INTERNATIONAL MONETARY FUND

Missing Imports in the Euro Area: Domestic Monetary Policy, Cross-Border Synchronization, and Demand Composition

Francesca Caselli and Allan Gloe Dizioli

WP/25/140

2025
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Prepared by Francesca Caselli and Allan Gloe Dizioli[1]

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IMF Working Paper
European Department

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July 2025

ABSTRACT: This paper sheds new light on an overlooked channel of monetary transmission: the relationship between central bank interest rate policy and the economy's trade position. It focuses on how tightening monetary policy, by altering the composition of domestic demand—due to different sensitivities to interest rates and the varying import content of each demand component and its subcategories—ultimately influence import dynamics. In 2023, the euro area faced a significant contraction in imports, despite resilient GDP growth, challenging traditional import elasticity models. While an import intensity-adjusted demand framework explains the Great Financial Crisis (GFC) trade-GDP disconnect, it fails to account for the euro area's recent import shortfall, indicating that additional factors beyond the varying degree of import intensity of each demand component are at play. Accounting for lending rates in the regression framework significantly improves the model's explanatory power for this recent period, underscoring the role of monetary policy in the recent decline in imports. Using local projection methods with high-frequency monetary policy shocks, we confirm that monetary tightening negatively impacts imports by suppressing demand components with higher import intensity. This effect is further amplified when accounting for cross-border synchronization of monetary policy tightening.

JEL Classification Numbers:	E52, E58, F10, F42
Keywords:	Monetary policy; Demand Composition; Monetary policy synchronization; International trade; Euro Area

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Missing Imports in the Euro Area: Domestic Monetary Policy, Cross-Border Synchronization, and Demand Composition*

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July 3, 2025

Abstract

This paper sheds new light on an overlooked channel of monetary transmission: the relationship between central bank interest rate policy and the economy's trade position. It focuses on how tightening monetary policy, by altering the composition of domestic demand—due to different sensitivities to interest rates and the varying import content of each demand component and its subcategories—ultimately influence import dynamics. In 2023, the euro area faced a significant contraction in imports, despite resilient GDP growth, challenging traditional import elasticity models. While an import intensity-adjusted demand framework explains the Great Financial Crisis (GFC) trade-GDP disconnect, it fails to account for the euro area's recent import shortfall, indicating that additional factors beyond the varying degree of import intensity of each demand component are at play. Accounting for lending rates in the regression framework significantly improves the model's explanatory power for this recent period, underscoring the role of monetary policy in the recent decline in imports. Using local projection methods with high-frequency monetary policy shocks, we confirm that monetary tightening negatively impacts imports by suppressing demand components with higher import intensity. This effect is further amplified when accounting for cross-border synchronization of monetary policy tightening.

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*Francesca Caselli, fcaselli@imf.org; Allan Gloe Dizioli, adizioli@imf.org. The views expressed in this working paper are those of the authors and do not necessarily represent those of the IMF, its Executive Board, or its management. Working papers describe research in progress by the authors and are published to elicit comments and to encourage debate. We thank Rudolfs Bems, Helge Berger, Oya Celasun, Malhar Nabar, and Joseph Platzer for helpful comments and suggestions. We thank Xiaosheng Guo for constructing the input-output trade weights used in the analysis and Kayla Qin for excellent research assistance.

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1 Introduction

It is widely recognized that different segments of the economy exhibit varying degrees of sensitivity to changes in interest rates. Notably, durable consumer goods and investment are particularly responsive to interest rates (Erceg and Levin, 2006), but there is little evidence on how these heterogeneous effects impact a country's trade position. Motivated by the recent disappointing import performance of the euro area, which coincided with the ECB's tightening cycle over 2022-23, this paper investigates how monetary policy impacts imports. It focuses on how tightening monetary policy, by altering the composition of domestic demand—due to differing sensitivities to interest rates and the varying import content of each demand component and its subcategories—ultimately influence import dynamics. The findings in this paper indicate that monetary policy could exert a greater influence on trade than traditionally understood, primarily due to its differential effects on demand components with varying levels of import intensity. We argue that the relationship between monetary policy and a country's trade position, mediated by changes in the composition of domestic demand, represents an overlooked channel of monetary policy transmission.

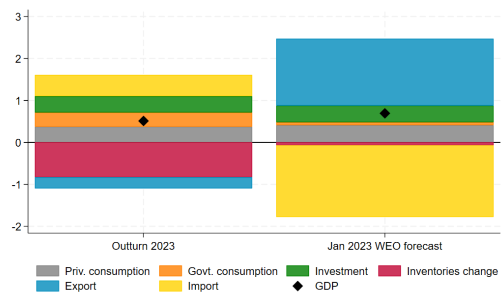
This paper is motivated by the observation that euro area imports collapsed in 2023, falling by over 10 percent in real terms. This decline was more pronounced than during the sovereign debt crisis and close to the levels seen at the peak of the pandemic crisis. Meanwhile, GDP growth, which is usually used to explain import growth, remained resilient (Figure 1). Moreover, the IMF and other forecasters have over predicted trade for the last two years (Figure 2a and Figure 2b), which suggests that existing models failed to predict the import collapse.

Figure 1: The 2023 euro area missing trade

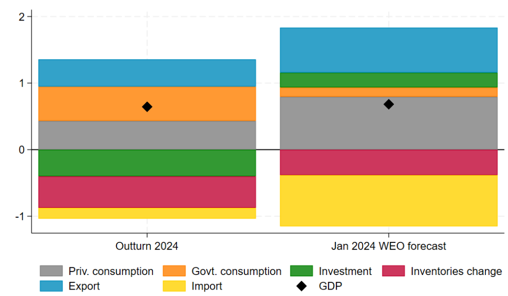
Note: Monthly HS6-level data from the Eurostat Comext database are aggregated up to the quarterly frequency. The dashed lines correspond to the GFC, the sovereign debt crisis, and the pandemic.

This paper investigates the drivers of this "missing trade" puzzle by focusing on the role of monetary policy. Beyond the large supply shocks that the euro area economy experienced, the 2022/23 period was characterized by an unprecedented tightening cycle that was triggered by the surge in inflation and inflation expectations. We first build upon the existing literature that examined the great trade collapse of 2008-2009, during which real world trade plummeted by approximately 15 percent, outpacing the decline in real world GDP by a factor of roughly four Bems, Johnson, and Yi (2013). To understand the causes of this trade-domestic activity disconnect these papers focused on the role played by different GDP components and their trade intensity. This prior literature often takes these fluctuations across GDP components as given without addressing the underlying structural shocks that drive them. We go a step further and investigate how monetary policy tightening, by affecting the composition of domestic demand, across and within components, direct affects import demand.

Figure 2: Euro area domestic demand forecast errors in 2023 and 2024Q1-Q3



(a)



(b)

Note: The figure plots GDP and demand components IMF WEO forecasts and outturns for the euro area in 2023 and 2024Q1-Q3.

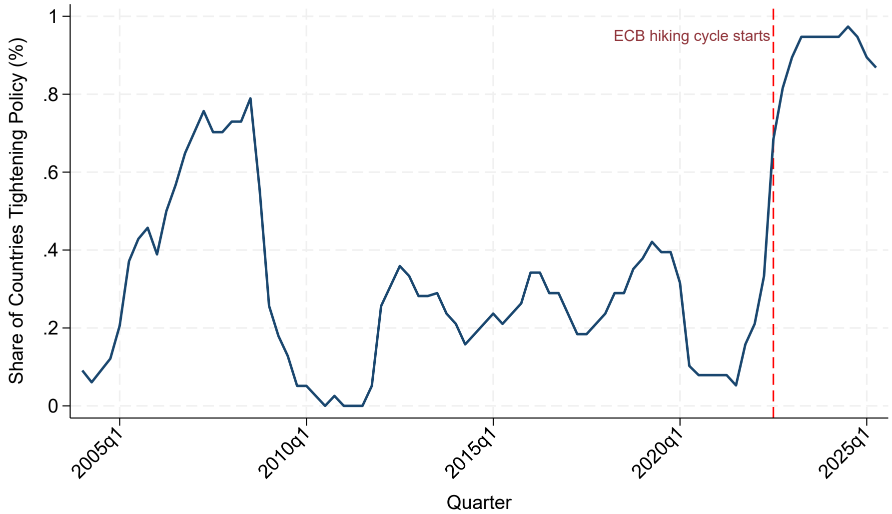
Building on the work by Bussière and others (2013), we estimate import demand elasticities accounting for the import-intensity of demand as opposed to more standard demand measures such as GDP. Their main finding is that the significant collapse in imports during the great financial crisis (GFC) and the subsequent disconnect with GDP can be attributed to the sharp decline in demand components characterized by high import intensity, namely exports and investment, which experienced a much steeper decline than GDP itself during the 2008-2009 period. Relying on input-output tables and following the methodology proposed by Bussière and others (2013) we construct a measure of import intensity for each demand component, and we use it in an import demand elasticity regression in a quarterly panel for nine euro area countries imports. Following the approach of Bussière and others (2013), we show that an import elasticity regression using the import-adjusted demand (IAD) can account for the trade collapse during the GFC. That is, the change in demand composition during the GFC explains the disconnect of import and GDP growth. However, when we extend this framework to the recent period, we fail to explain the missing trade puzzle in the euro area. This suggests that other factors are contributing to missing imports and the disconnect with activity during this recent period.

Augmenting the standard import-adjusted demand regression with country-specific lending rates—used as a proxy for the monetary policy stance—enhances the model's fit. For the whole sample, the fit of the model including lending rates is around 13 percent higher than the model that does not account for monetary policy. This improvement is particularly pronounced in recent periods (the residuals are around 40 percent smaller in 2023), suggesting that the monetary policy tightening initiated in mid-2022 may have contributed to a decline in imports.

Furthermore, we find that high lending rates lead to a stronger sensitivity of imports to domestic demand. In particular, capital goods imports tends to have an elasticity to domestic demand that increases with the level of interest rates. This non-linear effect is also observed, albeit to a lesser extent, with imports of semi-durable and durable consumption goods. This suggests that the impact of monetary policy on imports operates primarily through its effects on demand composition, as different demand components exhibit varying sensitivities to changes in interest rates. In other words, while IAD accounts for shifts in the composition of domestic demand across components—such as a shift from exports to government consumption—it does not capture changes within these components. For instance, it does not account for a decrease in the share of machinery investment and an increase in the share of intellectual property investments. It is this latter change that seems to explain why our empirical model that relies on IAD does not adequately explain the recent decline in imports. We further investigate whether these effects differ across countries, but we don't find evidence of significant heterogeneity.

Another distinguishing feature of the current monetary policy tightening cycle, in contrast to previous episodes of import-GDP disconnect, is the pronounced synchronization of policy actions across multiple countries (Figure 3). We show that this synchronization amplifies the effect of monetary tightening and contributes to explain the fall in imports in the euro area. If monetary policy tightening in a given country results in a shift in composition that reduces the import elasticity of domestic demand, a simultaneous tightening of monetary policy across a substantial number of countries may lead to an even greater decline in the import elasticity of global demand.

Figure 3: The ECB hiking cycle coincided with global synchronization of monetary policy.



Note: the figure reports the share of countries tightening monetary policy at the same time following Caldara and others (2024).

While the literature highlights that international transactions are characterized by higher working capital needs and hence tend to be more exposed to credit conditions (Chor and Manova, 2012), higher interest rates can also affect the composition within each demand component: for example, among the components in the investment category, machinery is particularly sensitive to changes in financial conditions. Machinery is also the most import intensive sub-component of investment. Thus, for example, if an increase in interest rate lowers the share of machinery in total investment, we should observe lower import content for the same measure of investment. Within the consumption category, purchases of durables and semi-durables tend to rely more on credit than non-durables or services (Casalis and Krustev, 2022). We argue that these factors are not fully captured by the import intensity adjusted demand measure and hence the baseline model is not able to fully capture the decline in import in 2023. Other explanations related to the unwinding of the pandemic crisis have been put forward to justify the collapse in trade (see for instance ECB Economic Bulletin, Issue 3/2024), but our results suggest that they are not enough to explain the trade gap. Taking the explanations into account by controlling for the exchange rate, trade policy uncertainty, and inventories does not affect the fit of the regression.

To confirm the heterogeneous effect of monetary policy on demand components and their subcomponents we rely on the high-frequency monetary policy shock developed by Jarociński and Karadi (2020) and estimate panel local projections on the four demand components and their subcategories. The objective of this exercise is to confirm that monetary policy has a stronger effect on the demand components that have the highest import intensity, namely investment and exports. Indeed, we find that these two components display the highest decline following an exogenous monetary policy shock. Private consumption also declines, but less so, whereas government consumption, the least import intensive of all components, is not affected by the shock. When zooming into the various subcomponents, we find that items that have the highest import intensity, namely intermediate goods exports, machinery investment and durables consumption have also the highest sensitivity to monetary policy shocks. Overall, these results confirm that monetary policy triggers a shift in the within-demand composition that reduces the import content of GDP. Finally, we confirm that these negative effects on imports are amplified in period of global monetary policy tightening. This is consistent with a stronger depreciation of the real effective exchange rate during periods of global tightening.

The ECB has entered a new phase of the cycle and properly acknowledging its impact on each GDP component is important for proper calibration of monetary policy. Furthermore, a deeper understanding of monetary policy transmission could provide valuable insights into its transmission lags, its effects on exchange rates, and its distributional impacts (winners and losers of changes in financial conditions).

The paper proceeds as follows: Section 2 reviews the relevant literature, Section 3 discusses some stylized facts related to the 2023 decline in import, Section 4 reviews the construction of the import adjusted domestic demand measures, Section 5 describes the import elasticity model and the results, section 6 zooms in on the impact of monetary policy on demand composition using high-frequency identification, and Section 7 concludes.

2 Literature review

This paper primarily relates to the literature on the great trade collapse during the global financial crisis (see Bems, Johnson, and Yi, 2013 and Levchenko, Lewis, and Tesar, 2010 for two comprehensive reviews). A widely accepted explanation for the disconnect between trade and GDP during the 2008-2009 period is that the crisis triggered changes in expenditure that have varying degrees of exposure to international trade. Specifically, since expenditure collapsed particularly in the most traded sectors, these shifts had a pronounced effect on imports (Bems, Johnson, and Yi, 2011 and Eaton and others, 2016). A compounding effect was triggered by the shift away from durables good consumption which tend to be more import intensive than other consumption goods such as services (Engel and Wang, 2011). A related finding in these studies is that the elasticity of world trade to GDP increased beyond one which is the standard assumption based on the aggregate CES framework.

Other papers have instead focused on the supply side of the economy and have investigated how the financial crisis, by affecting the availability of credit, disrupted international trade. Chor and Manova (2012) find that countries with tighter credit conditions exported less to the US, and this is particularly the case for sectors that are more financially vulnerable. Chor and Manova (2012) show that international trade transactions are typically characterized by additional costs, associated with higher risk, and higher working capital needs due to shipping lags make exporters more reliant on external financing than domestic producers. Similar to Chor and Manova (2012), our focus is on the impact of changing interest rates on trade. However, rather than examining the financial dependencies of different sectors, we emphasize how tightening monetary policy alters the composition of demand.

The paper also relates to the literature on the effects of monetary policy shocks on the real economy and heterogeneity across sectors. For instance, Kreamer (2022) builds a model with differential interest sensitivity of demand across sectors and shows that policymakers should weight sectors proportionally to their interest elasticities, and account for dynamic demand effects from durable goods when setting policy. Galesi and Rachedi (2018) find that inflation reacts less to monetary policy shocks in countries that are more intensive in services intermediates. Miranda-Agrippino and Ricco (2021) find heterogeneous effects of monetary policy across types of consumption goods. Jarociński and Karadi (2020) and Altavilla and others (2025) are recent paper discussing the effects of monetary policy shocks on the euro area real economy.

Finally, Caldara and others (2024) study the impact of monetary policy synchronization on the macroeconomy. They find that global lenders might amplify the effect of monetary policy on financial conditions when countries tighten at the same time. This mechanism cannot fully explain our results, as it does not account for the disconnect between GDP and imports.

3 The 2023 euro area missing trade: some stylized facts

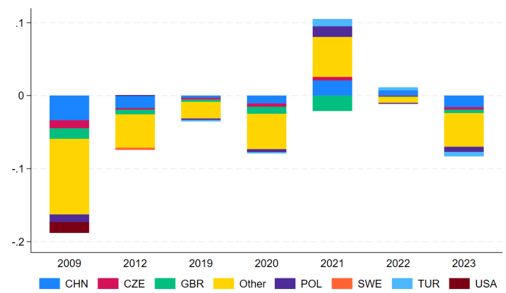
We start by documenting different aspects of the 2023 goods trade collapse in the euro area. We focus on a sample of nine euro area countries (EA9), we exclude energy goods import to avoiding capturing volatile developments due to the energy shock, and we consider extra-euro area trade (EA9).[1] First, to understand whether the drop in import is driven by specific trade partners, we calculate the contribution of the top-5 import partner in each year. Despite concern of fragmentation and possible re-routing of goods (Baba and others, 2023), China does not account for a disproportionate drop in import growth (Figure 4a. The drop in China's contribution to EA9 is less than the contribution during the GFC. In contrast, the category labeled "other," which aggregates all non-top 5 partners, constitutes the largest contributor to the drop in imports. When we consider the import growth goods composition (figure 4), we find that a combination of sectors is responsible for the decline in growth. While the iron and steel sector significantly contributed to the great trade collapse of 2008-2009—consistent with the decline in investment discussed in the introduction—this sector does not play a major role in the trade collapse of 2023.

Figure 5 confirms that investment did not contract through 2023 as it did during the GFC, but exports did. Unlike during the GFC, the Covid-19 recession saw all components—except for government spending—fell simultaneously and in alignment with GDP.

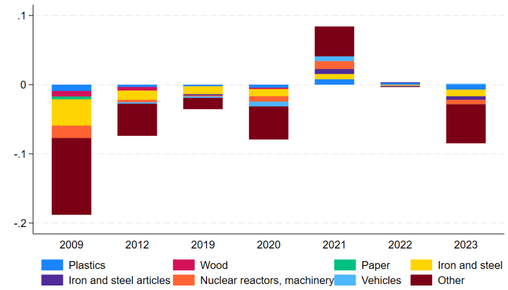
Other factors related to the exceptional nature of the recovery from the pandemic crisis might also influenced trade patterns through changes in consumer demand composition: first, supply chain

[1]EA9 represent 91 percent of EA GDP.

Figure 4: Countries and products contribution to euro area real import growth



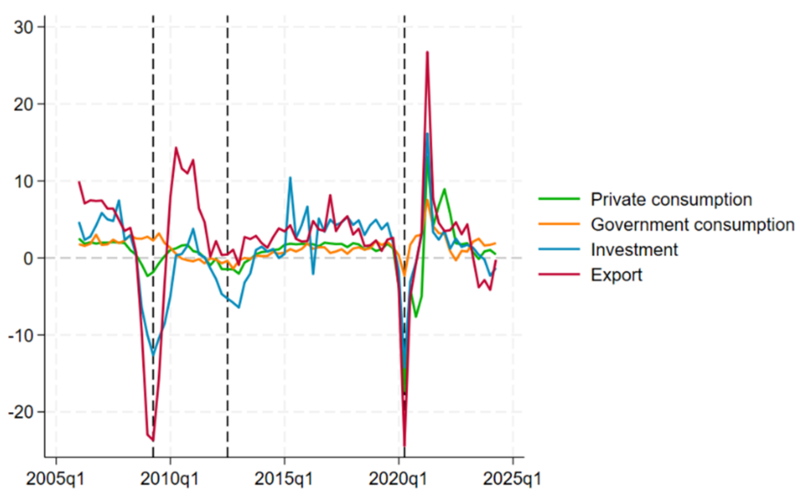
(a) Contribution to non-energy import growth by country .



(b) Contribution to non-energy import growth by product. The sampe exclude energy products.

Note: the two figures report the country and product composition of real import growth for a sample of 9 euro area countries for a selected sample of years.

Figure 5: Domestic demand evolution

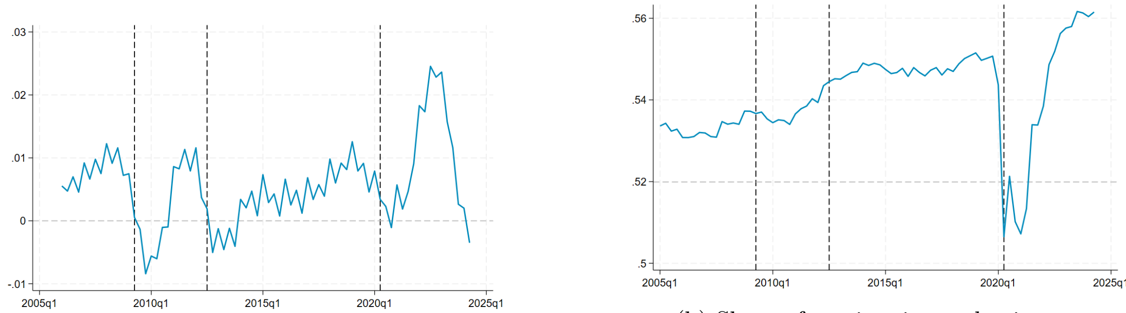


Note: the figure reports the year-over-year change in the domestic demand components. Vertical dashed lines correspond to the GFC, the sovereign debt crisis, and the Covid-19 pandemic.

bottlenecks and increased delivery time led to an unprecedented accumulation of inventories in 2021, which were subsequently unwound in 2022 (Figure 6a) (see Alessandria and others, 2023 for a discussion) potentially still affecting the level of international transactions in 2023. Second, after the mobility restrictions imposed by the pandemic were lifted, consumers spending started to shift from goods to services (Figure 6b), which could result in lower import since services are typically less trade-intensive. We will consider these two potential explanations for lower import intensity of GDP in 2023 as well.

An alternative explanation to the ones discussed above is that monetary policy also influences

Figure 6: Post-pandemic factors: inventories and rotation to services



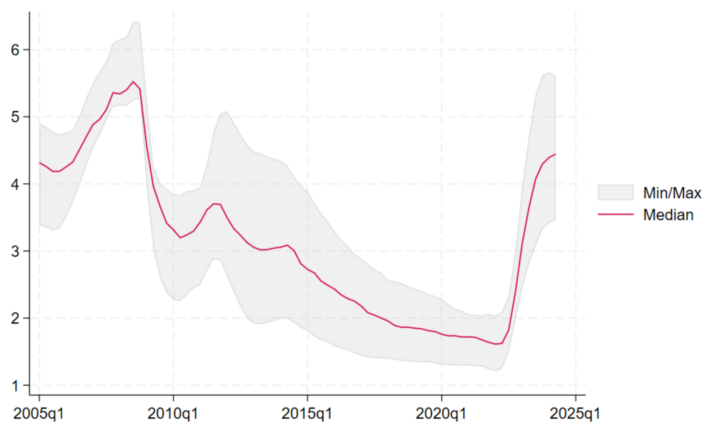
(a) Inventories.

(b) Share of services in total private consumption.

Note: the figure reports the year-over-year change in inventories and the level of services consumption as a share of total private consumption. Vertical dashed lines correspond to the GFC, the sovereign debt crisis, and the Covid-19 pandemic.

demand composition directly due to varying sensitivities to lending rates of the different components. Monetary policy in the euro area tightened significantly in the second half of 2022, resulting in stricter lending rates across euro area countries (Figure 7), suggesting a role for monetary policy in helping to explain the collapse of imports in 2023.

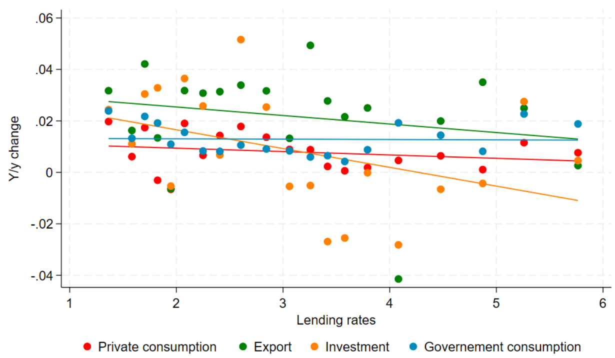
Figure 7: Rate on outstanding loans to non-financial corporations



Note: the figure reports the outstanding loans to non-financial corporations between 2005Q1-2024Q2 from Eurostat. The red line reports the median and the grey bars correspond to the minimum and maximum of the distribution.

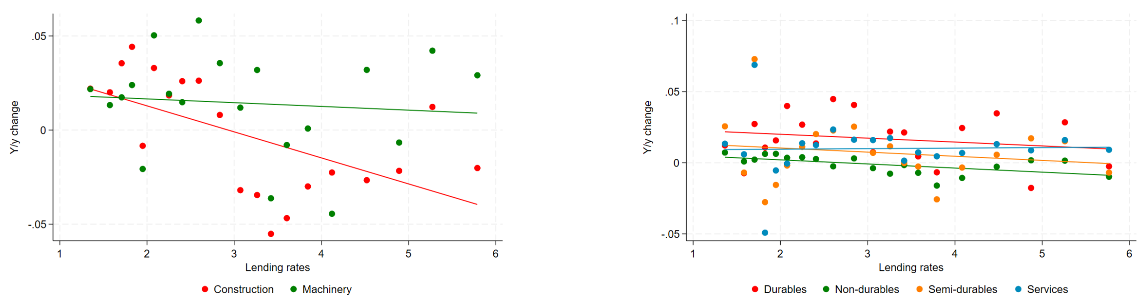
As Figure 8 shows, investment and exports exhibit slightly stronger average negative correlation with lending rates. Conversely, private and government consumption do not show a strong association with lending rates in our sample. Furthermore, sensitivity to interest rates varies within domestic demand components. For instance, when zooming into investment, machinery and construction exhibit the strongest correlation with financial conditions (Figure 9a). When considering consumption, services does not present a significant correlation with lending rates, while durables, non-durables and semi-durables all show similar negative average correlation through the sample (Figure 9b).

Figure 8: Correlation of lending rates and demand components



Note: the figure reports a binned scatter plot of the year-on-year change of each demand component and lending rates proxied by rates on outstanding loan to non-financial corporations. The sample includes nine euro area countries over 2005Q1-2024Q2. The slope for C is -0.0013, that for G is -0.0002, that for X is -0.003, and the one for I is -0.007 and is the only one significant.

Figure 9: Within demand components and financial conditions



(a) Investment types.

(b) Consumption goods.

Note: panel (A) reports a binned scatter plot of the year-on-year change of investment types and lending rates proxied by rates on outstanding loan to non-financial corporations. The slope for construction is -0.013 (p-value = 0.00), the one for machinery is -0.002 (p-value=0.49). Panel (B) reports a binned scatter plot of the year-on-year change of consumption of different types of goods. The slope for durables is -0.002 (p-value = 0.29), for non-durables is -0.003 (p-value = 0.00)) for semi-durable is -0.003 (p-value = 0.22), and for services is 0.000 (p-value = 0.89). The sample includes nine euro area countries over 2005Q1-2024Q2.

4 A measure of import intensity of demand

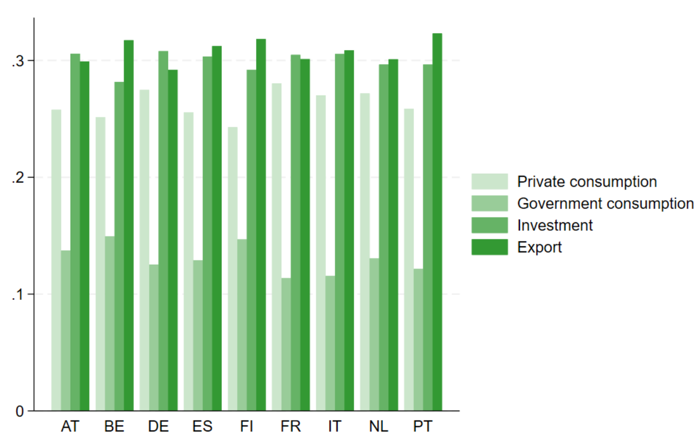
To formally test our hypothesis the regression analysis examines the relationship between imports and import-adjusted components of demand. Following Bussière and others (2013), we rely on OECD TiVa input output tables and Eurostat national account data to construct the import adjusted demand measure (IAD_{ct}) by weighting each demand component by its import intensity calculated as follows.

$$IAD_{ct} = C_t^{\omega_c} G_t^{\omega_g} I_t^{\omega_i} X_t^{\omega_x} \tag{1}$$

where C_t is private consumption, G_t government consumption, I_t investment and X_t exports. ω_c, ω_g, ω_i and ω_x measure the import content each demand component.

In the baseline estimation the import-intensity weights are time-invariant and constructed as the average between from 2005 to 2020 since the last input-output tables we have access to is from 2021. Moreover, excluding the Covid-19 period ensures that the weights in recent years are not affected by the pandemic shock. Figure 10 plots the average weights for each demand component across countries. In line with (Bussière and others, 2013), exports and investment have the highest import component, followed by private consumption. Government consumption shows the lowest import demand component as the government typically displays a high home bias (Mulabdic and Rotunno, 2022).

Figure 10: Import content by country and demand component



Note: the figure reports the import content weights for each domestic demand component by country. Weights are averaged through the period 2005Q1-2024Q2.

Given the significant drop in the most import-intensive components of demand, IAD displays a much sharper drop than GDP during the GFC (Figure 11). This is not the case during the Covid-19 recession, where IAD and GDP present a similar decline. The primary reason is that the composition of demand during the Covid-19 recession deviated significantly from typical recessionary patterns.

In standard recessions, services consumption tends to remain relatively stable, while investment and durable goods consumption—components with the highest trade intensity—experience the sharpest declines. However, during the Covid-19 recession, services consumption was disproportionately impacted, surpassing the contraction in goods consumption, reflecting the unique nature of the pandemic's economic disruptions. Similarly, during the post-GFC recovery, IAD rebounds more significantly than GDP, while the two measures move closely in the post-pandemic period. This might suggest that accounting for the import intensity of demand might not be sufficient to explain the disconnect between import and activity.

Figure 11: Comparison between IAD and GDP

Note: the figure reports the year-over-year change in IAD and GDP. Vertical dashed lines correspond to the GFC, the sovereign debt crisis, and the Covid-19 pandemic.

5 A model for import elasticities

The empirical analysis extends the model of Bussière and others (2013) to account for the other factors that could explain the 2023 missing imports discussed in previous sections. The data used in the estimation are presented in Annex A. The baseline estimation equation is as follows:

$$\Delta lnM_{ct} = \beta\Delta IAD_{ct} + \delta\Delta lnP_{ct} + \theta X_{ct} + \mu_c + \tau_q + \epsilon_{ct} \quad (2)$$

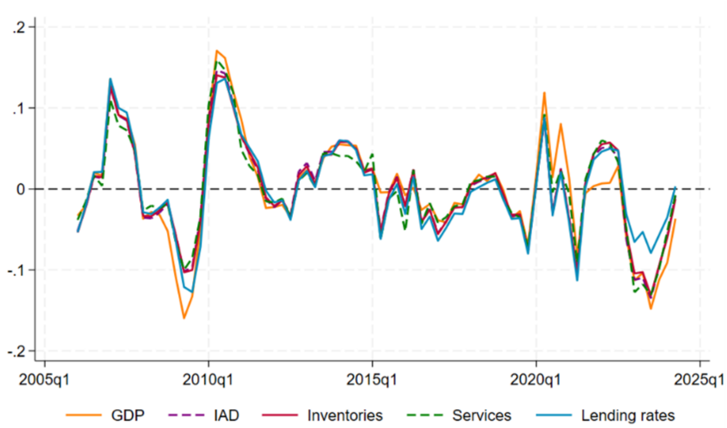
Where M_{ct} is real import, IAD_{ct} the import intensity adjusted demand, constructed as explained in section 4, P_{ct} are import unit values (calculated at the 6-digit levels and aggregated at the country-level) as proxies for import prices, and X_{ct} are other potential determinants of imports discussed in earlier sections, μ_c are country fixed effects and τ_q are quarter dummies. The sample covers the period 2006q1 to 2024q2 for the 9 euro area countries mentioned above and the HS-6 digit level data are aggregated up to the country-level. The product information will be used later in an alternative exercise where we consider the type of goods imported.

5.1 Baseline results

The estimation results are reported in Table 1 where we sequentially add the potential explanations for the 2023 missing trade. First, we confirm the previous result that IAD improves the overall fit of the model with respect to the regression based on GDP (column 1 and 2), as the R squared improves, however, as shown in Figure 12, this is not enough to close the residual in the recent period. Furthermore, the baseline elasticity of imports to domestic demand is slightly above one in line with the literature. Prices are negatively associated with imports. The inclusion of inventories and share of services in private consumption marginally improves the fit of the regression (column 3 and 4), but are not sufficient to explain the residual in 2023 (Figure 12). The results of column (5) and Figure 12 instead suggest that including country-specific lending rates in the regression not only improves the fit but also significantly reduces the size of the regression's residual in 2023, pointing to the importance of monetary policy in explaining import dynamics. This is also highlighted in Figure 13, that shows the contribution of the different variables to import growth throughout the estimation period. While a recovery in domestic demand as proxied by IAD explains the post-pandemic positive import growth partially offset by import prices in 2021 and 2022, lending rates appear as the key factor explaining the subdued performance of import in 2023.

Our hypothesis is that monetary policy affects imports changing the composition of domestic demand. To test this hypothesis, we interact IAD with a dummy for high lending rates. The dummy is equal to one when nominal lending rates are greater or equal than three (the cross-country average of the distribution). Column (6) shows that the import elasticity of demand is non-linear with the level of interest rates: namely the elasticity is 1.12 when interest rates are low (below three) and is above 2 when interest rates are high. This means that in times of high interest rates imports become much more sensitive to changes in domestic demand.

Figure 12: Residual comparison across models



Note: the figure reports the average residual from the panel regression for the 5 different linear models presented in Table 1.

Finally to assess whether there is heterogeneity in these effects across the nine countries, we estimate

Table 1: Baseline results: import growth

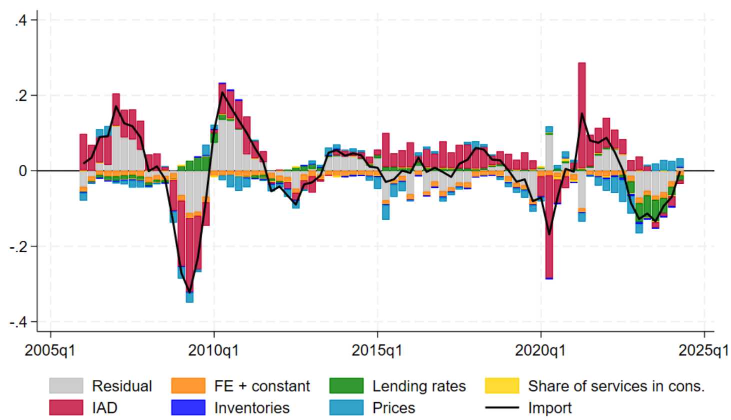
VARIABLES	(1) Import	(2) Import	(3) Import	(4) Import	(5) Import	(6) Import
Import prices	-0.40***	-0.38***	-0.37***	-0.33***	-0.39***	-0.31***
	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
GDP	1.96***					
	(0.16)					
IAD		1.62***	1.63***	1.62***	1.66***	1.12***
		(0.12)	(0.12)	(0.15)	(0.12)	(0.15)
Inventories			-0.58*			
			(0.27)			
Share of services in consumption				-0.06*		
				(0.03)		
Lending rates					-0.07***	
					(0.01)	
Dummy = 1 high lending rates						-0.01
						(0.01)
Dummy high lending rates x IAD						1.19***
						(0.22)
Observations	666	666	666	518	666	666
R-squared	0.46	0.55	0.55	0.56	0.57	0.61
Country FE	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO
R2adj	0.451	0.536	0.540	0.548	0.558	0.604
RMSE	0.0802	0.0737	0.0734	0.0719	0.0720	0.0681
Within R2	0.459	0.543	0.547	0.556	0.565	0.611

Note: The table reports the results of the baseline estimation. Standard errors are clustered at the country-level. The dependent variable is year-over-year real import growth. The independent variables are also included in year-over-year growth rates. The dummy high lending rates is defined as equal to 1 when rates are above the average of the distribution.

the model from Table 1 - Column 6 for each country separately. Figure 14 shows that Finland and Portugal display low and insignificant coefficients on the interaction term between IAD and lending rates, suggesting that for these countries monetary policy does not seem to play a role in altering the relationship between import and domestic demand. The estimates for the other seven countries are all positive and in the range of 1-1.7 with Germany presenting the largest coefficient, followed by France and the Netherlands.[2] This is consistent with the fact that economies with larger manufacturing sectors tend to be more sensitive to interest rate increases (see also Datsenko and Fleck, 2024 who discuss country specific effect of euro area monetary policy).

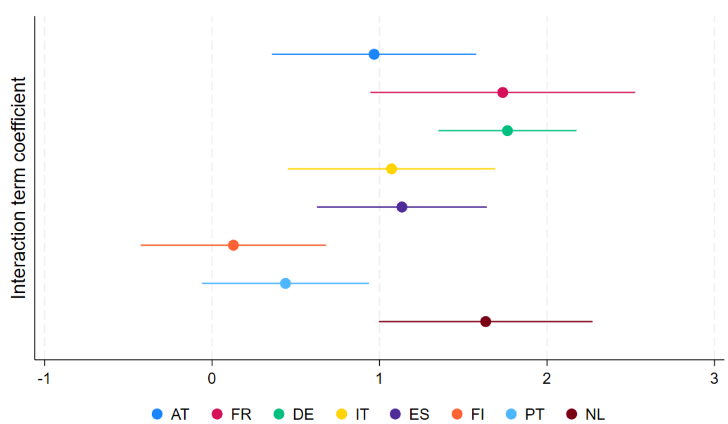
[2]While qualitatively there is a heterogeneity across countries, the variation across most countries is not statistically significant, with the exception of Portugal and Finland that are less sensitive to interest rate changes

Figure 13: Variables contribution to import growth



Note: the figure reports the contributions of the variables included in the elasticity model. The model is estimated including all the variables presented in Table 1 and country and quarter fixed effects.

Figure 14: Cross-country heterogeneity

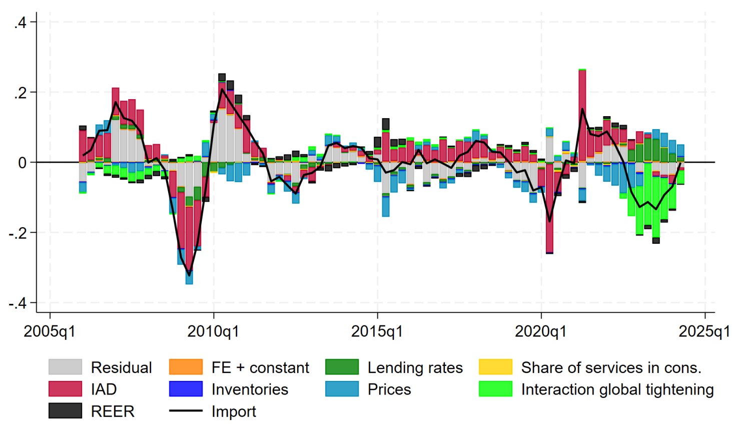


Note: the figure reports the coefficient on the interaction term from Table 1 – Column 6 estimated separately for each country. The bars represent confidence bands at the 95 percent level.

5.2 The role of monetary policy synchronization

As discussed in the introduction, this hiking cycle was characterized by the largest monetary policy tightening synchronization of the last 20 years (Figure 3). In this section we test whether monetary policy synchronization across countries contributes to explain the underperformance of import. In order to test this hypothesis, we interact domestic lending rates with the world's share of countries tightening monetary policy. Figure 15 shows that the interaction between lending rate and the share of countries tightening monetary policy has a negative effect on import growth. Moreover, the inclusion of this interaction shrinks the residual by about two thirds. In other words, the monetary policy tightening synchronization also contributes to explain the disconnect between imports and activity described in earlier sections. Figure 16 shows the marginal effect of monetary policy tightening for different levels of monetary policy synchronization.

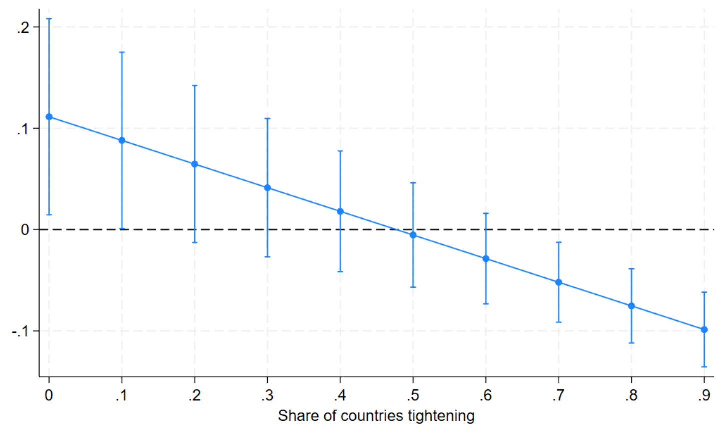
Figure 15: The interaction of lending rates and monetary policy synchronization to explain import growth



Note: the figure shows the contribution of the variables in the import regression when including the interaction between lending rate and monetary policy synchronization

The results show that the negative impact of lending rates on import growth increases with the level of monetary policy synchronization. In particular, the marginal effects becomes negative and significant when the share of countries tightening monetary policy at the same time is larger than 0.6. On the contrary, when there is monetary policy easing coordination, namely when the share of countries tightening is close to zero, then the marginal effect of lending rates on import growth is instead positive. One possible explanations relates to the role of the exchange rate. A tightening in domestic lending rates when there is global monetary policy tightening leads to less appreciation, which in turn should amplify the negative effect on imports. On the contrary, if a country tightens when everyone else is easing, the domestic currency would tend to appreciate more than under coordinated tightening. This extra appreciation makes imports cheaper and could be large enough to fully offset the impacts of the change in the decomposition of domestic demand and to trigger an increase in imports. We will test these channels in Section 6 where we consider the impact of monetary policy shocks on demand component and the real effective exchange rate.

Figure 16: The interaction of lending rates and monetary policy synchronization to explain import growth



Note: the figure shows the marginal effect of lending rates on imports depending on global monetary policy synchronization

5.3 Differential sensitivities across types of goods

We next exploit the granularity of our trade data and look at different types of import goods, classified into capital and consumption goods according to the Broad Economic Classification (BEC). The results reported in Table 2 show that capital goods display the highest coefficient on the interaction term of IAD and lending rates (column 1), in line with the initial evidence that investment has a higher sensitivity to financial conditions. Consumption goods as an aggregate exhibit an insignificant coefficient on the interaction term (column 2), but when we zoom into the different types of consumption we find that durables and semi-durables import tend to have a positive and significant coefficient on the non-linear term, albeit smaller than the one for capital goods (column 3). This suggests that elasticity of import of durables and semi-durables increases when lending rates are high. Finally, consumption of non-durables does not appear to have a varying elasticity with respect to financial conditions (column 4).

Table 2: Non-linear effect of lending rates and IAD on different goods import

VARIABLES	(1) Import	(2) Import	(3) Import	(4) Import
Import prices	-0.91***	-1.41***	-0.47***	-0.67***
	(0.06)	(0.38)	(0.10)	(0.08)
Inventories	0.02	1.05	-0.91	0.11
	(0.31)	(1.69)	(0.57)	(0.19)
Share of services in consumption	0.03	0.11	0.07**	-0.01
	(0.03)	(0.09)	(0.02)	(0.06)
IAD	1.01***	1.32***	1.09***	0.31***
	(0.19)	(0.34)	(0.22)	(0.05)
Dummy = 1 high lending rates	-0.05***	-0.08*	-0.02*	-0.01
	(0.01)	(0.03)	(0.01)	(0.01)
Dummy high lending rates x IAD	1.12***	0.39	0.34**	0.08
	(0.16)	(0.57)	(0.12)	(0.19)
Constant	0.04***	0.06*	0.03**	0.03***
	(0.01)	(0.03)	(0.01)	(0.01)
Observations	518	3,614	1,036	518
R-squared	0.89	0.46	0.49	0.57
Sample	Capital goods	Consumption goods	Durables/Semi-durables	Non-durables
R2adj	0.889	0.454	0.484	0.559

Note: The table reports the results of the regression with the non-linear terms for different types of import goods. Standard errors are clustered at the country-level. The dependent variable is year-over-year real import growth. The independent variables are also included as year-over-year growth rates. The dummy high lending rates is defined as equal to 1 when rates are above the average of the distribution.

5.4 Robustness

In Table 3 we test the robustness of our baseline estimation in different ways: i) we introduce lags of IAD and of inventories (column 1 and 2); ii) we augment the baseline estimation with the federal funds rate to proxy for global financial conditions (column 3); iii) we control for trade policy uncertainty (column 4); iv) we control for the real effective exchange rate (column 5), and v) we implement a restrictive specification where we control simultaneously for all these covariates. The baseline result showing that the elasticity of import to domestic demand increases with high rates is confirmed by this set of robustness exercises.

Table 3: Robustness exercises

VARIABLES	(1) Import	(2) Import	(3) Import	(4) Import	(5) Import	(6) Import
Import prices	-0.32***	-0.32***	-0.31***	-0.31***	-0.39***	-0.38***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
IAD	0.86***	1.08***	1.18***	1.11***	1.08***	0.86***
	(0.12)	(0.14)	(0.17)	(0.15)	(0.15)	(0.16)
Dummy = 1 high lending rates	-0.00	-0.00	-0.01	-0.01	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Dummy high lending rates x IAD	1.26***	1.22***	1.22***	1.21***	1.28***	1.29***
	(0.22)	(0.20)	(0.22)	(0.22)	(0.21)	(0.18)
L1.IAD	0.36***					0.26***
	(0.05)					(0.04)
L2.IAD	0.08					0.00
	(0.08)					(0.04)
L3.IAD	-0.11					-0.11
	(0.10)					(0.10)
L4.IAD	-0.31***					-0.18**
	(0.05)					(0.05)
L1.inventories		-0.17				0.10
		(0.14)				(0.20)
L2.inventories		-0.76**				-0.59*
		(0.26)				(0.25)
L3.inventories		-1.04**				-1.03**
		(0.39)				(0.36)
L4.inventories		-0.62**				-0.57*
		(0.24)				(0.26)
FFR			-0.01*			0.00
			(0.00)			(0.00)
Trade policy uncertainty				0.00		0.01
				(0.00)		(0.00)
REER					-0.68***	-0.46***
					(0.18)	(0.13)
Observations	630	630	666	666	592	560
R-squared	0.66	0.68	0.62	0.61	0.63	0.72
Country FE	YES	YES	YES	YES	YES	YES
Quarter FE	YES	YES	YES	YES	YES	YES
Time FE	NO	NO	NO	NO	NO	NO
R2adj	0.645	0.668	0.607	0.604	0.625	0.702

Note: The table reports the results of a series of robustness exercises. Standard errors are clustered at the country-level. The dependent variable is year-over-year real import growth. The independent variables are also included as year-over-year growth rates. The dummy high lending rates is defined as equal to 1 when rates are above the average of the distribution. Imports are classified according to the BEC classification.

6 The effect of monetary policy shocks on demand composition

The regression results in the previous section suggest that the sensitivity of import to IAD increases with interest rates, but they do not fully uncover the channels through which monetary policy affects import growth and that were responsible for the 2023 trade-GDP disconnect. This section aims to address this gap by focusing on the impact of monetary policy both between and within demand components.

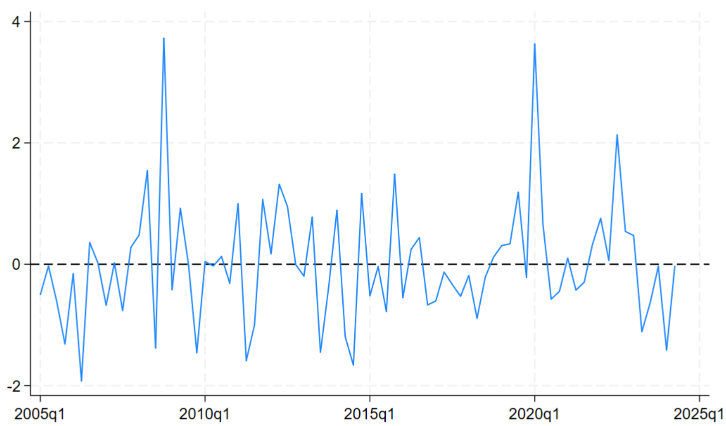
Interest rates can influence imports through various channels, with the most direct being their effect on domestic demand. Higher interest rates increase borrowing costs, leading firms to reduce investment. On the consumer side, households are incentivized to delay consumption today in favor of consuming more in the future. Additionally, households with variable-rate debt—such as mortgages, credit card loans, or auto loans—face higher repayment costs, effectively reducing their wealth and curbing current consumption. While these are not the only mechanisms highlighted in the literature, they illustrate why consumption and investment typically decline following a monetary policy tightening. The impact of interest rates directly on trade is less explored. Higher interest rates increase importer and exporter firms' financing cost and by affecting those costs it can have an impact on imports demand and exports supply. A tightening of monetary policy may lead to an appreciation of the currency, resulting in cheaper imports and more expensive exports. This dynamic is likely to increase import while suppressing export. Finally, government consumption is less impacted, as provision of public services and payments of government salaries is not as heavily influenced by fluctuations in borrowing costs compared to other components of demand. Overall, higher interest rates have varying effect on demand components, which in turn have an effect on imports demand depending on their imports intensity.

To explore the relative impact of interest rates on the different demand components, we use a well-identified monetary policy shock from Jarociński and Karadi (2020) (see Figure 17), who exploit high-frequency co-movement of interest rates and stock prices around policy announcements to disentangle the ECB's information effect regarding the economic outlook and monetary policy. We estimate the following quarterly local projections with each demand component on the left-hand side and the monetary policy shock on the right-hand side:

$$Y_{c,t+h} - Y_{c,t-1} = \sum_{p=1}^{P} \delta_p^h \Delta Y_{c,t-p} + \sum_{p=1}^{P} \beta_p^h shock_{t-p} + \sum_{p=1}^{P} \gamma_p^h X_{c,t-p} + \alpha_c^h + \tau_q^h + \varepsilon_{c,t+h} \tag{3}$$

Where $Y_{c,t-p}$ is the log of each demand component and its sub-categories. Given the flexibility of the local projection setting, the set of control variables $X_{c,t-p}$ varies for each component. Following Jarociński and Karadi (2020), the GDP and private investment equations control for EURO STOXX 50, a market capitalization-weighted stock market index including 50 blue-chip companies from 11 euro area countries, the BBB bond spread to account for financial conditions, as well as headline inflation, a measures of commodity import prices from Gruss and Kebhaj (2019) to account for possible effects of the 2022 energy crisis, and loans' volumes to non-financial corporations, as suggested by Altavilla and others (2025). The export equation controls for inflation, the real effective exchange rate, US and China GDP growth as proxies for foreign demand, real labor productivity per person, loans' volumes to non-financial corporation, and commodity import prices. The government consumption equation controls for inflation, STOXX 50, and the BBB bond spread. Finally, the private consumption equation includes inflation, STOXX50, the BBB yield, and commodity import prices. All variables enter the equation as year-over-year percentage changes and four lags are included. The regression further controls for four lags of the dependent variable and of the shock (to account for any remaining serial correlation) and for country α_c^h and quarter fixed effects τ_q. Standard errors are clustered at the country level to account for serial correlation. The sample spans from 2005q1 to 2024q2, but we exclude the period 2019q1-2022q1 to avoid capturing the unsual pandemic crisis and the subsequent recovery.[3]

Figure 17: Monetary policy shock



Note: the figure plots the standardized high-frequency monetary policy shock from Jarociński and Karadi (2020)

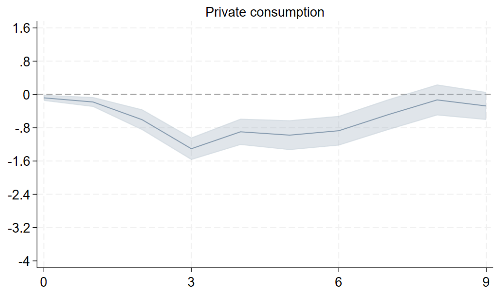
6.1 Baseline results

Figure 18 illustrates the effects of monetary policy tightening on GDP and its components. As expected, private consumption and investment decline (Figures 18a and 18b), while government consumption remains largely unaffected (Figures 18c). Notably, there is a significant negative impact on exports, despite the fact that we control for the exchange rate (Figure 18d). Since the contraction in exports and investment exceeds that of GDP (Figure 18e), this suggests that their shares in GDP

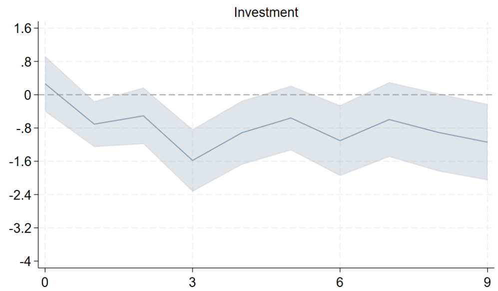
[3] Due to the nonparametric nature of local projections, the LP IRFs may suffer from excessive variability Barnichon and Brownlees (2019). To avoid excessive noise and lumpiness in our point estimates, we estimate the baseline IRFs exploiting the Hartley and Mejia (2025) panel extension of the smooth local projection technique of Barnichon and Brownlees (2019). Following Barnichon and Brownlees (2019), the IRFs coefficients are modeled as as a linear combination of B-splines estimated on the demeaned data to allow for the inclusion of fixed effects. Results are available upon request. Alternative ways of regularizing the LP IRFs include Miranda-Agrippino and Ricco (2021) and Plagborg-Møller (2019).

decrease following the monetary policy tightening. In contrast, the decline in private consumption is proportional to the fall in GDP, leaving its share in GDP broadly unchanged. Lastly, Figure 18 suggests that the share of government consumption in GDP increases slightly, as government consumption remains largely insulated from the effects of monetary policy tightening.

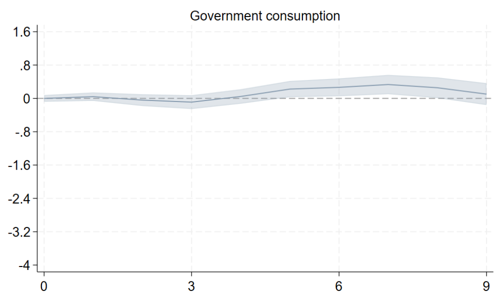
Figure 18: Effect of monetary policy shocks on demand components



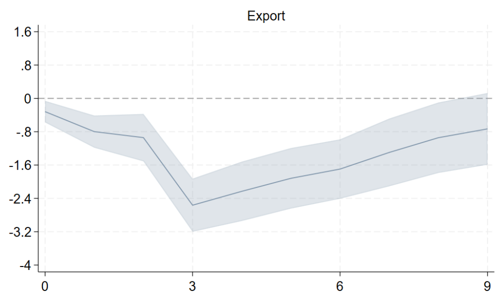
(a) Private Consumption



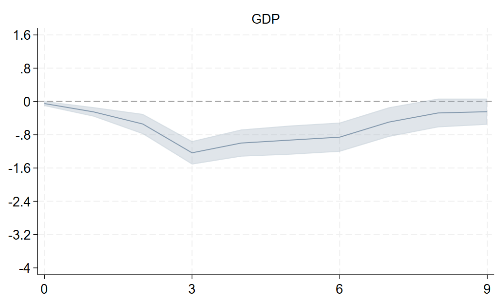
(b) Private Investment



(c) Government Consumption



(d) Exports



(e) GDP

Note: the figures report the impulse response functions and the associated 90 percent confidence bands estimated with Equation 3.

Overall, these findings suggest that GDP becomes less import-intensive following a monetary policy tightening. This is because the GDP components with the highest import content—exports and investment (Figures 18a and 18b)—see their shares decline, while the share of government consumption, which has the lowest import intensity, increases. In other words, the economy becomes more insulated from international trade as a result of monetary policy tightening. Imports demand regressions that rely solely on GDP as an explanatory variable may therefore overlook a crucial aspect of the business cycle.[4]

6.2 The effect of monetary policy on demand sub-components

In this section we go one step further and we test whether monetary policy shocks shift the composition of demand subcomponents. To test for this change in demand sub-components, we replicate the local projection analysis at a more disaggregated level. We decompose private consumption into durables and non-durables, private investment into construction and machinery, and exports into intermediate, capital and consumption goods. These sub-components have different import intensity and so if monetary policy drives a change in the their composition, that could explain why the inclusion of the aggregated IAD, which does not account for sub-components import intensity, is not sufficient to explain the 2023 import drop.

To calculate the import content across exports' types we follow the methodology of Soklis (2009) using OECD's input-output tables. Specifically, we use the following formula:

$$u^T * (I - A^D), \tag{4}$$

where u^T represents the share of intermediate inputs in the total value of outputs for a certain sector, that is, it is a vector with elements $u_j^T = \frac{m_j}{x_j}$, where m_j is total imports and x_j is total output for sector j, and $(I - A^D)$ is the Leontief matrix for domestic products. Once we have calculated import content for all the sectors, we use the concordance package developed by Liao and others (2021) to map the ISIC4 into the BEC4 industry classification. Finally, we use an unweighted average to calculate import content by broad economic categories. The import intensity of intermediate goods is 33 percent while the import intensity of consumption goods is just 24 percent (Table 4).

Table 4: Import intensity by BEC classification

Exports good sub-component	**Import intensity in %**
Capital goods	33.8
Intermediate goods	33.3
Consumption goods	24.4

Note: The import content per sector was calculated from OECD's TiVa input-output tables. The totals are calculated as an unweighted average across sectors.

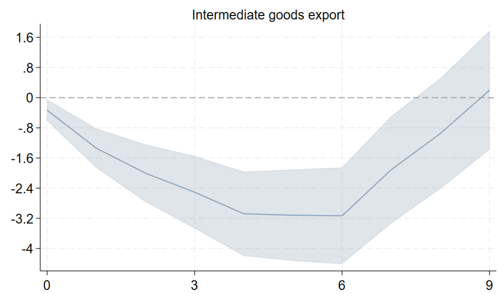
Turning to investment, the import intensity of machinery investment is higher than that of construction (according to the 2021 TiVa database, foreign value added in domestic demand in the European union in 2020 is about 20 percent and 1.3 percent of total value added for machinery and construction sectors, respectively). Regarding private consumption, durable goods are intensively traded, as discussed in Bems, Johnson, and Yi (2013) and Bems, Johnson, and Yi (2011).

Since the demand sub-components are not available with a seasonal adjustment and tend to exhibit significant volatility, we smooth these series with a simple moving average transformation. We start

[4] For an alternative way of looking at demand component shares in total GDP see B

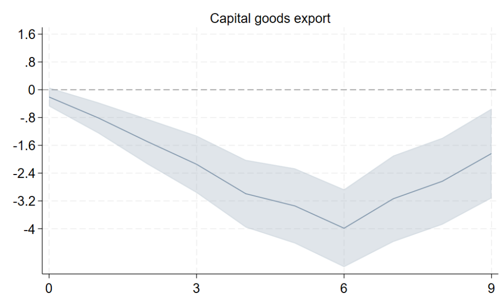
the description of the results with exports. Figure 19 shows that, following a monetary policy tightening, intermediate and capital goods exports fall significantly more (Figure 19a and 19c) than total exports, while consumption goods fall by less (Figure 19b). This suggests that the share in total exports of capital and intermediate goods decreases, while that of consumption goods increases after a tightening. According to Table 4, this composition change results in higher domestic value added embedded in total exports after a tightening.

Figure 19: Effect of monetary policy shocks on exports components



(a) Intermediate goods exports

(b) Consumer goods exports



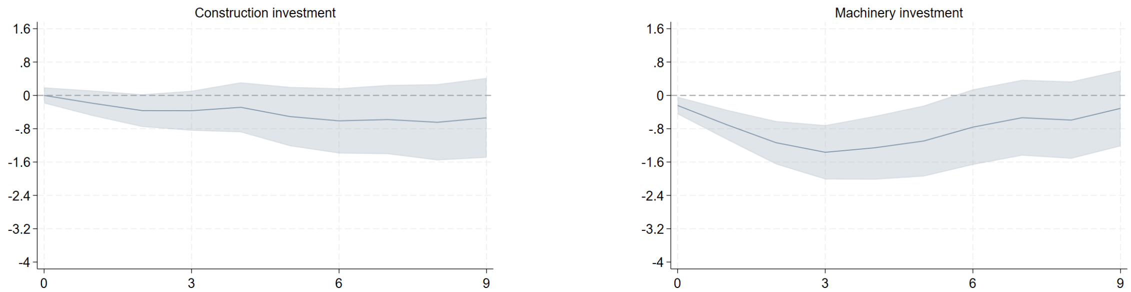
(c) Capital goods exports

Note: The figures report the impulse response functions and the associated 90 percent confidence bands estimated with Equation 3.

Moving to investment, Figure 20 shows that construction falls by less (Figure 20a) while machinery investment falls by more (Figure 20b) than overall investment. This suggests that the share in total investment of machinery investment decreases and that of construction increases following a monetary policy tightening. Since the import intensity of machinery is higher than of construction, this shift in composition also lowers the import content of investment.

Finally, the shift in import intensity of consumption following a monetary policy tightening is less clear. Figure 21 illustrates that durable consumption decreases slightly less, while non-durable consumption decreases slightly more compared to overall consumption. Monetary policy appears to have a minimal impact on the composition of consumption, with a tendency to slightly increase the import intensity of consumption

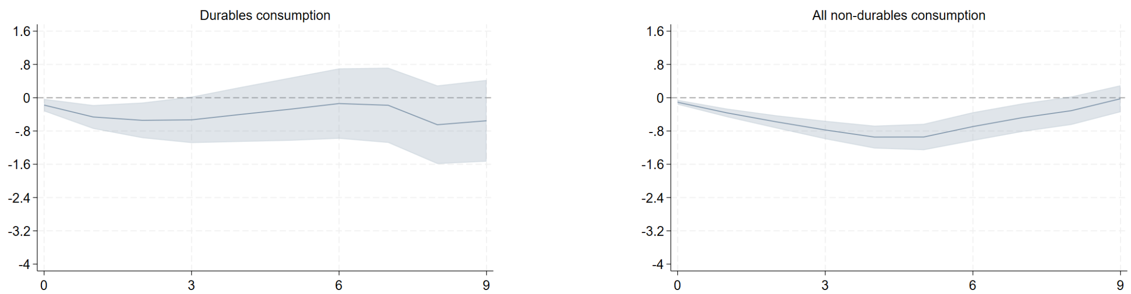
Figure 20: Effect of monetary policy shocks on investment components



(a) Construction Investment (b) Machinery Investment

Note: the figures report the impulse response functions and the associated 90 percent confidence bands estimated with Equation 3.

Figure 21: Effect of monetary policy shocks on private consumption components



(a) Durables consumption (b) Non-durables consumption

Note: the figures report the impulse response functions and the associated 90 percent confidence bands estimated with Equation 3.

Overall, these results suggest that there is a shift in internal composition of investment and exports that reduces their import intensity. This means that GDP relies more on domestic value-added content and less on foreign-value added following a monetary policy tightening. Moreover, it explains why the inclusion of interest rates in the IAD regression helps to improve its explanatory power in explaining import during the recent tightening episode.

6.3 Monetary policy shocks with global monetary policy synchronization

In section 5.2, we provided suggestive evidence that monetary policy synchronization is an important factor in explaining the recent missing imports in the euro area. We first argued that that when a single country tightens its monetary policy, it alters its demand composition, resulting in lower imports at the same level of GDP. A tightening in domestic lending rates at times of global monetary policy tightening would lead to a less significant exchange rate appreciation, which in turn should amplify the negative effect on imports making the disconnect between import and GDP even larger. In this section, we test this hypothesis by exploiting the dynamic local projection setting and the high frequency monetary policy shocks. More specifically, we interact the monetary policy shock with a dummy equal to one for values of synchronization above the sample mean $\mathbb{I}\{Sync_t > \overline{Sync_t}\}$. We estimate the following regression for imports:

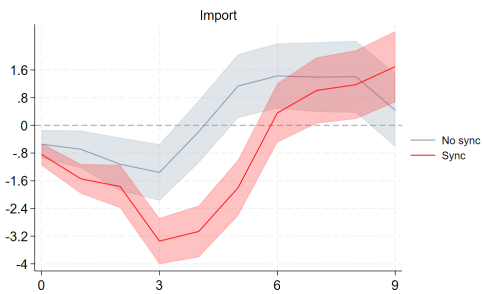
$$\begin{aligned} Y_{c,t+h} - Y_{c,t-1} = &\sum_{p=1}^{P} \delta_p^h \Delta Y_{c,t-p} + \sum_{p=0}^{P} \beta_p^h \, shock_{t-p} \\ &+ \sum_{p=0}^{P} \theta_p^h \, shock_{t-p} * \mathbb{I}\{Sync_t > \overline{Sync_t}\} + \delta^h \mathbb{I}\{Sync_t > \overline{Sync_t}\} \\ &+ \sum_{p=1}^{P} \gamma_p^h X_{c,t-p} + \alpha_c^h + \tau_q^h + \varepsilon_{c,t+h} \end{aligned} \quad (5)$$

where the policy shock is the series developed by Jarociński and Karadi (2020), and the controls include inflation, the real effective exchange rate, STOXX 50, and IAD. Country and quarter time fixed effects are also included.

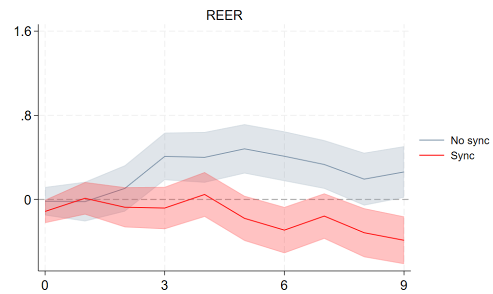
An exogenous tightening domestic monetary policy shock should weaken economic activity, reducing domestic demand for imports. At the same time, the exchange rate typically tends to appreciate, making imports cheaper and partially offsetting this decline in demand. Figure 22a shows that the first effect dominates and imports fall after the monetary policy tightening. Moreover, Figure 22a suggests that the negative impact of monetary policy tightening on imports is amplified in periods of global monetary policy tightening synchronization (the red line in the figure), providing supporting evidence for our amplification hypothesis.

Finally, an important channel through which monetary policy affects imports is through the exchange rate. We close this section by testing how monetary policy synchronization affects exchange rate developments. For that, we use the same specification as in equation 5, but with the exchange rate as the dependent variable and with inflation, productivity per worker, and trade openness, defined

Figure 22: Monetary policy shocks and global tightening



(a) Import



(b) Real effective exchange rate

Note: the figures report the impulse response functions and the associated 90 percent confidence bands estimated with Equation 5. The red line corresponds to the sum of coefficients β^h and θ^h, while the blue line corresponds to β^h.

as import plus export as a share of GDP, as controls. Figure 22b shows that synchronization plays a major role in determining exchange rate developments after a monetary policy tightening. When global monetary policy is not synchronized, the real effective exchange rate follows the expected dynamics and appreciates after three quarters. Interestingly, when there is a global tightening, the exchange rate initially does not move and eventually depreciates after a domestic monetary policy tightening. This is consistent with movements in the exchange rate depending on relative interest rates.

Caldara and others (2024) also finds that monetary policy synchronization amplifies the impact of monetary policy shocks in the domestic economy. However, Caldara and others (2024)'s main amplification mechanism relates to the presence of global lenders that enhance the effect of monetary policy on financial conditions when countries tighten at the same time. Our paper highlights instead the interaction of monetary policy synchronization and the change in the country's composition of domestic demand that can amplify the impact on monetary policy tightening on import.

7 Conclusion

This paper has investigated an overlooked channel of monetary transmission, the relationship between central bank interest rate policy and the economy's trade position. Our findings indicate that monetary policy may exert a greater influence on trade than previously recognized. In particular, we argue that the relationship between monetary policy and a country's import position, mediated by changes in the composition of domestic demand, represents a crucial monetary policy transmission channel that warrants thorough investigation. As the ECB enters a new phase of its policy cycle, it is crucial to accurately assess the impact of monetary policy on each component of GDP to ensure its effective calibration. Motivated by a disconnect between economic activity and import in 2023 in the euro area and building on the literature on the 2008-2009 great trade collapse, this study estimates import demand elasticities by considering the import intensity of various demand components. Although incorporating demand composition and import intensity improves model performance during the GFC, it fails to address the missing trade puzzle in 2023.

The introduction of country-specific lending rates in the baseline model, which proxy for monetary policy stance, enhances the regression fit, indicating that the monetary policy tightening initiated in mid-2022 contributed to declining imports. The fit of the model including lending rates improves significantly compared to the baseline import elasticity model. This improvement is particularly pronounced in 2023. High lending rates are shown to increase the sensitivity of imports to domestic demand, suggesting that monetary policy impacts imports through demand composition, due to varying interest-sensitivities among components. Notably, exports exhibits the highest sensitivity to interest rate conditions, consistent with existing literature on the capital needs of international transactions. Additionally, investment is found to have a negative correlation with financial conditions.

While capital goods imports show an increasing elasticity to domestic demand with rising interest rates, this non-linear effect is less pronounced for semi-durable and durable consumption goods. These effects are inadequately captured by the import intensity-adjusted demand measure, leaving the baseline model insufficient to explain the decline in imports in 2023. Other potential explanations, such as the unwinding of the pandemic crisis, lack supporting evidence, and controlling for variables like exchange rates and trade policy uncertainty cannot adequately explain the missing trade. To verify the heterogeneous impact of monetary policy on demand components and their sub-components, we estimate the effects of exogenous monetary policy shocks on each one of them using local projections. We find that exports and investment, the components with the highest import intensity, display the highest decline following an exogenous monetary policy shock. Private consumption also declines, but less so, whereas government consumption, the least import intensive of all components, is not affected by the shock. When zooming into the various sub-categories, we confirm that the sub-components that have the highest import intensity, namely intermediate goods exports and machinery investment also have the highest sensitivity to monetary policy shocks. Overall, these results confirm that monetary policy triggers a shift in the within-demand composition that reduces GDP's import content. Domestic production and consumption tend to rely more on domestic value-added content and less on foreign-value added following a monetary policy tightening. Finally, the paper shows that global monetary policy tightening coordination amplifies the negative effect of domestic monetary policy tightening. A tightening in domestic lending rates at times of global monetary policy tightening leads to a less significant exchange rate appreciation, which in turn amplifies the negative effect on imports making the disconnect between import and GDP even larger.

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A Appendix A - Data

This section presents the summary statistics of the variables used to estimate the import elasticities in Section 5 in Table 1 and Table 3. All variables are presented in year-over-year percentage changes. Import, GDP, inventories, import prices, and the share of services in total private consumption are obtained from Eurostat. IAD is also constructed using Eurostat data, as well as OECD Input Output tables, as explained in Section 4. Lending rates are from the ECB downloaded through Haver and corresponds to the interest rate on outstanding loans to non-financial corporations. The share of countries tightening to proxy for monetary policy synchronization is calculated following Caldara and others (2024) using IMF BIS data. The federal fund rate is from the Federal Reserve Board obtained through Haver. Trade policy uncertainty is from Caldara and others (2020). The real effective exchange rate is from the BIS,

Table 5: Summary Statistics - Import Elasticity Regressions

	mean	sd	min	max	count
Real import	0.00	0.11	-0.42	0.30	666
Import prices	0.02	0.08	-0.24	0.26	666
GDP	0.01	0.04	-0.24	0.18	666
IAD	0.01	0.05	-0.24	0.26	666
Inventories	0.01	0.01	-0.04	0.07	666
Share of services in consumption	-0.00	0.04	-0.27	0.22	518
Lending rates	0.00	0.24	-0.80	1.14	666
Share of countries tightening	0.35	0.27	0.00	0.95	702
Federal fund rate	0.03	1.24	-3.24	3.39	666
Trade policy uncertainty	0.05	0.41	-1.10	1.29	666
Real effective exchange rate	-0.00	0.02	-0.06	0.05	592

The data for different categories of import classified according to the Broad Economic Classification (BEC) are obtained from Eurostat. Capital goods corresponds to category 410. Consumption goods correspond to categories 111, 121, 210, 222, 310, 322, 420, and 530. Durables and semi-durables correspond to categories 610 and 620. Non-durables correspond to category 630.

B Appendix B - Demand components as compositional data

In this section, instead of looking at each demand component one at a time, we model the changes in demand composition all at once, allowing the share of one demand component to affect the others. We can model simultaneous changes in shares as follows: First, we build the demand component shares:

$$y_{w,c,t} = \frac{w_{c,t}}{GDP_{c,t}}, \tag{6}$$

$y_{w,c,t}$ measures the share of the component $w_{c,t}$ for country c at time t, where $w_{c,t} \in$ {Private consumption, Government Consumption, Investment, Exports}. Similarly, we calculate the shares of each demand sub-components within the broader GDP expenditure categories:

$$y_{k,c,t} = \frac{k_{c,t}}{w_{c,t}}, \tag{7}$$

where $k_{c,t} \in$ {Durable consumption, Services Consumption, Consumption goods other than durables } for private consumption, $k_{c,t} \in$ {Machinery, Construction, Intellectual property } for private investment and $k_{c,t} \in$ {Capital goods, Intermediate goods, Consumption goods} for exports.
We stack each variable $y_{w,c,t}$ and $y_{k,c,t}$ into vectors $Y_{w,c,t}$ and $Y_{k,c,t}$, respectively. Note that the vectors $Y_{w,c,t}$ and $Y_{k,c,t}$ belong to the Simplex, which is formally defined as:

$$Y_{w,c,t}, Y_{k,c,t} \in S^D, \tag{8}$$

where:

$$S^D = \left\{ \langle x_1, \ldots, x_D \rangle^\top : x_i > 0,\, i = 1, \ldots, D; \sum_{i=1}^{D} x_i = \kappa \right\} \tag{9}$$

Kynčlová, Filzmoser, and Hron (2015) defines a compositional time series (CTS) as a multivariate time series where each time data point is a composition, meaning the components are at the simplex at every period. This constraint poses challenges for standard multivariate time series methods due to the unique geometry of compositional data, known as Aitchison geometry. This geometry must be considered to properly analyze CTS.[5]
Several methods for modeling CTS have been developed, with the primary approach relying on log-ratio transformations. These transformations convert CTS into real coordinate space, bypassing the unit sum constraint and enabling the application of standard multivariate time series techniques. Pawlowsky-Glahn and Buccianti (2011) and Kynčlová, Filzmoser, and Hron (2015) find that the full compositional VARIMA and VAR models, and their estimation of parameters is independent of

[5]This type of compositional data represents a special case different from standard statistical methods. It was first studied by Aitchison (1982) and some special cases explained in Buccianti and Pawlowsky-Glahn (2011). One important difference is that the vectors in the simplex S^D carry relative information, which is given by the ratios between the components (parts). Moreover, traditional methods are typically used for data originating from real Euclidean space, which follows Euclidean geometry. However, compositional data naturally reside in the simplex (Aitchison (1982)). As a result, applying classical statistical techniques to model compositional data may produce unreliable or misleading results.

the chosen log-ratio transformation. The remaining provides a brief description of the geometry of compositional data and how to map it back to real coordinates. Given the definitions explained in the subsection B.1, we can build a regression model with compositional dependent variables.
The simplex space defined in equation 9, is a $(D1)$ dimensional vector space. The simplex S^D is endowed with the operations of perturbation and power transformation, defined for compositions $\mathbf{x}, \mathbf{y} \in S^D$ and $\alpha \in \mathbb{R}$ as

$$\mathbf{x} \oplus \mathbf{y} = C(x_1 y_1, x_2 y_2, \ldots, x_D y_D)^\top, \quad \alpha \odot \mathbf{x} = C(x_1^\alpha, x_2^\alpha, \ldots, x_D^\alpha)^\top$$

where $C()$ denotes the closure operation that converts each compositional vector from R^{D-1} into its representation in S^D. The inverse perturbation Θ can be defined as

$$\mathbf{y}^{-1} = C\left(y_1^{-1}, y_2^{-1}, \ldots, y_D^{-1}\right)^\top,$$

$$\mathbf{x} \Theta \mathbf{y} = \mathbf{x} \oplus \mathbf{y}^{-1}$$

Additionally, the Aitchison (1982) inner product is defined for two compositions $\mathbf{x}, \mathbf{y} \in S^D$ as

$$\langle \mathbf{x}, \mathbf{y} \rangle_a = \frac{1}{2D} \sum_{i=1}^{D} \sum_{j=1}^{D} \ln \frac{x_i}{x_j} \ln \frac{y_i}{y_j}$$

which induces the Euclidean vector space structure of the simplex S^D. The inner product can be used to construct a norm and a distance in the simplex

$$\|\mathbf{x}\|_a^2 = \langle \mathbf{x}, \mathbf{x} \rangle_a, \quad d_a(\mathbf{x}, \mathbf{y}) = \|\mathbf{x} \Theta \mathbf{y}\|_a$$

An important property of the Aitchison (1982) distance is that it is invariant under perturbation and permutation of the parts (Buccianti and Pawlowsky-Glahn (2011)). Compositional data can be represented as a perturbation-linear combination of compositional vectors, creating a basis in Aitchison geometry. To analyze them, we transform these compositions into real-valued coordinates using log-ratio transformations, which involve taking logarithms of ratios. The best way to represent compositions is through coordinates based on an orthonormal basis, ensuring a direct and consistent mapping between Aitchison geometry and standard Euclidean space. This paper uses the same strategy as in Kynčlová, Filzmoser, and Hron (2015) and applies isometric log-ratio (ilr) transformations (Egozcue and Pawlowsky-Glahn (2005)) in order to facilitate the interpretation in coordinates. More formally, the ilr transformation maps a composition $\mathbf{x}$ in the simplex S^D to an orthonormal coordinate system in Euclidean space $\mathbb{R}^{D-1}$, using the following equation:

$$\operatorname{ilr}(\mathbf{x}) = (z_1, \ldots, z_{D-1})^\top, \quad z_j = \sqrt{\frac{D-j}{D-j+1}} \ln \frac{x_j}{\sqrt[D-j]{\prod_{i=j+1}^{D} x_i}}, \quad j = 1, \ldots, D-1$$

This transformation ensures that the new coordinates $\mathbf{z} = (z_1, \ldots, z_{D-1})^\top$ are orthonormal with respect to the Aitchison geometry, enabling the use of standard statistical methods in Euclidean

space. Finally, the inverse ilr transformation $x = ilr^1(z)$ is used to express the coordinates back on the simplex.
Given the definitions explained above, we can build a regression model with compositional dependent variable using the linear Aitchison structure of the simplex:

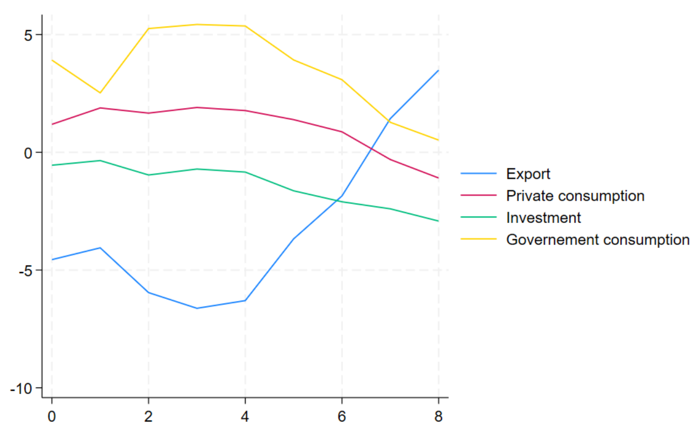
$$Y_{w,c,t} = b \oplus \left(A^{(1)} \odot Y_{w,c,t-1}\right) \oplus \left(A^{(2)} \odot Y_{w,c,t-2}\right) \oplus \cdots \oplus (\beta \odot MP_t) \oplus w_t \tag{10}$$

where $Y_{w,c,t}$ was defined earlier as a vector containing the shares of private consumption, government consumption, investment and exports over GDP, and MP_t is the usual monetary policy shock. After the ilr transformation, the $Y_{w,c,t}$ compositional vector becomes the real vector $z_{w,c,t}$, and equation 9 can be re-written as a usual LP:

$$z_{c,t+h} = \sum_{p=0}^{P} c_p^h z_{t-p} + \sum_{p=0}^{P} A_p^h shock_{t-p} + \varepsilon_{c,t+h} \tag{11}$$

where c_p is a real value, and $\varepsilon_{c,t+h}$ is the error.
The results obtained with this methodology reinforce the findings of Section 6 with greater rigor. Examining the composition of GDP, Figure 23 shows that demand becomes less import-intensive following a monetary policy tightening. Specifically, the export-to-GDP ratio declines by over 2 percent, while government consumption rises by nearly 3 percent. Additionally, there is a slight initial decrease in investment-to-GDP ratio and a corresponding increase in private consumption-to-GDP ratio. After 2 years, the shares of exports, private and government consumption broadly return to their initial values, but the share of investment remains about 2 percent below the pre-shock level. Overall, the result that monetary policy changes the composition of demand in a way that lowers its import intensity is robust to modeling changes in the composition of demand simultaneously.

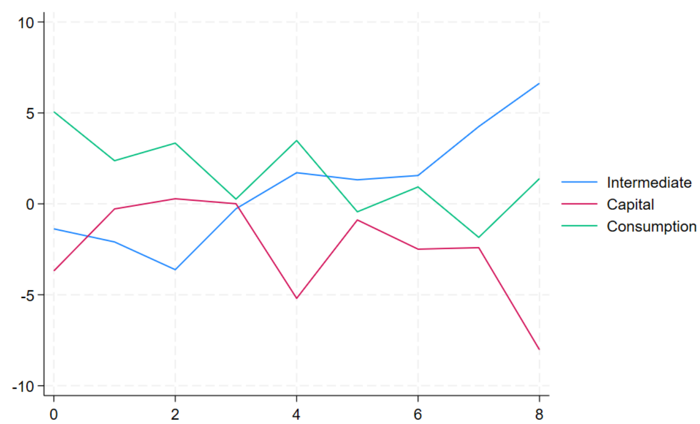
Figure 23: Changes in GDP composition, measured in % of GDP



Note: the figure reports the changes in the shares of each demand component over GDP.

Diving into the expenditure components, figure 24 suggests that exports become less import-intensive following a monetary policy tightening. Specifically, the capital and intermediates to export ratio decline at the impact while the consumption goods-to-export ratio increases. The share of intermediates keeps falling for 3 quarters before recovering. This result is also consistent to the analysis of Section 6 on the composition of exports.

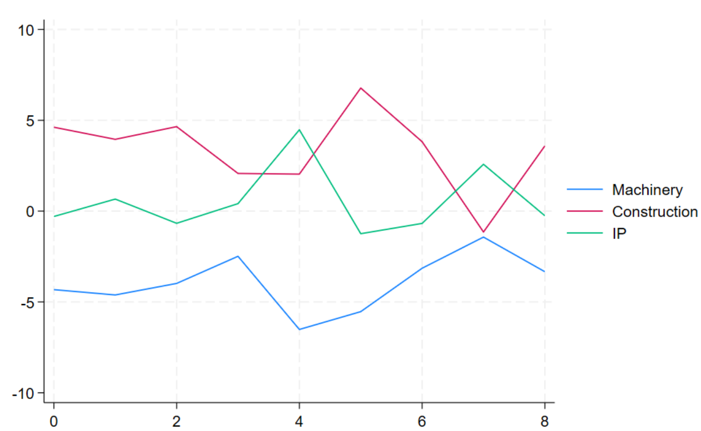
Figure 24: Changes in exports composition, measured in % of exports



Note: the figure reports the changes in the shares of each export sub-components over total exports.

Figure 25 indicates that machinery investment is more interest-sensitive than construction, as evidenced by a decline in the machinery-to-investment share and a rise in the construction share. The share of intellectual property investment remains largely unchanged. It takes nearly two years for these shares to return closer to their initial levels. This shift in composition also suggests that investment becomes less import-intensive following a monetary policy tightening.

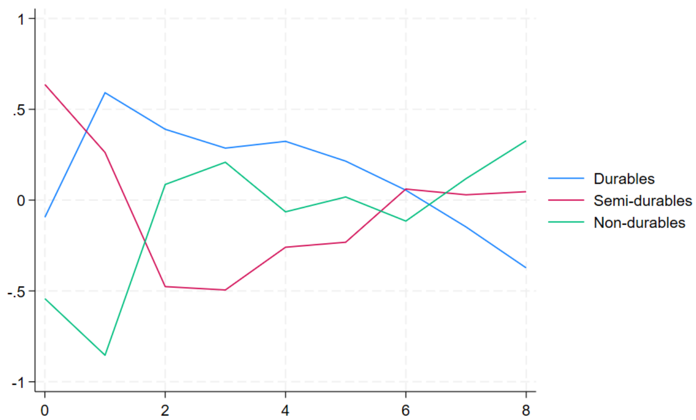
Figure 25: Changes in investment composition, measured in % of investment



Note: the figure reports the changes in the shares of each investment sub-components over total investment.

Finally, we conduct the same analysis for private consumption. Unlike exports and investment, there is no clear evidence that consumption becomes less import-intensive following a monetary policy shock. As shown in Figure 26, the share of semi-durables initially increases while that of non-durables decreases, whereas durable consumption remains largely unchanged. After three quarters, the semi-durables share falls below its initial level, while non-durables return to their original proportion. Overall, the compositional changes in consumption are much smaller than those observed for exports and investment, suggesting that any shift in consumption import intensity would be minimal.

Figure 26: Changes in consumption composition, measured in % of private consumption



Note: the figure reports the changes in the shares of each consumption sub-components over total consumption.

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