates.

3 The time series are expressed as indices and preferably already seasonally and working-day adjusted. However, if the national data are sent in a non-adjusted form, the adjustment is performed by the ECB.

4 Until 2013 the Eurostat country weights for the euro area new orders corresponding to base year 2005 had been used. Eurostat applies a new weighting scheme with a new base year 2010 for all its short-term business statistics from early 2013 onwards. Subsequently, the national data on industrial new orders have also been migrated to the new base year, so that the ECB indicator on euro area industrial new orders follows the base year convention of short-term business statistics. As Eurostat no longer provides an updated set of 2010 weights for industrial new orders, the ECB indicator on industrial new orders applies a weighting scheme derived from industrial turnover data for the year 2010. A complete set of weights is available on Eurostat's website at: https://circabc.europa.eu/ (in the Eurostat domain, navigate to "Short-term Statistics" and, under "Library", to the sub-folder on weights).

5 European Commission's (DG ECFIN) Joint Harmonised Business and Consumer Survey programme: http://ec.europa.eu/economy_finance/db_indicators/surveys/method_guides/index_en.htm.

Results from EC surveys are available for euro area/EU aggregates and all individual EU countries. The European aggregates and most national data start in the mid-1980s; for EU countries that have joined more recently time series start in the mid-1990s; the series are seasonally adjusted. Regarding the level of detail, all series are available at the level of the main industrial grouping and for manufacturing industries working on orders at the NACE Rev2 Divisions level.[6] The geographical breakdown on the origin of the orders (domestic, non-domestic, the latter further broken down into euro area and non-euro area) is not available for EC surveys.

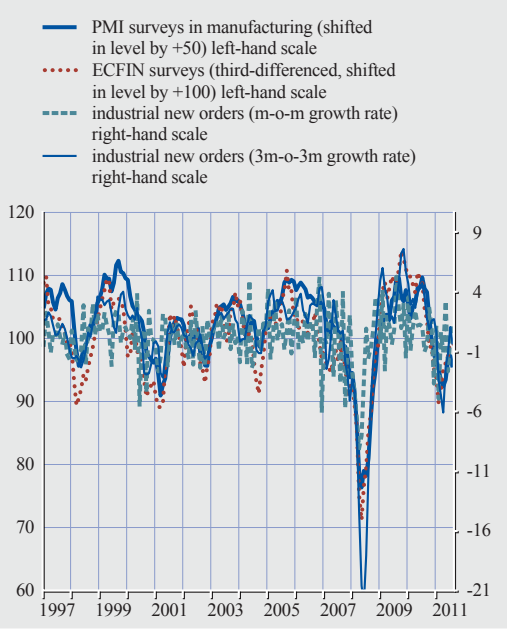
The PMI surveys conducted by Markit[7] assess new orders in manufacturing based on respondents' choice from the following options:

- The level of total orders received this month compared with one month ago was *higher/lower/same*.

Despite the obvious methodological differences between the EC and PMI surveys, side-by-side they exhibit a pronounced co-movement and turning point alignment. To line up with the PMI survey series, which, from the conceptual point of view, are preferable because they directly relate to the monthly growth rate of new orders, the EC survey results are transformed into third differences, i.e. three-month change (see Chart 1). EC surveys transformed merely into single or double differences appear to deviate from PMI surveys more dramatically. In this way, no further transformation is required for the PMI surveys. In addition to the targeted month-on-month growth rate in industrial new orders, the smoother three-month-on-three-month growth rate unveils the true relationship between new orders growth and surveys more pronouncedly.

PMI survey data are made available in a very timely manner, usually on the first working day after the end of the reference period. Results from the PMI manufacturing survey are available for the euro area, for the euro area countries Germany, Ireland, Greece, Spain, France, Italy, the Netherlands and Austria, and for the non-euro area EU countries Czech Republic, Poland and the United Kingdom. The euro area (and most national) data start in 1997; the series are seasonally adjusted. Regarding the level of detail, euro area series are available at the MIG-level and for manufacturing industries working on orders at the NACE Rev2 Divisions

Chart 1 Euro area total new orders



Sources: Eurostat, European Commission/DG ECFIN, Markit and ECB calculations.

6 NACE is the acronym for "Nomenclature statistique des Activités économiques dans la Communauté Européenne", i.e. the statistical classification of economic activities in the European Union; NACE is applied in all EU Member States and is updated occasionally; the current version of NACE is its second revision (NACE Rev. 2).

7 For further information on PMI surveys, refer to Markit's website at: http://www.markiteconomics.com/Survey/Page.mvc/AboutPMIData.

level. For Germany, Spain, France and Italy, MIG level results are also available. However, PMI surveys do not provide details at a lower level i.e. NACE Classes or Groups. The geographical breakdown on the origin of orders further broken down into euro area and non-euro area is not available from PMI surveys.

3.3 INDUSTRIAL TURNOVER

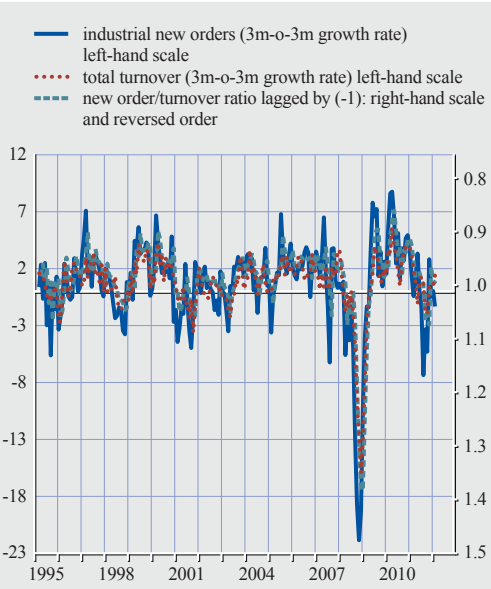
Industrial turnover measures the totals invoiced by the enterprise or kind-of-activity unit during the reference period. This corresponds to market sales of goods or services supplied to third parties. Industrial turnover includes all other charges (for example transport, packaging) passed on to the customer, even if these charges are listed separately in the invoice. Chart 2 reveals the close relationship between total manufacturing new orders and total manufacturing turnover (transformed into a three-month-on-three-month growth rate, as the month-on-month rate is too erratic to reveal the association).

The total industrial turnover is broken down into domestic and non-domestic turnover. Non-domestic turnover is further sub-divided into turnover dispatched to euro area countries and that dispatched to non-euro area countries.

The turnover index is a value index with a fixed base year (currently 2010 = 100) and is usually available around 45 days after the end of the reference period. The timeliness of the release of data on industrial turnover for those euro area countries that have discontinued data collection on industrial new orders is around 35 days for Luxembourg and Slovenia, around 42 days for Ireland, around 61 days for France and around 75 days for Malta and Cyprus.

Although the statistics on industrial turnover and industrial new orders differ in terms of coverage (industrial turnover covers all manufacturing industries whereas industrial new orders cover only industries that work on the basis of orders) and in valuation (turnover is recorded at price at time of sale whereas orders are recorded at price at time of order intake), the communalities remain large and turnover statistics are considered a good proxy for order intake.

Chart 2 Euro area industrial new orders, total turnover and new orders/turnover ratio



Sources: Eurostat and ECB calculations.

4 ESTIMATION RESULTS

This section reports OLS regression results for the euro area aggregate estimation obtained by the "direct" approach, i.e. where euro area aggregate data for the various subcategories requested for monthly transmission to the ECB are directly deployed by the modelling framework.

Individual, detailed country-level estimation results for total new orders and new orders (excluding heavy transport equipment) are available in Annex 1, grouped by the time series' subcategories as received from national sources, whilst more detailed estimation results for all main industrial groupings and breakdowns by origin of demand for the set of euro area and non-euro area EU countries are available upon request (for a detailed overview, see Table A.1 in Annex 1). The model is estimated at country level regardless of the countries' declared intent to (dis)continue industrial new order hard data collection at national level.

The estimation results for both the euro area aggregate and for individual euro area Member States reveal that all three groups of model determinants matter for explaining the month-on-month growth rate of industrial new orders, in particular, hard data and surveys, and to a lesser extent variables to improve the model dynamics. This is evidenced by expected relationships (signified by the coefficient signs), recurring statistical significance, and by the economically sound magnitude of the coefficients. Importantly, the model yields uncorrelated residuals for the euro area aggregate and at country level.

4.1 EURO AREA AGGREGATE RESULTS: MONTH-ON-MONTH GROWTH RATE

Table 2 summarises free and restricted estimation results for the monthly growth rate of euro area new orders for the various subgroupings. At the euro area aggregate level, both free and restricted estimation explains about 50% of the variation in the month-on-month growth rate of total new orders and results in a standard error of regression at 1.6 percentage points (see first two rows). In the restricted (in-sample) model, the delta PMI residual term that proved to have little explanatory power is eliminated, and turnover growth variables are restricted to not jointly exceed 1, as it is not economically viable in the long run for sales to exceed orders every month (coefficient restrictions are denoted by shading). Each tailored restriction set is tested for statistical viability using the Wald test (see last column). In the case of both free and restricted estimations, the model residuals show a satisfactory absence of correlation, as indicated by the reported Ljung-Box Q-statistics at lags 4 and 12.

With respect to the remaining subcategories, the euro area aggregate restricted estimation results are shown in the lower panel of Table 2. The average goodness of fit across the subcategories further corroborates the result for the month-on-month growth rate of total new orders at 50% of variation explained. The model performs comparatively well for intermediate goods (with an adjusted R-squared of over 70%) and for the total new orders (excluding heavy transport equipment) subcategory (65%). The latter, in particular, is in line with our expectations, as the subcategory is empirically known to mirror real economy developments more closely, undistorted by bulky and irregular ship, railway, and aerospace orders. On the contrary, the capital goods subcategory comparatively underperforms with an adjusted R-squared of 30%. In terms of goodness of fit, the remaining subcategories oscillate around 50%. For all categories, except non-durable consumer goods, the model residuals behave correctly according to the Q-statistics. In all cases the Wald statistics show that restrictions cannot be statistically rejected.

Table 2 Euro area aggregate total new orders month-on-month growth rate: free and restricted estimation by subgrouping

	ECFIN	Δ ECFIN	Resid PMI	Δ Resid PMI	Turnover growth	Turnover growth (-1)	NO-turnover ratio (-1)
EA total NO (free est.)	**0.13**	**0.13**	**0.20**	0.10	**0.93**	**0.34**	**-22.09**
EA total NO (restricted in-sample)	**0.16**	**0.14**	**0.23**	0	**0.81**	(1-β5)	**-25.28**
EA NO (excl. heavy transport equipment)	**0.10**	**0.12**	**0.16**	**0.15**	**0.86**	(1-β5)	**-17.46**
EA NO – capital goods	**0.17**	**0.17**	**0.27**	0	**0.42**	0.20	**-18.50**
EA NO – intermediate goods	**0.06**	0.04	0	0	**0.88**	(1-β5)	**-12.46**
EA NO – consumer goods	**0.12**	0	**0.08**	0	**0.90**	(1-β5)	**-33.18**
EA NO – consumer durable goods	**0.09**	0	**0.13**	0	**0.59**	0.16	**-18.89**
EA NO – consumer non-durable goods	**0.10**	0	0	0	**0.80**	0	**-32.31**
EA NO – domestic goods	**0.15**	0	**0.14**	0	**0.69**	(1-β5)	**-12.36**
EA NO – non-domestic goods	**0.17**	**0.26**	**0.23**	0.22	**0.70**	**0.29**	**-22.54**
EA NO – non-domestic goods (EA)	**0.25**	**0.35**	**0.48**	0	**0.30**	0	**-32.64**
EA NO – non-domestic goods (non-EA)	**0.22**	**0.26**	**0.31**	0	**0.60**	0.31	**-35.67**

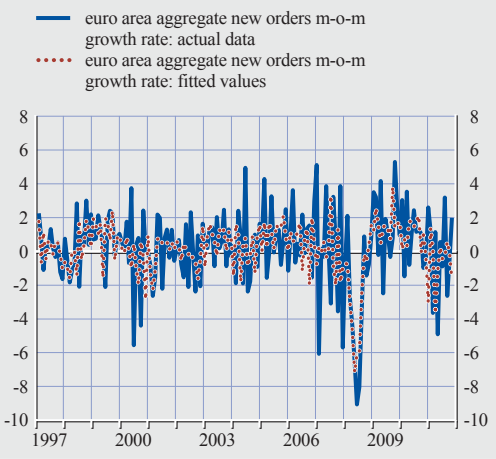
	Lagged dependent (-1)	Lagged dependent (-2)	Adj-R^2	*S. e. of reg*	p-value Q(4)	p-value Q(12)	p-value Wald χ
EA total NO (free est.)	**-0.36**	**-0.22**	0.52	*1.61*	0.64	0.79	-
EA total NO (restricted in-sample)	**-0.30**	**-0.19**	0.52	*1.62*	0.93	0.89	0.34
EA NO (excl. heavy transport equipment)	**-0.27**	0	0.65	*1.14*	0.57	0.21	0.19
EA NO – capital goods	**-0.43**	**-0.27**	0.29	*3.05*	0.92	0.63	0.13
EA NO – intermediate goods	-0.08	0	0.72	*1.16*	0.04	0.27	0.13
EA NO – consumer goods	**-0.39**	**-0.22**	0.57	*1.30*	0.03	0.03	0.53
EA NO – consumer durable goods	**-0.51**	**-0.15**	0.44	*2.49*	0.32	0.17	0.36
EA NO – consumer non-durable goods	**-0.28**	**-0.21**	0.50	*0.49*	0.05	0.01	0.72
EA NO – domestic goods	**-0.48**	**-0.33**	0.41	*2.03*	0.56	0.55	0.33
EA NO – non-domestic goods	**-0.40**	**-0.20**	0.50	*1.99*	0.89	0.92	-
EA NO – non-domestic goods (EA)	**-0.30**	0	0.45	*2.45*	0.90	0.95	0.68
EA NO – non-domestic goods (non-EA)	**-0.40**	**-0.35**	0.49	*2.98*	0.42	0.74	0.21

Sources: Eurostat, Markit, European Commission/DG ECFIN, and ECB calculations.
Notes: Sample period depends on data availability, which varies across variables. Light blue background denotes coefficient restriction imposed. Bold denotes statistical significance at 5% confidence level. P-values Q(4) and Q(12) refer to the probability of residuals being serially correlated at lag 4 and 12 respectively.

Chart 3 plots the actual and fitted values of the restricted in-sample estimation of the month-on-month growth rate of euro area aggregate total industrial new orders. Given the inherent noise of month-on-month industrial new order series (e.g. due to large new orders placed in a single month), the fitted euro area aggregate values are quite satisfactory, as even for monthly growth rates a close co-movement with the actual values is visible.

Chart 3 Euro area aggregate total new orders: actual versus fitted values

(month-on-month growth rates)



Sources: Eurostat and ECB calculations.

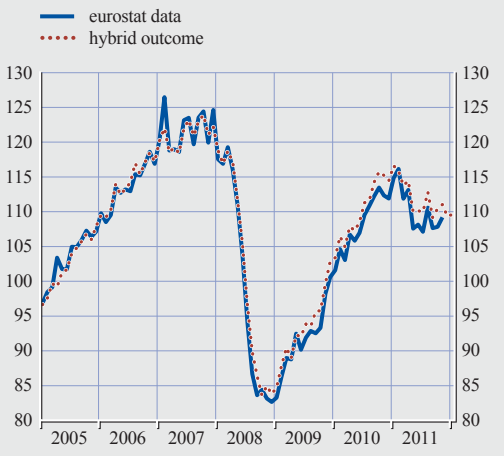
4.2 EURO AREA AGGREGATE RESULTS: INDEX LEVEL

Given the inherently erratic nature of new orders growth rate, results for the euro area aggregate are significantly more encouraging in terms of index levels. The fit is expressively more evident in Chart 4, which displays the

official Eurostat euro area statistics versus the fitted values obtained indirectly by aggregating the model outcome for countries that have stopped the data collection with hard data for the euro area countries that still collect data on new orders (hereafter referred to as the "hybrid outcome"). The chart points to a slight upward bias of the hybrid outcome from 2009 onwards; this may be due to the sharp and drastic fall of the series during the economic crisis and the somewhat slower response time of the model to such drastic changes. Furthermore, the volatility of the monthly series from France was particularly large, mainly due to the recording of new orders in the aircraft industry. The model outcome for France has contributed to this effect, as France is one of the countries that have discontinued the collection of new orders statistics.

Chart 4 Euro area aggregate total new orders: actual versus fitted values

(index levels)



Sources: Eurostat and ECB calculations.

5 ROBUSTNESS

This section analyses the robustness of the basic model estimates in various ways. The plausibility of the basic model is tested by i) an alternative estimation, i.e. seemingly unrelated regressions (SUR); ii) focusing on a three-month-on-three-month frequency of the dependent variable instead of month-on-month growth rates; iii) incorporating the information from surveys in a different way; iv) adding a foreign indicator at the euro aggregate level; v) adding a foreign indicator at the country-level; vi) out-of-sample dynamic forecasting; and vii) real-time forecasting. Annex II reports the detailed results of the first five robustness checks.

As it turns out, the basic model estimates do not improve in a statistical and/or economic way either by system estimation or by simplifying the incorporation of surveys or by adding a foreign indicator at the euro area aggregate or country level. Moving from the inherently noisy monthly growth rates in total new orders to the three-month-on-three-month growth rates confirms the explanatory power of the basic model determinants, as they explain slightly above 90% of total industrial new orders growth rates at this lower frequency. Furthermore, the basic model estimates are robust using a much shorter estimation sample period, as well as in real time. The real-time exercise, albeit necessarily based on a rather short sample owing to real-time data limitations at the country level, shows that the modelling approach used for the ECB indicator on euro area industrial new orders produces monthly growth rates as reliable in "predicting" the final releases for new orders as those from the initial Eurostat releases. Moreover, it shows that the modelling approach used for the index level of the ECB indicator on new orders is close to the index of Eurostat's final release and clearly more accurate than the index derived from cumulated Eurostat initial releases.

An initial robustness check consists of applying SUR system estimation (Zellner, 1962). The gains in coefficient efficiency (as contrasted to single equation OLS estimation) can be remarkable if explanatory variables are weakly correlated whilst the disturbance terms across equations are strongly correlated. Correspondingly, in the euro area context it is easy to conceive of a scenario where, across individual countries, factors which illuminate new orders growth are weakly correlated, while the portion of the variance unexplained by our model has a shared platform. The SUR results, however, turn out consistently inferior to the individual country-level OLS results. The average explanatory power is slightly lower than by OLS estimation. There are thus no efficiency gains in a system estimation compared to the single equation OLS estimations.

As another robustness check, the total new orders three-month-on-three-month growth rate is additionally estimated (although it is preferable to use the monthly growth rate, as the overall aim is to fill in monthly data gaps). As for the right-hand-side variables, all hard data are transformed correspondingly into three-month-on-three-month growth rates, and the lags are also adjusted as appropriate in order to avoid any overlapping observation. Not surprisingly, going from the noisy monthly growth rate to the much smoothened three-month-on-three-month growth rate, the goodness of the fit as measured by the adjusted R-squared improves markedly for total new orders, to 0.91 from 0.52, but at the cost of incorrect behaviour of the model residuals, as evidenced by the significant Ljung-Box Q-statistics at lags 4 and 12. This finding also applies to the various breakdowns of euro area new orders considered.

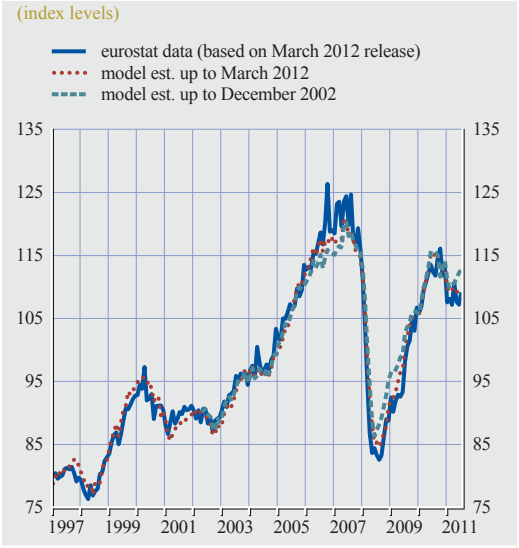
To further test the predictive power of the model, the basic model is compared against a version which deploys the raw series from the surveys in terms of index level and first difference. The underlying rationale is essentially not to omit any relevant information offered by alternative data sources (even if a portion of the information found in surveys overlaps). This approach is also

expected to reduce the individual regressors' standard errors, as well as those of the regression. The standard error of the regression indeed marginally declines across the majority of subgroupings of new orders and the explanatory power (as measured by adjusted R-squared) marginally improves. However, in seven out of the eleven subgroupings the simplified model version results in no impact for the ECFIN survey in level. The latter is a strong argument in favour of the basic model, given that the EC survey serves as the headline survey at the country level for those countries for which PMI data are unavailable. Consequently, the basic model allows for a fairer comparison amongst the countries for which PMI is available and those for which it is not.

The fourth robustness check consists of analysing whether adding a foreign indicator which tracks new order developments outside of the euro area improves the model for the euro area aggregate. The foreign indicator considered is the extra-euro area PMI for manufacturing new orders. It covers the rest of the world except for the euro area and is available as domestic totals and export totals. Each extra-euro area subgrouping is deployed in the estimation to match up with the sub-grouping of surveys already present in the equation. Additionally, for the sake of consistency, the foreign variable is included in terms of levels and as a first difference. Adding the extra euro area PMI surveys indicator improves the explanatory power for some subgroupings. However, on the whole, the fit deteriorates (as measured by the adjusted R-squared). Given the rather significant fluctuations in the fit across various subgroupings, going from the basic model to the augmented one, the original model version remains preferable.

The fifth robustness check involves adding a foreign indicator, i.e. growth rates of new orders in countries that continue to collect and disseminate data on new orders, to the basic model at the country level. From the outset, such an approach necessarily results in a unique specification for each country and/or each category for which the data collection has been discontinued. Evidently, this is at the cost of the simplicity and flexibility provided by the basic model. A new orders month-on-month cross-correlation matrix reveals that the "most relevant" foreign indicator for each discontinuing country at best lacks a sound conceptual and empirical basis, and, at worst, is arbitrary. In most cases, at least one foreign variable marginally enhances the goodness of fit, as yielded by the restricted OLS estimation, and in three out of five cases the foreign variable is also statistically significant at 5% at least. Nevertheless, given the lack of economic rationale underlying the approach, the modelling pitfalls and efficiency trade-offs, the basic model remains preferable.

Chart 5 Euro area aggregate total new orders: dynamic forecast



Sources: Eurostat and ECB calculations.

The sixth robustness check is to generate dynamic forecasts by estimating the basic model with the usual restrictions over a five-year period (1997 to 2002) and using these estimates to forecast a ten-year period (2003 to 2012) by deploying previously estimated values of the lagged dependent variables. Chart 5 plots the restricted out-of-sample forecast of the euro area total new order index along with the restricted in-sample estimations against the hard

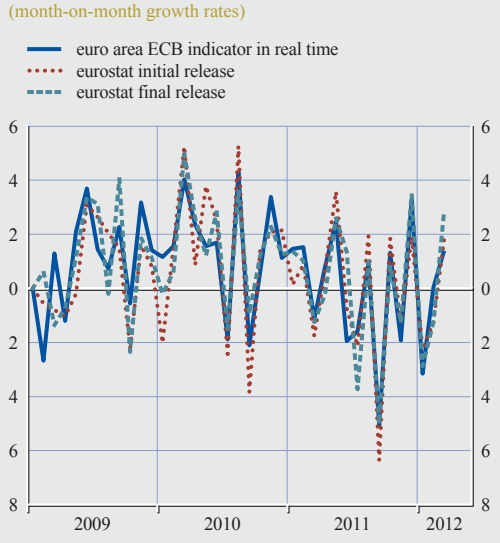
data based on the March 2012 release. The dynamic model forecasts for the euro area aggregate explain 97% of the variation in total industrial new orders index levels over the ten-year out-of-sample period. This compares to 98% for the in-sample results over the same period and 99% for the full in-sample period. Given the high correlations, it is not surprising that all three series follow similar trajectories.

While the out-of-sample forecasting performance shows that the basic model is robust, it is vital to assess whether the solution adopted for the countries that discontinued the collection of data on new orders is also robust in real time. To scrutinize the relationship under real-time conditions, the model is re-estimated once, up to January 2009 for the countries that have discontinued the collection of new order statistics (Ireland, France, Luxembourg, Malta and Slovenia[9]), using historical monthly data vintages instead of the final data releases. Subsequently, one-period-ahead real-time forecasts are generated for the respective countries, starting in February 2009 and ending in March 2012, i.e. 38 real-time month-on-month growth rates. This period is determined by the data availability at the country level in real time. To produce real-time euro area estimates, the real-time forecast results yielded at the country level are aggregated with the real-time new orders data for the remainder of the euro area countries.

As Chart 6 shows, the model-based monthly estimates closely align with Eurostat's initial releases over the real-time sample period, which is also confirmed by forecast error statistics: the model-based mean absolute error (MAE) outperforms the initial release MAE (0.96 versus 1.00 percentage points), whereas the root mean squared error (RMSE) in both cases is 1.6 percentage points.

Chart 6 Indicator on euro area aggregate total new orders in real time

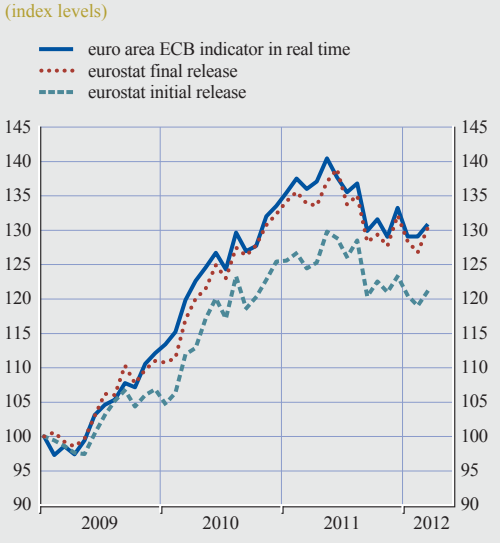
(month-on-month growth rates)



Sources: Eurostat and ECB calculations.
Notes: MAE denotes mean absolute error and RMSE root mean squared error.

Chart 7 Indicator on euro area aggregate total new orders in real time

(index levels)



Sources: Eurostat and ECB calculations.

9 Cyprus is excluded from the real-time forecasts owing to the unavailability of data vintages; although Cyprus provided estimates for industrial new orders to Eurostat, these national results were not publicly available and were only included in euro area totals.

The robustness of the model over time is further solidified at an index level (see Chart 7), where it becomes apparent that the real-time model-based estimates are much closer to the final Eurostat release, as compared with the initial Eurostat release, where this index is derived from cumulated initial releases of month-on-month growth rates.

6 POLICY USE

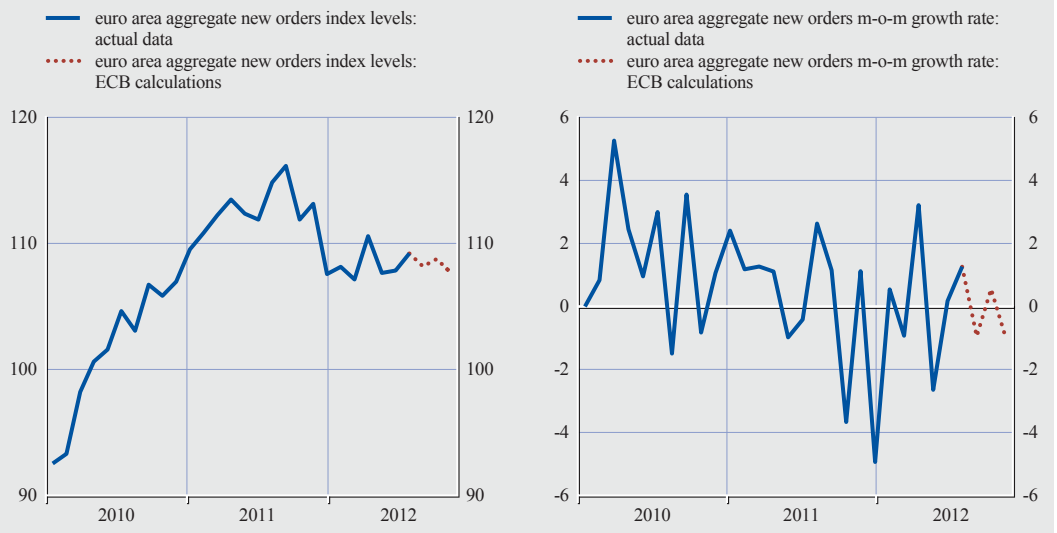
This section briefly describes the usefulness of the ECB indicator on euro area industrial new orders as a leading indicator, as well as for cross-checking developments in industrial production.

6.1 ECB INDICATOR ON EURO AREA INDUSTRIAL NEW ORDERS

The ECB indicator on euro area industrial new orders and the various breakdowns considered in this paper are available to users from the source "ECB experimental statistics based on national data". The ECB indicator on euro area industrial new orders is released in Table 5.2.4. of the Statistical Annex of the ECB Monthly Bulletin and in Table 3.3 of the ECB Statistical Pocket Book, as well as in the ECB Statistical Data Warehouse (SDW). Users should keep in mind that this indicator contains official hard data for the countries that continue to release national data on industrial new orders and model-based estimates for the countries that have stopped releasing such data. 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 described above. The ECB indicator on industrial new orders is calculated once the incoming national data coverage reaches the Eurostat-set threshold of 60% of the euro area. National data received after the euro area database has been updated for a new monthly observation replace the estimates and the euro area results are recalculated accordingly. Chart 8 plots the ECB indicator on euro area industrial new orders up to December 2012. The solid line represents the actual data provided until March 2012 by Eurostat, while the dotted lines represent the hybrid outcome as earlier plotted in Chart 4, i.e. based on official hard data for the countries that continue to release data on new orders and model-based estimates for the countries that have discontinued the release. Furthermore, the ECB indicator on euro area industrial new orders is calculated and available for total new orders, orders excluding

Chart 8 ECB indicator on euro area inustrial new orders

(index levels (left-panel) and month-on-month growth rates (right-panel))



Source: ECB experimental statistics based on national data.

heavy transport equipment, main industrial groupings and domestic and non-domestic new orders, with the latter further broken down into euro area and non-euro area EU Member States.

6.2 INDUSTRIAL NEW ORDERS AS LEADING SERIES

Analysts often closely monitor industrial new orders, mainly because of their leading properties for the business cycle. This section also formally analyses whether the ECB indicator on euro area industrial new orders leads industrial production. The results, which are robust across subgroupings of new orders as well as across two different empirical methods, indeed show that euro area new orders lead euro area industrial production. This implies that analysts may benefit from closely monitoring the ECB indicator on euro area industrial new orders in addition to other macroeconomic indicators.

The first empirical method deployed is pairwise Granger causality tests. The ECB indicator on industrial new orders "Granger causes" industrial production if current production can be explained by its own past values and the past values of new orders, and the coefficients of the lagged new orders are statistically different from zero. One prefers to refer to "Granger predictability" rather than "causality", because Granger causality does not necessarily imply causation in the ordinary sense of the word.

Table 3 shows the F-statistics of the pairwise Granger causality tests. A lag order up to nine months (three quarters) is examined. In case of significant F-statistics, one rejects the hypothesis that the former variable does not Granger predict the latter. As hypothesized, Table 3 corroborates that new orders significantly Granger predict production across all cases, but not the other way around (except for the borderline results for lags 3 and 4 in the case of capital goods in log levels).

Moreover, the finding that industrial new orders lead production and not vice versa holds across all other main industrial groupings, with the exception of non-durable consumer goods and consequently consumer goods.[10] The latter is not surprising, as orders for non-durable consumer goods have, by nature, a very short production time.

Table 3 Euro area new orders (excluding heavy transport equipment) granger predict euro area industrial production (excluding construction)

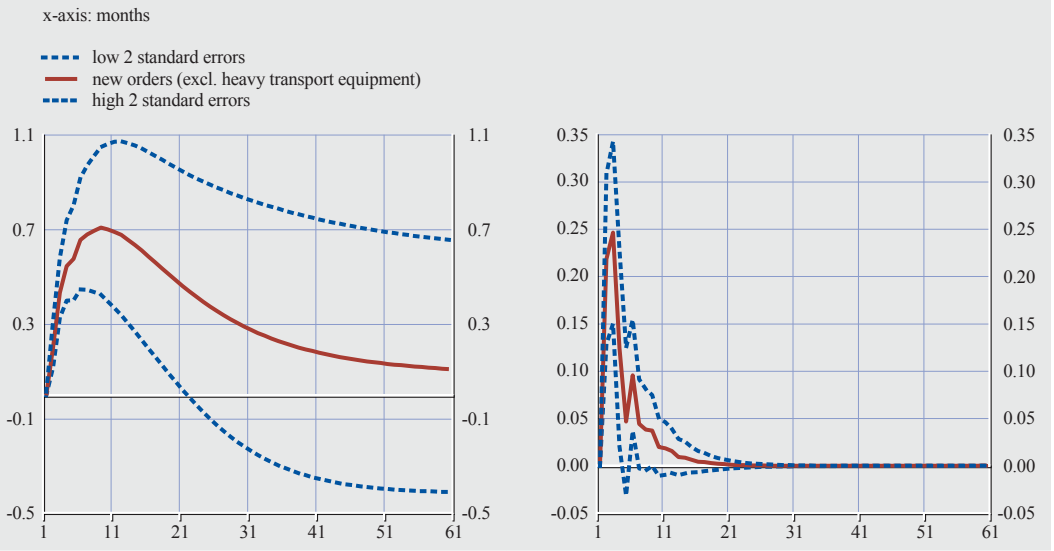
	Levels				Change in levels			
	Total		Capital Goods		Total		Capital Goods	
Lag	NO → IP	IP → NO	NO → IP	IP → NO	NO → IP	IP → NO	NO → IP	IP → NO
1	**11.0**	5.0	***82.1***	0.1	**16.7**	0.2	**8.4**	0.0
2	**11.0**	2.0	**50.4**	3.6	***26.5***	0.1	**12.4**	0.8
3	***17.6***	0.5	**31.8**	4.1	**22.4**	0.9	**20.9**	2.3
4	**16.3**	0.9	**23.8**	3.7	**17.1**	0.9	***22.5***	1.5
5	**13.5**	0.9	**21.1**	2.6	**12.8**	1.0	**19.1**	1.0
6	**10.7**	1.0	**17.7**	2.0	**10.7**	0.8	**17.7**	1.0
7	**9.4**	0.9	**15.8**	1.3	**9.3**	0.6	**16.1**	1.2
8	**8.2**	0.8	**14.5**	1.8	**8.3**	0.6	**14.7**	1.3
9	**7.3**	0.7	**13.3**	1.7	**7.1**	0.8	**12.9**	1.7

Source: ECB calculations.
Notes: NO = log of industrial new orders index. IP = log of industrial production index. Total NO refers to total new orders (excluding heavy transport equipment). Total IP refers to production (excluding construction). → denotes "lead". F-statistics is based on sample Jan. 1995 – Aug. 2012. Bold denotes strong evidence in favor of new orders leading production: hypothesis that the first mentioned variable does not Granger predict the second mentioned variable are rejected at 1% significance level. Cursive denotes maximum F-statistics, suggesting a peak in the leading properties of new orders.

10 Granger causality results across all other breakdowns are not shown here but are available upon request.

Chart 9 Response of euro area industrial production (excl. construction) to shock in euro area new orders (excl. heavy transport equipment)

(log levels (left pane) and changes (right pane))



Sources: ECB experimental statistics based on national data, Eurostat and ECB calculations.

The second empirical method deployed is an impulse response analysis based on a bivariate vector autoregressive model consisting of new orders and industrial production. The applied lag is four months for new orders in log levels, and three lags for the change in log levels of new orders. The impulse response functions plot the adjustment of industrial production to an unexpected temporary shock in the level or the change in new orders. Thus, while pairwise Granger causality tests focus on the average impact of new orders on production, the second method focuses on the bivariate relationship when a shock occurs. Impulse responses show that an unexpected temporary shock in new orders is followed by a significant delayed adjustment of production (see Chart 9 for levels and change).[11] The industrial production adjustment to a shock in the level of and change in new orders peaks at about nine and three months, respectively. At the same time, new orders do not react at all to a shock in production.[12]

6.3 INDUSTRIAL NEW ORDERS FOR CROSS-CHECKING INDUSTRIAL PRODUCTION

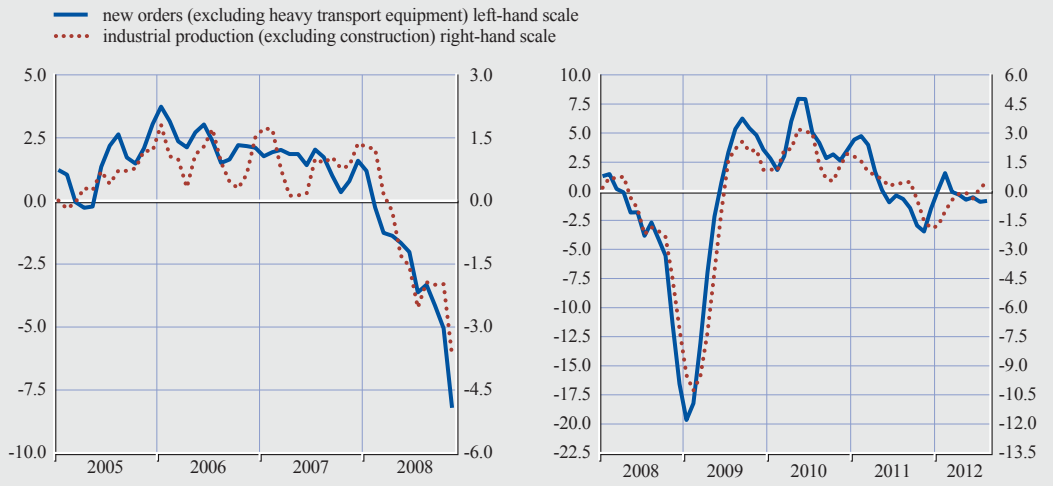
Besides the leading content of new orders for production, the monitoring of new orders is also useful for cross-checking developments in industrial production. This is particularly appealing during periods of heightened uncertainty about the reliability of industrial production data, as illustrated by the two real-time examples that follow. Another contribution of new orders data to the conjunctural analysis of the euro area economy is that – unlike production data – they provide information on the origins of demand (i.e. domestic or foreign).

Assessing production data in real time is not always straightforward, as production data can be revised quite substantially. The average absolute revision in the month-on-month changes in industrial production (excluding construction) over the period from January 2003 to September 2012

11 The impulse responses are based on non-factorized one-unit innovations.
12 These impulse responses are not shown in the chart, but are available upon request.

Chart 10 Real-time data on euro area new orders and euro area industrial production in January 2009 and October 2012

(three-month-on-three-month growth rates)



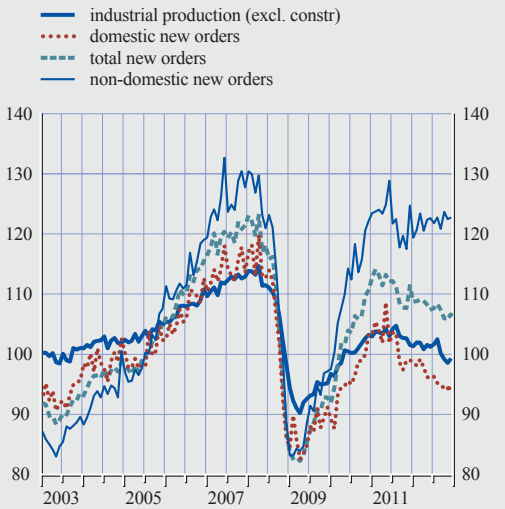
Sources: ECB experimental statistics based on national data, Eurostat and ECB calculations.

was 0.6 percentage points, with 90% of the errors being between -1.2 percentage points and +1.2 percentage points. Therefore, more caution than usual is warranted in the interpretation of recent industrial production data. New orders can be of help in this respect.

Chart 10 plots two cases of heightened uncertainty about the reliability of industrial production data. The first real-time case represents a situation from January 2009 where the main issue was whether the strong fall in production seen in November 2008 would continue or not. The second situation refers to October 2012 where the available production data for July and August were surprisingly positive compared to the signals for production derived from surveys. Chart 10 shows that, generally, there is a strong contemporaneous co-movement between new orders growth and industrial production growth, but a correlation analysis over the period from 1996 to 2012 shows that the three-month-on-three-month growth rate in new orders (excluding heavy transport equipment) has on average a lead time of about one month over the corresponding growth rate for production. For instance, new orders growth turned pointedly in January 2009, one month before the turn in industrial production growth. In both real-time cases, new orders data helped in assessing recent industrial production developments. In the January 2009 case, new orders suggested that the strong fall in industrial production had not yet halted in November 2008. In the

Chart 11 Euro area total new orders indices by origin and industrial production index (excl. construction)

(index levels)



Source: ECB experimental statistics based on national data and Eurostat.

October 2012 case, it was rather likely – based on new orders growth up to August 2012 – that the positive industrial production growth up to that point would not continue.

Finally, data on euro area industrial new orders have value-added for conjunctural analysis, because – unlike production data – they offer valuable information on the origins of demand (i.e. domestic or foreign), as illustrated for the euro area in Chart 11. Such information is distinctive and instrumental to the comprehensive monitoring of the euro area economy, as developments across origin might vary.

7 CONCLUDING REMARKS

In light of the discontinuation of euro area industrial new orders statistics by Eurostat as of March 2012, the ECB has designed a model-based proxy for euro area industrial new orders data to fill the gaps emerging at both European and national levels and facilitate the continuation of the series at an aggregate euro area level. Despite Eurostat's decision to discontinue the publication of European industrial new order statistics, a large number of euro area countries have continued to collect industrial new order data at national levels, reflecting the importance of such data for their respective conjunctural analyses. In fact, industrial new orders have empirically been shown to historically anticipate (turning points in) business cycles and are widely used for conjunctural analysis across the globe.

This paper models, for the first time, industrial new orders across all EU countries, for numerous breakdowns (total new orders, total orders excluding heavy transport equipment, main industrial groupings, and domestic and non-domestic, with the latter further broken down into euro area and non-euro area), while applying a common framework which capitalises on a varied mix of alternative data sources (including business opinion surveys and hard data on industrial turnover). In this way, the paper pioneers modelling industrial new orders in terms of geographical scale, scope, origin of demand, and the variety of sources of information deployed to obtain the final estimates.

The estimates show, for over 200 cases, that the selected model determinants significantly help in explaining the monthly growth rates of euro area industrial new orders. In particular, turnover data and surveys on new orders matter for monthly new order growth, whereas the variables considered to improve the model dynamics (i.e. monthly growth rates in new orders in previous periods) matter to a much lesser extent. This is evidenced by expected relationships (signified by the coefficient signs), recurring statistical significance, and by coefficients' economically sound magnitude. Importantly, the model yields healthy residuals for the euro area aggregate and country level.

Furthermore, a different estimation method, a focus on three-month-on-three-month growth rates instead of month-on-month growth rates, alternative model specifications, including adding foreign indicators, and out-of-sample and real-time forecasts corroborate the robustness of the basic model. Besides the leading content of industrial new orders for industrial production, the monitoring of the ECB indicator on euro area new orders is useful for cross-checking developments in production in real time. Finally, new orders data, in contrast to production data, provide valuable information on the origins of demand.

The paper does not only shed light on an under researched policy-relevant area, but also delivers an empirical indicator of European and international importance. The ECB indicator on euro area industrial new orders is compiled as an aggregation of national hard data (seasonally and working-day adjusted) transmitted from NCBs and NSIs to the ECB on a monthly basis, and estimates derived from the basic model for those countries that have discontinued the collection of industrial new orders data.

The new ECB indicator on euro area industrial new orders is available in the Statistical Data Warehouse (SDW) (under "ECB experimental statistics based on national data"), and is reported in the Statistical Annex of the ECB Monthly Bulletin (Table 5.2.4) as well as the ECB Statistical Pocket Book (Table 3.3). Consequently, policy-makers, professional analysts and academics are able to monitor and analyse industrial new orders at the euro area aggregate level. The ECB indicator on euro area new orders belongs to the set of indicators used to assess and monitor the state of the euro area economy. Finally, in light of the surprising lack of other empirical studies in this field, this study is a useful starting point for future research on industrial new orders.

REFERENCES

Alexander, S. S. and H. O. Stekler (1959), "Forecasting Industrial Production – Leading Series versus Autoregression", *Journal of Political Economy*, Vol. 67, No 4, pp. 402-409.

Cesaroni, T. (2011), "The Cyclical Behavior of the Italian Business Survey Data", *Empirical Economics*, Vol. 41, No 3, pp. 747-68.

Döpke, J., Krämer, J. W., Langfeldt, E. (1994), "Konjunkturelle Frühindikatoren in Deutschland (Leading Indicators for the Business Cycle in Germany, with English summary)", *Konjunkturpolitik*, Vol. 40, No 2, pp. 135-53.

Etter, R. and Graff, M. (2003), "Estimating and Forecasting Production and Orders in Manufacturing Industry from Business Survey Data: Evidence from Switzerland, 1990-2003", *Swiss Journal of Economics and Statistics*, Vol. 139, No 4, pp. 507-33.

European Central Bank (2003), "New Orders in Euro Area Manufacturing Industries", Box 7, *Monthly Bulletin*, December, pp. 45-46, available at: http://www.ecb.int/pub/pdf/mobu/mb200312en.pdf.

European Commission (2011), "Highlight: the relevance of BCS data for assessing new orders in Manufacturing", *European Business Cycle Indicators Report*, available at: http://ec.europa.eu/economy_finance/publications/cycle_indicators/2011/pdf/4_en.pdf, pp.14-18.

García-Ferrer, A. and Bujosa-Brun, M. (2000), "Forecasting OECD industrial turning points using unobserved components models with business survey data", *International Journal of Forecasting*, Vol. 16, No 2, pp. 207–227.

Herwartz, H. (2010), "A note on model selection in (time series) regression models – general-to-specific or specific-to-general?", *Applied Economics Letters*, Vol. 17, No 12, pp. 1157-1160.

Klein, P. A. and Moore, G. H. (1981), "Industrial surveys in the UK: Part I new orders", *Journal of Applied Economics*, Vol. 13, No 2, pp. 167-179.

Nicholson, R. J. and Tebbutt, S. G. (1979), "Modelling of New Orders for Private Industrial Building", *Journal of Industrial Economics*, Vol. 28, No 2, pp. 147-160.

Stock, J. H. and Watson, M. W. (1999), "Business Cycle Fluctuations in US Macroeconomic Time Series", *Chapter 1*, JB. Taylor and M. Woodford (eds.) Handbook of Macroeconomics, Vol. 1 Elsevier Science B.V., pp. 15-33.

Zellner, A. (1962), "An Efficient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias", *Journal of the American Statistical Association*, Vol. 57, No 298, pp. 348-368.

ANNEXES

1 EURO AREA AGGREGATE AND COUNTRY-LEVEL RESULTS

Restricted model versions are cleared of independent variables, which have empirically been shown to have little explanatory power in country-specific contexts. Turnover growth variables are limited not to jointly exceed 1 to ensure the turnover coefficients' economic viability vis-à-vis new orders. In the cases, when the free estimation yields a turnover growth coefficient larger than 1 (making the sum of turnover growth and lagged turnover growth coefficients well above 1), the basic model is re-specified by leaving the complementary lagged turnover growth term out. Owing to the deficiency of ECFIN data on the Irish case, PMI in levels and delta as a headline (and the only) survey indicator is deployed. Each restriction set, hypothesized on the grounds of free estimation, is first tested using the Wald test to ensure its statistical viability (last column in Tables B.1 and C.1). With the exception of Ireland at lag 4 and 12, and Cyprus and Estonia at lag 12, the model residuals exhibit a satisfactory absence of serial correlation, as documented by the Ljung-Box Q-statistics.

Table A.1 Overview of euro area and country-level estimation results

(available upon request)

euro area

New orders breakdown

Total industrial new orders
Industrial new orders (excluding heavy transport equipment)

Main industrial groupings (MIG)

Industrial new orders – capital goods
Industrial new orders – intermediate goods
Industrial new orders – consumer goods
Industrial new orders – consumer durable goods
Industrial new orders – consumer non-durable goods

By origin of demand

Industrial new orders – domestic
Industrial new orders – non-domestic
Industrial new orders – non-domestic (euro area)
Industrial new orders – non-domestic (non-euro area)

EU non-euro area

New orders breakdown

Industrial new orders
Industrial new orders (excluding heavy transport equipment)

By origin of demand

Industrial new orders – domestic
Industrial new orders – non-domestic

The total turnover index in manufacturing data series are deployed for all independent variables involving turnover, even though at a theoretical level it would be sounder to deploy total turnover index in manufacturing (excluding heavy transport equipment) to maintain the series' symmetry on the left and right-hand sides. The total turnover data (excluding construction) are, however, unavailable for most euro area countries. In the case of Ireland and Cyprus, the lagged turnover growth term is left out again to maintain the sum of turnover coefficients at or below 1. Correct coefficient signs, sound magnitudes, and their statistical significance, solidified by (for the most part) uncorrelated residual behaviour (despite the inherent high volatility of the series), jointly highlight that all three groups of explanatory variables hypothesized empirically work well to approximate the industrial new orders month-on-month growth rate and eventually fill country gaps at a monthly frequency.

Table B.1 Indicator on euro area *total new orders* month-on-month growth rate: restricted OLS estimation

	ECFIN	Δ ECFIN	Resid PMI	Δ Resid PMI	Turnover growth	Turnover growth (-1)	New order turnover ratio (-1)
Euro Area	**0.16**	0.14	**0.23**	0	**0.81**	(1-β5)	**-25.25**
Belgium	0.09	0	-	-	**0.55**	**0.34**	**-10.47**
Germany	**0.11**	**0.17**	**0.08**	**0.18**	**0.71**	(1-β5)	**-7.76**
Estonia	0.22	0	-	-	1.00	-	-2.00
Ireland	-	-	0.10	0	1.00	-	**-26.91**
Greece	0.06	0	0.11	0	**0.38**	0.06	-4.97
Spain	**0.15**	0	**0.27**	0	**1.03**	(1-β5)	**-45.41**
France	**0.11**	0	**0.22**	0	**0.41**	(1-β5)	**-12.84**
Italy	**0.19**	0	**0.25**	0	**0.83**	(1-β5)	**-35.67**
Cyprus	**0.51**	0	-	-	1.00	0	**-34.31**
Luxembourg	0.07	0	-	-	**0.47**	0	**-31.03**
Malta	0.02	0	-	-	1.00	-	**-24.02**
Netherlands	**0.21**	neg β1	**0.19**	0	**0.51**	0	**-12.69**
Austria	**0.22**	0	**0.48**	0	**0.56**	(1-β5)	**-52.17**
Portugal	0.03	0	-	-	**0.38**	0.23	**-33.21**
Slovenia	**0.13**	0	-	-	**0.52**	0	-3.45
Slovakia	0	0.01	-	-	**0.74**	(1-β5)	-2.81
Finland	0.32	**-0.32**	-	-	0.51	0.38	**-26.00**

	Lagged dependent variable (-1)	Lagged dependent variable (-2)	Adj-R^2	*S. e. of reg*	p-value Q(4)	p-value Q(12)	p-value Wald χ
Euro Area	**-0.30**	**-0.19**	0.52	*1.62*	0.93	0.89	0.34
Belgium	**-0.42**	**-0.18**	0.37	*4.04*	0.65	0.69	0.39
Germany	**-0.39**	**-0.14**	0.43	*1.95*	0.69	0.13	0.93
Estonia	**-0.40**	**-0.17**	0.24	*11.96*	0.59	0.06	0.33
Ireland	**-0.08**	-0.06	0.85	*2.70*	0.02	0.05	0.10
Greece	0	0	0.32	*2.85*	0.21	0.18	0.39
Spain	**-0.30**	-0.11	0.55	*2.77*	0.76	0.59	0.60
France	**-0.62**	**-0.35**	0.38	*4.82*	0.32	0.75	0.70
Italy	**-0.32**	**-0.30**	0.47	*3.47*	0.82	0.98	0.35
Cyprus	**-0.17**	**-0.17**	0.40	*8.65*	0.67	0.05	0.15
Luxembourg	-0.12	0	0.18	*8.19*	0.82	0.28	0.28
Malta	0	**-0.27**	0.79	*3.20*	0.68	0.78	0.19
Netherlands	**-0.24**	**-0.11**	0.29	*3.46*	0.76	0.83	0.72
Austria	**-0.18**	β8	0.48	*3.98*	0.93	0.66	0.93
Portugal	**-0.26**	-0.09	0.29	*5.39*	0.57	0.78	0.85
Slovenia	-0.18	**-0.27**	0.16	*6.52*	0.16	0.21	0.42
Slovakia	**-0.32**	**-0.12**	0.30	*4.22*	0.87	0.38	0.14
Finland	**-0.40**	**-0.34**	0.31	*8.01*	0.95	0.94	-

Sources: Eurostat, Markit, European Commission/DG ECFIN, and ECB calculations.
Notes: Sample periods depend on data availability, which varies across variables. The shaded background denotes coefficient restriction imposed. Bold denotes statistical significance at 5% confidence level. P-values Q(4) and Q(12) refer to the probability of residuals being serially correlated at lag 4 and 12 respectively. For Cyprus, total manufacturing working to order (except heavy transport equipment) series only are available and estimated.

Table C.1 Indicator on euro area *total new orders (excluding heavy transport equipment)* month-on-month growth rate: restricted OLS estimation

	ECFIN	Δ ECFIN	Resid PMI	Δ Resid PMI	Turnover growth	Turnover growth (-1)	New order turnover ratio (-1)
Euro Area	**0.10**	**0.12**	**0.16**	**0.15**	**0.86**	(1-β5)	**-17.46**
Belgium	0.11	0	-	-	**0.50**	**0.28**	**-9.58**
Germany	**0.08**	**0.15**	0.06	**0.16**	**0.76**	(1-β5)	**-7.76**
Estonia	0.23	0	-	-	**0.55**	(1-β5)	-2.00
Ireland	-	-	0.03	0	1.00	-	**-24.94**
Greece	0.12	0	**0.23**	0	**0.64**	0.16	**-8.99**
Spain	**0.13**	0	**0.20**	0	**0.86**	(1-β5)	**-33.38**
France	**0.11**	0	**0.20**	0	**0.66**	(1-β5)	**-8.42**
Italy	**0.15**	0	**0.23**	0	**0.84**	(1-β5)	**-32.85**
Cyprus	**0.51**	0	-	-	1.00	-	**-34.31**
Luxembourg	0.06	0	-	-	**0.61**	0.31	**-37.91**
Malta	**0.11**	0	-	-	**0.37**	0	**-24.46**
Netherlands	**0.14**	0	0	**0.28**	**0.61**	**0.23**	**-8.73**
Austria	**0.27**	0	**0.48**	0	**0.63**	(1-β5)	**-53.15**
Portugal	0.03	0	-	-	**0.41**	0.24	**-24.21**
Slovenia	**0.13**	0	-	-	**0.52**	0	-3.52
Slovakia	0	0.02	-	-	**0.74**	0.22	-3.39
Finland	**0.25**	-0.13	-	-	0.30	0.18	-5.00

	Lagged dependent variable (-1)	Lagged dependent variable (-2)	Adj-R^2	*S. e. of reg*	p-value Q(4)	p-value Q(12)	p-value Wald χ
Euro Area	**-0.27**	0	0.65	*1.44*	0.57	0.21	0.19
Belgium	**-0.48**	**-0.13**	0.35	*4.33*	0.70	0.99	0.44
Germany	**-0.32**	0	0.49	*1.65*	0.79	0.05	0.29
Estonia	**-0.39**	**-0.17**	0.20	*10.83*	0.20	0.01	0.45
Ireland	**-0.09**	-0.05	0.86	*2.71*	0.01	0.03	0.12
Greece	**-0.44**	**-0.23**	0.52	*4.46*	0.21	0.34	0.70
Spain	**-0.25**	**-0.15**	0.65	*1.66*	0.88	0.40	0.20
France	**-0.56**	**-0.31**	0.43	*2.34*	0.86	0.40	0.79
Italy	**-0.30**	**-0.26**	0.53	*2.50*	0.80	0.21	0.82
Cyprus	**-0.17**	**-0.18**	0.40	*8.64*	0.66	0.05	0.28
Luxembourg	**-0.27**	0	0.28	*9.17*	0.94	0.63	0.45
Malta	**-0.39**	-0.17	0.32	*6.93*	0.28	0.64	0.78
Netherlands	**-0.31**	0	0.35	*3.30*	0.43	0.38	0.31
Austria	**-0.29**	**-0.28**	0.52	*4.03*	0.95	0.92	1.00
Portugal	-0.18	0	0.25	*3.84*	0.65	0.98	0.35
Slovenia	-0.18	**-0.27**	0.16	*6.59*	0.17	0.23	0.41
Slovakia	**-0.30**	0	0.26	*4.46*	0.90	0.62	0.04
Finland	**-0.48**	**-0.29**	0.27	*4.22*	0.57	0.42	0.24

Sources: Eurostat, Markit, European Commission/DG ECFIN, and ECB calculations.
Notes: Sample periods depend on data availability, which varies across variables. The shaded background denotes coefficient restriction imposed. Bold denotes statistical significance at 5% confidence level. P-values Q(4) and Q(12) refer to the probability of residuals being serially correlated at lag 4 and 12 respectively.

2 ROBUSTNESS CHECKS

Table A.2 Euro area aggregate and country-level total new orders growth rate: OLS versus considered jointly (SUR)

	OLS Results		SUR Results	
	Adj-R^2	*SE*	Adj-R^2	*SE*
Euro area members for which PMI is available				
Germany	0.43	*1.95*	0.41	*1.99*
France	0.38	*4.82*	0.37	*4.81*
Italy	0.47	*3.47*	0.46	*3.49*
Spain	0.55	*2.77*	0.52	*2.86*
Netherlands	0.29	*3.46*	0.28	*3.47*
Austria	0.48	*3.98*	0.45	*4.00*
Greece	0.32	*2.85*	0.27	*2.86*
Euro area members for which PMI is unavailable				
Belgium	0.37	*4.04*	0.39	*4.10*
Estonia	0.24	*11.96*	0.29	*11.46*
Finland	0.31	*8.01*	0.26	*8.24*
Luxembourg	0.18	*8.19*	0.16	*7.99*
Malta	0.79	*3.20*	0.55	*4.69*
Portugal	0.29	*3.46*	0.29	*5.41*
Slovenia	0.16	*6.52*	0.16	*6.52*
Slovakia	0.30	*4.22*	0.30	*4.20*
Average fit	**0.37**	***4.86***	**0.34**	***5.07***

Sources: Eurostat, Markit, European Commission/DG ECFIN, and ECB calculations.

Chart B.2 Euro area aggregate total new orders: actual versus fitted values

Sources: Eurostat and ECB calculations.

Table C.2 Euro area aggregate total new orders growth rate: basic model versus model with surveys modelled in terms of index levels and first difference

	ECFIN	Δ ECFIN	PMI	Δ PMI	Turnover growth	Turnover growth (-1)	NO-turnover ratio (-1)
EA total NO (free est.)	**0.13**	**0.13**	**0.20**	0.10	**0.93**	**0.34**	**-22.09**
EA total NO (free est.)	-0.22	0.10	**0.20**	0.10	**0.93**	**0.33**	**-22.45**
EA total NO (restricted in-sample)	**0.16**	**0.14**	**0.23**	0	**0.81**	(1-β5)	**-25.28**
EA total NO (restricted in-sample)	0	0	**0.19**	**0.17**	**0.82**	(1-β5)	**-22.21**
EA NO (excl. heavy transport equipment)	0.10	**0.12**	**0.16**	**0.15**	**0.86**	(1-β5)	**-17.46**
EA NO (excl. heavy transport equipment)	0	0	**0.13**	**0.20**	**0.87**	(1-β5)	**-15.55**
NO – capital goods	**0.17**	**0.17**	**0.27**	0	**0.42**	0.20	**-18.50**
NO – capital goods	0	**0.17**	**0.27**	0	**0.36**	0	**-19.19**
EA NO – intermediate goods	**0.06**	0.04	0	0	**0.88**	(1-β5)	**-12.46**
EA NO – intermediate goods	**0.06**	0	0	0.58	**0.87**	(1-β5)	**-12.40**
EA NO – consumer goods	**0.12**	0	**0.08**	0	**0.90**	(1-β5)	**-33.18**
EA NO – consumer goods	**0.07**	0	**0.09**	0	**0.86**	0	**-35.90**
EA NO – consumer durable goods	**0.09**	0	**0.13**	0	**0.59**	0.16	**-18.89**
EA NO – consumer durable goods	0	0	**0.15**	0	**0.61**	**0.24**	**-20.81**
EA NO – consumer non-durable goods	**0.10**	0	0	0	**0.80**	0	**-32.31**
EA NO – consumer non-durable goods	**0.10**	0	0	0	**0.81**	0	**-32.54**
EA NO – domestic goods	**0.15**	0	**0.14**	0	**0.69**	(1-β5)	**-12.36**
EA NO – domestic goods	**0.14**	0	0.17	0	**0.67**	(1-β5)	-6.66
EA NO – non-domestic goods	**0.17**	**0.26**	**0.23**	0.22	**0.70**	**0.29**	**-22.54**
EA NO – non-domestic goods	0	**0.24**	**0.22**	0	**0.73**	(1-β5)	**-24.48**
EA NO – non-domestic goods (EA)	**0.25**	**0.35**	**0.48**	0	**0.30**	0	**-32.64**
EA NO – non-domestic goods (EA)	0	**0.31**	**0.33**	0	**0.34**	0.14	**-25.29**
EA NO – non-domestic goods (non-EA)	**0.22**	**0.26**	**0.31**	0	**0.60**	0.31	**-35.67**
EA NO – non-domestic goods (non-EA)	0	**0.26**	**0.31**	0	**0.60**	0.31	**-35.58**

	Lagged dependent (-1)	Lagged dependent (-2)	Adj-R^2	*S. e. of reg*	p-value Q(4)	p-value Q(12)	p-value Wald χ
EA total NO (free est.)	**-0.36**	**-0.22**	0.52	*1.61*	0.64	0.79	-
EA total NO (free est.)	**-0.36**	**-0.21**	0.52	*1.60*	0.67	0.75	-
EA total NO (restricted in-sample)	**-0.30**	**-0.19**	0.52	*1.62*	0.93	0.89	0.34
EA total NO (restricted in-sample)	**-0.30**	**-0.19**	0.52	*1.61*	0.90	0.92	0.15
EA NO (excl. heavy transport equipment)	**-0.27**	0	0.65	*1.14*	0.57	0.21	0.19
EA NO (excl. heavy transport equipment)	**-0.27**	0	0.66	*1.13*	0.67	0.13	0.20
NO – capital goods	**-0.43**	**-0.27**	0.29	*3.05*	0.92	0.63	0.13
NO – capital goods	**-0.41**	**-0.26**	0.30	*3.02*	0.97	0.63	0.64
EA NO – intermediate goods	-0.08	0	0.72	*1.16*	0.04	0.27	0.13
EA NO – intermediate goods	-0.09	0	0.73	*1.15*	0.06	0.18	0.13
EA NO – consumer goods	**-0.39**	**-0.22**	0.57	*1.30*	0.03	0.03	0.53
EA NO – consumer goods	**-0.37**	**-0.23**	0.58	*1.29*	0.04	0.03	0.51
EA NO – consumer durable goods	**-0.51**	**-0.15**	0.44	*2.49*	0.32	0.17	0.36
EA NO – consumer durable goods	**-0.55**	**-0.17**	0.43	*2.50*	0.83	0.63	0.49
EA NO – consumer non-durable goods	**-0.28**	**-0.21**	0.50	*1.46*	0.05	0.01	0.72
EA NO – consumer non-durable goods	**-0.28**	**-0.21**	0.50	*1.45*	0.04	0.00	0.79
EA NO – domestic goods	**-0.48**	**-0.33**	0.41	*2.03*	0.56	0.55	0.33
EA NO – domestic goods	**-0.52**	**-0.33**	0.40	*2.05*	0.30	0.33	0.31
EA NO – non-domestic goods	**-0.40**	**-0.20**	0.50	*1.99*	0.89	0.92	-
EA NO – non-domestic goods	**-0.38**	**-0.18**	0.49	*2.00*	0.96	0.94	0.53
EA NO – non-domestic goods (EA)	**-0.30**	0	0.45	*2.45*	0.90	0.95	0.68
EA NO – non-domestic goods (EA)	**-0.35**	0	0.45	*2.44*	0.87	0.97	0.55
EA NO – non-domestic goods (non-EA)	**-0.40**	**-0.35**	0.49	*2.98*	0.42	0.74	0.21
EA NO – non-domestic goods (non-EA)	**-0.40**	**-0.35**	0.50	*2.97*	0.42	0.74	0.42

Sources: Eurostat, Markit, European Commission/DG ECFIN, and ECB calculations.
Notes: Pale yellow denotes the original Basic Model results, vis-à-vis bright yellow, which denotes estimation results yielded by the simplified model. Sample periods depend on data availability, which varies across variables. The shaded background denotes coefficient restriction imposed. Bold denotes statistical significance at 5% confidence level. P-values Q(4) and Q(12) refer to the probability of residuals being serially correlated at lag 4 and 12 respectively.

Table D.2 Euro area aggregate total new orders: basic model versus model with foreign indicator

	Basic Model (BM)	BM+ foreign indicator residual terms in levels and delta
EA NO – total	0.52	0.54
EA NO (excl. heavy transport equipment)	0.65	0.68
EA NO – domestic goods	0.42	0.44
EA NO – non-domestic goods	0.50	0.52
EA NO – non-domestic goods (EA)	0.44	0.47
EA NO – non-domestic goods (non-EA)	0.50	0.47
EA NO – capital goods	0.29	0.37
EA NO – intermediate goods	0.73	0.70
EA NO – consumer goods	0.57	0.39
EA NO – consumer durable goods	0.44	0.44
EA NO – consumer non-durable goods	0.49	0.31
Average fit	**0.50**	**0.48**

Sources: Eurostat, Markit, DG ECFIN, and ECB calculations.

Table E.2 Euro area country-level total new orders: cross-correlation matrix

	Member States									
	Germany	Spain	Italy	Netherlands	Greece	Austria	Belgium	Estonia	Slovakia	Finland
Ireland	**0.18**	-0.08	0.01	-0.13	-0.10	0.02	**0.18**	-0.02	0.12	0.02
France	0.16	0.07	**0.31**	0.09	**0.29**	**0.21**	0.09	0.18	**0.21**	0.01
Luxembourg	**0.23**	0.05	0.07	**0.23**	0.20	0.16	**0.31**	0.10	0.15	0.01
Malta	0.15	0.07	0.10	**0.19**	**0.33**	0.12	0.17	0.10	**0.18**	0.03
Slovenia	0.24	**0.32**	0.23	**0.43**	0.16	**0.32**	0.10	0.31	**0.41**	0.18

Source: ECB calculations.
Notes: Bold denotes top three highest correlations between new order monthly growth rates of those euro area members that have discontinued and those who continue the collection of new order statistics at a national level. No series are available for Cyprus.

Table F.2 Euro area country-level total new orders: goodness of fit yielded by restricted OLS estimation with foreign variable added

		Member States									
	BM	Germany	Spain	Italy	Netherlands	Greece	Austria	Belgium	Estonia	Slovakia	Finland
Ireland	0.85	0.85	-	-	-	-	-	**0.86**	-	-	-
France	0.38	-	-	0.39	-	***0.40***	0.38	-	-	-	-
Luxembourg	0.18	0.21	-	-	0.19	-	-	***0.23***	-	-	-
Malta	0.79	-	-	-	0.79	0.79	-	-	-	0.79	-
Slovenia	0.16	-	***0.17***	-	0.16	-	0.16	-	-	0.15	-

Source: ECB calculations.
Notes: Bold denotes top fit as measured by adjusted-R^2, among specifications deploying the most highly correlated "foreign" new order monthly growth for the discontinuing countries. Light blue denotes original fits yielded by the Basic Model, and serves as a benchmark. Cursive denotes that the "foreign" variable is statistically significant at a minimum 5% confidence level. No series for estimation are available for Cyprus.

ISSN 1607-1484