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Nowcasting TiVA indicators

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Nowcasting TiVA indicators

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OECD Statistics and Data Directorate

Abstract / Résumé

Trade in value added (TiVA) indicators are increasingly used to monitor countries' integration into global supply chains. However, they are published with a significant lag - often two or three years - which reduces their relevance for monitoring recent economic developments. This paper aims to provide more timely insights into the international fragmentation of production by exploring new ways of nowcasting five TiVA indicators for the years 2021 and 2022 covering a panel of 41 economies at the economy-wide level and for 24 industry sectors. The analysis relies on a range of models, including Gradient boosted trees (GBM), and other machine-learning techniques, in a panel setting, uses a wide range of explanatory variables capturing domestic business cycles and global economic developments and corrects for publication lags to produce nowcasts in quasi-real time conditions. Resulting nowcasting algorithms significantly improve compared to the benchmark model and exhibit relatively low prediction errors at a one- and two-year horizon, although model performance varies across countries and sectors.

Keywords: Nowcasting, machine learning, global value chains.

JEL codes: C4, C53, F17.

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Les indicateurs d'échange en valeur ajoutée (TiVA) sont de plus en plus utilisés pour suivre l'intégration des pays dans les chaînes d'approvisionnement mondiales. Cependant, ils sont publiés avec un délais important - souvent de deux ou trois ans - ce qui réduit leur pertinence pour le suivi des évolutions économiques récentes. Ce document vise à fournir des informations plus à jour sur la fragmentation internationale de la production en explorant de nouvelles façons de prédire cinq indicateurs TiVA pour les années 2021 et 2022 couvrant un panel de 41 économies au niveau de l'économie dans son ensemble et pour 24 secteurs industriels. L'analyse repose sur une gamme de modèles, incluant des modèles d'apprentissage statistique (machine learning), utilise un large éventail de variables explicatives capturant les cycles économiques nationaux et les développements économiques mondiaux, et correcte des délais de publications pour être proche de conditions en temps réel. Les algorithmes de prévision qui en résultent constituent une amélioration considérable par rapport au modèle de référence et présentent des erreurs de prédiction relativement faibles à un horizon d'un et deux ans, bien que les performances des modèles varient selon les pays et les secteurs.

Mots-clés : Prévision immédiate, apprentissage statistique, chaînes de valeur mondiales.

Codes JEL: C4, C53, F17.

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1. Introduction

1. Integration in regional and global value chains and related disruptions have been high on the policy agenda since the beginning of the COVID-19 crisis. While the interconnectedness of global value chains (GVCs) has contributed to higher productivity, a greater variety of goods and income convergence across emerging economies, the production of some products has become highly concentrated in specialised firms and countries. GVCs have also become longer and more complex, making them more vulnerable to a variety of shocks. Recent policy analyses confirm a stabilisation of the depth of economic integration (Jaax, Miroudot and van Lieshout, 2023[1]), assess the vulnerabilities that come with deeper linkages of GVCs (Schwellnus et al., 2023[2]), and explore the potential for reducing GVC risks (OECD, forthcoming[3]).

2. Multi-country input-output tables and related trade in value added (TiVA) indicators, published by the OECD and other international organisations are the main source of information to monitor countries' engagement in global supply chains and the associated risks. They are constructed by mapping out global production networks, which involves compiling and harmonising national Supply and Use Tables (SUTs – which show production linkages *within* countries) and combining them with trade statistics (which show exchanges *between* countries). At the OECD the resulting SUTs are then used to produce a set of annual Inter-Country Input Output (ICIO) tables.

3. However, SUTs and Input-Output tables (IOTs) are, in general, published by national statistical agencies with a lag of several years, resulting in TiVA indicators also being available with a long delay. For European countries, for instance, the 2019 SUTs were published in 2022. As a result, the OECD produced preliminary TiVA indicators up to 2020 in June 2022, albeit with strong caveats. Collecting all the components which make up ICIOs is extremely costly. An efficient alternative could be to nowcast and present preliminary TiVA indicators to inform policymakers before a more complete and more accurate picture is provided through standard ICIO-based methods.

4. Nowcasting is not new. The term is a contraction for *now* and *forecasting* and is usually applied for the prediction of economic subjects in current time, the very near future and the very recent past. The basic principle of nowcasting is to exploit the information which is published early and possibly at higher frequencies than the variable of interest to obtain an 'early estimate' before the official figure becomes available (Bańbura Martha et al., 2013[4]). A novel strand of the literature has moved toward the use of Big Data, which have become easier to access and handle thanks to the recent progresses in machine learning techniques, data and text mining software and data warehouse storages (Bok et al., 2018[5]).

[1] The authors were all working in the Statistics and Smart Data Directorate at the time of writing. They are grateful to Asa Johansson, Antonella Liberatore, Alexander Jaax, Paul Schreyer Elena Rusticelli, Colin Webb and Nori Yamano for useful comments and discussions and to Virginie Elgrably for excellent technical assistance.

5. An important field of research has sought to nowcast ICIOs tables using accounting relations, and techniques to impute data while ensuring data consistency at the world level. In a nutshell, these approaches use national accounts and trade statistics time series to extrapolate ICIOs (see for instance Fortanier and Miao (2017[6]), Rueda-Cantuche et al. (2018[7]), Valderas-Jaramillo and Rueda-Cantuche (2021[8]), OECD (2022[9])). Following this approach, Rueda-Cantuche, Pinero and Kutlina-Dimitrova (2021[10]) predict indicators of employment supported by exports, which are also computed based on ICIOs. An important implicit assumption underlying these approaches is that countries' industry input and output structures in extrapolated SUTs are similar to the structures of the latest available SUTs. This is a reasonable assumption in the absence of global or regional economic shocks. These shocks may hit certain activities disproportionally and the timing and the pace of recovery may vary across countries and sectors. The magnitude of these changes and the extent to which they affect core TiVA indicators needs to be further investigated.

6. More recently, Metulini et al. (2022[11]) used more advanced statistical methods to "fill in" ICIOs matrices, building on seminal work by Athey and Imbens (2019[12]) related to matrix completion. The idea is to predict unobserved entries of a matrix using the remaining observed entries. This study has demonstrated an effective methodology for predicting missing values within the ICIO matrix. It uses data from both previous years and the current year and works well for countries that share similar characteristics with the country for which the data is not available. In contrast, the procedure is less effective if missing information is filled for countries belonging to quite different clusters.

7. A third strand of the literature nowcasts TiVA indicators using linear regression models to correct for the business cycle (Haugh et al., 2016[13]). Resulting estimates have proven relatively unstable, due to the small number of observations available to estimate the nowcasting models. Alternatively, trackers of global value chains (GVC) participation have been built using data on selected trade in intermediates and computed as the ratio of intermediate imports and exports as a share of total imports and exports. Those trackers are found to be relatively well correlated with GVC participation over the period 2001-2015 (Cigna, Gunnella and Quaglietti, 2022[14]; Federal Reserve Bank of New York, 2023[15]).

8. Against this background, the main objective of this paper is to explore new ways of nowcasting key TiVA indicators one and two years ahead (2021-2022). In addition to identifying models that have good nowcasting properties, the aim is also to set up a process that is for most part automatised so that nowcasts can be calculated at relatively low cost, once the best models have been selected.

9. The approach nowcasts TiVA indicators instead of ICIOs tables for two reasons. First, 'matrix completion' methods are still in their infancy, although they appear to be a promising way to get more timely indicators. Second, policymakers and analysts monitoring recent economic developments are essentially interested in key TiVA indicators. The procedure put in place could be replicated to other indicators derived from ICIOs.

10. The analysis covers 41 economies (36 OECD countries and Brazil, China, India, Indonesia, South Africa) and 24 sectors and nowcasts five TiVA indicators for 2021 and 2022, including the domestic value-added share of exports and the services content of exports. The proposed nowcast can complement current OECD TiVA indicators, which are available until 2020. The methodology relies on a range of different techniques including linear regressions, penalised regressions (lasso, ridge) and gradient boosted trees (GBM). Consensus models, which average the outcomes of the penalised models and GBM, were also tested.

11. Given the relatively small sample of observations, on which models can be tested and trained, countries were pooled into a panel, with fixed effects allowing for country-specific outcomes. Panel settings are increasingly used in nowcasting (Fosten and Greenaway-McGrevy, 2022[16]), including machine learning techniques (Babii et al., 2020[17]). The use of a panel approach has been found to lead to good predictive models for GDP (Woloszko, 2020[18]), well-being (OECD, forthcoming[19]) or at a more disaggregated level for ICT output (OECD, forthcoming[20]).

12. The main insights from the paper are as follows:

- Nowcasting models are found to outperform an autoregressive benchmark in about 75% of the cases, with generally very good performance of GBM-based models.
- Model performance differs across countries, sectors and target indicators. In general, models for large economies exhibit better nowcasting properties than smaller economies. Models related to economy-wide and services indicators have lower prediction errors than those related to manufacturing.
- Nowcasts for 2021-22 point to a decline in the share of domestic value added in export flows, albeit to a varying degree across countries and sectors.
- Domestic services value-added shares of exports are expected to have been broadly stable, while the foreign counterpart has increased.
- The share of domestic value added embodied in foreign demand is expected to have recovered in 2021-22.

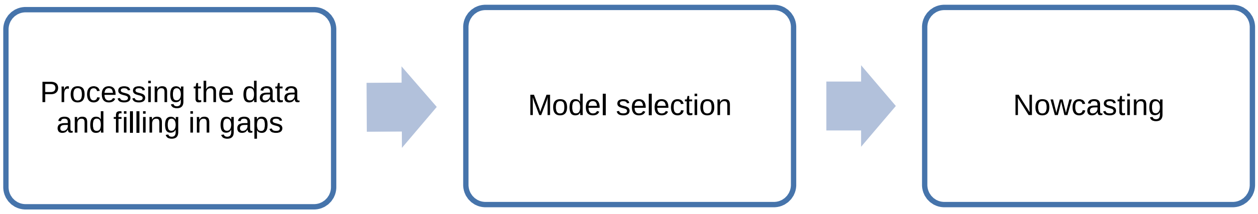
13. The paper is organised as follows. The next section gives an overview of the empirical strategy. Section 3 details the nowcasting methods and Section 4 describes the data. The approach to selecting best models is explained in Section 5, model performance is discussed in Section 6. Section 7 illustrates the results of nowcasting TiVA indicators for 2021 and 2022.

2. Overview of the empirical strategy

14. This section presents the overall strategy to nowcast TiVA indicators and describes how the different steps of the process fit together. Those steps and the methodologies underlying the different models are detailed in the subsequent sections. The logic is not different from standard nowcasting approaches (Bańbura Martha et al., 2013[4]), but the process is refined to include some of the specificities of machine learning techniques (e.g. using cross validation to help select the best nowcasting models) (Figure 1).

15. Five TiVA indicators (target variables) were considered: domestic value-added share of exports (EXGR_DVASH), domestic services value-added share of exports (EXGR_SERV_DVASH), foreign services value-added share of exports (EXGR_SERV_FVASH) and the share of domestic value added embodied in foreign final demand (VALU_FFDDVA). For these indicators, the overall share is nowcasted directly. Nowcasts of foreign value-added share of exports (EXGR_FVASH) are derived from the nowcast of the domestic value-added share of exports by subtracting the latter from one, as per the definition.

Figure 1. Main steps of the empirical strategy



Source: OECD illustration

16. The first step is to collect and process the data that are used to predict the target variables. Predictors are related to trade development or the business cycles. This includes data from national accounts and balance of payments, but also short-term indicators such as prices, employment or financial

indicators. Those data are then transformed in case they were not stationary. Indicators whose predictive accuracy is expected to be large, but which are not sufficiently timely, have been prolonged with “bridges” using different input data, but the same methods and model selection criteria as for nowcasting the TiVA indicators. This is the case for exports, value added and output at the economy-wide and sectoral level.

17. The second step is to select the best model to nowcast TiVA indicators. This is the core of the approach and combines several specificities:

- First, countries have been pooled to address the issue of small sample, which would have led to estimates lacking robustness. At the same time country fixed effects allow to compute country-specific nowcasts. A similar approach was used by Woloszko (2020[18]).
- Second, five types of models have been tested: gradient boosted tree (GBM), penalised regressions (ridge and lasso), a linear regression model and a “consensus” model derived as the simple average of the GBM, ridge and lasso. Consistent with the nowcasting literature, the performance of all these models is assessed against those of an autoregressive model of order 1, as the data are annual.
- Third, a cross-validation process, splitting the data in training, validation and test set, has been implemented to prevent overfitting. In this work, cross-validation is performed by combining an expanding and rolling window to ensure that sufficient observations were available to undertake standard diagnostics (e.g. test on the significance of the results). Publication lags were accounted for during the cross-validation to be as close as possible to real time conditions (“quasi real time nowcasting”, i.e. to ensure that when predicting indicators for year *t*, the models use only the information available at time *t*).
- Fourth, root mean squared errors (RMSEs) for one-year ahead predictions are computed using the outcomes of the cross-validation process and constitute the main criterion to select best models. 2-year ahead RMSEs and FDA (forecast direction accuracy, which summarises accuracy in predicting the direction - increasing or decreasing) are also computed to check the performance of the selected models.

18. The last step is to use the best models to nowcast the indicators for 2021 and 2022. Note that for each country/sector, we select the model that performs best, i.e. one best model per country-sector pair, rather than using the model that would perform best on average across all the countries for all the countries/sectors. The best model is selected for the one-year ahead prediction and deployed on the two-year ahead predictions, as nowcasting performance of best models are not found to deteriorate much in the second year.

19. One key specificity of the approach is to run machine learning algorithms in a panel setting. Standard forecasting literature has focused on the use of time series methods to nowcast economic aggregates for an individual economy. The approach requires nonetheless sufficiently long time series. In the case where data are only available over a short time span, as is the case in this study, pooling countries, regions or sectors offers a useful alternative. For instance, Mouchart and Rombouts (2005[21]) and Koop, McIntyre and Mitchell (2020[22]) developed a panel approach to nowcast regional gross value added in the United Kingdom using national aggregates.

20. In this study, using a panel approach over 41 countries enables the deployment of machine learning algorithms while ensuring high model performance. As the target variable is annual and available only since 1995, it would have been challenging to estimate nowcasting models using traditional time series nowcasting methods, which usually rely on longer series of historical data. Country-specificity is captured through country fixed effects.

3. Methods

21. Several nowcasting approaches were tested and compared to an autoregressive model (AR), that is used as a benchmark and assumes that a given TiVA indicator is a function of its own prior values. This subsection describes those approaches briefly.

Linear regressions

22. Linear regressions model each TiVA indicator as a function of the growth rate of gross value added. Fixed effects were added to control for all variables that vary over cross-sectional units, i.e. either countries or sectors, but are constant over time. While the model is relatively simple and restricted to capturing linear effects, it is easy to compute and interpret. Under the ordinary least squares approach, the coefficients of linear regression are obtained by minimising the residual sum of squares:

$$\widehat{\beta_{OLS}} = \arg min[\sum_{i=1}^{n}(Y_i - \beta x_i)^2],$$

where Y_i is the target indicator, x_i denotes the input variables and β stands for the vector of coefficients.

Penalised regression models: ridge and lasso

23. Ridge and lasso (least absolute shrinkage and selection operator) regressions are modified linear regression methods that constrain estimates and retain a limited number of indicators (Tibshirani, 1996[23]; Hoerl and Kennard, 1970[24]). Both techniques minimise the residual sum of squares and include a penalty term λ to tackle overfitting:

$$\widehat{\beta_{Penalised}} = \arg min[\sum_{i=1}^{n}(Y_i - \beta x_i)^2 + Penalty(\lambda, \beta)].$$

24. Ridge regression adds a penalty on the squared value of the coefficients, i.e. $Penalty(\lambda,\beta) = \lambda \sum_{j=1}^{p}(\beta_j)^2$, where p is the number of predictors, which has the effect of shrinking the estimated coefficients. In lasso regression, the penalty term is the sum of the absolute value of the coefficients, i.e. $Penalty(\lambda,\beta) = \lambda \sum_{j=1}^{p}|\beta_j|$, which shrinks the coefficients towards zero, while removing the covariates whose estimated coefficients are zero from the model. Compared to a linear regression, both ridge and lasso reduce the model's variance at the expense of a slight increase in bias. Both methods rely on the assumption that explanatory variables enter the model linearly and are considered more appropriate to capture the features of dense datasets, which have relatively few missing values and require only minimal or no imputation to process the data.

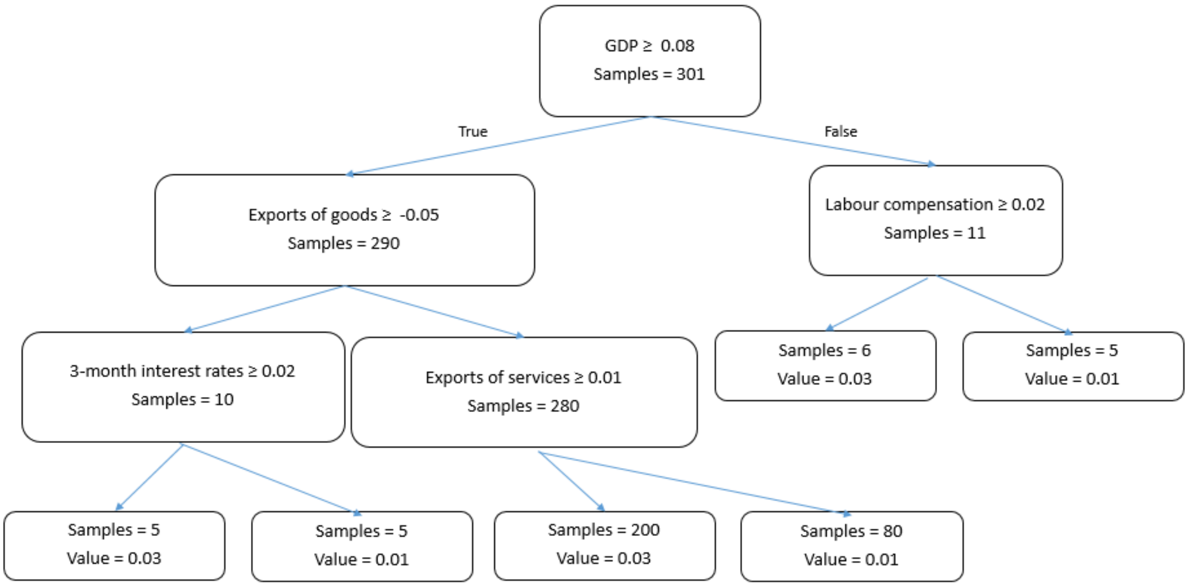
Decision tree ensemble methods (Gradient boosted trees)

25. Gradient boosted trees are a tree-based non-parametric methods, which is particularly apt to capture non-linear relationships and can be useful in the context of macroeconomic nowcasting (Chapman and Desai, 2021[25]). The high predictive performance of gradient boosted trees stems from the 'boosting' technique, in which trees are built sequentially to predict the error of the preceding trees. The predictions of all trees are averaged in a final step to reduce the overall prediction error (Dietterich, 2000[26]).

26. Tree-based methods predict the value of a target variable by dividing the sample of observations into sub-groups to minimise the within group variance of the predicted variable. Figure 2 provides an example of one specific prediction path of a regression tree trained on the panel dataset to nowcast the domestic value-added share of gross exports at a country level. At first, the algorithm selects the splitting variable, GDP, and the splitting point (0.08) that minimises the variance of the target variable within the two resulting sub-groups considering all possible variables and splits. It repeats this procedure at each node, choosing from the available explanatory variables those that provide the best splits, until it reaches the final leaf.

27. Compared to linear and penalised regressions, gradient boosted trees are more flexible in their functional form and less sensitive to outliers. However, the tree-based methods are computationally expensive, and make it more complicated to interpret the relationships between the target and feature variables, despite feature importance measures available. They are also prone to overfitting, which occurs when a model performs well on the training data, but poorly on new data.

Figure 2. Example of a prediction path in a regression tree



Note: On each branch, the value indicates the splitting point for the node. The first node (GDP) contains the full sample for that specific model (n = 301). Each node makes a split between observations that validate the condition and observations that do not. For instance, at the first node, the algorithm splits observations between years where GDP, current prices were equal to or above 0.08 (left) and below 0.08 (right). For the left path, the algorithm then subsequently picks the total value of exports above -0.05, and the interest rate above 0.02 to reach the final sample. The prediction is then a growth rate of 3% for the target variable (left bottom leaf).
Source: OECD illustration.

Consensus model

28. While the various methods come with their strengths and weaknesses, combining them can reduce the prediction error even further, as common in the nowcasting literature (Jaax, Gonzales and Mourougane, 2021[27]; Tiffin, 2016[28]). In this paper, the consensus model takes the average of all predictions resulting from the machine learning models, thus creating a model with less variance in the prediction.

4. Data

Constructing the database

29. The five target variables are taken from the OECD TiVA database. Data were extracted from the database in April 2023 and available from 1995 to 2020. The indicators are expressed in USD millions at current prices, in case of values, or in percent, in case of shares. Table 1 reports the main statistics of the target variables. The numbers in the table are reported in percentage points, for instance the change in domestic value-added share of exports increased by a maximum of 19.5 percentage points.

30. A range of explanatory variables capturing domestic business cycles and global economic developments was collected, including measures of business activity, trade and financial indicators (Table 2). The criteria for selecting variables were relevance, coverage in terms of countries, timeliness and length of the available time series.

Table 1. Basic statistics of target variables

	TiVA Codes	Average across countries	Standard deviation	Minimum	Maximum
Change in the domestic value-added share of exports	EXGR_DVASH	-0.2	2.1	-20.2	19.5
Change in the domestic services value-added share of exports	EXGR_SERV_DVASH	0.0	1.5	-19.0	15.1
Change in the foreign services value-added share of exports	EXGR_SERV_FVASH	0.2	1.1	-14.3	19.2
Change in the share of domestic value added embodied in foreign final demand	VALU_FFDDVA	0.3	3.7	-59.2	45.9

Note: Basic statistics were computed on annual percentual changes of TiVA indicators for the period 1995-2020 across the different sectors and countries analysed. The variable changes are reported in percentage points.
Source: Author's calculations.

31. The dataset incorporates both country-specific variables and global indicators that either describe trends in the world's largest economies (e.g. producer price index for scheduled passenger air transportation in the United States) or measure developments beyond country borders (e.g. global economic policy uncertainty index). Sector-level models additionally include sector-specific indicators for trade, gross value added and employment. Chile and Costa Rica could not be included in the sample due to a lack of data availability for the nowcast.

32. Data are sourced from national accounts, the OECD TiVA database, the OECD Main Economic Indicators, and national sources. Table A.1 provides a full description of the dataset, together with the sources.

Table 2. Examples of explanatory variables

	Examples of variables
Activity	GDP Gross value added Gross output by industry
International environment	Exports and Imports of total and intermediate goods and services Current account balance Global economic policy uncertainty index
Business cycles	Industrial Production Index Consumer Price Index Producer Price Index Employment by industry
Financial and monetary indicators	Long term interest rates Real effective exchange rates

Note: For a full list of indicators, please see Annex A. Data Sources.
Source: Author's compilations.

Pre-selection and processing of the data

33. The pre-processing was done separately for the training and test samples to avoid data leakage. All data series were transformed using first differencing to ensure stationarity. In addition, all variables were standardised by setting each variable's mean to zero and standard deviation to one – a step which minimises the impact of outliers and lowers the time needed to run the models.

34. The approach to handling missing values varied depending on the extent of missing observations. The series with a starting date after 2009 were excluded from the data set. When a variable had more than 10 observations missing for a given country, all values for the country were replaced with the mean values computed for the rest of the sample. For sector-specific variables, observations were imputed using growth rates of the corresponding broader sector in that country (e.g. for a given country, a missing value for gross value added in manufacturing of food products and beverages is imputed using the growth rates of gross value added in manufacturing). Any missing values remaining after the imputations performed in the previous steps were filled using the median imputation for a given country or sector. This was done to ensure that all models can be tested on the panel dataset. Overall, the percentage of missing data that was imputed using this procedure is small (Annex A provide more information on the missing data). Alternative ways of imputing would not markedly change the results. In addition, as a panel framework is used there is no systemic correlation between the percentage of missing data in one country and nowcasting performance.

35. In addition, gross output, gross exports and gross value added were prolonged until 2022 using bridge models, applying the same process as for the target variables (see below). The rationale is that those variables are expected to have a large information content in predicting TiVA indicators, and even an imperfect prediction could improve the accuracy of the nowcast.

36. Finally, many variables in the dataset are highly correlated with each other, which can worsen the predictive accuracy of the penalised regressions. To address potential multicollinearity, a two-step approach was taken to select which variables to include in the estimation for ridge and lasso. First, a set of 'core' variables was obtained by running multiple random forest regressions on the full set of variables and preserving the explanatory variables that had the largest impact on predictive accuracy. Secondly, the variance inflation factor (VIF) was computed for all the remaining variables and the threshold of ten was used to remove the highly correlated variables (James et al., 2013[29]).

5. Selecting best models

37. The best models were selected based on the out-of-sample, one-year ahead predictive performance relative to the benchmark model, an autoregressive model with one lag. In the economy-wide analysis, one best model was identified for each country. Irn sector-level estimation, best models were selected for each country-sector pair.

38. Predictive performance was evaluated in terms of the relative root mean squared error (RMSE), a metric that compares the average prediction errors of a model to the benchmark. A relative RMSE below one indicates that the model outperforms the benchmark. A Diebold-Mariano test with Harvey-Leybourne-Newbold correction was used to assess whether the relative RMSE is statistically different from one, i.e. the nowcasting models had significantly higher predictive accuracy than the benchmark.

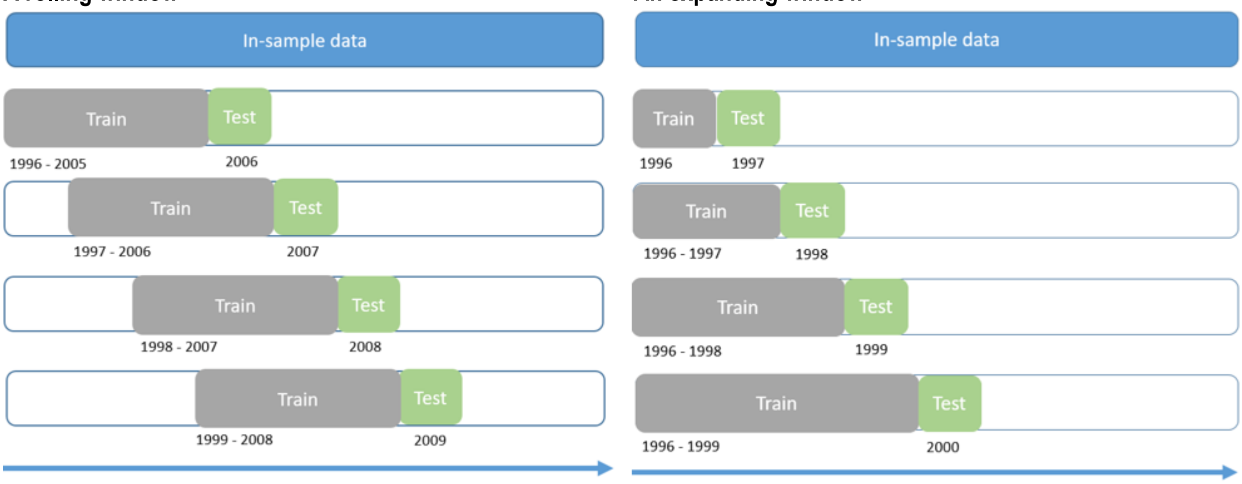
39. Additional statistics were used to assess the model quality. First, the forecasting directional accuracy (FDA) was computed – an indicator which measures the share of observations in the out-of-sample period for which the predicted and the actual growth rates have the same sign. Secondly, two-year ahead relative RMSEs were used to evaluate the predictive power of the models over two-years periods. Although this evaluation process is relatively standard in the nowcasting literature (Bańbura Martha et al., 2013[4]; Sédillot and Pain, 2003[30]; Mourougane, 2006[31]), the difficulty here is to compute those metrics in quasi real time.

40. Furthermore, deploying machine learning algorithms, such as gradient boosted trees requires data techniques to limit the possibility of overfitting the model on the training data. Cross-validation is a technique used to address overfitting by testing a model's performance on unseen data. In standard cross-validation, the dataset is split into k-folds, with k-1 folds used for in-sample training and one-fold used for out-of-sample testing. This process is repeated iteratively, and the performance is calculated by averaging the test scores of the model across all sample splits (Hastie, Tibshirani and Friedman, 2009[32]). However, in a panel setting with time series data, a random splitting of the training sample can break the order of the time series, potentially leading to inaccurate predictions (Bergmeir and Benítez, 2012[33]).

41. To address this issue, two cross-validation approaches are used (Figure 3). The data is split into in-sample and out-of-sample data, and a rolling window is created to operate on the in-sample data, with a horizon of ten years. The window is rolled over the full in-sample period, constantly splitting into training and test sets. Then, the iterations over the in-sample period are repeated with expanding windows (windows of one-to-nine-year horizons) to create additional training and test splits. The RMSE is calculated for each sample, and the final performance of the model is calculated as the average of RMSEs on all test splits generated from both cross-validation processes.

Figure 3. Example of a cross-validation strategy

A rolling window **An expanding window**



Source: OECD illustration.

6. Model performance

Nowcasting models are generally found to outperform an AR benchmark

42. The nowcasting models tend to perform better than the AR1 benchmark when performance is measured in terms of one-year ahead RMSE (Table 3). Overall, the benchmark is outperformed in nearly 76% of the instances, although to a varying degree across different indicators and sectors.

43. The GBM is selected most often as the best model (34.9% in all instances and 53% at the economy wide level), indicating that it generally has a higher predictive accuracy than the other models. Penalised regression models (lasso and ridge) also perform relatively well and are frequently selected, notably for services. Finally, the AR1 benchmark displays good performance based on their RMSEs although it has a lower average FDA than the other models.

Table 3. Best model selection based on one-year ahead RMSE

Percentage of instances selected as best model

	Benchmark AR1 (1)	GBM (2)	Lasso (3)	Ridge (4)	Consensus (5)	OLS (6)	Total instances (2-6)
EXGR_DVASH	**21.4**	**42.0**	**13.0**	**11.0**	**6.6**	**6.0**	**78.6**
Economy Wide	7.3	65.9	14.6	7.3	2.4	2.4	92.7
Agriculture	26.8	34.1	17.1	7.3	9.8	4.9	73.2
Manufacturing	19.5	70.7	4.9	2.4	2.4	0.00	80.5
Services	14.6	19.5	31.7	31.7	0.00	2.4	85.4
EXGR_SERV_DVASH	**24.3**	**20.9**	**21.0**	**15.6**	**10.6**	**7.7**	**75.7**
Economy Wide	7.3	39.0	19.5	26.8	7.3	0.00	92.7
Agriculture	19.5	29.3	34.1	0.00	4.9	12.2	80.5
Manufacturing	12.2	24.4	34.1	14.6	9.8	4.9	87.8
Services	22.0	4.9	29.3	34.1	4.9	4.9	78.0
EXGR_SERV_FVASH	**18.4**	**36.4**	**15.7**	**8.0**	**12.5**	**8.9**	**81.6**
Economy Wide	7.3	65.9	9.8	9.8	4.9	2.4	92.7
Agriculture	12.2	39.0	4.9	7.3	24.4	12.2	87.8
Manufacturing	17.1	58.5	12.2	0.00	12.2	0.00	82.9
Services	12.2	36.6	29.3	7.3	2.4	12.2	87.8
VALU_FFDDVA	**32.8**	**40.1**	**9.6**	**5.7**	**3.5**	**8.3**	**67.2**
Economy Wide	7.3	41.5	41.5	7.3	2.4	0.00	92.7
Agriculture	29.3	39.0	7.3	0.00	14.6	9.8	70.7
Manufacturing	46.3	34.1	9.8	4.9	0.00	4.9	53.7
Services	7.3	39.0	34.1	17.1	2.4	0.00	92.7
All indicator-country-sector instances	**24.2**	**34.9**	**14.8**	**10.1**	**8.3**	**7.7**	**75.8**

Note: Models are estimated at the indicator-sector level and one single model is selected as best for each country. The share of indicator-country-sector instances where selected best models correspond to one of the following statistical models: benchmark AR1, GBM, lasso, ridge, consensus and OLS.
Source: Authors' calculations.

Table 4. Relative RMSEs one-year ahead by sector and indicator

Best model RMSE for one-year ahead predictions relative to benchmark AR1, average across countries

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.69**	**0.74**	**0.78**	**0.70**
Mining and quarrying	**0.91**	**0.92**	**0.91**	**0.93**
Agriculture	**0.84**	**0.85**	**0.87**	**0.90**
Manufacturing	**0.75**	**0.86**	**0.82**	**0.90**
Food products, beverages and tobacco	0.77	0.90	0.82	0.89
Textiles, leather and footwear	0.83	0.90	0.83	0.96
Wood and products of wood and cork; Paper	0.79	0.91	0.88	0.90
Basic metals; Fabricated metal products	0.85	0.88	0.92	0.92
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.81	0.86	0.85	0.90
Computer, electronic and optical equipment; Electrical equipment	0.91	0.94	0.89	0.97
Motor vehicles; Other transport equipment	0.87	0.93	0.88	0.97
Machinery and equipment, nec	0.87	0.91	0.90	0.96
Services	0.77	0.79	0.86	0.74
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.75	0.80	0.89	0.85
Financial and insurance	0.91	0.92	0.91	0.89
Telecommunications; IT and other information services	0.89	0.91	0.89	0.87
Professional, scientific and technical activities; Administrative and support services	0.88	0.89	0.88	0.88
Other service activities	0.83	0.92	0.88	0.91
All indicator-country-sector instances	0.83	0.88	0.87	0.89
Economy Wide	0.69	0.74	0.78	0.70
Mining and quarrying	0.91	0.92	0.91	0.93
Agriculture	0.84	0.85	0.87	0.90
Manufacturing	0.75	0.86	0.82	0.90
Food products, beverages and tobacco	0.77	0.90	0.82	0.89
Textiles, leather and footwear	0.83	0.90	0.83	0.96
Wood and products of wood and cork; Paper	0.79	0.91	0.88	0.90
Basic metals; Fabricated metal products	0.85	0.88	0.92	0.92
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.81	0.86	0.85	0.90
Computer, electronic and optical equipment; Electrical equipment	0.91	0.94	0.89	0.97
Motor vehicles; Other transport equipment	0.87	0.93	0.88	0.97
Machinery and equipment, nec	0.87	0.91	0.90	0.96
Services	**0.77**	**0.79**	**0.86**	**0.74**
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.75	0.80	0.89	0.85
Financial and insurance	0.91	0.92	0.91	0.89
Telecommunications; IT and other information services	0.89	0.91	0.89	0.87
Professional, scientific and technical activities;	0.88	0.89	0.88	0.88
Administrative and support services	0.83	0.92	0.88	0.91
Other service activities	0.83	0.88	0.87	0.89
All indicator-country-sector instances	**0.69**	**0.74**	**0.78**	**0.70**

Note: Since more aggregated sectors like Manufacturing and Services were estimated independently of their corresponding disaggregated sectors, the relative RMSEs of the former do not represent the average of the latter.
Source: Authors' calculations.

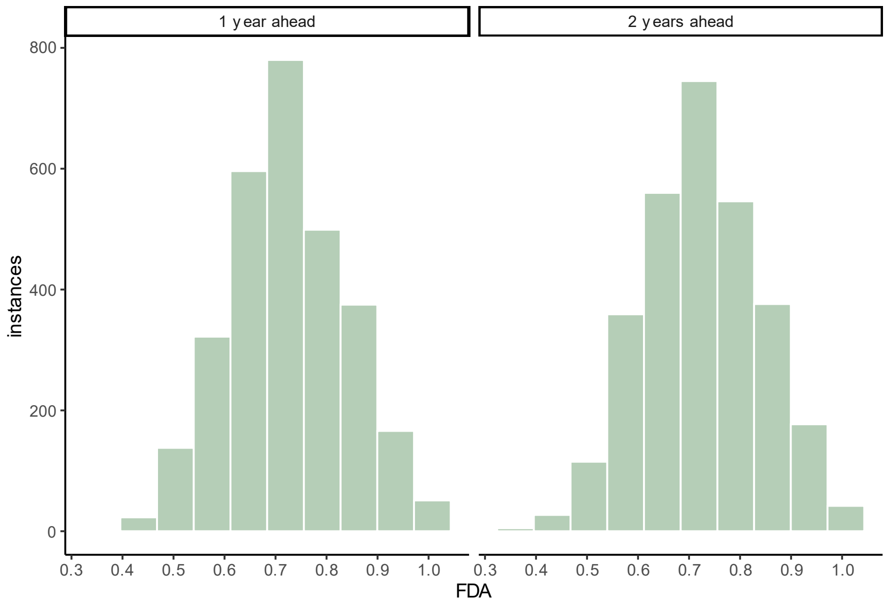
44. On average, the performance of the best models in one-year ahead nowcasts yields a relative gain over the benchmark ranging from 3% to 31%, as measured by (1 - relative RMSE) x 100 (Table 4). Models on aggregate economy level usually outperform sectoral models. However, differences in RMSE relative to the benchmark are less stark. Gains range from 32% to 40% for economy-wide models as compared to 15% to 20% in most instances at more disaggregated sectoral levels. In this analysis, better performance relative to the benchmark for more aggregated sectors is most often associated with the better quality of information.

45. The Diebold-Mariano tests, adjusted for small samples, confirm that for most indicator-country-sector instances the difference with respect to the benchmark is statistically different from zero, although less markedly so for disaggregated sectors. Some examples are shown in the Annex for a selection of countries where nowcasting performance is relatively high (United States, China), medium (Portugal) and low (Slovak Republic) (Table B.2 - Table B.5). Overall, the RMSE corresponding to the best model is significantly lower than the benchmark in 74% of the instances for the share of domestic value added embodied in foreign final demand and up to 82% of them for the domestic value-added share of exports.

46. Performances are slightly worse for two-years ahead than one-year ahead models. As expected, two-years ahead models showed an overall 5% decrease in performance based on their average RMSEs. This result holds across most of the indicators and sectors. Nevertheless, when analysing relative RMSEs (Table 4 vs. Table B.1), the performance of the models is quite similar for one and two-years ahead predictions, as the AR1 benchmark RMSEs decline to a similar degree as the other models. This masks some differences across indicators and sectors. For example, there is an increase in relative RMSEs when increasing the prediction horizon for all indicators associated with services. However, these differences are not significant in most cases.

Figure 4. Distribution of forecasting directional accuracy estimates

Per cent, across all indicator-country-sector instances



Note: Forecasting directional accuracy (FDA) measures the share of observations in the out-of-sample periods for which the predicted and actual growth rates have the same sign.
Source: Authors' calculations.

47. An additional metric, the FDA, also suggests that nowcasting models manage to predict the direction of annual developments in TiVA indicators in most cases. Indeed, in more than 85% of instances, the share one-year ahead models for which actual and predicted annual changes have the same sign is found to be greater than 60% (Figure 4). The two-years ahead predictions appear to be equally effective as the one-year ahead in predicting the directions of annual changes in the TiVA indicators.

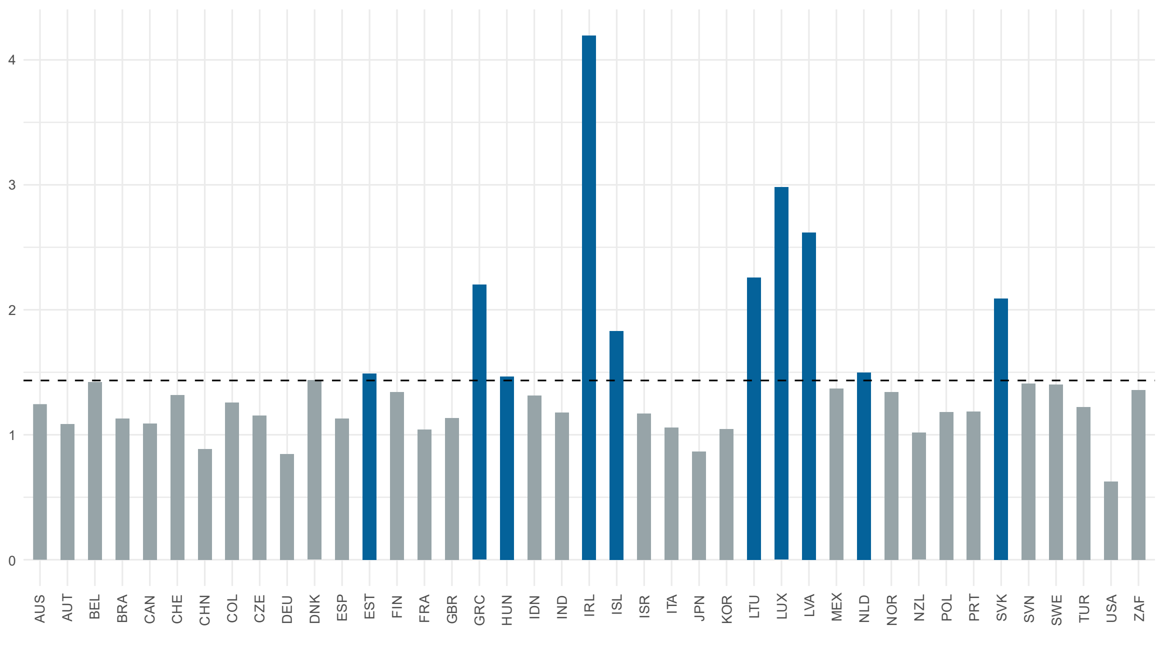
Performance is generally better for larger than for smaller economies

48. Overall, the performance, measured in terms of RMSEs, is very good for OECD aggregates, and at world level (see Figure 6).

49. But some structural differences exist across countries, with some countries performing on average across indicator-sector instances much better than others (Figure 5). This is the case of largest economies, in particular United States, Japan, Germany, and China, whose absolute RMSEs are on average 0.6 to 0.9 percentage point lower than the average of countries. Other large economies, such as France, Italy, the United Kingdom, Canada, India, Indonesia, Brazil also display relatively lower RMSEs (0.5 percentage point or less than the average).

Figure 5. Absolute RMSEs are lower in largest economies

Percentage points



Note: Country-average RMSEs were estimated for one-year ahead predictions and for all indicator-sector instances. The horizontal dashed line corresponds to the overall average absolute RMSE (1.5 percentage points).
Source: Authors' calculations.

50. By contrast a group of small economies has been found harder to nowcast. Ireland, Iceland, Greece, Lithuania, Luxembourg, Latvia, Slovak Republic and, to a lesser extent, Estonia, Hungary and the Netherlands present higher errors across all TiVA indicators considered (country average RMSE is equivalent to 1.5 percentage points).

51. Several factors may explain this relatively bad performance. First, the target variables (annual changes of TiVA indicators) have a larger standard deviation for those economies than for the rest.

This could reflect a higher volatility of the target variable or important structural changes in the country's engagement in global value chains.

52. Ireland, whose performance is estimated to be the worst in the group of countries considered, is a clear example where those two explanations compound each other. On the one hand, the volatility of the target is more pronounced than in other countries. For instance, the standard errors of domestic value-added shares are, on average, more than two times higher than those of the other countries. On the other hand, the country underwent significant changes in the nature and the depth of its global value chains. The domestic value-added shares in the information technology and other informational services industry were close to 80% in 1995 but dropped to only 30% in 2020. Due to these changes, and related to an increase in MNE's activities within Ireland and tax planning, the statistical office faced significant challenges in ensuring that the headline national accounts data captured the reality of businesses and households in the country (Central Bank of Ireland, 2023[34]; FitzGerald, 2016[35]).

53. Poorer performance is also sometimes associated with specific episodes, such as the 2008 global financial crisis. Eight out of ten countries with large nowcasting errors exhibited larger errors during the financial crisis than in normal times, explaining their overall worse performance. Bad performer countries were characterised by RMSEs 26% higher during the global financial crisis than in normal times (as compared to 20% in the other countries). The exception is Ireland whose RMSE was lower during the global financial crisis than in normal times (Figure 6).

Figure 6. One-year ahead predictive performance for domestic value-added shares

Source: Authors' calculations.

Prediction errors are found to be smaller at the economy wide and for services than for manufacturing

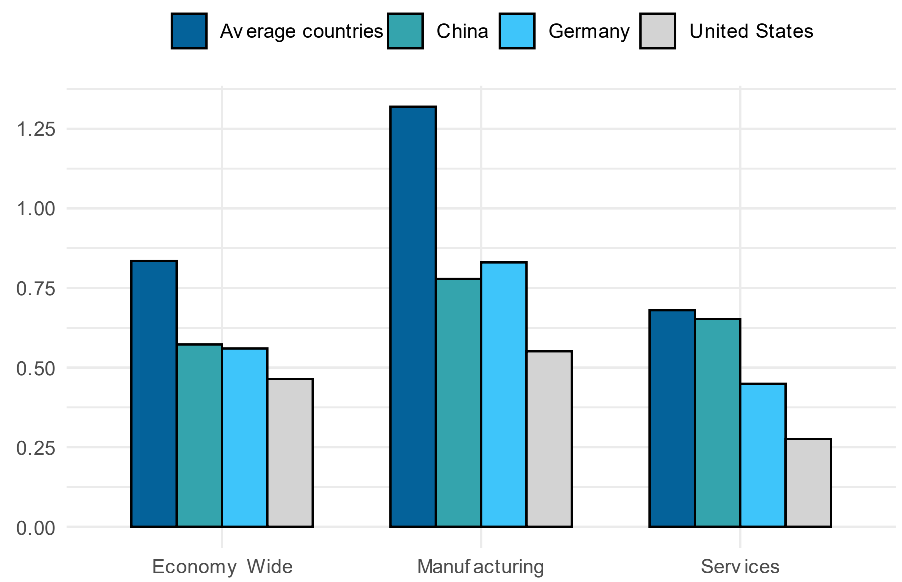
54. Performance across sectors also differs. Indeed, predictions errors for services and the aggregate economy are found to be lower than those for manufacturing. This is true on average across countries and for three reference economies, United States, China, and Germany, which display the lowest RMSEs overall (Figure 7). Differences between country averages and reference countries are also larger in manufacturing than in services and in the economy as a whole. This reflects large errors in a handful of countries (Ireland, Luxembourg, Australia, Greece, Slovak Republic, Mexico, and Lithuania) which drive the average RMSEs in the manufacturing upwards. Once excluding these countries, the difference between manufacturing and services and economy-wide is significantly reduced, both in terms of overall errors but also in terms of the gap between the RMSE on average across countries and in the three reference countries.

55. Disaggregating by sectors, the relatively worse performance for manufacturing is driven by motor vehicles, computers and electrical equipment, machinery and equipment, and coke and refined petroleum, plastics; pharmaceuticals and others, which show relatively higher RMSEs on average across countries and a more significant difference with respect to the United States (Figure 8). By contrast, manufacturing sectors such as wood and paper, and food products, beverages, and tobacco, show relatively good performance across indicators while the difference with respect to the United States is less significant.

56. It appears to be that country-sector pairs with a higher degree of backward participation such as computers and electrical equipment and motor vehicles, perform relatively less well than those with a lower degree of backward participation, like wood and paper. A positive relationship is found between RMSEs of country-sector pairs and the foreign share of exports, but essentially at low levels of the share (up to 35%).

Figure 7. RMSE economy-wide, manufacturing and services, selected economies

Percentage points

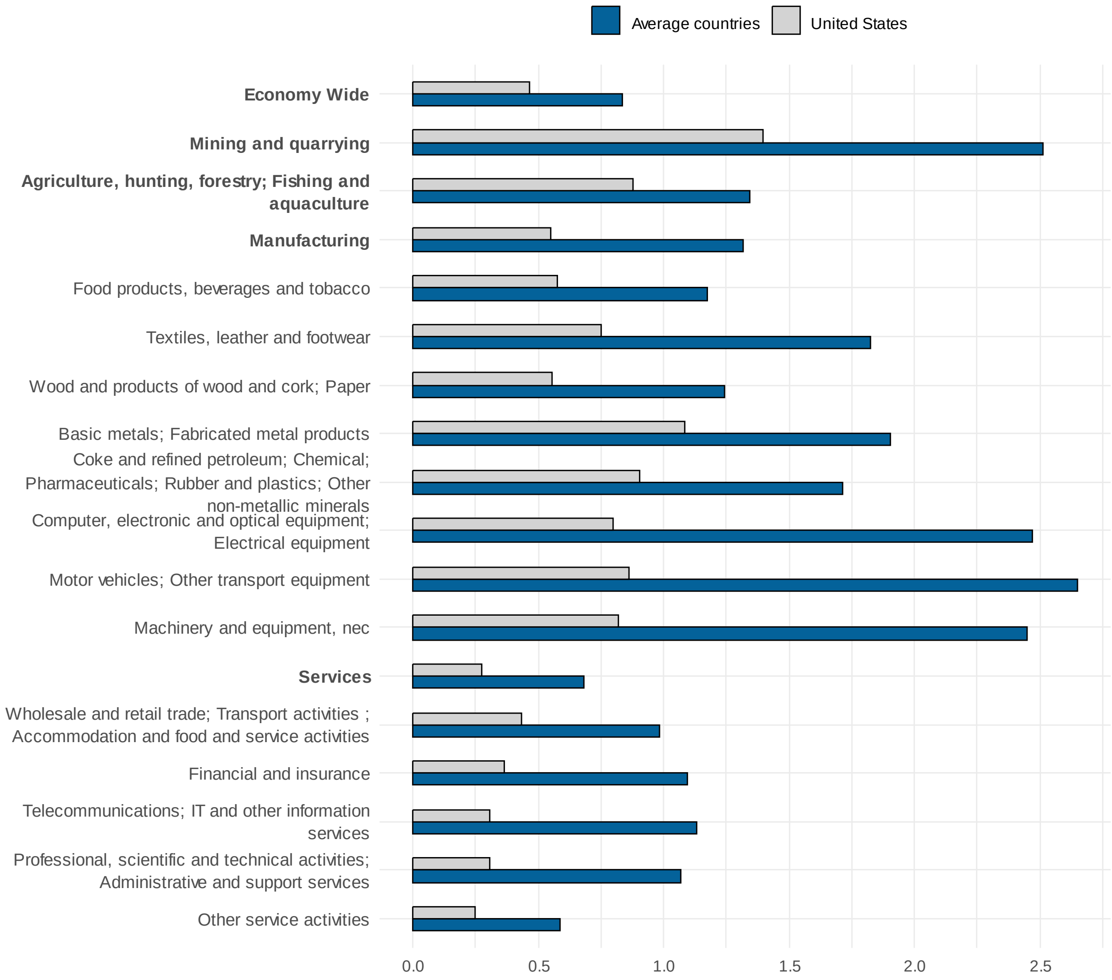


Note: RMSEs were averaged for the 41 countries at economy wide, manufacturing and services level.
Source: Authors' calculations.

57. Finally, services exhibit the lowest country average RMSEs and the difference with respect to reference countries is the least. Within services, wholesale and retail trade, transport activities; accommodation and food and service activities, financial and insurance, and professional, scientific, and technical activities; administrative and support services show good performance and the lowest difference with respect to the United States. One possible explanation is the lower volatility of the target variables for services compared to manufacturing sectors (see Table 5).

Figure 8. Absolute RMSEs by sectors

Percentage points



Source: Authors' calculations.

Export-related indicators exhibit on average better nowcasting performance than the foreign demand-based indicators

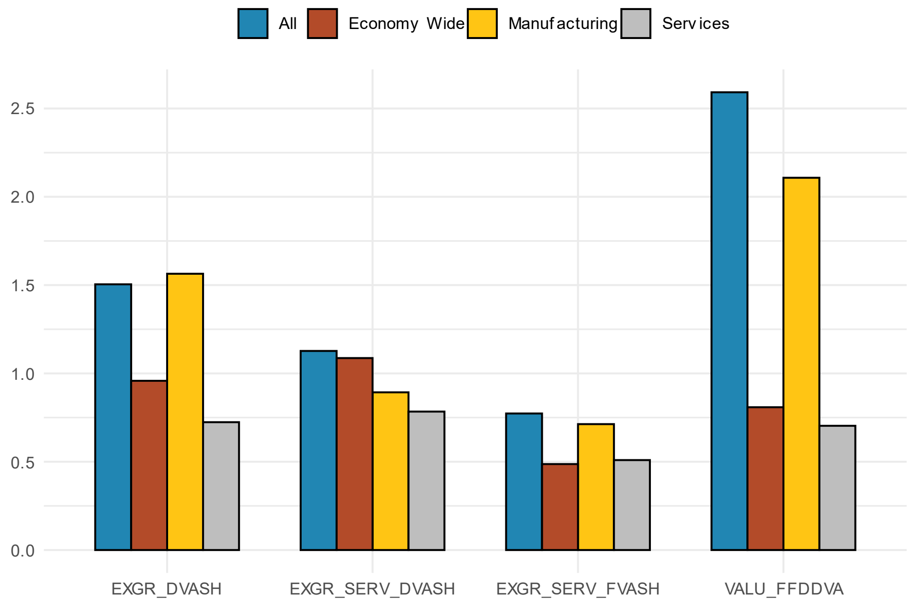
58. The basic TiVA indicators seek to capture the origin of the value added of industries based on different flows, either exports (e.g. the domestic value-added share of exports) or final demand for goods and services in foreign countries (e.g. the share of domestic value added embodied in foreign final demand). Other indicators such as the domestic or foreign services value-added share of exports capture the increasing importance of services inputs in the production processes of manufacturing firms (Miroudot and Cadestin, 2017[36]).

59. Export-based indicators exhibit lower RMSEs than foreign demand-based indicators (Figure 9). RMSEs are close to 2.5 percentage points for the share of domestic value added embodied in foreign final demand on average across countries, as opposed to slightly less to 1.5 percentage points for the domestic content of exports and close or lower than 1 percentage points for domestic and foreign services contents of exports. The difference is essentially due to relatively worse nowcasting performance for this indicator in the manufacturing sector (above 2 percentage points on average across countries, while it is close to

1-1.5 percentage points for the other indicators), which itself stems from a relatively higher volatility of the indicator in this sector (Table 5). Errors related to this indicator in manufacturing are particularly marked for in Ireland, Lithuania, Luxembourg, Sweden. At the economy-wide and for services, the performance of the models related to this indicator appear to be close or even sometimes slightly better than those of the other indicators.

Figure 9. Absolute RMSEs by indicators, selected sectors

Percentage points



Note: EXGR_DVASH: domestic value-added share of exports; EXGR_SERV_DVASH: domestic services value-added share of exports; EXGR_SERV_FVASH: foreign services value-added share of exports; VALU_FFDDVA: share of domestic value added embodied in foreign final demand.
Source: Authors' calculations.

60. Within export-based indicators, RMSEs are found to be relatively lower for the foreign services value-added share in exports. This holds at the economy-wide but also manufacturing and services levels. A lower volatility of this indicator explains this better performance (Table 5).

Table 5. Volatility of target variables

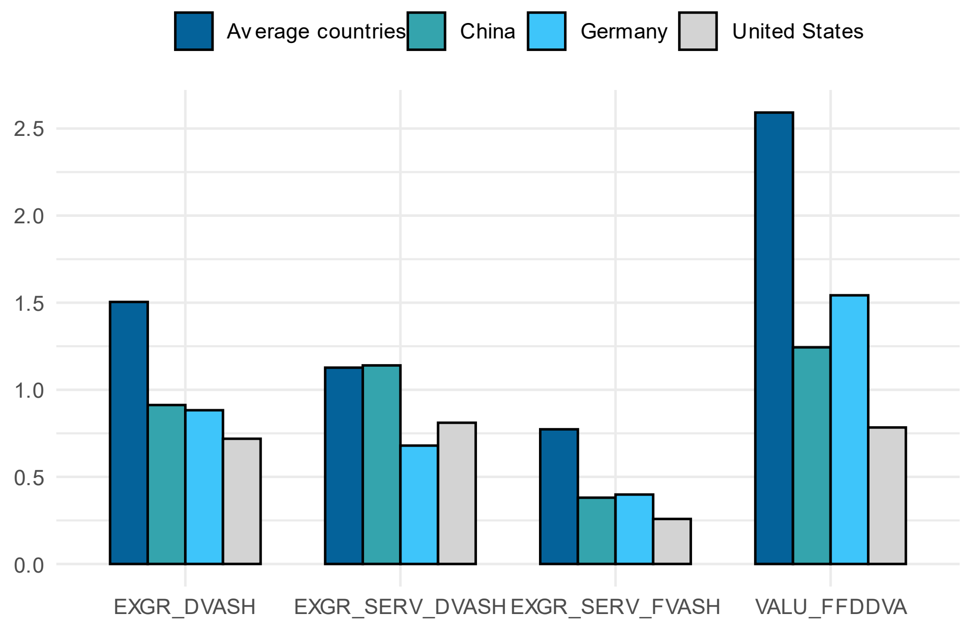
	TiVA Codes	Standard deviation (average 1995-2020)			
		All instances	Economy-wide	Manufacturing	Services
Change in the domestic value-added share of exports	EXGR_DVASH	2.06	1.56	2.07	1.21
Change in the domestic services value-added share of exports	EXGR_SERV_DVASH	1.50	1.61	1.09	1.27
Change in the foreign services value-added share of exports	EXGR_SERV_FVASH	1.07	0.77	0.99	0.82
Change in the share of domestic value added embodied in foreign final demand	VALU_FFDDVA	3.66	1.63	2.64	1.33

Source: Authors' calculations.

61. The difference between the country average and the reference countries appears to be largest for the share of domestic value added embodied in foreign final demand. This is essentially explained by much worse performance of Latvia, and to a lesser extent, Ireland, Lithuania and Luxembourg, for this indicator, and in the case of the manufacturing sector, a larger number of countries for which errors are relatively elevated. Excluding those countries from the analysis, the gap between the average of countries and the United States, where errors are the smallest, would be reduced by 13%.

Figure 10. One-year ahead absolute RMSE by indicators, selected economies

Percentage points



Note: EXGR_DVASH: domestic value-added share of exports; EXGR_SERV_DVASH: domestic services value-added share of exports; EXGR_SERV_FVASH: foreign services value-added share of exports; VALU_FFDDVA: share of domestic value added embodied in foreign final demand.

Source: Authors' calculations.

7. Nowcasting 2021 and 2022

62. This section reports the nowcast for 2021 and 2022 produced with the models discussed in the previous sections.

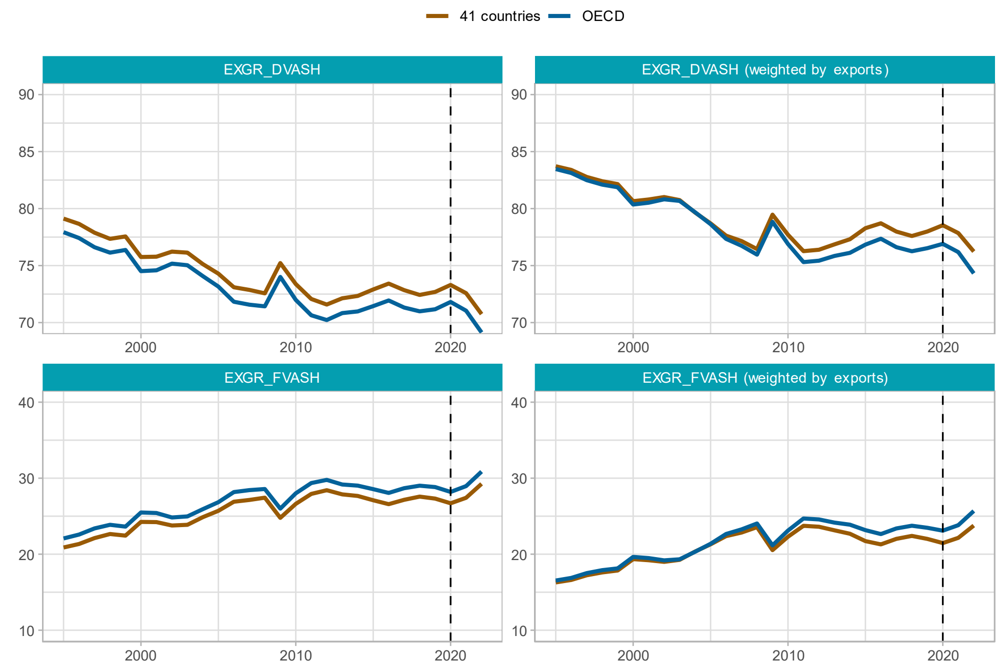
The share of domestic value added in exports is estimated to have fallen in 2021-22

63. At the economy-wide level, the share of domestic value added in exports declined from 1995 up until the global financial crisis, as countries across the globe engaged in global value chains and substituted domestic value added with imported intermediates to produce exportable goods and services (Figure 11). This is consistent with Antras and Chor (2022[37]). Since the financial crisis, the indicator has been broadly stable, a phenomenon often called de- or slow-balisation (Jaax, Miroudot and van Lieshout, 2023[1]).

ADB estimates value added and output for 2020, using a different methodology, and also found a decline in value added for most of the economies in their sample (ADB, 2022[38]).

Figure 11. Evolution of the share of domestic and foreign value-added in economy-wide exports

Per cent

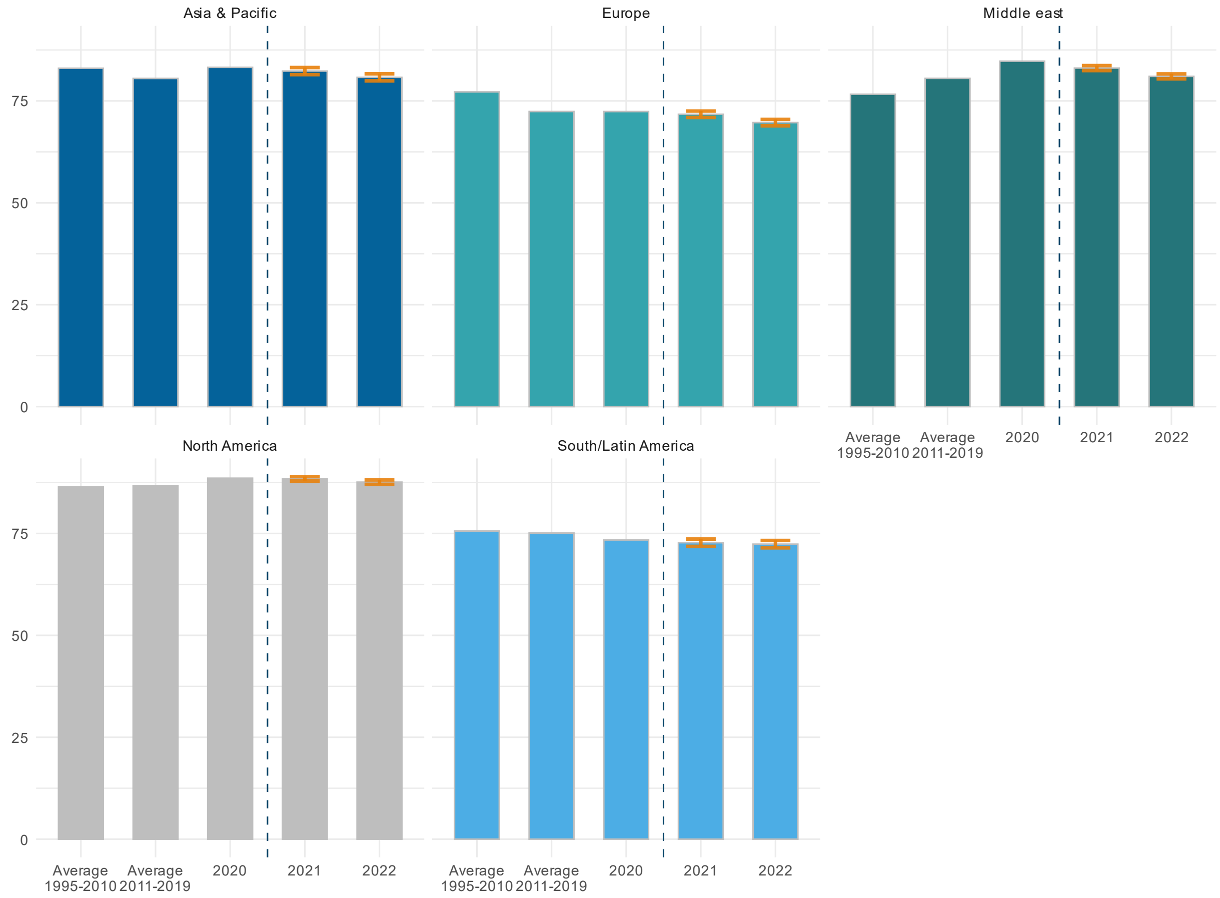


Note: Average over the corresponding country's domestic and foreign value-added shares of exports weighted with exports, not corrected for intra-region trade. This differs from estimates reported in the OECD TiVA database (Guilhoto, Webb and Yamano, 2022[39]). The OECD aggregate does not include Chile and Costa Rica. The OECD aggregate in TiVA database treats the OECD as a single economy and thus VA flows between OECD countries are regarded as domestic flows, while exports are to non-OECD members only.
Source: Authors' calculations.

64. Nowcasts for 2021-22, using the models described in the preceding sections suggest that the content of domestic value added in export has been falling in 2021 and 2022, both on average across OECD countries, and at a more global level, when large emerging-market economies are included. The fall was widespread, with all the regions and the vast majority of the 41 countries covered in the analysis experiencing a drop in the domestic value-added content of exports (Figure 12). A reason for this could be the increases in commodity prices, most notably oil, in 2021 and 2022 that may have led to an increase in the foreign value-added of exports.

Figure 12. Share of domestic value-added in exports at the economy-wide level by region

Per cent



Note: Regional averages over the corresponding country's domestic value-added shares of exports weighted with exports, not corrected for intra-region trade. This differs from estimates reported in the OECD TiVA database (Guilhoto, Webb and Yamano, 2022[39]). The OECD aggregate does not include Chile and Costa Rica. The OECD aggregate in TiVA database treats the OECD as a single economy and thus VA flows between OECD countries are regarded as domestic flows, while exports are to non-OECD members only. Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Authors' calculations.

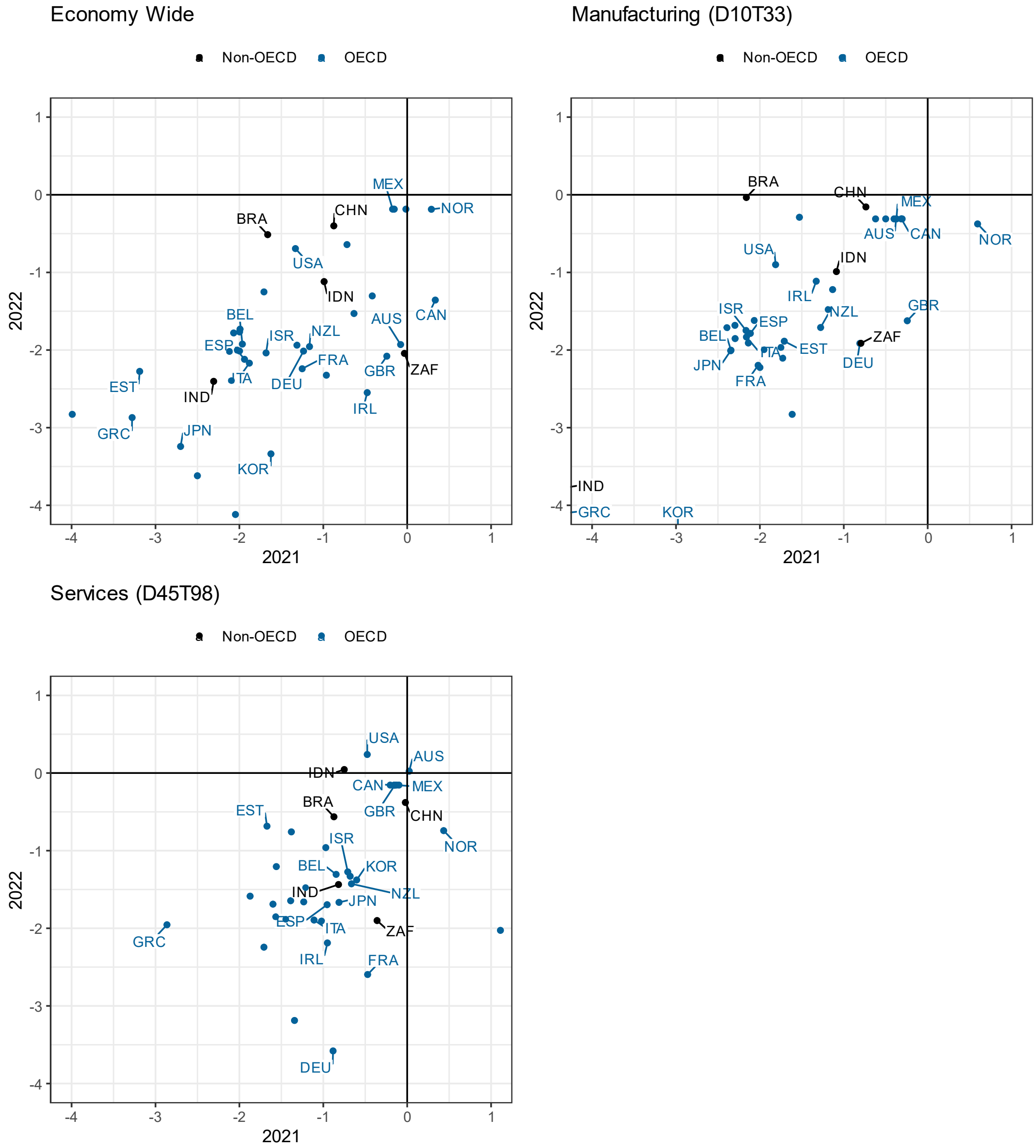
65. Aggregates at the economy-wide level are mirrored by developments at the sectoral level. Most countries experienced a decline in the domestic value-added share in exports in 2021 and 2022 in manufacturing and services (Figure 13). At the same time, global trade did not contract in 2021-22 (CPB Economic Policy Analysis, 2023[40]).

66. The intensity of the decline differs across sectors and appear stronger in manufacturing than in services for most economies. The contraction in manufacturing is particularly marked in Greece, India and Korea. Germany stands out with a more pronounced fall predicted in services rather than in manufacturing.

67. A group of countries, most notably China, Mexico, and Australia, experienced only very light negative changes in the domestic value-added share in exports at both economy and sectoral level. Norway is the only country that recorded an increase in 2021, at the economy-wide manufacturing and services levels. In Canada, the indicator is nowcasted to decrease in 2022 after a very small increase in 2021. But those moves are marginal within the confidence bands.

Figure 13. Change in the domestic value-added share of exports by sector

Percentage point



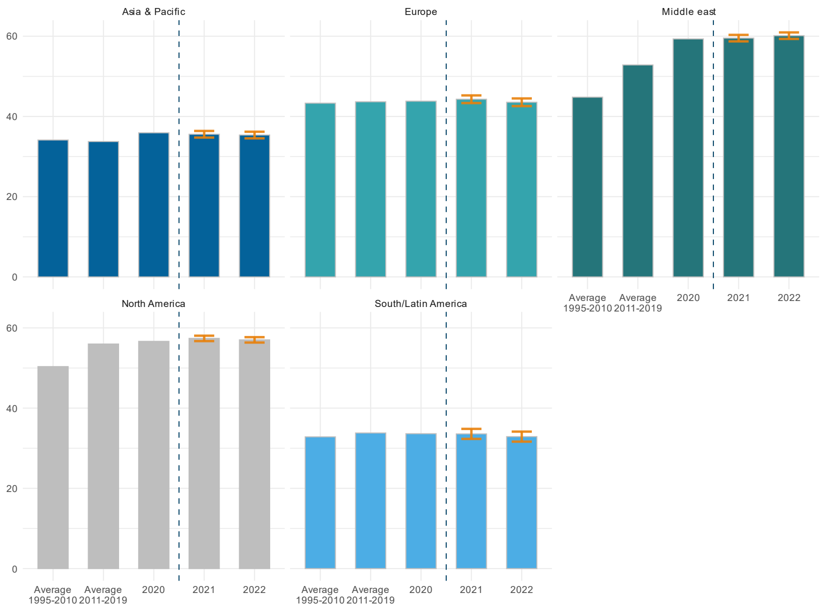
Note: Differences between developments at the economy-wide level on the one hand and manufacturing and services at the other hand may be explained by developments in sectors which are not shown.
Source: Authors' calculations.

Domestic services value-added shares of exports are expected to have been broadly stable, while the foreign counterpart has increased

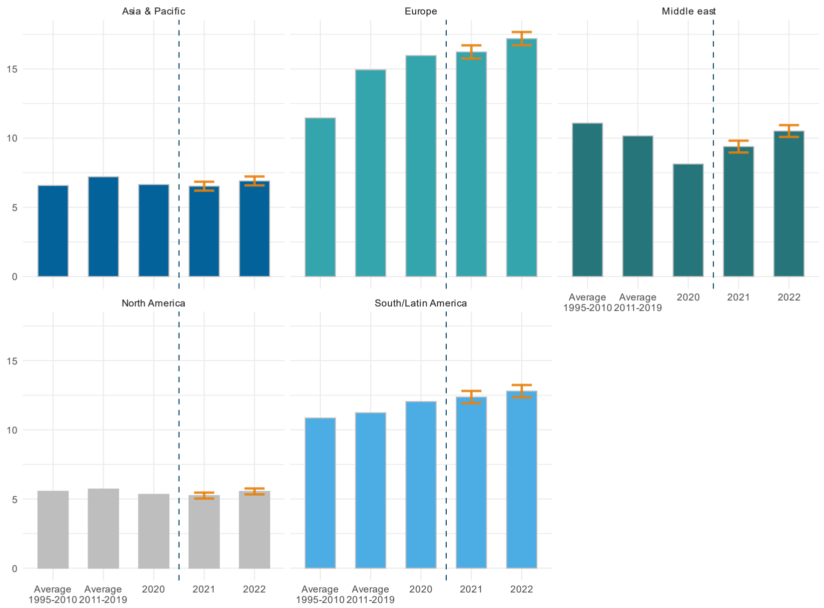
68. Nowcasts point to little movement in the domestic services content of export in 2021 and 2022 in all the regions (Figure 14).

Figure 14. Services content of exports by region

A – Domestic, Per cent



B – Foreign, Per cent



Note: Regional averages over the corresponding country's domestic value-added shares of exports weighted with exports, not corrected for intra-region trade. This differs from estimates reported in the OECD TiVA database (Guilhoto, Webb and Yamano, 2022[39]). The OECD aggregate does not include Chile and Costa Rica. Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Authors' calculations.

69. This stability masks a wide disparity in the direction of the nowcast across countries, but also across sectors (Annex D). While most countries experienced a decline in the indicator related to the manufacturing sector in 2021-22 and an increase in the agriculture sectors, outcomes were much more diverse in the services sector.

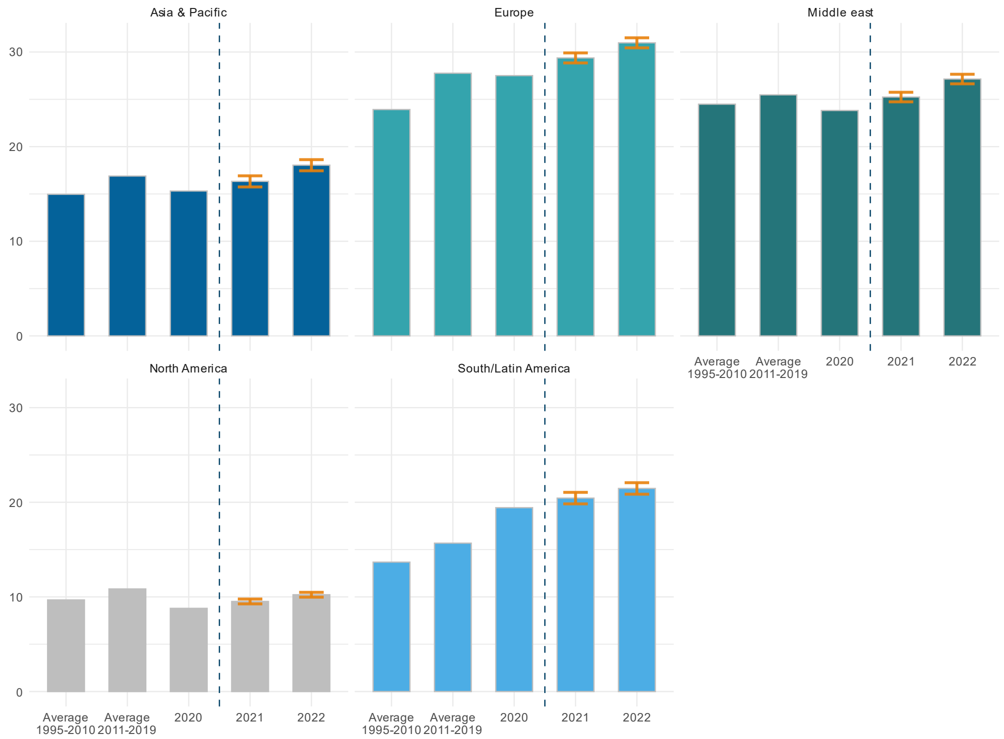
70. By contrast, the foreign services content of exports is found to have increased during the period, notable in Europe (from 16% in 2020 to 17.9% in 2022) and the Middle East (from 9.4% in 2020 to 10.5% in 2022). This increase was also broad-based when looking at sectoral developments.

The share of domestic value added embodied in foreign demand is nowcasted to have recovered in 2021-22

71. The share of domestic value added embodied in foreign final demand declined in most regions in 2020. But the fall is nowcasted to have been short-lived, and the share is estimated to have recovered steadily in 2021 and 2022 (Figure 15) Marked increases in the share can be observed in Europe (from 27.5% in 2020 to 31% in 2022), the Middle East (from 23.8% in 2020 to 27.1% in 2022) and South and Latin America (from 19.4% in 2020 to 21.5% in 2022). In all regions but North America, the indicator is expected to have exceeded in 2022 its pre-crisis level. While this stands in contrast to the decline of domestic value added as share of exports, other drivers of exports, influencing the competitiveness across countries may lead to the nowcasted increase of the domestic value added embodied in foreign demand.

Figure 15. Share of domestic value added embodied in foreign final demand by region

Per cent



Note: Regional averages over the corresponding country's domestic value-added shares of exports weighted with exports, not corrected for intra-region trade. This differs from estimates reported in the OECD TiVA database (Guilhoto, Webb and Yamano, 2022[39]). The OECD aggregate does not include Chile and Costa Rica. Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Authors' calculations.

72. The increase is estimated to have occurred in most sectors and countries, with different magnitude (Annex D). In the manufacturing sector, large increases are observed for the United Kingdom, Canada, China and Mexico. In the services sectors, the rise is more homogenous across countries.

8. Conclusion

73. This paper puts forward a new approach to nowcast five TiVA indicators, at economy-wide level and for 24 sectors and 41 countries. It relies on a range of machine learning approaches together with more simple linear regression-based models in a panel setting. Models are tested in pseudo- real time and appear to bring significant gains in nowcasting performances compared to a standard auto-regressive benchmark.

74. But there is variation in performance across countries, sectors and indicators. Model predictions appear to be much better for larger economies than for small economies (in particular Ireland, Lithuania and Greece). Predictions errors appear to be also lower at the economy-wide and services sector levels than for manufacturing. Export-related indicators exhibit on average better nowcasting performance than the foreign demand-based indicators.

75. Looking forward, a number of improvements could be made. First further investigation would be warranted to better capture the engagement in global value chains of small, open and fast-growing economies such as Ireland. Second, the performance of the models in nowcasting manufacturing could be further improved, most notably by including indicators capturing some of the volatility of the target variables. Examples could be linked to technology advancements, such as exposure to AI-technology by sector or proxies for supply chain disruptions, such as trade conflicts or geopolitical tensions. Third, the approach could be extended to nowcast bilateral indicators of TiVA, or more generally other indicators derived from ICIOs such as employment or carbon footprints.

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Annex A. Data sources

Table A.1. Information on data used in the analysis

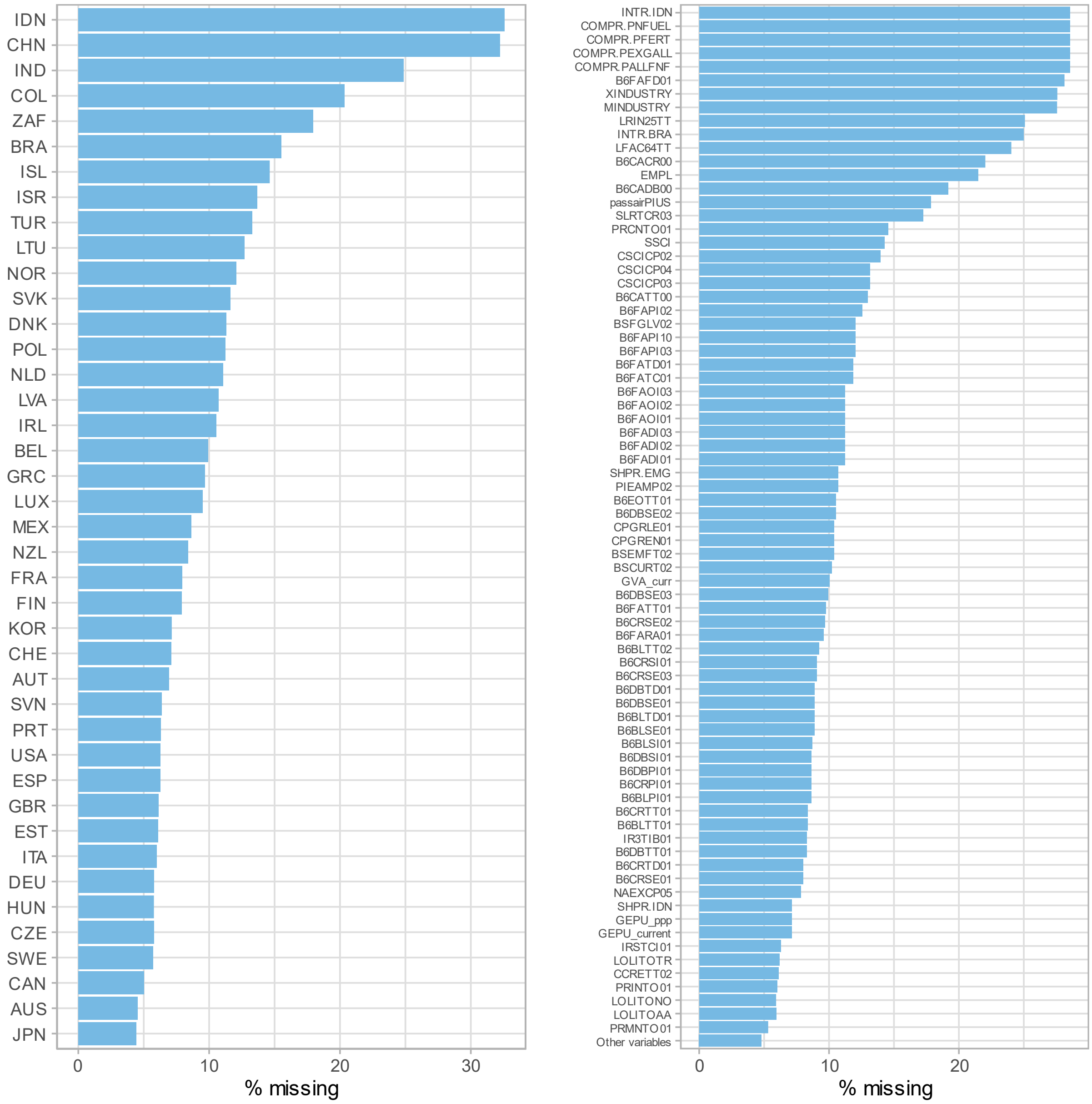
Category	Variable	Variable name	Source	Dimension
Balance of Payments	Capital account Balance	B6CATT00	Main Economic Indicators, OECD	Country
Balance of Payments	Capital account Credits	B6CACR00	Main Economic Indicators, OECD	Country
Balance of Payments	Capital account Debits	B6CADB00	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Total Balance of Goods	B6BLTD01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Total Balance of Primary Income	B6BLPI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Secondary Income	B6BLSI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Services	B6BLSE01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Total Balance	B6BLTT01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Balance, Total Balance as % of GDP	B6BLTT02	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Total Credits in Goods	B6CRTD01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Primary Income	B6CRPI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Secondary Income	B6CRSI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Services	B6CRSE01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Total as % of Current account	B6CRSE02	Main Economic Indicators, OECD	Country
Balance of Payments	Total Credits as % of Goods and Services	B6CRSE03	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Credits, Total Credits	B6CRTT01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Debits, Goods	B6DBTD01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account, Primary Income Debits	B6DBPI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account, Secondary Income Debits	B6DBSI01	Main Economic Indicators, OECD	Country
Balance of Payments	Current account Debits, Services	B6DBSE01	Main Economic Indicators, OECD	Country
Balance of Payments	Total Debits as % of Current account	B6DBSE02	Main Economic Indicators, OECD	Country
Balance of Payments	Current account, Services Total Debits as % of Goods and Services	B6DBSE03	Main Economic Indicators, OECD	Country
Balance of Payments	Current account, Total Debits	B6DBTT01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Direct investment Net	B6FADI01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Direct investment Net acquisition of financial assets	B6FADI02	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Direct Investments	B6FADI03	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Balance	B6FATT01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Net acquisition of financial assets	B6FATC01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account Net incurrence of liabilities	B6FATD01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Financial derivatives Net	B6FAFD01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Other investment Net	B6FAOI01	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Other investment Net acquisition of financial assets	B6FAOI02	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Other investment Net incurrence of liabilities	B6FAOI03	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Portfolio investment Net	B6FAPI10	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Portfolio investment Net acquisition of financial assets	B6FAPI02	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Portfolio Investments	B6FAPI03	Main Economic Indicators, OECD	Country
Balance of Payments	Financial account, Reserve Assets	B6FARA01	Main Economic Indicators, OECD	Country
Balance of Payments	Net errors and omissions Balance	B6EOTT01	Main Economic Indicators, OECD	Country
Business tendency surveys	Rate of capacity utilisation in manufacturing	BSCURT02	Main Economic Indicators, OECD	Country

Business tendency surveys	Confidence indicators in manufacturing	BSCICP02	Main Economic Indicators, OECD	Country
Business tendency surveys	Confidence indicator in manufacturing	BSCICP03	Main Economic Indicators, OECD	Country
Business tendency surveys	Future tendency of employment in manufacturing	BSEMFT02	Main Economic Indicators, OECD	Country
Business tendency surveys	Stocks of finished goods in manufacturing	BSFGLV02	Main Economic Indicators, OECD	Country
Business tendency surveys	Future tendency of selling prices in manufacturing	BSSPFT02	Main Economic Indicators, OECD	Country
Consumer opinion surveys	Consumer Confidence Indicator	CSCICP02	Main Economic Indicators, OECD	Country
Consumer opinion surveys	Confidence indicators, normalised	CSCICP04	Main Economic Indicators, OECD	Country
Price Index	Consumer Price Index (All items)	CPALTT01	Main Economic Indicators, OECD	Country
Price Index	Consumer Price of Food and non-Alcoholic beverages	CP010000	Main Economic Indicators, OECD	Country
Price Index	Consumer Price Index (All items non-food non-energy)	CPGRLE01	Main Economic Indicators, OECD	Country
Price Index	Consumer Prince Index (Energy: Fuel, electricity & gasoline)	CPGREN01	Main Economic Indicators, OECD	Country
Exchange rates	Real effective exchange rates, CPI based	CCRETT01	Main Economic Indicators, OECD	Country
Exchange rates	Real effective exchange rates, ULC based	CCRETT02	Main Economic Indicators, OECD	Country
Exchange rates	Average of daily exchange rates between national currency and USD	CCUSMA02	Main Economic Indicators, OECD	Country
Interest rates	Interbank rates (90-day)	IR3TIB01	Main Economic Indicators, OECD	Country
Interest rates	Interbank rates (< 24 hrs)	IRSTCI01	Main Economic Indicators, OECD	Country
International Trade	Total value of Exports of goods	XTEXVA01	Main Economic Indicators, OECD	Country
International Trade	Total value of Imports of goods	XTIMVA01	Main Economic Indicators, OECD	Country
International Trade	Trade Balance, goods	XTNTVA01	Main Economic Indicators, OECD	Country
Employment	Active population aged 15-64 (Labor Force Survey)	LFAC64TT	Main Economic Indicators, OECD	Country
Employment	Inactivity rate (all persons aged 25-54)	LRIN25TT	Main Economic Indicators, OECD	Country
Leading indicators	CLI (Amplitude adjusted)	LOLITOAA	Main Economic Indicators, OECD	Country
Leading indicators	CLI (Normalised)	LOLITONO	Main Economic Indicators, OECD	Country
Leading indicators	CLI (Trend restored)	LOLITOTR	Main Economic Indicators, OECD	Country
Leading indicators	GDP (Normalised)	LORSGPNO	Main Economic Indicators, OECD	Country
Leading indicators	GDP (Original series)	LORSGPOR	Main Economic Indicators, OECD	Country
Leading indicators	GDP (Ratio to trend)	LORSGPRT	Main Economic Indicators, OECD	Country
Leading indicators	GDP Trend	LORSGPTD	Main Economic Indicators, OECD	Country
National Accounts	Exports of Goods and Services (Constant prices)	NAEXKP06	Main Economic Indicators, OECD	Country
National Accounts	Government Final Consumption Expenditure (Constant prices)	NAEXKP03	Main Economic Indicators, OECD	Country
National Accounts	GDP (Constant prices)	NAEXKP01	Main Economic Indicators, OECD	Country
National Accounts	Gross Fixed Capital Formation (Constant prices)	NAEXKP04	Main Economic Indicators, OECD	Country
National Accounts	Imports of Goods and Services (Constant prices)	NAEXKP07	Main Economic Indicators, OECD	Country
National Accounts	Private Final Consumption Expenditure (Constant prices)	NAEXKP02	Main Economic Indicators, OECD	Country
National Accounts	Changes in inventories and net acquisition of valuables (Current prices)	NAEXCP05	Main Economic Indicators, OECD	Country
National Accounts	Exports of Goods and Services (Current prices)	NAEXCP06	Main Economic Indicators, OECD	Country
National Accounts	Government Final Consumption Expenditure (Current prices)	NAEXCP03	Main Economic Indicators, OECD	Country
National Accounts	GDP (Current prices)	NAEXCP01	Main Economic Indicators, OECD	Country
National Accounts	Gross Fixed Capital Formation (Current prices)	NAEXCP04	Main Economic Indicators, OECD	Country
National Accounts	Imports of Goods and Services (Current prices)	NAEXCP02	Main Economic Indicators, OECD	Country
National Accounts	Private Final Consumption Expenditure (Current prices)	NAEXCP07	Main Economic Indicators, OECD	Country
National Accounts	GDP Deflator	NAGIGP01	Main Economic Indicators, OECD	Country
National Accounts	Private Consumption Expenditure Deflator	NAGICE01	Main Economic Indicators, OECD	Country
Real Indicators	Domestic Producer Price Index (Manufacturing)	PIEAMP02	Main Economic Indicators, OECD	Country
Real Indicators	Production in Construction, index	PRCNTO01	Main Economic Indicators, OECD	Country
Real Indicators	Industrial Production, index	PRINTO01	Main Economic Indicators, OECD	Country
Real Indicators	Manufacturing Production, index	PRMNTO01	Main Economic Indicators, OECD	Country
Real Indicators	New passenger car registrations	SLRTCR03	Main Economic Indicators, OECD	Country
Real Indicators	Retail trade volume, index	SLRTCR01	Main Economic Indicators, OECD	Country
Share Prices	Share Prices, Index	SPASTT01	Main Economic Indicators, OECD	Country

National Accounts	Gross Value Added, current prices	GVA_curr	Detailed National Accounts, OECD, UNSD	Country-sector
National Accounts	Gross Output, current prices	OUTPUT	Detailed National Accounts, OECD, UNSD	Country-sector
Employment	Employment by industry	EMPL	Detailed National Accounts OECD	Country-sector
International Trade	Exports of Services in USD, EBOPS 2010	XINDUSTRY	ITSS OECD, EBOPS 2010	Country-sector
International Trade	Imports of Services in USD, EBOPS 2010	MINDUSTRY	ITSS OECD, EBOPS 2010	Country-sector
International Trade	Exports of Other Goods in USD	XINDUSTRY_FIN	Bilateral Trade by Industry and End Use, OECD	Country-sector
International Trade	Exports of Intermediate Goods in USD	XINDUSTRY	Bilateral Trade by Industry and End Use, OECD	Country-sector
International Trade	Imports of Other Goods in USD	MINDUSTRY_FIN	Bilateral Trade by Industry and End Use, OECD	Country-sector
International Trade	Imports of Intermediate Goods in USD	MINDUSTRY	Bilateral Trade by Industry and End Use, OECD	Country-sector
Interest rates	Yields on medium-term bonds, Brazil	INTR.BRA	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, Brazil	PMIE.BRA	Datastream	Global
Share Prices	Share Prices Index, Brazil	SHPR.BRA	Datastream	Global
Interest rates	Yields on medium-term bonds, China	INTR.CHN	Datastream	Global
Share Prices	Share Prices Index, China	SHPR.CHN	Datastream	Global
Interest rates	Yields on medium-term bonds, Emerging Markets	INTR.EMG	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, Emerging Markets	PMIE.EMG	Datastream	Global
Share Prices	Share Prices Index, Emerging Markets	SHPR.EMG	Datastream	Global
Interest rates	Yields on medium-term bonds, France	INTR.FRA	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, France	PMIE.FRA	Datastream	Global
Share Prices	Share Prices Index, France	SHPR.FRA	Datastream	Global
Interest rates	Yields on medium-term bonds, Indonesia	INTR.IDN	Datastream	Global
Share Prices	Share Prices Index, Indonesia	SHPR.IDN	Datastream	Global
Interest rates	Yields on medium-term bonds, India	INTR.IND	Datastream	Global
Share Prices	Share Prices Index, India	SHPR.IND	Datastream	Global
Interest rates	Yields on medium-term bonds, Italy	INTR.ITA	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, Italy	PMIE.ITA	Datastream	Global
Share Prices	Share Prices Index, Italy	SHPR.ITA	Datastream	Global
Interest rates	Yields on medium-term bonds, Japan	INTR.JPN	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, Japan	PMIE.JPN	Datastream	Global
Share Prices	Share Prices Index, Japan	SHPR.JPN	Datastream	Global
Interest rates	Yields on medium-term bonds, USA	INTR.USA	Datastream	Global
Leading indicators	Purchasing Managers Index New Export Orders, USA	PMIE.USA	Datastream	Global
Share Prices	Share Prices Index, USA	SHPR.USA	Datastream	Global
Others	Systemic Stress Composite Indicator (Europe)	airfrPIUS	ECB	Global
Price Index	Services Import Price Index: Import Air Freight (USA)	airpfaexJPN	FRED	Global
Price Index	Services Export Price Index: Export Air Passenger Fares (GBR)	airtrempUSSA	FRED	Global
Price Index	Services Export Price Index: Export Air Passenger Fares (JPN)	inclaimUS	FRED	Global
Price Index	Services Import Price Index: Import Air Passenger Fares - United Kingdom (GBR)	leisempUSSA	FRED	Global
Others	All Employees, Air Transportation (USA)	manfprodUSSA	FactSet	Global
Others	Weekly Initial Claims (ICSA) (USA)	mfcaputUSSA	FRED	Global
Others	All Employees, Leisure and Hospitality (USA)	passairPIUS	FRED	Global
Real Indicators	Industrial Production: Manufacturing (NAICS) (IPMAN) (USA)	schdairfrPIUS	FRED	Global
Real Indicators	Capacity Utilization: Manufacturing (NAICS) (MCUMFN) (USA)	airpexUK	FRED	Global
Price Index	Producer Price Index by Industry: Scheduled Passenger Air Transportation: International (USA)	airpimUK	FRED	Global
Price Index	Producer Price Index by Industry: Scheduled Freight Air Transportation: Scheduled Freight Air Transportation Services (USA)	SSCI	FRED	Global
Leading indicators	Economic policy uncertainty index	GEPU_current	Policyuncertainty.com	Global
Leading indicators	Global Economic policy uncertainty index (GDP weighted)	GEPU_ppp	Policyuncertainty.com	Global

Price Index	Beverage Price Index, 2016 = 100, includes Coffee, Tea, and Cocoa	COMPR.PBEVE	IMF Primary Commodity Prices	Global
Price Index	Coal Price Index, 2016 = 100, includes Australian and South African Coal	COMPR.PCOAL	IMF Primary Commodity Prices	Global
Price Index	Precious Metals Price Index, 2016 = 100, includes Gold, Silver, Palladium and Platinum Price Indices	COMPR.PPMETA	IMF Primary Commodity Prices	Global
Price Index	Agricultural Raw Materials Index, 2016 = 100, includes Timber, Cotton, Wool, Rubber, and Hides Price Indices	COMPR.PRAWM	IMF Primary Commodity Prices	Global
Price Index	Crude Oil (petroleum), Price index, 2016 = 100, simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh	COMPR.POILAPSP	IMF Primary Commodity Prices	Global
Price Index	Agriculture Price Index, 2016 = 100, includes Food and Beverages and Agriculture Raw Materials Price Indices	COMPR.PAGRI	IMF Primary Commodity Prices	Global
Price Index	All Metals Index, 2016 = 100: includes Metal Price Index (Base Metals) and Precious Metals Index	COMPR.PALLMETA	IMF Primary Commodity Prices	Global
Price Index	All Metals EX GOLD Index, 2016 = 100: includes Metal Price Index (Base Metals) and ONLY Silver, Palladium, Platinum	COMPR.PEXGMETA	IMF Primary Commodity Prices	Global
Price Index	Food and Beverage Price Index, 2016 = 100, includes Food and Beverage Price Indices	COMPR.PFANDB	IMF Primary Commodity Prices	Global
Price Index	Food Price Index, 2016 = 100, includes Cereal, Vegetable Oils, Meat, Seafood, Sugar, and Other Food (Apple (non-citrus fruit), Bananas, Chana (legumes), Fishmeal, Groundnuts, Milk (dairy), Tomato (veg)) Price Indices	COMPR.PFOOD	IMF Primary Commodity Prices	Global
Price Index	Industrial Inputs Price Index, 2016 = 100, includes Agricultural Raw Materials and Base Metals Price Indices	COMPR.PINDU	IMF Primary Commodity Prices	Global
Price Index	Base Metals Price Index, 2016 = 100, includes Aluminum, Cobalt, Copper, Iron Ore, Lead, Molybdenum, Nickel, Tin, Uranium and Zinc Price Indices	COMPR.PMETA	IMF Primary Commodity Prices	Global
Price Index	Natural Gas Price Index, 2016 = 100, includes European, Japanese, and American Natural Gas Price Indices	COMPR.PNGAS	IMF Primary Commodity Prices	Global
Price Index	Fuel (Energy) Index, 2016 = 100, includes Crude oil (petroleum), Natural Gas, Coal Price and Propane Indices	COMPR.PNRG	IMF Primary Commodity Prices	Global
Price Index	All Commodity Price Index, 2016 = 100, includes both Fuel and Non-Fuel Price Indices	COMPR.PALLFNF	IMF Primary Commodity Prices	Global
Price Index	Commodities for Index: All, excluding Gold, 2016 = 100	COMPR.PEXGALL	IMF Primary Commodity Prices	Global
Price Index	Fertilizer Index, 2016 = 100, includes DAP, Potash, UREA	COMPR.PFERT	IMF Primary Commodity Prices	Global
Price Index	Non-Fuel Price Index, 2016 = 100, includes Precious Metal, Food and Beverages and Industrial Inputs Price Indices	COMPR.PNFUEL	IMF Primary Commodity Prices	Global
Price Index	Producer Price Index, Manufacturing, Food, USA	PIEAFD01_USA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, CAN	PIEAMP01_CAN	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, DEU	PIEAMP01_DEU	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, FRA	PIEAMP01_FRA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, USA	PIEAMP01_USA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, DEU	PIEAEN01_DEU	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, FRA	PIEAEN01_FRA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, DEU	PIEAMI01_DEU	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, FRA	PIEAMI01_FRA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Manufacturing, USA	PIEAMI01_USA	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Industrial Activities, DEU	PIEATI01_DEU	Main Economic Indicators, OECD	Global
Price Index	Producer Price Index, Industrial Activities, FRA	PIEATI01_FRA	Main Economic Indicators, OECD	Global
Stock index	MSCI World Automobiles Index	MSCI_AUTOMOBILES	MSCI	Global

Figure A.1. Percentage of missing values



Source: Author's calculations.

Annex B. Additional results on model performance

Table B.1. Relative RMSEs two-years ahead by sector and indicator

Best model RMSE relative to benchmark AR1, average across countries

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.74**	**0.84**	**0.82**	**0.61**
Mining and quarrying	**0.90**	**0.91**	**0.91**	**0.90**
Agriculture	**0.85**	**0.91**	**0.90**	**0.88**
Manufacturing	**0.76**	**0.78**	**0.85**	**0.67**
Food products, beverages and tobacco	0.74	0.85	0.83	0.89
Textiles, leather and footwear	0.73	0.89	0.77	0.85
Wood and products of wood and cork; Paper	0.83	0.89	0.82	0.93
Basic metals; Fabricated metal products	0.76	0.91	0.85	0.91
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.85	0.89	0.91	0.91
Computer, electronic and optical equipment; Electrical equipment	0.78	0.84	0.87	0.91
Motor vehicles; Other transport equipment	0.92	0.93	0.89	0.97
Machinery and equipment, nec	0.88	0.93	0.88	0.97
Services	**0.87**	**0.91**	**0.90**	**0.97**
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.78	0.79	0.87	0.80
Financial and insurance	0.92	0.94	0.93	0.83
Telecommunications; IT and other information	0.86	0.89	0.87	0.81
Professional, scientific and technical activities; Administrative and support services	0.82	0.88	0.83	0.82
Other service activities	0.80	0.90	0.84	0.83
All indicator-country-sector instances	**0.82**	**0.88**	**0.86**	**0.86**

Note: Relative RMSEs for two-years ahead predictions with respect to the benchmark AR1, average across the countries. Since more aggregated sectors like Manufacturing (D10T33) and Services (D45T98) were estimated independently of their corresponding disaggregated sectors, the relative RMSEs of former do not represent the average of the latter.
Source: Authors' calculations.

Table B.2. United States: Relative RMSEs, one-year ahead, by sector and indicator

Best model RMSE relative to benchmark AR1

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.44*** **	**0.54*** **	**0.58*** **	**0.85*** **
Mining and quarrying	**1.00**	**0.95*** **	**1.00**	**0.97*** **
Agriculture	**0.69*** **	**0.8*** **	**0.76*** **	**0.67*** **
Manufacturing	**0.45*** **	**0.88* **	**0.49*** **	**0.95*** **
Food products, beverages and tobacco	0.51***	0.96**	0.51***	0.55***
Textiles, leather and footwear	0.53***	0.98	0.59***	0.94***
Wood and products of wood and cork; Paper	0.49***	0.96**	0.51***	0.92***
Basic metals; Fabricated metal products	0.75***	0.84**	0.89**	0.99
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.52***	0.73***	0.78***	1.00
Computer, electronic and optical equipment; Electrical equipment	0.65***	1.00	0.47***	1.00
Motor vehicles; Other transport equipment	0.51***	0.97	0.72***	0.97
Machinery and equipment, nec	0.57***	0.92*	0.8***	1.00
Services	**0.49*** **	**0.41*** **	**0.75*** **	**0.63*** **
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.53***	0.43***	0.84***	0.57***
Financial and insurance	0.74***	0.68***	0.73***	0.82***
Telecommunications; IT and other information	0.58***	0.71***	0.46***	0.71***
Professional, scientific and technical activities; Administrative and support services	0.95***	0.72***	0.76***	0.75***
Other service activities	0.55***	0.89***	0.79***	0.89***
All indicator-country-sector instances	**0.61**	**0.80**	**0.69**	**0.84**

Source: Authors' calculations.

Table B.3. China: Relative RMSEs, one-year ahead, by sector and indicator

Best model RMSE relative to benchmark AR1

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.45*** **	**0.67*** **	**0.64*** **	**0.43*** **
Mining and quarrying	**0.96**	**0.74*** **	**0.9* **	**0.64*** **
Agriculture	**0.65*** **	**0.77*** **	**0.91*** **	**0.83*** **
Manufacturing	**0.51*** **	**0.52*** **	**0.72*** **	**0.6*** **
Food products, beverages and tobacco	0.61***	0.63***	0.76***	0.78***
Textiles, leather and footwear	0.58***	0.66***	0.48***	0.66***
Wood and products of wood and cork; Paper	0.41***	0.71***	0.51***	0.57***
Basic metals; Fabricated metal products	0.63***	0.66***	0.76***	0.85***
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.48***	0.69***	0.62***	0.7***
Computer, electronic and optical equipment; Electrical equipment	0.74***	0.72**	0.7***	0.71**
Motor vehicles; Other transport equipment	0.61***	0.73***	0.48***	0.65**
Machinery and equipment, nec	0.58***	0.69***	0.67***	0.76
Services	**0.58*** **	**0.67*** **	**0.8*** **	**0.67*** **
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.52***	0.72***	0.79**	0.65***
Financial and insurance	0.96	0.97	0.97	0.65***
Telecommunications; IT and other information services	0.79***	0.79***	0.74***	0.71**
Professional, scientific and technical activities;	0.72***	0.86***	0.89***	0.68***
Other service activities	0.83***	0.97***	0.87***	0.95*
All indicator-country-sector instances	**0.64**	**0.73**	**0.73**	**0.69**

Source: Authors' calculations.

Table B.4. Portugal. Relative RMSEs, one-year ahead, by sector and indicator

Best model RMSE relative to benchmark AR1

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.67*** **	**0.93**	**0.81*** **	**0.87*** **
Mining and quarrying	**1.00**	**1.00**	**1.00**	**1.00**
Agriculture	**0.63*** **	**0.86*** **	**0.74*** **	**0.98**
Manufacturing	**0.73*** **	**0.6*** **	**0.78*** **	**0.99* **
Food products, beverages and tobacco	0.76***	0.88***	0.83**	0.98
Textiles, leather and footwear	0.81**	0.97***	0.78**	1.00
Wood and products of wood and cork; Paper	0.8***	0.87***	0.88***	1.00
Basic metals; Fabricated metal products	0.92*	0.81***	0.85***	0.73**
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.69***	0.93***	0.97	0.96
Computer, electronic and optical equipment; Electrical equipment	1.00	0.92*	1.00	1.00
Motor vehicles; Other transport equipment	0.81***	0.86***	0.96	0.94***
Machinery and equipment, nec	0.78***	0.95***	0.9***	0.99*
Services	**0.69*** **	**0.65*** **	**0.99* **	**0.68*** **
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.67***	0.64***	0.95*	0.89***
Financial and insurance	0.96	0.93	0.94	1.00
Telecommunications; IT and other information services	0.97	0.99	1.00	0.91***
Professional, scientific and technical activities; Administrative and support services	0.78**	0.77***	0.84**	0.83***
Other service activities	0.66***	0.91**	0.95*	0.89***
All indicator-country-sector instances	**0.8**	**0.86**	**0.9**	**0.92**

Source: Authors' calculations.

Table B.5. Slovak Republic, Relative RMSEs, one-year ahead, by sector and indicator

Best model RMSE relative to benchmark AR1

	Domestic value-added share of exports	Domestic services value-added share of exports	Foreign services value-added share of exports	Share of domestic value added embodied in foreign final demand
Economy Wide	**0.7*****	**0.91****	**0.86****	**0.61*****
Mining and quarrying	**0.98**	**1.00**	**0.88*****	**0.97**
Agriculture	**1.00**	**1.00**	**0.99**	**0.92*****
Manufacturing	**0.89****	**0.91*****	**0.99**	**1.00**
Food products, beverages and tobacco	0.88**	0.85***	0.96*	0.82***
Textiles, leather and footwear	1.00	1.00	1.00	1.00
Wood and products of wood and cork; Paper	0.83***	0.93**	0.97	1.00
Basic metals; Fabricated metal products	0.98	0.9**	1.00	1.00
Coke and refined petroleum; Chemical; Pharmaceuticals; Rubber and plastics; Other non-metallic minerals	0.78***	0.96	0.86***	1.00
Computer, electronic and optical equipment; Electrical equipment	1.00	0.97	0.99	1.00
Motor vehicles; Other transport equipment	0.85***	0.97*	0.99	1.00
Machinery and equipment, nec	1.00	0.92***	1.00	1.00
Services	**0.88***	**0.96**	**0.79*****	**0.7*****
Wholesale and retail trade; Transport activities; Accommodation and food and service activities	0.87***	0.91*	0.82***	0.83***
Financial and insurance	0.88***	0.83***	0.92**	0.94
Telecommunications; IT and other information services	1.00	0.94***	0.92***	0.8***
Professional, scientific and technical activities; Administrative and support services	1.00	1.00	0.92	0.92**
Other service activities	0.81	0.91	0.94	0.9*
All indicator-country-sector instances	**0.91**	**0.94**	**0.93**	**0.91**

Source: Authors' calculations.

Annex C. Additional information on one-step ahead nowcasting performance by indicator, sector and country

Keys to variables:

EXGR_DVASH: domestic value-added share of exports

EXGR_SERV_DVASH: domestic services value-added share of exports

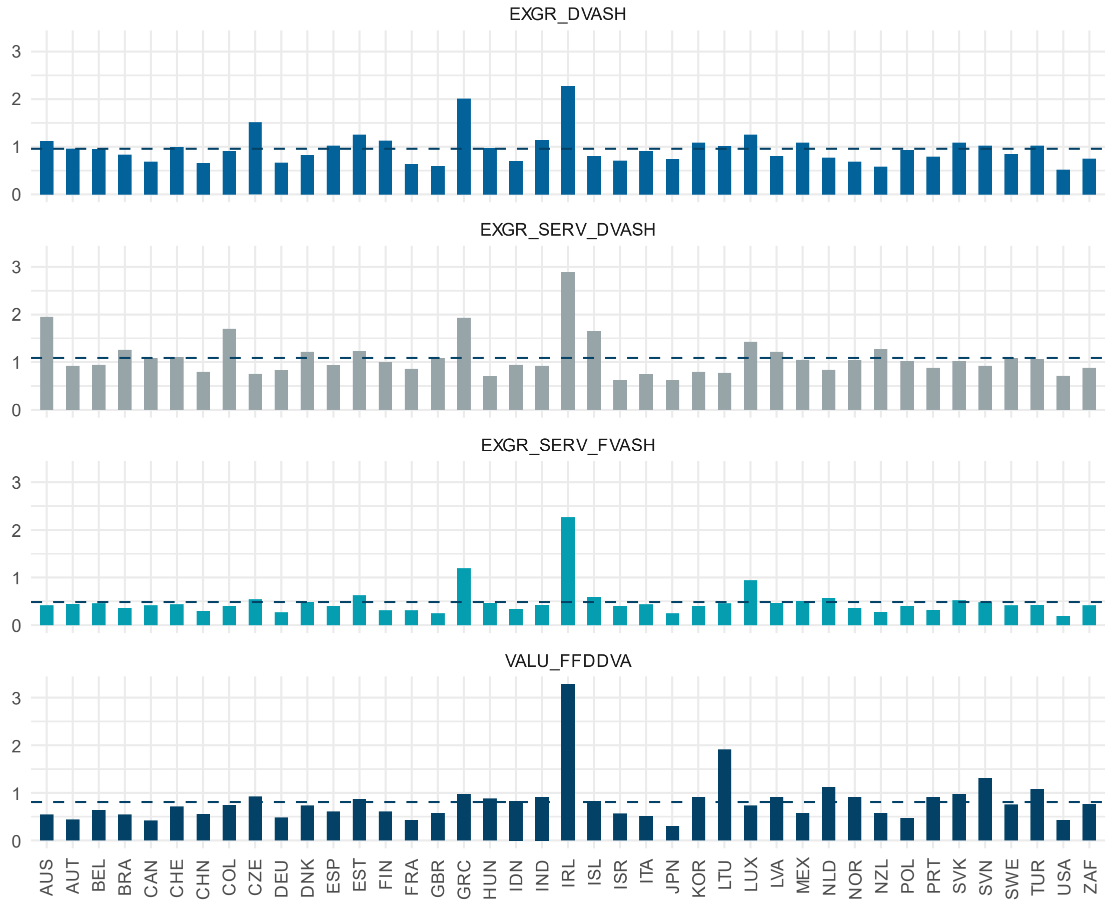
EXGR_SERV_FVASH: foreign services value-added share of exports

VALU_FFDDVA: share of domestic value added embodied in foreign final demand

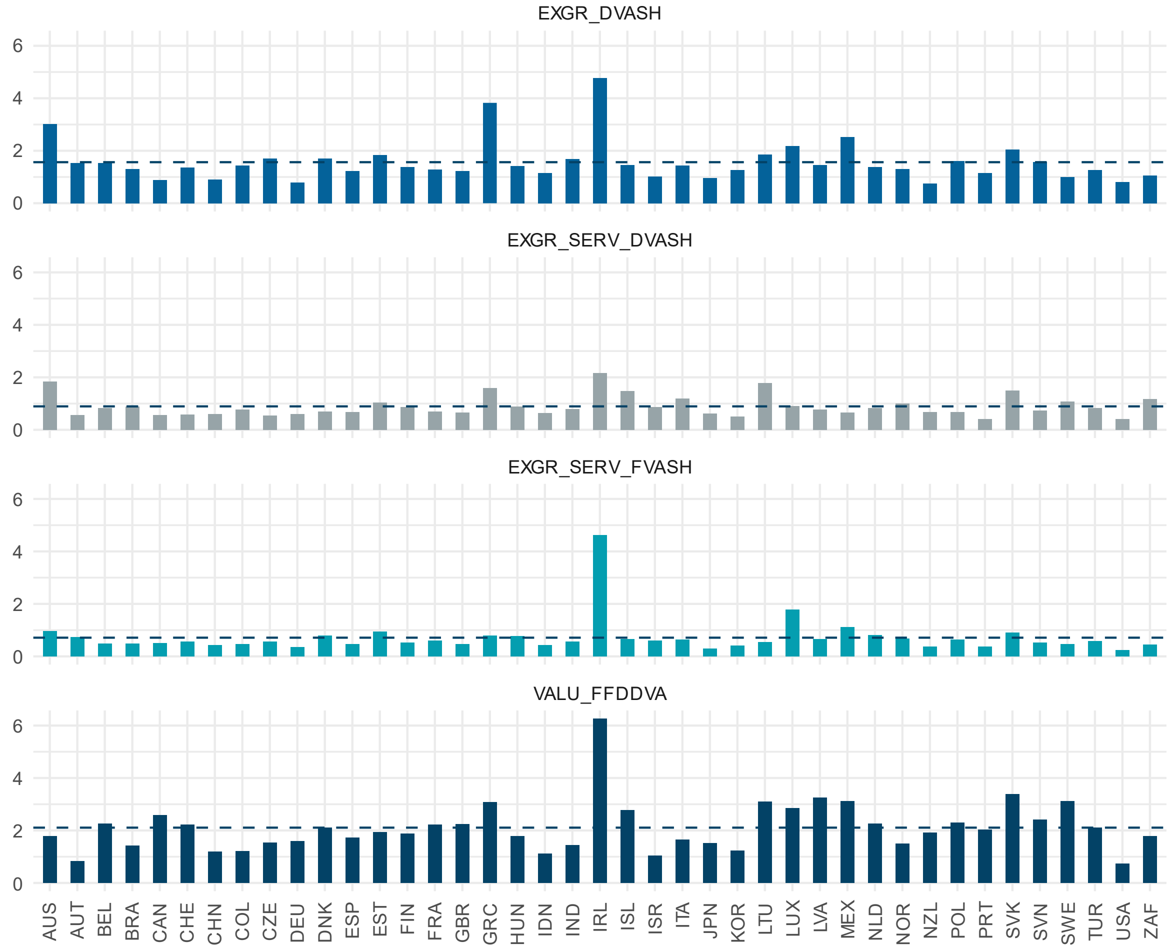
Figure C.1. One-step ahead nowcasting errors

Per cent, average

A – Economy wide



B – Manufacturing



C – Services


EXGR_DVASH
EXGR_SERV_DVASH
EXGR_SERV_FVASH
VALU_FFDDVA
2.0
1.5
1.0
0.5
0.0
AUS AUT BEL BRA CAN CHE CHN COL CZE DEU DNK ESP EST FIN FRA GBR GRC HUN IDN IND IRL ISL ISR ITA JPN KOR LTU LUX LVA MEX NLD NOR NZL POL PRT SVK SVN SWE TUR USA ZAF

Annex D. Additional information on nowcasts for 2021 and 2022

Figure D.1. Domestic value-added share of exports

Percentage point

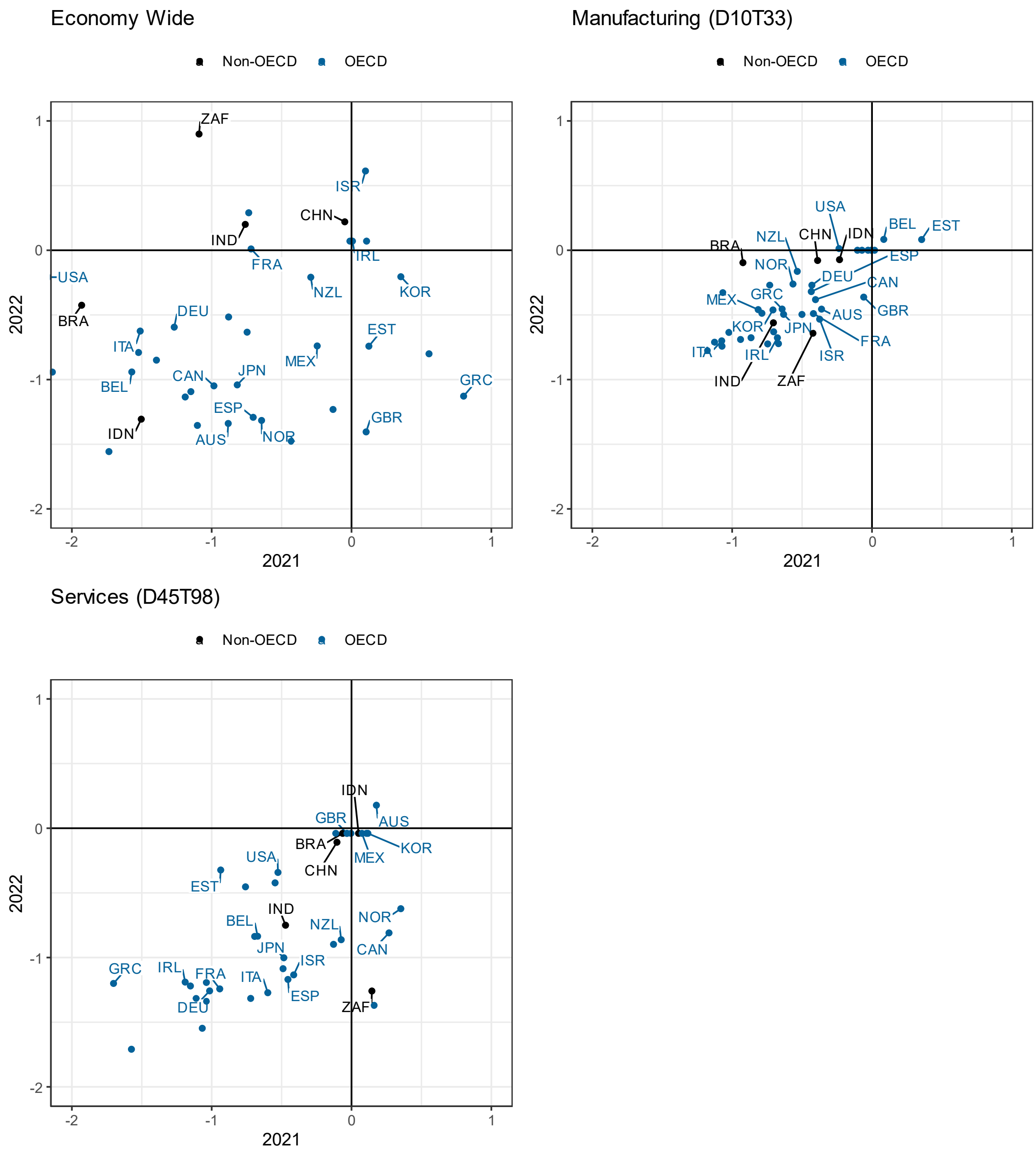


Figure D.2. Domestic services value-added share of exports

Percentage point

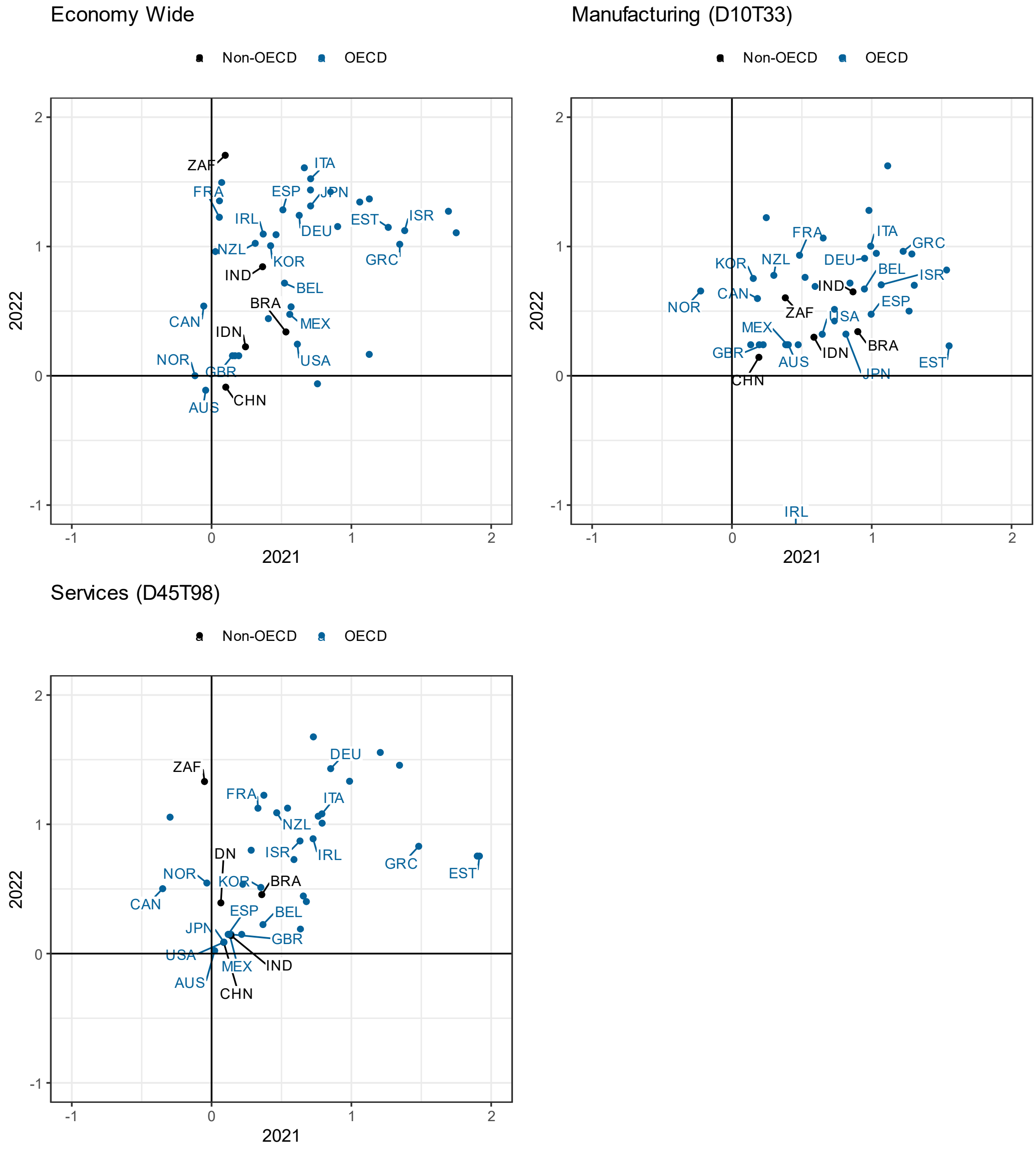


Figure D.3. Share of domestic value added embodied in foreign final demand

Percentage point

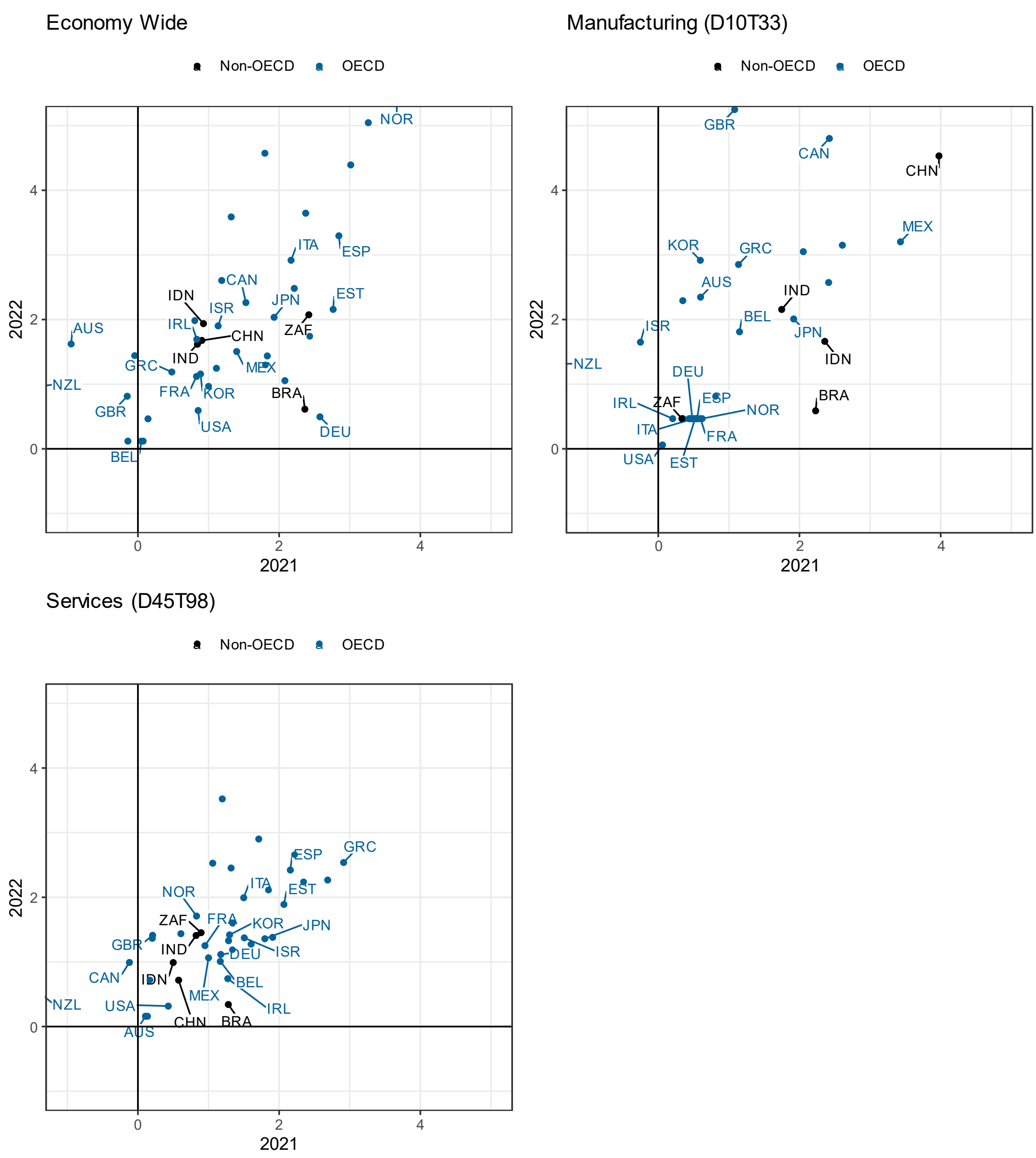


Table D.1. Nowcasts by country, economy wide, domestic value-added shares of exports

Per cent

Country	Average 1995-2010	Average 2011-2019	2020	2021	2022
AUS	86.97	87.50	89.70	90.21 [89.14-91.28]	88.28 [87.21-89.35]
AUT	74.73	68.31	68.23	66.71 [65.89-67.53]	63.88 [63.06-64.71]
BEL	65.43	63.06	64.59	63.56 [62.71-64.41]	61.64 [60.79-62.49]
BRA	88.80	88.08	85.49	85.10 [84.31-85.89]	84.59 [83.80-85.38]
CAN	75.26	75.64	74.94	76.58 [75.83-77.32]	75.22 [74.48-75.96]
CHE	78.55	76.68	76.79	77.83 [76.98-78.68]	76.30 [75.45-77.15]
CHN	79.71	81.97	83.89	83.34 [82.64-84.05]	82.94 [82.24-83.65]
COL	88.37	88.58	88.63	86.97 [86.22-87.72]	85.72 [84.97-86.47]
CZE	64.42	55.78	60.59	58.31 [57.11-59.51]	56.37 [55.17-57.57]
DEU	81.11	76.32	77.51	76.33 [75.85-76.80]	74.32 [73.84-74.79]
DNK	72.06	66.94	68.13	66.31 [65.72-66.91]	64.55 [63.95-65.14]
ESP	76.70	75.21	75.33	75.33 [74.41-76.25]	73.21 [72.30-74.13]
EST	65.58	61.36	63.49	62.51 [61.21-63.80]	60.23 [58.93-61.53]
FIN	73.21	69.05	70.25	70.28 [69.23-71.32]	68.97 [67.93-70.01]
FRA	79.80	75.93	76.98	76.10 [75.58-76.62]	73.86 [73.34-74.38]
GBR	84.28	82.22	83.31	83.70 [83.28-84.12]	81.63 [81.20-82.05]
GRC	78.89	70.46	61.25	62.34 [60.13-64.55]	59.47 [57.26-61.68]
HUN	56.13	51.89	52.13	51.39 [50.50-52.28]	48.99 [48.10-49.88]
IDN	85.38	86.94	88.57	88.04 [87.32-88.77]	86.92 [86.20-87.65]
IND	82.79	79.22	83.71	82.77 [81.47-84.06]	80.37 [79.07-81.66]
IRL	59.49	55.08	56.93	54.83 [52.62-57.04]	52.29 [50.07-54.50]
ISL	73.87	69.79	71.13	70.44 [69.79-71.08]	66.82 [66.17-67.46]
ISR	76.63	80.53	84.75	83.05 [82.44-83.66]	81.02 [80.41-81.62]
ITA	80.55	75.83	77.89	76.48 [75.68-77.28]	74.31 [73.51-75.11]
JPN	91.24	85.90	86.83	85.79 [85.04-86.55]	82.55 [81.79-83.30]
KOR	67.66	64.27	69.79	66.96 [65.66-68.26]	63.62 [62.32-64.92]
LTU	72.05	70.26	70.62	67.35 [66.34-68.36]	67.17 [66.16-68.18]
LUX	45.77	37.63	35.06	34.14 [33.02-35.27]	33.96 [32.83-35.08]
LVA	75.90	74.88	75.72	74.98 [74.44-75.51]	72.98 [72.44-73.51]
MEX	66.97	65.03	65.34	64.74 [63.76-65.72]	64.55 [63.57-65.53]
NLD	75.30	68.36	68.97	67.86 [67.33-68.39]	65.53 [65.00-66.07]
NOR	84.47	84.72	83.38	83.48 [82.70-84.27]	83.30 [82.51-84.08]
NZL	83.79	85.25	87.58	86.40 [85.94-86.85]	84.44 [83.99-84.89]
POL	74.02	70.13	69.88	69.56 [68.85-70.28]	67.83 [67.12-68.55]
PRT	73.17	69.30	68.78	68.27 [67.54-69.00]	66.26 [65.53-66.98]
SVK	58.11	50.36	51.62	50.88 [49.84-51.93]	48.87 [47.83-49.91]
SVN	66.62	64.17	65.51	64.05 [63.13-64.97]	62.27 [61.36-63.19]
SWE	74.08	74.30	74.70	74.82 [74.08-75.57]	70.71 [69.96-71.45]
TUR	84.01	78.33	77.06	77.84 [76.95-78.72]	77.19 [76.31-78.08]
USA	89.69	89.41	91.79	91.16 [90.66-91.66]	90.47 [89.97-90.97]
ZAF	82.27	77.95	78.63	79.02 [78.25-79.79]	76.98 [76.21-77.74]

Note: Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Author’s calculations.

Table D.2. Nowcasts by country, economy wide, domestic services value-added shares of exports

Per cent

Country	Average 1995-2010	Average 2011-2019	2020	2021	2022
AUS	41.65	42.72	38.65	41.03 [39.16-42.89]	39.69 [37.83-41.55]
AUT	40.65	39.54	38.30	38.85 [38.22-39.48]	37.69 [37.06-38.32]
BEL	40.17	43.85	44.45	44.31 [43.43-45.18]	43.37 [42.49-44.24]
BRA	38.62	40.51	39.27	38.70 [37.22-40.18]	38.27 [36.79-39.75]
CAN	33.04	39.05	41.14	40.19 [39.11-41.26]	39.14 [38.07-40.21]
CHE	47.81	47.77	46.11	46.36 [45.23-47.49]	45.84 [44.71-46.97]
CHN	26.18	29.83	32.67	32.12 [31.37-32.86]	32.34 [31.59-33.08]
COL	28.68	28.43	34.79	34.19 [32.29-36.09]	32.71 [30.81-34.61]
CZE	33.42	26.86	27.96	27.35 [26.74-27.96]	26.72 [26.11-27.33]
DEU	40.48	39.09	41.98	40.63 [39.92-41.33]	40.03 [39.33-40.74]
DNK	41.55	42.48	41.84	42.40 [41.37-43.43]	42.69 [41.66-43.72]
ESP	44.36	48.08	46.87	50.65 [49.88-51.42]	49.36 [48.59-50.13]
EST	40.80	38.81	39.49	43.54 [42.39-44.69]	42.80 [41.65-43.95]
FIN	29.31	36.00	36.55	36.78 [35.93-37.64]	35.84 [34.99-36.69]
FRA	47.40	51.45	51.39	51.17 [50.50-51.83]	51.18 [50.51-51.84]
GBR	54.09	60.40	62.18	63.96 [62.83-65.08]	62.55 [61.43-63.68]
GRC	54.93	51.19	43.29	48.52 [46.53-50.51]	47.39 [45.40-49.38]
HUN	28.17	26.34	25.82	27.43 [26.84-28.02]	27.50 [26.91-28.09]
IDN	26.65	26.78	29.83	31.27 [30.08-32.46]	29.96 [28.77-31.16]
IND	38.53	42.32	47.81	47.23 [46.35-48.11]	47.43 [46.56-48.31]
IRL	35.42	31.85	32.31	33.59 [30.92-36.27]	33.66 [30.99-36.34]
ISL	37.22	42.16	41.33	48.64 [46.86-50.42]	47.41 [45.63-49.19]
ISR	44.81	52.84	59.33	59.53 [58.72-60.34]	60.14 [59.33-60.95]
ITA	44.83	43.94	43.35	44.47 [43.88-45.05]	43.84 [43.26-44.43]
JPN	41.99	43.69	43.92	44.12 [43.49-44.74]	43.08 [42.45-43.70]
KOR	26.92	24.27	28.66	26.76 [26.06-27.45]	26.55 [25.86-27.25]
LTU	41.37	44.51	44.51	44.33 [43.41-45.25]	43.20 [42.28-44.12]
LUX	38.05	33.85	31.61	31.09 [29.67-32.52]	31.16 [29.74-32.59]
LVA	51.74	50.65	49.23	50.65 [49.57-51.72]	49.86 [48.78-50.93]
MEX	30.16	30.25	30.36	30.78 [29.71-31.84]	30.04 [28.97-31.10]
NLD	46.02	46.62	48.43	46.98 [46.20-47.75]	45.43 [44.66-46.21]
NOR	27.59	27.38	28.75	32.85 [31.47-34.24]	31.54 [30.15-32.92]
NZL	45.82	49.70	47.92	52.57 [51.45-53.68]	52.36 [51.24-53.48]
POL	40.10	39.74	39.88	40.30 [39.35-41.25]	39.45 [38.50-40.40]
PRT	41.17	43.50	40.41	44.02 [43.28-44.75]	41.56 [40.83-42.30]
SVK	29.83	26.35	27.45	26.56 [25.88-27.24]	25.47 [24.79-26.15]
SVN	32.12	33.98	33.57	34.74 [34.01-35.47]	33.38 [32.66-34.11]
SWE	36.86	44.73	46.16	45.91 [44.98-46.84]	44.35 [43.42-45.28]
TUR	44.13	41.89	38.84	43.60 [42.53-44.66]	42.80 [41.73-43.86]
USA	55.46	60.09	60.31	61.38 [60.80-61.96]	61.18 [60.60-61.75]
ZAF	37.27	37.07	35.25	35.12 [34.38-35.87]	36.02 [35.28-36.76]

Note: Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Author's calculations.

Table D.3. Nowcasts by country, economy wide, foreign services value-added share of exports

Per cent

Country	Average 1995-2010	Average 2011-2019	2020	2021	2022
AUS	5.60	5.44	4.63	4.96 [4.54- 5.38]	4.84 [4.43- 5.26]
AUT	12.22	16.19	16.80	17.76 [17.33-18.19]	18.86 [18.43-19.29]
BEL	17.82	21.25	21.91	21.98 [21.55-22.42]	22.70 [22.27-23.13]
BRA	4.86	5.80	7.12	6.94 [6.53- 7.35]	7.28 [6.87- 7.69]
CAN	11.00	11.77	12.61	12.15 [11.74-12.57]	12.69 [12.28-13.11]
CHE	11.85	13.66	13.83	14.30 [13.92-14.68]	14.23 [13.86-14.61]
CHN	8.09	6.75	6.08	5.82 [5.48- 6.15]	5.73 [5.39- 6.06]
COL	5.78	5.36	6.00	6.18 [5.81- 6.55]	6.63 [6.26- 7.00]
CZE	16.33	20.21	18.31	18.83 [18.31-19.35]	19.92 [19.40-20.44]
DEU	9.09	11.97	11.73	12.12 [11.89-12.34]	13.36 [13.13-13.58]
DNK	17.54	22.03	22.38	22.86 [22.35-23.37]	23.39 [22.88-23.90]
ESP	10.02	10.50	10.66	9.92 [9.60-10.25]	11.21 [10.88-11.53]
EST	18.31	20.93	21.16	20.81 [20.19-21.42]	21.95 [21.34-22.57]
FIN	12.63	15.99	16.43	16.62 [16.29-16.94]	17.58 [17.25-17.90]
FRA	9.25	12.08	12.38	11.68 [11.39-11.98]	12.91 [12.62-13.20]
GBR	7.67	9.12	9.65	10.06 [9.82-10.31]	10.22 [9.98-10.46]
GRC	9.42	13.94	18.10	18.01 [16.94-19.09]	19.03 [17.96-20.10]
HUN	19.98	22.80	22.72	22.00 [21.54-22.45]	23.35 [22.90-23.81]
IDN	6.66	5.57	5.02	4.92 [4.57- 5.27]	5.14 [4.79- 5.49]
IND	5.85	6.73	6.63	6.15 [5.75- 6.55]	7.00 [6.60- 7.39]
IRL	28.37	36.43	36.62	40.72 [38.47-42.97]	41.82 [39.57-44.07]
ISL	13.44	16.99	15.58	17.11 [16.64-17.58]	18.55 [18.08-19.02]
ISR	11.08	10.16	8.13	9.39 [8.96- 9.82]	10.51 [10.09-10.94]
ITA	8.72	11.09	10.61	10.37 [10.00-10.74]	11.89 [11.53-12.26]
JPN	3.38	5.25	5.63	5.48 [5.29- 5.66]	6.79 [6.61- 6.97]
KOR	11.69	12.83	12.02	12.46 [12.14-12.77]	13.46 [13.15-13.78]
LTU	12.50	14.55	14.55	15.90 [15.48-16.32]	17.27 [16.85-17.69]
LUX	45.73	55.50	59.19	60.77 [59.83-61.70]	60.93 [59.99-61.87]
LVA	12.16	13.33	12.96	14.08 [13.73-14.42]	15.35 [15.00-15.69]
MEX	14.68	15.47	15.31	15.86 [15.40-16.33]	16.34 [15.87-16.81]
NLD	13.22	18.43	18.30	18.86 [18.27-19.44]	20.35 [19.76-20.94]
NOR	8.51	8.59	9.29	10.02 [9.63-10.41]	10.02 [9.63-10.41]
NZL	8.08	7.07	6.09	6.83 [6.51- 7.15]	7.86 [7.54- 8.18]
POL	11.51	14.06	14.55	14.66 [14.35-14.97]	14.82 [14.51-15.13]
PRT	11.95	14.32	14.85	15.26 [14.99-15.53]	16.60 [16.33-16.87]
SVK	17.53	20.74	20.90	20.89 [20.53-21.25]	22.04 [21.68-22.40]
SVN	15.18	17.47	17.10	17.55 [17.13-17.97]	18.98 [18.56-19.40]
SWE	12.83	13.45	13.89	14.48 [14.10-14.87]	16.09 [15.71-16.47]
TUR	6.56	8.53	9.42	9.06 [8.66- 9.46]	9.22 [8.82- 9.62]
USA	3.95	4.25	3.61	3.64 [3.47- 3.81]	3.88 [3.72- 4.05]
ZAF	7.34	8.68	8.42	8.05 [7.71- 8.39]	9.76 [9.42-10.09]

Note: Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Author's calculations.

Table D.4. Nowcasts by country, economy wide, share of domestic value added embodied in foreign final demand

Per cent

Country	Average 1995-2010	Average 2011-2019	2020	2021	2022
AUS	17.91	19.04	21.18	19.11 [18.66-19.56]	20.73 [20.28-21.18]
AUT	31.15	34.66	33.23	34.15 [33.91-34.39]	37.74 [37.50-37.97]
BEL	37.51	37.63	38.57	39.39 [38.76-40.03]	39.51 [38.87-40.15]
BRA	10.50	11.53	15.20	16.11 [15.46-16.77]	16.73 [16.07-17.38]
CAN	27.49	22.94	21.36	23.04 [22.55-23.53]	25.30 [24.81-25.80]
CHE	33.00	37.91	36.66	39.19 [38.50-39.87]	40.24 [39.56-40.92]
CHN	19.67	15.85	13.99	15.23 [14.60-15.87]	16.91 [16.28-17.54]
COL	14.61	15.43	12.26	12.50 [11.73-13.27]	13.94 [13.17-14.71]
CZE	33.31	39.52	39.13	37.24 [36.46-38.01]	37.70 [36.93-38.48]
DEU	23.28	30.03	27.87	30.39 [30.03-30.74]	30.88 [30.53-31.23]
DNK	29.74	32.54	32.79	35.47 [35.19-35.74]	40.51 [40.24-40.79]
ESP	19.56	24.54	22.31	25.96 [25.59-26.32]	29.25 [28.89-29.62]
EST	38.35	43.94	39.76	45.47 [44.63-46.30]	47.62 [46.78-48.46]
FIN	29.73	26.00	24.96	26.57 [26.04-27.10]	29.05 [28.52-29.58]
FRA	20.52	21.54	20.28	21.60 [21.31-21.88]	22.72 [22.43-23.00]
GBR	19.34	20.91	20.22	20.89 [20.56-21.21]	21.70 [21.37-22.03]
GRC	15.69	22.43	19.64	24.21 [23.60-24.81]	25.40 [24.79-26.00]
HUN	36.82	44.29	42.04	44.12 [43.49-44.76]	44.24 [43.61-44.88]
IDN	25.09	19.27	15.39	15.25 [14.54-15.96]	17.18 [16.47-17.90]
IND	14.20	17.03	15.87	16.76 [16.19-17.34]	18.38 [17.80-18.96]
IRL	45.78	59.07	61.65	59.91 [56.84-62.98]	61.60 [58.53-64.68]
ISL	27.08	34.41	23.96	29.67 [28.67-30.66]	34.24 [33.25-35.23]
ISR	24.49	25.47	23.82	25.24 [24.74-25.75]	27.14 [26.64-27.65]
ITA	20.41	22.49	23.28	25.29 [24.91-25.67]	28.21 [27.83-28.59]
JPN	10.65	14.17	13.73	15.52 [15.11-15.92]	17.55 [17.15-17.96]
KOR	24.23	29.52	25.72	26.15 [25.35-26.95]	27.31 [26.51-28.10]
LTU	30.37	42.75	43.36	44.25 [42.36-46.15]	46.00 [44.10-47.89]
LUX	61.35	63.43	63.06	63.71 [62.98-64.44]	63.83 [63.10-64.56]
LVA	27.09	34.77	33.96	35.34 [34.53-36.14]	36.58 [35.78-37.38]
MEX	17.39	22.94	26.71	28.69 [28.19-29.19]	30.20 [29.69-30.70]
NLD	33.76	36.78	36.95	37.76 [36.59-38.93]	38.73 [37.56-39.90]
NOR	35.76	32.86	26.71	31.06 [30.02-32.10]	36.93 [35.89-37.97]
NZL	25.24	23.71	19.11	19.33 [18.74-19.92]	20.29 [19.71-20.88]
POL	23.74	33.26	37.05	39.32 [38.86-39.78]	40.61 [40.16-41.07]
PRT	21.06	27.97	25.73	30.93 [30.38-31.48]	35.32 [34.77-35.87]
SVK	36.93	41.43	38.71	39.98 [38.97-41.00]	41.97 [40.95-42.98]
SVN	36.22	43.40	43.20	45.33 [44.18-46.49]	47.94 [46.78-49.09]
SWE	31.21	30.07	29.97	32.19 [31.65-32.74]	35.84 [35.30-36.38]
TUR	18.44	19.74	21.85	26.25 [25.23-27.28]	27.69 [26.67-28.71]
USA	8.24	9.72	7.84	8.50 [8.27- 8.74]	9.10 [8.86- 9.33]
ZAF	21.12	21.98	22.22	25.25 [24.65-25.84]	27.32 [26.72-27.92]

Note: Error bands correspond to the nowcasted value -/+ the correspondent RMSE.
Source: Author's calculations.