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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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The importance of value chains for euro area trade: a time series perspective *

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Abstract

This paper analyses intra- and extra-euro area (EA) trade flows for the five largest EA countries in order to gauge the importance of value chains. We bridge findings from input-output table analysis with a time series approach. Evidence of value chains is found for all trade patterns and is most pronounced within the EA. Imports from EA and RoW are not only domestically absorbed, but also re-exported. Exports to EA depend on demand in both the importing country and the rest of the world (RoW), indicating the importance of re-exports to RoW. Demand factors play a large role in all trade patterns.

Keywords: global value chains, euro area, trade patterns

JEL Classification: F14, F45

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1. Introduction

This paper provides new evidence on the importance of international production chains to explain the imports and exports of euro area countries. In particular, the paper empirically estimates import and export equations and explicitly distinguishes between intra- and extra-euro area trade. More specifically, we complement findings from input/output table analysis by estimating four separate import and export equations for five euro area countries (Germany, France, Italy, Spain and the Netherlands). These equations explain for each of the five countries imports from other euro area countries, imports from non-euro area countries, exports to euro area countries and exports to non-euro area countries.

Imported goods can be used for two different purposes: to satisfy domestic demand or to be used as intermediate goods for exported goods. Therefore, in the import equations we include a country's domestic demand, exports to euro area countries and exports to non-EA countries. In the export equations we include three different demand variables: EA countries' final demand, non-EA countries' final demand and the country own domestic demand.[1] To account for potential competitiveness effects we include the real effective exchange rate in all import and export equations.

A vast empirical literature in international macroeconomics analyses the determinants of imports and exports. Many studies focus on explaining a country's total imports and exports. Recent examples for euro area countries include Belke et al. (2015), Esteves and Rua (2015) and Bobeica et al. (2016A). Other studies take a more detailed perspective and consider bilateral trade between countries. A well-known research question analysed in these studies is the effect of the euro on bilateral trade (see e.g. Glick and Rose, 2016). However, these studies generally do not take third-country effects or trade in intermediate goods explicitly into account. A notable attempt to include this in a gravity model is by Wang et al. (2010) who include FDI and R&D in the extended gravity model.

As put forward in the seminal paper of Hummels et al. (2001), vertical fragmentation of production has altered trade dynamics thoroughly. Indeed, while a German factory exports a fully assembled car, many of the car parts are not produced in Germany. For

[1] See e.g. Esteves and Rua (2015) for the importance of including domestic demand to explain export patterns.

example, the steel body is produced in the Czech Republic, the brakes in the Netherlands and the electronic parts in Japan. The reinforcement of trade relationships is most pronounced in intermediate inputs trade, which is evidence for value chain integration. For instance, the literature on trade in value added show that, in particular for manufacturing supply chains, intermediate goods cross borders several times before a final product is produced (see Johnson (2014) and Koopman et al. (2014) for an overview). The vast increase of intermediate goods trade is especially pronounced in the EA, as shown in Figure 1. This implies that classic trade theory models, which characterize the trade between two countries as country Home exporting a domestically produced good to country Foreign and vice versa, do not represent well modern economies that are characterized by often large global value chains.

(Figure 1 about here)

Even though value chains become increasingly global (see e.g. Los et al. (2015)), a regional focus is warranted. Baldwin and Lopez-Gonzales (2015) and Lejour et al. (2017) identify three regional supply chain hubs Europe, North America and East Asia, where supply chains are regionally very strong. Focusing on the euro area, trade with other EA countries can have significantly different characteristics than with the rest of the world (RoW). First, the formation of a currency union and the removal of exchange rate risk lowers trade costs. Second, all euro area countries are member of the Single Market with very low trade barriers. Third, distances in Europe are relatively small compared to other continents and the infrastructure is relatively good. These factors combined foster the creation of value chains within Europe.[2] Therefore distinguishing between intra- and extra-euro area imports and exports is warranted.

We therefore take a similar approach as Wierts et al. (2014) and Bobeica et al. (2016B) by distinguishing between euro area and non-euro area countries when empirically estimating the models. However, while these authors focus mostly on price competitiveness in explaining imports and exports, our focus is on the importance of euro area and non-euro area demand in the import and export equations. To the best of our

[2] Another approach would have been to make the EU/non-EU (RoW) distinction. Nonetheless, we argue that the EU is a multi-currency area where exchange rate risk exists. Also, a significant majority of EU economies is also part of the euro area, with the UK the only large economy not using the euro. This makes the difference between the EU and euro area focus smaller.

knowledge, this aspect has not been analysed before in the empirical literature explaining intra- and extra-euro area trade.

In our set-up, we can analyse the role of the euro area as regional supply chain hub. If intra-EA value chains are important to supply goods from EA to ROW countries, we would expect intra-EA exports to depend on ROW final demand. Similarly, for the import side, we hypothesize that imports from ROW countries depend on exports to EA countries. Besides testing these specific hypotheses, we can also identify which demand factors are most important for each of the four equations and whether this differs across the five EA countries being analysed.

Our empirical strategy differs from Wierts et al. (2014) and Bobeica et al. (2016B). While these studies estimate the equations in levels, we estimate it in first differences. The main reason for doing so it that exports and imports are non-stationary variables and we do not find a cointegrating relationship between these variables and the explanatory variables. To avoid a spurious regression, we therefore estimate the models using first differences. We take special care to establish the appropriate lead-lag structure in the time series models.

The results show that both "classic" demand factors as well as the presence of (global) value chains drive euro area trade flows. While this is an established result in the input-output literature, we complement the literature by presenting additional evidence using time series analysis. In addition, using time series analysis, we quantify the "classic" and "value chain" trade drivers for five euro countries. Imports, both from EA and RoW, are not only used to satisfy domestic demand, but are used hugely for re-exporting purposes as well. In addition, exports to other EA countries are not only driven by demand in the partner country, but also by demand in RoW, thus satisfying global demand. Conversely, exports to RoW are not driven by EA demand. This highlights the importance of intra-EA value chains. The magnitude of estimated coefficients points to a significant importance of these value chains. For some countries, value chain-induced trade is equally or more important than "classic" domestic demand-induced trade. Conversely, cost and price measures are not found to be crucial.

The structure of this paper is as follows. Section 2 provides a theoretical framework and Section 3 provides stylized facts based on input-output tables. Section 4 explains the data and the used methodology. Section 5 draws out the results, while Section 6 presents several robustness exercises. Section 7 concludes and links the results to policy implications.

2. Theoretical framework

A useful model framework to illustrate the different channels we distinguish is the Leontief input-output model. This input-output model describes the production processes and linkages between sectors within an economy, but can also be extended to a multi-country setting by incorporating trade linkages. For the purpose of this paper a three country, one sector input-output model provides the easiest exposition. Consider the following countries in the model (Home, Other-Euro Area (OEA) and Rest of World (ROW)).

Figure 2 shows a simplified input-output table, consisting of three parts. The first part represents intermediate good supply and demand denoted by x. The subscripts first contain the country that supplies the good and then the country which uses the intermediate good. For example, xOEA,Home denotes the amount of intermediate goods country Home imports from OEA. The second part consists of the fourth row, which indicates how much value added each country generates. Put differently, vaHome indicates Home's GDP, i.e. its value added. The third part captures final demand, i.e. the goods and services used for consumption and investment. Here, fdOEA,ROW indicates the amount of final goods ROW imports from OEA.

(Figure 2 about here)

Based on the input-output matrix, we can identify both direct and indirect production linkages. For example, since the input-output table tracks all linkages we can determine by which amount Home exports to OEA increase when ROW final demand for OEA goods increases. In order to revisit the import and export equations which exploit the time series dimension, we subsequently shut down different channels to estimate the importance of the drivers of imports and exports.

When investigating the import demand of Home for OEA goods we set xROW,Home = 0, fdROW,Home = 0 and fdHome,ROW = 0. In this way, our coefficient still tracks imports from OEA because of ROW demand for OEA goods, but not ROW direct demand for Home goods. Indeed, we thus capture the intermediate goods trade generated by ROW demand, yet dismissing the direct goods trade between Home and ROW. The intermediate goods flow from OEA to Home, generated by ROW demand, is of importance. This allows assessing the importance of ROW final demand via international production chains. In the same vein, when investigating the import demand of Home for ROW goods, we set xOEA,Home = 0 and fdOEA,Home = 0.

For the exports of Home to OEA and ROW, we apply similar restrictions. When considering exports from Home to OEA we consider xHome,ROW = 0 and fdHome, ROW = 0. Thus, we isolate the effect of ROW demand on exports of intermediate goods from Home to EOA. For Home to ROW exports we have xHome,OEA = 0 and fdHome, OEA = 0. Indeed, we then observe the demand from ROW for intermediate goods generated by higher demand in OEA.

3. Descriptive evidence from input-output tables

In this paper, we focus on the role that intra-EA and extra-EA (RoW) value chains play in the import and export equations for the five largest EA countries. By using the World Input-Output Database (WIOD) we decompose the value added in each country's exports in 2000 and 2014 in six parts: 1) final goods exports to other EA countries, 2) intermediate goods exports to EA countries that end up in EA final demand, 3) intermediate goods exports to EA countries that end up in RoW final demand, 4) final goods exports to RoW, 5) intermediate goods exports to RoW that end up in EA final demand and 6) intermediate goods exports to RoW that end up in RoW final demand.[3] Figure 3 shows the importance of each category for Germany, France, Italy, Spain and the Netherlands in 2014.

(Figure 3 about here)

[3] The value added in exports is calculated as exports – imports used to export. So, the numbers reflect how important each flow is to generate a country's GDP.

Figure 3 shows for each country what the share in total exports was for each category in 2014, the latest year available in WIOD. Over half of exports consists of intermediate goods in all countries (dark blue, green, grey and red blocks). For the Netherlands about three-quarters of exports consist of intermediate goods. The main components of these intermediate goods are intermediate good exports to ROW for ROW final consumption (dark blue) and exports of intermediate goods to EA for EA final consumption (red). The grey component (exports of intermediate goods to EA countries for ROW final consumption) is for all countries larger than the green component (exports of intermediate goods to ROW for EA final consumption). When considering final goods exports we observe that final goods exports to ROW countries are generally much larger than exports of final goods to EA countries. The only exception is the Netherlands where both components have a similar magnitude.

A fair point is to ask why we do not use the calculated coefficients from the Leontief input-output model directly. The main reason for not doing so is that the Leontief model uses the proportionality assumption. The proportionality assumption states that the input mix for all products produced by a country, or an industry for a more detailed input-output tables, are the same. So, the model assumes that the German electronics industry produces a homogeneous good which is the same domestically sold and exported to all countries. While this is a common assumption in input-output analysis, it is quite restrictive. Using a time series approach can allow us to relax this assumption. However, the above results do provide a useful overview of the important of each of the demand factors. In addition, the WIOD data in this section is based on nominal US$ and there is no reliable methodology to convert the nominal numbers in real numbers. When analysing trade patterns over time it is crucial to use real numbers. Moreover, the data is only available at the annual frequency. This would amount to fifteen observations and making a time series analysis very unreliable. So, it should be noted that the data used in this section (WIOD) is different to the Eurostat trade flow data that will be used in the regression analysis in the next section.

4. Empirical methodology and data

Global value chains have implications for how researchers model import and export demand. First, imports are not only used for domestic consumption, but also as intermediate goods in order to export intermediate or final goods. Second, exports consist of intermediate goods and final goods, which implies that the final demand of a certain country B to which A exports is not the key driver of country A's exports when these intermediate exports are triggered by the final demand of country C.

4.1 Empirical Methodology

We present four baseline regressions: a) imports from other EA, b) imports from RoW, c) exports to other EA and d) exports to RoW. We capture the existence of value chains on the import side by assuming that countries import in order to use these imports for their own exports. Hence, imports are explained by both domestic demand and exports, be it to EA or RoW. When value chains are present, exports to either EA or RoW should come up as a significant factor explaining imports. We allow this mechanism for imports from both the EA and RoW: the model specification is similar for both import regressions.

On the export side, we allow for the possibility that exports are not only final goods, but also intermediate goods which are re-exported overseas in turn. This is done by including not only domestic demand in the source destination, but also demand in the other region. Indeed, demand for final goods in RoW might first drive demand for intermediate goods in the EA. This assumption is backed by the strong correlation between intra-euro area and extra-euro area exports (Figure 4). By using this model set-up, "spill-overs" from EA to RoW and vice versa are allowed for in both export specifications. Lastly, we also include demand in the home country in order to control for possible "spill-backs" (i.e. the own country re-imports goods at some point in the value chain).

An additional feature of our model is that we exploit the time series dimension of the data. As value chains can be long and complex, goods are not necessarily exported, transformed and consumed all in one quarter. Indeed, an export of an intermediate good in t, such as a commodity, might only be transformed into a final consumer good in t+1 and consumed abroad in t+2. Therefore, we include leads and lags in all import and export specifications. In order to not overburden the model set-up, we delete insignificant estimates until the most fitting time structure is obtained. An additional advantage of this method is that we remain agnostic about the timing of the trade linkages and thus the value chain structure: we allow the value chain to be shorter (e.g. effect in t) or longer (effect in t+1). Mind that we keep at least one lead, lag or contemporaneous regressor per demand variable.

(Figure 4 about here)

We use robust regression in order to control for possible outliers in the data, such as crises-induced effects during the global financial crisis, which impacted world trade strongly. If not taken into account, this may bias the coefficients. Also, we choose not the pool the data as we believe this would lead to losing country-specific information.

This yields the following four baseline regressions:

$$
\begin{aligned}
\Delta \log(imports\ from\ EA)_t
&= \alpha + \beta_1 \Delta \log(imports\ from\ EA)_{t-1} \\
&+ \beta_2 \Delta \log(exports\ to\ EA)_{t-1} \\
&+ \beta_3 \Delta \log(exports\ to\ EA)_t \\
&+ \beta_4 \Delta \log(exports\ to\ EA)_{t+1} + \beta_5 \Delta \log(exports\ to\ ROW)_{t-1} \\
&+ \beta_6 \Delta \log(exports\ to\ ROW)_t + \beta_7 \Delta \log(exports\ to\ ROW)_{t+1} \\
&+ \Delta\beta_8 \log(domestic\ demand)_{t-1} + \Delta\beta_9 \log(domestic\ demand)_t \\
&+ \Delta\beta_{10} \log(domestic\ demand)_{t+1} + \beta_{11} \log(REER_{EA})_{\ t-4} + \varepsilon_t
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
\Delta \log(imports\ from\ ROW)_t
&= \alpha + \beta_1 \Delta \log(imports\ from\ ROW)_{t-1} \\
&+ \beta_2 \Delta \log(exports\ to\ EA)_{t-1} \\
&+ \beta_3 \Delta \log(exports\ to\ EA)_t \\
&+ \beta_4 \Delta \log(exports\ to\ EA)_{t+1} + \beta_5 \Delta \log(exports\ to\ ROW)_{t-1} \\
&+ \beta_6 \Delta \log(exports\ to\ ROW)_t + \beta_7 \Delta \log(exports\ to\ ROW)_{t+1} \\
&+ \Delta\beta_8 \log(domestic\ demand)_{t-1} + \Delta\beta_9 \log(domestic\ demand)_t \\
&+ \Delta\beta_{10} \log(domestic\ demand)_{t+1} + \beta_{11} \log(REER_{EA})_{\ t-4} + \varepsilon_t
\end{aligned}
\tag{2}
$$

$$
\begin{aligned}
\Delta \log(exports\ to\ EA)_t
&= \alpha + \beta_1 \Delta \log(exports\ to\ EA)_{t-1} \\
&+ \beta_2 \Delta \log(domestic\ demand\ EA)_{t-1} \\
&+ \beta_3 \Delta \log(domestic\ demand\ EA)_t \\
&+ \beta_4 \Delta \log(domestic\ demand\ EA)_{t+1} \\
&+ \beta_5\, \Delta \log(domestic\ demand\ ROW)_{t-1} \\
&+ \beta_6 \Delta \log(domestic\ demand\ ROW)_t \\
&+ \beta_7 \Delta \log(domestic\ demand\ ROW)_{t+1} \\
&+ \beta_8 \Delta \log(domestic\ demand)_{t-1} + \beta_9 \Delta \log(domestic\ demand)_t \\
&+ \beta_{10} \Delta \log(domestic\ demand)_{t+1} + \beta_{11} \log(REER\_EA)_{\ t-4} + \varepsilon_t
\end{aligned}
\tag{3}
$$

$$
\begin{aligned}
\Delta \log(exports\ to\ ROW)_t = & \\
= \ & \alpha + \beta_1 \Delta \log(exports\ to\ ROW)_{t-1} \\
& + \beta_2 \Delta \log(domestic\ demand\ EA)_{t-1} \\
& + \beta_3 \Delta \log(domestic\ demand\ EA)_t \\
& + \beta_4 \Delta \log(domestic\ demand\ EA)_{t+1} \\
& + \beta_5\, \Delta \log(domestic\ demand\ ROW)_{t-1} \\
& + \beta_6 \Delta \log(domestic\ demand\ ROW)_t \\
& + \beta_7 \Delta \log(domestic\ demand\ ROW)_{t+1} \\
& + \beta_8 \Delta \log(domestic\ demand)_{t-1} + \beta_9 \Delta \log(domestic\ demand)_t \\
& + \beta_{10} \Delta \log(domestic\ demand)_{t+1} + \beta_{11} \log(REER\_EA)_{\,t-4} + \ \varepsilon_t
\end{aligned} \tag{4}
$$

where t indicates the quarter. The models are estimated for each country separately.

All time series except the REER variables are transformed in first differences to obtain stationary time series. While estimating a VECM is a possibility we are not able to find stable cointegrating vectors.[4] So, we choose to estimate the models in first differences.

4.2 Data

The data contains real export and import flows of goods to/from EA and RoW for the five largest EA countries during 2000Q1-2016Q4. Data are on a quarterly basis and from Eurostat. We focus on the five biggest EMU members (Germany, France, Italy, Spain and the Netherlands) as these countries make up over 80% of EA GDP and differ from each other. France, Germany and the Netherlands are often seen as core countries, while Italy and Spain as peripheral countries. A variable for the real exchange rate (REER) is introduced, which is split for EA and RoW, allowing for divergent paths of the REER vis-à-vis EA and RoW. The REER variable is constructed for all five considered countries separately. Data are from the European Commission and track the REER for every country i vis-à-vis other individual countries. We thus group the individual REERs to construct an intra-euro and extra-euro REER variable for every EMU country. The level of the REER enters the regression with a lag of four quarters, in order to account for the lagged pass-through of relative prices and exchange rate movements. Allowing the exchange rate to have a lagged effect is in line with Berger and Nitsch (2010).

[4] Comunale and Hessel (2014) argue that the long-run coefficients are sensitive to the specification, because of differences in the long-run trends of exports and the REER. They also state that the long-run coefficients of the REER are sensitive to other variables in the model. So, finding a stable long run relationship between both variables is challenging.

Basic explanatory variables as domestic and foreign countries' domestic demand are included. We do not include foreign import demand as an explanatory because we are interested in the effects of exports on shifts in domestic demand in foreign countries. Including foreign import demand – as some other studies do – would thus exclude the possibility of re-exports to other regions. Variables are also tailored to the country we study. For example, when considering the importance of euro area domestic demand for German exports we exclude German domestic demand from the euro area total.

5. Results

5.1 Import regressions

First and foremost, we find significant evidence of the presence of value chains. This is especially pronounced within EA. Imports from both the EA (Table 2) and RoW (Table 3) are significantly and positively affected by exports, mainly to EA. This holds true for all five countries in the case of exports to EA. Put differently, in order to export to EA, countries use imports from other EA countries. This is in addition to the classical demand mechanism, which is strongly at work in both import regressions. The elasticity of imports to domestic demand is mostly around 1.5%, significantly above the "value chain" elasticity, which is between 0.3% and 0.8% in the case of intra-EA trade (=imports from EA, subsequent exports to EA). The latter elasticity points thus to a 1% increase in exports to EA leading up to rising imports from EA of around 0.5%. The elasticity for the imports from RoW to export to EA is similar in magnitude.

(Tables 2 and 3 about here)

An interesting fact emerges from results for the Netherlands, the smallest and most open economy in our sample. Imports from RoW are far more affected by exports to EA than by own domestic demand. A 1% increase in Dutch exports to EA coincides with a 0.6% rise of imports from RoW. On the other hand, domestic Dutch demand has no significant effect on imports from RoW. In other words, the Netherlands imports from RoW mainly to export to other EA countries, with the own economic cycle being of seemingly no importance. This is in line with Statistics Netherlands (2017), who underline the importance of re-exports of final goods (and thus, foreign demand in other euro countries) for Dutch imports. This finding is linked to the Netherlands as a gateway for global imports to Europe, i.e. a "Port of Rotterdam" effect. For the other countries, the coefficient on domestic demand is generally much higher than the coefficient on exports, generally more than double.

5.2 Export regressions

Regarding export patterns, we introduce a novel approach to capture the possibility that exports to one region are not domestically absorbed but rather subsequently exported (see above). We find evidence of these value chain-alike patterns in the euro area (Table 4). Exports to other EA countries do not only depend on demand in the importing region, but also on demand in RoW. Interestingly, our agnostic approach regarding value chain length indicates that exports to EA are affected contemporaneously by demand in EA, while the effect takes longer for overseas demand. Indeed, for DE, FR and NL, the RoW demand is significant in t+1. A possible explanation is that demand in EA leads to exports of *final* goods within EA in t, whilst RoW demand in t+1 incites *intermediate* exports within EA in t (to be subsequently re-exported to ROW). For the Netherlands, this "European gateway" mechanism is evidenced by Statistics Netherlands (2018).[5] These mechanisms are mostly at play for "core" EA economies (DE, FR, NL); for "periphery" economies a fitting specification is not found. This suggests that the latter countries are less involved in value chains that serve RoW consumers. Also, if economic conditions in RoW are relatively better than in EA, core-EA countries benefit more than periphery states. This is in line with Wierts et al. (2014), who find that core exports are relatively high-tech and have higher elasticities with respect to demand, thus benefiting relatively more when RoW income increases. Lastly, "spill-backs" to the own economy of the initial exporter are not found.

(Tables 4 and 5 about here)

Regarding exports to the RoW (Table 5), we find evidence of a strong domestic demand effect in RoW, but no "spill-backs" from RoW to EA or the own economy. Indeed, the elasticity of RoW exports to RoW demand is elevated (2.4-3.6). This is in line with the category "exports of intermediates to RoW and subsequently re-exported" being vast for

[5] For example, CBS notes that in 2014 Dutch exports of intermediary goods and services to the EU15 which were subsequently re-exported to the rest of the world added EUR 25 billion to the Dutch economy. This is more than the value added that corresponds to final exports to NAFTA in 2014 (EUR 22 billion).

many countries in the export mix (Figure 3) – constituting almost 40% of the export composition for Germany and the Netherlands in 2014.[6] For most economies, in contrast, the EA demand does not show up to affect exports to RoW – and thus the EA-RoW spill-over effect described above is not mirrored. For example, NL could export to DE, with DE subsequently exporting to the US. Yet, if NL exports to the US directly, it is not re-exported to DE. This underlines the notion of value chains being stronger in the EA.

Conventional explanations of trade patterns hold and are in line with previous results in the literature. Foreign domestic demand drives export strongly, while the home country's domestic demand drives import growth. We find the trade elasticities to be slightly higher than those found in previous literature (Bayoumi et al, 2011; Bobeica et al, 2016B; Chen et al, 2013). Import elasticities are in the range of 1 to 2, whilst export elasticities are a bit higher (2 to 3). Again, the results differ between countries for all baseline regressions (see discussion regarding the Netherlands above, for example).

Conversely, the real exchange rate does not significantly explain trade patterns for both EA and RoW. Coefficients on the REER variable are small and often non-significant. These findings are not in line with Bobeica et al (2016B) and Bayoumi et al (2011), who find that cost measures matter, explicitly within the EA. Wierts et al. (2014) argue that the share of high technology exports explains the insignificance of real exchange rates. These exports have a smaller price elasticity compared to commodities, say.

6. Robustness

We conduct three tests to verify the robustness of our results, one pertaining to the lag structure, one regarding the REER variable and one on causality. First, with respect to the lag structure, we discard the lead and lag structure we obtained from the general to specific approach and only consider contemporaneous effects. We find that the main results hold up (Appendix Tables A.1-A.4). Both with respect to the impact of value chains and domestic demand on trade patterns and the size of the elasticities, differences are not sizable. Indeed, exports still come out as triggering import growth, while the spill-over from ROW demand to EA trade in exports also remains. Nonetheless, we opt to keep the obtained lead and lag structure as preferred set-up due to the information gains

[6] This number takes into account value added in the export composition (based on WIOD data).

regarding the timing of trade impact. For instance, the significance of ROW demand in t+1 (instead of t) for contemporaneous EA exports possibly signals the importance of intermediate goods trade.

Second, we consider an alternative measure for the REER. In our baseline regression, we use unit labor costs to deflate the nominal effective exchange rate. Although price competitiveness indicators may be strongly correlated, considering only unit labor costs may seem ad hoc. Therefore, we present as well the results when using the harmonized index of consumer prices (HICP) as the deflator for nominal effective exchange rates (Appendix Tables A.5-A.8). The results are broadly the same when including the REER based on HICP in the baseline regressions. The REER is only significant in three cases and there appears to be no clear pattern. Furthermore, most of the coefficients on the other variables retain their sign and significance.

Third, we investigate into the causality of the trade patterns. We want to ensure that our initial rationale of higher exports leading to more imports is not undermined. Recall that our import regression is based on the premise of export growth causing import growth. Indeed, countries import intermediate goods in order to use for their own exports. Therefore, export growth should lead to import growth, but not the other way around (i.e. countries do not export in order to import). We check for reverse causality by performing Granger causality test (Appendix Table A.9) and find no causal relationship running from exports to imports.

7. Conclusion

This paper offers the literature a new perspective on euro area trade flows by explicitly taking into account the role of production chains going beyond classic demand and cost factors. We do so by distinguishing between intra- and extra-euro area exports and considering lead and lag structures. Regarding imports, domestic activity is decoupled into domestic demand and exports, both to euro and non-euro area countries. Regarding exports, we account for spill-overs and spill-backs from demand in other regions.

Our findings confirm that value chains have a prominent role in euro area trade. This is true both for imports and exports. Imports from EA and RoW are not only used for domestic demand, but are also affected by a country's exports, mainly to EA. In addition, exports to other EA countries not only depend on demand in the importing country, but also on non-EA demand. Hence, exports within the EA are re-exported to RoW. Furthermore, demand is confirmed to be a crucial driver of trade flows. Elasticities are slightly higher than in preceding literature but seem reasonable. In contrast, price competition (real exchange rates) seems far less important.

A possible avenue for further related research is the inclusion of time variation. We considered a relatively small dataset from the inception of the euro area onwards. It is possible that the structure of trade and value chain patterns change over time. Investigating how this would affect import and export growth, for instance as re-exports and intermediate trade become more important over time, will be of interest to researchers.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: This article does not contain any studies with human participants performed by any of the authors.

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Data appendix

Variable	Definition	Source
Import growth	Imports of total (all products), seasonally and working day adjusted volume indices (2010=100)	Eurostat
Export growth	Exports of total (all products), seasonally and working day adjusted volume indices (2010=100)	Eurostat
Domestic demand of euro area countries	Final domestic expenditure, volume	OECD
Domestic demand of Rest of World	Gross domestic product, constant prices	IMF
Real effective exchange rate	Quarterly Real Effective Exchange Rates vs EA19 (2005 = 100) and Quarterly Real Effective Exchange Rates vs IC37 (2005 = 100) Based on HICP deflator and nominal unit labour cost, total economy	European Commission

Tables

Table 1: Summary statistics

	Obs	**Mean**	**Std. dev.**	**Min**	**Max**
Netherlands					
Δ log(import from EA)	66	0.0036	0.0269	-0.1145	0.0746
Δ log(import from RoW)	66	0.0095	0.0339	-0.0793	0.0843
Δ log(export to EA)	66	0.0068	0.0230	-0.0608	0.0513
Δ log(export to RoW)	66	0.0128	0.0292	-0.0808	0.0744
Δ log(domestic demand)	66	0.0023	0.0072	-0.0224	0.0181
Germany					
Δ log(import from EA)	66	0.0050	0.0268	-0.0740	0.0678
Δ log(import from RoW)	66	0.0052	0.0283	-0.1135	0.0754
Δ log(export to EA)	66	0.0033	0.0273	-0.1285	0.0610
Δ log(export to RoW)	66	0.0097	0.0360	-0.1701	0.0793
Δ log(domestic demand)	66	0.0022	0.0056	-0.0125	0.0159
France					
Δ log(import from EA)	66	0.0010	0.0284	-0.0889	0.0550
Δ log(import from RoW)	66	-0.0001	0.0317	-0.0579	0.0575
Δ log(export to EA)	66	-0.0020	0.0283	-0.0920	0.0605
Δ log(export to RoW)	66	0.0022	0.0314	-0.1217	0.0627
Δ log(domestic demand)	66	0.0034	0.0039	-0.0080	0.0097
Italy					
Δ log(import from EA)	66	0.0009	0.0322	-0.1226	0.1305
Δ log(import from RoW)	66	0.0008	0.0312	-0.0847	0.0739
Δ log(export to EA)	66	-0.0004	0.0325	-0.0881	0.1212
Δ log(export to RoW)	66	0.0035	0.0344	-0.1649	0.0914
Δ log(domestic demand)	66	0.0000	0.0063	-0.0209	0.0109
Spain					
Δ log(import from EA)	66	0.0006	0.0376	-0.1425	0.0717
Δ log(import from RoW)	66	0.0058	0.0378	-0.1165	0.0807
Δ log(export to EA)	66	0.0048	0.0294	-0.1368	0.0842
Δ log(export to RoW)	66	0.0123	0.0384	-0.1392	0.0860
Δ log(domestic demand)	66	0.0032	0.0103	-0.0247	0.0165

Table 2: Import from Euro Area

	DE	FR	IT	ES	NL
Δ log(imports from EA (-1))	-0.556***	-0.313**	-0.061	-0.261**	-0.111
	(0.098)	(0.127)	(0.073)	(0.112)	(0.095)
Δ log(exports to EA(t-1))	0.573***	0.279**		0.428***	
	(0.100)	(0.129)		(0.134)	
Δ log(exports to EA(t))	0.312***	0.590***	0.751***	0.680***	0.451***
	(0.105)	(0.108)	(0.093)	(0.106)	(0.123)
Δ log(exports to EA(t+1))					
Δ log(exports to ROW(t-1))					0.163*
					(0.091)
Δ log(exports to ROW(t))	0.057	0.111	0.158*	0.267***	0.159*
	(0.081)	(0.099)	(0.086)	(0.082)	(0.093)
Δ log(exports to ROW(t+1))					
Δ log(fde(t-1))					
Δ log(fde(t))	1.588***	1.481**	0.564	1.397***	1.051***
	(0.416)	(0.720)	(0.480)	(0.378)	(0.345)
Δ log(fde(t+1))	0.705*				
	(0.389)				
log(reer_ulc_ea(-4))	0.002	0.217	-0.049	-0.032	0.217
	(0.038)	(0.201)	(0.063)	(0.073)	(0.171)
Constant	-0.007	-1.004	0.225	0.136	-1.005
	(0.173)	(0.925)	(0.292)	(0.334)	(0.789)
Observations	62	63	63	63	63
R-squared	0.711	0.630	0.741	0.726	0.532

Note: fde is final domestic expenditure. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Import from Rest of the World

	DE	FR	IT	ES	NL
Δ log(imports from ROW (-1))	0.001	-0.392***	-0.195	-0.422***	-0.371***
	(0.094)	(0.131)	(0.117)	(0.098)	(0.103)
Δ log(exports to EA(t-1))					
Δ log(exports to EA(t))	0.745***	0.471***	0.295**	0.524***	0.637***
	(0.106)	(0.144)	(0.113)	(0.122)	(0.163)
Δ log(exports to EA(t+1))	-0.344**				
	(0.137)				
Δ log(exports to ROW(t-1))		0.302**	0.323***	0.177*	0.469***
		(0.133)	(0.104)	(0.090)	(0.128)
Δ log(exports to ROW(t))				0.268***	0.322***
				(0.096)	(0.119)
Δ log(exports to ROW(t+1))	0.151		-0.174*		
	(0.103)		(0.103)		
Δ log(fde(t-1))					
Δ log(fde(t))	1.193**	1.464	1.634**	2.234***	
	(0.474)	(1.056)	(0.669)	(0.386)	
Δ log(fde(t+1))			1.203*		-0.421
			(0.684)		(0.430)
log(reer_ulc_row(-4))	0.074	0.068	0.027	0.046	0.056
	(0.054)	(0.045)	(0.030)	(0.033)	(0.042)
Constant	-0.341	-0.319	-0.123	-0.216	-0.261
	(0.248)	(0.206)	(0.137)	(0.152)	(0.192)
Observations	62	63	62	63	62
R-squared	0.618	0.344	0.482	0.635	0.591

Note: fde is final domestic expenditure. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Export to Euro Area

	DE	FR	IT	ES	NL
Δ log(exports to EA (t-1))	-0.233**	-0.252*	-0.287***	-0.058	-0.309**
	(0.093)	(0.130)	(0.074)	(0.089)	(0.140)
Δ log(fde EA excl. own country(t-1))			2.274***		1.237
			(0.620)		(0.764)
Δ log(fde EA excl. own country(t))	2.318***	2.082***	2.403***	3.177***	
	(0.589)	(0.779)	(0.707)	(0.891)	
Δ log(fde EA excl. own country(t+1))			-1.593**		
			(0.604)		
Δ log(fde ROW(t-1))			-4.797***	-1.247*	
			(0.866)	(0.625)	
Δ log(fde ROW(t))			4.788***		
			(0.868)		
Δ log(fde ROW(t+1))	2.233***	2.840***			3.293***
	(0.583)	(0.845)			(0.712)
Δ log(fde own country(t-1))		-0.929		-0.991**	
		(1.093)		(0.395)	
Δ log(fde own country(t))			0.709		
			(0.485)		
Δ log(fde own country(t+1))	0.260			0.875*	0.065
	(0.425)			(0.437)	(0.391)
log(reer_ulc_ea(-4))	-0.039	0.301	0.261***	0.062	-0.021
	(0.047)	(0.290)	(0.057)	(0.069)	(0.208)
constant	0.157	-1.418	-1.215***	-0.275	0.071
	(0.215)	(1.338)	(0.261)	(0.316)	(0.957)
Observations	60	61	62	62	61
R-squared	0.506	0.300	0.646	0.361	0.399

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

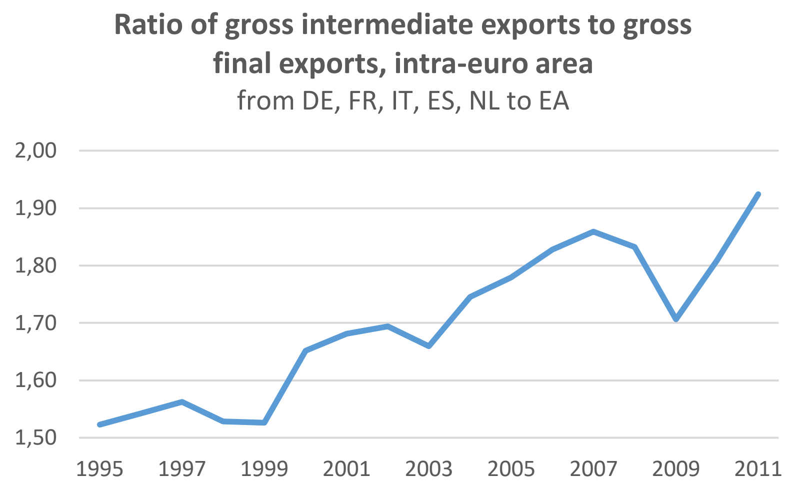
Table 5: Export to Rest of the World

	DE	FR	IT	ES	NL
Δ log(exports to ROW (-1))	-0.085	-0.384***	-0.226**	-0.399***	-0.159
	(0.103)	(0.110)	(0.100)	(0.114)	(0.141)
Δ log(fde EA excl. own country(t-1))	-1.889*	0.562			1.579
	(0.957)	(0.704)			(0.988)
Δ log(fde EA excl. own country(t))	2.451***		2.152**		
	(0.904)		(1.041)		
Δ log(fde EA excl. own country(t+1))			-2.237**	0.420	
			(0.944)	(1.519)	
Δ log(fde ROW(t-1))					-3.145**
					(1.377)
Δ log(fde ROW(t))					5.817***
					(1.429)
Δ log(fde ROW(t+1))	4.145***	3.625***	3.169***	2.474**	
	(0.882)	(0.916)	(0.949)	(1.214)	
Δ log(fde own country(t-1))	0.958*				
	(0.571)				
Δ log(fde own country(t))			0.877	-0.667	
			(0.744)	(0.677)	
Δ log(fde own country(t+1))		-1.170			-0.261
		(1.016)			(0.501)
log(reer_ulc_ea(-4))	-0.106	0.033	0.004	0.007	-0.010
	(0.071)	(0.041)	(0.033)	(0.051)	(0.056)
constant	0.456	-0.181	-0.041	-0.036	0.031
	(0.322)	(0.188)	(0.146)	(0.228)	(0.254)
Observations	61	61	61	59	62
R-squared	0.485	0.334	0.391	0.253	0.350

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Figures

Figure 1: Intermediate goods trade in the euro area

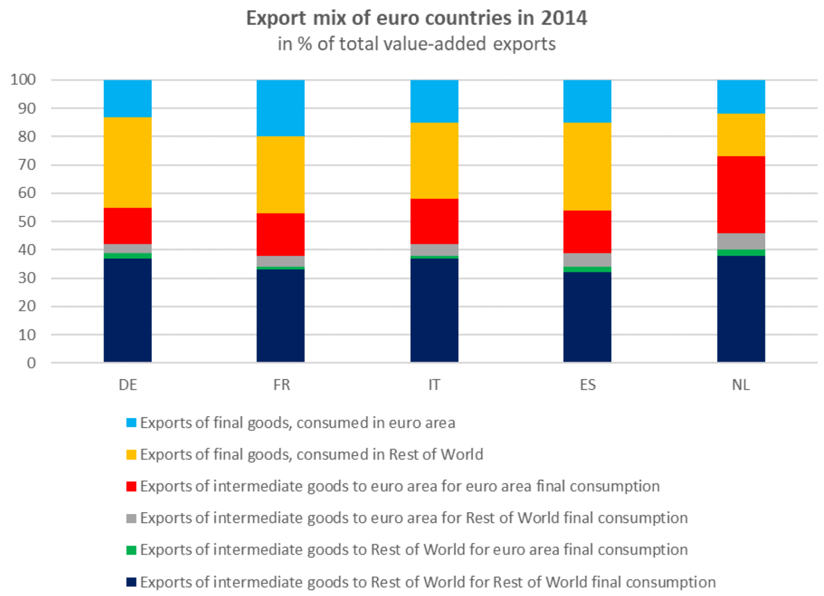


Source: OECD TiVA.

Figure 2: Stylized Leontief input-output model

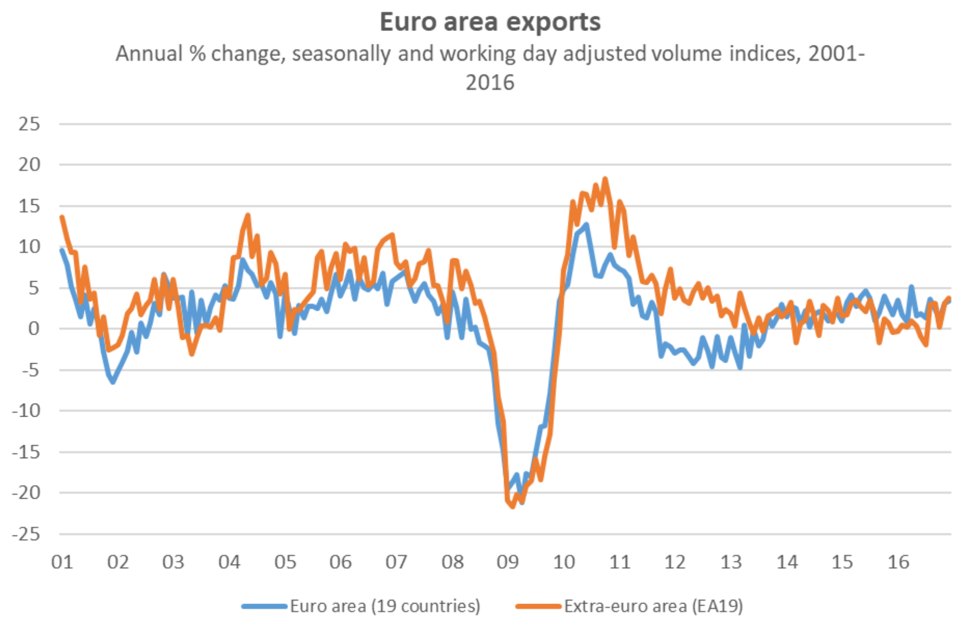
	Intermediate goods			Final demand		
	Home	OEA	ROW	Home	OEA	ROW
Home	$x_{Home,Home}$	$x_{Home,OEA}$	$x_{Home,ROW}$	$fd_{Home,Home}$	$fd_{Home,OEA}$	$fd_{Home,ROW}$
OEA	$x_{OEA,Home}$	$x_{OEA,OEA}$	$x_{OEA,ROW}$	$fd_{OEA,Home}$	$fd_{OEA,OEA}$	$fd_{OEA,ROW}$
ROW	$x_{ROW,Home}$	$x_{ROW,OEA}$	$x_{ROW,ROW}$	$fd_{ROW,Home}$	$fd_{ROW,OEA}$	$fd_{ROW,ROW}$
value added	va_{Home}	va_{OEA}	va_{ROW}			

Figure 3: Exports by use and destination



Source: WIOD and based on own calculations.

Figure 4: Euro area exports, by destination



Source: Eurostat

Appendix Tables

Table A.1: Import from Euro Area

	DE	FR	IT	ES	NL
Δ log(imports from EA (-1))	-0.390***	-0.136	-0.061	-0.091	-0.033
	(0.089)	(0.087)	(0.073)	(0.090)	(0.086)
Δ log(exports to EA(t))	0.507***	0.602***	0.751***	0.603***	0.479***
	(0.117)	(0.111)	(0.093)	(0.112)	(0.110)
Δ log(exports to ROW(t))	0.139	0.067	0.158*	0.317***	0.103
	(0.093)	(0.099)	(0.086)	(0.085)	(0.088)
Δ log(fde(t))	1.358***	1.897**	0.564	1.371***	0.772**
	(0.474)	(0.714)	(0.480)	(0.401)	(0.327)
log(reer_ulc_ea(-4))	-0.050	0.306	-0.049	-0.040	0.186
	(0.039)	(0.206)	(0.063)	(0.077)	(0.162)
Constant	0.230	-1.415	0.225	0.171	-0.861
	(0.181)	(0.951)	(0.292)	(0.354)	(0.748)
Observations	63	63	63	63	63
R-squared	0.600	0.602	0.741	0.659	0.453

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.2: Import from Rest of the World

	DE	FR	IT	ES	NL
Δ log(imports from ROW (-1))	-0.063	-0.221*	-0.243**	-0.365***	-0.204**
	(0.093)	(0.125)	(0.093)	(0.091)	(0.101)
Δ log(exports to EA(t))	0.783***	0.307*	0.266**	0.635***	0.740***
	(0.132)	(0.183)	(0.113)	(0.123)	(0.168)
Δ log(exports to ROW(t))	-0.038	0.171	0.041	0.235**	0.305**
	(0.108)	(0.169)	(0.105)	(0.095)	(0.134)
Δ log(fde(t))	1.182**	1.417	2.447***	1.966***	0.344
	(0.496)	(1.157)	(0.570)	(0.391)	(0.485)
log(reer_ulc_row(-4))	0.078	0.070	0.029	0.051	0.071
	(0.054)	(0.048)	(0.027)	(0.034)	(0.047)
Constant	-0.357	-0.329	-0.133	-0.237	-0.327
	(0.247)	(0.223)	(0.122)	(0.154)	(0.217)
Observations	63	63	63	63	63
R-squared	0.616	0.273	0.475	0.621	0.470

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Export to Euro Area

	DE	FR	IT	ES	NL
Δ log(exports to EA (t-1))	-0.233**	-0.215	-0.244***	-0.104	-0.183
	(0.088)	(0.132)	(0.091)	(0.076)	(0.142)
Δ log(fde EA excl. own country(t))	2.440***	1.391	1.782**	2.710***	1.935**
	(0.548)	(0.870)	(0.832)	(0.741)	(0.884)
Δ log(fde ROW(t))	1.927***	1.775**	1.152*	0.843	1.879**
	(0.520)	(0.852)	(0.669)	(0.521)	(0.811)
Δ log(fde own country(t))	-0.187	0.907	1.257**	-0.517	-0.032
	(0.397)	(1.219)	(0.586)	(0.331)	(0.484)
log(reer_ulc_ea(-4))	-0.053	0.181	0.227***	-0.146**	0.001
	(0.045)	(0.293)	(0.070)	(0.058)	(0.217)
constant	0.224	-0.861	-1.064***	0.658**	-0.021
	(0.208)	(1.351)	(0.319)	(0.266)	(1.000)
Observations	62	62	62	62	62
R-squared	0.497	0.233	0.417	0.398	0.302

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.4: Export to Rest of the World

	DE	FR	IT	ES	NL
Δ log(exports to ROW (-1))	-0.160*	-0.348***	-0.249**	-0.389***	-0.142
	(0.084)	(0.110)	(0.110)	(0.102)	(0.142)
Δ log(fde EA excl. own country(t))	0.681	-0.307	0.890	0.579	1.023
	(0.530)	(0.806)	(1.155)	(1.294)	(1.182)
Δ log(fde ROW(t))	3.385***	2.201**	2.498**	2.669**	3.336***
	(0.829)	(0.956)	(1.025)	(1.064)	(1.125)
Δ log(fde own country(t))	-0.154	1.829	0.691	-0.816	0.141
	(0.487)	(1.154)	(0.748)	(0.609)	(0.601)
log(reer_ulc_ea(-4))	-0.057	0.055	0.014	0.004	-0.015
	(0.064)	(0.042)	(0.035)	(0.046)	(0.058)
constant	0.237	-0.278	-0.086	-0.024	0.048
	(0.289)	(0.191)	(0.154)	(0.205)	(0.261)
Observations	61	62	61	62	62
R-squared	0.321	0.316	0.261	0.277	0.293

Note: fde is final domestic expenditure and reer_ulc is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Import from Euro Area

	DE	FR	IT	ES	NL
Δ log(imports from EA (-1))	-0.556***	-0.313**	-0.061	-0.261**	-0.111
	(0.098)	(0.127)	(0.073)	(0.112)	(0.095)
Δ log(exports to EA(t-1))	0.573***	0.279**		0.428***	
	(0.100)	(0.129)		(0.134)	
Δ log(exports to EA(t))	0.312***	0.590***	0.751***	0.680***	0.451***
	(0.105)	(0.108)	(0.093)	(0.106)	(0.123)
Δ log(exports to EA(t+1))					
Δ log(exports to ROW(t-1))					0.163*
					(0.091)
Δ log(exports to ROW(t))	0.057	0.111	0.158*	0.267***	0.159*
	(0.081)	(0.099)	(0.086)	(0.082)	(0.093)
Δ log(exports to ROW(t+1))					
Δ log(fde(t-1))					
Δ log(fde(t))	1.588***	1.481**	0.564	1.397***	1.051***
	(0.416)	(0.720)	(0.480)	(0.378)	(0.345)
Δ log(fde(t+1))	0.705*				
	(0.389)				
log(reer_hicp_ea(-4))	0.002	0.217	-0.049	-0.032	0.217
	(0.038)	(0.201)	(0.063)	(0.073)	(0.171)
Constant	-0.007	-1.004	0.225	0.136	-1.005
	(0.173)	(0.925)	(0.292)	(0.334)	(0.789)
Observations	62	63	63	63	63
R-squared	0.711	0.630	0.741	0.726	0.532

Note: fde is final domestic expenditure and reer_hicp is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.6: Import from Rest of the World

	DE	FR	IT	ES	NL
Δ log(imports from ROW (-1))	0.014	-0.386***	-0.191	-0.430***	-0.379***
	(0.093)	(0.129)	(0.118)	(0.098)	(0.103)
Δ log(exports to EA(t-1))					
Δ log(exports to EA(t))	0.771***	0.484***	0.304***	0.510***	0.644***
	(0.108)	(0.140)	(0.112)	(0.121)	(0.163)
Δ log(exports to EA(t+1))	-0.318**				
	(0.141)				
Δ log(exports to ROW(t-1))		0.300**	0.322***	0.179**	0.472***
		(0.130)	(0.104)	(0.089)	(0.128)
Δ log(exports to ROW(t))				0.276***	0.314**
				(0.095)	(0.119)
Δ log(exports to ROW(t+1))	0.143		-0.170		
	(0.104)		(0.103)		
Δ log(fde(t-1))					
Δ log(fde(t))	1.211**	1.405	1.611**	2.278***	
	(0.481)	(1.027)	(0.666)	(0.374)	
Δ log(fde(t+1))			1.154*		-0.442
			(0.678)		(0.429)
log(reer_hicp_row(-4))	0.053	0.082	0.037	0.060	0.078
	(0.043)	(0.052)	(0.042)	(0.036)	(0.048)
Constant	-0.245	-0.381	-0.167	-0.280*	-0.359
	(0.199)	(0.239)	(0.191)	(0.166)	(0.221)
Observations	62	63	62	63	62
R-squared	0.614	0.350	0.481	0.641	0.595

Note: fde is final domestic expenditure and reer_hicp is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Export to Euro Area

	DE	FR	IT	ES	NL
Δ log(exports to EA (t-1))	-0.242**	-0.293**	-0.305***	-0.060	-0.305**
	(0.092)	(0.132)	(0.084)	(0.088)	(0.139)
Δ log(fde EA excl. own country(t-1))			2.056***		1.295*
			(0.695)		(0.749)
Δ log(fde EA excl. own country(t))	2.211***	2.195***	2.185***	2.924***	
	(0.529)	(0.787)	(0.796)	(0.886)	
Δ log(fde EA excl. own country(t+1))			-1.933***		
			(0.698)		
Δ log(fde ROW(t-1))			-4.750***	-1.288**	
			(0.973)	(0.616)	
Δ log(fde ROW(t))			5.312***		
			(0.973)		
Δ log(fde ROW(t+1))	2.331***	2.413***			3.150***
	(0.577)	(0.833)			(0.697)
Δ log(fde own country(t-1))		-0.219		-0.816*	
		(1.159)		(0.408)	
Δ log(fde own country(t))			0.628		
	0.269		(0.551)		
Δ log(fde own country(t+1))	(0.441)			0.831**	0.124
				(0.407)	(0.383)
log(reer_hicp_ea(-4))	-0.085	-0.648*	0.679***	0.123	0.002
	(0.124)	(0.327)	(0.231)	(0.108)	(0.238)
constant	0.366	2.945*	-3.142***	-0.557	-0.035
	(0.573)	(1.504)	(1.064)	(0.496)	(1.091)
Observations	60	61	62	62	61
R-squared	0.514	0.315	0.565	0.363	0.401

Note: fde is final domestic expenditure and reer_hicp is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.8: Export to Rest of the World

	DE	FR	IT	ES	NL
Δ log(exports to ROW (-1))	-0.064	-0.381***	-0.238**	-0.400***	-0.157
	(0.102)	(0.111)	(0.098)	(0.113)	(0.141)
Δ log(fde EA excl. own country(t-1))	-1.763*	0.533			1.626*
	(0.966)	(0.710)			(0.950)
Δ log(fde EA excl. own country(t))	2.270**		2.209**		
	(0.931)		(1.027)		
Δ log(fde EA excl. own country(t+1))			-2.319**	0.424	
			(0.927)	(1.533)	
Δ log(fde ROW(t-1))					-3.158**
					(1.378)
Δ log(fde ROW(t))					5.753***
					(1.422)
Δ log(fde ROW(t+1))	3.591***	3.670***	3.426***	2.515**	
	(0.846)	(0.935)	(0.932)	(1.112)	
Δ log(fde own country(t-1))	0.759				
	(0.576)				
Δ log(fde own country(t))			0.808	-0.688	
			(0.722)	(0.646)	
Δ log(fde own country(t+1))		-1.184			-0.257
		(1.024)			(0.502)
log(reer_hicp_ea(-4))	-0.030	0.034	-0.020	0.006	-0.005
	(0.058)	(0.051)	(0.046)	(0.051)	(0.061)
constant	0.112	-0.187	0.064	-0.030	0.007
	(0.264)	(0.231)	(0.207)	(0.232)	(0.278)
Observations	61	61	61	59	62
R-squared	0.457	0.331	0.415	0.253	0.347

Note: fde is final domestic expenditure and reer_hicp is the real effective exchange rate based on unit labour cost deflators. *** p<0.01, ** p<0.05, * p<0.1.

Table A.9: Granger causality tests

causality from:	to:	DE	FR	IT	ES	NL
Δ log(imports from EA)	Δ log(imports from ROW)	0.53	0.87	0.66	0.56	0.20
Δ log(imports from EA)	Δ log(exports to EA)	0.01	0.19	0.21	0.04	0.27
Δ log(imports from EA)	Δ log(exports to ROW)	0.34	0.78	0.62	0.17	0.00
Δ log(imports from ROW)	Δ log(imports from EA)	0.30	0.01	0.10	0.00	0.34
Δ log(imports from ROW)	Δ log(exports to EA)	0.03	0.12	0.98	0.91	0.38
Δ log(imports from ROW)	Δ log(exports to ROW)	0.20	0.16	0.40	0.34	0.00
Δ log(exports to EA)	Δ log(imports from EA)	0.45	0.44	0.96	0.35	0.21
Δ log(exports to EA)	Δ log(imports from ROW)	0.15	0.64	0.90	0.81	0.69
Δ log(exports to EA)	Δ log(exports to ROW)	0.17	0.45	0.09	0.91	0.00
Δ log(exports to ROW)	Δ log(imports from EA)	0.48	0.04	0.56	0.90	0.26
Δ log(exports to ROW)	Δ log(imports from ROW)	0.75	0.58	0.68	0.26	0.92
Δ log(exports to ROW)	Δ log(exports to EA)	0.26	0.42	0.01	0.21	0.42

Note: P-values of Granger causality test with null hypothesis of no causality.

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