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Selective regulation of agri-food markets: a bibliometric review and a testable framework linking endogenous market structures, policy instruments and value chain integration

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Abstract

Agri-food systems in the economies of EU enlargement share a structural weakness: export revenue concentrates in raw commodities while value-added processing lags behind. Three research traditions bear on this problem — the theory of endogenous market structures, the literature on agri-food policy instruments, and value chain governance — yet each has developed largely in isolation. This paper asks how far these traditions interact in the published literature, which theoretical mechanisms remain structurally disconnected, and what the pattern of disconnection implies for the choice between stabilising and formative regulatory instruments. A bibliometric analysis of 21,060 Scopus documents published in 2000–2025 combines cross-cluster intersection mapping, keyword co-occurrence networks with temporal overlays and co-authorship analysis by country. Pairwise overlaps between the traditions are substantial (8–22% of the dataset), but only 219 documents (1.0%) address market structure, regulation, value chains and the EU integration context together, and none within a unified framework; the term 'selective regulation' does not occur in the dataset. Endogenous market structure terms occupy a chronologically frozen edge of the keyword network (average publication year 2013–2014) and share almost no co-occurrence with policy-instrument terms, while blockchain, resilience and conflict-related topics expand without theoretical anchoring. Building on these results, the paper formalises selective regulation as a decision framework that matches diagnosed market-system states to instrument types and formulates five propositions that can be tested with trade and policy data. A comparison of raw-to-processed grain export ratios across Poland, Hungary, Bulgaria, Romania and Ukraine shows the commodity trap to be a regional gradient rather than a single-country anomaly, which is the empirical setting in which the propositions should be tested.

JEL codes: Q13, Q17, Q18, L11, F14, O25

1 Introduction

Economies on the eastern edge of the European Union, and the candidate countries beyond it, sell grain more successfully than they sell flour, feed or bakery products. In 2024 the value of raw cereal exports (Harmonized System, HS, Chap. 10) exceeded the combined value of milling and bakery exports (HS Chaps. 11 and 19) by a factor of five in Romania and by a factor of almost three in Bulgaria, whereas in Poland processed exports were more than twice the value of raw exports (Eurostat 2026). Ukraine sits at the far end of this gradient with a ratio between twelve and eighteen to one in 2023–2025 (State Customs Service of Ukraine 2025). The pattern is not a deficit of production capacity; it is a failure to capture value within domestic processing chains, and it has proved remarkably persistent across two decades of Common Agricultural Policy (CAP) membership for some countries and across wartime disruption for others (Ambroziak and Bułkowska 2024; Ben Hassen and El Bilali 2022; Abay et al. 2023; Countryman et al. 2024).

The academic resources for addressing this problem are substantial, but they are distributed across three traditions that rarely cite one another. The theory of endogenous market structures (EMS), from

Romer (1990) and Aghion and Howitt (1992) to its formalisation by Etro (2007, 2009), explains market structure as an outcome of entry, innovation and strategic behaviour rather than as an exogenous datum. The literature on agri-food policy instruments — CAP reform, the Unfair Trading Practices (UTP) Directive, eco-schemes, LEADER and Community-Led Local Development (CLLD) — is rich in evaluations of individual instruments but thin on criteria for choosing among them (Lovec et al. 2024; Bazzan and Vogeler 2025). Value chain governance, building on Humphrey and Schmitz (2002) and Gereffi (2020), has increasingly turned to technological upgrading and traceability without engaging the regulatory conditions under which upgrading actually occurs (Singh and Dwivedi 2025). Each tradition holds one piece of the answer to why commodity dependence persists and how it might be reversed; none holds all three.

This paper examines the relationship between these traditions systematically and draws from it a framework that can be tested. It addresses three research questions. RQ1: To what extent do the three traditions interact in the published literature, and how does the degree of interaction change when the EU integration context is added? RQ2: Which theoretical mechanisms of each tradition are structurally disconnected from the others, and is that disconnection stable or narrowing over time? RQ3: What conditions for selecting between stabilising and formative regulatory instruments follow from the pattern of disconnection, and how can those conditions be stated as testable propositions?

The first two questions are answered with a bibliometric analysis of 21,060 Scopus documents published between 2000 and 2025, retrieved through a three-stage search of 45 documented queries plus gap-filling searches and assigned by a reproducible dictionary rule to four thematic clusters: grain and food markets (C1), regulation and policy instruments (C2), value chain governance and trade (C3), and the EU integration and conflict context (C4). Cross-cluster intersection mapping answers RQ1; keyword co-occurrence networks with temporal overlays and country co-authorship networks answer RQ2. The third question is answered analytically in the Discussion, where the bibliometric results are used to specify the selective regulation framework — a distinction between stabilising regulation, which removes disruptions in value flows between adjacent market stages, and formative regulation, which activates stages with unrealised value-added potential (Authors 2024c; Authors 2026) — as a decision matrix and a set of five propositions.

The paper contributes to the agricultural economics literature in three ways. It provides the first quantitative mapping of the intersection between EMS theory, agri-food policy instruments and value chain integration, and shows that the intersection is small (1.0% of the field) and descriptive rather than integrative. It converts a conceptual distinction developed in the institutional economics of transition economies into a framework whose components are observable — market-system states diagnosed through EMS indicators, instruments classified by their mechanism of action, and chain outcomes measured by trade composition — and whose predictions can be falsified. And it locates the empirical setting for such tests: a gradient of commodity dependence across the enlargement economies of Central and Eastern Europe that existing comparative work has not explained.

Section 2 sets out the three traditions and the selective regulation lens. Section 3 describes the data, cluster definitions and analytical tools, including the trade indicator used for the comparative illustration. Section 4 reports the bibliometric results in the order of RQ1 and RQ2. Section 5 answers RQ3: it interprets the three disconnects, formalises the framework as a matrix, states the propositions, illustrates the empirical setting and discusses limitations. Section 6 concludes.

2 Three traditions and the selective regulation lens

2.1 Endogenous market structures and their limits

The theory of endogenous market structures provides the analytical foundation for understanding why some market systems evolve towards deeper processing while others remain locked in commodity export. Romer (1990) showed that investment in research generates knowledge spillovers with increasing returns at the system level; Aghion and Howitt (1992) formalised growth through creative destruction, in which more productive entrants displace incumbents and continuously renew market structure. Etro (2007, 2009) carried this logic to the meso level: market structure is determined by the interplay of entry, exit and strategic behaviour, so that firms' decisions shape entry conditions and entry in turn reshapes strategies. Etro (2014) surveys the theory's reach across trade, monetary policy and industrial organisation. Aghion et al. (2001) established the inverted-U relationship between competition and innovation, a result with direct implications for the design of interventions in concentrated agri-food markets; Aghion et al. (2015) showed that sectoral industrial policy raises productivity where it preserves rather than suppresses competition. Czarnitzki et al. (2014) confirmed empirically that the threat of entry raises the R&D of incumbent leaders while reducing that of the average firm, Chu and Ji (2016) extended the framework to monetary transmission, and Jiang et al. (2024) showed that reducing entry barriers generates sustained productivity growth precisely through endogenous restructuring of markets — a result that resonates with the principle of removing barriers rather than injecting resources.

The application of EMS to agri-food markets remains limited, and the reasons are structural. Agricultural production is land-based and seasonal; perishability constrains storage and trade; processors and retailers exercise monopsony power; and millions of smallholders coexist with large agroholdings in a polarised structure that defies the representative-firm assumption. The path dependence of such systems produces what Unruh (2000) called lock-in, and Schneiberg (2007) showed that escaping lock-in requires institutional breakthroughs through alternative organisational forms rather than incremental adjustment. The analytical power of EMS — its capacity to explain how endogenous dynamics generate concentration, innovation patterns and lock-in — has therefore not been brought to bear on the question of why agri-food systems in transition economies fail to move beyond commodity export. This is the first disconnect.

2.2 Policy instruments without a diagnostic framework

The second tradition is the literature on agri-food policy instruments. The CAP 2023–2027 reform, enacted through Regulation (EU) 2021/2117 (European Parliament and Council 2021) with its national

strategic plans and New Delivery Model, was shaped as much by external shocks and veto players as by a coherent theory of intervention (Lovec et al. 2024). Implementation of common rules is differentiated across member states according to national conditions rather than to the diagnosed state of the markets concerned (Bazzan and Vogeler 2025). The Unfair Trading Practices Directive (2019/633) addresses bargaining asymmetries along the supply chain; Daskalova (2020) argues that it treats the symptoms of superior bargaining power rather than the market structure that produces it, and Iamiceli and Cafaggi (2019) that power concentration at chain level calls for chain-specific rules and remedies rather than transaction-by-transaction enforcement. LEADER/CLLD programmes mobilise neo-endogenous local action (Bosworth et al. 2016), and eco-schemes attach environmental conditions to income support, but neither is linked to a prior assessment of which market stages need stabilisation and which need activation.

The broader industrial policy literature has moved beyond the market-failure rationale towards a structural-dynamics view in which the purpose of policy is to change the direction of economic activity (Bailey et al. 2023; Juhász et al. 2024). Coyle (2025) argues that competition policy and industrial policy must be designed jointly in an era of structural change. What the agri-food instrument literature lacks is exactly this: a diagnostic layer that tells the policymaker which instrument to deploy, in which market stage, and in what sequence. This is the second disconnect.

2.3 Value chain upgrading without regulatory linkage

The third tradition, global value chain (GVC) analysis, explains upgrading through chain governance and the power relations between lead firms and suppliers (Humphrey and Schmitz 2002; Gereffi 2020). Applied to natural-resource economies, it shows that moving up the chain is a political-economy achievement rather than a market outcome: Lebdioui (2022) documents how Malaysia added value to its commodity exports through deliberate, selective industrial policy over decades. The recent agri-food supply chain literature, as the bibliometric review of Singh and Dwivedi (2025) maps it, has gravitated towards technology — blockchain traceability, smart contracts, Industry 4.0 applications — and tends to treat these as upgrading mechanisms in their own right. Traceability technologies do not, by themselves, alter who captures value; that depends on the regulatory rules governing market access, quality certification and contract enforcement. This is the third disconnect.

2.4 Selective regulation: bridging the gap

Selective regulation, developed in the institutional economics of Ukrainian commodity markets (Authors 2024c; Authors 2026), combines the three traditions into a single logic of intervention. Its unit of analysis is the system of vertically adjacent markets — the chain from seed and grain through milling, feed and bakery to distribution — treated at the meso level of sectors rather than firms, which distinguishes it from the firm-centred GVC tradition. Its central claim is that development in such systems is endogenous: value added created in processing returns to the system as income, demand and investment, so that the chain either reproduces itself cumulatively or, where the circuit is interrupted, locks into commodity export. Three principles follow. Endogeneity: intervention should release blocked internal mechanisms

rather than inject resources from outside. Selectivity: intervention is addressed to specific nodes of the system, and — following the 'let losers go' criterion of Juhász et al. (2024) — must be capable of being withdrawn. Adaptivity: under instability new disruptions appear and old ones disappear, so instruments must be reconfigured continuously.

The framework identifies two kinds of object. Disruptions ('gaps') are interruptions of the flow of goods and value between adjacent stages — for example between grain production and milling. Authors (2026) classify them on seven criteria and distinguish price, information, logistics, institutional, structural and financial gaps; for the purposes of instrument choice this paper collapses the classification to two dimensions — cause, natural (seasonality, technology, transfer of ownership, external shock) or artificial (entry barriers, monopsony, institutional deformation), and depth, from superficial to deep, the last corresponding to lock-in in the sense of Unruh (2000). Growth points are resource-generating stages, identified by their share of the chain's value added, the value-added content of output, reproductive profitability and tax intensity. From EMS the framework takes the diagnosis of these objects as endogenous outcomes of entry, concentration and bargaining; from the instrument literature it takes the repertoire, sorted by mechanism of action rather than by policy domain — stabilising instruments (safety nets, UTP enforcement, contract rules, tariff and procurement measures) remove disruptions, and formative instruments (processing investment support, quality-standard alignment, cooperative organisation, origin certification, LEADER-type local action) activate growth points; from value chain analysis it takes the direction of change, the reorientation of the chain from commodity export towards processing and value capture within the domestic economy. The two types of intervention are sequenced in a cycle: diagnosis of the circuit, addressed intervention, release of blocked mechanisms, monitoring and return to diagnosis.

The framework is not a synthesis of the three traditions' findings but a set of claims about their combination: that disruptions and growth points can be diagnosed from observable indicators; that instruments differ systematically in what they can do about each; and that sequencing matters. Whether such claims hold is an empirical question. The bibliometric analysis that follows establishes, first, whether the literature has already addressed them (it has not) and, second, which of the framework's components are the least developed and therefore where testing should begin.

3 Methods

3.1 Data collection and search strategy

The bibliometric analysis draws on the Scopus database, selected for its coverage of peer-reviewed literature in agricultural economics, food policy, industrial organisation and development studies. Retrieval proceeded in three stages, all of which are documented in full in Additional file 1. Stage 1 comprised 35 core queries (Q1–Q35) organised in 17 thematic sections that span the three research traditions and the EU integration context: CAP reform and the 2023–2027 programming period; the Farm to Fork Strategy and the European Green Deal; resilience of food systems; selective, differentiated and

industrial policy in agri-food; grain and milling markets; sustainability assessment; Ukraine's integration into EU value chains; global value chains; institutional frameworks for trade integration; value addition in grain chains and the commodity trap; the impact of war on food markets; implementation of EU standards and the Unfair Trading Practices Directive; the accession experience of Central and Eastern Europe; post-conflict recovery; competitiveness and cooperatives; circular economy; and cross-cutting theoretical queries on market power, path dependence, endogenous growth and lock-in. Stage 2 added ten supplementary queries (SQ1–SQ10) on nation branding, export promotion, multi-stakeholder partnerships, geographical indications, digital traceability, value chain upgrading, producer organisations and post-conflict marketing. Stage 3 applied gap-filling queries derived from a diagnostic of the source base against the conceptual framework — alternative terminologies for selective regulation, market failure and intervention, cost discovery and mission-oriented industrial policy, evolutionary and regulation theory, lock-in mechanisms, value-added distribution across sectors and food security in conflict. Core queries were limited to the subject areas of economics, agricultural and biological sciences, social sciences, and business and management, and several carry recency limits (PUBYEAR > 2015 to > 2022) that are listed with the query strings; the gap-filling stage was run without these limits, which is why the merged export also contains earlier and non-English records. Table 1 summarises the design and the clusters that each thematic section primarily feeds.

Table 1
Search design: stages, thematic sections and clusters primarily fed (Scopus, 2000–2025)

Stage	Thematic section	Queries	Cluster(s) primarily fed
1 Core	A. Common Agricultural Policy and its reform	Q1–Q3	C2
	B. Farm to Fork Strategy and the European Green Deal	Q4–Q5	C1, C2
	C. Resilience of EU food systems; supply chain disruptions	Q6–Q7	C1, C3
	D. Selective, differentiated and industrial policy in agri-food	Q8–Q9	C2
	E. Grain and milling markets; price volatility and interventions	Q10–Q11	C1, C2
	F. Sustainable development of agri-food markets	Q12	C1
	G. Ukraine's integration into EU value chains; DCFTA	Q13–Q14	C3, C4
	H. Global value chains in agri-food	Q15–Q16	C3
	I. Institutional framework for trade integration; food safety standards	Q17–Q18	C2, C3
	J. Value addition in grain chains; commodity trap	Q19–Q20	C3
	K. Impact of war on food markets; grain corridors	Q21–Q22	C1, C4
	L. Implementation of EU standards; Directive 2019/633	Q23–Q24	C2, C4
	M. CEE accession experience; lessons for candidate countries	Q25–Q26	C2, C4
	N. Post-conflict recovery and agri-food	Q27–Q28	C4
	O. Competitiveness, modernisation, cooperatives and SMEs	Q29–Q30	C2, C3
	P. Circular economy and bioeconomy in the grain sector	Q31	C1
	Q. Cross-cutting: market power, path dependence, endogenous growth, lock-in	Q32–Q35	C2

Stage	Thematic section	Queries	Cluster(s) primarily fed
2 Supplementary	Nation branding, export promotion, partnerships, geographical indications, digital traceability, upgrading, producer organisations, post-conflict marketing	SQ1–SQ10	C3, C4
3 Gap-filling	Thirteen thematic gaps identified by a diagnostic of the source base against the conceptual framework (≈ 102 queries)	—	C1–C4

Total records before deduplication = 25,906; after deduplication by Scopus electronic identifier (EID) = 23,444 unique documents, of which 21,060 published in 2000–2025 (excluding errata and retracted items) form the analysed dataset. Full query strings, PUBYEAR limits and general search parameters are given in Additional file 1. Clusters are assigned by dictionary terms (Section 3.2), not by query; the last column indicates the cluster that each section mainly contributes to.

The combined searches yielded 25,906 records. Deduplication by unique Scopus identifier (EID) left 23,444 unique documents, of which 1,829 published before 2000 and 507 dated 2026 (articles in press) were removed, together with 48 errata and retracted items, to give the analysed dataset of 21,060 documents: 15,007 research articles, 1,551 reviews, 2,079 book chapters, 1,794 conference papers and 629 books, notes, editorials and other types. English accounts for 92% of records; Chinese (747), Spanish (170), Russian (155) and French (129) are the largest other languages. Annual output rises from 199 documents in 2000 to 2,286 in 2025, with a marked acceleration after 2015. The strategy was deliberately inclusive: casting a wide net across all three traditions captures not only the documents that explicitly address selective regulation (of which there are none in Scopus) but also those that address its constituent elements in various combinations. This inclusiveness is what makes the cross-cluster intersection analysis possible.

3.2 Cluster definition

Each document was assigned to one or more of four thematic clusters by a dictionary rule applied to its title, abstract and author keywords: a document belongs to a cluster if at least one dictionary term occurs as a whole word or phrase (singular and plural forms are both listed). Cluster 1 (grain and food markets) includes documents containing 'food security', 'agriculture', 'agricultural', 'agri-food', 'wheat', 'grain', 'maize', 'cereal', 'bread', 'flour', 'crop', 'farming', 'food system' or 'food production'. Cluster 2 (regulation and policy) captures 'regulation', 'industrial policy', 'market failure', 'competition', 'imperfect competition', 'endogenous growth', 'market structure', 'market power', 'game theory', 'Common Agricultural Policy', 'CAP reform', 'governance', 'subsidy' and 'tariff'. Cluster 3 (value chain and trade) encompasses 'value chain', 'supply chain', 'commodity chain', 'global value chain', 'trade', 'export', 'value added', 'processing', 'upgrading', 'logistics', 'blockchain' and 'traceability'. Cluster 4 (EU integration and conflict context) identifies documents mentioning 'European Union', 'EU accession', 'EU enlargement', 'European integration', 'Central and Eastern Europe', 'Eastern Europe', 'post-Soviet', 'transition economy',

'Ukraine', 'war' or 'conflict'. Assignment was implemented in Python (pandas); the dictionaries and the classification script are reproduced in Additional file 1, so that every count reported below can be regenerated from a Scopus export of the same queries.

A single document may belong to several clusters; the design is intentional, because the first research question concerns the degree and nature of overlap between traditions. Cluster 4 deserves comment. Its dictionary combines the vocabulary of enlargement (accession, integration, Central and Eastern Europe) with that of conflict; the two are joined because the research shock of 2022 made the largest candidate country's integration and its wartime disruption a single object of study. Cluster sizes are C1 = 13,045 (61.9% of the dataset), C2 = 6,149 (29.2%), C3 = 6,377 (30.3%) and C4 = 2,341 (11.1%); 2,539 documents (12.1%) match no dictionary, 11,093 (52.7%) match one, and 7,428 (35.3%) match two or more.

3.3 Analytical tools

Three complementary tools were used. Cross-cluster intersection analysis, implemented in Python, generated a matrix of all pairwise and higher-order intersections among the four clusters; it quantifies the share of documents that address two, three or all four themes simultaneously and is the primary evidence for RQ1. Keyword co-occurrence network analysis was performed in VOSviewer 1.6.20 (van Eck and Waltman 2010) on the core subset of documents belonging to two or more clusters (n = 7,428), using author keywords with full counting, a thesaurus that merges plural and variant forms (Additional file 1) and a minimum occurrence threshold of 15, producing a network of 175 keywords in 6 clusters connected by 2,655 links; layout and clustering used VOSviewer's default settings (association strength normalisation, resolution 1.0). The same network was visualised with a temporal overlay in which node colour represents the average publication year of each keyword. Co-authorship analysis by country was performed on the full analysed dataset (n = 21,060), with countries taken from the affiliation field and a minimum of 10 documents per country, producing a network of 108 countries in 6 clusters connected by 2,285 links. Map and network files for both networks are provided in Additional file 2. Each map was constructed to test a specific expectation derived from Section 2: whether EMS terms are structurally connected to agri-food policy terms; whether the theoretical vocabulary has kept pace with emerging empirical topics; and whether the research communities of the enlargement region are integrated into the global structure of knowledge production on agri-food regulation. These are the evidence for RQ2. The analysis follows the guidelines of Donthu et al. (2021) for bibliometric reviews; network visualisations are used here as tests of stated expectations rather than as descriptive illustration.

3.4 Comparative trade indicator

To locate the empirical setting for the propositions derived in Section 5, a simple indicator of commodity dependence was computed for four EU member states of the 2004 and 2007 enlargements (Poland, Hungary, Bulgaria, Romania) and for Ukraine: the ratio of raw cereal exports (HS Chap. 10) to the combined exports of milling products (HS 11) and preparations of cereals, flour and starch (HS 19), in value terms. Values for the EU member states are annual exports to all partners in euro from the Eurostat Comext database, dataset DS-045409, for 2023 and 2024 (Eurostat 2026); the extraction code

is provided in Additional file 1. Values for Ukraine are annual exports in US dollars from the State Customs Service of Ukraine (2025) for 2023–2025, with the chapter-level series for 2019–2025 reproduced in Additional file 1; because the indicator is a ratio, the difference in reporting currency does not affect comparability. The indicator is illustrative: it identifies the gradient across countries that the framework seeks to explain and does not itself test any proposition.

3.5 Use of artificial intelligence tools

In preparing this work, the authors used Claude (Anthropic) for language editing, computational implementation of the analyses and drafting support under the authors' direction. The authors reviewed, verified and edited all content and take full responsibility for the publication.

4 Results

4.1 Publication trends and descriptive overview

The field is expanding rapidly. Annual output grew from 199 documents in 2000 to 2,286 in 2025, an elevenfold increase that reflects the convergence of food security concerns, climate policy, digitalisation and geopolitical shocks. All four clusters follow an upward trajectory but with different inflection points (Fig. 1). Clusters 1 and 3 grow steadily throughout the period, and cluster 3 accelerates after 2020 with the supply-chain literature. Cluster 2 grows more slowly and only passes 400 documents a year in 2023. Cluster 4, the smallest in absolute terms, shows the sharpest inflection: from 176 documents in 2022 to 258 in 2023 and 330 in 2025, driven by the research shock of Russia's full-scale invasion of Ukraine. The United States (4,001 documents), China (3,187), the United Kingdom (1,633) and India (1,470) dominate output; Ukraine ranks fourteenth with 492 documents, ahead of Poland (479) and every other country of the enlargement region. The outlets with most documents are *Sustainability* (293), *Agriculture* (115), the *IOP Conference Series: Earth and Environmental Science* (103) and the *Journal of Cleaner Production* (98); the core agricultural economics journals — *Journal of Rural Studies* (72), *Food Policy* (67), the *American Journal of Agricultural Economics* (50) — contribute far fewer, which already indicates that the field is dominated by sustainability and food-systems outlets rather than by economics.

4.2 Cross-cluster intersections (RQ1)

The intersection matrix (Fig. 2; Table 2) provides the answer to the first research question.

Table 2
Cluster sizes and cross-cluster intersections (N = 21,060)

Intersection	C1 Grain/food	C2 Regulation	C3 Value chain	C4 EU integration/conflict	Documents	% of dataset
Cluster sizes						
C1	●				13,045	61.9
C2		●			6,149	29.2
C3			●		6,377	30.3
C4				●	2,341	11.1
Pairwise intersections						
C1 ∩ C2	●	●			1,879	8.9
C1 ∩ C3	●		●		4,530	21.5
C1 ∩ C4	●			●	1,580	7.5
C2 ∩ C3		●	●		1,709	8.1
C2 ∩ C4		●		●	792	3.8
C3 ∩ C4			●	●	1,083	5.1
Higher-order intersections						
C1 ∩ C2 ∩ C3	●	●	●		843	4.0
C1 ∩ C2 ∩ C4	●	●		●	430	2.0
C1 ∩ C3 ∩ C4	●		●	●	797	3.8
C2 ∩ C3 ∩ C4		●	●	●	331	1.6
C1 ∩ C2 ∩ C3 ∩ C4	●	●	●	●	219	1.0

Documents may belong to several clusters simultaneously; percentages refer to the analysed dataset (N = 21,060). The four-way intersection (219 documents) is the quantitative evidence for the selective regulation gap. Source: authors' calculations from Scopus data with the classification script in Additional file 1.

Pairwise intersections are substantial. 4,530 documents (21.5%) connect grain markets with value chains (C1∩C3), 1,879 (8.9%) connect grain markets with regulation (C1∩C2), and 1,709 (8.1%) connect regulation with value chains (C2∩C3). The three traditions are therefore not hermetically sealed: a sizeable minority of the literature addresses two of them at once. Higher-order intersections, however, fall away sharply. The triple intersection of the three traditions (C1∩C2∩C3) contains 843 documents (4.0%). Adding the EU integration and conflict context reduces the intersection to 219 documents — 1.0% of the dataset. This core is the closest approximation to an integrated field, and its composition is telling. Its most frequent author keywords are 'food security' (20), 'agriculture' (17), 'Ukraine' (12), 'GMO' (12), 'Common Agricultural Policy' (10) and 'risk assessment' (9); a substantial share consists of regulatory safety assessments of genetically modified maize for import and processing, trade-effect studies of the EU–Ukraine Deep and Comprehensive Free Trade Area (DCFTA) and CAP implementation analyses. Only five of the 219 documents mention endogeneity and four mention market structure anywhere in title or abstract. The core is descriptive — it analyses trade flows, policy impacts and market disruptions — rather than integrative, and the term 'selective regulation' occurs in none of the 21,060 documents.

The answer to RQ1 is therefore twofold. Interaction between any two traditions is common; interaction among all three is rare; and interaction among all three in the specific context where the commodity trap is most acute is rarer still and, where it exists, does not take the form of a framework.

4.3 Keyword co-occurrence: structural disconnects (RQ2)

The keyword co-occurrence network (Fig. 3), built from the 7,428 documents that belong to two or more clusters, reveals the internal structure of the field: 175 keywords in 6 algorithmically identified clusters connected by 2,655 links. The clusters are readily interpretable: market economics and EU policy (58 items, including 'European Union', 'industrial policy', 'competition', 'market structure', 'endogenous growth', 'market power', 'game theory', 'price transmission', 'regulation'); grain production, processing and nutrition (42 items, including 'processing', 'value addition', 'rice', 'maize', 'nutrition', 'Africa'); sustainability, CAP and resilience (27 items, including 'sustainability', 'Common Agricultural Policy', 'governance', 'resilience', 'value chain', 'circular economy'); blockchain and digital supply chains (26 items, including 'blockchain', 'traceability', 'smart contract', 'Internet of Things', 'artificial intelligence', 'Industry 4.0'); food security and the war (14 items, including 'food security', 'Ukraine', 'war', 'Russia–Ukraine war'); and genetically modified crops (8 items). Three features answer the first part of RQ2.

The first is the peripheral isolation of endogenous market structure terms. 'Endogenous growth', 'market structure', 'game theory' and 'market power' lie along the lower edge of the network, connected to one another and to 'innovation', 'competition' and 'international trade' but weakly to anything else: 'endogenous growth' has 12 links and 'market structure' 20, against 120 for 'food security'. The six EMS-related keywords have a combined link strength of 130, of which 6 — five per cent — connects them to policy-instrument terms ('Common Agricultural Policy', 'agricultural policy', 'governance', 'regulation', 'subsidies', 'food policy', 'rural development', 'industrial policy'). This confirms the first disconnect: EMS

theory has developed as an intellectually self-contained domain that does not exchange vocabulary with the agri-food policy literature.

The second is the self-contained blockchain cluster at the upper right of the network. 'Blockchain' (317 occurrences, the second most frequent keyword after 'food security'), 'traceability', 'smart contract', 'Internet of Things' and 'Industry 4.0' form a dense sub-network: the link strength within the cluster is 1,194, against 264 to the market-economics and policy cluster, and 'blockchain' co-occurs with 'regulation' in no document and with 'Common Agricultural Policy' in one. This confirms the third disconnect: technological upgrading in agri-food value chains proceeds without substantive engagement with regulatory frameworks.

The third concerns the enlargement and conflict vocabulary. 'Ukraine' (101 occurrences) co-occurs most strongly with 'Russia' (23), 'European Union' (20), 'food security' (17), 'agriculture' (9), 'war' (7), 'grain production', 'trade' and 'export' (3–4 each), and not once with 'endogenous growth', 'market structure', 'blockchain' or 'traceability'. Research on the region where the commodity trap is most severe therefore remains at the descriptive level, documenting flows, war impacts and logistics disruptions, and does not engage the theoretical frameworks or technological instruments that a transformative regulatory response would require.

4.4 Temporal evolution: frozen theory and emerging topics (RQ2)

The temporal overlay (Fig. 4) answers the second part of RQ2: whether the disconnection is narrowing. It is not. Keywords associated with EMS theory have the earliest average publication years in the network: 'market structure' 2013.4, 'endogenous growth' 2014.4 and, just below the display threshold, 'imperfect competition' 2012.3; 'regulation' (2016.8) and 'competition' (2017.1) are little later. These are the oldest active keywords in the network, which indicates that the theoretical foundations relevant to selective regulation effectively stopped developing within this field a decade ago. At the opposite end, 'artificial intelligence' (2024.0), 'Russia–Ukraine war' (2023.8), 'blockchain' (2023.2), 'Industry 4.0' (2023.2), 'circular economy' (2023.1) and 'resilience' (2022.5) mark the research frontier. 'Ukraine' (2020.4), 'unfair trading practices' (2020.8) and 'global value chain' (2021.4) lie between the two. The overlay thus reveals a paradox: the most theoretically grounded tradition is chronologically frozen, whereas the most empirically urgent topics are expanding rapidly without theoretical anchorage. The gap between them is widening, not closing.

4.5 Co-authorship geography (RQ2)

The co-authorship network by country (Fig. 5) encompasses 108 countries in 6 clusters. The global core — the United States, China, the United Kingdom, Germany and Italy — occupies the centre with dense mutual connections. The member states of the 2004–2013 enlargements (Poland, Romania, Hungary, the Czech Republic, Slovakia, Bulgaria, Slovenia, the Baltic states, Croatia) belong to the large European cluster anchored by Germany and the United Kingdom but sit at its right edge; Ukraine lies beyond them,

at the outer margin of the map, in a small cluster with Moldova, Georgia and a few non-European countries. Ukraine's 54 links carry a total strength of 223, of which Poland accounts for 40, the United States 19, Germany 16 and the United Kingdom 11: its ties to the core are few and mediated primarily through Poland and Germany. The implication is direct: the conceptual resources needed to build an integrative framework — EMS theory, GVC analysis and CAP evaluation expertise — reside in research communities with which the region's scholars have limited collaborative ties.

The temporal overlay of the same network (Fig. 6) shows Ukraine in the newest colour band: its average publication year of 2021.8 is the latest of any country with more than 100 documents, against 2015.2 for the United States, 2016.0 for the United Kingdom, 2016.4 for Germany, 2019.5 for Poland and 2018.4 for Romania. The region's position is thus characterised by a double peripherality — geographical, at the edge of the collaboration network, and temporal, entering the field mainly in response to crisis. Overcoming it requires substantive theoretical integration, not merely more co-authorship.

5 Discussion

5.1 Three disconnects and their consequences

The three tools converge on the same structure. The co-occurrence network shows EMS terms at the periphery; the temporal overlay shows that their isolation is chronological as well as topological; the co-authorship network shows that the research communities where the commodity trap is most acute are the least connected to the communities where the theoretical resources for addressing it are produced. Each disconnect has a consequence for regulatory design. Without EMS-based diagnostics, policymakers cannot distinguish disruptions that are endogenous — self-reinforcing through lock-in and bargaining asymmetry — from those that are exogenous, and so cannot know whether an instrument that removes a symptom will also remove its cause. Without a link between instrument choice and value chain analysis, interventions address individual stages rather than the flow between them. Without a bridge across the geographical gap, the evidence base for the enlargement economies remains descriptive.

The history of EU enlargement shows what these consequences look like in practice. Gorton et al. (2009) argued that the CAP, transferred to Central and Eastern Europe as a package designed for Western European commercial farming, did not fit the region's semi-subsistence farm structures and rural economies. Two decades on, the trade data confirm the persistence of structural differences within the enlarged Union: Poland, whose accession coincided with sustained investment in processing capacity, exports more processed than raw grain products, whereas Romania and Bulgaria, with polarised farm structures and weaker processing sectors, remain net exporters of raw grain (Section 5.4). Agri-food systems resist directional change because the incumbents of existing configurations benefit from them (Béné 2022; Conti et al. 2021); the resilience framework of Meuwissen et al. (2019), which distinguishes robustness, adaptability and transformability, maps directly onto the distinction between stabilising and

formative regulation. The question is not whether the instruments exist but on what basis they are selected and sequenced.

The EU's own regulatory architecture already contains the two-component structure that the framework makes explicit, without naming it. Within the CAP 2023–2027, enhanced conditionality enforces minimum standards — a stabilising function that removes disruptions — while eco-schemes reward practices beyond the baseline, a formative function that activates growth points; within the common market organisation under Regulation (EU) 2021/2117, the safety net of intervention, private storage aid and the crisis reserve stabilises flows disrupted by exogenous shocks, while support for producer and interbranch organisations and supply regulation for protected designations of origin are formative instruments that concentrate value added in specific chains. The evolution of the CAP from guaranteed prices and intervention purchasing to decoupling, cross-compliance and the New Delivery Model can be read as a gradual and incomplete shift from uniform exogenous regulation to differentiated selective regulation, delegated to member states through national strategic plans (Lovec et al. 2024). What the architecture lacks is the diagnostic layer: nothing in it requires a member state to classify the state of a stage pair before choosing between the stabilising and formative components.

5.2 From gap to framework: the selective regulation matrix

The bibliometric results identify the components of the framework that the literature has left least developed: the diagnostic layer (EMS applied to agri-food stages) and the mapping from diagnosis to instrument. Table 3 states that mapping explicitly. Rows are the states in which an adjacent pair of market stages — for example grain production and milling, or milling and bakery — can be found, diagnosed from observable indicators; columns give the instrument type indicated for each state, the chain outcome expected, and the indicator that would show whether the outcome has occurred.

Table 3

The selective regulation matrix: diagnosed state of adjacent market stages and indicated instruments

Diagnosed state of a stage pair	Diagnostic indicators (EMS)	Indicated instrument type	Examples of instruments	Expected chain outcome	Outcome indicator
A. Stable flow: competitive entry, value flow between stages uninterrupted	Low concentration at both stages; entry and exit responsive to margins; stable inter-stage price transmission	None beyond general competition policy	Monitoring; horizontal rules	Continued upgrading through market forces	Stable or falling raw-to-processed export ratio
B. Artificial (endogenous) disruption: value flow interrupted by market power, entry barriers or institutional deformation; deep cases correspond to lock-in	High concentration or monopsony at the downstream stage; asymmetric price transmission and unequal distribution of the retail price along the chain; persistent margin squeeze; share of raw flow diverted from processing to export rising across price cycles; shadow segment	Stabilising	UTP enforcement; contract and payment-term rules; safety-net purchasing; cooperative bargaining structures	Restored flow; volatility of inter-stage margins reduced; no level change in chain composition	Reduced margin volatility; unchanged export ratio
C. Natural or exogenous disruption: value flow interrupted by seasonality, technology or an external shock	Capacity loss or logistics failure at a stage; input flow interrupted without change in concentration or bargaining structure	Stabilising (temporary)	Targeted tariff or procurement measures; corridor logistics; reconstruction support for the affected stage	Flow restored to pre-shock level	Recovery of the affected stage's output and exports
D. Growth point: resource-generating stage with unrealised	High share of chain value added and tax revenue; high value-added content of	Formative (after B or C has been stabilised)	Processing investment support; quality-standard alignment;	Reorientation of the chain towards processing	Falling raw-to-processed export ratio; rising domestic

Diagnosed state of a stage pair	Diagnostic indicators (EMS)	Indicated instrument type	Examples of instruments	Expected chain outcome	Outcome indicator
value-added potential	output; reproductive profitability; unused or importable capacity; domestic demand supplied by imports		origin certification; LEADER-type local action; cooperative processing		share of processed supply

A stage pair is two adjacent stages of a value chain, for example grain production and milling, or milling and bakery. The distinction of disruptions by cause (natural/artificial) and depth condenses the seven-criterion typology of Authors (2026); the value-added indicators for growth points follow the intersectoral value-added balances of the same source. The same instrument may be indicated in one state and contraindicated in another; formative instruments presuppose a stabilised flow (Section 5.2).

Two features of the matrix distinguish it from a list of instruments. The first is that the same instrument can be indicated or contraindicated depending on the diagnosed state. Tariff protection for a processing stage is a stabilising measure where the disruption is exogenous (a war-induced loss of capacity) and a distortion where the disruption is endogenous (a domestic monopsony that would simply capture the rent). Processing investment support is formative where a growth point exists — unused milling capacity, a domestic feed market supplied by imports — and wasteful where the binding constraint is upstream bargaining asymmetry that no amount of downstream investment will relieve. Extended producer responsibility schemes are a further formative instrument of this kind: by assigning the cost of by-products and residues to the stage that generates them, they create demand for circular processing links — feed and bioenergy from milling and bakery residues — that the chain would not otherwise form (Authors 2024a). The second feature is sequencing: formative instruments presuppose a stabilised value flow, because investors in processing capacity will not enter a stage whose input supply is disrupted. The matrix therefore implies an order of intervention, not merely a menu.

5.3 Testable propositions

The matrix generates the following propositions. Each is stated with the observable variables and the empirical design that would allow it to be rejected (Table 4).

P1 (endogeneity of disruptions). In agri-food market systems of the enlargement region, the raw-to-processed export ratio is persistent: it does not revert towards the EU average in response to price cycles alone, because the disruption between production and processing reproduces itself through entry barriers and bargaining asymmetry. A rejection would be a ratio that mean-reverts across the 2007–2024 panel without any change in instruments.

P2 (instrument specificity). Stabilising instruments reduce the volatility of value flows between adjacent stages but do not shift the level of the ratio; formative instruments shift the level. A rejection would be a significant level effect of UTP transposition or safety-net measures, or the absence of a level effect of processing investment support in countries where it was deployed at scale.

P3 (sequencing). The level effect of formative instruments is conditional on prior stabilisation: it is larger where the volatility of the upstream value flow has fallen below a threshold, and negligible where it has not. A rejection would be an unconditional effect of formative instruments regardless of upstream volatility.

P4 (structural conditionality). The effect of uniform CAP instruments on chain reorientation decreases with the polarisation of farm structure, measured as the share of utilised agricultural area held by holdings above 1,000 hectares relative to the share held by holdings below 10 hectares. A rejection would be a homogeneous effect across countries with different polarisation.

P5 (conflict adaptation). In conflict-affected systems, the destruction of processing capacity converts stages that were growth points before the shock into disruptions after it, so that the indicated instrument sequence temporarily reverses: stabilisation of the affected stage precedes any formative measure. A rejection would be a sustained recovery of processed exports under formative instruments alone, without prior restoration of the stage's input flow.

Table 4
Propositions, observable variables and empirical designs

Proposition	Dependent variable	Explanatory variables	Design	Data
P1 Endogeneity of disruptions	Raw-to-processed export ratio (HS 10 / HS 11 + 19), annual	Own lags; price cycle (world cereal prices); instrument dummies	Panel unit-root and persistence tests; half-life of deviations from EU mean	Eurostat Comext, national customs statistics, 2007–2024
P2 Instrument specificity	Level and volatility of the export ratio; volatility of inter-stage margins	Timing of stabilising instruments (UTP transposition, safety nets) and formative instruments (processing investment schemes)	Difference-in-differences with staggered adoption; separate level and variance equations	CAP strategic plans; national transposition dates; Comext
P3 Sequencing	Level of the export ratio	Formative instrument × prior upstream volatility (interaction); threshold in volatility	Interaction and threshold regression	As P2, plus monthly price and margin series
P4 Structural conditionality	Change in export ratio after instrument adoption	Instrument × farm-structure polarisation (area share of holdings > 1,000 ha relative to < 10 ha)	Heterogeneous-effects estimation across countries	Eurostat Farm Structure Survey; national agricultural censuses
P5 Conflict adaptation	Processed exports and imports of the affected stage (flour, feed)	Capacity destruction; corridor closures; timing of stabilising and formative measures	Before-and-after analysis with 2022 as the break; event study by stage	State Customs Service of Ukraine, monthly, 2019–2025

Each proposition is stated in Section 5.3 with the observation that would reject it.

5.4 The empirical setting: a gradient of commodity dependence

The propositions are to be tested where the commodity trap varies most. Table 5 shows that the enlargement economies of Central and Eastern Europe form a gradient rather than a homogeneous group.

Table 5
Raw-to-processed grain export ratio, selected enlargement economies and Ukraine, 2023–2025

Country	Year	Raw cereals, HS 10 (million)	Milling and bakery products, HS 11 + 19 (million)	Ratio HS 10 / (HS 11 + 19)
Poland	2023	EUR 3,576.0	EUR 5,149.0	0.69
	2024	EUR 2,302.8	EUR 5,331.0	0.43
Hungary	2023	EUR 1,650.7	EUR 695.8	2.37
	2024	EUR 1,696.9	EUR 706.4	2.40
Bulgaria	2023	EUR 2,135.8	EUR 506.7	4.22
	2024	EUR 1,495.2	EUR 523.5	2.86
Romania	2023	EUR 4,125.5	EUR 534.0	7.73
	2024	EUR 2,954.6	EUR 592.7	4.98
Ukraine	2023	USD 8,306.5	USD 471.8	17.61
	2024	USD 9,418.4	USD 508.2	18.53
	2025	USD 7,274.5	USD 618.5	11.76

Export values to all partners. EU member states: Eurostat Comext, dataset DS-045409, annual data, accessed 1 September 2026 (Eurostat 2026). Ukraine: State Customs Service of Ukraine (2025), authors' calculations; the 2019–2025 series at HS heading level is given in Additional file 1. Because the indicator is a ratio, the difference in reporting currency does not affect comparability across countries.

Poland exports between one and a half and two and a half times more processed than raw grain products, a position reached over two decades of CAP membership; the input–output comparison of Ambroziak and Bułkowska (2024) documents the resulting structural contrast between the Polish and Ukrainian agri-food sectors. Hungary's ratio is stable at about 2.4. Bulgaria and Romania, members since 2007, export three to eight times more raw than processed grain products, and the fall in their ratios between 2023 and 2024 reflects a decline in raw cereal export values rather than growth in processing. Ukraine is the extreme case: a ratio of 17.6 in 2023 and 18.5 in 2024, falling to 11.8 in 2025. The fall is not a sign of upgrading in the milling stage. Raw cereal exports of US$7.3 billion in 2025 were 41% below the 2021 peak under wartime logistics constraints, while wheat flour exports collapsed fourfold, from US$93 million in 2019 to US$23 million in 2025, and imports of compound feed doubled from US$212 million to US$455 million, leaving a feed trade deficit of US$404 million (State Customs Service of Ukraine 2025; Authors 2024b). The one stage that moved is bakery: exports of bread, pastry and biscuits (HS 1905) rose from US$174 million in 2019 to US$373 million in 2025, which is why the 2025 ratio improved. In the terms of the matrix, the milling stage is a growth point that has become a disruption under the conflict shock (state C); the feed stage is a growth point supplied from abroad

(state D, unactivated); and the bakery stage is a growth point that is activating through market forces alone — the case in which formative instruments have the highest expected return.

Two further diagnostics from the same system illustrate what the matrix requires. The first is the long-run allocation of the grain flow: in 1995, 81% of Ukraine's grain use went to domestic processing (food, feed and industrial use) and 2.3% to export; by 2020 processing took 23% and export 72%, so that raw exports exceeded domestic processing threefold (authors' calculations from the grain balances of the State Statistics Service of Ukraine 2021 and earlier editions). A disruption of that depth and duration is deep and artificial in the framework's typology — it has reproduced itself through the incentives of exporters, port logistics and grain traders across every price cycle of two decades, which is the persistence P1 predicts. The second is the diagnosis of gaps in the same chain from intersectoral value-added balances for 2010–2021 (Authors 2026): a price gap, with import prices of processed grain products exceeding export prices of raw grain by a factor of two to seven, so that value added is redistributed to the importing countries; an information gap in the form of opaque price formation between stages; a financial gap in the working capital of processors; and a structural gap in the raw orientation of exports — while the processing stages generate the highest value added per unit of raw material. That configuration — a growth point squeezed between an upstream disruption of price transmission and a downstream financing constraint — is state B upstream and state D downstream in Table 3, and it indicates a stabilising instrument (UTP enforcement, contract and payment-term rules) before a formative one, exactly the sequence P3 posits.

The gradient is the reason the framework matters beyond a single country. If Romania and Bulgaria, with full access to CAP instruments for almost twenty years, display a ratio five to eight times higher than Poland, then instrument availability is not the explanation; the basis on which instruments are selected and sequenced is. Nivievskyi (2024) shows that the administrative capacity of Ukrainian agri-food public authorities to implement the acquis remains underdeveloped, which argues for a selective and sequenced approach rather than wholesale transplantation; Halytsia et al. (2025) find that environmental performance differs across Ukrainian crop producers, which argues for differentiated instruments; and Régnier and Aubert (2025) show that Ukraine's exports to the EU are predominantly raw cereals and oilseeds of low added value and that accession would reinforce rather than reverse the trade trends in place since the mid-2010s. All three observations are consistent with P4 and with the diagnostic logic of the matrix, and all three await a test.

5.5 Research agenda

Testing the propositions requires four lines of work, listed in order of dependence. The diagnostic indicators of Table 3 must be operationalised and validated against expert assessment of known cases, so that the state of a stage pair can be classified reproducibly. A panel of enlargement economies must be assembled, combining trade composition (Comext and national customs data at HS chapter level), instrument timing (CAP strategic plans, UTP transposition dates, national processing-support schemes) and farm-structure indicators (Eurostat Farm Structure Survey), to test P1–P4 with difference-in-differences and threshold designs. The conflict adaptation proposition (P5) requires a before-and-after

design on Ukrainian customs data with 2022 as the break. And the technological upgrading literature must be reconnected to regulation by treating blockchain-enabled origin certification and quality verification as candidate formative instruments whose effect on value capture can be measured, rather than as ends in themselves. The CAP post-2027 debate offers a policy window for the first two lines: if national strategic plans were required to classify stage pairs before selecting instruments, the classification itself would become data.

5.6 Limitations

Scopus introduces a language bias: English-language publications dominate the analysed set, and the substantial body of Ukrainian-, Polish- and Romanian-language scholarship on grain market regulation is underrepresented. Keyword-based cluster assignment is an approximation; a document may address value chain issues without using the terms in the Cluster 3 dictionary. Cross-cluster analysis quantifies thematic overlap, not depth of integration, and the 219-document core was characterised through its keywords and a reading of titles and abstracts rather than a full content analysis. The dictionary rule is transparent and reproducible but coarse: it counts a document that mentions 'competition' in passing as belonging to the regulation cluster, and the pre-2000 and non-English records retrieved by the gap-filling stage were excluded rather than classified. The comparative trade indicator is a ratio of export values and does not control for domestic consumption of processed products, exchange rates or the composition of HS Chap. 19, which includes products with imported inputs. The framework itself is not tested here: the bibliometric evidence establishes that the literature has not tested it and identifies where testing should begin, but the propositions of Section 5.3 remain propositions until the designs of Table 4 have been executed.

6 Conclusions

This paper asked how far three research traditions relevant to the regulation of agri-food markets — endogenous market structures, policy instruments and value chain integration — interact, which of their mechanisms remain disconnected, and what the pattern of disconnection implies for instrument choice. A bibliometric analysis of 21,060 Scopus documents shows substantial pairwise overlap but a sharp narrowing at higher orders: 1.0% of the field addresses all three traditions in the EU integration context, and none within a unified framework. The disconnection is structural and widening: EMS vocabulary is frozen at 2013–2014 and shares five per cent of its link strength with policy-instrument vocabulary, while the empirical frontier moves to blockchain, resilience and conflict; the research communities of the enlargement region are doubly peripheral, geographically and temporally.

From these results the paper derives selective regulation as a decision framework rather than a concept: a matrix that maps diagnosed states of adjacent market stages to stabilising or formative instruments, and five propositions — on the endogeneity of disruptions, instrument specificity, sequencing, structural conditionality and conflict adaptation — that can be rejected with trade, policy and farm-structure data. The empirical setting for those tests is the gradient of commodity dependence across Poland, Hungary,

Bulgaria, Romania and Ukraine, where instrument availability cannot explain the differences and instrument selection might.

For agricultural economics the contribution is a way of asking the question of how to regulate more efficiently that does not begin with a list of instruments. For policy the contribution is a criterion: before an instrument is deployed at a stage of the grain chain, the state of that stage and its neighbours should be diagnosed and the instrument chosen for the state, not for the stage. For the enlargement process, in which the CAP will have to accommodate an agricultural sector of Ukraine's scale, the contribution is a research agenda whose first steps — operationalising the diagnostic indicators and assembling the panel — can be taken now.

Abbreviations

CAP: Common Agricultural Policy

CEE: Central and Eastern Europe

CLLD: Community-Led Local Development

DCFTA: Deep and Comprehensive Free Trade Area

EID: Electronic identifier (Scopus document identifier)

EMS: Endogenous market structures

GMO: Genetically modified organism

GVC: Global value chain

HS: Harmonized Commodity Description and Coding System

LEADER: Liaison Entre Actions de Développement de l'Économie Rurale

UTP: Unfair trading practices

Declarations

Author Contribution

OZ and SB conceptualised the study. SB and ON designed the bibliometric methodology. OZ and ON developed the search strategies and collected the data. OZ performed the VOSviewer analyses; ON and VD performed the cross-cluster intersection analysis. OZ, SB and ON developed the selective regulation framework and the propositions. ONk and SS carried out the analysis of CAP instruments and policy. OZ

and SB wrote the original draft; SB and ONk reviewed and edited the manuscript. All authors read and approved the final manuscript.

Data Availability

Four datasets underlie the results. (1) Scopus bibliographic records (Elsevier): 25,906 records retrieved with the queries listed in Additional file 1, deduplicated to 23,444 unique documents, of which 21,060 were analysed; the records are used under the Scopus licence and cannot be redistributed, but the query strings, term dictionaries and classification script in Additional file 1 allow the dataset and every count in the paper to be regenerated from a Scopus export. (2) Eurostat Comext, dataset DS-045409 (EU trade since 1988 by HS2-4-6 and CN8), publicly available at https://ec.europa.eu/eurostat/comext; the extraction code and the values used are in Additional file 1. (3) State Customs Service of Ukraine customs statistics, publicly available at https://customs.gov.ua/statistika-ta-reiestri; the 2019–2025 series used are in Additional file 1. (4) VOSviewer map and network files for the keyword co-occurrence and country co-authorship networks (Figs. 3–6), provided as Additional file 2.

References

1. Abay KA, Breisinger C, Glauber J, Kurdi S, Laborde D, Siddig K (2023) The Russia–Ukraine war: implications for global and regional food security and potential policy responses. Glob Food Secur 36:100675. doi:10.1016/j.gfs.2023.100675
2. Aghion P, Cai J, Dewatripont M, Du L, Harrison A, Legros P (2015) Industrial policy and competition. Am Econ J Macroecon 7(4):1–32. doi:10.1257/mac.20120103
3. Aghion P, Harris C, Howitt P, Vickers J (2001) Competition, imitation and growth with step-by-step innovation. Rev Econ Stud 68(3):467–492. doi:10.1111/1467-937X.00177
4. Aghion P, Howitt P (1992) A model of growth through creative destruction. Econometrica 60(2):323–351. doi:10.2307/2951599
5. Ambroziak Ł, Bułkowska M (2024) Agri-food sector in Ukraine and Poland: a comparative analysis using the input–output model. Sustainability 16(19):8577. doi:10.3390/su16198577
6. Authors (2024a) [Details removed for double-anonymous review]
7. Authors (2024b) [Details removed for double-anonymous review]
8. Authors (2024c) [Details removed for double-anonymous review]
9. Authors (2026) [Details removed for double-anonymous review]
10. Bailey D, Labory S, Tomlinson PR (2023) Industrial policy beyond market failure: structural dynamics, innovation and economic governance for industrial development. In: Bianchi P, Labory S, Tomlinson PR (eds) Handbook of industrial development. Edward Elgar, Cheltenham, pp 322–337. doi:10.4337/9781800379091.00030

11. Bazzan G, Vogeler CS (2025) Differentiated policy implementation in food safety and animal welfare policymaking. Eur Policy Anal 12(1):e1239. doi:10.1002/epa2.1239
12. Ben Hassen T, El Bilali H (2022) Impacts of the Russia–Ukraine war on global food security: towards more sustainable and resilient food systems? Foods 11(15):2301. doi:10.3390/foods11152301
13. Béné C (2022) Why the Great Food Transformation may not happen – a deep-dive into our food systems' political economy, controversies and politics of evidence. World Dev 154:105881. doi:10.1016/j.worlddev.2022.105881
14. Bosworth G, Annibal I, Carroll T, Price L, Sellick J, Shepherd J (2016) Empowering local action through neo-endogenous development: the case of LEADER in England. Sociol Rural 56(3):427–449. doi:10.1111/soru.12089
15. Chu AC, Ji L (2016) Monetary policy and endogenous market structure in a Schumpeterian economy. Macroecon Dyn 20(5):1127–1145. doi:10.1017/S1365100514000765
16. Conti C, Zanello G, Hall A (2021) Why are agri-food systems resistant to new directions of change? A systematic review. Glob Food Secur 31:100576. doi:10.1016/j.gfs.2021.100576
17. Countryman AM, Litvinov V, Kolodiazhnyi I, Bogonos M, Nivievskyi O (2024) Global economic effects of war-induced agricultural export declines from Ukraine. Appl Econ Perspect Policy 47(2):624–665. doi:10.1002/aepp.13468
18. Coyle D (2025) The relationship between competition policy and industrial policy in an era of structural change. Intereconomics 60(4):205–209. doi:10.2478/ie-2025-0040
19. Czarnitzki D, Etro F, Kraft K (2014) Endogenous market structures and innovation by leaders: an empirical test. Economica 81(321):117–139. doi:10.1111/ecca.12061
20. Daskalova V (2020) Regulating unfair trading practices in the EU agri-food supply chain: a case of counterproductive regulation? Yearb Antitrust Regul Stud 13(21):7–53. doi:10.7172/1689-9024.YARS.2020.13.21.1
21. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM (2021) How to conduct a bibliometric analysis: an overview and guidelines. J Bus Res 133:285–296. doi:10.1016/j.jbusres.2021.04.070
22. Etro F (2007) Competition, innovation, and antitrust: a theory of market leaders and its policy implications. Springer, Berlin
23. Etro F (2009) Endogenous market structures and the macroeconomy. Springer, Berlin. doi:10.1007/978-3-540-87427-0
24. Etro F (2014) The theory of endogenous market structures. J Econ Surv 28(5):804–830. doi:10.1111/joes.12020
25. European Parliament and Council (2021) Regulation (EU) 2021/2117 amending Regulations (EU) No 1308/2013, (EU) No 1151/2012, (EU) No 251/2014 and (EU) No 228/2013. Off J Eur Union L 435:262–314
26. Eurostat (2026) EU trade since 1988 by HS2-4-6 and CN8 (DS-045409) [Data set]. Eurostat Comext. https://ec.europa.eu/eurostat/comext. Accessed 1 Sept 2026

27. Gereffi G (2020) What does the COVID-19 pandemic teach us about global value chains? The case of medical supplies. J Int Bus Policy 3(3):287–301. doi:10.1057/s42214-020-00062-w
28. Gorton M, Hubbard C, Hubbard L (2009) The folly of European Union policy transfer: why the Common Agricultural Policy (CAP) does not fit Central and Eastern Europe. Reg Stud 43(10):1305–1317. doi:10.1080/00343400802508802
29. Halytsia O, Vrachioli M, Nivievskyi O, Sauer J (2025) Assessing the environmental performance of agricultural production using a parametric approach: an application for crop producers in Ukraine. East Eur Econ 63(4):684–706. doi:10.1080/00128775.2024.2368042
30. Humphrey J, Schmitz H (2002) How does insertion in global value chains affect upgrading in industrial clusters? Reg Stud 36(9):1017–1027. doi:10.1080/0034340022000022198
31. Iamiceli P, Cafaggi F (2019) Unfair trading practices in food supply chains. Regulatory responses and institutional alternatives in the light of the new EU Directive. Eur Rev Priv Law 27(5):1075–1113. doi:10.54648/ERPL2019058
32. Jiang H, Zheng Y, Zhu L (2024) Entry barriers and growth: the role of endogenous market structure. Int Econ Rev 65(3):1221–1248. doi:10.1111/iere.12695
33. Juhász R, Lane N, Rodrik D (2024) The new economics of industrial policy. Annu Rev Econ 16:213–242. doi:10.1146/annurev-economics-081023-024638
34. Lebdioui A (2022) The political economy of moving up in global value chains: how Malaysia added value to its natural resources through industrial policy. Rev Int Polit Econ 29(3):870–903. doi:10.1080/09692290.2020.1844271
35. Lovec M, Rac I, Erjavec E (2024) External shocks, policy spillovers, and veto players: (post)exceptionalist common agricultural policy and the case of the 2023–2027 reform. J Eur Integr 46(4):433–453. doi:10.1080/07036337.2023.2300366
36. Meuwissen MPM, Feindt PH, Spiegel A, Termeer CJAM, Mathijs E, de Mey Y, Finger R, Balmann A, Wauters E, Urquhart J, Vigani M, Zawalińska K, Herrera H, Nicholas-Davies P, Reidsma P (2019) A framework to assess the resilience of farming systems. Agric Syst 176:102656. doi:10.1016/j.agsy.2019.102656
37. Nivievskyi O (2024) EU integration of Ukraine – assessing the challenges for agri-food public authorities. SSRN working paper. doi:10.2139/ssrn.4957056
38. Régnier E, Aubert P-M (2025) Ukraine's accession to the EU: implications for the European agricultural sector. EuroChoices 24(2):4–10. doi:10.1111/1746-692X.70001
39. Romer PM (1990) Endogenous technological change. J Polit Econ 98(5, Part 2):S71–S102. doi:10.1086/261725
40. Schneiberg M (2007) What's on the path? Path dependence, organizational diversity and the problem of institutional change in the US economy, 1900–1950. Socio-Econ Rev 5(1):47–80. doi:10.1093/ser/mwl006
41. Singh R, Dwivedi G (2025) Agri-food supply chain management: a review using bibliometric, network, and content analyses. Oper Res Forum 6(2):62. doi:10.1007/s43069-025-00460-x

42. State Customs Service of Ukraine (2025) Customs statistics [Data set]. https://customs.gov.ua/statistika-ta-reiestri. Accessed 9 Apr 2026
43. State Statistics Service of Ukraine (2021) Balansy ta spozhyvannia osnovnykh produktiv kharchuvannia naselenniam Ukrainy 2020 [Balances and consumption of the main food products by the population of Ukraine 2020]. Statistical publication, Kyiv. https://www.ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/07/Zb_Bsph_2020.pdf. Accessed 12 Apr 2026
44. Unruh GC (2000) Understanding carbon lock-in. Energy Policy 28(12):817–830. doi:10.1016/S0301-4215(00)00070-7
45. van Eck NJ, Waltman L (2010) Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics 84(2):523–538. doi:10.1007/s11192-009-0146-3

Figures

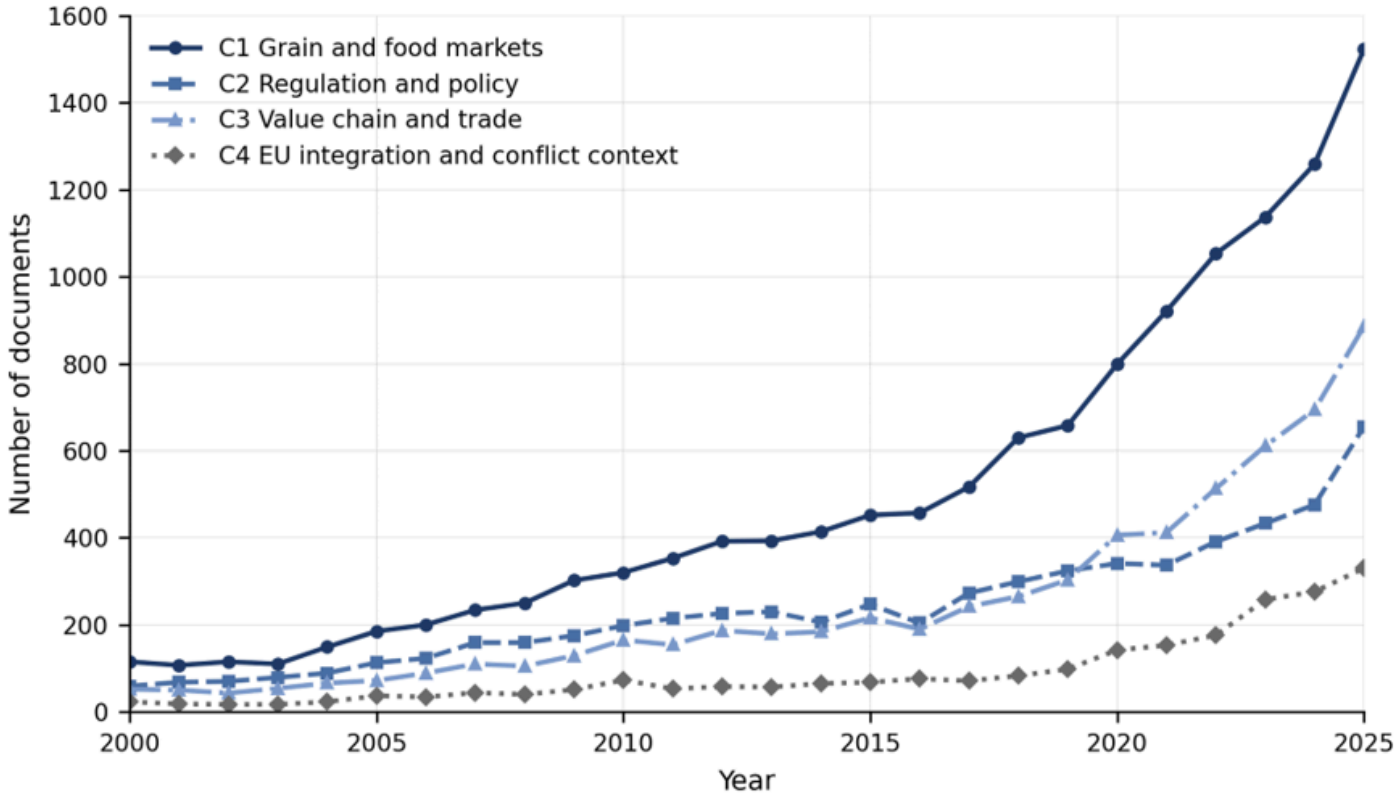


Figure 1

Publication trends by thematic cluster, 2000–2025. Annual number of Scopus documents in each thematic cluster: C1 grain and food markets, C2 regulation and policy, C3 value chain and trade, C4 EU integration and conflict context. A document may belong to more than one cluster. Source: authors' calculations from Scopus data (N = 21,060).

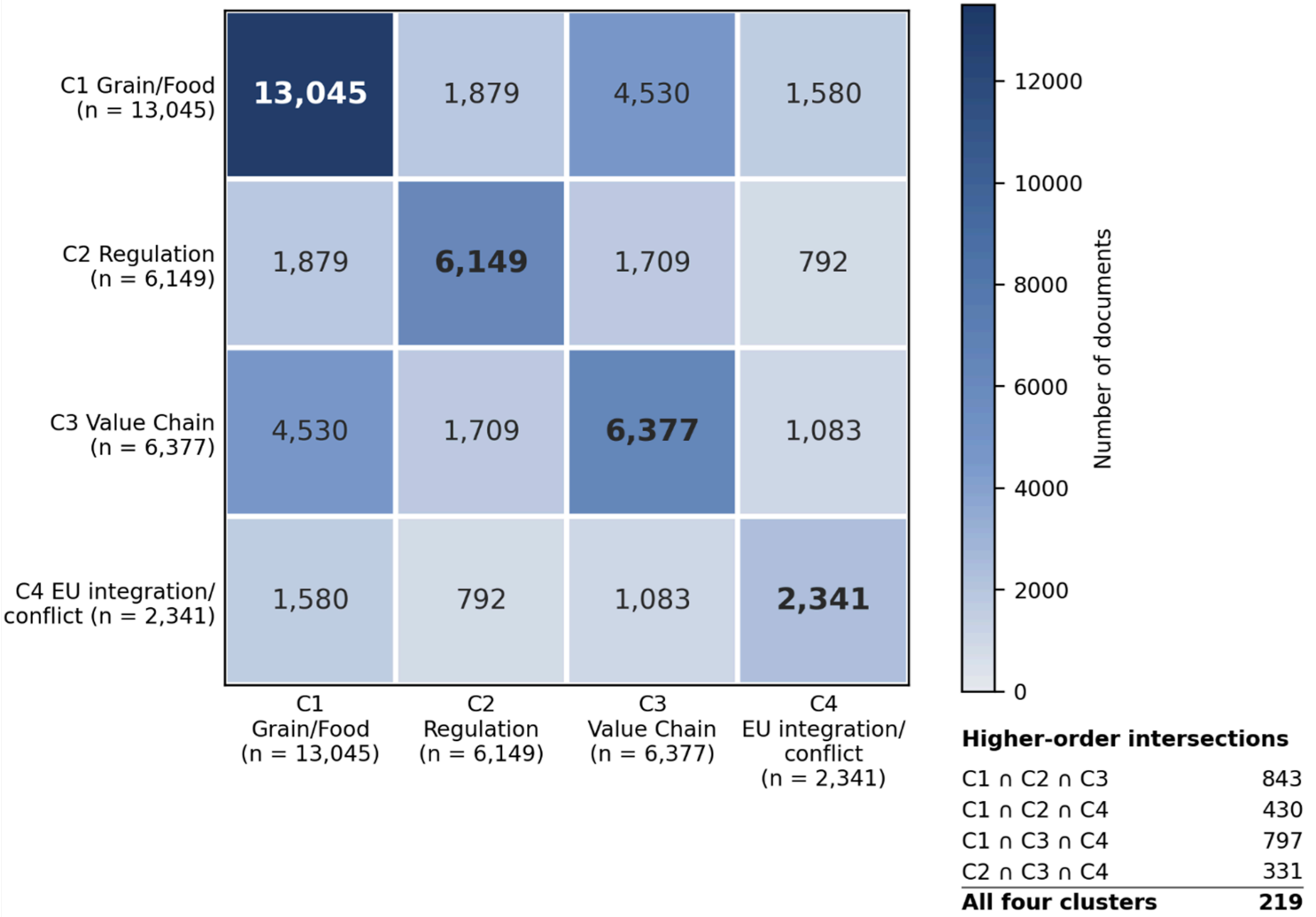


Figure 2

Cross-cluster intersection matrix. Number of documents at each pairwise and higher-order intersection of the four thematic clusters; the intersection of all four clusters contains 219 documents (1.0% of the dataset). Source: authors' calculations from Scopus data (N = 21,060).

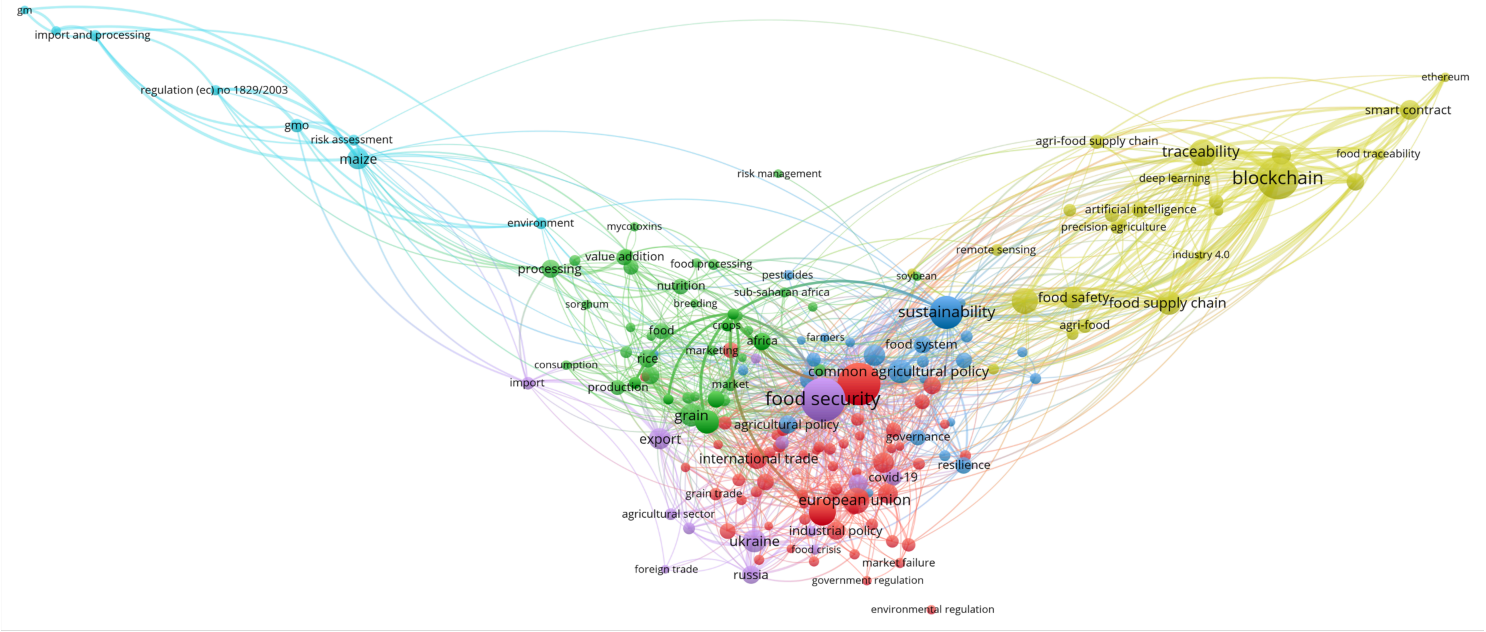


Figure 3

Keyword co-occurrence network of the core subset. Core subset of documents belonging to two or more clusters (n = 7,428); author keywords with at least 15 occurrences after thesaurus merging, 175 items, 6 clusters, 2,655 links. Node size is proportional to occurrences and colour to VOSviewer cluster; endogenous market structure terms lie along the lower edge below 'industrial policy' and 'market failure', the blockchain cluster at the upper right and the genetically modified crops cluster at the upper left. VOSviewer suppresses overlapping labels of low-frequency items; the coordinates of every item are in Additional file 2. Source: VOSviewer 1.6.20 analysis of Scopus data.

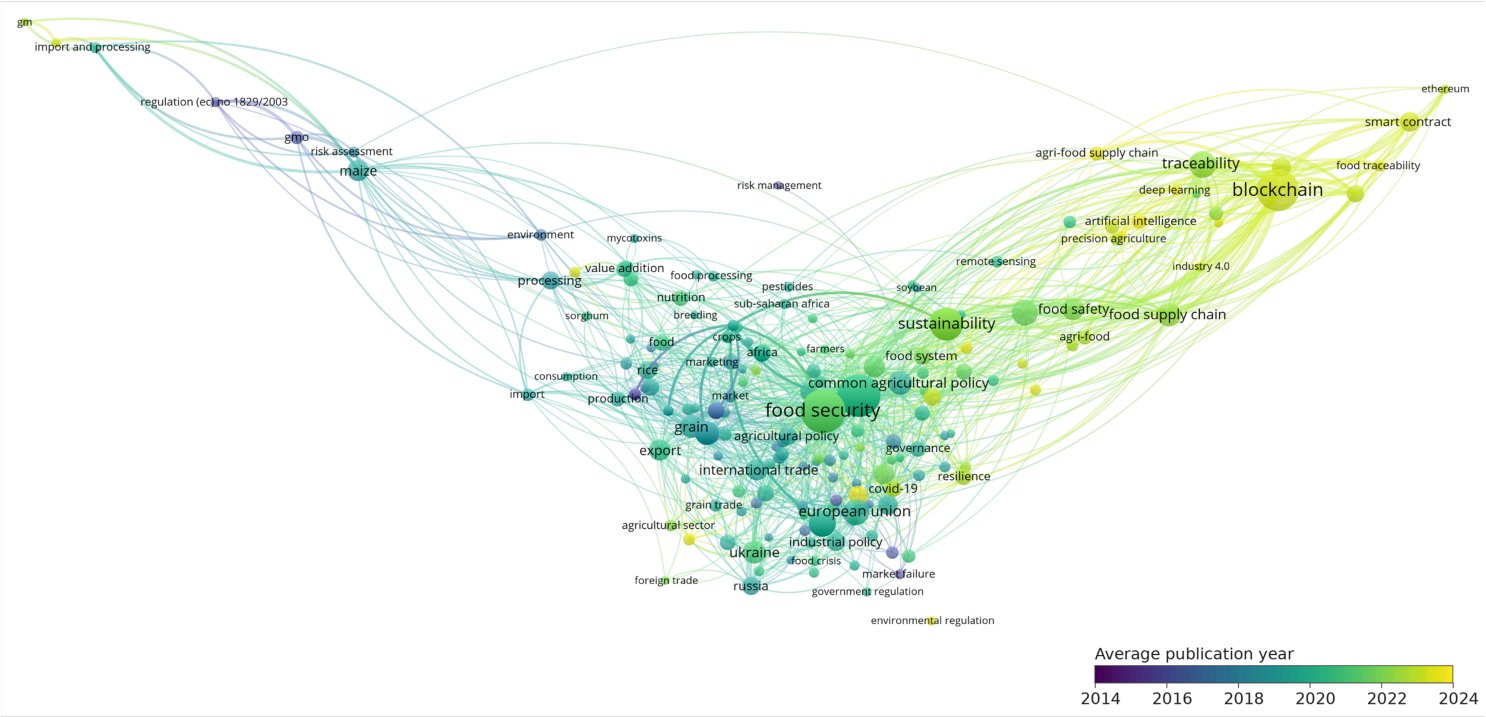


Figure 4

Keyword co-occurrence network with overlay by average publication year. Same network as Fig. 3; node colour shows the average publication year of each keyword on a scale from 2014 (dark blue) to 2024 (yellow). Source: VOSviewer 1.6.20 analysis of Scopus data.

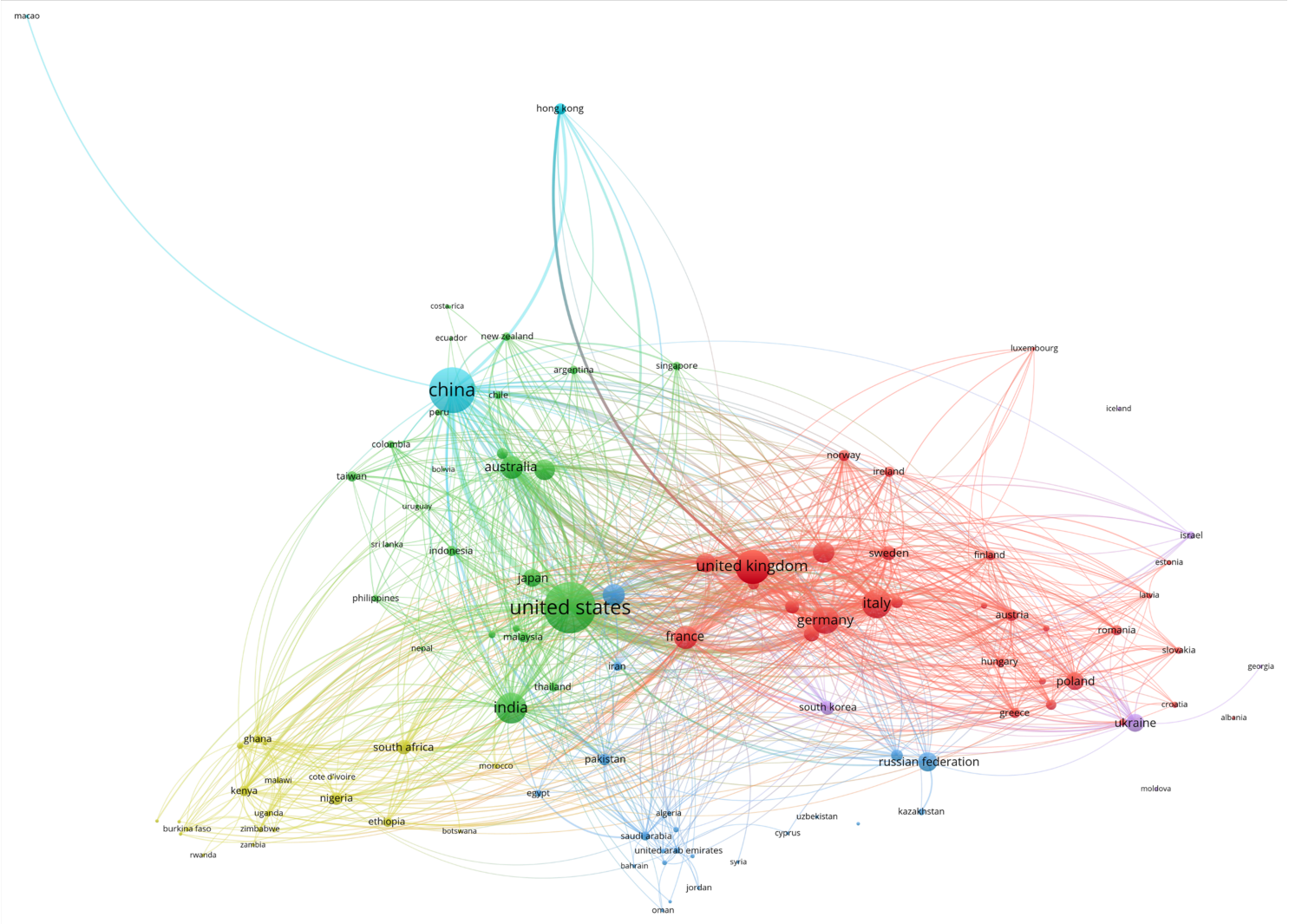


Figure 5

Co-authorship network by country. Analysed dataset (n = 21,060); 108 countries with at least 10 documents, 6 clusters, 2,285 links. Node size is proportional to documents; the member states of the 2004–2013 enlargements are at the right edge of the European cluster and Ukraine at the outer margin. Source: VOSviewer 1.6.20 analysis of Scopus data.

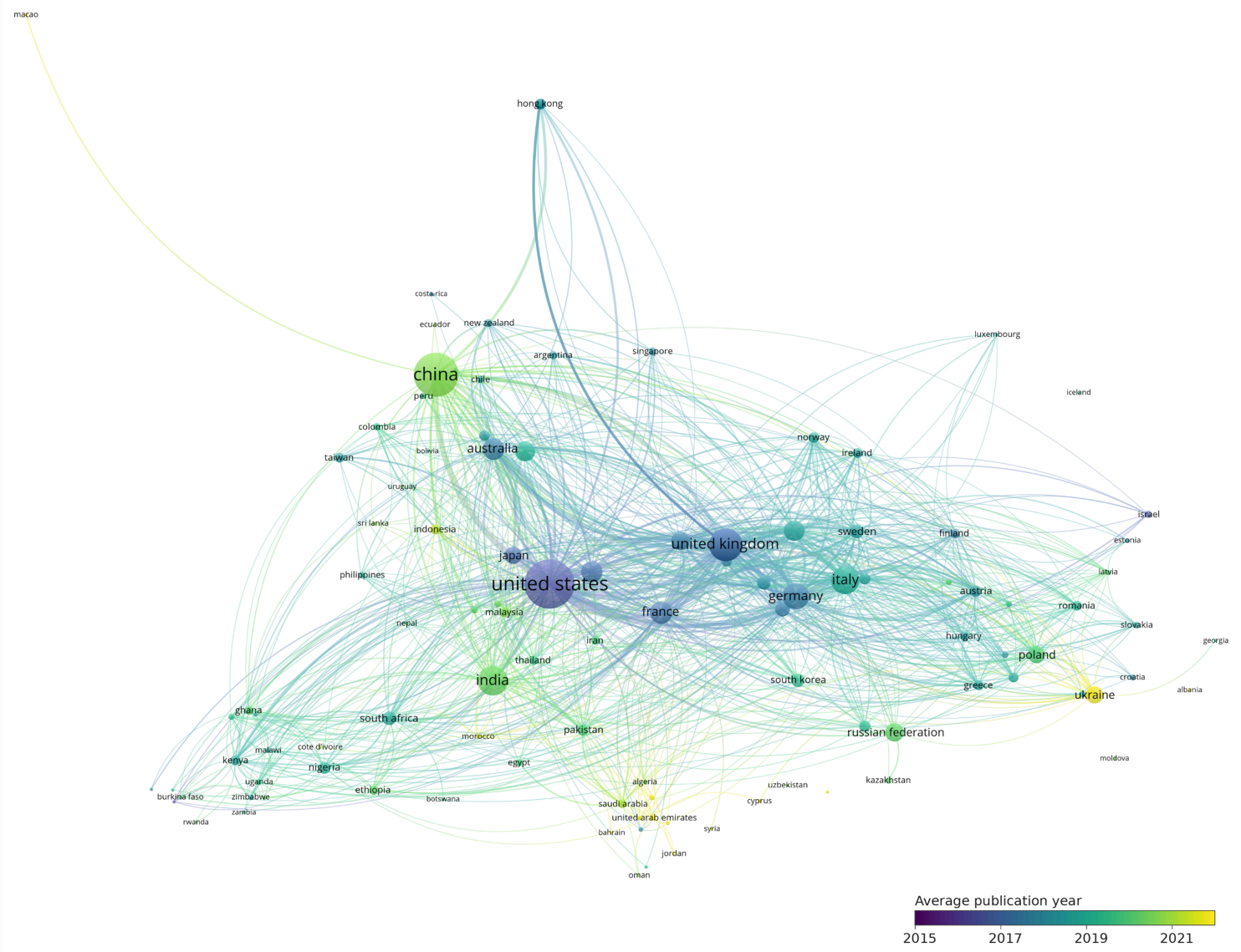


Figure 6

Co-authorship network with overlay by average publication year. Same network as Fig. 5; node colour shows the average publication year of each country's documents on a scale from 2015 (dark blue) to 2022 (yellow). Source: VOSviewer 1.6.20 analysis of Scopus data.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AdditionalFile1AFE.docx
- AdditionalFile2VOSviewer.zip