NARODOWY
BANK POLSKI

NBP Working Paper No. 387

Understanding the dynamics of export in the short run. The role of foreign and global shocks

Paweł R. Galiński, Jakub Mućk

NBP Working Paper No. 387

Understanding the dynamics of export in the short run. The role of foreign and global shocks

Paweł R. Galiński, Jakub Mućk

Narodowy Bank Polski
Warsaw 2026

Paweł R. Galiński – Narodowy Bank Polski and SGH Warsaw School of Economics;
pawel.galinski@nbp.pl
Jakub Mućk – Narodowy Bank Polski and SGH Warsaw School of Economics;
jakub.muck@nbp.pl

Acknowledgements:
We would like to thank participants at the NBP (Narodowy Bank Polski), BBK (Deutsche Bundesbank), CNB (Czech National Bank) and ECB (European Central Bank) seminars for useful comments and discussions. The views expressed herein belong to the authors and have not been endorsed by Narodowy Bank Polski.

Published by:
Narodowy Bank Polski
Education & Publishing Department
ul. Świętokrzyska 11/21
00-919 Warszawa, Poland
nbp.pl

ISSN 2084-624X

Contents

Abstract

This paper introduces a novel Bayesian SVAR framework to identify the short-run drivers of export fluctuations across 18 EU economies, focusing on transmission through Global Value Chains (GVCs). By applying shock identification via sign restrictions within a hierarchical block exogeneity structure (domestic, foreign, and global), we offer four key insights. First, we show that while the Great Trade Collapse was primarily driven by global demand and uncertainty, the COVID-19 crisis involved a complex confluence of non-domestic demand and supply shocks. Second, tight integration within European production networks does not shield these economies from global structural shocks, which remain the primary drivers of export variance. Third, we provide evidence that trade openness and participation in investment-specific GVCs heighten the sensitivity of domestic exports to global shocks, particularly through cost-push mechanisms in backward linkages, while shorter GVC forward linkages tend to reduce this exposure.

Keywords: structural VAR, exports, sign restrictions, Global Value Chains

JEL Classification Numbers: C32, F14, F15, F43, F60

Introduction

Export is a crucial driver of long-run growth, especially in small open economies. However, in the short-run, export fluctuations are more volatile than the variability of other macroeconomic variables (Engel and Wang, 2011; Vannoorenberghe, 2012). Especially, in turbulent times, when negative global shocks affect many economies' simultaneously, the slowdown in foreign sales can be disproportionately larger than the reactions of domestic activity indicators. For instance, the outbreak of the COVID-19 pandemic led to a unprecedented drop in international trade, while the Global Financial Crisis was followed by the so-called the Great Trade Collapse (GTC), which refers to substantial decline in world exports.

The identification of these short-term fluctuations in exports is challenging, as a significant share of international trade is conducted through the so-called Global Value Chains (GVCs). Since the 1970s, the liberalization of trade flows and the ICT revolution have led to the international fragmentation of production (see Baldwin and Lopez-Gonzalez, 2015; Antràs and Chor, 2022, for a general review). Manufacturing processes for many products have been segmented into several highly specialized stages reallocated to countries based on relative comparative advantages. Consequently, a bulk of tradable products cross borders multiple times before reaching their final destination (Johnson and Noguera, 2012). Countries participation in GVCs is typically categorized into two types. First, backward GVC participation corresponds to case when the export-oriented production relies to a large extent on imported intermediates. Second, the forward GVC participation captures mostly export upstreamness of exports, describing the proportion of exports used as imports for further production and trade within the GVC.

To unravel the short-run drivers of export dynamics, we identify two distinct layers of non-domestic activity: the first, foreign factors, involve major trading partners, usually neighbouring economies, while the second captures general global conditions transmitted via both forward and backward linkages. Given that many exporters produce not only final goods but also intermediates, global fluctuations represent a vital export driver in our analysis. To capture factors from those two layers, we estimate a Bayesian Structural Vector Autoregression (BSVAR) model capable of distinguishing between domestic, foreign, and global sources of variation. Identification is achieved by applying a hierarchical block exogeneity restriction, where global variables are assumed exogenous to the foreign and domestic blocks, and foreign variables are exogenous to the domestic block. Finally, we impose a set of on-impact sign restrictions on the impulse responses to obtain orthogonal shocks that align with economic theory.

The first group of shocks consists of domestic demand and supply shocks, which affect the potential of the exporting sector in the short run. The second group, foreign shocks, is associated with economic activity in major trading partners. The last group, global shocks, relates to the remaining part of the global economy. Finally, we also identify an exchange rate shock, which affects the price competitiveness of exports in the short-run.

Our empirical analysis covers 18 selected European Union (EU) economies, for each of which we estimate parameters of a dedicated BSVAR model. The domestic block includes standard indices of industrial production and producer prices. To capture foreign dynamics, we assume that the primary trading partners for each economy are other EU member states; accordingly, we construct foreign variables as the aggregate industrial production and PPI of the EU, exclusive of the country under analysis. This choice stems out from a tight economic integration of economies (i.e. the European Single Market) that goes beyond traditional tariffs measures and is also supported by prevailing role of intra-EU trade in overall exports of EU economies. To empirically identify the global shocks we use detailed trade data to carefully construct appropriate variables that allow to study transmission of global shocks via trade linkages. Specifically, in our framework global demand is proxied by extra-EU export volumes (in other EU economies), while global supply is captured by the EU average import prices (also in remaining EU economies). This global supply side proxy accounts for general global price fluctuations faced by the EU economies, but also covers commodity prices and GVC disruption factors. Finally, we incorporate the VIX index to control for global macroeconomic uncertainty and geopolitical risks.

Our contribution is fivefold. First, we propose a new approach to study trade flows for small open economies that involves hierarchical three-layer (domestic, foreign, global) block exogeneity with on impact sign-restrictions. In particular, we follow the recent application of SVAR for small open economies that introduce foreign and/or domestic variables to better identify external shocks (see Binici et al., 2024; Ascari et al., 2024; Szafranek et al., 2024, for example). However, unlike the output and inflation the gross exports is, by construction, exposed to a greater extent to external factors and, thus, careful distinction between foreign and global shocks seems to be a necessary step in the highly fragmented global trade environment. On the other hand, contrary to the standard large-scale GVAR (Global Vector Autoregression, Pesaran et al., 2004; Chudik and Pesaran, 2016) models our approach does not required detailed on bilateral trade flows and, more importantly, is able to identify different origins of the external shocks and connect them to nature of the GVC participation.

Second, we can explain the divergent factors driving exports during two major global disruptions: the Great Trade Collapse (GTC) and the COVID-19 pandemic. Our results show that the fall in EU export volumes during the GTC was primarily triggered by adverse global demand and elevated uncertainty, which subsequently propagated into a contraction of intra-EU demand. The predominant role of global contraction is consistent with the empirical literature exploring casuses of GTC (see Bems et al., 2013, for a general review). In contrast, the COVID-19 period was characterized by a simultaneous and adverse change of global and foreign factors from both demand and supply sides. While the EU post-pandemic export recovery was largely supported by a resurgence in intra-EU demand, this momentum was substantially hindered by a global supply-side constraints, specifically tensions in global value chains that intensified following the Russian invasion of Ukraine and the ensuing surge in global commodity prices. These findings align with existing literature on the drivers of export performance during and after the COVID-19 pandemic, highlighting the central role of global supply factors triggered by lockdowns that led to subsequent demand adjustments (Berthou and Stumpner, 2022; Aiyar et al., 2022; Hayakawa and Mukunoki, 2021). These results confirm that our framework robustly distinguishes between demand and supply factors and accurately identifies whether shocks originate from global developments or local fluctuations.

Third, we also provide a new insight on the nature of business cycle synchronization between EU economies. Since trade flows strongly co-move between integrated economies, we provide indirect evidence that it can be resulted from vertical specialization of regional production chains. In particular, we found that the synchronization of exports could be to a large extent explained by foreign and global shocks. In contrast, all domestic shocks, including the demand, supply, and export-specific supply shock, exhibit a lower degree of synchronization.

Fourth, by identifying the structural shocks that drive the exports of European economies in the short run, we quantify the specific contributions of domestic, foreign, and global factors to export fluctuations. We demonstrate that the deep integration of European economies within regional production networks (Baldwin and Lopez-Gonzalez, 2015) does not diminish their exposure to global structural shocks. In particular, we find that on average EU exports are primarily driven by global factors, which account for 66.4 percent of the forecast error variance decomposition (FEVD), while foreign factors provide a much smaller contribution of 17.1 percent. This result suggests that although economic integration within the EU saturates bilateral trade and welfare increase (Hagemejer and Mućk, 2019), it does not simultaneously act as a shield against global macroeconomic factors.

Fifth, by further investigating FEVDs we also provide a suggestive evidence about the link between the role of macroeconomic factors and the structural features of economies. By investigating cross-country heterogeneity in the forecast error variance decomposition it is found that global shocks play more important role in economies with high trade openness as well as relatively intensive participation in investment-specific GVCs. In addition, the GVC participation rises exposure to non-domestic shock. Especially, more intensive backward linkages elevate the role of global and foreign shocks due to cost-push mechanism. Since exporter-oriented production relies strongly on imported inputs, which are directly affected by global and foreign shocks, the cost channel becomes very important for exporters engaged backwardly in the GVCs.

The remainder of the paper is as follows. Methodology and underlying identifying restrictions are discussed in the section 1. The section 2 describes our empirical measurement of key variable of interest. Baseline results are presented in the section 3 while the robustness check is provided in the section 4. Finally, section 5 concludes.

1 Methodology

This section outlines the empirical strategy, which combines the estimation of a Bayesian Vector Autoregressive (BVAR) model with the identification of structural shocks based on sign restrictions.

1.1 Bayesian SVAR

To empirically assess the magnitude of macroeconomic shocks we estimate Bayesian Structural Vector Autoregression (BSVAR) for each economy separately. Denoting the country by an index i the BSVAR model characterizes the joint dynamics of $n = 9$ endogenous variables, i.e., $y_{it} = [y_{1,it}, \ldots, y_{n,it}]'$ and follows the specification from Dieppe et al. (2016):

$$A_{0i} y_{it} = c_i + \sum_{l=1}^{p} A_{il} y_{it-l} + \varepsilon_{it}, \quad \varepsilon_{it} \sim \mathcal{N}(0, I), \quad t = 1, \ldots, T, \quad i = 1, \ldots, N, \qquad (1)$$

where T denotes the time dimension, p is the lag order of the VAR, A_{0i} are invertible matrices describing contemporaneous relationships among the variables, A_{li} ($l = 1, \ldots, p$) are $n \times n$ matrices of structural parameters at lag l, c_i is n-dimensional vector of constants, and ε_{it} is an $n \times 1$ vector of orthonormal structural shocks.

The corresponding reduced form of the BVAR model can be obtained by premultiplying equation (1) by A_{i0}^{-1}:

$$y_{ti} = B_{0i} + \sum_{l=1}^{p} B_{il} y_{it-l} + \eta_{it}, \quad \eta_{it} \sim \mathcal{N}(0, \Sigma_i), \quad t = 1, \ldots, T, \quad i = 1, \ldots, N, \qquad (2)$$

where $B_{i0} = A_{i0}^{-1} c_i$, $B_{il} = A_{0i}^{-1} A_{il}$ for $l = 1, \ldots, p$, and $\eta_{it} = A_{0i}^{-1} \varepsilon_{it}$. The B_0 contains the intercepts, the matrices B_{il} represent the autoregressive parameters while η_{it} denotes a vector of disturbances which in the reduced form are assumed to be normally distributed with zero mean and a positive-definite variance–covariance matrix Σ_i.

The parameters of the reduced form, i.e., $B_{i0}, B_{i1}, \ldots, B_{ip}$ and Σ_i, are treated as random normal variables and inferred using standard Bayesian methods. The estimation relies on the widely used in applied macroeconometrics Minnesota prior (Litterman, 1986), which is also characterized by lower computational requirements (compared to, for example, the independent normal-Wishart prior). This is particularly important to us due to the high complexity of the applied model. Under this framework, the variance-covariance matrix Σ_i is assumed to be known while other parameters of the model (2) are estimated. In particular, the standard Minnesota prior encodes the belief that each variable in the system follows a near–random walk process, with its own lag providing the most relevant predictive information. Deviations from this benchmark are typically penalized through the prior variance, which is controlled by a small set of hyperparameters.

The standard Minnesota prior assumes that the autoregression coefficients are close to unity, while other coefficients are close to zero. In turn, the prior variance for coefficients in B_{il} relating variable k to its own lags l is given by

$$\sigma^2_{b_{lki}} = (\lambda_1 l^{-\lambda_3})^2,$$

where λ_1 is the overall tightness hyperparameter, which smaller values shrink the model for y_{ij} towards random walk. The λ_3 parameter denotes the pace with which the higher autoregression order approach zero.

The prior variance for remaining coefficients is defined as

$$\sigma^2_{b_{likj}} = \frac{\sigma^2_i}{\sigma^2_j}(\lambda_1 \lambda_2 \lambda_5 l^{-\lambda_3})^2,$$

where λ_2 governs cross-variable shrinkage and λ_5 scales the prior variance for variables treated as block exogenous.

To identify the best hyperparameter values for each country separately we adopt the algorithm proposed by Dieppe et al., 2016 which selects values that minimize the Deviance Information Criterion (DIC). For each estimation we optimize the parameters by searching over the grids of $AR \in [0.7, 1]$, $\lambda_1 \in [0.05, 0.5]$, $\lambda_2 \in [0.1, 1]$ and $\lambda_3 \in [1, 2]$. The block exogeneity hyperparameter λ_5 is set to 10^{-3} for all economies.

1.2 Identification strategy

We identify domestic, foreign and global shocks by imposing a block-exogeneity structure. To do so, we set the hyperparameter λ_5 to very small value (10^{-3}). A tight value of λ_5 in the Bayesian estimation allows to introduce a restriction that variable y_j has no effect on variable y_k. This corresponds to assigning a prior mean of zero to cross-variable lags within the Minnesota prior. By setting λ_5 sufficiently small, the prior variance around this zero assumption becomes negligible, effectively constraining the estimated effect of y_j on y_k to be close to zero.

Moving to the blocks, domestic variables are assumed to not affect foreign and global macroeconomic indicators. The domestic block consists of four variables: industrial production (denoted as $\mathcal{IP}_{it}^{\mathcal{D}}$), producer prices ($\mathcal{PPI}_{it}^{\mathcal{D}}$), exports of goods ($\mathcal{EX}_{it}$) and exchange rate ($\mathcal{ER}_{it}$). Apart from important assumption for small open economy that these variables will not affect foreign and global variables we impose additional restriction that domestic production will not directly influence on export performance. This, in turn, is necessary to distinguish between supply versus demand shock.

The next block consists of foreign variables which might have some impact on domestic activity but it will be assumed that they do not drive global activity. Within this block, we proxy foreign variable by using industrial production ($\mathcal{IP}_{it}^{\mathcal{F}}$), and producer prices ($\mathcal{PPI}_{it}^{\mathcal{F}}$) in the major trading partners. In general, foreign variable will not affect global condition. However, we allow the supply shock to have some impact on global demand which will be appealing in identification of supply shocks in foreign economy.

Finally, we impose no restrictions on global variables, which are assumed to possibly drive all other blocks in the model.

Table 1: Block exogeneity

	$\mathcal{IP}_{it}^{\mathcal{D}}$	$\mathcal{PPI}_{it}^{\mathcal{D}}$	$\mathcal{EX}_{it}$	$\mathcal{ER}_{it}$	$\mathcal{IP}_{it}^{\mathcal{F}}$	$\mathcal{PPI}_{it}^{\mathcal{F}}$	$\mathcal{DEM}_{it}^{\mathcal{G}}$	$\mathcal{PRI}_{it}^{\mathcal{G}}$	$\mathcal{UNC}_{t}^{\mathcal{G}}$
$\mathcal{IP}_{it}^{\mathcal{D}}$	.	.	.	.	.	.	.	.	.
$\mathcal{PPI}_{it}^{\mathcal{D}}$	.	.	.	.	.	.	.	.	.
$\mathcal{EX}_{it}$	•	.	.	.	.	.	.	.	.
$\mathcal{ER}_{it}$	.	.	.	.	.	.	.	.	.
$\mathcal{IP}_{it}^{\mathcal{F}}$	•	•	•	•	.	.	.	.	.
$\mathcal{PPI}_{it}^{\mathcal{F}}$	•	•	•	•	.	.	.	.	.
$\mathcal{DEM}_{it}^{\mathcal{G}}$	•	•	•	•	•	.	.	.	.
$\mathcal{PRI}_{it}^{\mathcal{G}}$	•	•	•	•	•	•	.	.	.
$\mathcal{UNC}_{t}^{\mathcal{G}}$	•	•	•	•	•	•	.	.	.

Variables: $\mathcal{IP}_{it}^{\mathcal{D}}$ – domestic industrial production; $\mathcal{PPI}_{it}^{\mathcal{D}}$ – domestic producer prices; $\mathcal{EX}_{it}$ – exports of goods; $\mathcal{ER}_{it}$ – exchange rate; $\mathcal{IP}_{it}^{\mathcal{F}}$ – foreign industrial production; $\mathcal{PPI}_{it}^{\mathcal{F}}$ – foreign producer prices; $\mathcal{DEM}_{it}^{\mathcal{G}}$ – measure of global demand; $\mathcal{PRI}_{it}^{\mathcal{G}}$ – measure of global prices; $\mathcal{UNC}_{t}^{\mathcal{G}}$ – global uncertainty.
Shocks: • indicates that variable in row i is independent from variable from column j.

Apart from the above set of exogeneity assumptions, a bulk of sign and zero restrictions about the contemporaneous reaction of key variables to structural shock are imposed. The sign-restriction approach bases on the model's posterior distribution

Arias et al. (2018). Specifically, using a sampling algorithm (the Gibbs sampler in our case), we draw the SVAR coefficients from the posterior distribution and compute the corresponding structural impulse response functions (IRFs). Each draw is then evaluated against the imposed sign restrictions. If the IRFs satisfy all restrictions the draw is retained. Otherwise, the drawn estimates are discarded. This procedure is repeated until a sufficient number of accepted draws is achieved.

All restrictions imposed are summarized in the table 2. In our identification scheme, based mostly on variation of domestic industrial production and producer prices two shocks related solely to home economy will be identified: domestic demand ($\varepsilon_{it}^{\mathcal{DD}}$) and supply shock ($\varepsilon_{it}^{\mathcal{DS}}$). Both of them are assumed to increase production in the home economy while the domestic supply shock will have disinflationary effect while the $\varepsilon_{it}^{\mathcal{DD}}$ is expected to move prices due to an excess demand. Another difference is that the domestic demand shock will be orthogonal to foreign sales while the reaction of exports to supply shocks remains unrestricted.

Table 2: Sign and restrictions used for identification of structural shocks

Variable/ **Shock**	$\varepsilon_{it}^{\mathcal{DD}}$	$\varepsilon_{it}^{\mathcal{DS}}$	$\varepsilon_{it}^{\mathcal{DE}}$	$\varepsilon_{it}^{\mathcal{ER}}$	$\varepsilon_{it}^{\mathcal{FD}}$	$\varepsilon_{it}^{\mathcal{FS}}$	$\varepsilon_{it}^{\mathcal{GD}}$	$\varepsilon_{it}^{\mathcal{GS}}$	$\varepsilon_{it}^{\mathcal{GU}}$
$\mathcal{IP}_{it}^{\mathcal{D}}$	+	+	+	.	+	.	+	+	.
$\mathcal{PPI}_{it}^{\mathcal{D}}$	+	−	.	.	.	.	+	−	.
$\mathcal{EX}_{it}$	0	+	+	−	+	.	+	+	.
$\mathcal{ER}_{it}$	.	.	.	+	.	.	.	.	.
$\mathcal{IP}_{it}^{\mathcal{F}}$	0	0	0	0	+	+	+	+	.
$\mathcal{PPI}_{it}^{\mathcal{F}}$	0	0	0	0	+	−	+	−	.
$\mathcal{DEM}_{it}^{\mathcal{G}}$	0	0	0	0	0	.	+	+	-
$\mathcal{PRI}_{it}^{\mathcal{G}}$	0	0	0	0	0	0	+	−	.
$\mathcal{UNC}_{t}^{\mathcal{G}}$	0	0	0	0	0	0	.	.	+

Variables: $\mathcal{IP}_{it}^{\mathcal{D}}$ – domestic industrial production; $\mathcal{PPI}_{it}^{\mathcal{D}}$ – domestic producer prices; $\mathcal{EX}_{it}$ – exports of goods; $\mathcal{ER}_{it}$ – exchange rate; $\mathcal{IP}_{it}^{\mathcal{F}}$ – foreign industrial production; $\mathcal{PPI}_{it}^{\mathcal{F}}$ – foreign producer prices; $\mathcal{DEM}_{it}^{\mathcal{G}}$ – measure of global demand; $\mathcal{PRI}_{it}^{\mathcal{G}}$ – measure of global prices; $\mathcal{UNC}_{t}^{\mathcal{G}}$ – global uncertainty.

Shocks: $\varepsilon_{it}^{\mathcal{DD}}$ – domestic demand; $\varepsilon_{it}^{\mathcal{DS}}$ – domestic supply; $\varepsilon_{it}^{\mathcal{DE}}$ – domestic export-specific; $\varepsilon_{it}^{\mathcal{ER}}$ – exchange rate shock; $\varepsilon_{it}^{\mathcal{FD}}$ – foreign demand; $\varepsilon_{it}^{\mathcal{FS}}$ – foreign supply; $\varepsilon_{it}^{\mathcal{GD}}$ – global demand; $\varepsilon_{it}^{\mathcal{GS}}$ – global supply; $\varepsilon_{it}^{\mathcal{GU}}$ – global uncertainty.

In our framework, we are able to disentangle effect of relative prices by identify the exchange rate shock ($\varepsilon_{it}^{\mathcal{ER}}$). In particular, we assume that unexpected appreciation of home currency stimulates exports by an improvement in its cost competitiveness. At the same time, we leave reaction of domestic prices and production unrestricted as any unpredictable changes in exchange rates could have ambiguous effect on home economy.

In foreign block and in analogous fashion to home economy both demand and supply shocks are identified. The foreign demand shock ($\varepsilon_{it}^{\mathcal{FD}}$) works in the same manner like in domestic economy, i.e., increases prices and production in major trading partners. But due to the block exogeneity assumption it is allowed that the $\varepsilon_{it}^{\mathcal{FD}}$ stimulates also exports and industrial production in domestic economy. The foreign supply shock ($\varepsilon_{it}^{\mathcal{FS}}$) is assumed to affect prices and production in opposite way while contemporaneous reaction of domestic variable to ($\varepsilon_{it}^{\mathcal{FS}}$) is not restricted. In addition, it is allowed that positive supply shocks could also stimulate exports since the negative price effect in foreign economy translates into competitiveness gains in global markets.

Moving to global economy, we distinguish three shocks that could directly or indirectly affect exports: global demand shock ($\varepsilon_{it}^{\mathcal{GD}}$), global supply shock ($\varepsilon_{it}^{\mathcal{GS}}$) and global uncertainty shock ($\varepsilon_{it}^{\mathcal{GU}}$). The first two shocks, i.e., global supply and demand, are identified in the same way as in the domestic and foreign block. The $\varepsilon_{it}^{\mathcal{GS}}$ is set to rise production and have disinflationary effect on global and foreign market as well as home economy. In addition, it is imposed that global improvement in efficiency of production will also reduce uncertainty. Besides, the global demand shock will represent a rise in worldwide demand that is accompanied by some inflationary pressure in all blocks of the BSVAR model. To close the global block we introduce the global uncertainty shock ($\varepsilon_{it}^{\mathcal{GU}}$) which is targeted to rise global uncertainty and reduce demand for exported goods from foreign economy. This restrictions stem out from empirical literature documenting that trade flows react in opposite way to movement in uncertainty (Novy and Taylor, 2020).

Finally, we complete list of structural shocks by introducing domestic export-oriented shock ($\varepsilon_{it}^{\mathcal{DE}}$). This shock is set to affect exports and home production. Although the nature of this shock seems to be technical it can be economically interpreted as supply-side improvement that takes place in export-oriented industries. In particular, it might refer to extensive margins which in the case of export activity capture new entries which include both new market destination and exporting products.

2 Data

In this section we discuss our measurement strategy as well as key properties of data.

Since we are measuring key variables of interest for 18 European economies[1] our main data source is Eurostat. Starting with domestic variables we take standard series of producer prices and industrial production in manufacturing for domestic economy. The exports of goods is sourced from the Comext database while the nominal effective exchange rates indices are taken from BIS and will capture overall variation in exchange rates.

A choice of foreign economy block could be arbitrary. But, given our empirical interest in European economies, we define foreign economies as consisting of remaining EU members. This stems out from an intensive economic integration between EU economies because it goes beyond the typical important for trade tariffs measures and within the European single market it covers also free movement of capital, services as well as labor mobility. From that reason, the foreign variables, i.e., $\mathcal{IP}_{it}^{\mathcal{F}}$ and $\mathcal{PPI}_{it}^{\mathcal{F}}$, will be proxied as weighted average of industrial production and producer prices in manufacturing in 26 EU members states. It should be noted that due to the Brexit we exclude the UK from entire sample and a home economy is excluded from calculating the foreign counterparts of industrial production and producer prices. Finally, we use the gross production of manufacturing from national accounts in 2019 as weights for remaining EU countries.

A proper measurement of global variables is more challenging. Ideally, it should refer to remaining part of world economy. However, the fundamental problem with this approach is that it ignores nature of the trade linkages between foreign economy and rest of world. For instance, it abstracts from product specialization of EU exports and/or disregard structure of EU imports. To account for these limitations we use detailed data on EU international trade. Namely, the demand for the EU exported goods will be approximated by the EU exports of merchandises to non-EU economies. Besides, an identification of global supply shocks will base on variation in important prices. Namely,

[1] To maintain the consistency of our structural analysis, we exclude peripheral EU members and small economies such as Cyprus, Luxembourg, and Malta, where trade flows are heavily influenced by idiosyncratic one-off transactions. Although nine countries are removed, the remaining sample is highly representative of the aggregate EU economy, covering over 94% of GDP and 92% of total merchandise exports in 2019. The largest excluded economy, Ireland, represents 2.6% of EU GDP and 4.7% of total exports.

using the detailed Comext data we carefully measure the unit values in EU import from non-EU economies to capture global supply shocks that play important role for the EU producers. It should be highlighted that all these measures are constructed without a home economy in order to have proxies of external variables for the foreign block.

In our baseline estimation, we use the CBOE Market Volatility Index (VIX) as a proxy of global uncertainty. But we will cross-check sensitivity of our key results by employing the Trade Policy Uncertainty (TPU) Index proposed by Caldara et al. (2020).

With the above measurement strategy, our sample consists of 18 economies, for which there are 241 monthly observations from 07/2005 to 08/2025. In the baseline estimation of country-specific VAR models all series are taken as natural logarithms while the production- and export-based series are additionally HP-filtered. We will investigate a sensitivity of that transformation strategy by considering also first-differencing all variables in one of our robustness checks.

3 Baseline results

In this section, we present the baseline results of our empirical analysis which was conducted using ECB BEAR toolbox (Dieppe et al., 2016). First, we examine the impact of the identified structural shocks on export volumes using impulse response functions (IRFs). Next, we discuss cross-country heterogeneity in the identified shocks (median of *a posteriori* shocks distribution) and their significance for export dynamics. This is followed by an analysis of the aggregated historical decomposition of exports. Finally, we provide suggestive evidence on the link between the importance of specific shocks and the structural characteristics of an economy's participation in global supply chains.

3.1 Shocks transmission

The full set of impulse response functions (IRFs) for all model variables is presented in Figure A.1 in the Appendix. These IRFs are derived by aggregating country-specific estimates using 2019 export volumes as weights.

The resulting responses are fully consistent with the imposed sign restrictions and the hierarchical block exogeneity structure. Furthermore, the responses of variables not explicitly constrained by sign restrictions also align with standard economic intuition. For instance, an exchange rate shock—representing a nominal appreciation—lowers domestic producer prices (PPI_{it}^{D}) on impact, reflecting the loss of price competitiveness for the domestic economy, which is in line with Comunale and Kunovac, 2017. Simultaneously, we identify significant transmission of foreign shocks to the domestic economy; both foreign demand and supply shocks stimulate domestic industrial production, while exerting opposite effects on domestic producer prices and the exchange rate. A similar pattern is observed for global demand and supply shocks. Finally, in line with our identification strategy, a global uncertainty shock leads to a contraction of production across all three layers - domestic, foreign, and global - while simultaneously causing a decline in producer prices.

Next we move to the response of exports to various macroeconomic shocks presented in Figure 1. Starting with domestic variables, the impact of the domestic demand shock $\epsilon_{it}^{\mathcal{DD}}$ is numerically zero. This result is consistent with the block exogeneity restrictions imposed during the identification process. On the supply side, a domestic supply shock lowers production prices which stimulates demand for domestic goods including exports. This leads to a positive effect on export volumes that materializes on impact and persists up to five months.

The domestic export shock $\epsilon_{it}^{\mathcal{DE}}$ affects export volumes in a similar fashion. We interpret this innovation as a supply-side improvement specific to export-oriented sectors. This shock potentially captures adjustments along the extensive margin such as new entries into international markets or the introduction of new product categories.

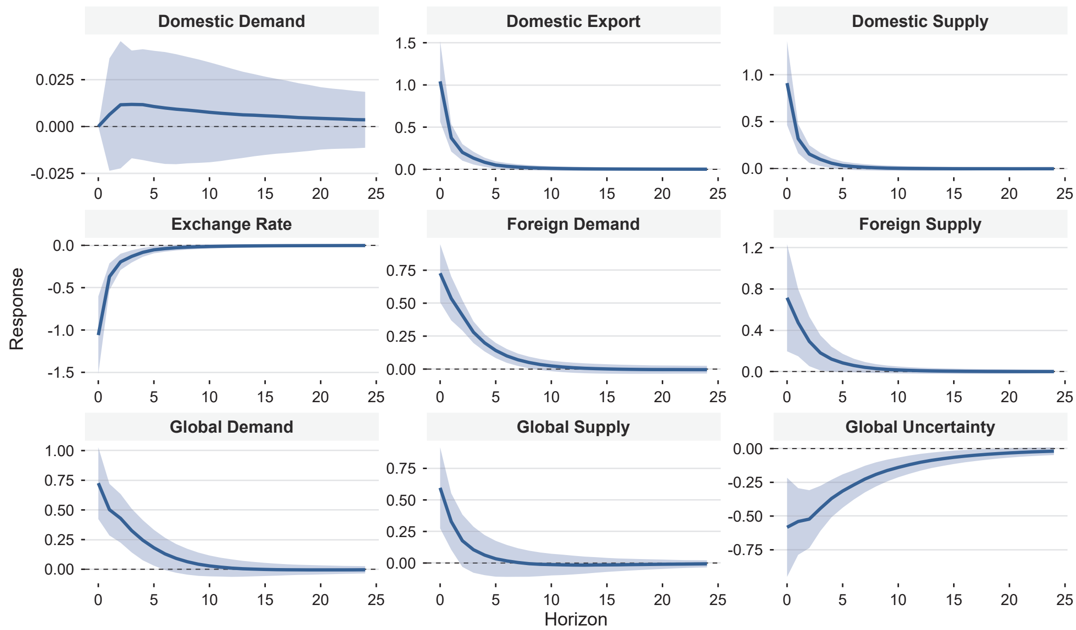
Turning to the exchange rate shock $\epsilon_{it}^{\mathcal{ER}}$, our identification scheme implies that this innovation leads to an appreciation of the nominal effective exchange rate. Such a movement reduces the price competitiveness of domestic goods and consequently triggers a decline in export volumes. This contraction is both economically large and statistically significant on impact. The negative effect on exports persists for more than five months following the initial shock.

The next part of the analysis explores shocks originating from the foreign EU economies. A foreign demand shock $\epsilon_{it}^{\mathcal{FD}}$ increases the production in the EU economies due to higher demand which also saturates the foreign economy demand for both intermediate and final goods produced in the domestic economy. As an result the foreign demand shock support the domestic export growth.

A more nuanced picture concerns the transmission of the foreign supply shock $\epsilon_{it}^{\mathcal{FS}}$, which involves further interactions within global value chains. A positive foreign supply shock reduces production costs for foreign firms and allows them to expand their global market presence, which supports their domestic production growth. The impact of this shock on domestic exports has two layers. First, through a direct channel, higher profits and demand in the foreign economy increase its demand for domestic final goods, leading to an export increase. Second, through an indirect channel, foreign firms facing higher demand from the global economy will increase their imports of intermediate goods from the domestic economy, which are then used to produce final products sold in the global economy. This mechanism underscores how supply-side improvements in foreign countries translate into significant gains for domestic exporters of intermediate and final goods through the backward and forward connections of global value chains.

The final group of structural shocks relates to global factors driving both the domestic and foreign economies. We find that both global demand $\epsilon_{it}^{\mathcal{GD}}$ and global

Figure 1: The response of exports to selected shocks



Note: the solid lines and the shaded areas represent weighted averages from country-specific estimates of the IRFs and the corresponding 95% credibility intervals. The country level estimates are weighted by value of exports in 2019 while the credibility intervals are estimated with the delta method.

supply $\epsilon_{it}^{\mathcal{GS}}$ shocks act as powerful drivers of domestic export growth, with transmission mechanisms similar to those of foreign shocks. This transmission occurs through two distinct channels. In the direct channel, a surge in global trade activity increases international demand for domestic goods, including both final products and intermediate inputs. Simultaneously, an indirect channel operates through the foreign economy. As global conditions improve, exports from the foreign economy also rise, which in turn boosts its demand for domestic intermediate goods.

Furthermore, we observe that global demand shocks exhibit higher persistence than supply-side shocks. This phenomenon can be attributed to the nature of global consumption and investment cycles. While supply-side shocks reflect transitory price and cost fluctuations, negative shifts in aggregate demand can lead to abnormal savings and caution in consumption decisions among consumers. For firms, this may lead to freezing investments until demand rebuilds, a phenomenon that can be further prolonged as it propagates through the global value chain.

The last global shock we analyze in our framework is the global uncertainty shock $\epsilon_{it}^{\mathcal{GU}}$. The estimated negative effect on exports is persistent compared to other global shocks. A key mechanism is taking place on firm level. As suggested by Novy and

Taylor (2020), after uncertainty shock firms are initially more willing to reduce imports of foreign inputs rather than domestic ones. As a results, the exports from EU is falling. The persistence of the exports response could be explain by a fact that most of exporters are using imported intermediates. This, in turn, creates an opportunity to propagate this shock along the highly fragmented supply chains. This channel seems to outweigh potential capital outflow to safe haven, which, in turn, could lead to a substantial depreciation is small open currency.

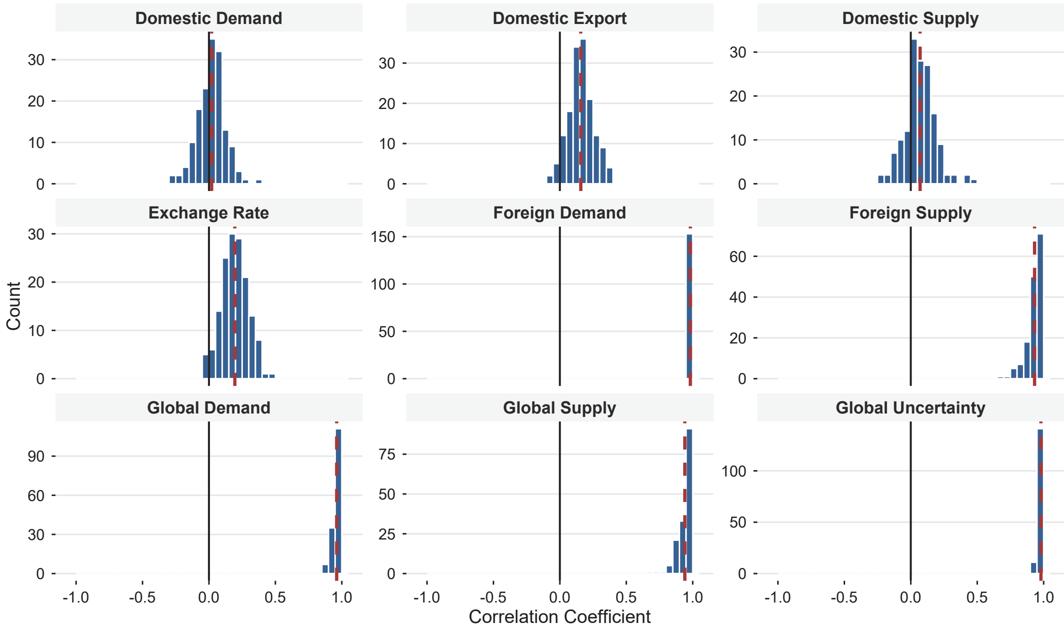
3.2 Cross-country correlations

Having discussed the aggregate impact of structural shocks on export volumes, we now examine the consistency of these innovations across the 18 European Union economies in our sample. Given that our Bayesian Structural Vector Autoregression (BSVAR) models are estimated individually for each country using country-specific datasets, analyzing the synchronization of the identified shocks provides significant validation of our empirical framework. Figure 2 illustrates the distribution of pairwise correlation coefficients for each of the structural shocks, offering a clear view of how synchronized these economic factors are across the European Union

The domestic block is characterized by a high degree of heterogeneity, which aligns with the theoretical expectation that these shocks represent country-specific factors. Domestic demand and supply shocks show average correlations close to zero because they capture unique national factors such as domestic productivity shifts or local economic policies. While domestic export and exchange rate shocks also show low average synchronization, they tend to be more positively correlated than other domestic variables. This pattern suggests that these variables partially capture common external pressures that influence domestic export sectors and currency markets simultaneously across the region.

Foreign shocks demonstrate high cross-country similarity with correlations concentrated near the unity. This finding is a direct result of our modeling choice where the foreign environment for each country is defined as the aggregate European Union excluding the economy under analysis. The fact that these shocks are highly correlated across independent estimations confirms that our framework accurately and consistently captures a shared foreign economic factors. This high degree of overlap serves as a

Figure 2: Cross-country correlations of identified shocks



Note: the blue bars denote the number of pairwise correlation coefficient between countries for a given shock. The dashed red lines represent the average from pairwise correlation.

powerful robustness check for our identification strategy as it shows that the model isolates the same external shocks regardless of the domestic data used in each separate estimation.

Global shocks follow a similar pattern of high correlation with most country pairs showing coefficients close to unity. However, the histograms reveal a slightly broader spread in global shock correlations compared to the foreign block, which points to a more nuanced transmission of global events. This heterogeneity reflects the varying degrees of sensitivity to global disruptions depending on an economy's structural and geographic features.

For example, Central Eastern European economies such as Poland, Romania, or Czechia were more exposed to global supply and uncertainty shocks resulting from the Russian invasion of Ukraine than countries from the Western part of the EU. Such geographic disparities explain why the identified global shocks are not perfectly uniform across the sample, highlighting the fact that global innovations can manifest with different intensities.

3.3 Historical decomposition

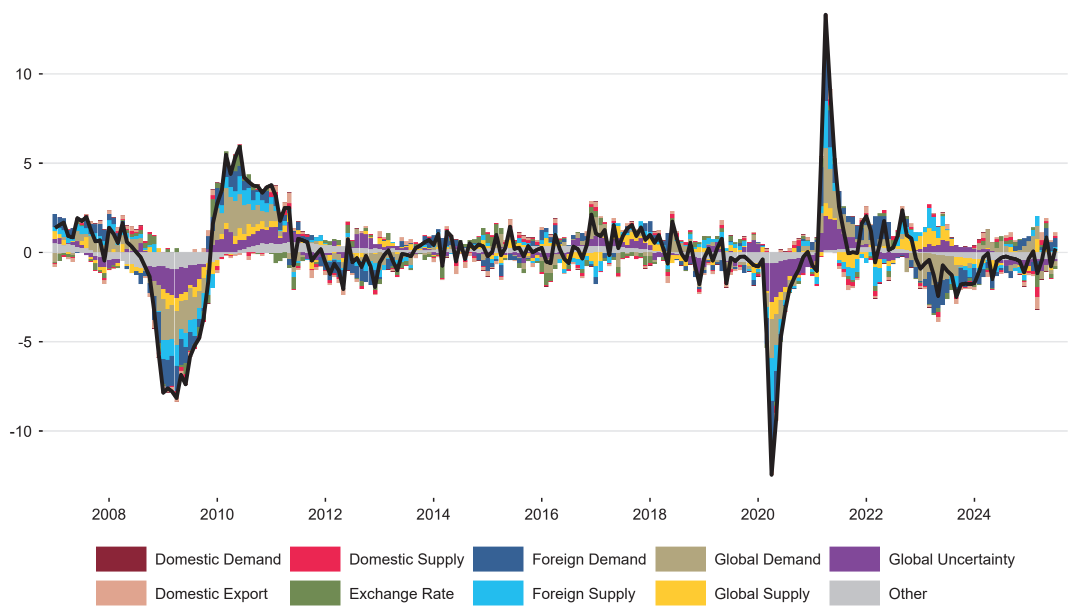
To further evaluate our framework, we examine its ability to explain short-run export fluctuations during the past twenty years. For each of the 18 examined EU economies, we perform a historical decomposition[2] of export volumes which we then aggregate using current export values as weights. The results presented in Figure 3 allow us to compare the drivers of the Great Trade Collapse (GTC) with those of the COVID-19 pandemic.

The collapse in EU exports during the GTC was primarily a demand-driven event initiated by an adverse global demand and uncertainty shocks. The demand nature of initial reaction of exports seems to be consistent with the associated literature which also highlights the predominant role of global demand shock (Bems et al., 2011; Bems et al., 2013; Bricongne et al., 2012). However, the unprecedented surge in export was further accelerated by the so-called bullwhip effect as firms across the global value chain reacted to uncertainty by reducing inventories (Altomonte et al., 2013) which was especially most pronounced in highly vertically specialized industries like automotive industry (Alessandria et al., 2010). Consequently, the initial global impulse propagated into a significant decline in intra-EU demand which became one of the major factors in the trade slowdown. Besides, demand-driven surge in exports was additionally deepened by a slight negative contribution of external supply shocks. The associated literature highlights the role of credit constraints (Amiti and Weinstein, 2011; Chor and Manova, 2012) or decrease in durable investment efficiency (Eaton et al., 2016) but, as in our results, these factors played only limited role (Bems et al., 2013).

Recently, the COVID-19 period was driven by more complex mechanisms characterized by adverse shifts in both supply and demand across foreign and global structural blocks of shocks. The pandemic-induced lockdowns created a synchronized halt in international trade and production (Berthou and Stumpner, 2022; Aiyar et al., 2022; Hayakawa and Mukunoki, 2021). While a resurgence in intra-EU demand eventually supported a post-pandemic recovery, this process was obstructed by global supply-side bottlenecks (Brancaccio et al., 2025). These tensions were fueled by a surge in demand as consumers and firms realized previously delayed spending, which in turn led to significant delays in international trade and skyrocketing sea freight prices. These

[2] The individual export historical decompositions for each country are presented in Appendix B..

Figure 3: Aggregated EU export volume decomposition (% yoy change)



Note: the historical decomposition for EU aggregate dynamics of export is the weighted average from country-specific decomposition while the value of exports in 2019 is taken as weights. The other term contains the medium- and long-run trend obtained from the HP filter as well as effect of initial conditions. The second effect is dying out over the estimation sample.

global supply constraints placed a persistent ceiling on the recovery of export volumes.

Negative supply-side factors intensified significantly in early 2022 due to the outbreak of the war in Ukraine and the resulting energy crisis. Our BSVAR model captures this period as a sharp negative foreign supply shock reflecting the surge in global commodity prices and specific electricity price pressures faced by European economies. The geographic proximity of EU members to the conflict ensured that these shocks had a particularly strong negative impact on their export performance. These findings confirm that our methodology provides a robust distinction between shocks originating from global developments and regional fluctuations.

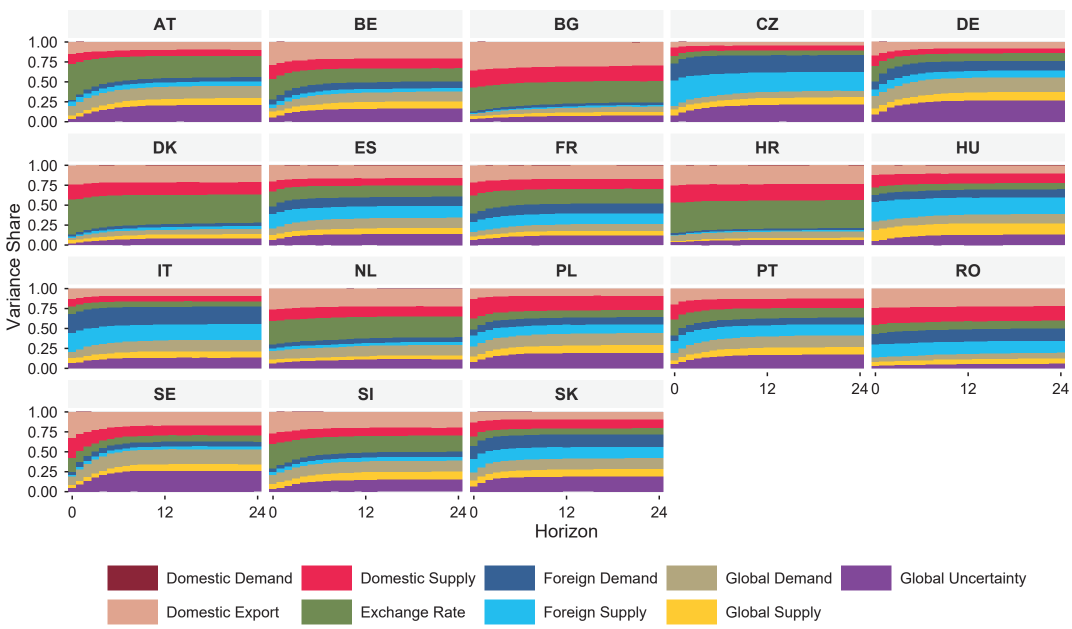
3.4 Shocks importance and GVC exposure

The historical decomposition analysis offers a cohesive overview of the structural factors shaping European Union export dynamics. While the primary results are aggregated across the 18 sample economies, individual country estimates are provided in Appendix B. These country-specific results highlight that both export behavior and its underlying drivers differ significantly across the analyzed economies. This heterogeneity is further confirmed by the forecast error variance decompositions (FEVDs) in Figure 4, which illustrate that the contribution of specific shocks to export variability varies substantially by country. While domestic shocks remain the primary drivers of export performance in some economies, others are predominantly influenced by foreign and global factors.

By aggregating country-specific results using 2019 export volumes as weights, we demonstrate that European Union exports are primarily driven by global shocks, which account for 66.4% of the forecast error variance decomposition (FEVD). In comparison, the contributions of foreign, domestic, and exchange rate shocks stand at 17.1%, 11.1%, and 5.5%, respectively. This aggregated outcome reveals that despite deep integration within regional supply networks, which has significantly increased intra-EU bilateral trade and overall welfare, these regional connections do not effectively mitigate risks associated with global economic shifts.

This lack of insulation likely stems from the fact that EU economies maintain substantial extra-EU linkages, characterized by both backward connections (e.g., intermediate inputs sourced from China and broader Asia) and forward ties with other developed nations. Consequently, even with strong intra-regional dependencies, structural shocks occurring at different stages of the global value chain are transmitted to European economies and may even be amplified within regional production networks.

Figure 4: Export volume FEVD for all countries in the sample



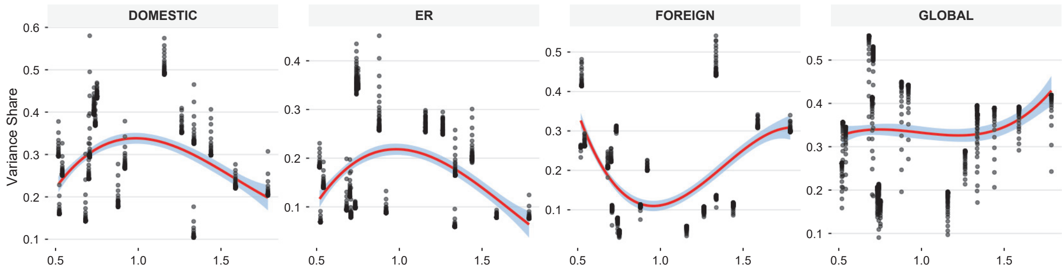
To better understand the EU economies exposure to non-domestic shocks we move back to country-specific results and map the FEVDs at horizons from 0 to 20 months against various metrics of international economic integration as shown in Figure 5. We calculate the underlying structural features of economies using the recent data on international input-output tables (see table A.2). To make this analysis better to visualize we group the contributions of the analyzed shocks to wider groups of domestic, exchange rate, foreign and global shocks. This approach allows us to evaluate how an economy's position in global production chains influences its vulnerability to different types of structural shocks.

First, we observe a robust positive correlation between trade openness and the share of foreign and global shocks in FEVDs (Figure 5a). Similarly, as total GVC participation increases, the contribution of global and foreign innovations to export variability grows, while the role of domestic supply and exchange rate factors is reduced (Figure 5b). All in all, this exercise provides suggestive evidence that for economies highly integrated into the global economy, export performance is primarily dictated by non-domestic factors. For such countries, domestic supply and exchange rate factors exert only a limited impact on the behavior of exports.

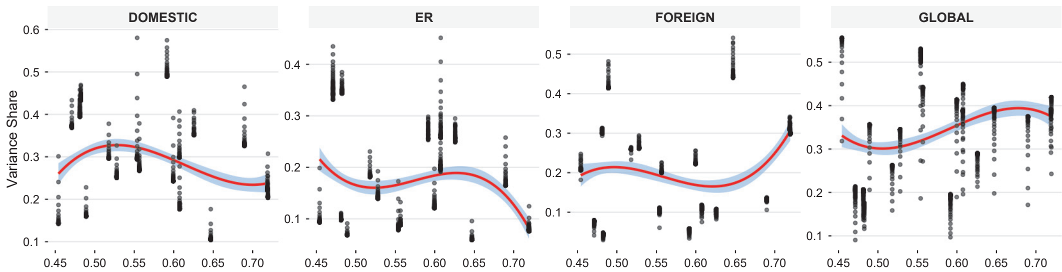
To gain a more nuanced perspective on the relationship between GVC participation and exposure to non-domestic shocks, we further distinguish between backward and forward participation. Backward GVC participation serves as a measure of input dependency, capturing the foreign value added embedded in domestic exports. Our results indicate that economies with higher shares of foreign value added in export are more exposed to foreign and global shocks (Figure 5c). The primary transmission mechanism here is the cost channel. Exporters who rely heavily on imported components are directly affected by global supply-side or uncertainty shocks that impact input prices. As input costs rise, domestic firms face pressure to increase their export prices, thereby reducing their international competitiveness and dampening demand. This cost-push mechanism makes import-dependent economies particularly sensitive to global inflationary and supply chain pressures. In a border context, the presence of this cost-push mechanism is coherent with empirical studies documenting that more intensive GVC participation reduces responsiveness of exports to exchange rate fluctuations (Swarnali et al., 2017; de Soyres et al., 2021; Adler et al., 2023).

Figure 5: Cross-country heterogeneity in importance of shocks

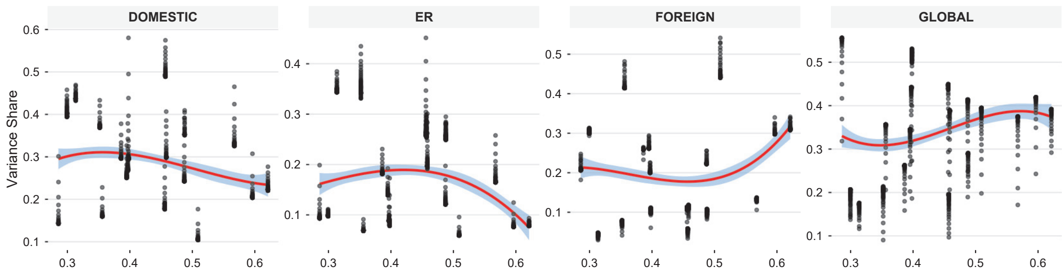
(a) Trade Openness



(b) Total GVC participation



(c) Backward GVC participation

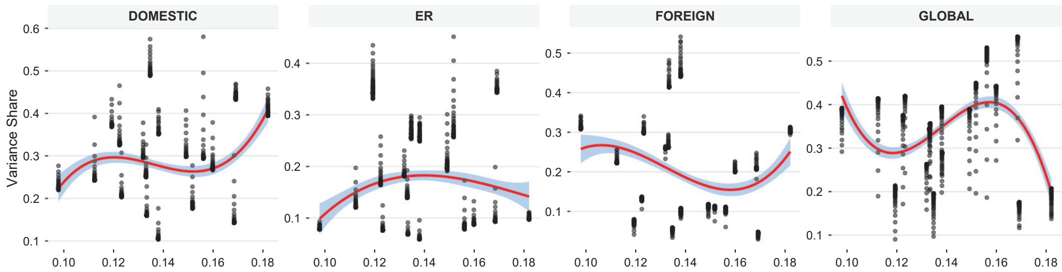


The evidence regarding GVC forward linkages is also important but less conclusive. Forward GVC participation measures the domestic value added share in foreign exports. We could expect that stronger forward linkages can also lead to higher dependence of the economy on foreign factors due to stronger ties with the global production network. However, given the relationship presented in Figure 5d, it is not clear in what way forward participation impacts the exposure to global shocks. Some insights can, however, be drawn from the relationship between global and foreign shock exposure and the share of non-EU partners in countries' exports (Figure 5e). In this case, for global variables, it is clear that the stronger the direct ties with non-EU partners, the lower the exposure to global, and to some extent, foreign factors. This at first counterintuitive example likely reflects a diversification effect, i.e., by having direct economic ties with non-EU partners and potentially final consumers, the effects of non-domestic shocks are not amplified by complex multi-country production stages. These results provide suggestive evidence that the length of economic ties also plays a role in export exposure to non-domestic shocks, with countries that have shorter forward connections being less dependent on those non-domestic factors.

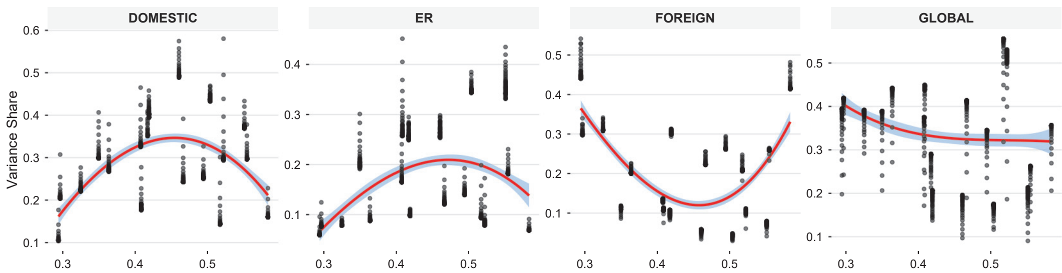
A final suggestive relationship concerns the specialization in investment-specific products. Our findings indicate that global shocks play a dominant role in economies which specialize in capital goods (Figure 5f). There are two possible reasons behind this empirical pattern. First, at the firm level investment decisions are often the first to be postponed during periods of global uncertainty and, therefore, the demand for these goods is much more sensitive to global factors than the demand for other goods. Second, the production of investment goods is highly concentrated in several economies that are also specialized with R&D activity (Eaton and Kortum, 2001; Mutreja et al., 2018). Thus, the strong vertical specialization in capital goods might act as an additional amplifier of global shocks. Nevertheless, this pronounced volatility means that economies specialized in investment-oriented production stages are more vulnerable to global demand and supply fluctuations than those focusing on more stable ones.

Figure 5: Cross-country heterogeneity in importance of shocks (continued)

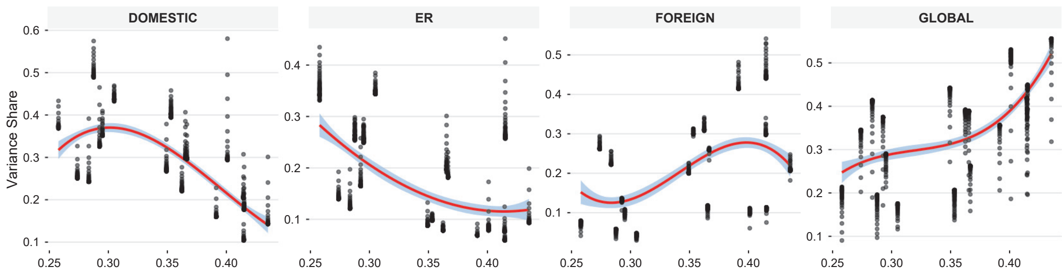
(d) Forward GVC participation



(e) Non-EU export share



(f) Relative specialization in investment-specific GVC



Note: the importance of shocks is measured by the share of specific/group of specific shocks in forecast variance decomposition (FEVD) for exports. This measure is on the vertical axis while the variation in the selected structural features of economy is depicted on the horizontal axis. The black points represent variability in the FEVD estimates for horizon ranging from contemporaneous impact to the 20-months horizon. The red straight line denotes the relationship estimated with cubic polynomial while blue shaded areas correspond the 95% confidence intervals. Detailed description of structural features is collected in table A.2.

4 Robustness check

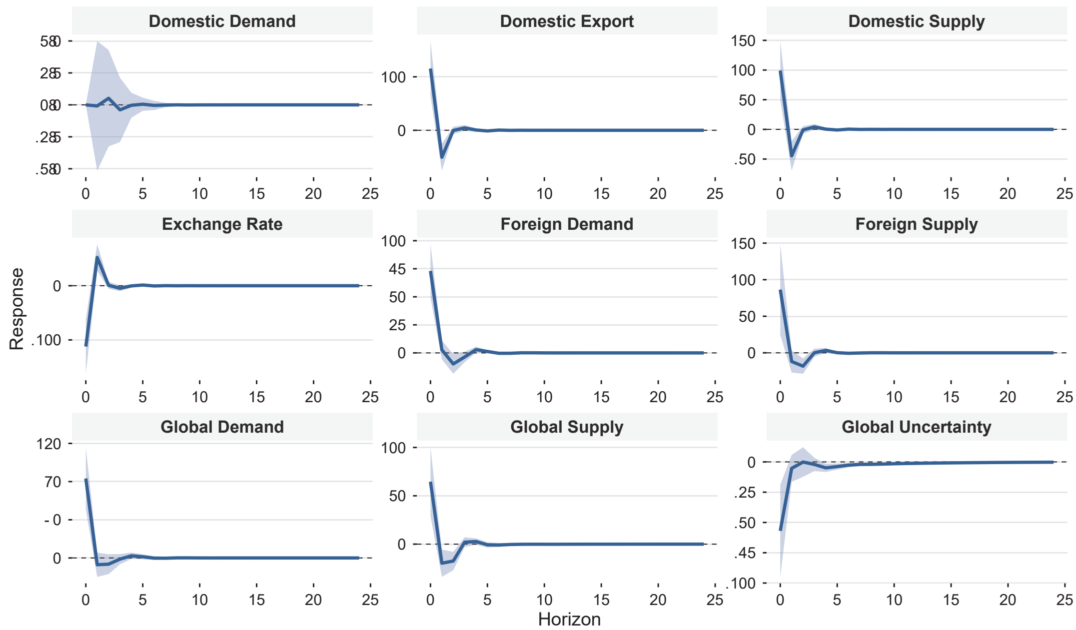
To ensure the reliability of our findings, we conducted a series of robustness checks. These additional exercises allow to verify whether our results are sensitive to the choice of proxy variables, different data frequencies, different identification scheme, or alternative data transformation methods. In our baseline specification, we use the cyclical components of industrial production and export volumes obtained with the Hodrick-Prescott filter while keeping other variables in natural logarithms.

First-differencing instead of HP filter. To address concerns with non-stationary data and HP filter-based variables in our model, we estimated an alternative model where all series except for the VIX index are transformed into first differences. The resulting impulse response functions and historical decompositions are presented in Figures 6 and 7. The impulse responses suggest that the directions of the shocks are qualitatively consistent with our baseline results. However, because the export series is differenced, the responses lose a significant portion of their persistence. This indicates that the first-difference specification may not fully capture the prolonged transmission of shocks to exports.[3] Most importantly, the results from the historical decomposition and the forecast error variance decomposition remain aligned with the baseline, supporting our primary conclusions regarding the role of global supply chain participation and historical decompositions.

Export volume measure from the National Accounts. We further verify our findings by examining whether our results are sensitive to the specific measure of export volume and the frequency of the data. Our baseline model uses monthly trade statistics from Eurostat Comext because they offer granular insights into international trade flows. However, these data can differ from higher-quality National Accounts statistics, which are typically used for broader economic analysis but are restricted to a quarterly frequency. By using monthly data, we can leverage a larger sample size, which improves the reliability of the posterior distributions in our BVAR framework and allows for a more robust identification of structural innovations. In this robustness check, we

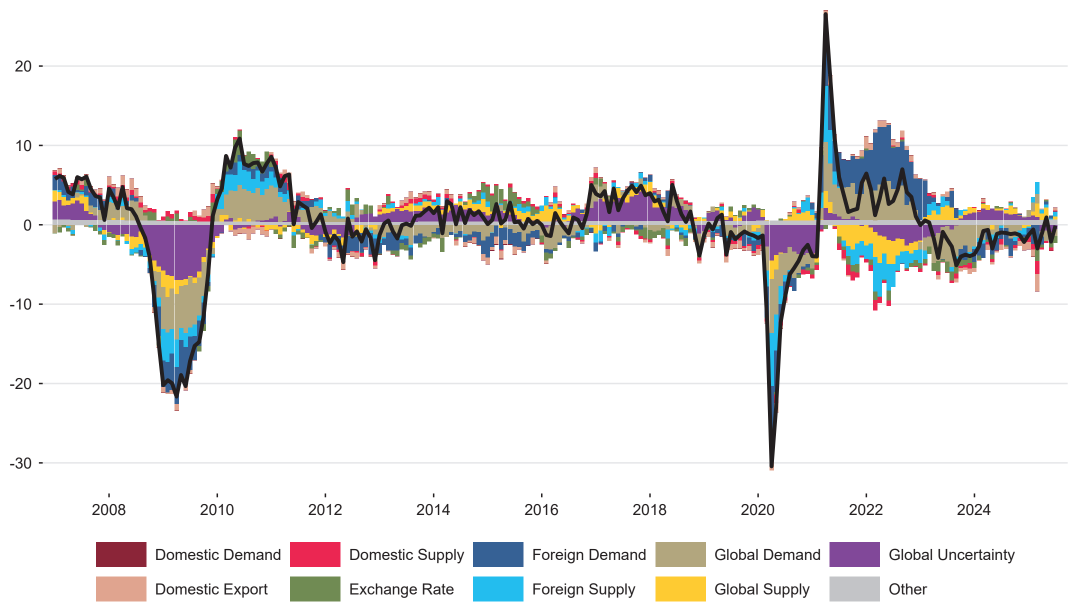
[3] On a technical level, this model required a substantially higher number of iterations to achieve a sufficient set of valid structural draws during the BSVAR estimation process. This could be explained by a negative persistence of first differences of trade flows.

Figure 6: The response of exports to selected shocks (first differences)



Note: as in figure 1

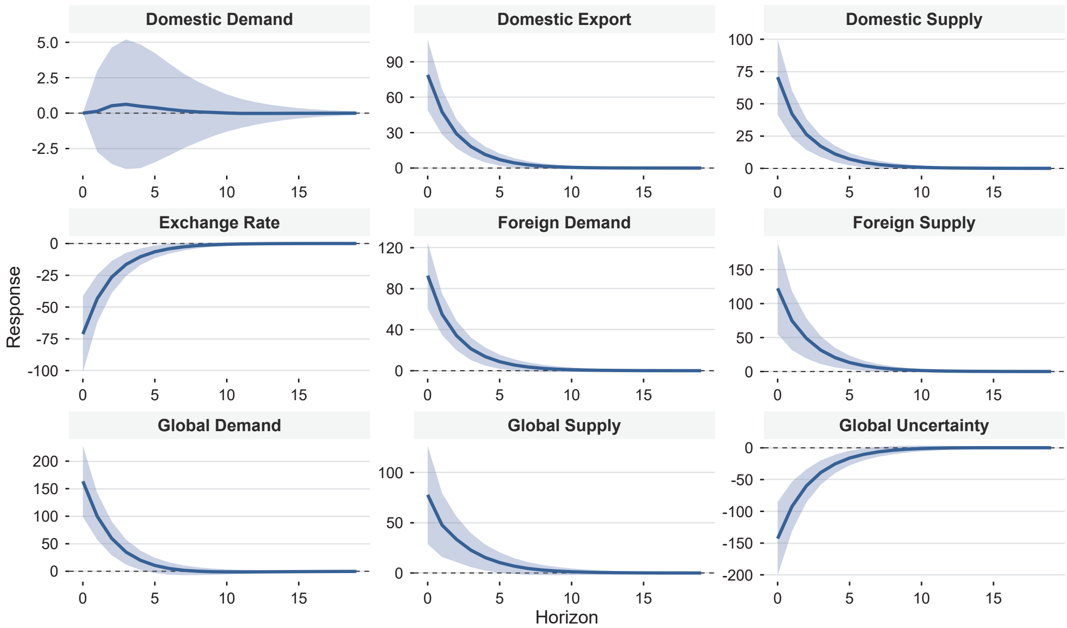
Figure 7: Aggregated EU export volume decomposition (% yoy change, first differences)



Note: as in figure 3

substitute our export measure with National Accounts volumes and convert all remaining series into a quarterly frequency. The IRF and historical decomposition results are shown in Figures 8 and 9. While the results remain largely analogous to the baseline, we observe that global shocks exhibit lower persistence in the quarterly model. In the monthly baseline, global factors had a significantly more prolonged impact on export volumes. This difference indicates that monthly data are better equipped to capture the multi-layered propagation of global trade impulses. These results reinforce the validity of our preferred specification, as it more accurately identifies the persistent effects of global developments compared to more transitory domestic or foreign shocks.

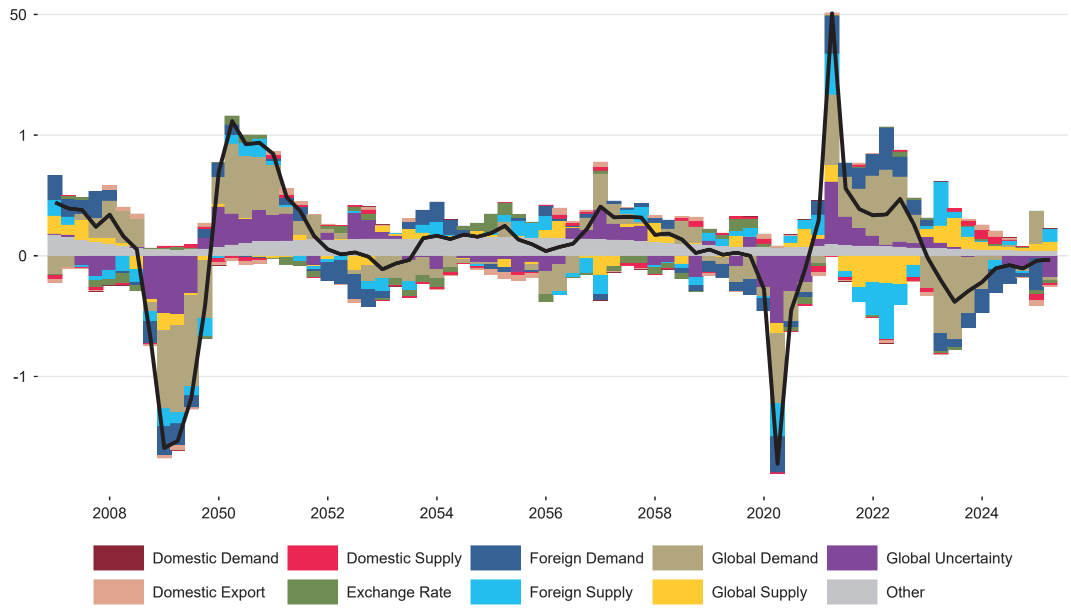
Figure 8: The response of exports to selected shocks (National Accounts quarterly data)



Note: as in figure 1

Trade Policy Uncertainty index as proxy for global uncertainty. In our baseline specification, we utilize the Chicago Board Options Exchange Volatility Index (VIX) to proxy for global uncertainty. The VIX measures the market's expectation of 30-day volatility based on S&P 500 index options and is widely regarded as the premier global uncertainty index due to the central role of US financial markets in international capital flows. However, recent shifts in international trade dynamics suggest that general financial volatility may not fully encompass the uncertainty associated with protectionist measures. Specifically, changes in US trade policy and the imposition of tariffs on global partners, including the European Union, have introduced a distinct layer of trade policy uncertainty.

Figure 9: Aggregated EU export volume decomposition (% yoy change, National Accounts quarterly data)

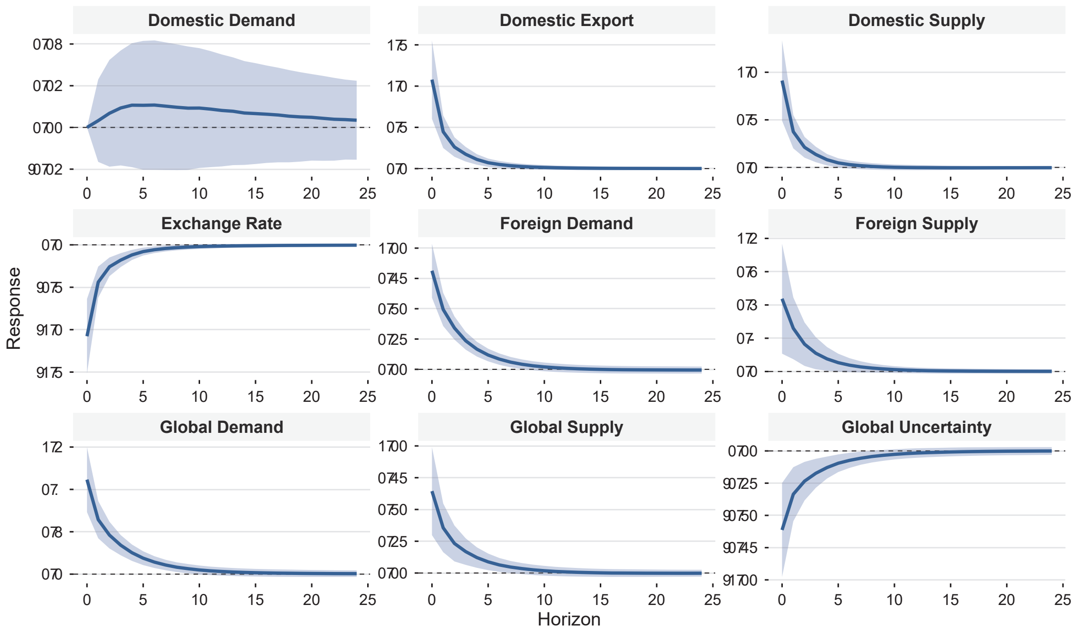


Note: see figure 3.

Beyond the direct contractionary effects of trade barriers, the threat of such measures increases global uncertainty and potentially alters the timing of shipments and investment decisions. To ensure that our baseline uncertainty shock accurately reflects these trade-specific factors, we conduct a sensitivity analysis by replacing the VIX with the Trade Policy Uncertainty (TPU) index. This allows us to study another source of uncertainty that could be faced by exporters. The results of this robustness check are presented in Figures 10 and 11. We find that when using the TPU index, the contribution of the uncertainty shock to the historical decomposition decreases, identifying it as a slightly weaker driver than the VIX-based shock. This is further reflected in the impulse response functions; while the baseline VIX-based shock yielded a strongly positive and persistent response, the aggregated IRF for the TPU-based shock is less persistent. Nevertheless, the role of remaining global and foreign shocks is quite similar to the baseline case.

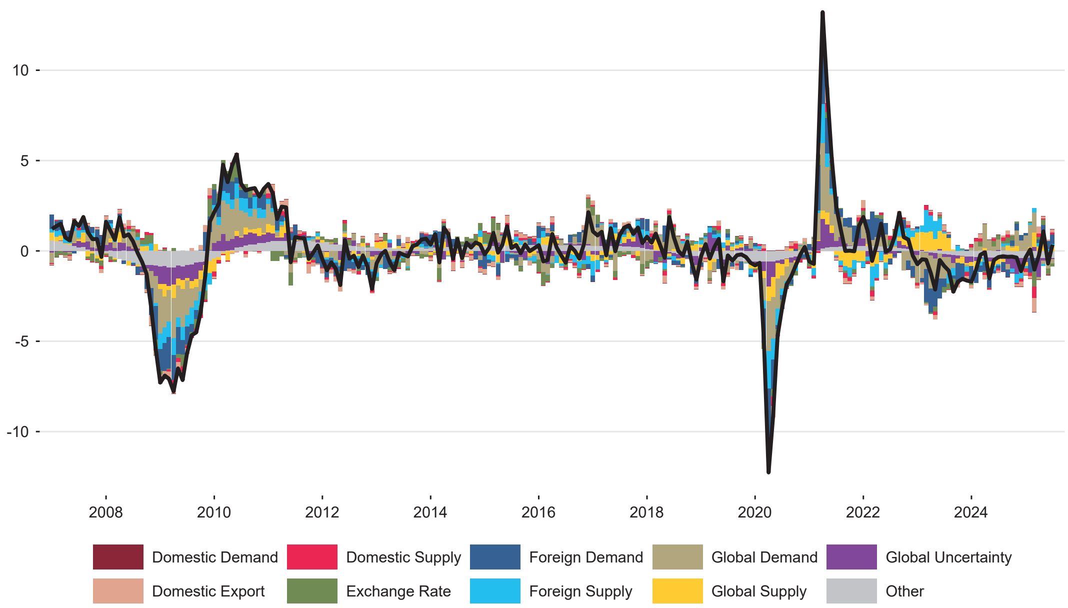
Relaxing Block Exogeneity for Domestic Production and the Foreign Block. In our baseline specification, we assumed that domestic industrial production does not directly affect domestic exports (Table 1), under the premise that domestic production factors

Figure 10: The response of exports to selected shocks (TPU as uncertainty proxy)



Note: as in figure 1

Figure 11: Aggregated EU export volume decomposition (% yoy change, TPU as uncertainty proxy)



Note: see figure 3.

do not significantly drive the export performance of export-oriented firms. However, extreme scenarios such as the Global Financial Crisis (GFC) suggest that a simultaneous contraction in global and domestic demand can lower investment and induce production caution, which, in turn, may ultimately impact exports significantly. Furthermore, the second aspect of our framework requiring a sensitivity check is the small open economy (SOE) assumption. While this holds for economies with a non-dominant share of aggregated EU GDP, it may be too restrictive for major economies like Germany or France. In these cases, the resulting exogeneity of foreign variables relative to the domestic variables might be overly strong.

To evaluate the implications of these restrictions, we re-estimated the model and identified shocks for the 18 EU economies while relaxing the block exogeneity of the foreign block relative to domestic variables, as well as the exogeneity of domestic industrial production relative to exports. Simultaneously, we maintained the zero-impact restriction for domestic shocks on foreign variables (a zero restriction in the first month), and likewise for the impact of domestic demand shocks on exports. The results, presented as aggregated Impulse Response Functions (IRFs) in Figure A.2, show that foreign variable responses to domestic shocks remain near zero and statistically insignificant, even without the exogeneity constraint. This also applies to the reaction of exports to a domestic demand shock. Consequently, the Forecast Error Variance Decomposition (FEVD) and historical decomposition do not deviate significantly from the baseline estimates.

5 Conclusions

This study develops a novel empirical framework to identify the short-term drivers of export fluctuations in 18 EU economies, focusing on the transmission of these shocks through Global Value Chains (GVCs). To disentangle the short-run determinants of export dynamics, we identify two distinct layers of non-domestic activity: foreign factors involving activity within major trading partner economies, and general global conditions transmitted via both forward and backward linkages.

Identification is achieved using a Bayesian Structural Vector Autoregression (BSVAR) model by applying a hierarchical block exogeneity restriction. Under this framework, global variables are assumed exogenous to the foreign and domestic blocks, while foreign variables are exogenous to the domestic block. Finally, we impose a set of on-impact sign restrictions on the impulse responses to identify orthogonal structural shocks that align with economic theory.

Our framework allows us to distinguish between the structural determinants of exports during two major global disruptions. We find that the fall in EU export volumes during the Great Trade Collapse (GTC) was primarily triggered by adverse global demand and uncertainty factors, which subsequently propagated into a contraction of intra-EU demand. In contrast, the COVID-19 pandemic was characterized by a more complex confluence of supply and demand shocks originating from both foreign and global layers. While the post-pandemic recovery was supported by a resurgence in intra-EU demand, this momentum was hindered by global supply-side constraints and tensions in global value chains that intensified following the Russian invasion of Ukraine. These findings also provide new insights into business cycle synchronization, revealing that the co-movement of trade flows between EU economies is largely explained by their shared exposure to foreign and global shocks, whereas domestic shocks exhibit a significantly lower degree of synchronization.

Finally, by quantifying the specific contributions of structural shocks, we demonstrate that deep integration within European production networks does not diminish the exposure of EU economies to global structural shocks. On average, EU exports are primarily driven by global factors, which account for a more substantial share of the forecast error variance decomposition than foreign factors. Furthermore, we provide evidence that the impact of these macroeconomic factors is closely linked to the structural features of an economy. Global shocks play a more prominent role in countries with high trade openness and intensive participation in investment-specific GVCs. We find that more intensive backward linkages heighten the sensitivity of domestic exports to non-domestic shocks through a cost-push mechanism, as export-oriented production relies heavily on imported inputs. Conversely, shorter GVC linkages tend to reduce this exposure, suggesting that the complexity and length of production ties are key determinants of an economy's vulnerability to global disruptions.

References

Adler, G., S. Meleshchuk, and C.O. Buitron (2023). "Global value chains and external adjustment: Do exchange rates still matter?" *Economic Modelling* 118, p. 106073. https://doi.org//10.1016/j.econmod.2022.106073.

Aiyar, S., D. Malacrino, A. Mohommad, and A.F. Presbitero (2022). "International Trade Spillovers from Domestic COVID-19 Lockdowns". 2022 (120). https://doi.org/10.5089/9798400212178.001.

Alessandria, G., J.P. Kaboski, and V. Midrigan (2010). "The Great Trade Collapse of 2008-09: An Inventory Adjustment;" *IMF Economic Review* 58 (2), pp. 254–294. https://doi.org/10.1057/imfer.2010.10.

Altomonte, C., F. Di Mauro, G. Ottaviano, A. Rungi, and V. Vicard (Dec. 2013). "Global Value Chains during the Great Trade Collapse: A Bullwhip Effect?" In: *Firms in the International Economy: Firm Heterogeneity Meets International Business*. The MIT Press. https://doi.org/10.7551/mitpress/9780262019743.003.0010.

Amiti, M. and D. Weinstein (2011). "Exports and Financial Shocks". *The Quarterly Journal of Economics* 126 (4), pp. 1841–1877. https://doi.org/10.1093/qje/qjr033.

Antràs, P. and D. Chor (2022). "Chapter 5 - Global value chains". In: *Handbook of International Economics: International Trade, Volume 5*. Ed. by G. Gopinath, E. Helpman, and K. Rogoff. Vol. 5. Handbook of International Economics. Elsevier, pp. 297–376. https://doi.org/10.1016/bs.hesint.2022.02.005.

Arias, J.E., J.F. Rubio-Ramírez, and D.F. Waggoner (2018). "Inference Based on Structural Vector Autoregressions Identified With Sign and Zero Restrictions: Theory and Applications". *Econometrica* 86 (2), pp. 685–720. https://doi.org/10.3982/ECTA14468.

Ascari, G., D. Bonam, and A. Smadu (2024). "Global supply chain pressures, inflation, and implications for monetary policy". *Journal of International Money and Finance* 142, p. 103029. https://doi.org/10.1016/j.jimonfin.2024.103029.

Baldwin, R. and J. Lopez-Gonzalez (2015). "Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses". *The World Economy* 38 (11), pp. 1682–1721. https://doi.org/10.1111/twec.12189.

Bems, R., R.C. Johnson, and K.-M. Yi (2011). "Vertical Linkages and the Collapse of Global Trade". *American Economic Review* 101 (3), 308–12. https://doi.org/10.1257/aer.101.3.308.

— (2013). "The Great Trade Collapse". *Annual Review of Economics* 5 (1), pp. 375–400. https://doi.org/10.1146/annurev-economics-082912-110201.

Berthou, A. and S. Stumpner (2022). *Trade Under Lockdown*. Working papers 867. Banque de France.

Binici, M., S. Centorrino, S. Cevik, and G. Gwon (2024). "Here Comes the Change: The Role of Global and Domestic Factors in Post-Pandemic Inflation in Europe". *International Journal of Central Banking* 20 (2), pp. 237–290.

Brancaccio, G., M. Kalouptsidi, and T. Papageorgiou (2025). *Rigidities in Transportation and Supply Chain Disruptions*. Working Paper 33452. National Bureau of Economic Research. https://doi.org/10.3386/w33452.

Bricongne, J.-C., L. Fontagné, G. Gaulier, D. Taglioni, and V. Vicard (2012). "Firms and the global crisis: French exports in the turmoil". *Journal of International Economics* 87 (1), pp. 134–146. https://doi.org/10.1016/j.jinteco.2011.07.002.

Caldara, D., M. Iacoviello, P. Molligo, A. Prestipino, and A. Raffo (2020). "The economic effects of trade policy uncertainty". *Journal of Monetary Economics* 109. SI:APR2019 CRN CONFERENCE, pp. 38–59. https://doi.org/10.1016/j.jmoneco.2019.11.002.

Chor, D. and K. Manova (2012). "Off the cliff and back? Credit conditions and international trade during the global financial crisis". *Journal of International Economics* 87 (1). Symposium on the Global Dimensions of the Financial Crisis, pp. 117–133. https://doi.org/10.1016/j.jinteco.2011.04.001.

Chudik, A. and M.H. Pesaran (2016). "Theory And Practice Of Gvar Modelling". *Journal of Economic Surveys* 30 (1), pp. 165–197. https://doi.org/10.1111/joes.12095.

Comunale, M. and D. Kunovac (2017). *Exchange rate pass-through in the euro area*. 2003. ECB working paper.

de Soyres, F., E. Frohm, V. Gunnella, and E. Pavlova (2021). "Bought, sold and bought again: The impact of complex value chains on export elasticities". *European Economic Review* 140, p. 103896. https://doi.org/10.1016/j.euroecorev.2021.103896.

Dieppe, A., R. Legrand, and B. Van Roye (2016). "The BEAR toolbox".

Eaton, J. and S. Kortum (2001). "Trade in capital goods". *European Economic Review* 45 (7), pp. 1195–1235. https://doi.org/10.1016/S0014-2921(00)00103-3.

Eaton, J., S. Kortum, B. Neiman, and J. Romalis (2016). “Trade and the Global Recession”. *American Economic Review* 106 (11), 3401–38. https://doi.org/10.1257/aer.20101557.

Engel, C. and J. Wang (2011). “International trade in durable goods: Understanding volatility, cyclicality, and elasticities”. *Journal of International Economics* 83 (1), pp. 37–52. https://doi.org/10.1016/j.jinteco.2010.08.007.

Hagemejer, J. and J. Mućk (2019). “Export-led growth and its determinants: Evidence from Central and Eastern European countries”. *The World Economy* 42 (7), pp. 1994–2025.

Hayakawa, K. and H. Mukunoki (2021). “Impacts of COVID-19 on Global Value Chains”. *The Developing Economies* 59 (2), pp. 154–177. https://doi.org/10.1111/deve.12275.

Johnson, R.C. and G. Noguera (2012). “Accounting for intermediates: Production sharing and trade in value added”. *Journal of International Economics* 86 (2), pp. 224–236. https://doi.org/10.1016/j.jinteco.2011.10.003.

Litterman, R.B. (1986). “Forecasting with Bayesian vector autoregressions—five years of experience”. *Journal of Business & Economic Statistics* 4 (1), pp. 25–38. https://doi.org/10.1080/07350015.1986.10509491.

Mutreja, P., B. Ravikumar, and M. Sposi (2018). “Capital goods trade, relative prices, and economic development”. *Review of Economic Dynamics* 27, pp. 101–122. https://doi.org/10.1016/j.red.2017.11.003.

Novy, D. and A.M. Taylor (2020). “Trade and Uncertainty”. *The Review of Economics and Statistics* 102 (4), pp. 749–765. https://doi.org/10.1162/rest_a_00885.

Pesaran, M., T. Schuermann, and W. S.M. (2004). “Modeling Regional Interdependencies Using a Global Error-Correcting Macroeconometric Model”. *Journal of Business Economic Statistics* 22, pp. 129–162. https://doi.org/10.1198/073500104000000019.

Swarnali, A., A. Maximiliano, and R. Michele (2017). “Global value chains and the exchange rate elasticity of exports”. *The B.E. Journal of Macroeconomics* 17 (1), pp. 1–24. https://doi.org/10.1515/bejm-2015-0130.

Szafranek, K., G. Szafrański, and A. Leszczyńska-Paczesna (2024). “Inflation returns. Revisiting the role of external and domestic shocks with Bayesian structural VAR”. *International Review of Economics Finance* 93, pp. 789–810. https://doi.org/10.1016/j.iref.2024.03.054.

Vannoorenberghe, G. (2012). “Firm-level volatility and exports”. *Journal of International Economics* 86 (1), pp. 57–67. https://doi.org/10.1016/j.jinteco.2011.08.013.

Wang, Z., S.-J. Wei, and K. Zhu (2013). *Quantifying International Production Sharing at the Bilateral and Sector Levels*. NBER Working Papers 19677. National Bureau of Economic Research, Inc. https://doi.org/10.3386/w19677.

A Additional tables

Table A.1: Data sources

Variable	Description	Source
Domestic variables		
$\mathcal{EX}_{it}$	Exports of goods, volume	Eurostat/Comext
$\mathcal{IP}_{it}^{\mathcal{D}}$	Industrial production in manufacturing	Eurostat
$\mathcal{PPI}_{it}^{\mathcal{D}}$	Producer prices in manufacturing	Eurostat
$\mathcal{ER}_{it}$	Nominal effective exchange rate, an increase reflects to appreciation of a home currency	BIS
Foreign variables		
$\mathcal{IP}_{it}^{\mathcal{F}}$	Industrial production in manufacturing in other EU economies; weighted by global production in 2019	Eurostat
$\mathcal{PPI}_{it}^{\mathcal{F}}$	Producer prices in manufacturing in other EU economies; weighted by global production in 2019	Eurostat
Global variables		
$\mathcal{DEM}_{it}^{\mathcal{G}}$	The remaining EU's export volume to non-EU countries	Eurostat/Comext
$\mathcal{PRI}_{it}^{\mathcal{G}}$	The remaining EU's import unit values from non-EU partners	Eurostat/Comext
$\mathcal{UNC}_{t}^{\mathcal{G}}$	Volatility Index (VIX)	CBOE

Table A.2: Detailed description of key structural features

Variable & Description	Source
Trade Openness is the ratio of gross exports and imports of product to the GDP	Eurostat
Total GVC participation is the the sum of forward and backward GVC participation (see below)	Eurostat/FIGARO
Non-EU export share is the share of non-EU economies in gross exports of products	Eurostat/FIGARO
Forward GVC participation is the share of domestic value added in export of products that is further used in export-oriented production of importing country. The above measure is estimated at the industry level using the Wang et al. (2013) method and then aggregated to total exports of manufactured goods	Eurostat/FIGARO
Backward GVC participation is the foreign value added in gross exports of products (import content of gross exports). The foreign value added is estimated at the industry level using the Wang et al. (2013) method and then aggregated to total exports of manufactured good	Eurostat/FIGARO
Relative specialization in investment-specific GVC is the share of foreign investment in total exported value added	Eurostat/FIGARO

Figure A.1: All aggregated impulse response functions from the model

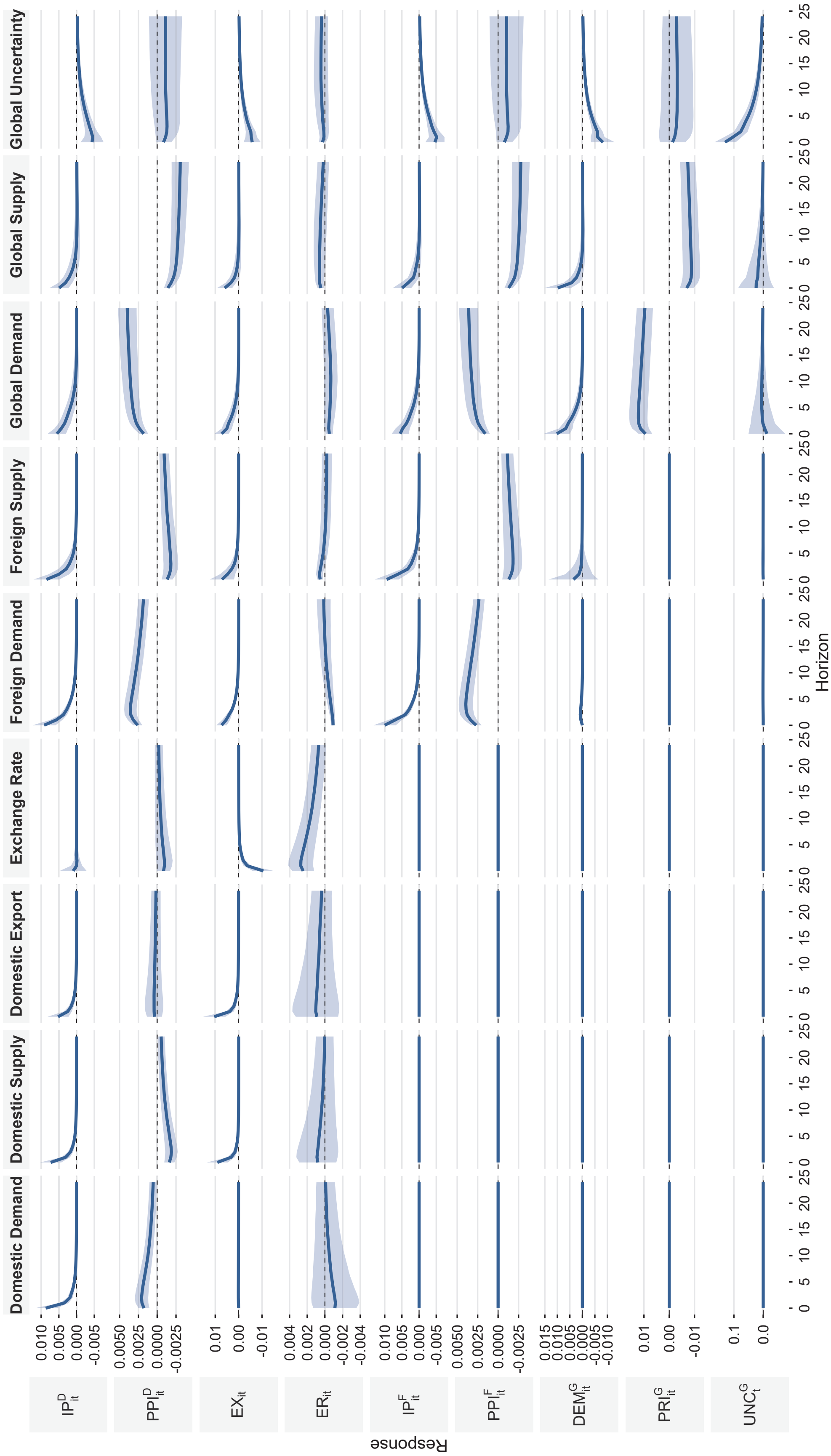
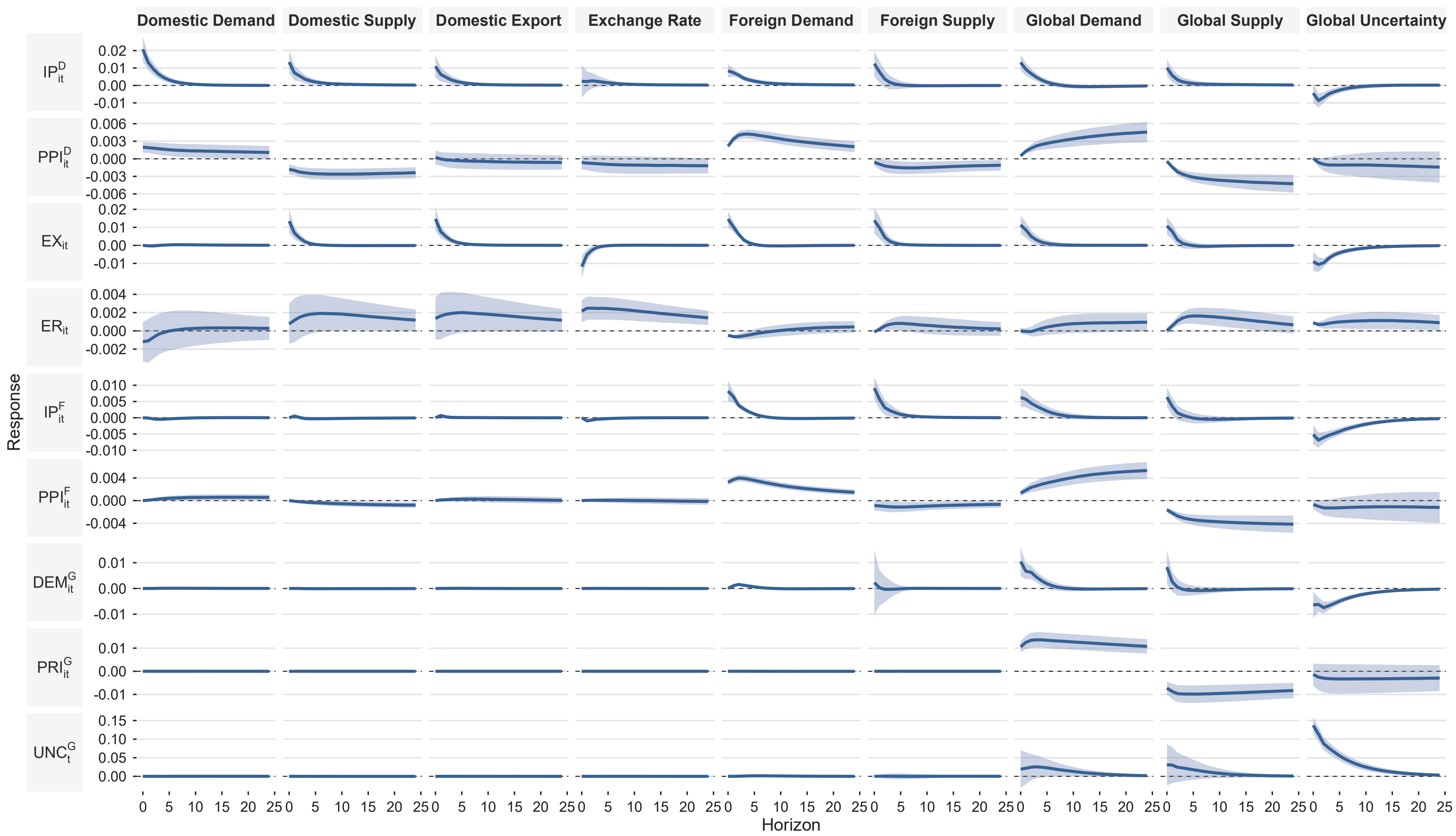


Figure A.2: All aggregated impulse response functions from the alternative model with no foreign block exoogeneity



B. Country-specific results

Figure B.1: Austria export volume decomposition (% yoy change)

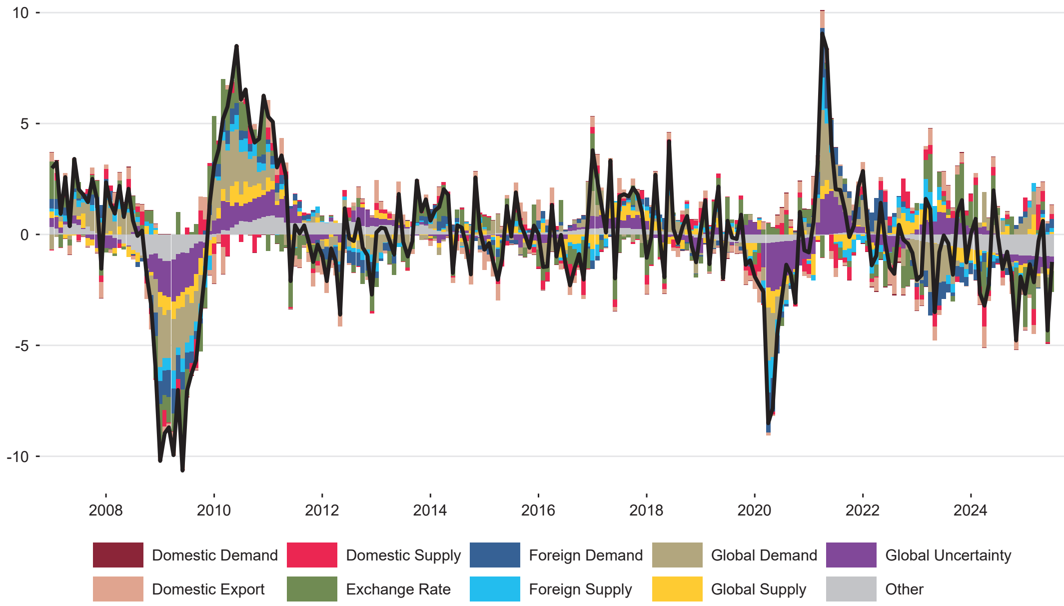


Figure B.2: Belgium export volume decomposition (% yoy change)

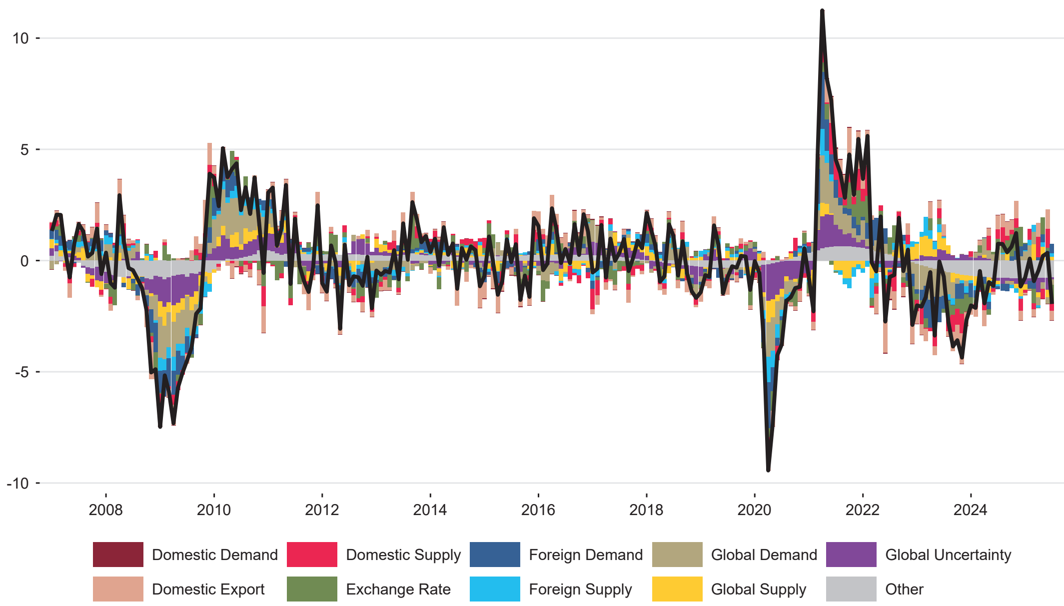


Figure B.3: Bulgaria export volume decomposition (% yoy change)

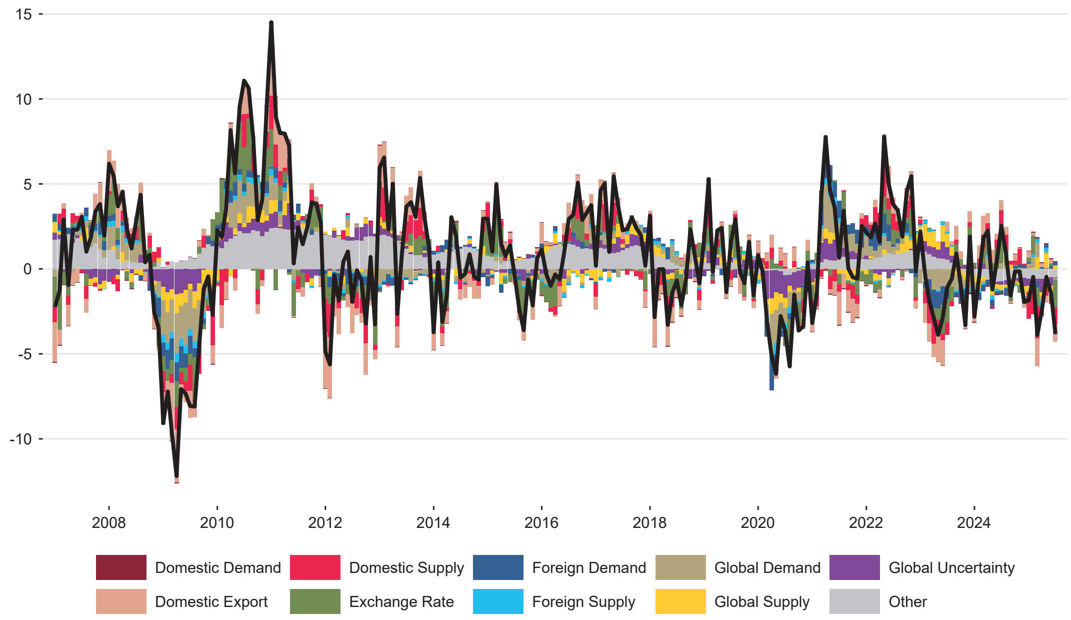


Figure B.4: Czech Republic export volume decomposition (% yoy change)

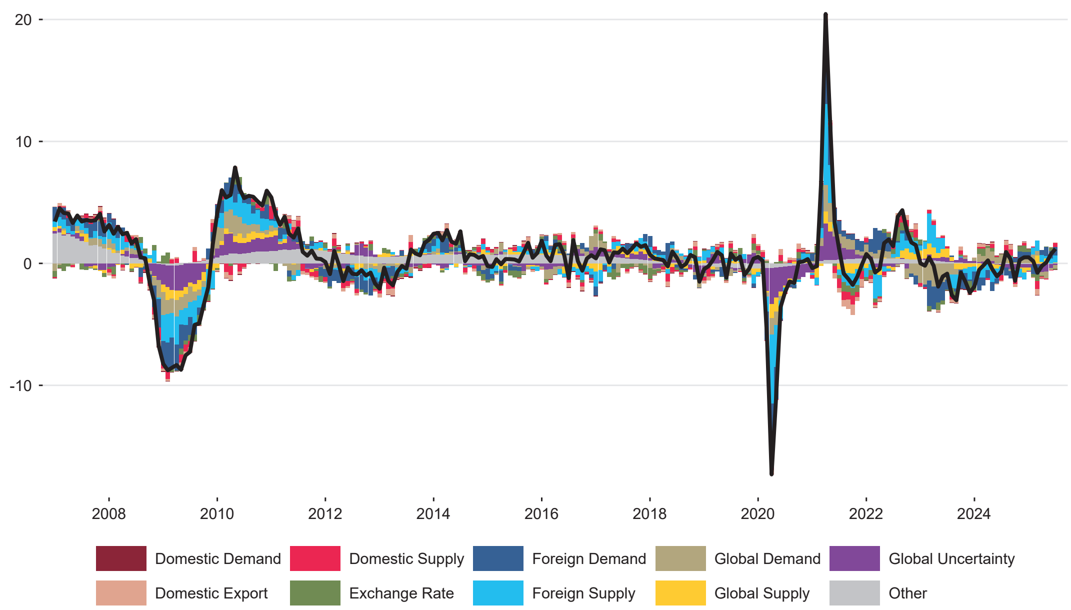


Figure B.5: Germany export volume decomposition (% yoy change)

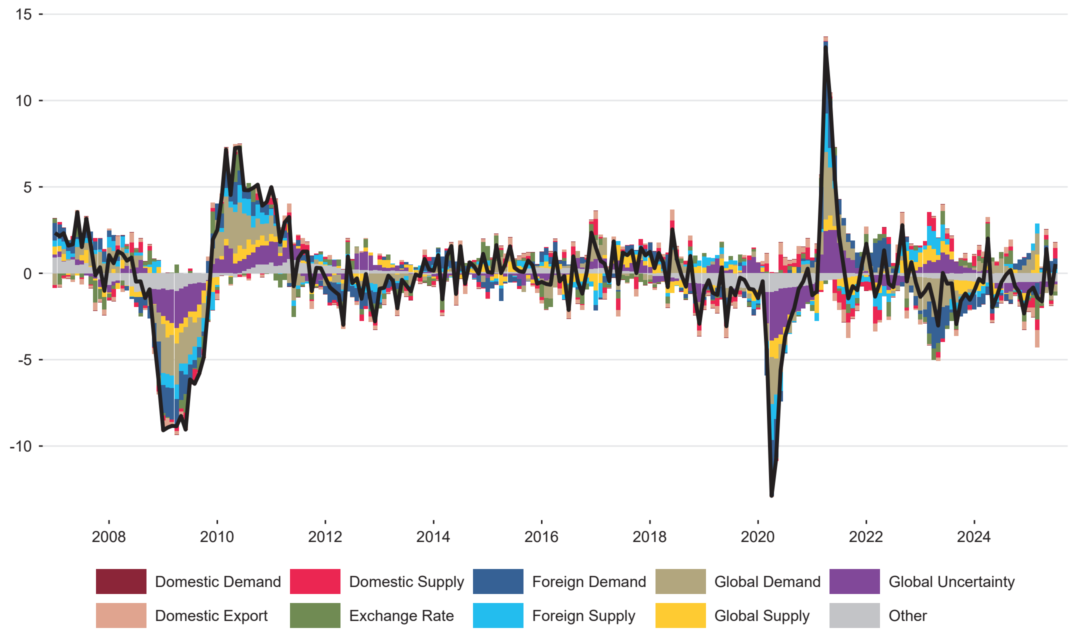


Figure B.6: Denmark export volume decomposition (% yoy change)

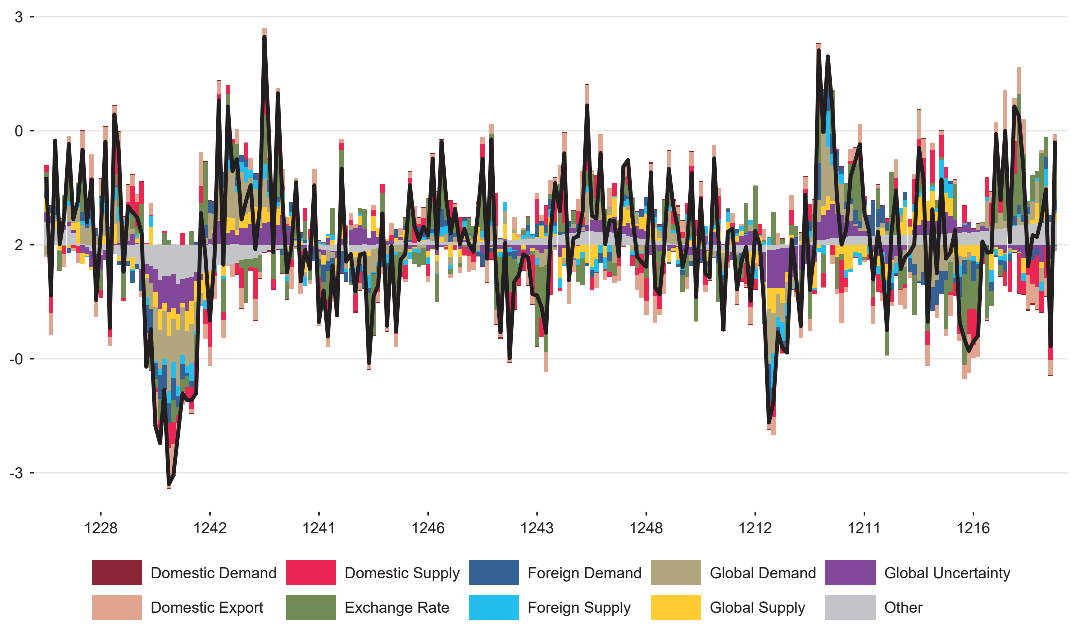


Figure B.7: Spain export volume decomposition (% yoy change)

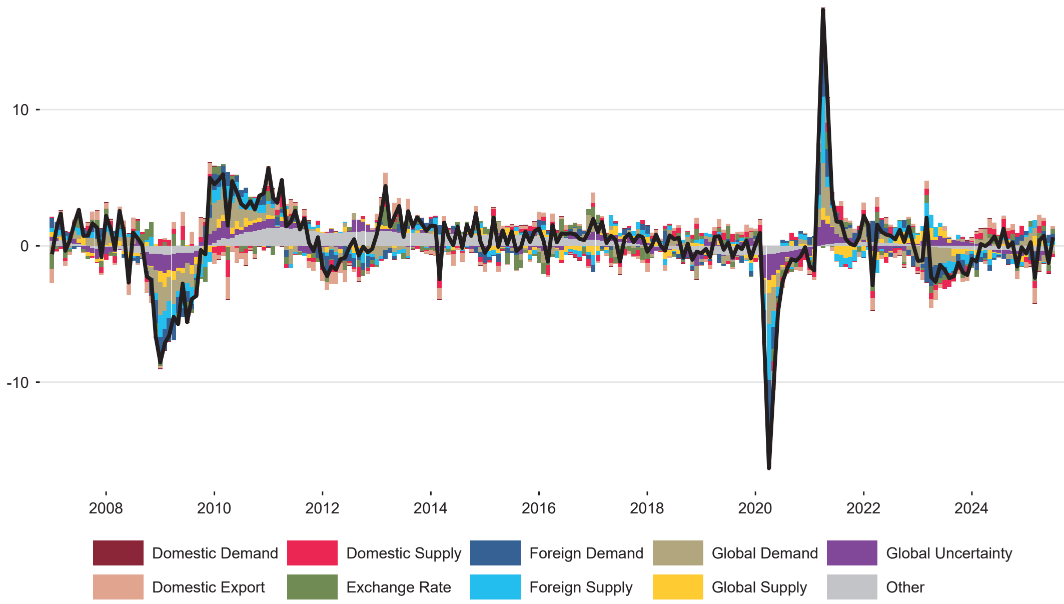


Figure B.8: France export volume decomposition (% yoy change)

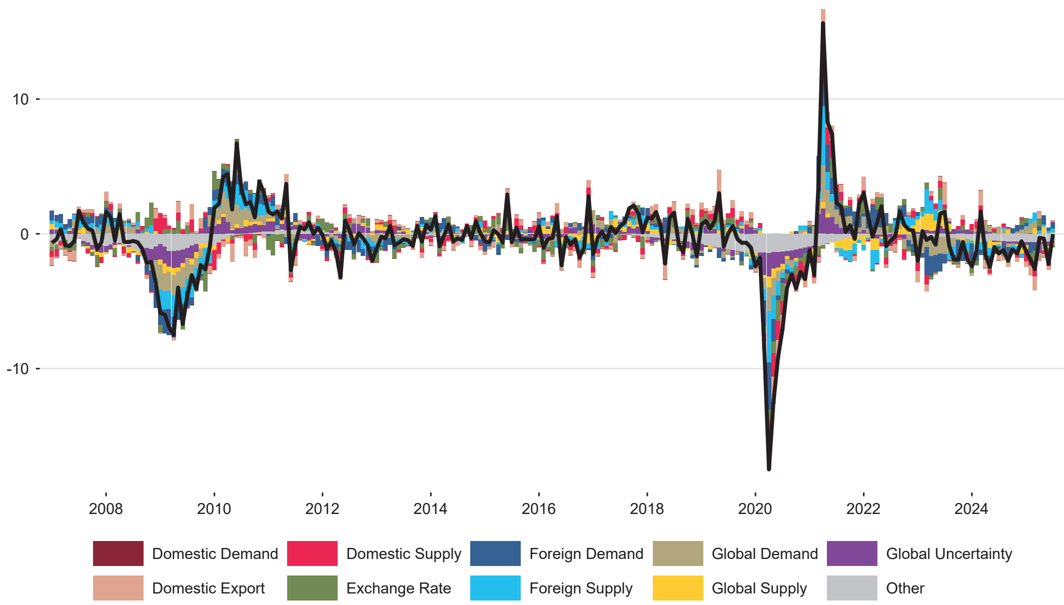


Figure B.9: Croatia export volume decomposition (% yoy change)

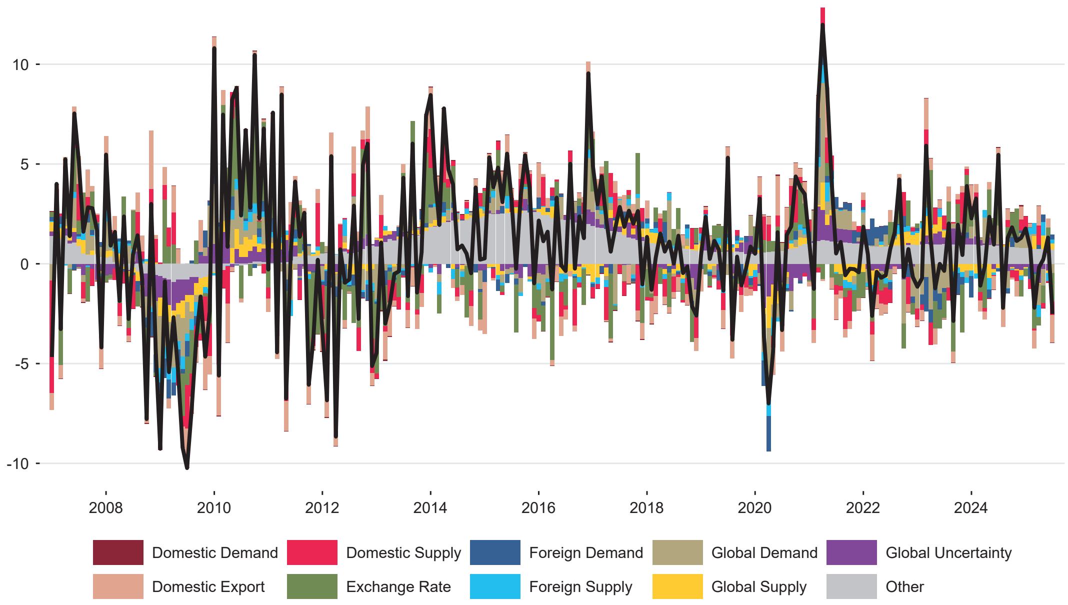


Figure B.10: Hungary export volume decomposition (% yoy change)

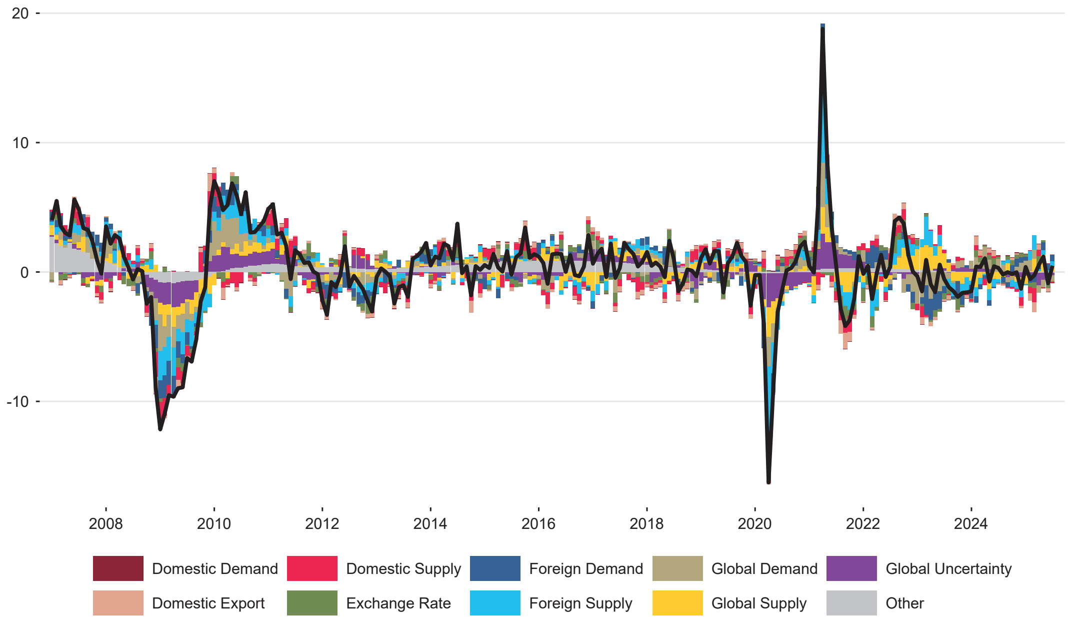


Figure B.11: Italy export volume decomposition (% yoy change)

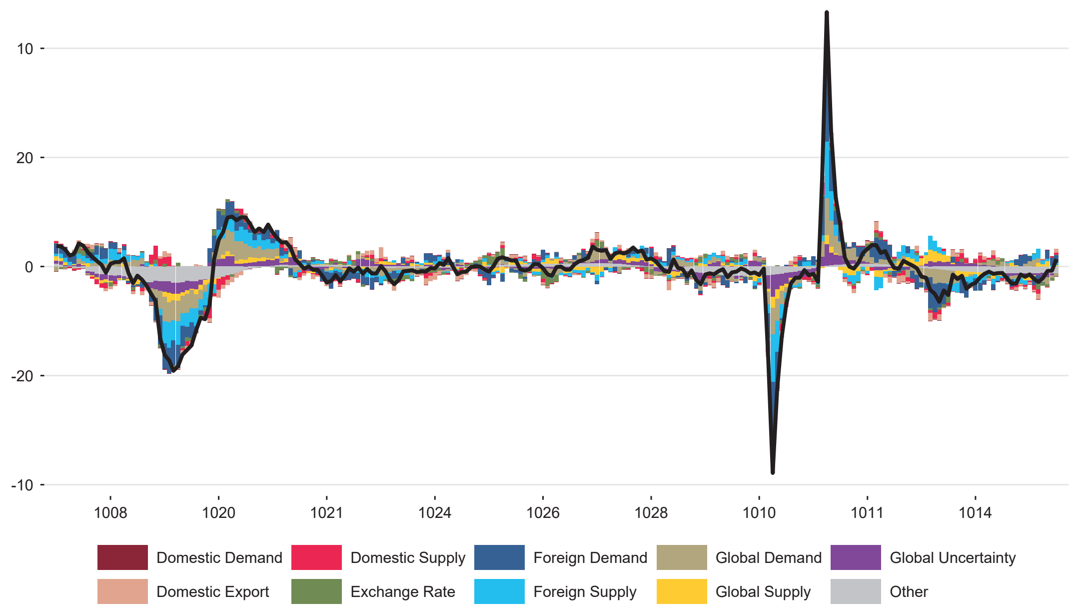


Figure B.12: Netherlands export volume decomposition (% yoy change)

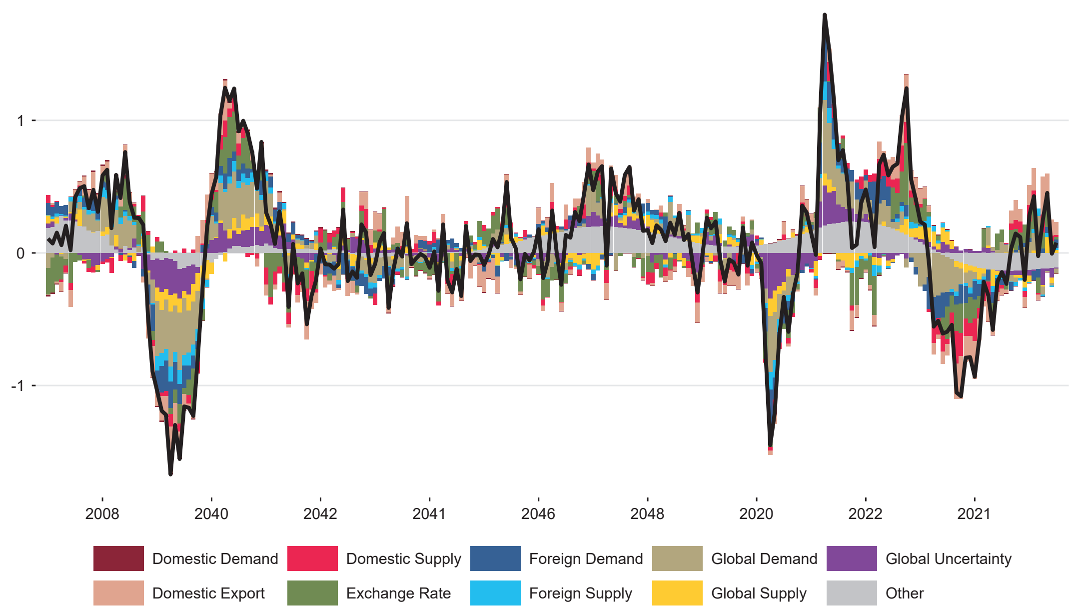


Figure B.13: Poland export volume decomposition (% yoy change)

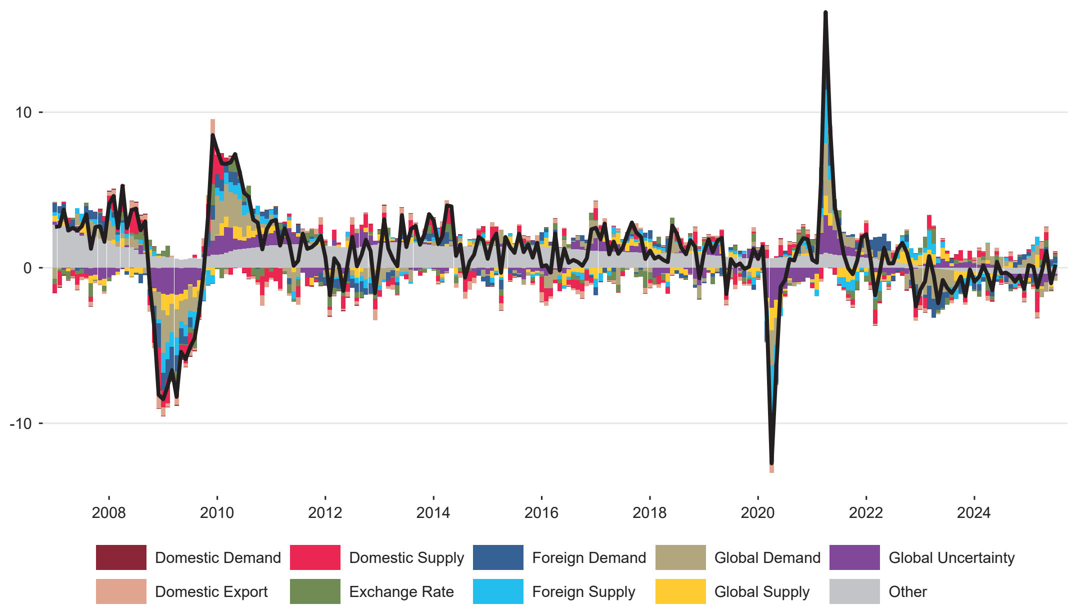


Figure B.14: Portugal export volume decomposition (% yoy change)

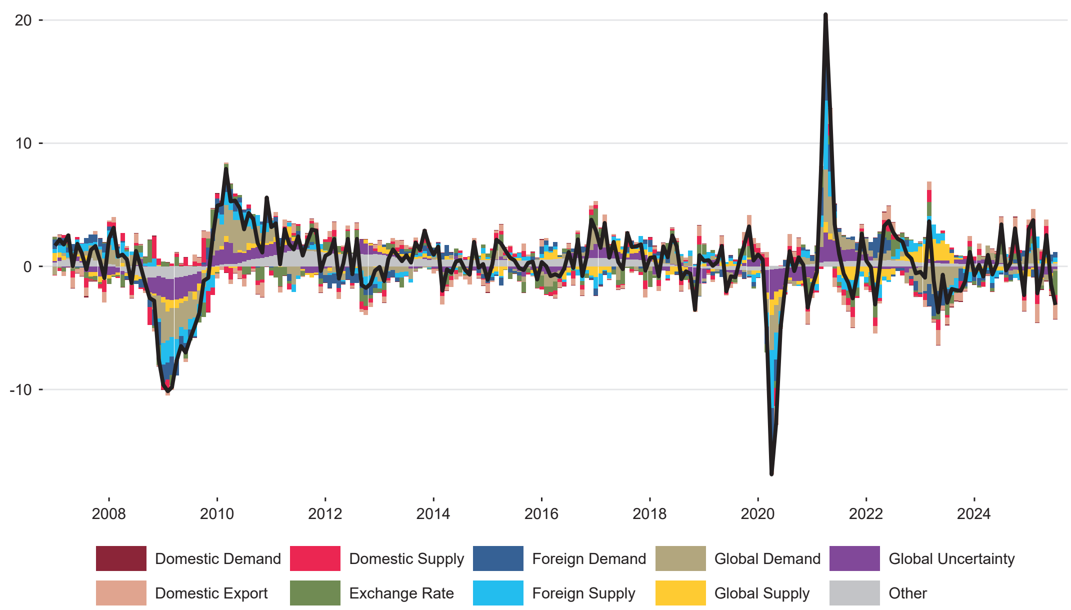


Figure B.15: Romania export volume decomposition (% yoy change)

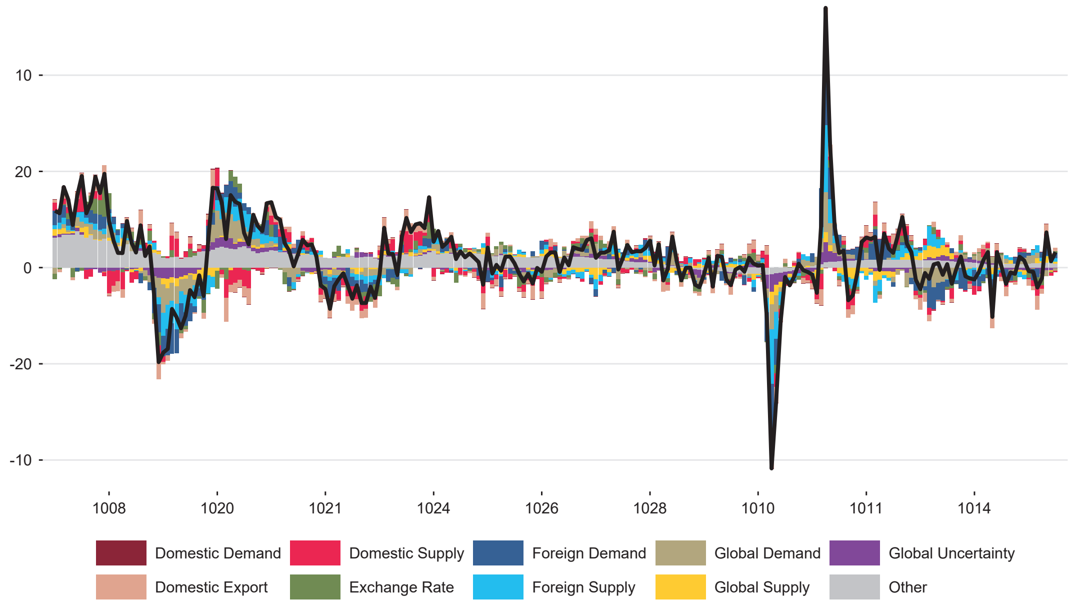


Figure B.16: Sweden export volume decomposition (% yoy change)

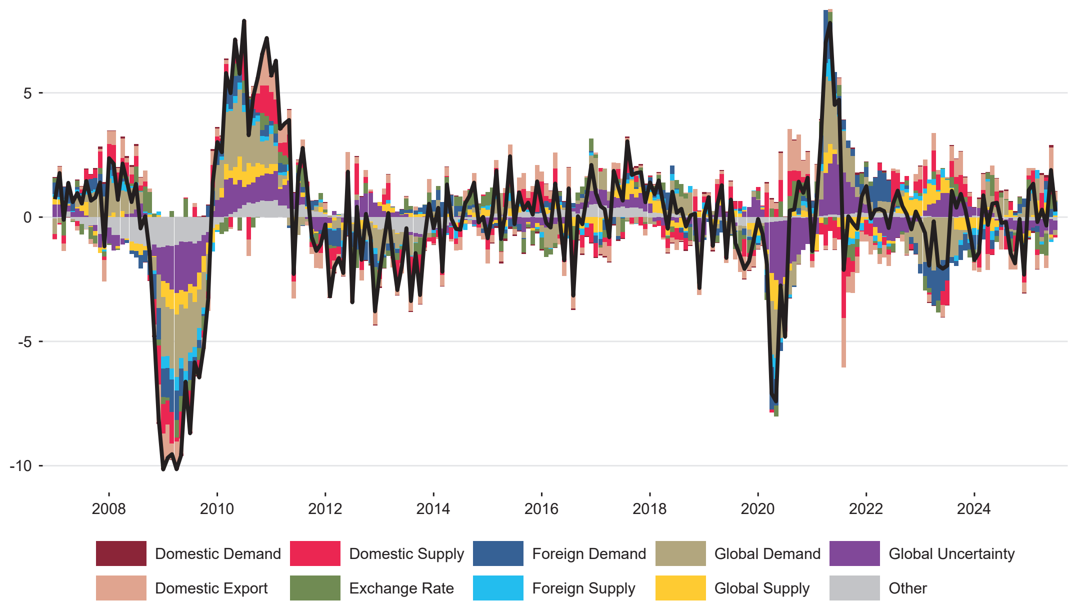


Figure B.17: Slovenia export volume decomposition (% yoy change)

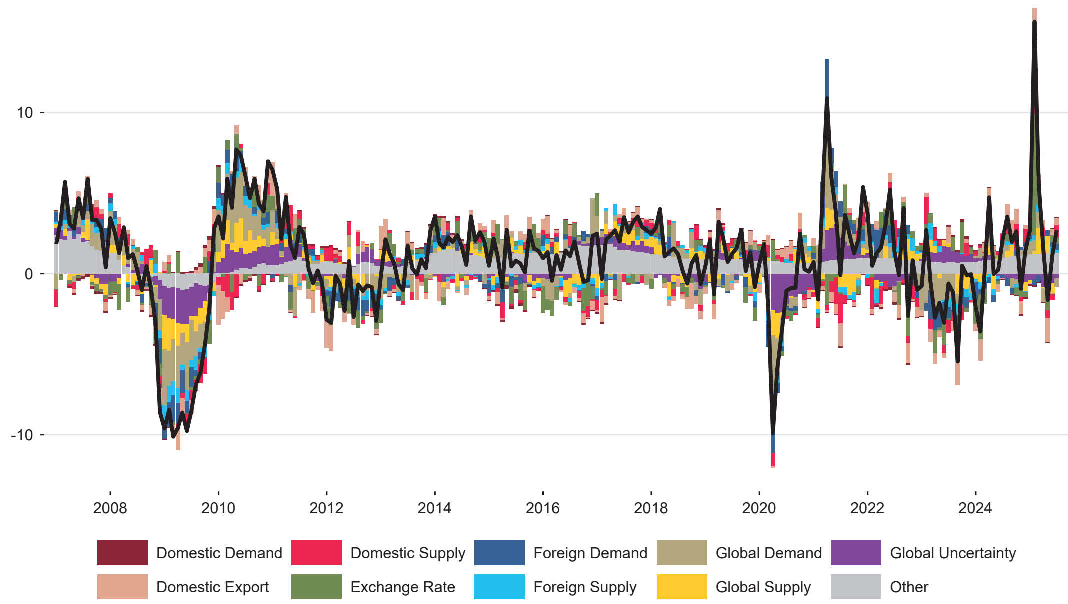
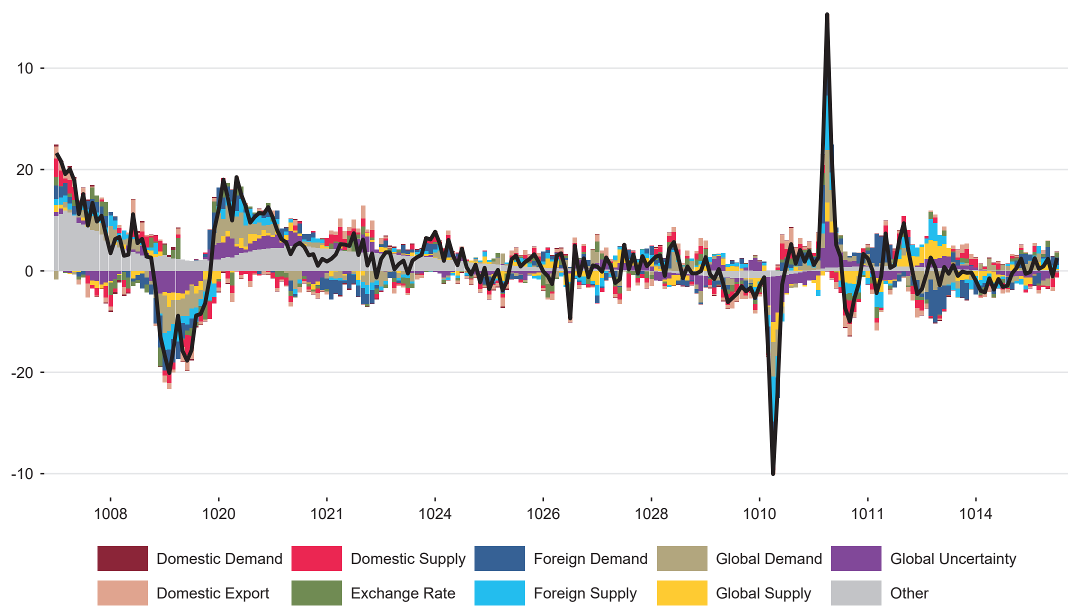


Figure B.18: Slovakia export volume decomposition (% yoy change)



nbp.pl