Jun, 2025
GRINS DISCUSSION PAPER SERIES DP N° 10/2025 ISSN 3035-5567

GRINS

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ACKNOWLEDGEMENTS

This study was funded by the European Union - NextGenerationEU, in the framework of the GRINS - Growing Resilient, INclusive and Sustainable project (GRINS PE00000018). The views and opinions expressed are solely those of the authors and do not necessarily reflect those of the European Union, nor can the European Union be held responsible for them.

CITE THIS WORK

Title: Trade and fiscal policy links: the twin deficit risk from a network perspective. Publication Date: 2025.

GRINS FOUNDATION

Discussion Paper Series

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Discussion paper n. 10/2025

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ISSN 3035-5567

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

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March, 2025

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1 Introduction

The global integration of financial markets and the real sectors, 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.

*Authors acknowledge financial support from Italian Ministry MIUR under the PRIN projects '*Hi-Di NET - Econometric Analysis of High Dimensional Models with Network Structures in Macroeconomics and Finance*' (grant 2017TA7TYC) and '*Discrete random structures for Bayesian learning and prediction*' (grant 2022CLTYP4), and from the EU under the Next Generation EU Project '*GRINS - Growing Resilient, INclusive and Sustainable*'; National Recovery and Resilience Plan (NRRP). This research used the SCSCF and HPC multiprocessor cluster system provided by the Venice Centre for Risk Analytics (VERA) at Ca' Foscari University of Venice. The views and opinions expressed are only those of the authors and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

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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, 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).

The difference in productivity across countries and their interactions with the Global Value Chains(GVCs) directly and indirectly condition the effectiveness of stability policies addressing macroeconomic imbalances. Florio et al. (2025) study the effect of GVC on the Phillips Curve's slope in the European Monetary Union (EMU). The authors analyze 11 EMU countries in the period 1999–2019 and find that a higher GVC participation reduces the level of inflation–unemployment trade–off, that is a flatter Phillips Curve. The lower sensitivity of inflation to employment challenges the traditional application of the Taylor rule and makes it more difficult for the monetary policy to achieve price stability, considering that domestic conditions are not enough to evaluate the limits of potential interventions and the complexity of the international production network. In the case of fiscal policy, apart from the indirect effect of monetary policy in a monetary dominance context, persistent trade deficits jeopardize external debt sustainability and reduce the policy space. Barbosa-Filho (2004) test for cointegration between the exports and imports of a panel of EU countries and assess the stationarity of their current account balance–to–GDP ratios to evaluate the long–run relationship in the external accounts and they find evidence of external unsustainability in eight out of twenty–two EU countries.

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 to twin–deficits. The following section 2 examines the literature 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 twin–deficit hypothesis has induced important disagreements not only in terms of the mechanisms involved between internal and external equilibrium, but also in policy prescriptions. Although fiscal adjustments may be a first reaction in a context of monetary dominance through government spending restrictions, the significance and directionality of the causality between the fiscal and external unbalances is an open debate. In this sense, investigating the dynamic between these sectors is essential from an economic policy perspective because it addresses potential constraints on the policy instruments in a context of internal disparities and economic partial integration.

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 context policies aimed at adjusting exchange rates or trade balances are more convenient.

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 the 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, the literature has underscored the dynamic nature of the twin– deficit hypothesis since this phenomenon may be very sensitive to specific economic circumstances. Afonso and Coelho (2023) propose a time–varying analysis of the twin deficits in the Euro area and identify the macroeconomic conditions under which the fiscal–external interactions intensify. Global demand shifts, interest rate changes, monetary policy decisions, and institutional reforms are some of the aspects that must be considered to have a timely policy reaction. Rigid policies such as fiscal rules may be suboptimal and omit the evolving nature of these relationships. Policymakers should consider the temporal dimension of the twin–deficit relationship and mixed–frequency models may relevant tool in practice.

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.

Recent work has not only focused on the domestic link between fiscal and external balances or in a panel of countries with a potential twin–deficits within each unit of analysis, but also on potential spill–over effects and interdependencies among countries. Network analysis has been an important tool to analyze the relationships of fiscal and trade imbalances cross–countries, which is even more relevant in the context of economic unions such as the EU (Matesanz and Ortega, 2015; García and Rambaud, 2023; Gaysset et al., 2019). The interconnectedness of economic imbalances suggests that it is essential to monitor systemic risk of fiscal and trade policies for a proper coordinated policy response.

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, the vulnerability at a network level 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 directly observed as the trade flows 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 decreasing betweenness centrality ($ABetCen$), and is consistent with the rest of the network indicators, such as the average path length and th clustering coefficient. In contrast, in the fiscal layer, the De is far from one (full integration), which may indicate that the members' debts are not following a single trend. Moreover, there are fluctuations in the average number of synchronized countries (average degree, AD), in particular for extreme

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

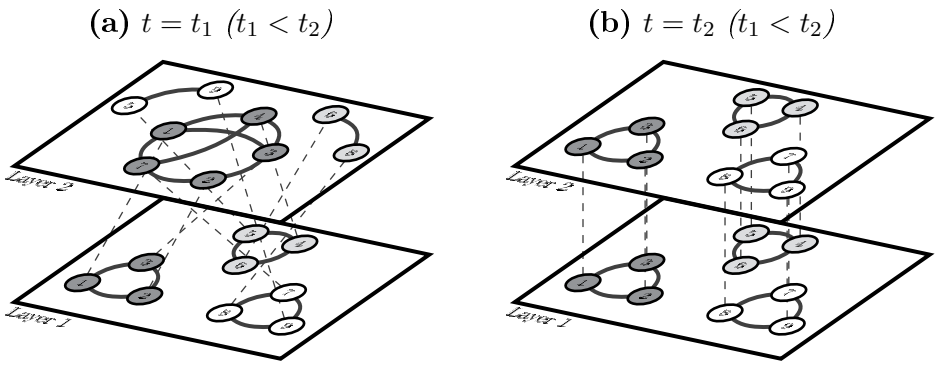
Note: Average Degree (AD), Average In–Degree (AID), Density (De), Average Degree Strength (ADS), Average Degree In–Strength ($AIDS$), Average Path Length (APL), Number of Weakly and Strongly Connected Components (WCC and SCC), Average Clustering Coefficients ($AClu Coe$), Average Betweenness Centrality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

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 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 and must be inferred from the data to test the twin–deficit at a network level.

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

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).*



DSBMM is used to estimate the gray shades of the nodes that identify the clusters/blocks 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 because they only trade among themselves, 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.

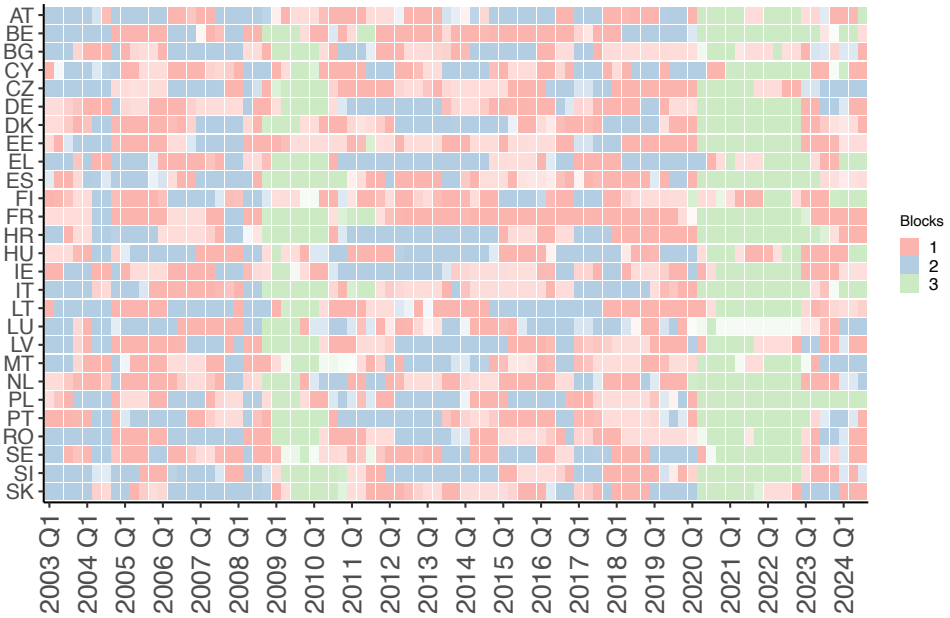
Table 2: *Posterior median and 95% credible intervals (in parenthesis) of the correlation between community q and r in the debt layer after controlling for macroeconomic features. Table from Baltodano López and Casarin (2023).*

$q\backslash r$	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 in the debt

[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.*



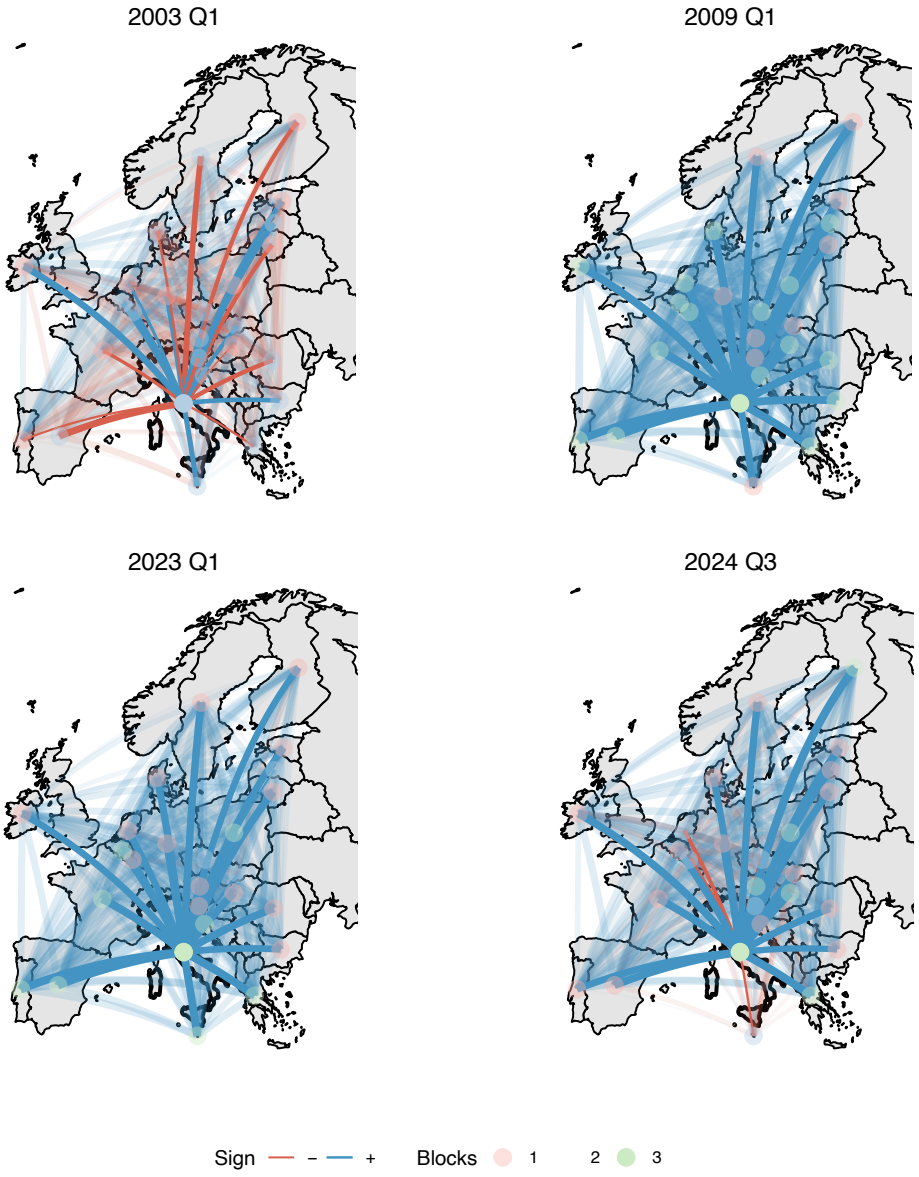
network. The features of these groups are summarized in Table 2, where the entries indicate the average correlation within and between them after controlling for macroeconomic variables. For instance, in terms of within–group interaction the (high) low correlation between countries belonging to the (third) 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 a weak and even negative correlation between countries of different groups. 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.

Although some degree of persistence in the group composition is expected, the countries' memberships change over time. Figure 2 presents the block membership (color) path (x-axis) of each country (on the y-axis), and the membership uncertainty, which is proportional to the degree of the corresponding color transparency. During extreme events, the connectivity properties of the debt synchronization network change dramatically, leading to an increase in systemic risk. In particular, a core–periphery structure is observed during negative shocks. For instance, during the sovereign debt crisis or COVID–19, community 3 (green) is the most prevalent, which is characterized by a high density. On the other hand, communities 1 and 2 (red and blue, respectively) capture an assortative structure of the

network 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. 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.*



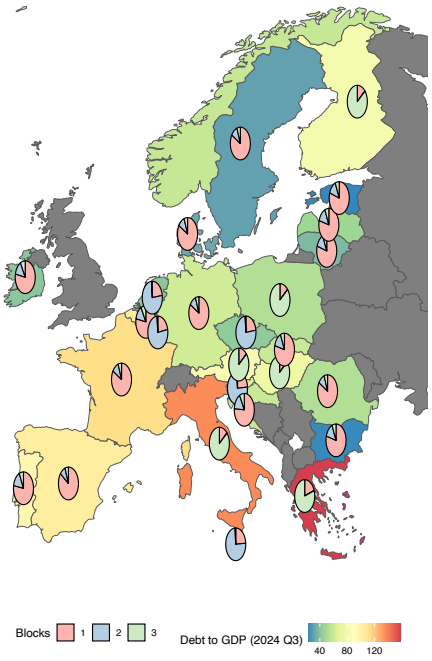
Based on the most recent available quarters, seven countries present a high systemic

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.

This pattern is expected to persist into 2024Q4 as shown by the one–step forecast of the transition probabilities in Figure 4. While the pie charts provide information on the posterior predictive probability of belonging to each specific block, forecasting the next unobserved period (2024Q4), the colors in the map are related to the observed debt–to–GDP level for 2024Q3. In the case of Italy, there is a high probability of remaining in community 1, and a very low likelihood of change to a more stable state in community 2. This is consistent with its level of debt–to–GDP, which is the second highest in the network. Other countries, such as Findland have a similar probability, even if they present a medium level of debt–to–GDP ratio. Overall, the one–step forecasts show few variation between countries belonging to the same block, which indicates that the trade growth network is not unidirectionally Granger–causing topological changes in the debt–to–GDP network. Therefore, we can conclude that currently there is no evidence of a significant network—level twin–deficit hypothesis in the EU 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, which suggests further investigation is needed by considering other layers that cannot be omitted, such as geopolitical risks, capital flows, and climate risks (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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