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Functional Integration and Regional Restructuring in the Black Sea Region: An EU-Oriented Analytical Framework

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This article examines the ongoing restructuring of the Black Sea region in the context of intensifying security risks, institutional fragmentation, and the reconfiguration of regional transport and connectivity networks. Unlike traditional models of regional integration, which are typically grounded in institutional convergence, common market formation, and a stable geopolitical environment, the evolving relationship between the Black Sea littoral states and the European Union is unfolding under conditions of war-related disruption, uneven regulatory alignment, and shifting port, shipping, and trade corridors. The analysis focuses on nine countries – Bulgaria, Romania, Greece, Türkiye, Ukraine, Moldova, Georgia, Armenia, and Azerbaijan – and explores how their economic links with the EU are being redefined within the broader framework of the EU's Black Sea Strategy.

Special attention is paid to four dimensions of regional restructuring: security – institutional embedment, corridor – logistics connectivity, energy – digital interconnection, and market – production network embedment. These dimensions are used to explain how the Black Sea region is being reorganised not through the formation of a traditional common market, but through a more flexible and uneven process of functional integration. In this emerging configuration, the EU serves as the institutional centre, while connectivity infrastructures and cross-border networks provide the material foundation for regional economic reordering.

The study further evaluates this framework through comparative calculations covering the nine selected countries. The results suggest that the proposed analytical model is effective in distinguishing the differentiated trajectories followed by various country groups within the regionalisation process. Ultimately, the article argues that the Black Sea region is evolving into a functionally integrated economic space shaped by security shocks, corridor restructuring, regulatory adjustment, and infrastructural interdependence, offering a more explanatory perspective on contemporary regional transformation than conventional integration paradigms.

Keywords: Black Sea region, functional integration, regional restructuring, European Union

JEL classification*: F15, F50, R11*

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У цій статті розглядається поточна реструктуризація Чорноморського регіону в контексті посилення ризиків для безпеки, інституційної фрагментації та переформатування регіональних транспортних мереж і мереж зв'язку. На відміну від традиційних моделей регіональної інтеграції, які зазвичай ґрунтуються на інституційній конвергенції, формуванні спільного ринку та стабільному геополітичному середовищі, відносини між причорноморськими державами та Європейським Союзом розвиваються в умовах воєнних потрясінь, нерівномірного узгодження нормативно-правових баз та змін у портових, судноплавних і торговельних коридорах. Аналіз зосереджується на дев'яти країнах – Болгарії, Румунії, Греції, Туреччині, Україні, Молдові, Грузії, Вірменії та Азербайджані – і досліджує, як їхні економічні зв'язки з ЄС переосмислюються в ширших рамках Чорноморської стратегії ЄС.

Особлива увага приділяється чотирьом вимірам регіональної реструктуризації: безпека – інституційна інтеграція, коридори – логістична зв'язність, енергетика – цифрове взаємоз'єднання та ринок – інтеграція виробничих мереж. Ці аспекти використовуються для пояснення того, як Чорноморський регіон реорганізується не шляхом формування традиційного спільного ринку, а через більш гнучкий і нерівномірний процес функціональної інтеграції. У цій новій конфігурації ЄС виступає інституційним центром, тоді як інфраструктура зв'язку та транскордонні мережі забезпечують матеріальну основу для регіонального економічного переупорядкування.

У дослідженні також оцінюється ця система за допомогою порівняльних розрахунків, що охоплюють дев'ять обраних країн. Результати свідчать про те, що запропонована аналітична модель є ефективною для розрізнення диференційованих траєкторій, якими рухаються різні групи країн у процесі регіоналізації. Зрештою, у статті стверджується, що Чорноморський регіон еволюціонує у функціонально інтегрований економічний простір, сформований безпековими потрясіннями, реструктуризацією коридорів, регуляторним коригуванням та інфраструктурною взаємозалежністю, що пропонує більш пояснювальну перспективу щодо сучасної регіональної трансформації, ніж традиційні парадигми інтеграції.

Ключові слова: Чорноморський регіон, функціональна інтеграція, регіональна реструктуризація, Європейський Союз

JEL classification*: F15, F50, R11*

Formulation of the problem. The Black Sea region is undergoing a profound process of regional realignment. Unlike classical theories of regional integration, which typically emphasise institutional convergence, common markets and a stable security environment, the current ties between the Black Sea littoral states and the European Union are advancing amidst rising security pressures, the restructuring of port and shipping order, adjustments to transport corridor systems, and diverging approaches to institutional alignment [1]. The EU's 'Strategic Approach to the Black Sea Region', published in 2025, has defined the Black Sea as a key hub connecting Europe, the South Caucasus, Central Asia and the Eastern Mediterranean, and has established security, stability and resilience; sustainable growth and prosperity; and environmental protection and climate resilience as the three pillars of cooperation in the region; The EU also noted that the region has evolved into a significant geo-economic space with a population of nearly 174 million, a GDP of approximately €2 trillion, and total trade with the EU amounting to around €310 billion [4]. However, the Black Sea region has not yet formed a highly institutionalised common market with a high degree of regulatory harmonisation, nor does it have a mature single regional organisation to comprehensively lead the integration process. Nevertheless, in

reality, cross-border links in the region have not weakened; on the contrary, they have continued to deepen through EU-led security governance, the construction of logistics corridors, energy interconnections and digital connectivity [2]. Taking the Ukraine-related corridors as an example, by December 2025, the EU's 'Corridor of Solidarity' had already handled approximately 80% of Ukraine's imports and 80% of its non-agricultural exports, whilst around 80% of grain, oilseeds and related products were transported via the Black Sea. This indicates that the Black Sea region no longer relies on a single maritime route, but has instead formed a new spatial division of labour between seaports, land routes, border crossings and multimodal transport [5]. At the same time, the institutional relationships between the EU and the countries surrounding the Black Sea are also undergoing a marked differentiation. Ukraine and Moldova formally launched EU accession negotiations in June 2024, marking their entry into a deeper phase of institutional integration; Türkiye, meanwhile, possesses the dual status of both a candidate country and a partner in the EU Customs Union; other countries are participating in regional restructuring primarily through infrastructure projects, partnership cooperation and limited regulatory alignment [3]. Research on the EU's external governance has long pointed out that EU rules do not stop at formal membership, but can extend to surrounding regions through various institutional interfaces, which also provides a theoretical foundation for understanding the current differentiated integration in the Black Sea region [6].

Consequently, the central question addressed in this paper is: why is there still a trend towards integration in the Black Sea region, despite the fact that formal institutional unification has not yet been achieved and regional security risks remain high? Does this trend signify the formation of a traditional regional common market, or does it point to a new form of regional integration characterised by functional linkages and the embedding of rules? This question relates both to the classic debate within new regionalism concerning 'how regionalism is formed', and to the latest debates in Europeanisation and external governance studies regarding 'how rules spread across borders' [1; 6].

Literature Review. Research on the Black Sea region can broadly be categorised into three main strands. The first strand falls within the framework of neo-regionalism. In this approach, regional integration is generally understood as a historical process that advances gradually through institutional design, policy coordination and market expansion, with the core issue being whether a relatively stable system of rules and cooperation mechanisms can be established within the region. [7] Further developments within this framework emphasise that regionalism should not be viewed merely as the outcome of economic cooperation, but rather as a constructive process shaped by the interplay of politics, institutions and identity [8]. From this perspective, regional integration often manifests as the continuous deepening of free trade agreements, common markets, cross-border governance and multi-level coordination mechanisms [1].

However, this classical model has limited explanatory power when applied to the Black Sea region. This is because the Black Sea region has not formed a highly institutionalised community akin to the European Union, nor does it possess a mature supranational mechanism capable of imposing uniform regulatory constraints on regional integration [10]. Nevertheless, actual cross-border links,

transport interdependence, energy cooperation and institutional convergence have not diminished; on the contrary, they have continued to strengthen in certain areas [11]. This suggests that integration in the Black Sea region does not simply unfold along the linear logic of 'institutional unification – market integration', but is more likely a process of functional regionalisation that continues to advance despite institutional imbalances [12].

The second category of research falls within the context of Europeanisation and the diffusion of EU rules. This approach emphasises how the EU influences neighbouring countries through the candidate country mechanism, legal convergence, the principle of conditionality, market access and administrative capacity building.[3] Within this research framework, the EU is not merely a geographically proximate centre, but rather an external centre of rule-setting capable of exporting institutional norms, regulatory standards and governance logic. [13] Research on Europeanisation further indicates that the spillover of EU rules is not confined to formal member states, but can extend to a wider region through pathways such as enlargement, neighbourhood policies, partnerships and sectoral integration [14].

With regard to the Black Sea region, this research direction offers strong explanatory power. The fact that Ukraine and Moldova have commenced accession negotiations with the EU indicates that institutional embedment is deepening; this implies that part of the impetus for regionalisation stems from a proactive alignment with EU rules and market systems [15]. Although Türkiye has not entered the EU's internal institutional space, its long-standing customs union and high-level economic and trade ties with the EU demonstrate that the diffusion of EU rules is not confined to member states and countries engaged in formal negotiations, but rather possesses a broader capacity for external governance [2]. For Ukraine, research on regional innovation policy and smart specialisation also indicates that Europeanisation is no longer confined to the macro-political level, but is beginning to permeate innovation governance, regional development strategies and policy implementation [16].

The third category of research falls within the framework of connectivity politics and geo-economics. This research approach emphasises that ports, corridors, energy networks, submarine cables and digital infrastructure are not merely technical projects, but rather key vehicles for shaping regional order and spatial structures [17]. In this sense, infrastructure is no longer merely a 'means of transport', but a tangible conduit for the diffusion of institutions, the inflow of capital, market restructuring and the allocation of power [18]. Whoever organises connectivity, leads financing, defines standards, and channels the flows of goods, energy and data is the one shaping the operational logic of the regional space [19]. When applied to Black Sea studies, this context is particularly significant. Existing research indicates that regionalisation practices in the Black Sea region have consistently been influenced by a combination of geopolitical competition, sub-regionalism and the intervention of external actors; consequently, its boundaries and logic of cooperation are not merely geographical realities, but rather the result of political and institutional construction [20]. At the same time, the Black Sea region has long been characterised by a distinct 'security paradox': whilst there is a coexisting demand for economic cooperation and regional growth, security

concerns, geopolitical competition and nation-state logic continually undermine the potential for institutionalised cooperation [21]. Research on the failures of Black Sea governance, the limitations of regionalism and the dilemmas of the pan-European security architecture further illustrates that the Black Sea issue is not a singular matter of economic integration, but rather a complex problem intertwined with security, institutional and power structures [22]. In more specific empirical studies, analyses of the development of Bulgarian Black Sea towns and municipalities reveal that a direct link has been established between local-level investment, infrastructure and the European integration agenda. This indicates that Black Sea regionalisation exists not only at the national level but is also manifested in spatial reorganisation at the sub-national scale [23]. Research by Ukrainian scholars on the turbulence within the Black Sea economic space further highlights that geopolitical uncertainty and European integration reforms are simultaneously reshaping the region's economic order and cooperative structures [24; 25].

Overall, each of these three strands offers partial explanatory power. Neo-regionalism explains the general logic of regional cooperation but cannot account for deepening integration in the absence of formal institutional convergence. Europeanisation theory explains rule diffusion effectively but treats EU centrality as a given rather than something to be empirically measured across heterogeneous country trajectories. Connectivity politics illuminates the material infrastructure of integration but lacks the institutional dimension needed to distinguish genuine embedment from transient project-driven linkages. The key gap, therefore, is not a shortage of relevant frameworks but the absence of a unified analytical instrument capable of simultaneously capturing security – institutional, logistical, energy – digital, and market – production dimensions within a single comparative framework – and of demonstrating empirically how different countries enter regionalisation via different dimensional pathways. This paper addresses that gap directly by constructing the EU-oriented functional integration framework and operationalising it through a nine-country index.

The purpose of the article. This paper aims to construct a new analytical framework capable of explaining the current changes in the Black Sea region, and to use this framework to provide a systematic interpretation of the region's integration trends. Specifically, this paper has the following three objectives.

First, to redefine the analytical focus and developmental characteristics of the Black Sea region within the strategic framework of the European Union. This paper no longer regards the Black Sea region simply as a traditional geographical neighbourhood, but rather as a strategic space of connectivity shaped by the combined effects of EU policies, regulations, markets and infrastructure investment.

Second, to propose a 'EU-oriented functional integration analytical framework' to explain the restructuring of the regional economic space in the Black Sea region under conditions of high uncertainty. This paper argues that integration in the Black Sea region does not follow the classical 'institutional unification – market integration' pathway, but rather, under the combined influence of security pressures, corridor restructuring, regulatory alignment and infrastructure interconnectivity, is gradually forming a functionally integrated economic space with the EU as its institutional centre and the connectivity network as its material foundation.

Third, the paper assesses the framework's operationality and discriminatory power through calculations using continuous variables for nine countries and descriptive empirical tests. The paper does not treat the case studies as strict econometric models, but rather uses calculations for representative countries and the nine-country aggregate to demonstrate that this framework is not only capable of identifying the general trend of integration in the Black Sea region, but also of distinguishing the specific pathways through which different countries enter regionalisation via different dimensions.

Presentation of the main research materials.

1. *Empirical research design and variable framework*

The empirical analysis is based on a latest-available cross-sectional dataset centered on 2024 for nine countries in the wider Black Sea region: Bulgaria, Romania, Greece, Türkiye, Ukraine, Moldova, Georgia, Armenia, and Azerbaijan. The selection of a 2024-centered cross-section reflects a balance between recency and cross-country comparability. Specifically, the World Bank's WGI series now reports governance estimates through 2024, while the WDI, ITU DataHub, and UNCTADstat provide the most complete and internationally comparable coverage for the socioeconomic, digital, and trade-related indicators used in this study. This approach helps minimize distortions caused by asynchronous data availability across countries and preserves a coherent indicator structure for cross-national comparison.

The underlying data were retrieved from the official portals of the Worldwide Governance Indicators, World Development Indicators, ITU Data Hub, and UNCTAD stat Data Centre [26-29].

In theory, 'EU-oriented functional integration' is divided into four dimensions: security – institutional embedment; transport – logistical connectivity; energy – digital interconnection; and markets – production network embedment. To ensure continuity in empirical analysis, this paper does not employ a binary coding method, but instead utilises continuous variables wherever possible. The specific variables are defined as follows:

First, the security – Institutional Embedment Dimension (D1). The core of this dimension lies in the predictability of regional security and the degree of institutional embedment within the EU. This paper selects three variables: the State Political Stability Index (SPI), the homicide rate (log-transformed), and the EU institutional linkage score (EU_link). The first two reflect the general security environment and levels of social violence, respectively, whilst the third reflects the level of formal institutional linkage between a country and the EU.

Second, the corridor – Logistics Connectivity Dimension (D2). This dimension reflects whether the region has formed a stable network of cross-border physical connections. Due to limitations in the availability of harmonised data across the nine countries, this study employs two continuous variables – the openness of goods and the openness of services – to characterise external corridor and logistics connectivity in the cross-sectional analysis. These are defined respectively as the ratio of total goods imports and exports to GDP and the ratio of total services imports and exports to GDP.

Third, the energy – Digital Interconnection Dimension (D3). This dimension represents one of the key innovations of this study, serving to illustrate whether

the Black Sea region has expanded beyond traditional goods flows to encompass electricity and data flows. This study employs three indicators: internet penetration, the share of non-hydro renewable electricity, and the share of ICT goods exports.

Fourth, the market – Production Network Embedment Dimension (D4). This dimension reflects whether regional linkages can ultimately be transformed into stable market and capital embedment. Taking into account the standardisation and availability of data across the nine countries, this paper uses the ratio of FDI inflows to GDP as a proxy variable in the baseline model.

2. *Index construction methodology*

In order to systematically measure the relative levels of functional integration among countries in the Black Sea region within the context of EU-oriented integration, this paper constructs a Functional Integration Index (FI). Taking into account the differences among variables in terms of units, value ranges and directionality, this paper first performs dimensionless processing on the raw data. It then calculates indices for the four dimensions – security and institutional embedment, transport and logistics connectivity, energy and digital interconnectivity, and market and production network embedment – separately, before finally aggregating them using equal weights to form the composite index. For positive indicators – that is, variables where a higher value indicates a higher level of integration – the range standardisation method is employed:

$$z_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (1)$$

For reverse indicators – that is, variables where a higher value indicates greater risk or weaker conditions – reverse range standardisation is used:

$$z^{*}ij = \frac{\max(x_j) - xij}{\max(x_j) - \min(x_j)} \quad (2)$$

Here, x_{ij} denotes the raw value for the i -th country on the j -th indicator, whilst $\min(x_j)$ and $\max(x_j)$ denote the minimum and maximum values for that indicator across the entire sample, respectively. Following standardisation, the values for each indicator fall within the interval ([0,1]), with higher values indicating that the country performs better on the corresponding indicator.

On this basis, this paper constructs four-dimensional indices. First, the security – Institutional Embedment Dimension D_1 is used to reflect the overall level of each country's security environment and institutional embedment within the EU. It comprises the political stability index, the homicide rate and the score for institutional links with the EU; as the homicide rate is a reverse indicator, its standardised value is calculated using a reverse transformation. The formula for its calculation is:

$$D_1 = \frac{z(\text{SPI}) + z^{*}(\text{Homicide}) + z(\text{EUlink})}{3} \quad (3)$$

In this context, SPI denotes the Political Stability Index, Homicide denotes the homicide rate, and EUlink denotes the EU institutional linkage score.

Secondly, the corridor – Logistics Connectivity Dimension D_2 reflects a country's level of connectivity within regional goods and services flows and cross-border logistics networks; it comprises two indicators – goods openness and services openness – and is calculated as follows:

$$D_2 = \frac{z(\text{Goods Openness}) + z(\text{Services Openness})}{2} \quad (4)$$

In this context, Goods Openness refers to the ratio of total imports and exports of goods to GDP, whilst Services Openness refers to the ratio of total imports and exports of services to GDP.

Third, the energy – Digital Connectivity Dimension D_3 reflects a country's overall capacity in terms of digital access, energy transition and technology integration. It comprises internet usage rates, the share of renewable electricity and the share of ICT goods exports, and is calculated using the following formula:

$$D_3 = \frac{z(\text{Internet}) + z(\text{Renewable Electricity}) + z(\text{ICT Export Share})}{3} \quad (5)$$

In this context, Internet denotes internet usage, Renewable Electricity denotes the share of renewable electricity, and ICT Export Share denotes the proportion of ICT-related exports in total exports.

Fourth, the market – Production Network Embedment Dimension D_4 is used to measure a country's capacity to attract capital and integrate into cross-border production networks. In this paper, we use the ratio of foreign direct investment inflows to GDP as a proxy variable, calculated as follows:

$$D_4 = z(\text{FDI In flows}/GDP) \quad (6)$$

In this context, FDI Inflows/GDP represents the ratio of foreign direct investment inflows to gross domestic product.

Having obtained the indices for the four dimensions, this paper employs the equally weighted average method to construct a comprehensive functional integration index:

$$FI = \frac{D_1 + D_2 + D_3 + D_4}{4} \quad (7)$$

In this context, the value of (FI) ranges from [0,1]; a higher value indicates a country's stronger overall performance in terms of security – institutional embedment, transport – logistics connectivity, energy–digital interconnection, and market – production network embedment, and a higher degree of embedment in the EU-oriented process of functional integration. The reason for adopting equal weighting in this paper is primarily to ensure transparency and reproducibility.

Given the limited sample size and the clear theoretical significance of all four dimensions, the equally weighted averaging method helps to avoid excessive interference in the results caused by subjective weighting. This index construction method not only preserves the comprehensive characteristics of multi-dimensional factors such as security, institutional, logistics, energy, digital and market embedment, but also enhances the feasibility of cross-national comparisons through standardisation and dimensional aggregation, thereby providing a unified measurement tool for subsequent empirical comparisons across the nine countries.

3. *Original variables and results for countries in the Black Sea region*

Following the methodology outlined above, this paper first collates the raw variable values for the nine countries and standardises them using a uniform methodology. Table 1 presents the raw variables.

Table 1

Raw Variable Values for Nine Black Sea Region Countries

country	SPI	Homicide rate per 100,000 people	EU_ link	trade openness (%)	Service trade openness (%)	Internet usage %	Share of renewable electricity excluding hydropower %	Share of ICT goods exports %	FDI inflows as a percentage of GDP %
Bulgaria	83.6	1	1.00	90.0	22.2	82	11.5	3.75	3.1
Romania	91.0	1	1.00	61.6	19.1	91	15.0	3.08	1.9
Greece	86.6	1	1.00	56.8	33.9	86	29.7	2.53	2.6
Türkiye	79.3	3	0.60	45.8	12.7	87	18.7	0.69	0.9
Ukraine	76.0	4	0.80	58.0	20.9	82	5.5	0.70	2.1
Moldova	85.7	3	0.80	68.3	24.3	80	1.8	0.58	2.5
Georgia	87.7	2	0.55	70.1	34.4	82	0.8	0.45	4.7
Armenia	82.2	2	0.30	116.3	36.7	80	2.1	8.28	0.5
Azerbaijan	69.5	2	0.30	64.1	24.6	89	1.2	0.04	0.3

Note: The data in the table has been compiled and converted by the author based on official data from the WGI, WDI, ITU, UNCTAD and the European Union regarding institutional ties. The EU_link score is a continuous variable coded by the author on a scale from 0 to 1.00, based on official EU classification of countries' relationship with the EU: EU Member States (Bulgaria, Romania, Greece) = 1.00; countries with formally opened accession negotiations (Ukraine, Moldova) = 0.80; candidate countries with longstanding customs union ties (Türkiye) = 0.60; countries with an Association Agreement and visa liberalisation (Georgia) = 0.55; and countries engaged in limited partnership frameworks without formal candidacy (Armenia, Azerbaijan) = 0.30. These values reflect the depth of formal institutional integration rather than political proximity, and are intended to capture the regulatory and legal embedding dimension of EU orientation.

Based on these original variables, the scores for the four dimensions and the overall Functional Integration Index (FI) are calculated as follows. As shown in Table 2, the nine countries exhibit clear differences in institutional, trade, digital, and sustainability dimensions.

Table 2

Original Variables and Dimension Scores for the Functional Integration Index (FI)

Country	D1 Security–Institutional Embedment	D2 Corridor–Logistics Connectivity	D3 Energy—Digital Connectivity	D4 Market–production integration	FI
Greece	0.932	0.519	0.616	0.523	0.647
Bulgaria	0.885	0.512	0.334	0.636	0.592
Georgia	0.623	0.624	0.077	1.000	0.581
Romania	1.000	0.245	0.620	0.364	0.557
Armenia	0.419	1.000	0.348	0.045	0.453
Moldova	0.600	0.401	0.033	0.500	0.384
Ukraine	0.339	0.257	0.142	0.409	0.287
Türkiye	0.406	0.000	0.445	0.136	0.247
Azerbaijan	0.222	0.377	0.277	0.000	0.219

4. *A structural interpretation of the estimation results*

Firstly, high-scoring countries did not follow the same path to regionalisation. The high scores achieved by Greece and Bulgaria stem primarily from the combined advantages of security–institutional embedment and market–production network embedment; both countries are highly embedded within the EU institutional framework and possess relatively robust digital and energy infrastructures, which explains their high composite scores. Romania's standout feature is that both D1 and D3 are relatively high, indicating significant advantages in institutional embedment and energy–digital connectivity. This aligns with its status as an EU member state and its role as a key node in the Black Sea submarine cable project.

Secondly, Georgia's high ranking is not due to the strongest institutional embedment, but rather because its performance in D2 and D4 is significantly higher than expected. This implies that Georgia possesses project-driven advantages in logistics connectivity and capital embedment, yet its security–institutional embedment dimension is markedly weaker than that of EU member states and countries that have commenced accession negotiations. In other words, Georgia exemplifies a typical path of uneven integration characterised by 'leading project connectivity but relatively insufficient institutional alignment'.

Thirdly, Armenia's mid-table position offers methodological insights. Its openness to trade in goods and services is high, and the share of ICT goods exports is also among the highest in the sample, meaning its D2 and D3 scores are not low; however, its scores for institutional linkages and the ratio of FDI inflows to GDP are weak, preventing its overall score from reaching the top ranks. This result suggests that measuring regionalisation solely through trade or ICT indicators tends to overestimate the degree of integration in some countries; incorporating institutional and capital embedment into a unified framework yields a more balanced picture.

Finally, the relatively low rankings of Ukraine and Türkiye do not imply that they are 'unimportant' within the Black Sea region, but rather indicate that the index structure of this benchmark model places greater emphasis on institutional embedment, continuity-based numerical indicators, and capital embedment. In reality, Ukraine holds significant strategic importance as a transit

corridor; however, in the cross-sectional model used in this paper, D2 is primarily represented by openness variables and does not yet fully incorporate the strategic division of labour associated with the 'port-land dual corridor'. As for Türkiye, since D4 uses only FDI/GDP as a proxy variable, it does not fully reflect the country's deep integration with the EU market.

5. *The empirical implications of this section*

Taking the above calculations and tests together, the empirical section of this paper yields three main implications. First, integration in the Black Sea region can indeed be measured in operational terms, and the differences in scores across countries on the four dimensions clearly reflect their distinct paths towards regionalisation. This suggests that 'EU-oriented functional integration' is not merely a theoretical judgement, but an empirical phenomenon that can be captured by continuous variables and comparative indices.

Second, institutional embedment is not the sole determining factor. Countries with high institutional embedment typically score higher overall, but project-based linkages, capital embedment and openness structures can also significantly alter a country's relative position within the regionalisation process. The results for Georgia and Armenia demonstrate that membership or candidate status alone is insufficient to capture the complexity of Black Sea regional restructuring.

Third, the baseline model presented in this paper still has scope for expansion. The most immediate next step is to expand D4 from a single FDI/GDP indicator to a three-indicator combination comprising 'share of exports to Europe + share of imports from Europe + FDI/GDP', and to expand D2 from a simple measure of openness to a combination of 'openness + shipping connectivity + transport efficiency'. In this way, the framework can be further developed from its current comparative empirical prototype into a more comprehensive comparative empirical tool for the nine countries.

Conclusions and suggestions. The Black Sea region is not currently evolving along the path of a traditional common market or a closed regional bloc; rather, under the combined influence of security pressures, the restructuring of transport corridors, the harmonisation of rules, and the integration of infrastructure, it is gradually taking shape as a functional, EU-oriented economic space. Its core characteristics lie not in formal institutional unification, but in the continuous densification of cross-border functional networks, the increasing compatibility of rules, and the deepening embedment of market–production networks.

More specifically, this paper presents four key observations. First, security issues have become the primary prerequisite for the economic restructuring of the Black Sea region; security shocks have not simply severed regional links, but have instead given rise to new transport networks and hierarchical nodes. Second, an EU-centred institutional gradient has formed within the Black Sea region, with different countries embedding themselves into the EU regulatory framework at varying speeds and levels. Third, ports, corridors, railways, roads and border crossings collectively constitute the material foundation of integration, whilst a dual connectivity structure combining sea and land transport is reshaping the regional economic landscape. Fourth, energy and digital interconnectivity are driving regional integration from traditional transport coordination into a deeper phase of composite connectivity.

Based on the above conclusions, this paper puts forward the following recommendations. First, in terms of research, the focus should shift from 'whether a common market exists' to 'how functional integration can be advanced'. Second, in terms of policy, priority should be given to consolidating the security–institutional foundation; without security guarantees for ports, borders, waterways and critical infrastructure, the regional connectivity network will struggle to operate stably. Third, corridor construction and regulatory coordination should be advanced in tandem to avoid a disconnect between 'building roads and ports' and 'aligning regulations'. Fourth, energy and digital interconnectivity should be elevated to a new priority in Black Sea regional cooperation, with more stable institutional arrangements established around power grids, fibre-optic networks, digital redundancy and platform governance. Fifth, subsequent empirical research should build upon the framework of this paper to further refine indicators and expand the sample. Specifically, D4 should be extended from the single FDI/GDP proxy to a three-indicator composite comprising share of exports to the EU, share of imports from the EU, and FDI/GDP; D2 should be expanded from trade openness to a combination of openness, shipping connectivity, and transport efficiency. Robustness checks should also be conducted by varying indicator weights, replacing the range standardisation method with z-score normalisation, and substituting alternative proxy variables, in order to verify that the country rankings and integration pathways identified in this paper are not artefacts of the specific methodological choices made, but reflect genuine cross-national differences in EU-oriented functional integration.

Declaration on the Use of Artificial Intelligence. *During the preparation of this manuscript, the author used ChatGPT (OpenAI) solely for language translation and linguistic polishing to improve the clarity and readability of the text. AI was not used for scientific research, data analysis, or the formulation of conclusions. The author reviewed and verified the final manuscript and bears full responsibility for its content.*

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Functional Integration and Regional Restructuring in the Black Sea Region: An EU-Oriented Analytical Framework

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This article examines the ongoing restructuring of the Black Sea region in the context of intensifying security risks, institutional fragmentation, and the reconfiguration of regional transport and connectivity networks. Unlike traditional models of regional integration, which are typically grounded in institutional convergence, common market formation, and a stable geopolitical environment, the evolving relationship between the Black Sea littoral states and

the European Union is unfolding under conditions of war-related disruption, uneven regulatory alignment, and shifting port, shipping, and trade corridors. The analysis focuses on nine countries—Bulgaria, Romania, Greece, Türkiye, Ukraine, Moldova, Georgia, Armenia, and Azerbaijan—and explores how their economic links with the EU are being redefined within the broader framework of the EU's Black Sea Strategy.

Special attention is paid to four dimensions of regional restructuring: security–institutional embedment, corridor–logistics connectivity, energy–digital interconnection, and market–production network embedment. These dimensions are used to explain how the Black Sea region is being reorganised not through the formation of a traditional common market, but through a more flexible and uneven process of functional integration. In this emerging configuration, the EU serves as the institutional centre, while connectivity infrastructures and cross-border networks provide the material foundation for regional economic reordering.

The study further evaluates this framework through comparative calculations covering the nine selected countries. The results suggest that the proposed analytical model is effective in distinguishing the differentiated trajectories followed by various country groups within the regionalisation process. Ultimately, the article argues that the Black Sea region is evolving into a functionally integrated economic space shaped by security shocks, corridor restructuring, regulatory adjustment, and infrastructural interdependence, offering a more explanatory perspective on contemporary regional transformation than conventional integration paradigms.

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