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Trade and fiscal policy links: The twin deficit risk from a network perspective*

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1 Introduction

The integration of financial markets and the real sector, driven by the increase in international trade flows and investments, presents significant challenges in terms of economic policy. In particular, national macroeconomic objectives, such as growth, price stability, or debt sustainability, are more prone to be influenced by global and regional shocks, international agreements, and institutional arrangements that, together with structural characteristics of each system, condition the policy instruments, transmission channels and effectiveness of State intervention. The European Union, as a political and economic entity including 27 countries, has fostered an institutional architecture that combines a single market of goods, high mobility of labor and capital, a common currency, and a set of policies aiming at fiscal discipline and debt sustainability. Considering this context, we summarize the main findings of the working paper Baltodano López et al. (2024), which explores the relationship between external and fiscal balance from a network perspective, with a particular focus on its policy implications and its relation to the existing literature.

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In the EU framework, the effectiveness of these common policies is a on–going debate as part of the gradual process of European integration. This process has been challenged by specific events such as the Financial crisis, the debt crisis, Brexit, or COVID–19, which interact with structural issues, such as the persistent polarization between their members. In particular, Lopez-Gomez (2024) studies the income per capita convergence of the EU members and finds multiple convergence clusters influenced by political institutions, trade flows, and other variables. Similar results of no global convergence hold at a regional level where the economic structure and a solid manufacturing sector and service activities with high productivity are key elements explaining the high polarization (Cutrini, 2019). This long–term heterogeneity may limit the resilience of the system during extreme shocks and economic policy response (e.g., Bănică et al., 2024).

Although, the single market and the factor mobility contribute to the flexibility of the economy by reducing barriers the structural differences persist. Petrović et al. (2020) develop a computational theoretical model to determine the conditions for a successful monetary and trade union and they identify that the productivity gap may be exacerbated without a fiscal integration of the members in conjunction with recurring fiscal and external unbalances. From an empirical perspective, Uni (2018) compares the expanding trade imbalance in East Asia, primarily driven by the export-led growth strategies of countries like China, Korea, and Taiwan, with the Eurozone characterized by competitiveness disparity and underlines how the common currency limits the members' ability to respond to asymmetric shocks and exacerbates imbalances by preventing currency depreciation. In other words, private incentives are not enough to close productivity gaps and stabilize the fiscal and trade deficits (see also Bruno et al., 2019).

Apart from the imbalances, the productivity gap makes stability policies even more difficult by conditioning the member's participation in Global Value Chains (GVCs). Florio et al. (2025) evaluate the effect of GVC on the Phillips Curve's slope within the European Monetary Union (EMU). Utilizing data from 11 EMU countries between 1999 and 2019, their research reveals that increased GVC participation correlates with a flatter Phillips Curve, suggesting a weakened link between domestic unemployment and inflation. This flattening implies that traditional monetary policy tools may be less effective in controlling inflation, as domestic economic conditions are increasingly influenced by global production networks. In this sense, domestic measures alone may be insufficient in managing inflation. In the case of fiscal policy, the accumulation of external deficits may jeopardize external debt sustainability while reducing the policy space. Barbosa-Filho (2004) conduct stationarity tests on current account balance-to-GDP ratios and cointegration tests between exports and imports of goods and services to assess the long-term equilibrium relationships and find evidence of instability in eight out of twenty–two EU countries included in their sample.

Considering the complexity of the trade and fiscal balances, the context of economic integration, and common institutional arrangements, a dyadic perspective can complement policy analysis. Network models are convenient to deal with propagation, contagion, and structural dependence (Graham, 2020). Although the network perspective seems a natural framework in the context of multiple sources of instability in the economy, few studies have jointly considered both balances and higher–order dependence through network moments

simultaneously. Baltodano López et al. (2024) propose an initial step towards a compound risk approach. The following section 2 examines the literature on twin–deficits for the EU and describes their policy considerations. Section 3 summarizes the main findings in Baltodano López et al. (2024) with the updated results from a set of periodic reports. Finally, Section 4 discusses the policy implications of the network approach.

2 The twin deficit phenomenon in the EU

The debate surrounding the twin-deficit hypothesis has been central to macroeconomic research suggesting that fiscal deficits can lead to deteriorating current accounts, especially in economies with high government spending. This relationship, however, is far from straightforward, as its directionality, that is whether fiscal imbalances cause external deficits or vice versa, has remained an open debate. Understanding this dynamic is essential for policymakers, as it shapes the available tools for addressing trade and fiscal imbalances.

Several empirical studies have discussed the causality between fiscal and external deficits, with contrasting arguments. The traditional view suggests that increases in government spending affect imports, which in turn lead to a higher current account deficit, potentially inducing fiscal imbalances. However, the reverse causality has also been indicated, i.e. external shocks or deteriorating external conditions can lead to a decline in output, causing a worsening fiscal balance (Nikiforos et al., 2015). The policy implications of these causal directions differ significantly. In the former case, fiscal interventions might be necessary to restore balance, while in the latter policies aimed at adjusting exchange rates or trade balances are more convenient to avoid.

In the case of no twin–deficit evidence, a Ricardian explanation, where tax–payers foresee future taxes and increase savings is plausible. However, it is not the only possibility, because investments or savings excess can interact with public and external balances based on effective capital mobility, income distribution, and labor market conditions, which is essential in the context of a common currency with no exchange rate policy instruments (e.g., Taylor et al., 2019; Bibow, 2012). Alternative channels linking fiscal and trade balances involve the impact of high deficits or debt levels on a country's reputation, which can, in turn, influence access to trade credit and the terms of trade, ultimately affecting the external balance (Rose, 2005; Gu, 2021).

Another aspect of this debate is the role played by institutional structures. On the one hand, Afonso et al. (2022) finds that stronger fiscal governance can mitigate the link between fiscal and current account deficits, especially in times of fiscal stress. Keita et al. (2023) explore the nonlinear effects of fiscal policies on current account balances in European economies, emphasizing that institutional quality matters in moderating the impact of fiscal deficits on trade balances. Both studies may be interpreted as a credibility improvement channel that allows agents to anchor their expectations reinforcing the Ricardian equivalence hypothesis mechanism. On the other hand, even under explicit rules in an ambiguous context, even if individuals understand all the potential states of the policy, they may still ignore their corresponding probabilities. Some examples examined in the behavioral economic literature comprise the concept of fundamental uncertainty used by

Keynes to give some explanation on the liquidity preference and the irreversibility of investment decisions, or schumpeterian creative destruction process in the cycle movements in the economy (see for example, Dequech, 2000). More rigorous stability requirements to reduce ambiguity aversion effects may create a trade–off with the ability of governments to adjust to external shocks, leading to unintended consequences for the current account. This highlights the need for dynamic and adaptable fiscal policies that account for shifting macroeconomic conditions.

In this sense, an important stream of the literature has stressed that the twin–deficit relationship is not static but varies over time. This time-varying nature has important policy implications, particularly in light of evolving economic conditions such as global demand shifts, interest rate changes, and institutional reforms. Afonso and Coelho (2023) employ a time-varying model to analyze twin deficits in the Euro area and conclude that the relationship between fiscal and external deficits fluctuates in response to changing macroeconomic environments. Their findings suggest that policymakers should account for the temporal dynamics of fiscal and trade imbalances, as rigid policy frameworks may not adequately address the evolving nature of these relationships.

More generally, the inconsistencies between theoretical perspectives and empirical results have often been attributed to non-linearities in the relationship between fiscal and external deficits. Trachanas and Katrakilidis (2013) identify an asymmetric cointegration pattern, where the link between the two sectors is more pronounced during periods of declining deficits. Meanwhile, Bilman and Karaoğlan (2020) highlight the instability of this relationship over time, showing that under conditions of low real interest rates, fiscal and external deficits tend to move together, whereas in high-interest-rate environments, they tend to diverge. Furthermore, Akanbi and Sbia (2018) underscores the role of economic structure and policy orientation, noting that the twin-deficit connection varies between oil-exporting and non-oil economies, as well as between countries following pro-cyclical versus counter–cyclical fiscal policies. Despite extensive research using cross–country samples, existing studies have largely overlooked the issue of interdependence between countries, which could provide deeper insights into the twin–deficit phenomenon.

While much of the literature on twin deficits has focused on the direct relationship between fiscal and external balances, more recent work has highlighted the importance of spillover effects and interdependencies among countries. Network analysis has been applied to understand how fiscal and trade imbalances in one country can affect others, particularly in the context of economic unions such as the EU (Matesanz and Ortega, 2015; García and Rambaud, 2023; Gaysset et al., 2019). These studies underscore the systemic risk that arises from fiscal and trade policies, emphasizing the importance of coordinated policy responses to address the interconnectedness of economic imbalances.

In this spirit, End et al. (2019) develop a public debt relational database with creditors and debtors information of more than 18 countries to analyze their debt management decisions between 1913—1946 in a context of war–induced unbalances. They show how governments can design more sustainable debt strategies to prevent systemic risk, which is influenced by debt arrangements, currency regimes, and banking systems. Regarding more recent times, Matesanz and Ortega (2015) analyze debt synchronization in the EU, revealing that countries are not isolated from each other's fiscal challenges, especially during

times of crisis. The network density increased during the 2008 financial crisis, highlighting the interdependence of fiscal policies across the region. Similarly, García and Rambaud (2023) show that volatility in sovereign bond markets in southern Europe can be transmitted to other countries, influenced by European Central Bank policies and inflation rates. Still, networked vulnerability highlights the need for integrated fiscal and monetary policies that account for cross–border spillovers. These analyses focus on the dependence between countries but do not consider the different types of relationships between EU members, such as trade and capital mobility.

3 Results from a network perspective

In order to study the link between trade and fiscal deficits together with the cross–country dependence in a unified framework, Baltodano López et al. (2024) use a Dynamic Stochastic Block Model for Multi-Layer Networks (DSBMM) proposed in Baltodano López and Casarin (2023). In a standard network setting, there are two essential elements: i) the nodes, that is, the member states of the EU, and ii) the edges that provide information on the relationship between each pair of countries. In the DSBMM, two more dimensions are considered: iii) time, to analyze the evolution of the pairwise connections, and iv) layers that stand for the two different types of interactions between the countries—i.e., trade and debt synchronization.

3.1 Data structure

The trade layer edges are directly observed because they represent the level/growth of the imports/exports between countries. In contrast, the debt/fiscal layer is not available in a quarterly frequency as the trade flow and it must be estimated using the correlations of the debt–to–GDP changes. In other words, a high (negative) positive correlation between two EU members reflects a high (divergence) synchronization in the fiscal balance, while a correlation close to zero suggests no relationship between the fiscal evolution of the two economies.

Table 1 shows the up–to–date characteristics of the database for specific quarters. For the trade layer, the average strength (AS) represents the mean of the trade flows across all pairs of countries. As expected from an integration process, there is an increasing trend in the average levels of imports/exports of the EU members, except in the last part of the sample which indicates a slowdown potentially due to geopolitical conflicts, energy prices, and low demand (e.g., Qiu et al., 2025). Still, the members trade with the rest of the EU without a need for intermediaries, which is reflected in a high network density (De) and the betweenness centrality ($ABetCen$), and consistent with the rest of the network indicators. In contrast, in the fiscal layer, the De is far from one (full integration), which may indicate that the members are not following a single trend. Moreover, there are fluctuations in the average number of synchronized countries (average degree, AD), in particular for extreme shocks such as COVID–19. Although both layers differ in some of the network indicators, the average clustering ($AClueCoe$) is high for the two types of links. This means that it is highly likely that members with similar trends in trade/debt also share a third member

Table 1: *Connectivity in the Trade–Debt networks*

Date	$AD(S)$	$AID(S)$	De	$APL^{\dagger}$	$WCC^{\dagger}$	$SCC^{\dagger}$	$AClueCoe^{\dagger}$	$ABetCent^{\dagger}$
Trade Flows Layer (weighted and directed):								
2004 Q1	28.67	14.34	1	0	1	1	1	49.48
2008 Q4	39.41	19.7	1	0.01	1	1	1	40.7
2020 Q1	54.59	27.29	1	0.01	1	1	1	35.3
2023 Q1	77.43	38.72	1	0.02	1	1	1	40.93
2024 Q1	72.51	36.26	1	0.02	1	1	1	39
2024 Q3	69.81	34.9	1	0.01	1	1	1	40.67
Debt Layer (unweighted and undirected):								
2004 Q1	7.63	7.63	0.29	2.04	1	1	0.61	13.48
2008 Q4	16.07	16.07	0.62	1.45	1	1	0.89	5.85
2020 Q1	13.41	13.41	0.52	1.58	1	1	0.74	7.59
2023 Q1	18.37	18.37	0.71	1.33	1	1	0.9	4.33
2024 Q1	11.41	11.41	0.44	1.61	2	2	0.79	7.37
2024 Q3	17.48	17.48	0.67	1.36	1	1	0.87	4.67

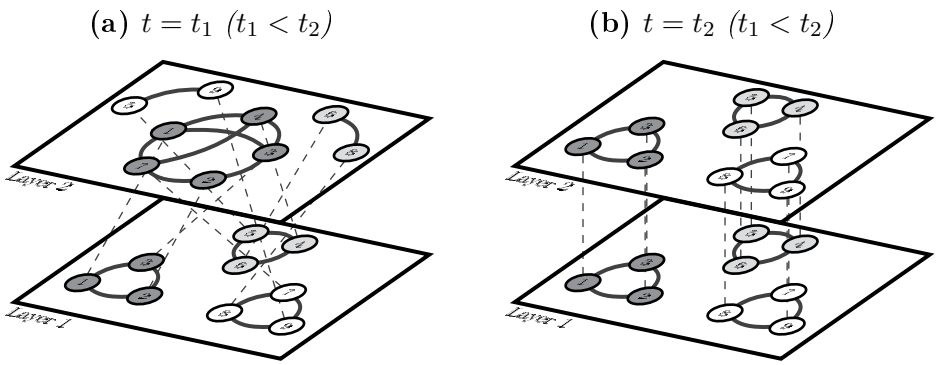
Note: Average Degree (AD), Average In–Degree (AID), Density (De), Average Degree Strength (ADS), Average Degree In–Strength ($AIDS$), Average Path Length (APL), Number of Weakly and Strongly Connected Components (WCC and SCC), Average Clustering Coefficients ($AClu Coe$), Average Betweenness Centrality ($ABetCen$). The indicators with † account for the weights of the Trade Flows. Trade flows are expressed in thousands of millions.

that is synchronized with both of them—triangles of edges. A high clustering coefficient indicates the existence of groups of countries with analogous connectivity behavior within the cluster, but heterogeneous across clusters, i.e. not a single, but multiple trends. A network perspective of the twin–deficit phenomenon implies an overlap of the groups of countries in the trade and fiscal layer because it would suggest that countries with similar trends in international trade are highly negative or positively correlated. However, these groups are not directly observable from the data, and the twin–deficit at a network level cannot be tested.

3.2 Results

The application of the DSBMM approach to twin–deficit allows for membership estimation and fiscal–trade clustering dependence. Figure 1 illustrates a toy example of this model and the concept of unidirectional non–linear Granger–Block causality. In this case, there are nine countries with two types of relationships between them: trade (layer 1) and fiscal relationships (layer 2) at two points in time t_1 and t_2. For instance, at time t_1, the edge between countries 4 and 5 in layer 1 suggests these two countries exchange goods and services, while in layer 2 there is no interaction between them implying no debt synchronization. The DSBMM is used to estimate the gray shades of the nodes that identify the clusters/blocks

Figure 1: *Example of a Dynamic undirected and unweighted network with two layers over time (different panels), where Layer 1 causes Layer 2. In each panel, the block structure (grey shades) and node alignment (dashed lines). Figure from Baltodano López and Casarin (2023).*



of countries with dense within–group interactions and low between–group interactions.[1] At t_1 in layer 1, the countries 4 to 6 are in the same group considering that they only trade among them, but these countries belong to different groups in terms of fiscal trend (layer 2). Therefore, at time t_1 there is no overlap between the block structure of the trade and fiscal layer. In contrast, at t_2 there is a perfect overlap between the groups, which reveals a fiscal-trade clustering dependence. Considering that the blocks remain the same in the trade layer (layer 1), the direction of the dependence goes from trade interactions to fiscal trend similarity—a unidirectional non–linear Granger–Block causality. In other words, the structural heterogeneity in trade has a predictive power on the groups of countries with synchronized debt trends favoring the twin–deficit interpretation of Nikiforos et al. (2015). The reverse direction of group alignment would favor a standard mechanism of twin–deficit and the no–alignment would indicate no fiscal–trade dependence at the network level.

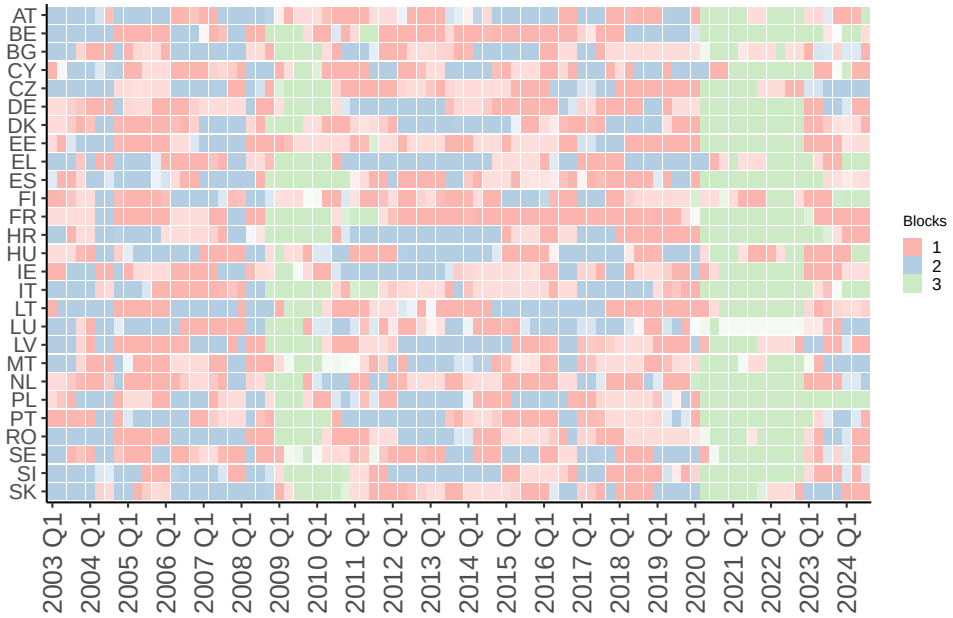
Table 2: *Posterior median and 95% credible intervals (in parenthesis) of the correlation between community q and r in the debt layer after controlling for macroeconomic features. Table from Baltodano López and Casarin (2023).*

$q\backslash r$	1	2	3
1	0.59 [0.57,0.60]	−0.24 [−0.25,−0.21]	0.876 [0.87,0.88]
2	−0.24 [−0.25,−0.21]	0.22 [0.18,0.25]	0.47 [0.38,0.55]
3	0.876 [0.87,0.88]	0.47 [0.38,0.55]	0.973 [0.97,0.975]

Using the empirical data, the DSBMM results indicate that EU countries can be categorized into three distinct blocks based on their connectivity characteristics within the debt network. The features of these groups is summarized by the average correlation within and between them after controlling for macroeconomic features is presented in Table 2. For

[1]The terms group, community, block are used interchangeably to denote a set of EU members with similar network connectivity features.

Figure 2: *Dynamics of block memberships of countries (colors) and membership uncertainty (transparency) in the debt network from 2003Q1 to 2024Q1. Figure from Report III—International trade and public debt from a network approach.*



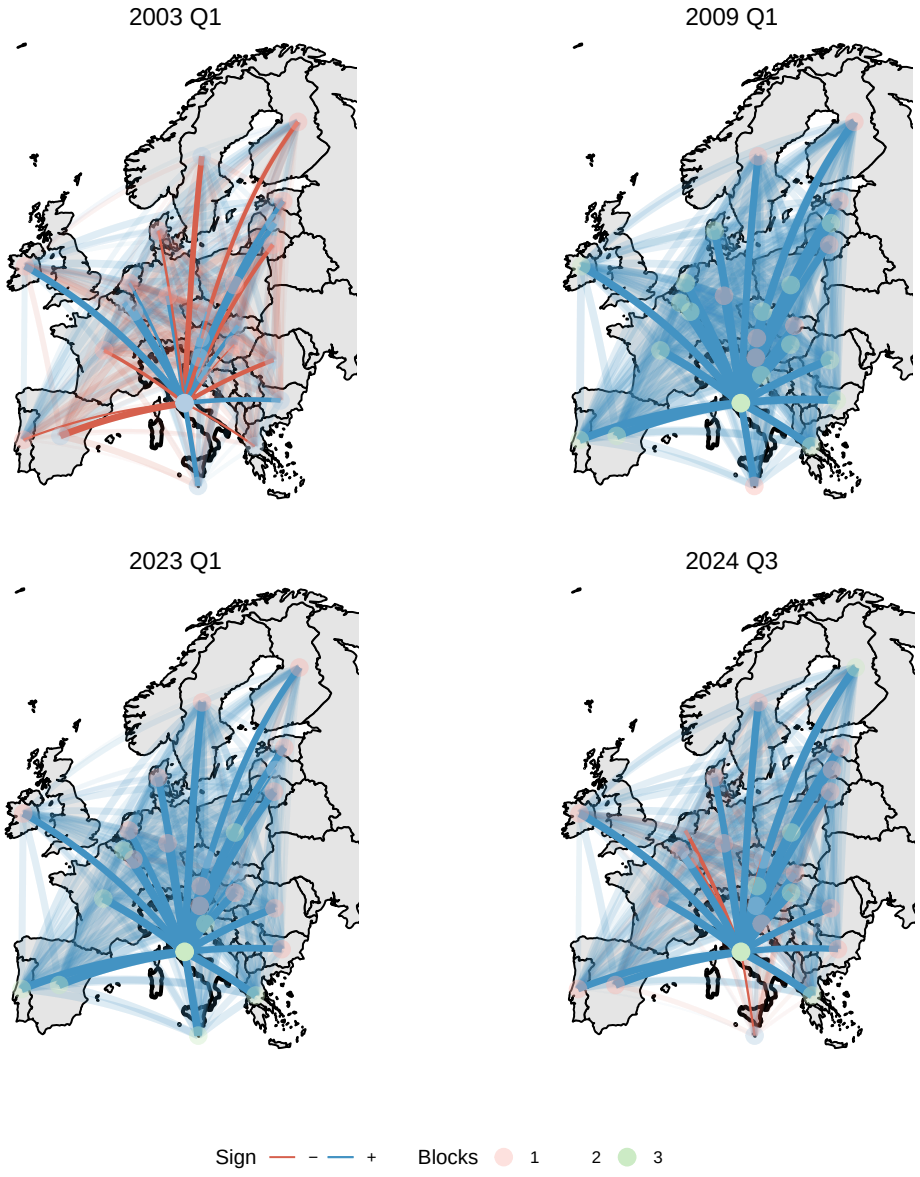
instance, in terms of within–group interaction the (high) low correlation between countries belonging to the (third) second block, (0.973) 0.22, suggests relatively (high) low debt synchronization among them. Thus, based on internal group relationships the countries can be classified in high (3), medium (1), and low (2) synchronization. However, a more convenient classification should also consider the between–group interactions. The joint analysis of all relationships shows that groups 1 and 2 follow an assortative behavior, that is the countries have a high synchronization with members of the same group, but between countries of different groups there is a weak and even negative correlation. On the other hand, the countries in group 3 tend to have high synchronization with all groups, which is usually described as a core–periphery structure. The core (group 3) is well connected with all countries, while the periphery (groups 1 and 2) tends to be less related within and between them.

The group composition is not static. Figure 2 illustrates the block membership of countries (on the y-axis) with different colors and its trajectories over time (x-axis), and the transparency level shows the level of membership uncertainty. The structure of the debt network undergoes significant changes during extreme events, leading to an increase in systemic risks. Notably, a core–periphery structure is evident during negative shocks, as seen with community 3 (green) during the sovereign debt crisis and COVID-19. In contrast, communities 1 and 2 (red and blue) exhibit an assortative structure during normal periods. Therefore, the changes in network clustering are a useful signal for debt management decisions from a supranational perspective that accounts for dependence on the fiscal trends in the rest of EU members, as in End et al. (2019).

In this regard, it is crucial to highlight some specific cases. Poland has consistently

maintained a strong synchronization with other EU member states post-COVID-19, despite having moderate debt-to-GDP ratios. Furthermore, the updated estimates show increased uncertainty in membership following the pandemic, as indicated by transparency levels. This is particularly evident in countries like Austria, Ireland, Belgium, and Lithuania, which is corroborated by the posterior probabilities (refer to Table **??**). A significant systemic risk is observed in Greece, Italy, Hungary, and Finland, as these nations have rejoined the core of the network, suggesting a potential rise in debt-to-GDP trend similarity.

Figure 3: *Italy's links in the extracted public debt network, node's membership (node color) and sign of the correlations (edge color) for 2003Q1, 2009Q1, 2023Q3 and 2024Q1. Figure from Report III—International trade and public debt from a network approach.*



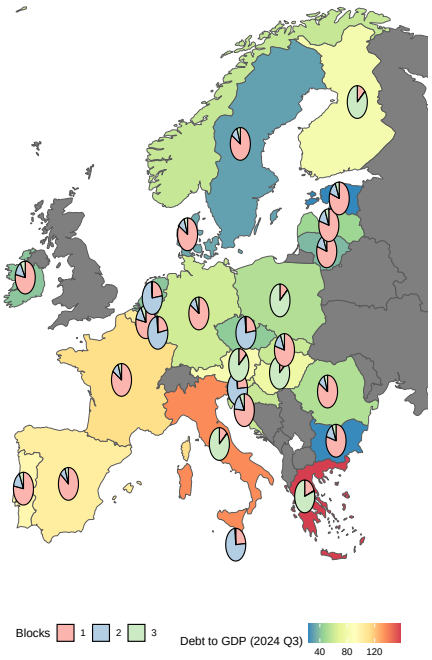
Based on the most recent available quarters, seven countries present a high systemic risk because they belong to the core, while the majority of the remaining countries are grouped in block 1, and only four countries in block 2. As described before, block 1 and block 2 are characterized by an assortative behavior, but block 1 generally exhibits stronger correlations compared to block 2 suggesting a medium risk. From a systemic perspective,

the situation in block 1 appears to be in transition towards a more stable state (block 2), similar to the conditions seen before the COVID-19 pandemic, such as in 2013Q1.

Figure 3 illustrates Italy's debt linkages with other countries. The edges in the figure represent active dependencies between the countries, with the width of the links indicating the strength of the correlation, and the color (red or blue) showing the sign of the relationship, where red indicates a negative correlation and blue a positive one. Italy was in a less risky situation in 2003Q1 belonging to group 2 (blue node) and having negative and positive correlations with the rest of the members, but in 2024Q3 it is part of the core, as evidenced by its strong positive correlations with most other countries.

A one-step-ahead forecast of the transition probability suggests that this pattern will persist into 2024Q4, as shown in Figure 4. The map highlights each country's debt–to–GDP level for 2024Q3, and the pie charts for each country represent the probabilities of their membership in the next period (2024Q4). Italy has a high likelihood of remaining in community 1, with a much lower probability of transitioning to the more stable situation in community 2. This aligns with Italy's debt-to-GDP ratio, which remains the second highest in the network. Other countries, like Finland, show similar probabilities despite having lower debt levels. The one-step forecast shows minimal variation within countries in the same community, suggesting that the trade growth network is not driving transitions in the debt–to–GDP network. This indicates there are no twin-deficit risks present in the system.

Figure 4: *One–step forecast of the transition probabilities of the countries' memberships (pie charts) for 2024Q4 and the level of debt 2024Q3 (colors in the map). Figure from Report III—International trade and public debt from a network approach.*



4 Policy implications

The results presented in the previous section re–interpret the twofold fiscal and trade risk using a dynamic stochastic block model in a multi–layer network context, which allows for clusters of countries sharing similar topological characteristics in each layer and directional dependence between layers through the transition probabilities. From a network lens, in this period a significant systemic debt risk is present in the sample, but no twin–deficits phenomenon is observed in the network clustering. Nevertheless, as indicated by existing literature, monitoring these risks remains crucial for policymaking given the possibility of fluctuations over time.

This study emphasizes the importance of considering the complex relationship between macroeconomic objectives, such as debt and fiscal sustainability, and the need for policy frameworks that account for the interaction between public deficits and international trade flows not only in an integration process, such as the EU but also in a context of international interdependence.

The evidence of no link between fiscal and trade clustering alignment contrasts with part of the existing literature analyzing the twin–deficit phenomenon using panel data and evaluating the importance of institutional context. Further investigation deepening these puzzles between panel and network perspectives can provide more insights for policymakers in the context of composite risk events such as COVID–19 and the financial crisis. Although the network perspective may provide evidence of the global structural dependence, previous studies may focus on the national-level phenomenon.

High–frequency data would be an important tool for policymakers considering the timing in fiscal and trade policy. A possibility is to use the Credit Default Swap (CDS) data to improve the estimation of the network perspective as in Buchholz and Tonzer (2016); Matesanz and Ortega (2015). This would also allow for a comparison of the CDS and debt–to–GDP extracted networks and consider further asymmetries in risks (see for example Giannini and Oldani, 2022). Notice that Granger causality provides important information on the direction of the dependence between fiscal and trade risks, but the frequency of the data may also influence the results (Shojaie and Fox, 2022).

The debt–to–GDP network shows significant shifts in topology during crises, further layers should be considered, such as geopolitical risks, capital flows, and climate risks that cannot be assessed in isolation (e.g., Qiu et al., 2025). Policymakers should adopt an integrated approach that includes the multi–layer and spill–over effects across countries when designing macroeconomic policies. Indeed, the resilience of the system should evaluate the multiple types of relationships between EU members to improve coordination, while identifying targeted interventions. The multi–layer perspective can also provide a more complete view of the effect of the current EU integration arrangements in terms of risk exposure, volatility contagion, and structural divergence.

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