An economic geography perspective on risk and uncertainty in commodity markets

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Abstract

This thesis examines commodity markets through two complementary lenses. First, it engages with the literature on the material, institutional, and political dimensions of commodity production and trade, emphasizing how governance structures, institutional arrangements, and power asymmetries shape value creation and distribution across space. Second, it investigates the financial dimension of commodity markets, focusing on how the expansion of derivatives trading reconfigures the spatial concentration of market power and the allocation of risk.

More specifically, the thesis analyzes the global wheat market through an integrated perspective at the intersection of economic geography and finance. This approach highlights how physical commodity flows and financial markets interact within a context increasingly shaped by geopolitical tensions and heightened uncertainty. Wheat serves as a critical empirical case due to its systemic importance for food security, its historical and geopolitical relevance, and its central role in derivatives trading.

The conceptual framework draws on multiple strands of literature, notably relational economic geography, new institutional economics, asset pricing, and geographical political economy. Commodity markets are presented as socio-spatial systems in which production, circulation, and financial trading are co-constituted and embedded in evolving institutional and geopolitical contexts. An integrated Global Production and Financial Network (GPFN) approach is developed, where risk and uncertainty are treated as key analytical categories that shape both the structural

configuration and temporal evolution of commodity networks. Particular attention is paid to the role of states as key actors in the network.

Methodologically, the thesis adopts a mixed-method research design, combining qualitative and quantitative analyses across three papers. It integrates in-depth qualitative case studies and an interpretive, critical political economy perspective with econometric modeling. This methodological pluralism is consistent with the traditions of economic geography and enables a comprehensive analysis of both structural patterns and dynamic processes, capturing the interplay between material supply conditions, financial market behavior, and political decision-making.

The key findings underscore the central role of risk and uncertainty in shaping commodity markets. The analysis shows that the structure of the global wheat network reflects deliberate strategies by market participants to manage risk and uncertainty, resulting in the concentration of key nodes and the emergence of new financial centers specialized in the sector, notably Paris. Geopolitical uncertainty is found to exert a significant and persistent impact on wheat futures prices, particularly when it affects supply-side conditions, and cannot be fully hedged by market actors. In addition, state interventions and institutional dynamics play a decisive role in reconfiguring trade flows and network relations, often generating fragmentation. Overall, the thesis demonstrates that commodity markets are highly interconnected yet inherently unstable systems, shaped by the interaction of economic, financial, and political forces across multiple scales.

The thesis contributes to economic and financial geography, particularly to research at the intersection between Global Production Networks (GPNs) and finance, as well as to scholarship on financial markets and political and economic integration processes. By

drawing normative implications, it also provides insights of direct relevance to policymakers, especially in light of increasing geopolitical uncertainty and the strategic importance of commodity markets for macroeconomic stability.

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List of Acronyms

ABCD	Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus
CBOT	Chicago Board of Trade
CCP	Central counterparty
CISS	Composite Indicator of Systemic Stress
CME	Chicago Mercantile Exchange
CSO	Civil society organization
EC	European Commission
ECB	European Central Bank
EU	European Union
EEG	Evolutionary Economic Geography
EPU	Economic Policy Uncertainty
FABS	Financial and business service
FAVAR	Factor-Augmented Vector Autoregressive
GCC	Global Commodity Chain
GFN	Global Financial Network
GPFN	Global Production and Financial Network
GPN	Global Production Network
GPU	Geopolitical Uncertainty
GVC	Global Value Chain
GWC	Global Wealth Chain

HRW	Hard red winter
MATIF	*Marché À Terme International De France*
NEG	New Economic Geography
NIE	New Institutional Economics
OLS	Ordinary Least Squares
TNC	Transnational corporation
REG	Relational Economic Geography
SRW	Soft red winter
UN	United Nations
US	United States
VHI	Vegetation Health Index
WTO	World Trade Organization

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Chapter 1: Introduction

1.1 Background and rationale

Global economic development has been driven by the large-scale production, circulation, and consumption of raw materials essential to food, energy, and the foundations of modern economies. Over the past century, global commodity markets have played a crucial role in sustaining rapid population growth and facilitating industrialization – contributing, albeit unevenly, to rising living standards, poverty reduction and economic development (Baffes and Nagle, 2022). Precisely because commodity markets generate profoundly uneven outcomes across space, they have long constituted a central object of inquiry for economic geographers.

One influential strand of economic geography has focused on the political economy of commodity production and trade, seeking to understand how different actors, institutions, and infrastructures shape governance arrangements and distributional outcomes. A key concern has been the uneven spatial distribution of value, whereby value is generated in extractive or agricultural regions – often located in the Global South – but disproportionately captured in trading, corporate, and financial centers such as London and Geneva (Bargawi and Newman, 2017; Neilson et al., 2018). This literature highlights the persistent marginalization of producing regions and the central role of global lead firms in shaping patterns of accumulation, emphasizing power asymmetries within commodity chains, particularly between producers, traders, processors, and

financial actors. States, international organizations, and regulatory frameworks influence commodity markets mainly through taxation regimes, export controls, trade agreements, and competition policy, shaping both market access and distributional outcomes (Smith, 2015; Horner, 2017). Finally, this body of work situates contemporary commodity geographies within longer historical trajectories, accentuating the enduring influence of colonial legacies and successive waves of globalization on present-day market structures and patterns of accumulation (Tirmizey, 2023).

A second, fundamental line of research has examined how the spatial and temporal logics of physical commodity markets intersect with commodity-linked financial instruments, and particularly how the expansion of derivatives markets has reconfigured the spatial concentration, temporal horizons and distribution of risk in commodity trading (Pike and Pollard, 2010; French et al., 2011; Field, 2016). Long before the recent acceleration of financialization, Marxist and political economy–oriented geographers had already drawn attention to the role of finance in reshaping commodity circulation and accumulation (Harvey, 2006). Scholars have highlighted how derivatives and increasingly algorithmic trading compress time, anticipate future production, and abstract commodities from their material and social conditions of extraction (Engel, 2015). This literature also draws attention to the spatial concentration of financial power, as expertise and decision-making authority cluster in a small number of global financial hubs, while peripheral regions remain largely excluded from price-setting arenas (Staritz et al., 2023). Finally, it foregrounds the redistribution of risk and uncertainty across space and actors, often shifting volatility and downside risk onto producers while enabling financial actors to hedge or speculate (Staritz et al., 2018).

Recent developments further reinforce the relevance of commodity markets as a core subject of inquiry within economic geography, reflecting the growing entanglement of their political and financial dimensions. Over the past three to five decades, global commodity markets have evolved within a broader context of deepening economic (and financial) integration (Donadelli et al., 2024). While this process was interpreted through the lens of globalization, recent years have seen a marked discursive shift toward geopolitical fragmentation and the reassertion of state power in economic governance (Clark and Wójcik, 2007). Geopolitical shocks, including wars, trade disputes, and sanctions, have heightened uncertainty and exposed the strategic importance of fundamental commodities for national security and macroeconomic stability. In response, states have increasingly intervened in commodity markets to enhance resilience, secure domestic supply, and manage political risk, reshaping trade flows and long-established principles of liberal trade. These interventions have had far-reaching implications for global economic and market governance. As noted by the Cyclope study group – a private research organization that provides fundamental market intelligence on commodity markets for traders, analysts, policy makers, and investors – "*the WTO, a child of the thirty glorious years of happy globalization, is in a state of 'clinical death'*" (Cyclope, 2023, 71)[1].

At the same time, financialization remains a critical dimension of contemporary commodity markets (Cheng and Xiong, 2014; McGill, 2018). The growing participation

[1] In this context, the UN- and Turkey-brokered grain corridor enabling Ukraine to resume maritime exports in 2022 amid the ongoing conflict with Russia has been widely regarded as one of the few successful instances of international economic coordination – although, as discussed in Chapter 5, this arrangement itself later became the subject of political contestation.

of financial investors – such as hedge funds and asset managers – in commodity derivatives markets has intensified concerns that financial trading dynamics contribute to the sharp increases in agricultural prices observed since the early 2000s, and that futures markets may act as a transmission channel through which macroeconomic and financial shocks spill over into food prices (Chen et al., 2010; Gilbert, 2010; Cheng and Xiong, 2014; Goldstein and Yang, 2022). Importantly, these developments have both institutional and relational dimensions, reflecting changes in the composition, strategies, and interactions of market participants.

Against this background, this thesis develops an analytical framework designed to travel across commodity markets to uncover their underlying dynamics, while centering empirically on wheat – a market that remains comparatively underexplored in economic geography despite its global significance. Grounding the analysis in a specific sector is important to avoid overly abstract generalizations about "commodity markets" as a homogeneous category: in practice, the geographies of production, circulation, and financialization vary substantially across commodities, shaped by distinct supply chain configurations, market structures, and regulatory regimes among other factors. Consider the contrast between so-called hard commodities (such as minerals and energy resources) and soft commodities (agricultural goods), which differ not only in their physical properties, production timelines and vulnerability to weather-related and biological constraints, but also in the types of actors involved and the organization of their trade.

Several considerations motivate the decision to focus on wheat. First, wheat has occupied a central position in world history and remains a cornerstone of global food consumption. Long before the emergence of coined or paper currencies, grains such as wheat functioned as forms of money, underscoring their foundational economic role

across societies. According to the so-called "grain hypothesis", cereal grains (wheat in particular) are foundational to states "*as only the cereal grains can serve as a basis for taxation: visible, divisible, assessable, storable, transportable, and "rationable"*" (Scott, 2017, 129). The organization of wheat production, storage and trade has long shaped patterns of economic development and geopolitical power while fluctuations in wheat prices have historically triggered social unrest and political instability, underscoring the grain's systemic relevance and making it a critical object of study (Nelson, 2022).

A second motivation is more contextual and concerns the profound disruptions that have affected the global wheat market in recent years, rendering wheat a particularly salient case in the current global environment. Wheat production, storage, and trade have been among the sectors most heavily impacted by the ongoing conflict between Russia and Ukraine (Izzeldin et al., 2023). As two of the world's major wheat exporters, their confrontation – the first war on the European continent since 1945 – has generated significant supply shocks that have reverberated across both real and financial markets. Disruptions stemming from port closures, logistical bottlenecks, and export restrictions have highlighted the tight interconnections between physical infrastructure, geopolitical power, and market outcomes.

Finally, wheat occupies a central position within agricultural derivatives markets. Commodity futures contracts – standardized agreements to buy or sell a commodity at a predetermined price on a specified future date – allow producers, traders and processors to hedge against price volatility, while also attracting financial actors seeking speculative returns. Many of the characteristics that historically made wheat and other grains suitable as early media of exchange – including their divisibility, measurability, storability, and relative standardization – also made them particularly suited to contractual exchange

across time and space, laying the foundations for the development of futures trading. As of today, wheat futures markets are especially well suited for empirical analysis due to their high liquidity, the relative standardization and homogeneity of the underlying commodity, and the broad geographic diversity of participating exporting and importing countries. In this respect, the thesis highlights the close interdependence between the physical wheat market and derivatives trading in two principal financial centers, Chicago and Paris, illuminating how price formation emerges from the interaction between material supply conditions and financial market dynamics.

Taken together, these considerations underscore the complexity of contemporary commodity markets and illustrate why economic geography provides a particularly fruitful lens through which to analyze them. Commodity markets cannot be understood solely in terms of abstract supply–demand equilibria or price mechanisms, as they are shaped by relational networks among heterogeneous actors, embedded in specific institutional arrangements, and deeply entangled with geopolitical dynamics and financial infrastructures. By integrating relational, institutional and financial perspectives, this thesis seeks to contribute to a more comprehensive understanding of how commodity markets operate and evolve, generating uneven outcomes across space and time.

In doing so, the thesis engages with a longstanding critique of mainstream economics – namely, the question of whether formal, model-based approaches can adequately capture the full range of forces shaping economic landscapes. As Garretsen and Martin (2010) argue, many of these forces are historical, social, institutional, and cultural in nature, and therefore resist straightforward formalization in mathematical models. Taking geography and history more seriously entails recognizing that markets are always situated in space and time, shaped by power relations and path-dependence.

This applies to both real and financial markets. In mainstream accounts, financial systems efficiently channel funds from savers to borrowers under conditions of perfect information, symmetry, and frictionless exchange, making location irrelevant. However, in reality actors operate under uncertainty, imperfect competition, and asymmetric, costly information, alongside significant transaction costs, resulting in uneven financial development, with over-accumulation of credit in some sectors or regions and under-accumulation in others (Wójcik, 2018). The perspective adopted in this thesis – aligned with heterodox traditions (including behavioral, institutional and Marxian economics) as well as with political economy – does not reject economic modeling *per se* but rather situates it within a broader analytical framework that acknowledges the spatial and historical contingencies through which commodity markets are constituted and transformed.

1.2 Positioning within economic geography and financial scholarship

This thesis is positioned at the intersection of economic geography and finance. Without aiming to provide a comprehensive review of these bodies of scholarship – relevant strands of which are developed in greater detail in Chapter 2 – it is nonetheless important to clarify from the outset how the present research is situated within and contributes to these literatures.

Economic geography – particularly its relational strand – provides a particularly powerful analytical framework for this thesis as it foregrounds the spatial, relational, and institutional dimensions of economic processes. Rather than treating markets as abstract and placeless mechanisms governed solely by supply and demand, economic geography emphasizes that economic activity is embedded in specific locations, structured through

uneven power relations across space, and shaped by historically contingent institutional arrangements. This perspective is especially well suited to the study of commodity markets, where production and circulation are organized through geographically dispersed yet tightly interconnected networks linking resource-rich regions to trading, financial, and corporate centers.

Most notably, this thesis builds on the Global Production Network (GPN) literature, which provides a geographical toolkit for mapping the evolving configurations of complex firm networks and territorial institutions that underpin global economic activity (Ernst and Kim, 2002; Henderson et al., 2002; Coe and Yeung, 2015, 2019). In recent years, a growing strand of this literature has sought to theorize the forces that drive the formation and reconfiguration of GPNs – a line of inquiry that still has significant scope for further elaboration. This thesis contributes to that effort, amongst others, by emphasizing the role of risk and uncertainty in shaping the decisions and interactions of diverse actors within these networks.

At the same time, this thesis is equally grounded in the study of finance, understood not merely as a technical system of intermediation but as a set of social, political, and spatially embedded practices that actively shape economic outcomes. Traditional economic accounts have often conceptualized financial markets as efficient and largely neutral mechanisms for allocating capital under conditions of perfect information. In contrast, a geographically informed perspective highlights how financial systems are characterized by asymmetries of information, uneven access, and spatial concentration of expertise and decision-making power. These features result in differentiated patterns of financial development and contribute to uneven distributions of risk and return.

The convergence of these perspectives has fostered a vibrant area of scholarly dialogue, particularly alongside the significant expansion of financial geography. This field has grown markedly – especially since the global financial crisis – as researchers have sought to better understand the spatial organization and societal implications of financial systems. Bibliometric evidence shows rapid growth in financial geography since the early 2000s, with a diverse set of intellectual traditions shaping its development (Wójcik, 2025). These include: (*i*) political and cultural economy approaches concerned with power, calculative practices, regulation, and crisis (Hall, 2010; Christophers, 2015); (*ii*) regional development and institutional studies that explore the behavior of financial institutions and the localized impacts of finance (Martin, 2011; Clark, 2018); and (*iii*) analyses of urban networks and global financial centers (Aalbers, 2019).

Across these three strands of scholarship, several themes are especially relevant to this thesis. First, political and cultural economy approaches have foregrounded the role of finance in reshaping economic relations and distributional outcomes, especially in the context of regulatory transformation, while also emphasizing how financial expertise and knowledge actively contribute to the construction of markets themselves. Second, research on regional development and institutional dynamics has drawn attention to the uneven territorial effects of financial processes, as well as to the ways risk and uncertainty are produced and managed across space. Finally, work on urban networks and financial centers has highlighted the strong spatial concentration of financial activities in a limited number of global hubs, emphasizing how these locations exercise disproportionate influence over price formation, capital allocation, and market governance.

This thesis engages directly with these debates by examining commodity markets, and particularly commodity derivatives markets, as key sites where financial and material

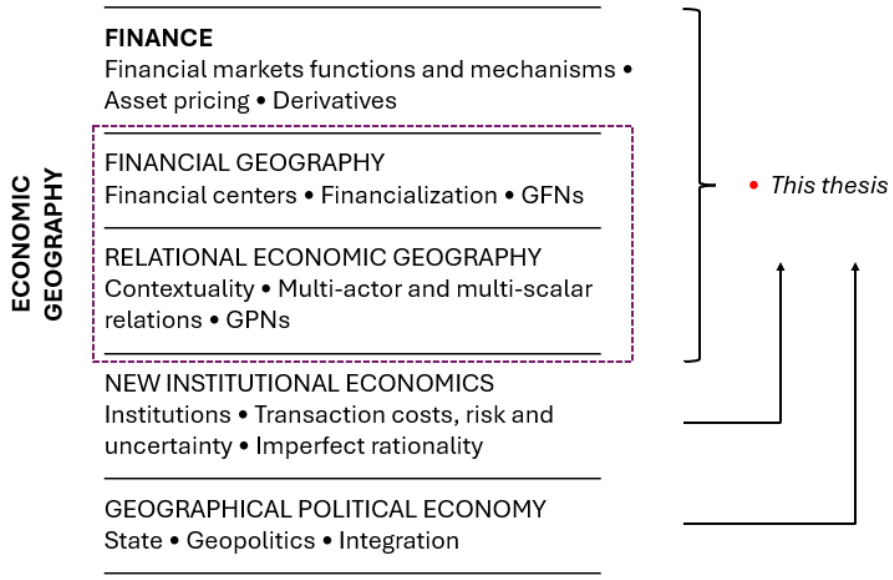
dynamics intersect, shaping the production and distribution of value and wealth across global networks. It highlights the concentration of knowledge and power among a limited set of key actors and how this concentration enables a disproportionate accumulation of wealth, while leaving other participants exposed to heightened risk and uncertainty. The analysis further emphasizes how these asymmetries are spatially translated into the formation and consolidation of global financial centers. While doing so, the thesis speaks to an important shift within financial geography away from purely quantitative and model-based approaches toward more qualitative, relational, and case-based analyses. Without rejecting quantitative methods (indeed, econometric analysis is central to one of the substantial chapters), the approach adopted here seeks to integrate them within a broader analytical framework that is attentive to spatial relationships and institutional context.

Figure 1.1 synthesizes the positioning outlined above, while also signaling the foundational relevance of concepts drawn from New Institutional Economics (NIE), which underpin and inform several of the literatures considered in this thesis, and pointing to a related yet distinct engagement with debates on the role of the state and geopolitics in shaping financial and commodity markets. With respect to the first dimension, the thesis brings together a relational emphasis on networks and context-specific interactions with an institutional focus on rules, governance structures, and the management of risk and uncertainty. In doing so, it advances an integrated perspective in which economic and financial processes are seen as jointly constituted by evolving relationships and by the formal and informal institutional frameworks within which they are embedded. Turning to the second dimension, recent scholarship has increasingly highlighted the significance of the state–finance nexus, encompassing fiscal geographies, state-led financialization, and the strategic deployment of financial instruments in pursuit of

national economic objectives (Wójcik, 2025). The analysis that follows demonstrates that this nexus is especially pronounced in commodity markets, where geopolitical tensions, trade disruptions, and policy interventions play a central role in structuring both physical supply chains and financial market behavior.

As suggested by the preceding discussion and explored in greater depth in Chapter 2, the bodies of literature represented in Figure 1.1 are already interconnected, albeit sometimes through bilateral or partial engagements. This thesis does not establish entirely new connections among them but rather brings these perspectives into a more coherent and systematic dialogue around the specific problem under investigation. Within this framework, finance provides the analytical foundations for understanding market mechanisms, asset pricing, and derivatives trading. Relational Economic Geography (REG) offers a lens through which to examine how economic processes are embedded within multi-actor, multi-scalar, and context-specific networks of relations. Financial geography occupies an intermediary position, illuminating the spatial organization of financial activities and the ways in which financial processes are embedded within and shape broader economic geographies. NIE provides a foundation for understanding governance structures and the management of risk and uncertainty, while geographical political economy situates these processes within broader dynamics of state power, geopolitics, and economic integration. Taken together, these perspectives offer a more comprehensive framework for analyzing the Global Production and Financial Network (GPFN) of wheat.

Figure 1.1 *Thesis positioning*



Source: Author's elaboration.

1.3 Aims and significance

Drawing on several intersecting strands of literature, this thesis aims to illuminate the complexity of commodity market dynamics and to advance understanding along several key dimensions.

A central objective is to substantiate the significance of a geographical perspective on the structure and performance of global commodity markets. By portraying commodity markets as networks, the thesis highlights the relational architecture through which these markets are constituted and governed, while underscoring the importance of spatial and contextual factors. Rather than treating markets as abstract spaces of exchange or focusing narrowly on specific groups of actors, it emphasizes the interactions, interdependencies, and power relations that connect heterogeneous (and sometimes

neglected) agents – from trading houses to states, from financial intermediaries to labor, and more. This network-based perspective highlights how market outcomes are shaped not only by price signals, but also by negotiated relationships, infrastructural control, and institutional positioning. Particular attention is devoted to the role of states and their evolving relationships with supranational institutions, recognizing that public authority and regulatory frameworks are integral components of market organization rather than external constraints (Coe and Yeung, 2015).

The thesis further aims to advance an integrated perspective that brings together the material, financial, and political dimensions of commodity markets. It does so, first, by emphasizing the inescapable interdependence between the physical and financial spheres of these markets. Much of the existing literature tends to examine physical production and trade on the one hand, and financial trading and derivatives markets on the other. In contrast, this research integrates these dimensions within a single analytical framework, building on and complementing previous research at the intersection of GPNs and finance (see Coe and Yeung, 2019). This approach reflects the empirical reality of commodity markets, in which price formation, investment decisions, hedging strategies, and logistical arrangements are deeply intertwined. Physical supply conditions shape financial expectations, while financial activity feeds back into production, storage, and trade decisions, rendering the two domains mutually constitutive.

In addition, the thesis integrates a (geo)political perspective, addressing a dimension that has often been underplayed in economic analyses of commodity markets. While recognizing the enduring depth of economic and financial integration that has characterized the global economy throughout the late twentieth and twenty-first centuries, it explicitly incorporates geopolitical dynamics, regulatory interventions, and domestic

political considerations, highlighting how economic processes are shaped by political power and conflict across multiple spatial scales. This perspective underscores that commodity markets are not merely economic systems, but also arenas of strategic contestation.

Finally, the thesis seeks to deepen understanding of the role of risk and uncertainty in the functioning and evolution of global commodity markets. It examines economic decision-making under conditions of risk and uncertainty, exploring how actors perceive, manage, and redistribute them through institutional arrangements, financial instruments, and strategic behavior. In doing so, the thesis moves beyond the assumptions of standard rational economic theory contributing to a more advanced understanding of how commodity markets function in contexts marked by volatility, incomplete information, and geopolitical instability.

Conceptually, the thesis provides a fruitful synthesis of diverse perspectives within economic geography. At its core, it combines an integrated GPFN framework with institutionalist concepts such as risk and uncertainty to analyze market structure and dynamics. While risk and uncertainty are longstanding themes in economics and finance, they are typically examined in abstraction from their spatial and relational contexts. Embedding these concepts within an economic geography framework enables a more holistic understanding of how markets operate in practice.

Alongside this, the thesis contributes to economic geography research on trade by introducing relational concepts into a strand of literature that has remained more strongly influenced by the New Economic Geography (NEG) framework pioneered by Krugman in the early 1990s. While other areas of economic geography – such as evolutionary and financial geography – have incorporated relational thinking since the 2000s, trade-

focused research has continued to rely predominantly on formal modelling and spatial equilibrium approaches. Although NEG has generated powerful insights into agglomeration, scale, and trade patterns, it has tended to privilege abstraction over contextual specificity. By emphasizing contextuality, institutional embeddedness and multi-scalar interactions, the approach advanced in this thesis offers an alternative lens through which to analyze trade dynamics, particularly in settings characterized by political fragmentation and geopolitical tensions, where formal assumptions of frictionless adjustments sit uneasily with empirical realities.

Integrating distinct theoretical frameworks inevitably raises challenges of coherence and consistency. The thesis addresses these challenges by identifying shared analytical concerns – such as risk management and network evolution –, embracing methodological pluralism, and employing detailed case studies to demonstrate how the combined framework can be operationalized empirically. This strategy allows theoretical integration to emerge from empirical application rather than from abstract synthesis alone, showing how concepts drawn from different frameworks can be mobilized in a complementary and mutually reinforcing manner.

Empirically, the thesis provides new insights into the recent evolution of the global wheat market. It highlights the emergence of Paris as a central financial hub for wheat futures trading, demonstrates the decisive role of geopolitical uncertainty in shaping price dynamics, and illustrates how trade and investment decisions are influenced by multi-scalar dynamics that extend beyond purely market-driven considerations. While the empirical focus is deliberately narrow – an intentional choice to engage deeply with a specific commodity and set of actors –, the findings offer a foundation for extending the

framework to other commodities, markets, and geopolitical contexts, suggesting its broader applicability across diverse sectors.

In conclusion, the significance of the thesis lies not only in its conceptual and empirical contributions, but also in its potential policy relevance. Each paper draws out implications for policymakers, with the explicit aim of bridging the gap between academic research and policy practice. This orientation is informed by my professional role at a central bank and reflects the overarching ambition of the thesis to provide analytically rigorous and empirically grounded insights that can inform more nuanced and effective policy responses to the complex challenges facing contemporary commodity markets.

1.4 Methodology

Consistent with the methodological diversity that characterizes research in economic geography, this thesis adopts a mixed research strategy to investigate economic processes and provide empirically grounded answers to the research questions it raises. The combination of qualitative and quantitative methods is well established in the geographical literature (Gomez and Jones, 2010; Clifford et al., 2016; Wójcik, 2022) and is particularly valuable for enabling triangulation, enhancing the validity and robustness of empirical findings by mitigating potential biases inherent in single-method approaches. Here I draw on the work by Wójcik (2022) and Bryman (2015), who distinguish between three overarching research strategies – quantitative, qualitative, and mixed – and five research designs – case study, comparative, cross-sectional, longitudinal, and experimental – as foundational approaches to data collection and analysis in social research.

Two chapters of the thesis rely primarily on qualitative methods. Chapter 3 employs a theory-driven case study design, which is especially well suited to the analysis of contemporary phenomena. This approach allows for an in-depth examination of processes and decisions – focusing on why they were taken, how they were implemented, and with what outcomes (Yin, 2014). Beyond providing empirical insight into a specific context, the case study design also serves a theory-building function, enabling the refinement of existing conceptual frameworks through the revision of relationships among key concepts and models. Chapter 5, on the other hand, is grounded in an interpretive and critical political economy perspective, emphasizing the role of power relations, institutional dynamics, and the political underpinnings of economic outcomes. Interpretive research understands reality as inherently embedded within – and therefore impossible to abstract from – its social setting and seeks to apprehend it through a "sense-making" process (Schwartz-Shea and Yanow, 2012).

While primarily qualitative, both chapters employ a mixed-method approach, combining content analysis of several documentary sources – including policy and legal documents, media articles, press releases, speeches, corporate and government reports, and websites – with descriptive statistical evidence. This allows me to triangulate evidence while mitigating some of the limitations commonly associated with case study and interpretive research, particularly concerns regarding internal validity and potential subjectivity in interpreting qualitative materials.

Triangulation is further achieved across chapters. In particular, Chapter 4 adopts a quantitative research strategy and employs a longitudinal research design to test hypotheses concerning the role of uncertainty – especially geopolitical uncertainty, as proxied by index developed by Caldara and Iacoviello (2022) – in wheat derivatives

markets. The chapter applies advanced regression-based time-series econometric techniques allowing for a systematic assessment of how exogenous political shocks influence commodity market dynamics over time. In doing so, it responds directly to calls within financial and economic geography for more rigorous quantitative analyses that move beyond descriptive statistics (Wójcik, 2022). Moreover, the use of uncertainty proxies derived from textual analysis of newspaper coverage establishes a clear connection between this chapter and a broader strand of research on information diffusion and market behavior (Beaudry and Portier, 2006; Berger et al., 2020; Aizenman et al., 2023; Hao et al., 2023; Hassan et al., 2024).

As will be elaborated in Chapter 2, underpinning the whole thesis is a conceptual framework grounded in the GPN and Global Financial Network (GFN) approaches in economic geography (Ernst and Kim, 2002; Henderson et al., 2002; Coe et al., 2014; Wójcik, 2018) and the relational approach more generally (Bathelt and Glückler, 2018). Relational research places particular emphasis on networks, interdependencies, and reciprocal relationships among economic actors, but has been criticized for its limited ability to clearly specify causal mechanisms and to explain how and why particular outcomes emerge from relational configurations (Sunley, 2008). To address this limitation, the framework developed in this thesis combines relational and institutionalist perspectives, mobilizing key analytical concepts from institutional economics – most notably transaction costs, risk, and uncertainty – which provide greater leverage for identifying causal processes and explaining observed patterns of behavior and governance. Drawing on both foundational and contemporary contributions (Knight, 1921; Clark, 1983; North, 1991; Lo and Mueller, 2010; Bookstaber, 2017; Haberly and Wójcik, 2022), these concepts help illuminate how actors operating within global

production and financial networks perceive, manage, and redistribute risk and uncertainty, and how institutional arrangements shape their strategic responses.

The empirical focus of the analysis centers on the EU and the US from 2000 onwards, or relevant sub-periods thereof. This geographical and temporal focus is motivated by several considerations. Geographically, the EU and the US are top wheat producers and exporters, and they host the main global wheat derivatives markets. As such, they play a central role in shaping both the production and financial dimensions of the wheat GPFN. Concentrating on these regions therefore allows the analysis to capture key nodes where agricultural production, trade, regulation, and financial market activity intersect. Focusing on the EU, in particular, also allows me to address integration processes across states – an issue that lies at the core of research in economic geography. The EU's evolving regulatory architecture, common agricultural policy, and increasingly integrated financial markets offer a unique institutional environment in which to explore how cross-border coordination, policy harmonization, and regulatory fragmentation influence the organization and governance of GPNs and GFNs.

Historically, the last 25 years have seen a striking evolution of the wheat GPFN, as explained in Section 1.1, which is somewhat unique given the inherent latency of such structures. The wheat sector thus provides a compelling case in which relatively rapid change can be observed within an otherwise structurally constrained network, making it especially suitable for examining how risk, uncertainty, and institutional change reshape network configurations over time.

The data used, compiled into a freshly gathered dataset, are drawn from a variety of sources, the main ones listed in Table 1.1 below[2]. While most of the data originate from open-access sources, access to Bloomberg data was made possible through the license granted to Banca d'Italia.

Table 1.1 *Main data sources*

Source	**Description of data**
Bloomberg	Prices, volumes traded and open interest of wheat futures contracts; Prices of other commodity futures contracts (oil, gold, corn); Oil spot price
US Department of Agriculture (USDA)	World wheat production; Wheat exports; Wheat export prices (US); Area harvested for wheat (EU and US)
European Commission	Wheat imports, exports and prices in individual EU Member States
International Monetary Fund (IMF)	Commodity spot prices (global benchmarks)
International Grains Council	Wheat export prices
www.matteoiacoviello.com	Geopolitical uncertainty indicator

[2] Additional secondary sources have been used, especially in Chapter 4, and are duly detailed within it.

www.policyuncertainty.com	Economic policy uncertainty indicator
ECB Statistical Data Warehouse	Financial stress indicator
National Oceanic and Atmospheric Administration (NOAA) – US Department of Commerce	Vegetation Health Index

1.5 Thesis outline

This thesis follows a three-paper route. The present chapter serves an introductory function, providing the general background, motivation, methodology, and overall structure of the thesis. Chapter 2 engages with the broader bodies of literature relevant to the thesis, developing the shared conceptual framework that underpins the three subsequent substantive papers. Chapters 3, 4, and 5 constitute the core of the thesis and are organized as stand-alone research papers. Each chapter is self-contained, while remaining closely aligned with the overarching theoretical framework and research agenda of the thesis. The thesis concludes with Chapter 6, which synthesizes the findings across the three papers, reflects on their theoretical and empirical contributions, and outlines implications for future research and policy.

More specifically, Chapter 2 situates the thesis at the intersection of economic geography and finance highlighting its integrative approach that brings together relational and institutionalist perspectives. It reviews the key theoretical debates surrounding the relational turn in economic geography and the role of institutions in shaping economic

outcomes, developing the foundations of a unified conceptual framework that integrates GPN and GFN approaches (further developed in Chapter 3) and emphasizes the centrality of risk and uncertainty in shaping behavior and network dynamics. The chapter also highlights the significance of both political and financial factors for the dynamics under study, as hinted above, drawing on relevant literature from geographical political economy and asset pricing to inform the analysis.

Chapters 3 to 5 examine how different actors within the wheat GPFN respond to, manage, and shape conditions of risk and uncertainty. Specifically, the papers focus on: (*i*) key transnational corporations (TNCs) and financial and business service (FABS) firms operating at the intersection of the wheat GPN and GFN (Chapter 3); (*ii*) market participants more broadly, including both industrial and financial actors in derivatives markets (Chapter 4); and (*iii*) governments and supranational institutions, with particular attention to the EU (Chapter 5). The concepts of risk and uncertainty are central to all three chapters, though they are emphasized in different ways. Chapter 3 addresses both risk and uncertainty, with particular attention to the institutional mechanisms through which they are governed within the wheat GPFN. Chapters 4 and 5 place greater emphasis on uncertainty and its implications for behavior, decision-making, and market outcomes – Chapter 4 focusing on financial markets and Chapter 5 on physical trade and policy interventions.

While each chapter is presented as an independent paper and provides its own specific contribution to the field, they are closely interconnected and mutually complementary, together constituting a coherent program of research. In particular, each paper makes a distinct contribution to understanding how risk and uncertainty are produced and managed across the wheat GPFN, while collectively advancing an

integrated perspective on the interplay between commodity markets and finance and underscoring the importance of geography to this understanding. Chapter 3 shows how different actors govern risk and uncertainty through institutional and network-based arrangements at the intersection of production and finance. Chapter 4 examines how uncertainty, particularly related to geopolitical developments, affects price formation in commodity derivatives markets. Chapter 5 brings the state and supranational institutions into the analysis, demonstrating how policy interventions and geopolitical dynamics reshape market outcomes and the distribution of risk. Taken together, the chapters bridge analyses of GPNs, financial markets, and the state by examining firms, market participants, and public institutions within a single framework. In doing so, the thesis shows how commodity markets are constituted through the interaction of material supply and demand conditions, financial mechanisms, and policy interventions, and how these interactions shape the uneven distribution of risk and uncertainty across space.

Chapters 3 and 4 are co-authored, while the remaining chapter is sole-authored. In the co-authored chapters, I was responsible for leading all core stages of the research process, including project administration, conceptual development, research design, empirical investigation, data analysis, and the drafting of the manuscripts. In the case of Chapter 3, my co-authors contributed in their supervisory capacity by providing guidance on the overall logic of the paper and its positioning within the relevant literatures, as well as through detailed comments and editorial feedback on successive drafts. They did not draft sections of the paper nor lead their conceptual development. In Chapter 4, my co-author contributed primarily to data curation and the implementation of econometric analysis through specialized software, with methodological choices developed collaboratively. Formal statements confirming the respective contributions of the authors have been provided.

All three substantive chapters were prepared for peer-reviewed publication and submitted to academic journals prior to the submission of the thesis. Chapter 3 was published in *Economic Geography* in August 2025.

Ultimately, Chapter 6 reflects on the broader significance of the thesis for the field of economic geography. The chapter synthesizes the findings from previous chapters to show how risk, uncertainty, and institutional arrangements shape the behavior of diverse actors across multiple scales, and how these processes collectively influence the organization and dynamics of commodity markets. In doing so, Chapter 6 underscores the relevance of integrating relational, institutional, and financial perspectives for explaining contemporary commodity market phenomena and offers pathways for extending this analytical framework to other commodities and markets.

1.6 Professional engagement and doctoral research

As a part-time student, my doctoral research at the University of Oxford has been conducted alongside my professional role at the Banca d'Italia. This dual position has provided valuable experience that has shaped both the orientation and execution of the thesis. In particular, my work at the central bank has fostered a strong sensitivity to the institutional dimensions of economic activity, as well as an appreciation of the multifaceted nature of financial and commodity market issues, spanning operational, regulatory, and geopolitical domains.

Over the years, my primary professional responsibilities have concerned the supervision of post-trading infrastructures – an area that is only marginally addressed in the empirical chapters of this thesis but has nevertheless deepened my understanding of

the functioning of financial markets more broadly, informing my awareness of market architecture, risk management practices, and institutional coordination. A noteworthy development occurred in 2024, when the Italian central counterparty (CCP) became the central clearing entity for the largest European financial market for grain derivatives. This institutional change, unfolding contemporaneously with my doctoral research, provided additional motivation and context for the thesis.

Alongside my DPhil studies, my professional environment has also provided additional valuable opportunities to engage in research. Through this engagement, I co-authored two peer-reviewed papers in addition to the chapters included in this thesis. The first paper focuses on repo markets and CCPs, still adopting a geographical comparative research design to examine how institutional arrangements and market structures vary across jurisdictions (Di Luigi et al., 2024). The second paper explores the historical evolution of financial market infrastructures following the end of the Bretton Woods system in 1971, addressing processes of market integration, the influence of geopolitical forces, and other issues that intersect with economic geography (Di Luigi and Perrella, 2026). These experiences have sharpened my insight into the spatial and institutional dimensions of financial markets and enriched the analytical perspective brought to this thesis.

Throughout the research process, I have been mindful of potential conflicts of interest arising from my professional role. This thesis is based entirely on publicly available data, licensed datasets, and academic sources, and does not draw on any confidential or proprietary information obtained through my employment. All analyses, interpretations, and conclusions presented herein are entirely my own and do not represent the views of the Banca d'Italia or the Eurosystem.

Chapter 2: Literature review and overarching conceptual framework

2.1 Introduction

The objective of this chapter is to engage with the broader bodies of literature that are relevant to the thesis and to develop the shared conceptual framework that underpins the three substantive papers that follow – each of which subsequently presents a more tailored and focused conceptual framework and literature review. In doing so, the chapter situates the research within the diverse intellectual traditions that inform both its theoretical and empirical approaches.

Sections 2.2 and 2.3 provide a detailed review of the key literatures on which the thesis draws, highlighting the central concepts that guide the analysis. Section 2.2 focuses on Relational Economic Geography (REG), examining how actor relationships, interdependencies and networks shape economic activity across space. Section 2.3 addresses New Institutional Economics (NIE), emphasizing how institutions mediate economic behavior and structure market outcomes. Together, these two strands form the conceptual backbone of the thesis, the primary aim being to show that markets can be better understood by integrating relational and institutionalist perspectives: on one hand, relational approaches reveal how institutions are continuously shaped through networked

interactions; on the other, institutionalist concepts help explain patterns of stability and change within both production and financial networks.

Sections 2.4 and 2.5, in turn, center on additional literatures that the papers engage with, albeit to a lesser extent, demonstrating how they intersect with the core relational and institutional perspectives. These include work on asset pricing and geographical political economy, both of which illuminate specific mechanisms and contextual factors that are critical for understanding commodity markets.

By integrating diverse perspectives, this chapter underscores the diversity of analytical lenses necessary to address the complexity of contemporary commodity Global Production Networks (GPNs) and Global Financial Networks (GFNs). Commodity markets, as highlighted throughout this thesis, are multifaceted systems in which production, regulation, finance and geopolitics intersect. Approaches that attempt to analyze them in isolation have proven limited in capturing their full relational, institutional and geopolitical embeddedness (see Chapter 5 on the limits of the New Economic Geography – NEG framework).

At the same time, the chapter emphasizes that the incorporation of institutional notions – particularly transaction costs, risk, and uncertainty – alongside econometric and asset-pricing analyses, serves to mitigate some of the potential limitations associated with purely qualitative and interpretive approaches. This integration allows the thesis to combine the depth and contextual sensitivity of relational and interpretive analysis with the rigor and systematic insight offered by quantitative methods.

2.2 Relational Economic Geography

REG has established itself as a prominent framework within contemporary economic geography by advancing a conceptual apparatus that embeds economic analysis within a broader social science ontology (Amin and Thrift, 1992; Bathelt and Glückler, 2011; 2018). Rather than treating economic processes as analytically separable from their social, institutional, cultural, and political dimensions, REG emphasizes positionality and conceives economic action as constituted through complex webs of relations (Yeung, 2005). From this perspective, the spatiality of economic processes cannot be reduced to physical distance or territorial containers, but is produced through relational proximities, network configurations and multi-scalar interactions that connect heterogeneous actors (Amin and Thrift, 2002; Bathelt and Glückler, 2011).

This orientation marks a departure from conventional approaches in economic geography that privilege spatial structures or aggregate spatial variables as explanatory starting points. Where traditional analyses might explain, for instance, regional decline by correlating cost structures, labor market indicators, or infrastructure variables with macroeconomic performance, the relational approach instead begins with the actors most relevant to the question under investigation, seeks to uncover the contexts shaping their behavior, and traces the linkages and relations through which economic decisions are made. Accordingly, REG prioritizes the study of inter-firm networks, producer–user relations, and the strategic positioning of actors with a view to revealing how economic outcomes depend upon complementarities, competition, learning dynamics and knowledge flows extending across local and trans-local environments (Amin, 2002; Bathelt and Glückler, 2003; Clark and Tracey, 2004; Bathelt et al., 2004).

Bathelt and Glückler (2011) identify three guiding principles of a relational research design. First, contextuality emphasizes that economic interactions are always situated and context is not merely an external condition but rather is constitutive of economic action. Second, relational analysis acknowledges path dependence, whereby firms' decisions are informed by pre-existing structures resulting from earlier choices and reflexive learning processes translate past experiences into future orientations – historical developments matter because they structure the set of available options, shape expectations, and influence strategic differentiation. Third, contingency underscores the open-endedness of economic processes. Pre-existing contexts and structures do not determine outcomes and firms operating under similar conditions may pursue divergent strategies. Thus, relational analysis rejects deterministic or life-cycle models in favor of evolutionary and process-oriented perspectives.

These principles are reflected in several methodological commitments. A relational research design assumes that social and economic outcomes can only be understood through the analysis of relations among actors. Society and economy do not simply "have" relations – they are constituted through them. Accordingly, relational inquiry is inherently attentive to the meanings and conditions embedded in time–space–situated phenomena and inclined toward case-sensitive empirical research. Moreover, relational analysis adopts a processual rather than a strictly causal perspective. It traces how interactions and relational configurations unfold and transform over time to produce particular outcomes. Development is thus understood as historically path-dependent and, at the same time, contingent with regard to future trajectories.

Despite its strong emphasis on context, relational theory is not idiosyncratic or confined to singular cases. Rather, it seeks to produce abstract and transferable insights.

Following Sayer (2000), relational analysis differentiates between necessary and contingent conditions within particular contexts in order to strengthen external validity. As Bathelt and Glückler (2018) argue, relational theories are sufficiently grounded in empirical richness to ensure authenticity, while remaining abstract enough to account for variation across contexts. In this way, they resist universal, scale-free, or deterministic claims, yet still strive for conceptual generalization. This thesis adopts precisely such an approach. By focusing on a specific commodity and selected key developments, it seeks to distill findings that, while grounded in a particular empirical setting, may hold relevance beyond it and prove applicable to other contexts.

In terms of applications, relational approaches have been widely used across a range of substantive fields in economic geography. In cluster research – extending into innovation and entrepreneurship studies – relational frameworks have advanced understanding of firm competitiveness by foregrounding network externalities, knowledge spillovers, and institutional embeddedness (Porter, 1990; Delgado et al., 2016; Boschma et al., 2023; Harris and Menzel, 2023). In Global Value Chain (GVC) and GPN research, relational analysis has shed light on how transnational chains and networks coordinate activities across multiple territories (Henderson et al., 2002; Gereffi et al., 2005). Likewise, in the field of global finance, REG has examined the relational infrastructures through which capital, expertise, and opportunity circulate (Haberly and Wójcik, 2022). The latter two areas of application form the focus of the following section and constitute the core domains of this thesis.

2.2.1 The Global Production Network and Global Financial Network frameworks

The GPN and GFN approaches in economic geography both place networks at the center of their analytical frameworks, arguing that the complexity of the contemporary global economy can only be properly understood through a relational lens. Rather than viewing economic activity as organized through linear chains or territorially-bound systems, these perspectives conceptualize production and finance as constituted through interconnected actors operating across multiple scales and institutional environments.

The GPN approach emerged in the early 2000s, notably through the work of Ernst and Kim (2002) and Henderson et al. (2002), as a response to the perceived limitations of earlier Global Commodity Chain (GCC) and GVC frameworks. While providing relevant insights into the nexus of interconnected functions, operations and transactions through which products and services are produced, GCC and GVC analysis, associated with scholars such as Gary Gereffi, was often criticized for its linearity and insufficient attention to spatial and institutional diversity (Coe et al., 2008). The GPN framework sought to move beyond these constraints by conceptualizing production as organized through complex, non-linear networks linking all relevant sets of relationships and actors – including not only firms (particularly transnational corporations – TNCs), but also states, labor, consumers and civil society organizations (CSOs). A GPN is defined as an "*organizational arrangement, comprising interconnected economic and non-economic actors, coordinated by a lead firm, and producing goods or services across multiple geographical locations for worldwide markets*" (Coe and Yeung, 2015, 1-2).

A central contribution of the GPN approach lies in its explanation of regional development through processes of "strategic coupling" between TNCs and specific territories. Rather than treating regions as passive recipients of investment, GPN scholars

argue that regional outcomes depend on how local institutions, firms, and labor markets align with the strategic needs of global lead firms. Development, in this sense, is neither automatic nor uniform, but is rather contingent on negotiated relationships embedded within broader political and economic structures. TNCs and territories are connected through a wide array of formal and informal institutions functioning across multiple scales, ranging from international bodies such as the World Trade Organization (WTO) to national legal and regulatory frameworks, extending further to local norms, practices and business cultures.

Building on these ideas, financial geographers extended the network perspective to the realm of finance. Beginning with the work of Coe, Lai, and Wójcik (2014), the GFN approach has been developed to map and theorize the relational organization of global finance highlighting the interconnections of financial and business service (FABS) firms (encompassing firms offering financial services, as well as business services in accountancy, law, business consultancy, recruitment services and information technology related to financial services), governments, financial centers (defined as concentrations of FABSs and public financial institutions) and offshore jurisdictions (see Wójcik, 2018).

In doing so, the GFN approach reconceptualizes the geography of finance as a set of overlapping and interacting networks that span onshore and offshore domains. Offshore jurisdictions are places where financial vehicles – such as holding entities, funds or trusts – are registered outside the jurisdiction where the individual or firm establishing them resides or operates, in order to subject those vehicles, their activities and proceeds to a different set of laws and regulations. These differences may include tax rules but also extend to broader legal and regulatory frameworks that provide greater flexibility for international operations, asset structuring, or financial secrecy. In fact, the key attraction

of offshore jurisdictions lies in their jurisdictional autonomy, that is, their capacity to maintain distinct regimes that can be strategically selected for specific financial purposes; while jurisdictions are typically associated with state sovereignty, full sovereignty is not a necessary condition for a territory to function as an offshore jurisdiction (Wójcik, 2018). The analysis of networked and relational offshore legal, regulatory, and fiscal spaces has, over the past decade, shifted from a relatively specialized field of inquiry to a central and rapidly expanding area within international political economy as well (Haberly and Wójcik, 2022).

Despite their focus on different sectors, GPN and GFN approaches share several core characteristics. First and foremost, both are relational, as they prioritize the analysis of key actors and the structured relationships among them. Economic outcomes are understood not as the product of abstract market forces but as the result of interactions embedded within specific institutional and geographical contexts, with particular attention being paid to multi-scalar dynamics as well as to the unbundling of finance through onshore and offshore domains. The emphasis on relationality draws on foundational sociological insights, particularly those of Mark Granovetter (1985), whose concept of embeddedness points to the fact that economic action is always situated within social and institutional environments.

Second, both approaches attach considerable importance to the dynamic nature of networks and their evolving trajectories within and across economic systems. In this regard, the transition from the GPN 1.0 to the GPN 2.0 framework (Coe and Yeung, 2015) represented a major conceptual advance. Whereas GPN 1.0 primarily served as a heuristic device for mapping and describing spatio-sectoral configurations in the global economy, GPN 2.0 strengthened the framework's explanatory capacity, particularly its

capacity to explain endogenous change, moving beyond descriptive application. More specifically, GPN 2.0 sought to: (*i*) identify the competitive pressures and risk conditions shaping firm-level strategies and behavior; (*ii*) explain how particular combinations of these pressures and risks give rise to distinct firm-specific strategies and practices; (*iii*) scale up from firm-level analysis to account for the emergence and configuration of GPNs; and (*iv*) draw on these insights to analyze how regional economies strategically couple with lead firms and their associated GPNs, thereby shaping regional development trajectories (ibid.). In doing so, GPN 2.0 moved beyond approaches that privilege exogenous shocks and deepened the analysis of political context by situating regions within broader national and macro-regional regulatory frameworks rather than treating them as isolated units. By examining how internal network dynamics, strategic recalibrations, and institutional adjustments interact, it can illuminate how networks adapt and reconfigure in response to crises, technological changes, and geopolitical shifts – as demonstrated in this thesis.

Regarding their core concepts, both approaches revolve around three interrelated categories: value, power, and – as previously noted – embeddedness. Value captures how economic actors generate, enhance, and appropriate profits within networks. Power refers to the capacity of actors to shape network structures and outcomes, reflecting the fact that networks are not neutral arenas of exchange but are structured by asymmetries in bargaining strength, access to resources, and regulatory authority. Consequently, decisions over investment, production, financial flows, and the distribution of value are profoundly influenced by these power relations. While lead firms often wield significant authority, states and supranational institutions also play crucial roles, particularly through regulatory frameworks, trade agreements, and financial governance mechanisms.

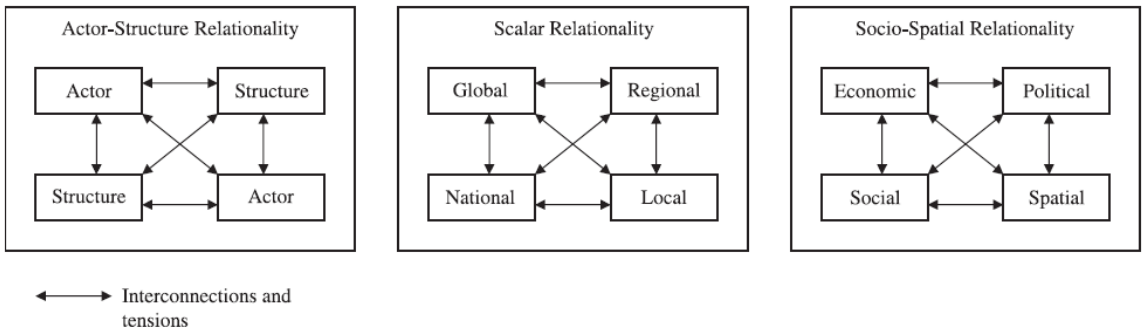
Building on these shared characteristics, this thesis demonstrates how the GPN and GFN frameworks can be combined to illuminate the evolution of commodity markets, while also highlighting the flexibility of the network approach across different sectors (see Chapter 3). Commodity-based networks, particularly those for wheat, display features that distinguish them from manufacturing networks. They are dominated by supply-side factors including natural resource endowments and weather conditions (whereas manufacturing networks are more strongly influenced by demand-side dynamics), with important implications for logistics, storage, and the management of price volatility. Governance structures likewise vary, as manufacturing GPNs are typically coordinated by powerful lead firms that manage complex supplier hierarchies, whereas commodity networks tend to be less centralized, with influence distributed among trading houses, resource-owning states, and regulatory authorities. Despite these differences, both types of networks are fundamentally shaped by multi-scalar interactions among firms, states, and other institutional actors, as further discussed in the next section.

2.2.2 Multi-actor and multi-scalar perspective

As previously emphasized, REG, and particularly the GPN and GFN approaches, are grounded in the premise that economic action is always embedded within specific spatial, social and institutional contexts. From this perspective, economic outcomes cannot be understood in isolation from the socio-spatial relationships that connect actors to one another and to broader structural forces operating across multiple geographical scales. Accordingly, two analytical dimensions become central: a multi-actor perspective, which focuses on relations among firms, institutions, and individuals, and a multi-scalar perspective, which examines how these relations are constituted across, and shaped by,

different geographical scales. Building on this foundation, Yeung (2005) developed the concept of "relational geometries" to theorize the nature of relationality in economic geography, where relational geometries refer to the dynamic configurations of relationships linking actors, structured through both horizontal and vertical power relations. Figure 2.1 illustrates this conceptualization of relationality within REG distinguishing between actor-structure relationality, scalar relationality and socio-spatial relationality.

Figure 2.1 *The nature of relationality in REG*



Source: Yeung (2005).

The actor–structure relationality perspective privileging horizontal, and often relatively stable, ties among actors has been central in approaches emphasizing relational embeddedness, including research on inter-organizational networks, global production chains and gender relations (Yeung, 2005). In fact, this constitutes a theoretically and empirically diverse strand of literature, encompassing a wide range of analytical concerns. Scholars such as Peter Dicken and Nigel Thrift (1992) focused on inter-firm networks to explain processes of industrialization, production, and territorial

development. Other economic geographers were concerned with how identities of actors are relationally constituted through different types of networks (for example, see Thrift and Olds, 1996). In much of this work, geographical scale tends to remain implicit or analytically fixed, with limited attention paid to how scale itself is constructed and reconfigured.

A second strand of relational thinking – gaining significant attention since the early 1990s – has instead been concerned with the geographies of scale. Much of this body of work seeks to interpret and clarify the role of overlapping scalar geographies and the reconfiguration of territorial units, raising both ontological and methodological issues. Ontologically, this literature interrogates the "relativization" of scales, a term associated with Bob Jessop (2007), highlighting how scalar configurations are reshaped in response to globalization. As a matter of fact, contributions by scholars such as Herod and Wright (2002) and Sheppard (2002) have emphasized that geographical scales are not fixed or pre-given, but rather socially constructed, historically contingent, and politically contested. Scales are not ontologically fixed entities that can simply be instrumentalized by global actors but are rather depicted as continuously (re)produced, negotiated, and contested through social struggles and political strategies. From this perspective, the relative importance and influence of scales such as the city, the region or the state fluctuate across different regimes of accumulation, reflecting shifting power relations and institutional arrangements. This scalar relationality is fundamental for understanding the spatial restructuring associated with globalization and its uneven territorial impacts.

Methodologically, issues arise concerning the significance of spatial scale in economic analysis. While economists often employ terms such as "location", "region", or "place" interchangeably, without clearly specifying the spatial unit of analysis, this

ambiguity can lead to misleading conclusions, as relationships observed at one scale may not hold at another. For example, Rosenthal and Strange (2020) highlights substantial evidence that agglomeration economies attenuate with distance, with nearby interactions exerting stronger effects than more distant interactions, thereby demonstrating that the nature and intensity of agglomeration economies vary significantly across spatial scales. At the same time, when spatial units are poorly defined, theories become harder to falsify, as any mismatch between theory and evidence can be dismissed as a problem of using the "wrong" scale.

Against this backdrop, the GPN and GFN frameworks – upon which this thesis builds – represent a significant advancement within REG. Unlike earlier approaches that tended to privilege either horizontal networks among actors or multi-scalar processes, these frameworks explicitly integrate both dimensions, offering a socio-spatial relationality perspective. The network metaphor that is central to the GPN framework captures both vertical linkages (e.g., supplier–buyer relationships) and horizontal connections (e.g., partnerships, alliances, and institutional interactions). At the same time, GPN scholarship has become increasingly sensitive to the multi-scalar organization of value creation, coordination, and governance, partly in response to the limitations of the more linear GVC framework. In this sense, GPN and GFN approaches offer a more comprehensive analytical lens for understanding economic phenomena, as they adopt an actor-centered perspective that integrates both horizontal and vertical relations, while foregrounding the inherently spatially contingent nature of economic organization.

2.3 New Institutional Economics

The term New Institutional Economics (NIE) was coined by Oliver Williamson to describe a diverse group of economists – the most notable proponents being Williamson (1971, 1975) himself and Douglass North (1990, 2005) – working across micro theory, economic history, property rights, comparative systems, labour economics, and industrial organization. Much like arguments later echoed in economic geography, these scholars contended that conventional microeconomic theory was too abstract to adequately explain real-world economic phenomena. They instead emphasized the centrality of transactions as the core unit of economic analysis (Williamson, 1975) and developed a multidisciplinary, yet coherent framework organized around three main pillars: (*i*) key concepts such as transaction costs, risk and uncertainty; (*ii*) a critique of the behavioral assumptions of mainstream economics; and (*iii*) a methodology grounded in comparative institutional analysis. Economic actors are understood to operate through systems of decision rights, defined and allocated through contracts, organizations, and broader institutional arrangements, without access to full information or perfect rationality. Institutional arrangements structure interactions across multiple scales – from bilateral exchanges to global systems – and highlight how agents actively shape and reshape the "rules of the game".

Important internal distinctions exist within NIE. Most notably, as noted by Rafiqui (2009), Williamson's transaction cost economics and North's institutional analysis of economic history diverge in three key respects. First, they differ in their understanding of institutional efficiency: Williamson, focusing on competitive markets, tends to view institutions as efficient solutions to transaction cost problems, whereas North, incorporating political markets, emphasizes that inefficient institutions can persist over long periods. Second, Williamson treats the institutional framework as given and

examines how different governance structures minimize transaction costs within it, while North is concerned with how institutions themselves evolve and how this evolution affects economic performance (North, 1990). Third, Williamson conceptualizes transaction cost economics primarily as a theory of contracts – especially ex post governance under bounded rationality and imperfect enforcement – whereas North advances a broader, context-sensitive theory of choice in which individuals are socially embedded actors whose preferences and rationality are neither fixed nor fully independent.

Building on these foundations, North's work has proved particularly valuable for economic geographers. Notably, Martin (2000) draws on North and Davis (1971) to elaborate the distinction between "organizations as players of the game" and "institutions as rules of the game". While in practice organizations and institutions are deeply intertwined, analytically separating rules (whether formal or informal) from players is crucial for understanding economic change (North, 1990), foregrounding the importance of collective action and the structuring role of rules over the organizations that enact them (Clark, 2015). What matters is the dynamic interplay between organizations and institutions and how this interaction drives institutional change and long-term economic performance.

A key strength of NIE lies in fact in its evolutionary orientation. Because social systems are composed of numerous interacting agents with bounded rationality and innovative capacities, outcomes cannot be fully anticipated or optimized ex ante. Institutional arrangements are rarely the product of coherent design. Instead, they emerge through processes of trial and error and are best understood as imperfect and provisional solutions to coordination problems. Actors respond strategically to inherited institutional

arrangements by adapting, contesting, or circumventing them, requiring any "social planner" to balance long-term vision with short-term pragmatism (see Brousseau and Glachant, 2008). Institutional change – which redistributes decision rights (and thus power) as well as access and use rights (and thus wealth) – tends to occur through incremental and cumulative adjustments rather than wholesale redesign. Understanding economic organization consequently requires close attention to processes of change, adaptation[3], and evolution over time.

This evolutionary understanding creates a natural point of connection with Evolutionary Economic Geography (EEG). Both perspectives reject static equilibrium models and instead highlight path dependence, cumulative causation, and the historically contingent character of economic development. As Boschma (2014) argues, institutional and evolutionary approaches are fundamentally complementary, since economic evolution is always embedded within institutional structures that both constrain and enable change. Similarly, Maskell and Malmberg (2007) locate the core of EEG in the interaction between knowledge creation and its institutional foundations, while Rafiqui (2009) highlights the broader affinities between evolutionary and institutional reasoning in economic geography. The difference lies largely in analytical emphasis: whereas NIE places institutions at the center of analysis as governance structures shaping incentives and coordination, EEG focuses more directly on the evolution of routines, capabilities, and technologies across firms, industries, and regions. Institutions, in this view, form part of the evolving environment through which these processes unfold.

Taken together, these insights also open a dialogue with REG. If economic development is shaped by the co-evolution of organizations (actors) and institutions

[3] See Chapter 5 for a discussion of adaptation as a key concept.

(rules), then attention must also be directed towards the relationships through which coordination is achieved. While Jessop (2007) criticizes early institutional approaches for treating institutions as fixed or reified entities, a strategic-relational perspective views them as complex, emergent, and inherently unstable phenomena that are continuously reproduced through social action. NIE already points in this direction through its concern not only with internal organization, but also with the governance of external relationships, including contracts, alliances, partnerships, and other forms of coordination. Institutions are path-dependent and historically contingent, co-evolving with actors whose identities, interests, and strategies they simultaneously shape[4]. Economic outcomes therefore emerge not simply from institutions themselves, but from the dynamic interplay between actors, institutions, and the relational configurations through which coordination is enacted. Institutions remain incomplete and provisional, continually subject to reinterpretation, contestation, and competing institutional projects (Jessop, 2007).

This perspective has important methodological implications. First, NIE prioritizes learning from real-world phenomena, recognizing the complexity of economic systems and orienting research toward practical issues and decision-making contexts. Second, it is inherently open and pluralistic, drawing on insights from multiple disciplines to better understand the dynamics of institutions, organizations, and interactions. Both aspects are highly compatible with relational approaches, which similarly emphasize complexity, interdependence, and methodological diversity. In this spirit, the present thesis adopts both an empirical focus and a pluralistic framework, examining economic decision-

[4] Karl Polanyi's central argument that the economy, and markets in particular, are embedded in social, political and cultural institutions that vary across space, has been highly influential in this context.

making under conditions of risk and uncertainty (as defined in the next section) across diverse actors and organizational forms, while paying close attention to the relational and institutional contexts in which such decisions are embedded.

2.3.1 Risk and uncertainty

NIE as a coherent theoretical framework draws on a set of shared analytical concepts, two of which are particularly central to this thesis: risk and uncertainty. Both notions have long occupied a foundational place in economic thinking, dating back to the seminal contribution of Knight (1921). In line with this tradition, I distinguish between uncertainty and risk according to the extent to which future outcomes can be probabilistically specified. Uncertainty characterizes situations in which reliable probability estimates cannot be formed because the relationships between actions and outcomes are unknown, indeterminate, or subject to disruption. This may arise from the emergence of entirely new phenomena or from unpredictable reactions within complex systems that disrupt established patterns (Bookstaber, 2017). Risk, by contrast, pertains to situations in which the probability distribution of potential outcomes can, at least in principle, be estimated. Its sources are diverse and salient in both real and financial markets. In their formulation of the GPN 2.0 framework, Coe and Yeung (2015) categorize risk into five broad types – economic (including financial), product, regulatory, labor, and environmental –, each having distinct causal mechanisms and implications, as summarized in Table 2.1.

Table 2.1 *Types of risks affecting GPNs*

Form	Nature	Negative effects on actors
Economic risk	Systemic shifts in (physical or financial) markets – e.g. new technologies, exchange rate fluctuations, etc.	Lower income and/or reduction in financial returns; loss of competitive position
Product risk	Quality, safety, branding, and efficiency considerations	Negative views of goods or services by end-users resulting in lower income and/or reputational damage
Regulatory risk	Political, public-private governance, changing standards and norms	Disruption or termination of production, existing industrial practices and/or organizational arrangements
Labor risk	Struggles over working conditions and employment practices	Disruption to production and employment prospects; reputational damage
Environmental risk	Natural hazards	Accentuating the above forms of risk and their causal effects

Source: Adapted from Coe and Yeung (2015).

Responses to risk and uncertainty can be understood at two analytically distinct but interconnected levels: the micro level of decision-making and the macro level of institutional and network organization.

At the micro level, risk and uncertainty shape how economic actors make decisions. Because risk is measurable, it is also, to some extent, manageable. Under conditions of risk, actors can draw on probabilistic assessments and deploy strategies designed to hedge against adverse outcomes. In financial markets, for example, investors are typically assumed to adjust their decision-making protocols in line with Bayesian principles – that is, by continuously evaluating new market signals against prior distributions of outcomes and updating their expectations accordingly. In practice, however, decision-making frequently departs from such idealized rationality. As demonstrated by behavioral approaches, actors systematically over- or underweight information (e.g. investors tend to focus disproportionately on the arrival of new information rather than on its relative significance, a tendency that often results in overreaction), exhibit loss aversion and rely on cognitive shortcuts that can lead to biases (Kahneman and Tversky, 1979; Kahneman, 2003; Clark, 2018). Importantly, market participants may also form expectations about how others are likely to respond to new information, including the possibility of overreaction or underreaction, and adjust their behavior accordingly. Awareness of well-established behavioral biases does not imply fully rational behavior and does not necessarily mitigate their effects, but rather may generate second-order beliefs and strategic responses that themselves shape market outcomes. Under conditions of uncertainty, such heuristics become even more important. Rather than optimizing, actors rely on rules of thumb, routines, experience and judgement, while taking account of their perceptions of how other actors may interpret and react to unfolding events.

Economic geographers have long emphasized that access to information, analytical capabilities and risk management instruments tools are unevenly distributed across both space and actors, with significant distributional implications (Staritz et al., 2018). Large international firms typically possess the financial resources, technical expertise, and

institutional access required to engage in sophisticated hedging strategies (including active participation in derivatives markets) and advanced forms of risk assessment. By investing in information-gathering, scenario planning and anticipatory capabilities, they may also be able to transform certain forms of uncertainty into more manageable risks. On the other hand, smaller or locally embedded actors frequently lack such capabilities. As a result, they are often compelled to rely on alternative, often less effective, means of coping with price fluctuations.

Similarly, research in financial geography suggests that how actors cope with risk and uncertainty depends on the specific circumstances in which issues arise, as well as on the domain-specific skills and expertise of market participants (Clark et al., 2024). Being knowledgeable about probability, experienced in applying statistical tools to a range of relevant events, and capable of calibrating and recalibrating models of market movements equips decision-makers with the capacities needed to respond to the unexpected. Over the long term, such actors tend to be more effective in managing risk and uncertainty than neophytes (Clark et al., 2012). These asymmetries become especially pronounced under conditions of uncertainty, where informational advantages can generate significant rents for well-positioned actors – an issue that will be examined in greater detail in the following chapter.

At the macro level, risk and uncertainty are not simply attributes of individual decision-makers but are structured by the broader institutional and organizational environments in which economic activity takes place. Coe and Yeung (2015) conceptualize production networks as organizational platforms through which firms seek to manage the risks inherent in contemporary capitalism that emerge from the competitive dynamics associated with cost reduction, capability development, market expansion, and

financial discipline. Here, I argue that this conceptualization can be extended to a combined Global Production and Financial Network (GPFN) perspective (see Chapter 3), while emphasizing that one of the principal arenas in which such risk management occurs is the financial system – particularly derivatives markets where key financial instruments enable economic actors to hedge against adverse outcomes, stabilize returns and reduce exposure to volatility (see Clark et al., 2009).

Organizational and institutional arrangements also play a central role in managing uncertainty. One prominent organizational response is intra-firm coordination, whereby (lead) firms internalize and consolidate control over key stages of production and distribution. This allows them to manage volatility more effectively while enhancing their capacity to capture value under uncertain conditions. As will be demonstrated in this thesis, such strategies are particularly characteristic of large TNCs operating in the wheat sector – an industry exposed to multiple, overlapping, and often compounding forms of uncertainty.

Institutions can be understood as a further key mechanism for reducing and structuring uncertainty in line with the NIE tradition. As North (1991) argues, institutions comprise the formal rules and informal rules of the game that structure expectations and facilitate coordination. By providing relatively stable frameworks for interaction, they render social and economic interactions, and therefore economic outcomes, more predictable. However, the effectiveness of institutions is neither automatic nor guaranteed. Their capacity to reduce uncertainty depends on a range of factors, including their legitimacy and effectiveness, which in turn hinges on their clarity, boundedness and efficacy (Clark, 2015) – particularly in settings that require coordinated or collective action.

This observation points to a crucial feature of risk and uncertainty within GPNs and GFNs – namely that they are rarely generated by a single actor in isolation but rather arise through collective dynamics that involve multiple participants (Coe and Yeung, 2015). Risk is often co-produced through the interactions of multiple participants within a network. For example, a lead firm may introduce a new technology or production process that generates potential hazards, yet the transformation of these conditions into concrete risks depends on how other actors – such as suppliers, regulators, workers, and local communities – respond and interact. In this sense, risk is not merely an exogenous factor but an outcome of ongoing social and economic processes.

At the same time, broader structural dynamics play a decisive role in shaping both the magnitude and distribution of risk. Changes in regulatory frameworks at national or international levels can significantly alter the risk landscape and reshape competitive positions across entire production networks, affecting all participating actors. Additionally, the mitigation of risk does not necessarily follow a zero-sum logic in which one actor's gain is another's loss, and there are many situations in which risks generate negative outcomes for a broad range of actors simultaneously. Economic crises, for instance, often produce widespread losses that affect firms, workers, and state institutions alike (although actors in weaker structural positions – such as local workers – tend to bear a disproportionate share of the costs; as will be further explored in Chapter 5, these adverse dynamics frequently reveal the "dark sides" of global economic integration).

Understanding risk and uncertainty within GPNs and GFNs therefore requires an analytical approach that integrates both actor-level strategies and structural conditions, while maintaining a multi-actor and multi-scalar perspective. The relative salience of different forms of risk varies across contexts and over time, influencing which risks firms

prioritize and how they respond. In general, firms are more likely to focus on those risks that present significant opportunities for value capture or, conversely, substantial threats to profitability. Strategic responses are thus closely aligned with the evolving configuration of risks within the systems in which economic actors operate, reflecting an ongoing process of adaptation to shifting conditions.

2.4 Asset pricing

As noted in Chapter 1, a growing body of research in economic geography has examined commodity supply chains and financial markets, yet these two spheres have often been studied separately. One key aim of this thesis is to contribute to research in economic geography that investigates the intersection between physical commodity markets and derivatives markets. Physical markets involve the production, storage, and trade of material commodities, while derivatives markets involve financial instruments – such as futures contracts – whose value is derived from those underlying commodities. At the same time, prices formed in derivatives markets provide important signals that influence behavior in spot markets. In principle, spot and futures markets are linked through arbitrage, meaning that if markets operate without frictions, price discrepancies between spot and futures contracts create arbitrage opportunities that traders exploit until prices converge as the contract approaches maturity.

Prices therefore represent the critical link connecting the material economy of commodities with financial markets. They coordinate production, distribution, and consumption decisions while also shaping the distribution of value among actors in commodity chains. For commodities such as wheat, the price that emerges in futures markets can influence the expectations of farmers, traders, processors, and investors,

thereby linking financial speculation to the organization of agricultural production and global trade. Despite their centrality, detailed empirical investigations of price formation processes have been relatively scarce (Bargawi and Newman, 2017). In supply chain studies, for instance, prices often appear as background variables that shape the organization of production rather than as objects of inquiry in their own right. As Beckert (2011) argues, prices should not be understood simply as the aggregate outcome of supply and demand interactions – rather, they are anchored in institutional regulation, social structures, and shared meanings within markets. Understanding commodity prices therefore requires examining both economic fundamentals and the institutional and relational contexts within which markets operate.

Mainstream economics provides a set of well-established frameworks for understanding the pricing of derivatives and commodities. At the core lies the neoclassical theory of price determination, which views prices as the result of the interaction between supply and demand under conditions of market competition. Firms decide how much to produce based on profit maximization, while consumers determine demand according to preferences and income constraints. The equilibrium price emerges where aggregate supply meets aggregate demand. In spatially separated markets, standard economic theory predicts that prices should differ only by transportation and storage costs if markets are fully integrated. The concept of market integration is therefore central: if arbitrage opportunities exist, traders will exploit them until price differences disappear. Empirical studies frequently test this hypothesis using econometric methods such as co-integration analysis and error correction models, which examine whether price series move together over the long run and how quickly deviations from equilibrium are corrected.

In commodity derivatives markets, several additional factors influence price levels and volatility. While Chapter 4 provides further detail, supply and demand conditions remain fundamental, including crop yields, inventories, and consumption patterns, as well as variables that influence them – such as weather conditions and seasonality (Fleming et al., 2006; Arismendi et al., 2016). Derivatives prices are also shaped by financial variables, including exchange rates and factors related to market structure, such as the degree of concentration among traders, the balance between hedging and speculative activity, and liquidity conditions (Chen et al., 2010; Asness et al., 2013).

While mainstream economics models provide valuable insights, they rely on a simplified view of markets that abstracts from institutional contexts and social relations. As a result, they often struggle to explain persistent spatial price differences or the political dynamics that shape commodity markets. In economics, there is a general presumption in favor of market efficiency: according to the logic of the efficient market hypothesis, unexpected outcomes arise only from new information, otherwise relevant developments would already be incorporated into market expectations and reflected in prices. By contrast, a substantial body of research in geography and finance highlights the presence of localized and often highly differentiated networks through which market information circulates, producing varied patterns of expectations both within and across markets (see Clark and Wójcik, 2007). While acknowledging the importance of the revolution in access to market information, this body of research highlights that (*i*) information is not universally shared through neutral channels but is instead systematically filtered and directed, (*ii*) disparities persist among market participants in their access to the volume of information required to make well-informed investment decisions, and (*iii*) the abundance of available data does not guarantee its quality (Clark et al., 2006).

Against this background, relational and institutionalist approaches offer an alternative perspective on price formation, emphasizing that markets are socially embedded rather than purely mechanical systems. From this viewpoint, prices are the outcome of interactions among actors operating within institutional frameworks that structure market behavior. The marketization approach, for instance, emphasizes the role of socio-technical devices in shaping markets (Çalişkan and Callon, 2010; Çalişkan, 2010). Markets are constructed through assemblages of technologies, standards, metrics, and calculation tools. Price formation therefore involves not only negotiation between actors but also the deployment of technical instruments that quantify value. In the context of agricultural commodities, examples of such devices include benchmark price indices, influential market reports, and derivatives contracts traded on major exchanges. These instruments provide reference points that guide negotiations and expectations across commodity chains. Importantly, different actors possess unequal access to these tools and the expertise required to interpret them, leading to asymmetries in power and influence over price-setting processes.

Price formation can thus be understood as a political process in which actors compete to impose their valuation frameworks. More powerful actors – such as large trading houses, financial institutions, or state agencies – may be able to shape the standards and calculation methods that determine prices, thereby influencing the distribution of value across the commodity chain[5]. Informational asymmetries may also

[5] See Chapter 3 for a discussion of the role of large commodity trading houses (notably, the so-called ABCD firms), which channel orders from a wide range of market participants and operate across both physical and derivatives markets; major financial institutions, including investment banks, which contribute to price discovery and offer commodity indices and risk-management

generate potential conflicts of interest, where actors occupying central positions within commodity and financial networks, particularly large trading houses, simultaneously facilitate risk management and provide market access to producers, processors, and other commercial counterparties, while at the same time managing their own trading positions and advancing proprietary commercial objectives. As a result, these actors are not neutral conduits of information but market participants with their own strategic objectives. Their superior access to market intelligence, order flows, and analytical capabilities may enhance the efficiency of price discovery and risk allocation, yet it may also strengthen their ability to influence the terms under which market information is interpreted and incorporated into prices.

Institutional frameworks also play a crucial role in shaping how prices emerge in markets. As Polanyi (1957) argues, prices do not emerge spontaneously from isolated acts of exchange but are rather embedded in institutional arrangements. Regulations that affect competition, labor rights, quality standards, or intellectual property can alter production costs and market power, thereby influencing price levels. Taxes and subsidies may incentivize or discourage the production and consumption of certain commodities, while monetary policies influence interest rates and credit availability, affecting investment and storage decisions. Chapter 5 examines the implications of trade measures (also) for pricing. In commodity derivatives markets, regulatory frameworks governing margin requirements, position limits, and access to trading venues can directly influence liquidity, volatility, and price discovery. In this sense, institutions function as mediators between the physical and financial dimensions of commodity markets. Futures contract

products; and state agencies, which can influence price formation through regulatory standards and other policy interventions.

specifications, benchmark indices, and regulatory infrastructures translate the material characteristics of commodities – such as quality grades, delivery locations, and storage requirements – into standardized financial attributes that can be traded globally.

Economic geography adds a further layer of analysis by highlighting how spatial factors shape price formation processes. Markets are embedded in particular places, and the distribution of knowledge, infrastructure, and institutional power across space affects how prices emerge and circulate. Financial markets exhibit strong tendencies toward spatial concentration. Major financial centers concentrate specialized labor markets, technological infrastructures, and dense networks of financial institutions (see Wójcik, 2018). Such agglomeration facilitates information exchange and enhances the efficiency of price discovery. Evidence from financial markets shows that proximity among firms, investors, and institutions often matters even in highly digitized trading environments. For example, price discovery for globally traded securities often remains concentrated in a single financial center where key actors and information sources are located. Similar dynamics can be observed in commodity derivatives markets, where exchanges located in major financial hubs play a central role in determining benchmark prices that influence global trade. In this thesis, particular attention is given to Chicago and Paris.

Geography also matters because commodity production itself is spatially uneven. Agricultural commodities such as wheat are produced in specific regions characterized by distinct climatic, ecological, and infrastructural conditions. Transportation networks, storage facilities, and logistical infrastructures shape how commodities move across space and therefore affect price differentials between regions. In this respect, this thesis highlights a significant overlap in the territorial configuration of the physical and financial markets for wheat, which differs from the pattern observed for tropical commodities like

coffee, cocoa, and cotton, where production is concentrated in the Global South with key financial centers located elsewhere. These different spatial configurations have important distributional implications.

Finally, a key insight emerging from the literature discussed in this chapter – particularly the discussion of uncertainty – is that the inability to anticipate future states of the world is itself a factor shaping expectations and asset pricing. Changes in fiscal, monetary, or trade policy can influence commodity derivatives markets indirectly by affecting exchange rates, interest rates, and production and transport costs. Political tensions, wars, trade disputes, and sanctions can have similar effects. Chapter 4 examines these dynamics in greater detail by focusing on the impacts of Economic Policy Uncertainty (EPU) and geopolitical uncertainty respectively, showing how policy decisions and geopolitical events become integral components of the institutional environment within which prices are formed.

2.5 Geographical political economy

Contemporary geographical political economy can be traced to the emergence of radical geography in the 1970s and its sustained engagement with Marxian thought. A foundational intervention in this tradition is *The Limits to Capital* ([1982] 2006) by David Harvey, which offers a geographical critique and extension of Marx's theory of capitalism and uneven development. This body of work emphasizes how capitalism is inherently conflictual and crisis-prone, unable to resolve its internal contradictions and systematically productive of socio-spatial inequalities. As such, geographical political economy is characterized by skepticism toward equilibrium analysis, methodological individualism, and the separation of economic dynamics from co-evolving social

processes. Instead, it foregrounds the historically and geographically specific configurations through which capital accumulation unfolds (Sheppard, 2011).

This critical tradition has already productively engaged with literatures grounded in relational and institutionalist approaches. One relevant example is the varieties of capitalism literature, which demonstrates how capitalist economies develop distinct institutional arrangements that give rise to divergent national development trajectories. The varieties of capitalism approach adopts a relational view of the firm, emphasizing the actions and interactions of economic agents within nationally specific institutional contexts. Central to this perspective is the role of "deliberative institutions," which structure ongoing coordination among firms, labor, and the state (Hall and Soskice, 2001). By deploying a micro-analytical lens to explain macro-level divergence, the approach offers important opportunities for dialogue with relational economic geography. Although critics have sometimes characterized it as overly institutionally deterministic, its core insight – that firms often interact more easily within shared institutional frameworks – resonates strongly with geographical analyses of embeddedness and coordination (Faulconbridge, 2008). This perspective also connects with research on national systems of innovation, which shows that global exchange processes, such as trade fairs, do not necessarily promote convergence among national varieties of capitalism but instead reinforce specialization and sustain differentiation in technology use and adaptation (Gibson, 2024).

Building on these foundations, the first strand of geographical political economy relevant to this thesis concerns the geography of production, particularly in relation to commodities. Geographical political economy begins analytically not with the moment of market exchange but with the point at which capital is advanced to organize commodity

production. Capitalists invest in transforming socially constructed "natural resources" into material and immaterial commodities whose sale promises profit. Production is therefore inseparable from biophysical, social, political, and cultural processes, and it presupposes the commodification of nature (Sheppard, 2011). Commodification frequently proceeds through dispossession and is deeply politicized, shaped by pre-existing power asymmetries across multiple geographical scales (Robbins, 2004). Control over land, water, minerals, or agricultural outputs is never neutral but reflects ongoing struggles over property, sovereignty, and labor. These concerns resonate with recent contributions in economic geography on Global Wealth Chains (GWC), which – somewhat distinctively from the GPN and GVC literatures – emphasize a broader notion of internationalization encompassing the movement of both commodities and money, that is, capital (Seabrooke and Wigan, 2022).

The second relevant strand concerns regional political economy and the enduring question of uneven development. During the 1990s, influential narratives of globalization suggested that technological advances in telecommunications, transport and finance were eroding the significance of space, producing either a homogenized global culture or a "space of flows" superseding territoriality. O'Brien's "end of geography" thesis is emblematic of this view (O'Brien, 1992). Yet the persistence – and in some cases intensification – of regional disparities challenged such claims. Political mobilizations based on regional marginalization, the revitalization of subnational governance within the expanding EU, and growing recognition that firm performance is sensitive to regional context all pointed to the continuing salience of territory. Scholars have increasingly emphasized external economies arising from agglomeration, differences in physical geography shaping growth prospects, the accumulation of social capital and cultures of trust, the resurgence of regionalism within state structures, and the strategic cooperation

of regional political and economic elites (Agnew, 2000). While these perspectives differ in emphasis, they converge in responding to the rediscovery of uneven development and in challenging simplistic convergence narratives. The relational turn in economic geography has further contributed to this debate by explaining how cycles of investment and divestment across regions can often be traced to variations in relational assets and institutional thickness (Yeung, 2005).

As Sheppard (2011) argues, while geographical political economy may appear heterodox from the perspective of mainstream economics, regional political economy offers a potential bridge by providing a space in which formal modeling and critical analysis can engage. By examining how regional institutions, agglomeration dynamics, social networks, and state restructuring interact, it highlights the scalar dimensions of capitalist development. Regions are neither passive recipients of global forces nor self-contained containers of endogenous growth. Rather, they are relationally constituted through flows of capital, labor, commodities, and governance. In this sense, regional political economy complements the geography of production: while the latter illuminates the material and socio-natural processes of commodity creation, the former situates these processes within territorially differentiated institutional landscapes. Chapter 5 builds on these traditions by examining regional and national dynamics within the EU associated with processes of value creation and capture in wheat production and trade.

At a higher level, while geographical political economy has made major contributions by foregrounding conflict, power asymmetries and the inherently uneven and crisis-prone dynamics of capitalism, there is also a need to more fully account for the enabling and coordinative dimensions of global economic integration. Processes of accumulation and commodification are not only constituted through dispossession and

struggle, but also through sustained forms of interdependence and institutionalized coordination across space. GPNs and GFNs depend on extensive infrastructures of contract enforcement, standard-setting, logistics and financial intermediation that make large-scale coordination possible (Coe et al., 2008; Dicken, 2015). Recognizing this duality allows to better capture how cooperation and contestation are co-constituted within global economic systems. It also provides a more precise analytical lens for the empirical chapters that follow, which examine how wheat production and trade are structured through overlapping networks, and how actors strategically navigate both the enabling and constraining dimensions of these integrated systems. As will be shown, in the wheat GPFN, coordinated trade, pricing, and risk-management systems coexist with recurrent contestation over standards, regulation, and market access. From this perspective, conflict is internal to processes of integration rather than opposed to them.

2.6 Overarching conceptual framework

As noted in Chapter 1, bringing together distinct theoretical traditions inevitably raises questions of coherence and internal consistency. Yet, the preceding discussion also reveals a set of shared analytical concerns that stem from a common departure from standard economic theory – particularly its reliance on full rationality and equilibrium assumptions – and that collectively inform the development of this thesis. In what follows, I identify three overarching points of convergence bridging REG, NIE, the asset pricing literature, and geographical political economy, which together provide a coherent framework for analyzing economic behavior and market outcomes, and particularly for understanding commodity markets.

First, these approaches share a commitment to contextuality over abstraction. REG emphasizes the importance of relational proximity, network configurations, and multi-scalar interactions in shaping economic outcomes. Rather than assuming atomistic agents operating in frictionless markets, it foregrounds the ways in which economic actors are embedded within dense webs of social, spatial, and institutional relations. Similarly, NIE highlights how institutional arrangements structure interactions across multiple scales, conditioning both incentives and constraints. Formal and informal institutions mediate access to resources, information, and opportunities, thereby influencing economic behavior in ways that deviate from abstract models of perfect rationality. This emphasis on embeddedness resonates strongly with developments in the asset pricing literature that challenge the assumption of homogeneous expectations. If actors are socially and institutionally situated, they will differ in their preferences, cognitive frameworks, and access to information. Consequently, expectations about future asset values are not uniform but systematically differentiated. Geographical political economy further reinforces this point by situating economic processes within historically and geographically specific configurations of capital accumulation.

Second, the four traditions converge around a dynamic perspective that privileges processes of evolution over static equilibrium. Standard economic models often rely on comparative statics and equilibrium conditions, implicitly assuming that markets tend toward stable outcomes. In contrast, REG, NIE, asset pricing approaches, and geographical political economy all emphasize temporality, path dependence, and the open-ended nature of economic processes. Economic landscapes are understood as continuously evolving, shaped by both incremental changes and abrupt disruptions, both endogenous and exogenous factors. Within REG, network structures are not fixed but evolve over time as relationships are formed, maintained, or dissolved. NIE similarly

recognizes that institutions are not static constraints but evolving frameworks that are subject to renegotiation and transformation. As North (1990) argues, institutional change – whether gradual or discontinuous – has profound implications for economic performance and development trajectories. This insight aligns with geographical political economy, which underscores how capitalist economies develop distinct institutional configurations that give rise to divergent pathways of growth. In the context of asset pricing, expectations are continuously revised in response to new information, shifting narratives, and changing institutional conditions. Both endogenous dynamics (such as feedback loops within markets) and exogenous shocks (such as geopolitical events or regulatory changes) shape price formation processes. As a result, asset prices cannot be understood as equilibrium outcomes reflecting fully rational expectations, but rather as emergent properties of evolving, context-dependent systems.

Third, these frameworks collectively advance a relational and collective view that challenges methodological individualism and highlights unequal development. While standard economic theory typically centers on individual decision-making, the approaches considered here emphasize the relational constitution of economic action and the structural inequalities that permeate markets. Economic outcomes are not simply the aggregate result of individual choices but are shaped by asymmetries in power, access, and capability. REG draws attention to the uneven distribution of relational assets, which confer advantages on certain actors over others. NIE complements this by outlining how institutional arrangements can privilege particular groups while marginalizing others, thereby reinforcing patterns of inequality. In the asset pricing literature, this translates into differences in the ability of market participants to acquire, process, and act upon information. Such disparities affect not only investment strategies but also the ability to hedge risk. Geographical political economy brings these insights into sharper focus by

foregrounding the structural dynamics of uneven development. It challenges narratives of convergence by demonstrating how capitalist development systematically produces and reproduces spatial and social inequalities.

The three points of convergence outlined above shape the approach adopted in this thesis. In addition, the analysis draws on key concepts from the various strands of literature discussed, including network, embeddedness, value, power, transaction costs, and – most prominently – risk and uncertainty. For clarity and reference, definitions of these concepts are summarized in the table below, while they are also revisited and applied throughout the thesis to guide the analytical framework and empirical investigation.

Table 2.2 *Key concepts*

(*Global Production/Financial*) Network	A network refers to an organizational arrangement composed of interconnected economic and non-economic actors whose activities are coordinated across multiple geographical locations to produce goods or services for (global) markets.
Embeddedness	Embeddedness denotes the idea that economic action is always situated within broader social and institutional contexts.
Value	Value captures the processes through which economic actors generate, enhance, and appropriate profits within networks.
Power	Power refers to the capacity of actors to shape network structures, rules, and outcomes.

Transaction costs	Transaction costs are the costs of carrying out exchange transactions through the price mechanism.
Risk	Risk pertains to situations in which possible events can be identified and assigned probability distributions.
Uncertainty	Uncertainty refers to situations in which outcomes, probabilities, or even possible events cannot be fully known.

Chapter 3: Taming transaction costs, risk, and uncertainty in Global Production and Financial Networks: The case of wheat futures markets

(Paper written with Gordon L. Clark and Dariusz Wójcik)

Abstract

We apply a novel conceptual framework that integrates the Global Production Network (GPN) and Global Financial Network (GFN) approaches combined with the notions of transaction costs, risk, and uncertainty to shed new light on commodities markets, using wheat futures markets as a case study. We critically assess three major trends characterizing the evolution of wheat futures trading since 2000: horizontal and vertical integration, the establishment of a new EU price benchmark, and heightened volatility. The focus of this article is the infrastructural backbone of the market, which includes trading houses, warehouses, derivatives exchanges, central counterparties, and investment banks. Conceptually, it is argued that the wheat Global Production and Financial Network (GPFN) can be conceived as a means of taming transaction costs, risk, and uncertainty. These concepts are crucial for understanding the network's configuration and evolution, explaining increasing concentration in a limited number of key nodes and the existence of interlinkages not only within but also across the wheat GPN and GFN. Empirically, it is shown that Paris has become a key financial center for

trading wheat futures flanking (if not supplanting) Chicago — a notable development given the typically slow pace of change in GPFNs.

3.1 Introduction

The vicissitudes of wheat production and trade have had profound historic implications, shaping the rise and fall of empires, wars, pandemics, and famines (Scott, 2017; Nelson, 2022). More recently, the Russian invasion of Ukraine disrupted global wheat supply chains, creating the 2022 price boom (Baffes and Nagle, 2022). Wheat appears to shape and be shaped by geopolitical developments for as long as it remains essential to global food consumption.

Since their inception in the 1860s, futures markets have been central to the evolution of wheat trade. The first wheat derivatives exchanges were established in Chicago, followed by Kansas City and Minneapolis, where merchants, aided by advances in railroads and road infrastructure, began gathering to exchange information (Irwin, 1954). This helped establish US dominance in the international wheat market in the second half of the nineteenth century, before the innovation gained ground in Europe, particularly in Paris and Liverpool (Nelson, 2022). Subsequent technological advances facilitating faster shipping and financial innovation have favored the emergence of a more global market. The market participant base has expanded from agricultural producers and traders to include financial institutions, especially since the early twenty-first century (Cheng and Xiong, 2014). As a result, trading volumes have surged, reaching a record high of 62.8 million trades in 2020, when markets in Chicago, Kansas City, Minneapolis, and Paris – still the largest on a global scale – are combined (Cyclope, 2023).

Wheat futures trading involves buying and selling standardized contracts to purchase or sell wheat at a predetermined price on a future date. It serves both hedgers, who manage price risks, and speculators, who seek profit from price fluctuations. In the absence of frictions, futures markets and spot markets, where wheat is traded for immediate delivery, are linked through arbitrage, which ensures price convergence as contract maturity approaches. Futures markets influence inventory decisions: when futures prices exceed spot prices, storage is encouraged, as traders can sell wheat at a higher price at a future date, while higher spot prices create an incentive for immediate sales, so that traders can benefit from a better price today.

Futures markets also provide critical supply and demand signals: by offering continuous trading and price discovery, they influence spot market behavior and help it reflect current economic conditions. This interconnected framework ensures aligned prices, helps risk management, and provides vital information for market participants assuming no frictions related to storage costs, transportation expenses, or market imperfections. Indeed, over time at least some of these frictions have become less significant due to reductions in transaction costs, broader access to information, and greater liquidity, as we observe in this article.

This functional and geographic interconnectedness has far-reaching implications for food security, economic growth, price stability, and international relations. Given that, wheat futures markets offer a compelling case study for testing the explanatory power of our conceptual framework, which merges the Global Production Network (GPN) and the Global Financial Network (GFN) approaches to show that the financial aspects of commodity markets are as material as their physical dimensions (Harvey, 2006; Labban, 2010; Grote et al., 2023).

The economic geography literature has recognized the need to thoroughly assess the role of different actors, institutions, and infrastructures in determining governance and distributional outcomes in commodity markets. Related research includes studies on commodity exchanges, derivatives trading, and the financialization of commodities (Laulajainen, 1995, 2003; Pike and Pollard, 2010; French et al., 2011; Muellerleile, 2013; Field, 2016; Bargawi and Newman, 2017; Clapp and Isakson, 2018; Neilson et al., 2018; Staritz et al., 2018; Fischer et al., 2022). Compared to these studies, our article provides a focused and detailed analysis of the relatively underexplored wheat market, adopting a distinct conceptual angle that emphasizes the institutional geography of commodity markets while focusing on its underlying drivers and dynamics.

The empirical focus of the article is the backbone of wheat futures markets, including derivatives exchanges, central counterparties (CCPs), warehouses, and trading houses, which are often neglected despite representing critical nodes in the wheat GPFN. Also important for the article are investment banks, whose role in commodities markets has been more widely debated in recent studies on financialization (Cheng and Xiong, 2014; McGill, 2018). We identify key patterns and trends from 2000 onward, tracking the growing centrality of the EU in global wheat trading within the broader context of European financial integration. Additionally, by studying this period we capture both phases of relative calm and heightened volatility, including the bursting of the early-2000s commodity supercycle and the Russian invasion of Ukraine. This enables us to assess how wheat futures markets behave in the face of uncertainty not just risk.

Methodologically, we employ a mixed-methods case study approach combining quantitative evidence from Bloomberg and the US Department of Agriculture (USDA) with data collected by the Cyclope study group (Cyclope, 2023), a private research organization that provides fundamental market intelligence on commodity markets for

traders, analysts, policy makers, and investors, condensed in a yearly report. This is supplemented by document analysis using industry and policy reports, press releases, and reliable news sources. Analyzing wheat as a case study of GPFN allows us to draw implications that can be applied to other commodities and markets.

The article makes two contributions to economic geography. First, we complement previous research at the intersection of GPN and finance (Coe and Yeung, 2019; Grote et al., 2023) and provide a more thorough understanding of the global wheat market by showing how the wheat GPFN is a means of taming transaction costs, risk, and uncertainty. The limited number of key nodes in the network, and the existence of interlinkages both within and across the wheat GPN and GFN, reflects attempts to reduce transaction costs and deal with risk and uncertainty. We argue that these interlinkages are strong, and accounting for them helps our understanding of the complexity and dynamics of the global wheat market. In doing so, we address criticisms of the GPN framework regarding its inability to establish causality and, therefore, deepen the conceptual sophistication of the GPN and GFN approaches. As such, we go beyond description by highlighting transaction costs, risk, and uncertainty as the essential underlying determinants of the network's configuration and evolution.

Second, we show that the configuration of the wheat GPFN, including its key nodes and interlinkages therein, has changed over time, as economic actors have sought ways to reduce transaction costs through spatial and functional integration and manage risk and uncertainty more effectively. The recent growth of Paris as a leading financial center for wheat futures trading is a major footprint of this process, driven by a combination of exogenous factors related to geopolitical events and, perhaps more fundamentally, endogenous forces linked to the behavior of market participants – notably their willingness to cope with market risk in response to increased exposure to EU, Russian,

and Ukrainian wheat. While highlighting the value of proximity between Paris as a financial center and critical wheat production and storage regions, the analysis underscores a key feature of the wheat GPFN, namely, that it is largely shaped by supply-side factors, unlike demand-driven networks such as manufacturing. In this context, proximity refers primarily to the relatively short geographical distance between Paris and the major wheat-producing and exporting regions that underpin the European physical and derivatives wheat markets, as well as the increasingly important wheat-production and export hubs in neighboring countries, particularly Ukraine and Russia. However, a broader, relational conception of proximity is also relevant, encompassing the connections with leading grain trading houses and financial institutions active in agricultural commodity markets, together with the longstanding political, commercial, and linguistic ties between France and major grain-importing countries in North Africa. From this perspective, historic, political, geographic, and economic factors have interacted in complex ways to drive a shift in global wheat trading from the US to the EU and, hence, the shift of futures trading from Chicago to Paris. This finding challenges the asserted dominance of the Anglo-American financial system and the assumption that traditional financial centers remain unsurpassed (Dalio, 2021).

The article proceeds as follows. It first sets out our conceptual framework, followed by an introduction to the key actors and their territorial organization. The next three sections explore interrelated trends that have shaped wheat futures markets since 2000 – specifically, vertical and horizontal integration, establishment of new price benchmarks, and heightened wheat price volatility – noting their implications for the wheat GPFN. The notion of transaction costs is central to the discussion on integration, whereas the concepts of risk and uncertainty are prominent in the following sections. The final section

summarizes the findings of the article and their relevance for understanding the geography of commodity markets.

3.2 Conceptual framework

3.2.1 A combined GPFN framework

The GPN and GFN approaches to economic geography view networks as key to understanding the complexity of the global economy. The GPN approach has been used since the early 2000s (Ernst and Kim, 2002; Henderson et al., 2002) to explain regional development as a result of strategic couplings between transnational corporations (TNCs) and territories, going beyond the linear strictures of the global commodity chain and Global Value Chain (GVC) formulations (Coe et al., 2008). Beginning with Coe, Lai, and Wójcik (2014), financial geographers have drawn on the analogous notion of GFN to reconceptualize the map of finance, highlighting links between financial and business services (FABSs), financial centers, offshore jurisdictions, and government actors (see Wójcik, 2018).

Both approaches are relational, focusing on key actors and their relationships within production, distribution, and consumption structures, and how these are organized. Emphasized are the roles of firm and non-firm actors in shaping economic systems and the institutional and geographic contexts within which networks evolve. In this vein, the roles of states and other institutions are particularly relevant, with focus on multi-scalar interactions at different levels, from sub- to supranational (Coe and Yeung, 2019), as well as on the political and legal unbundling of finance through offshore and onshore spheres (Haberly and Wójcik, 2022). Another shared characteristic of the two approaches is the attention paid to the dynamic nature of networks and their trajectories of change within

and across economic systems. Consistent with the above-mentioned interest in the role of institutions, economic geographers often link the development of GPNs and GFNs with the process of political and economic global integration wherein "pressures exerted by TNCs on states for greater integration of regional economic spaces may, in some cases, help to speed up the process of political integration" (Coe et al., 2008, 284).

At the conceptual level, the GPN approach builds on the core categories of value, power, and embeddedness (Coe and Yeung, 2015), which have also been adopted in GFN research. Both approaches examine how economic actors contribute to value creation and enhancement, particularly in the form of profits, and how this value is captured and distributed. These are also key themes in GVC research (see Gereffi et al., 2005; Bair et al., 2023), which, however, overlooks the significance of spatial relationality. Nonetheless, the two approaches are concerned with power structures and dynamics, exploring how different forms of power are enacted across networks, and how decisions regarding resource allocation and value distribution are made and enforced. Finally, referencing Granovetter (1985) and others, embeddedness refers to the ways in which economic activities are situated in social, cultural, and institutional contexts.

Relying on their common features and continuing the efforts of Grote et al. (2023) to complement previous studies in economic geography that focus on either production or finance, this article combines the GPN and GFN approaches into a unified GPFN framework applied to wheat futures markets. The GPFN perspective is particularly fitting, considering the interplay between the physical and financial factors that affect the global wheat market and the significance of futures trading. Using a combined framework allows us to capture interlinkages not only within but also across the wheat GPN and GFN. Recognizing the linkages between the two networks also paves the way for a more comprehensive understanding of the price formation mechanism in both spot

markets (GPN) and derivatives markets (GFN), and how the two markets influence each other (Bargawi and Newman, 2017). Finally, the GPFN perspective offers a more complete picture of the territorial organization of value-creating activities related to wheat trading, whether through physical processes or financial activity.

While the relationship between the space-time logics of derivatives and real markets captivated Marxist geographers long before the trend toward financialization in commodity markets (Harvey, 2006), we argue that the combined GPFN framework is particularly well suited to contextualize this trend, which reflects the rising influence of financial actors, markets, and motivations across all sectors of the economy since the turn of the millennium (Pike and Pollard, 2010; Field, 2016; Clapp and Isakson, 2018). The GPFN framework enables us to map the increasing relevance of financial nodes in the wheat market and presents wheat futures markets as a key channel for wealth accumulation.

Our analysis contributes to the literature at the intersection of GPN and finance (for an overview, see Coe and Yeung, 2019) in three ways. First, we contribute to the GFN literature, which views global finance as operating through a distinctive type of network, showing that GPNs and GFNs coexist and are closely integrated (Wójcik, 2018). Building on Grote et al. (2023), we enhance the explanatory power of the GPFN framework through the use of institutionalist concepts, as discussed in the next subsection. Second, by highlighting the concentration of power and profits in a few nodes within the global network and framing futures markets as a channel for wealth accumulation, we contribute to the literature on global wealth chains (see Seabrooke and Wigan, 2014; Wigan et al., 2024), providing insights beyond traditional production networks. Third, we extend GVC and GPN research, which has explored the role of

derivatives trading in tropical commodity markets (Bargawi and Newman, 2017), by emphasizing the distinctive features of the global wheat market.

3.2.2 Transaction costs, risk, and uncertainty

While the core categories of value, power, and embeddedness remain important in this article, we leverage three core institutionalist notions to address the dynamics of market evolution, adhering to the view that the (new) institutionalism provides a powerful setting for economic geographers to study economic and financial processes (Rafiqui, 2009).

First, we utilize the notion of transaction costs, originally defined by Coase (1937, 396) as the "costs of carrying out exchange transactions through the price mechanism" and used to explain why firms emerge in a market economy and why they do not grow indefinitely. This concept, further developed by economists like Dahlman (1979) and North (1991, 1994, 2005), inspired scholars, such as Buckley, Casson, Hennart, Rugman, and Teece, to establish the so-called internalization school of TNCs, according to which a TNC is "an organizational hierarchy which internalizes the market for cross-border intermediate products" (Dunning and Lundan, 2008, 81). Nonetheless, this perspective often overlooks the broader social and institutional contexts in which firms are situated. To this effect, Granovetter (1985) provides a robust critique of transaction cost economics, arguing that the Coasian understanding of the firm is overly narrow and that firms should be understood as embedded in ongoing social relations.

Here, we demonstrate that the two approaches are not mutually exclusive, and the notion of transaction costs adds significant value to a relational framework like the GPFN, helping to explain its underlying dynamics—not only with reference to firms but also in a broader context including non-firm actors and other institutional factors (such as

benchmarks). Recent research in economic geography has effectively applied the notion of transaction costs to explain the emergence of monopolistic market platforms (Haberly and Wójcik, 2022) and the impact of information technology (IT) on organizational dynamics in logistics (Aoyama and Ratick, 2007).

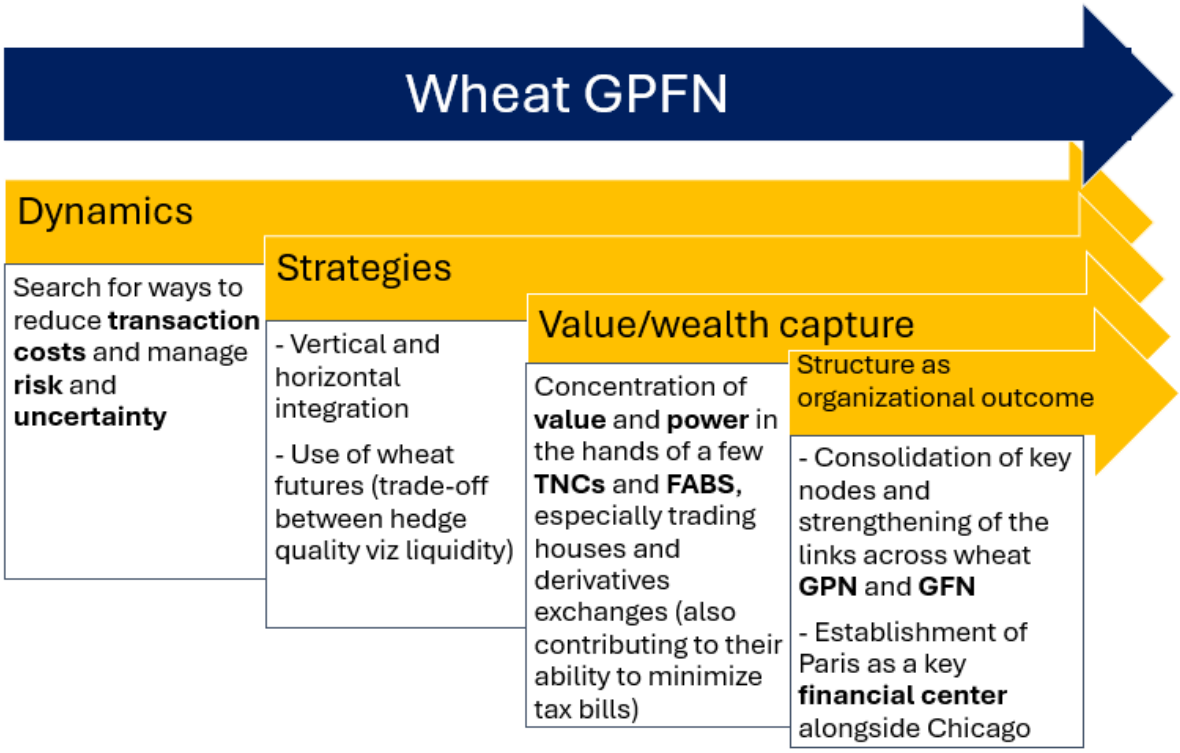
Other key factors in our analysis are risk and uncertainty, which have been central pillars in economic research since the seminal contributions of Knight (1921). Risk pertains to events for which a probability distribution can be established, enabling measurement and the possibility of hedging. In contrast, uncertainty refers to the lack of knowledge about possible occurrences, be it the result of new events materializing or unexpected reactions that hinder the possibility of forming stable expectations (Bookstaber, 2017). According to North (1991), the existence of institutions can be attributed to the establishment of rules that shape expectations around others' behaviors, thereby reducing uncertainty. However, no institutional device can fully eliminate uncertainty, suggesting that most transaction costs can only be managed and mitigated rather than entirely eliminated (Clark, 1983).

Coe and Yeung (2015) reference risk and uncertainty when conceptualizing the drivers of value activity in their GPN 2.0 framework. By incorporating these concepts into our combined GPFN framework, we align with their work while addressing a key critique of relational economic geography, namely, its tendency to offer descriptive accounts of networks filled with abstract generalizations (Sunley, 2008) yet struggling with the identification of causal mechanisms. We demonstrate that markets can be better understood by blending relational and institutionalist perspectives. On the one hand, institutions are shaped through networked relations. On the other hand, the notions of transaction costs, risk, and uncertainty help explain the specific organization, power asymmetries, and dynamic evolution of GPFNs (see Coe et al., 2008). While recognizing

the role of historic and political institutions, our conceptual apparatus proves to be a useful device to explain the drivers of actors' behavior and network evolution.

Figure 3.1 presents our conceptual framework in a stylized form, highlighting the underlying dynamics, strategies adopted by key actors, and implications for the wheat GPFN. These will be discussed in the empirical sections. As a simplified representation, it abstracts from contextual factors, and the embeddedness of the agents involved, but these factors will also be considered in the discussion.

Figure 3.1 *GPFN conceptual framework applied to the wheat market*



Source: Authors drawing from Coe and Yeung (2015).

We show that the wheat GPFN has evolved as an institutional device on a global scale to tame transaction costs, risk, and uncertainty, making decisions and transactions easier and more cost effective. The very existence of futures markets can be seen as an attempt to reduce transaction costs by centralizing exchanges and standardizing contracts while facilitating contract enforcement and addressing uncertainty by locking together distant markets in an intertemporal contract (Bardhan, 1983). In doing so, futures markets provide an opportunity not only to hedge risk but also to profit from superior knowledge or judgment without necessarily engaging in production (Coase, 1937; Grossman, 1977).

3.3 The backbone of the wheat GPFN

Table 3.1 presents the main actors in the wheat GPFN. Among TNCs, we focus on trading houses and warehouses. FABS companies central to our inquiry include futures exchanges, CCPs, and investment banks. We concentrate on these actors because they are key nodes at the intersection of the wheat GPN and GFN, reinforcing the argument that finance is deeply integrated with the real economy (Muellerleile, 2013). The table also identifies other elements of the GPFN. Governments and intergovernmental organizations that exercise extraterritorial authority are important, even if their powers are often contested locally and globally. Financial centers are cities that host FABS and, in some cases, are the hubs for the decision-making functions of TNCs as well as those of governments (where financial centers overlap with political centers). Offshore jurisdictions are key locations often used to bypass tax, regulatory, and transparency constraints elsewhere (see Clark and Monk, 2014).

Table 3.1 *Main actors in the wheat GPFN*

TNCs	*Trading houses*	Archer Daniels Midland—ADM (US)[1]; Bunge (US); Cargill (US); Louis Dreyfus (NL)
	Warehouses[2]	ADM (US); Ardent Mills (US); Bunge (US); Cargill (US); Cefetra (NL); COFCO International (CH); InVivo (FR); Louis Dreyfus (NL); The Andersons (US); Viterra (NL)
FABS	*Futures exchanges*	Australian Securities Exchange—ASX (AU); Chicago Mercantile Exchange (CME) Group[3] (US); Euronext Paris—MATIF (FR); ICE Futures Europe (UK); Johannesburg Stock Exchange—JSE (ZA); Matba Rofex (AR); Minneapolis Grain Exchange—MGEX (US)
	CCPs	Argentina Clearing (AR); ASX Clear (AU); CME Clear (US); ICE Clear Europe (UK); JSE Clear (ZA); LCH SA (FR)[4]; Euronext Clearing (IT)[5]; MGEX (US)
	Investment banks	Goldman Sachs (US); J.P. Morgan (US); Morgan Stanley (US); Citi (US); Bank of America (US); Barclays (UK); Deutsche Bank (DE); UBS (CH); BNP Paribas (FR); Société Générale (FR)
Key governments[4]		Argentina; Australia; Canada; France; Russia; US
Other governments		Ukraine
Financial centers		Chicago; Paris
Offshore jurisdictions		Bermuda; Delaware; Jersey; Netherlands; Switzerland

[1] Countries in parentheses are often the locations of operational headquarters, which can differ from the place of incorporation. For example, Bunge is headquartered in Missouri but incorporated in Bermuda; the CME Group is headquartered in suburban Chicago, Illinois, but incorporated in Delaware; Viterra is headquartered in the Netherlands, and incorporated in Jersey; Euronext Paris is headquartered in France, but operates as a segment of Euronext N.V. incorporated in the Netherlands. Those locations are indicated as offshore jurisdictions.
[2] We draw a distinction between trading houses and warehouses, although the same TNCs are involved in both businesses.
[3] In 2007 the Chicago Board of Trade (CBOT) merged with the Chicago Mercantile Exchange (CME) to form the CME Group. The Kansas City Board of Trade (KCBT) became part of the same group in 2012.
[4] Until July 2024, when LCH SA was replaced by Euronext Clearing for the clearing of Euronext Paris—MATIF.
[5] From July 2024; see footnote 4.
[6] Our analysis focuses on major wheat exporters, which often overlap with countries hosting significant FABS. While China and India are top producers, their output is essentially for domestic use, with limited exports (implying that they are less embedded in the wheat GPFN).

Wheat futures exchanges were first established in the 1860s in the US (Chicago, Kansas City, Minneapolis), followed by the creation of the *Syndicat Général de la Bourse de commerce de Paris* in 1864 and the Liverpool Corn Exchange in 1883. These centers were enabled by important technological changes, including the diffusion of the telegraph and, more recently, of electronic trading at remote locations. Today, the Chicago-based CME Group remains the largest marketplace for wheat futures trading, closely followed by Euronext Paris (MATIF).

CCPs were introduced after the establishment of derivatives exchanges (Williams, 2009) as infrastructure designed to interpose net trades between multiple market participants, while guaranteeing the successful execution of transactions and shielding them from counterparty risk. By reducing margin requirements associated with futures trading through netting, CCPs have facilitated the availability of liquidity for market participants and the growth of exchanges, while increasing confidence in their resilience

(Bernstein et al., 2019). The CME and Euronext groups avail themselves of their own CCPs, CME Clear and Euronext Clearing, which gives them the ability to control and extract value from the entire trading and post-trading process.

Investment banks like BNP Paribas, Société Générale, Goldman Sachs, and J.P. Morgan began significant operations in commodity markets during the late 1970s and 1980s, and dramatically increased their presence in the early 2000s (McGill, 2018) sustaining the so-called commodities boom until its collapse. They provide liquidity, facilitate price discovery, and offer risk management tools and commodity indices (such as Standard and Poor's Goldman Sachs Commodity Index) to a wide range of market participants. Beyond acting on commodity derivatives markets, they can also purchase and sell certain physical commodities, arrange for their storage and transport, or invest in and finance entities that engage in these activities.

Warehouses have subtended futures markets since the 1860s (Orenstein, 2019), storing and preserving the quality of wheat through advanced technology, thereby ensuring that derivatives traded on exchanges are grounded in demonstrable, objective value. Their importance, and that of grain storage in general, has grown in parallel with the development of derivatives exchanges and CCPs with whom they are often linked by contractual relationships concerning physical settlement. Given the vastly increased complexity and geographic extensiveness of production networks, warehouses also play a fundamental logistical role – a feature typically associated with the GPN (see Aoyama and Ratick (2007) and Coe et al. (2008), who argue that these organizations and functions deserve greater research).

Finally, four trading houses – Archer Daniels Midland (ADM), Bunge, Cargill, and Louis Dreyfus, known as the ABCD – have dominated domestic and cross-border wheat

trading since the nineteenth century, when the transatlantic telegraph and the rise of the American futures market enabled them to concentrate control by interposing between producers and consumers (Nelson, 2022). The market share of these four giants has grown since then, since they have expanded their global reach and developed information systems that cannot be matched by smaller competitors (Murphy et al., 2012). The ABCD own and operate global storage and delivery systems that are indispensable to the global trade in grain, and are among the most profitable TNCs in the world (Blas and Farchy, 2021).

Economic theory predicts that each of these five groups of actors should contribute to the reduction in transaction costs associated with wheat trading in different ways, and do so in relation to the effective management of risk and uncertainty. Derivatives exchanges, investment banks, and trading houses lessen search and information costs as well as bargaining and decision costs internal to the market. Derivatives exchanges allow trade to be concentrated in space and time, helping traders to more easily reach a common price and respond consistently to unanticipated price-related shocks. Trading houses have similar effects by intermediating among large numbers of merchants. CCPs and warehouses, in turn, help reduce costs associated with policing and enforcing contracts after their execution. CCPs also prompt decreases in search and information costs: as long as the CCP is the counterparty to all buyers and sellers, there is no need for a potentially lengthy search for trustworthy trading partners.

Relationships among these actors have changed over time, as has the firm-territory nexus of the wheat GPFN – also influenced by exogenous supply-side factors (to which the network is particularly vulnerable, as explained later) and changes in regulation. The growth of these actors has contributed to the establishment of Chicago and, more recently, Paris as key financial centers, providing the infrastructure required for wheat futures

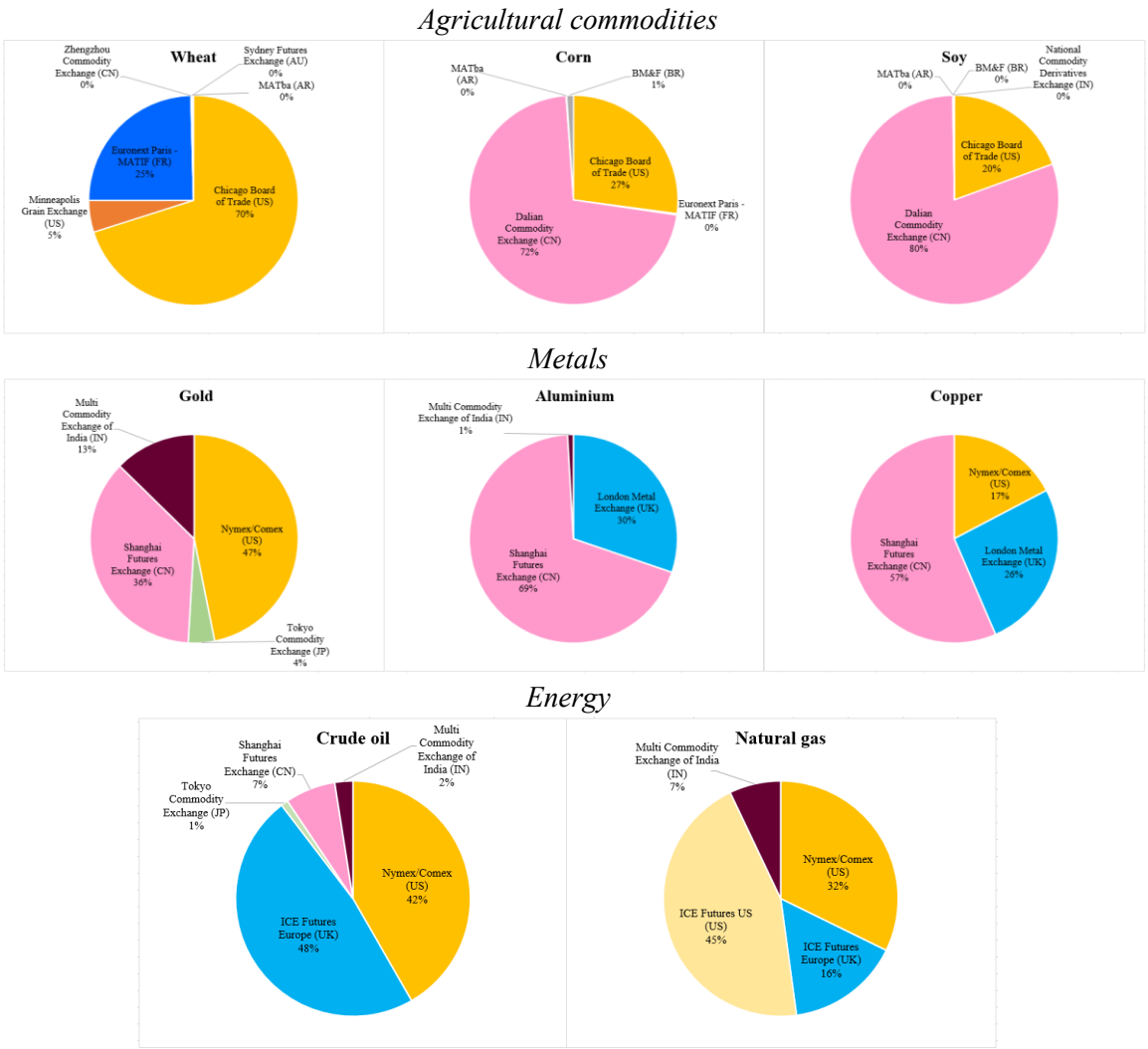
trading to become concentrated in space and time (Wójcik, 2018). In the process, many have been incorporated in offshore jurisdictions, which is not surprising considering increasingly stringent financial and tax regulations since 2008, on the one hand, and their rising profits, on the other. Equally important are their interactions with global institutions and governments, given the political importance of wheat trading, domestically and internationally.

In this respect, there is significant overlap in the territorial configuration of the wheat GPN and GFN. As key governments we identify countries that are major wheat producers and exporters, particularly the US and France, which also host the main financial centers for wheat futures trading worldwide and are home to key TNCs and FABS, a feature not common in the GPFNs of other commodities. To date, GVC and GPN research have mainly focused on tropical commodities like coffee, cocoa, and cotton (Bargawi and Newman, 2017; Neilson et al., 2018; Staritz et al., 2018), where key producers and exporters are not among the most financialized nations and typically do not host significant financial infrastructure. This difference gives rise to distinct distributional implications for the wheat GPFN.

Additionally, Paris's centrality and the virtual absence of wheat futures trading activity in China (volumes traded in Zhengzou representing 0.1% of those in Paris in 2021) can be recognized as a unique feature of the wheat GPFN compared to other commodities, where major financial centers are located in the US (Chicago and New York), China (Dalian, Shanghai, and Zhengzhou), the UK (London), and India (Mumbai) (see Figure 3.2). As we will argue later, the key place occupied by Paris is related to historic and political factors besides market dynamics. Brexit may have accelerated the shift of wheat derivatives trading from London to Paris, though it is important to note that the growth of Euronext Paris began before the Brexit referendum.

Conversely, while China competes with the US in several commodity markets (particularly oil) to establish its commodity derivatives as benchmarks and enhance its influence as the issuer of the renminbi (Dalio, 2021; Schindler et al., 2024), its wheat futures market remains largely absent, likely due to a combination of factors, including China's protectionist policies and the significance of wheat to Western countries.

Figure 3.2 *Volume of activity in key commodity futures exchanges, 2021*



Notes: Volume of activity is measured as the number of contracts traded. Shares reported as 0% correspond to positive shares lower than 0.5%. Soy includes contracts on soybeans, soybean meal, and soybean oil; crude oil includes contracts on both WTI and BRENT oil.

Data source: Cyclope (2023).

3.4 Vertical and horizontal integration

The configuration of the wheat GPFN can be viewed as the outcome of a complex and ongoing process, where market actors, driven by the need to reduce transaction costs, seek to respond to changing dynamics, manage risk, and optimize supply chains. Since the early 2000s, a clear trend toward integration, both vertical and horizontal, has emerged within the wheat GPFN, leading to an increase in the size of TNCs and FABS. Consistent with Coase's (1937) and Williamson's (1971) arguments, an explanation lies with the willingness of TNCs and FABS to internalize production, mitigate uncertainty, and lower the burden of transaction costs. Vertical integration helps overcome principal-agent problems, reduce informational frictions, and avoid wasted resources along the supply chain, offering a more efficient alternative to market exchange, especially for complex, risky, asset-specific, or recurring transactions. Although wheat is relatively standardized compared to sectors like manufacturing, coordination costs due to time-sensitive supply, increasingly complex regulatory environments, and frequent transactions can still justify a preference for internalizing production (Gereffi et al., 2005).[6] Horizontal integration promotes economies of scale and, in case of multiproduct diversification, scope. This enables firms to expand their geographic reach, capture positive externalities, and manage uncertainties related to competition – particularly relevant during the transformation stage of any market or sector. The early 2000s were a transformative period for wheat futures markets given the advent of new technologies and the entry of new players from the financial sector (Field, 2016; McGill, 2018).

[6] This holds true for the backbone of the wheat GPFN, while the market solution seems to prevail moving toward the network's periphery.

On the GPN side, since the early 2000s trading houses have intensified vertical integration, becoming managers of entire value chains. The integration of production, storage, and distribution dates back to the 1920s when it became apparent that the division of labor necessitated "handling" not only after but also during production, as TNCs began controlling long supply chains with storage needed in between production stages (Orenstein, 2019). By the turn of the millennium, trading houses possessed warehouses and had developed global logistics networks, yet they continued investing considerable resources in distribution systems to manage growing wheat volumes. This reflected a desire for greater control and the opportunity to capitalize on the elimination of government food stock programs in major exporting countries like the US and EU (Blas and Farchy, 2021; Hopewell and Margulis, 2023). Reinforcing market dominance, trading houses also expanded into ethanol production and strengthened global food supply chains. Notable examples include the acquisition of Netherlands-based Provimi by Cargill in 2011, the France-based Neovia by ADM in 2019, the Soufflet Group by InVivo (labeled as a "cornerstone of food sovereignty in France"; InVivo, 2021) in 2021, and the merger between Bunge and Viterra announced in June 2023 (Bunge and Viterra 2023).

The diversification of trading houses' businesses away from wheat trading has gone beyond food and agriculture, leading to the formation of multifunction and multiproduct conglomerates. As their traditional business model was eroded by growing access to information for smaller players, trading houses prioritized building scale and engaging in new businesses to preserve their profitability. Cargill has been particularly successful (Blas and Farchy, 2021), reinvesting profits in other agricultural commodities (including soy, cotton, palm, meat and poultry), pharmaceuticals, and beauty products.

In the GFN, vertical consolidation in the derivatives market infrastructure, which accelerated in the EU after the introduction of the euro, led to the establishment of full-service *silos* providing different services along the value chain, from trading to central clearing to settlement (European Central Bank, 2001). The success of these silos is evident in the ownership of CCPs, mostly controlled by the exchanges they clear. One exception was the French CCP, LCH SA, clearing wheat futures on Euronext Paris (MATIF) while belonging to the London Stock Exchange Group, but things have recently changed: after the 2021 acquisition of the Italian CCP, Euronext announced plans to designate the latter as its CCP of choice over LCH SA (Euronext, 2023), completing the transition for MATIF in July 2024. This marks the emergence of a new silo within the GFN. Moving up the proprietary chain, the ownership of derivatives exchanges themselves also reveals significant interlinkages within the GFN. Euronext, once a subsidiary of an American financial conglomerate, is now publicly listed with major EU financial institutions such as ABN AMRO and Intesa SanPaolo among its main shareholders. Similarly, the CME Group's ownership is concentrated in the US, with a majority of shares held by institutional investors, including investment banks like J.P. Morgan. This suggests that these groups are conducted and controlled within their respective jurisdictions, reflecting vested political interests of the latter.

Horizontally, globally active exchange groups have emerged, with the CME Group that controls the US wheat futures market, and the Euronext Group, which dominates in continental Europe, in the lead. CME consolidated the wheat futures markets of Chicago (Chicago Board of Trade, CBOT) and Kansas City (Kansas City Board of Trade, KCBT). Euronext, in turn, owns Euronext Paris (and its MATIF segment), which after Brexit became the only wheat futures market in the EU.

Whereas vertical integration has shaped the wheat GPN and GFN separately, to understand the process of horizontal integration more fully, consider the interlinkages across the two networks. First, derivatives exchanges have extended their geographic reach, and competed with each other by enlarging their warehouse networks (Laulajainen, 1995; Reuters, 2016). Second, greater integration has come from trading houses through new kinds of financial dealings. Historically involved in derivatives trading and farm credit, aside from their wheat trading business (Nelson, 2022),[7] they began acting as intermediaries within financial markets around 2000 – and more so in the wake of the 2008 global financial crisis when investment banks were in retreat due to regulatory changes – offering risk management and commodity investment services to financial institutions, including pension plans and asset managers (Sheppard, 2014; Blas and Farchy, 2021).

As a result of these vertical and horizontal integration processes, trading houses and derivatives exchanges have claimed unrivaled knowledge and power in the wheat GPFN. Though possibly less centralized than manufacturing GPNs (typically governed by lead firms), their status and position grant them control over orders from a multitude of players, and therefore a significant informational advantage that reinforces incentives for further integration, not only to reduce transaction costs, but also to strengthen control over information, logistics, and market access. In this sense, integration may reflect not only

[7] By 2000, trading houses had developed sophisticated risk-management and information networks, enabling successful bets on wheat prices through derivatives (Blas and Farchy, 2021). Their extensive history in the Chicago futures markets, along with their ability to aggregate information from thousands of farmers to trading desks in Chicago and Geneva provided them with a competitive edge. Offshore locations like Switzerland also helped safeguard private information for use in derivatives markets.

efficiency considerations but also strategic attempts to consolidate dominant positions and limit competitive pressures. As a result, efficiency considerations and the pursuit of market power may operate as mutually reinforcing drivers of organizational change.

By controlling supply chains, trading houses and derivatives exchanges have raised barriers to entry, particularly given the high fixed costs of building and maintaining the infrastructure to store and move wheat and trade wheat futures. Their superior knowledge has enhanced their profit margins, reinvigorating doubts as to whether wheat exchanges spread risks as opposed to concentrating profits for those who know the most about the market – an important question in the ongoing debate on commodity market financialization (Cheng and Xiong, 2014; McGill, 2018). From this perspective, participation in global wheat finance remains geographically uneven, and while the European and US markets benefit from dense networks of traders, information providers and financial intermediaries, countries such as Australia (or China) remain comparatively detached. This suggests that financialization does not necessarily produce a single integrated global market but may instead reinforce existing hierarchies by concentrating informational advantages and price-setting influence in a limited number of financial centers, while leaving other regions relatively peripheral to the dominant circuits of price discovery and risk management.

Linked to market power is the ability of wheat trading houses to minimize their tax bills by exploiting their global presence (Murphy et al., 2012). In December 2022, the Argentine Tax Court ruled on a Cargill transfer-pricing case concerning the use of foreign branches and the timing of benchmarking commodity exports (Rosso Alba, 2022). The case revolved around the practice of Cargill's Argentine subsidiary to channel 98% of exports through a Uruguayan branch (which would not be exposed to foreign exchange restrictions) and to price commodities on contract rather than shipment date. Although

the case was dismissed, it illustrates how trading houses can benefit from favorable tax treatment given their places of incorporation (often in offshore jurisdictions). This aspect has important implications for the links between trading houses and offshore jurisdictions within the wheat GPFN (see also Seabrooke and Wigan, 2014).

Regulatory initiatives have been undertaken with the aim of curbing such tax practices (the OECD BEPS – Base Erosion and Profit Sharing Program being a prominent example). There has also been growing antitrust scrutiny of vertical mergers and integrations, as evidenced by the new 2020 US vertical merger guidelines. Eventually, however, the size and global operations of trading houses have given them political influence across countries, giving momentum to the adoption of policies that reflect their interests. Derivatives exchanges and global exchange groups wield similar power due to their role as providers of essential financial infrastructure that can affect large parts of capital markets. Relevant examples include the adoption of measures supporting domestic ethanol production by the US government – a result of ADM lobbying (Blas and Farchy, 2021) – and the difficulties of introducing commodity derivatives reforms in the US and EU (Murphy et al., 2012; Engel, 2019). This is generally consistent with legal institutionalist arguments according to which financial systems evolve through political contestation over regulations between states and private actors and are inherently hierarchical, with legal frameworks applying differently to actors based on their systemic significance (Engel, 2020). These dynamics have implications for the links between TNCs and FABS, on the one hand, and governments, on the other, within the wheat GPFN.

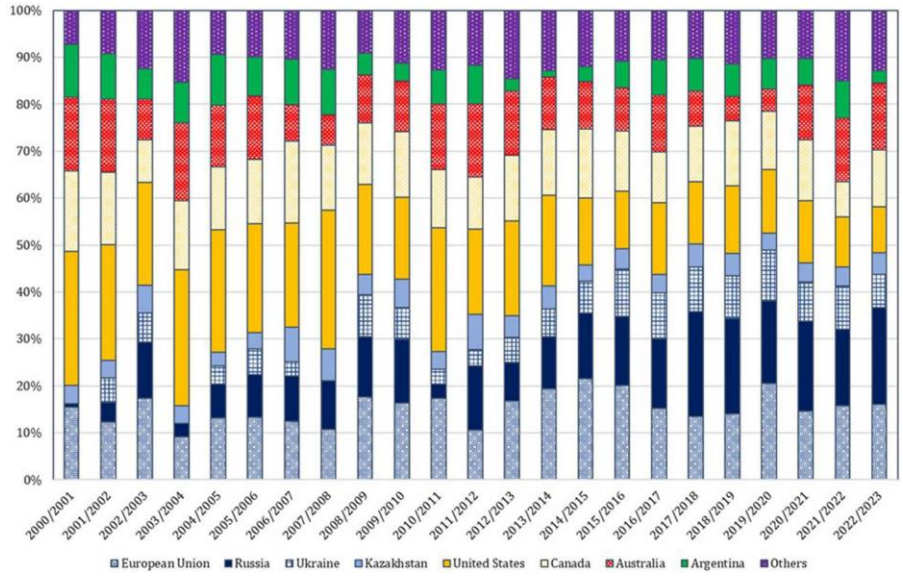
3.5 Establishment of new price benchmarks

Benchmarks lower search and information costs (Duffie et al., 2017). From a geographic perspective, this is important for understanding the optimal reach of a benchmark and the likely number of coexisting benchmarks. While it would seem helpful to converge on a single benchmark, economic theory shows that contracts tend to cluster around a few (rather than a single) discrete values (Young and Burke, 2001). At the same time, multiple benchmarks can emerge and even coexist if the demand for high-quality hedges (or the reward to information advantage) outweighs traders' preference for liquidity (Cuny, 1993).[8] We argue that this has happened following the rise of the EU, Russia, and Ukraine among the top global exporters in the wheat GPFN.

Figures 3.3 and 3.4 illustrate this point. The share of exports from the four markets that are closer to Paris (EU, Russia, Ukraine, Kazakhstan) more than doubled, from 20% in 2000/2001 to almost 50% in 2022/2023. The open interest position for the Paris milling wheat futures contract has demonstrated structural growth over the same period. Consequently, according to industry participants and academic research, the share of price discovery for the Paris market increased noticeably (Janzen and Adjemian, 2017), and the price of Paris milling wheat has emerged as a global benchmark, alongside that of Chicago. This trend can be expected to continue over the coming years due to several factors, including the geography of production, infrastructure investment, and the proximity of Paris to the largest grain importers in North Africa.

[8] Cuny (1993) notes the failure of the North Pacific Coast soft wheat futures introduced by the CBOT in 1950, attributing it to Northwest Pacific hedgers' preference for Chicago and Kansas City hard wheat futures (low-quality but liquid hedge) rather than switching to the new contract (high-quality but less liquid).

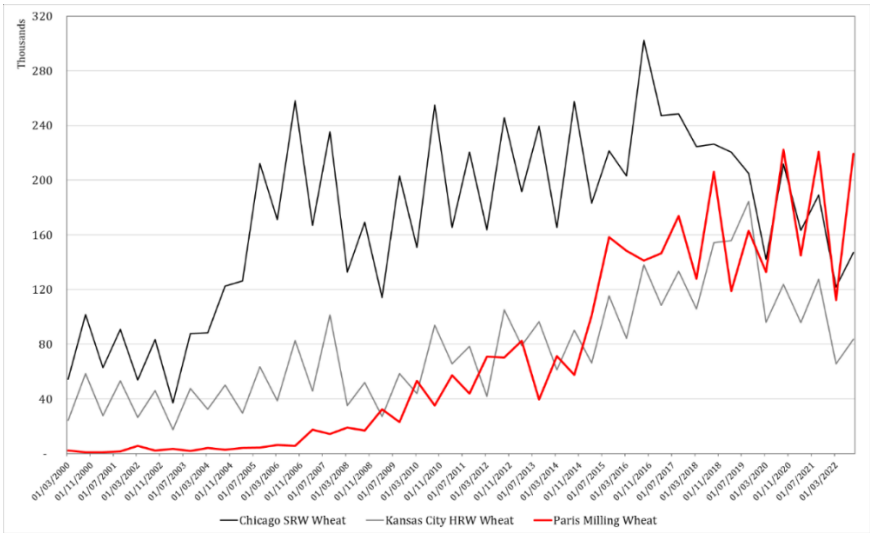
Figure 3.3 *Top wheat exporters in the world*



Notes: European Union represents external trade for all 27 countries for 2016/17 to present. Up to 2015/16, this includes the UK.

Data source: USDA, Foreign Agricultural Service, *Production, Supply and Distribution database.*

Figure 3.4 *Open interest for selected wheat futures contracts, 2000-2022*



Data source: Bloomberg.

The rise of Paris should be seen in the context of efforts by the French government to assert itself in the global wheat trade, underpinned by financial integration across the EU. Wheat has been a long-term concern of French politics across multiple dimensions, including food products and security, agriculture, trade, and international relations. The EU benefits from French wheat production and has had a vested interest in reinforcing its position in global agricultural commodity markets, historically dominated by the US and Russia. This aligns with broader strategies to rebuild regional resilience through institutional and state-led initiatives amid growing concerns over supply chain disruptions, overdependence on critical imports, financial market upheavals, and market fragmentation (Yeung, 2024). The European Commission (2021a) has stressed that the development of euro-denominated instruments and benchmarks, including in the commodities sector, is a relevant contributing factor to an enhanced international role of the euro, instrumental to strengthen EU's influence in the world; shield its economy from foreign exchange shocks; and reduce transaction, hedging, and financing costs for firms. From this perspective, we can see the significance of geopolitics and institutional factors shaping the wheat GPFN referencing historic legacies, politics, as well as supranational institutions (see generally Gertler, 2018).

Well-established financial theory also helps explain the link between the location of wheat price discovery and global export patterns: foreign trading locations may be disadvantaged by restricted access to high-quality information (Bacidore and Sofianos, 2002). At the same time, well-functioning markets offer efficient mechanisms for futures trading and central clearing that enhance the ability of market players to hedge inventories (Vuillemey, 2020). Proximity to wheat production and storage regions remains important. This also reflects a key feature of the wheat GPFN, which distinguishes it from other types of networks, especially manufacturing, namely, that the wheat GPFN is

largely influenced by supply-side factors, including resource availability, weather, and geopolitical considerations (which also justifies significant influence being exerted by resource-owning countries), unlike other networks where demand-side factors such as consumer preferences play a greater role.

Since 2000, as trading houses began holding more stocks, their warehousing functions became closely integrated with their trading activities (Murphy et al., 2012), and the need to hedge against price fluctuations through wheat futures heightened, creating the potential for new conflicts of interest (IOSCO, 2016) and strengthening the links with derivatives exchanges and CCPs. As trading activity and inventories in European, Russian, and Ukrainian wheat grew, dealers progressively favored the Paris market over Chicago due to reduced spatial and quality-related risks, and hence more effective hedging opportunities. Simultaneously, with supply shocks in the EU, Russia, and Ukraine becoming increasingly important, traders in the Paris market appear to have benefited from being *close-to-production* wherein they have accessed better and deeper market-sensitive information relevant to pricing (Clark et al., 2006; Janzen and Adjemian, 2017).

The establishment of the French wheat futures contract as a new global benchmark has been contested. While open interest grew in Paris, new trading locations and futures contracts have been created. Increased demand for hedging on European, Russian, and Ukraine wheat led the CME Group to launch EU, Black Sea, and Ukrainian wheat futures in 2016, 2017, and 2021 respectively, to attract liquidity away from Paris (Euronext also discussed Black Sea wheat futures in 2016). The Russian JSC Mercantile Exchange introduced grain futures in 2020 underpinned by the Russian National Clearing Center, with VTB Capital (one of the largest Russian banks and part of the VTB group controlling a large share of Russian wheat exports) as primary market maker. A new commodity

exchange is also opening in Egypt, which is expected to deal first in Russian wheat (Cyclope, 2023). Beyond the political aim of boosting regional resilience as mentioned earlier, the initiatives by Russia and Egypt (a major wheat importer) may reflect uneven access to price risk management and exposure to price instability (Staritz et al., 2018), which have significant distributional implications. While international traders can manage price risks through hedging and expand profit opportunities through financial activities in derivatives markets, local actors may lack access to such financial strategies and seek alternatives – especially in Russia, following the post-Ukraine war restrictions imposed on its banks.

The success of these initiatives has been generally limited, however: CME delisted EU wheat futures contracts in 2018, and trading volumes in the other instruments are negligible (if not null) based on data from Bloomberg and the Russian JSC Mercantile Exchange. There are two possible explanations consistent with the above line of reasoning. On the one hand, in line with Cuny (1993), traders may have considered Euronext wheat futures contracts as a sufficiently effective, and more liquid, viable alternative. On the other hand, there are limits to the reduction in uncertainty and transaction costs stemming from derivatives trading and central clearing in the face of significant geopolitical tensions such as those witnessed since 2022. While derivatives exchanges and CCPs provide risk-reduction facilities, uncertainty in the Knightian sense cannot be fully eliminated.

3.6 Heightened wheat price volatility

Beyond supporting risk management and efficient price formation in normal times, derivatives exchanges, CCPs, warehouses, and trading houses are also designed to

promote consistent responses to unanticipated stress episodes. This is achieved by establishing and controlling the rules of the game *ex ante* and boosting confidence in the market's ability to absorb shocks. CCPs and warehouses play a key role in ensuring contract enforcement – a particularly relevant function in crisis times, when incentives to breach contractual obligations increase. Recent developments in the global wheat market, however, suggest that predefined rules are not (or not always) sufficient to prevent market participants from taking uncoordinated self-interested actions, highlighting that the wheat GPFN may be exposed to uncertainties that cannot be eliminated and may threaten the integrity of the market.

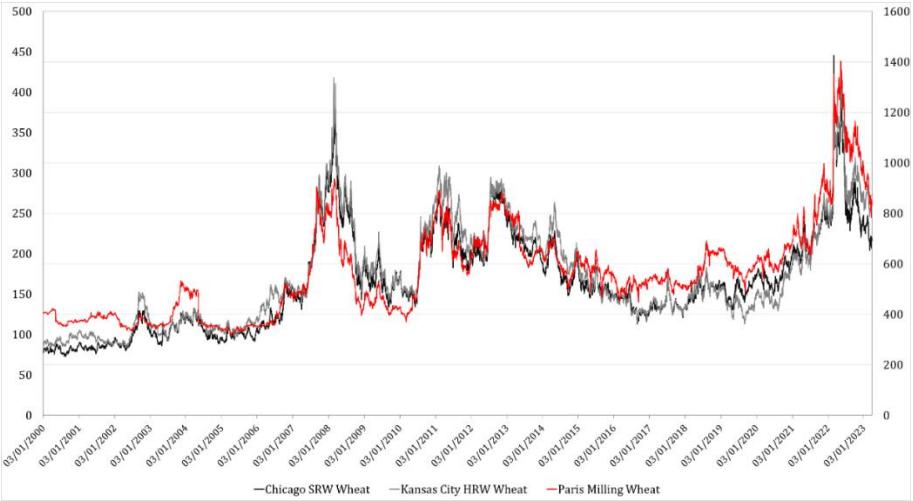
Between 2000 and the end of 2022 two major crises sent wheat prices and volatility soaring (see Figure 3.5). The first was an outcome of the so-called commodity supercycle, a period of prolonged high demand and rising prices for commodities, particularly from emerging economies like China (McGill, 2018), which culminated in 2008 (when the global financial crisis triggered a sharp decline in demand and a subsequent fall in commodity prices). In the first half of 2008, the prices of the Paris-based wheat futures contract, the Chicago SRW, and the Kansas City HRW reached a record high of 292.75 euro/metric ton, 1280 dollar/bushel, and 1337 dollar/bushel, respectively: between 2.3 and 3.5 times higher than their averages over the period 2000–2007. A global food crisis ensued, with protests spreading across Egypt, Bangladesh, and Mexico and other at-risk countries.

The second crisis period was precipitated by Russia's invasion of Ukraine, leading to severe disruptions in several commodity supply chains. Wheat was especially affected, most likely reflecting the inelasticity of its demand locally and globally. In the spring of 2022, wheat futures prices surpassed their 2008 peaks. Prices began to fall over the summer, mainly because of ample world supplies, which may have helped avoid a full-

scale food crisis, although food insecurity worsened in many regions (Hopewell and Margulis, 2023). By early 2023 prices had fallen significantly, although the slightest hint of disruption – such as the failed coup attempt against the Russian government in June 2023 – could recreate market turbulence.

Both the 2008 and the 2022 crises saw a decline in open interest, that is, the volume of outstanding contracts in global wheat derivatives exchanges (or a halt to growth in Paris), reflecting hedgers and other traders holding positions for shorter time horizons or exiting the market. It is a typical feature of financial markets that during moments of turmoil, when expectations are not met and traders increasingly acknowledge that they are operating under conditions of uncertainty, prices can become an unsuitable metric for establishing the fair value of an asset. In response, investors often move to short-term contracts, increasing turnover, or sit out market turmoil altogether (Clark and Monk, 2014).

Figure 3.5 *Price of selected wheat futures contracts, 2000-2022*

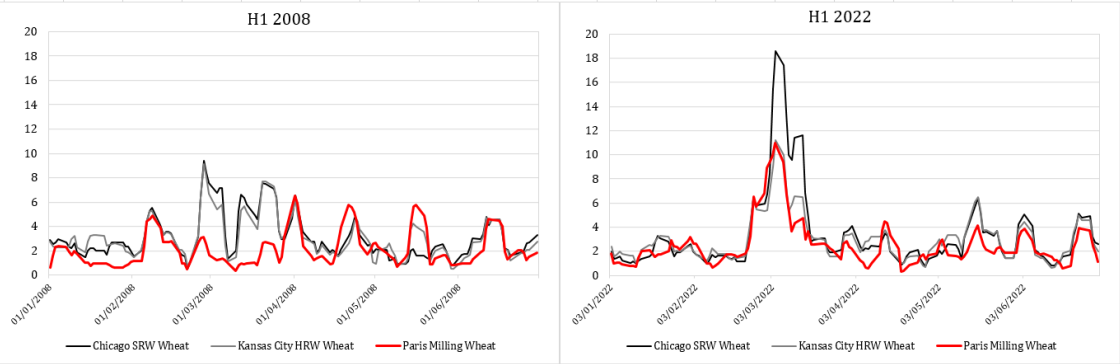


Notes: Prices for Chicago SRW and Kansas City HRW contracts are in US dollar/bushel, and are shown on the right-hand axis. The price of the Paris-based wheat futures contract is in euro/metric ton, and is shown on the left-hand axis. Contract size differs, being equal to five thousand bushels and fifty metric tons, respectively.

Data source: Bloomberg.

Additional insights into the two crisis episodes are revealed by examining price volatility (see Figure 3.6). On the one hand, price variability was generally higher in 2022 than in 2008. While this may be surprising considering the relatively narrow geographic scope of the events triggering the 2022 price boom and the abundance of alternatives to Ukrainian and Russian wheat, higher volatility may be explained by greater perceived uncertainty. This uncertainty likely related not only to the duration and consequences of the war, but also to the potential responses of governments and public authorities, including trade policy measures, sanctions, and efforts to safeguard domestic food supplies. On the other hand, Figure 3.6 shows that, during peak volatility, price swings in Paris were generally smaller than in Chicago and Kansas City. Alongside falling open interest in US wheat futures markets, this suggests a perception that existing derivatives offered less effective risk hedging in the US compared to Europe in 2022.

Figure 3.6 *Price volatility for selected wheat futures contracts: 2008 vs 2022*



Notes: Volatility is measured as the coefficient of variation in prices over a one-week period.

Data source: Own elaboration based on data from Bloomberg.

There are three key issues to consider when discussing the origins of the 2008 and 2022 events and their impacts on the wheat GPFN. First, aside from investment banks, the actors we focus on profited from both episodes, strengthening their positions in the network. Derivatives exchanges saw increased turnover, CCPs gained from higher margins, warehouses controlled increasingly valuable stocks, and trading houses leveraged superior market knowledge. While isolating income from wheat futures trading and clearing is difficult for exchanges and CCPs, Cargill's net profits rose from under $500 million in 2000 to $4 billion in 2008 (Blas and Farchy, 2021). The 2022–23 fiscal year was the most profitable year in its history, with record revenues of $177 billion (Cargill, 2023; Plume, 2023). These examples suggest that periods of heightened volatility and uncertainty can create significant profit opportunities for actors occupying strategic positions within the network. While this does not imply that such actors actively seek to generate disruptions, they are typically better equipped than others to benefit from the market conditions that disruptions create. Indeed, large price swings tend to increase the value of trading expertise, information advantages, storage capacity, and risk-management services, thereby reinforcing the competitive position of incumbent firms.

Second, closely related to value creation and distribution is the role of financialization and speculation, alleged to have been particularly relevant at least until 2008 (McGill, 2018). Deregulation in the early 2000s, notably the 2000 US Commodity Futures Modernization Act, reduced oversight of commodity markets and allowed greater participation by financial institutions and speculative investors who saw commodities as an attractive asset class due to their potential for high returns. Investment banks capitalized through trading, structuring complex financial products, and facilitating large-scale speculative investments, which amplified market volatility. All of this generated unreliable price signals, and therefore greater overall market uncertainty.

Third, both crises strained market liquidity. As the search for liquid assets intensified, spurred by higher margin calls from CCPs, the financing needs of trading houses increased dramatically (BCBS-CPMI-IOSCO, 2023; FSB, 2023). The problem varied between smaller players (most affected) and the giant trading houses (least affected), but its overall impact was to strengthen ties between the wheat GPN and GFN, with trading houses increasing their reliance on credit lines with commercial banks (BCBS-CPMI-IOSCO 2023; FSB, 2023). After the 2008 price boom, regulators flagged this dependence as a notable vulnerability. In 2014, the US government fined BNP Paribas (referred to as the king of commodity trade finance by Blas and Farchy (2021)) nearly $9 billion for processing, through various entities across the US, France, and Switzerland, billions of dollars of transactions on behalf of Sudan, Iranian, and Cuban entities subject to US economic sanctions (US Department of Justice, 2014). Thereafter, BNP Paribas ended its relationships with major global commodity trading firms, and trade finance in general became increasingly problematic, so that by 2022, although grains were excluded from sanctions, trading houses found it almost impossible to finance transactions involving Russian wheat (Payne and Nikolaeva, 2019; Cyclope, 2023).

This analysis yields two key insights. The first stems from the observation that, while damaging for most market participants, uncertainty has benefited the biggest players in the wheat GPFN. Derivatives exchanges, CCPs, trading houses, and warehouses provide essential infrastructure and, like other utilities, tend to experience increased demand during times of uncertainty. While their informational edge has narrowed during normal periods with the spread of real-time data technologies (Blas and Farchy, 2021), their business model increasingly relies on the unpredictability of crop failures and export restrictions. As climate and geopolitical crises grow more frequent, this reliance is likely to persist – especially given the nonergodic nature of such crises

(Visco, 2013; Bookstaber 2017), meaning past crises do not reliably predict future ones: context matters, and each crisis is different.

The second, related insight concerns the role of regulators in mitigating uncertainty or, at least, limiting the ability of certain actors to unduly benefit from it. The post- 2008 environment has been marked by a notable shift from deregulation to regulation, both in the US and EU. The 2010 Dodd-Frank Act and 2013 Volcker Rule in the US, as well as the 2012 European Market Infrastructure Regulation (EMIR) and 2014 Markets in Financial Instruments Directive and Regulation (MiFID II-MiFIR) in the EU sought to create a new infrastructural system for over-the-counter (OTC) derivatives, increase transparency, and reduce systemic risk, including by curbing excessive risk-taking by banks and requiring them to focus on their traditional business activities. From this perspective, the 2008 commodity price shock acted as a catalyst for states – the US in the lead – to demonstrate their capacity to reregulate derivatives markets, including OTC markets considered by some scholars to be beyond state reach (Clapp and Helleiner, 2012). More recently, global standard setters have renewed their focus on transparency, publishing best practice standards on storage and delivery infrastructures (IOSCO, 2019), and undertaking work on margin practices (BCBS-CPMI-IOSCO, 2023). In the EU, the EMIR framework was revised in December 2024. While the opacity surrounding commodity markets may decline, trading houses are still affected by regulation mostly indirectly, via strengthened requirements applicable to banks.

3.7 Conclusions

By combining the GPN and GFN approaches in economic geography and incorporating the notions of transaction costs, risk, and uncertainty, we examined the crucial, yet largely

understudied, global wheat market. We focused on wheat futures markets, which stand at the intersection of the wheat GPN and GFN and have shaped the trajectory of global wheat trade since the 1860s, concentrating on the core nodes of the combined wheat GPFN occupied by trading houses, warehouses, derivatives exchanges, CCPs, and investment banks.

Three major trends were identified as affecting the evolution of wheat futures markets since 2000. First, we analyzed vertical and horizontal integration, noting that trading houses have come to control entire value chains beyond food and agriculture, while globally active exchange groups offering multiple services, from trading to settlement, provide the financial infrastructure sustaining wheat futures trading. Second, we discussed the establishment of the Paris wheat futures contract as a global benchmark, linking it to France and the EU's efforts to assert their role in wheat futures trading, as well as to the benefits from being close-to-production, given the increasing importance of supply shocks affecting EU, Russian, and Ukrainian wheat. Finally, we assessed wheat futures markets' response to uncertainty comparing the 2008 commodity supercycle crash with the Russian invasion of Ukraine, suggesting that higher perceived uncertainty contributed to greater volatility during the latter. We highlighted the implications of these crisis periods for derivatives exchanges, CCPs, trading houses, and warehouses in terms of increased profitability, as well as policy makers' responses to mitigate uncertainty.

Throughout the article, we argued that these trends reflect efforts to reduce transaction costs and manage risk and uncertainty more effectively. The configuration and evolution of the combined wheat GPFN are the result of intentional strategies to achieve these aims even if shaped by historic legacies and politics. As such, our main contribution has been to show that the wheat GPFN by itself can be conceived as a means

of taming transaction costs, risk, and uncertainty. The same conceptual framework could be usefully employed to analyze the GPFNs for other commodities, goods, and services.

In terms of implications, we emphasized the strengthening of the links between key wheat GPFN nodes and the establishment of a monopoly or oligopoly viz market knowledge by derivatives exchanges and trading houses that has allowed them to remain profitable, and increasingly so, during crisis periods. The size, relevance, power, and political influence of the TNCs and FABS we have identified have expanded over time. The significance of financial centers has altered as a consequence. Paris's rise as a leading financial center for wheat futures trading illustrates how geographic nodes evolve in the process of taming transaction costs, risk, and uncertainty, while contradicting the expectation that the entrenched dominance of the Anglo-American financial system will persist or that the financial center of gravity will shift to China (Dalio, 2021). This demonstrates the importance of analyzing the geography of finance within specific sectors and products and considering combined GPFN forces.

Looking forward, there is no indication that the trends we discussed will abate. Further integration, particularly for what concerns the GFN toward realizing the EU's Savings and Investments Union, seems likely. As of the time of this writing, negotiations are underway for the accession of Ukraine into the EU. Ukraine's accession could further boost Paris's role, notwithstanding organic growth driven by infrastructure investments and proximity to major grain importers in North Africa. The main actors in the wheat GPFN are poised to continue benefiting from increasingly frequent climate and geopolitical shocks.

This highlights the importance of empirical tests for several key hypotheses that can be drawn from our analysis. First, to what extent has increasing integration led to a

reduction in transaction costs, and what are the subsequent impacts on market concentration? Specifically, how has this benefited the largest players in the wheat GPFN through increased profits while disadvantaging final consumers – a key issue given the centrality of wheat for food consumption? Second, how significant is Paris in terms of world wheat price discovery compared to Chicago, and how strong are the advantages of being close- to-production in an increasingly integrated financial network, where arbitrage across markets homogeneous products is easier? Finally, to what extent does uncertainty affect futures prices compared to other demand and supply factors?

From a conceptual point of view, while we have shed light on power asymmetries and patterns of wealth accumulation within the wheat GPFN (Seabrooke and Wigan, 2014; Bair et al., 2023), further investigating the role of smaller players on the periphery of the wheat GPFN – which we deliberately excluded from the scope of our analysis – would reveal more about uneven distributional outcomes also within, not just among, countries. Relatedly, the analysis leaves open a normative question as to the role of trading houses, warehouses, derivatives exchanges, CCPs, and investment banks from a distributive justice perspective. We observed that the territorial organization of wheat GPFN differs from other agricultural commodities networks – as countries like the US and France are simultaneously top wheat producers and exporters, home to key TNCs and FABS, and host major financial centers for wheat futures trading – giving rise to distinct distributional implications and justice concerns. While other GPFNs often involve issues related to value extraction from producing countries, the primary concern in the wheat GPFN is the very significant concentration of power within developed nations over a commodity crucial for food security.

Additional research is necessary not only as a contribution to economic geography but also to inform the ongoing debate about the proper regulatory framework for global commodity derivatives markets.

Chapter 4: Commodity markets in an uncertain world: Geopolitical uncertainty and wheat futures prices

(Paper written with Federico Puglisi)

Abstract

We investigate the effects of geopolitical uncertainty on wheat futures prices by means of a comprehensive array of time-series models, analyzing potential differences between the US and EU markets and measuring how the importance of shocks that are native of the geopolitical domain varies over time. The analysis is based on a novel dataset that compiles monthly data for all relevant real and financial variables spanning from 2000 to end-2022. Our findings corroborate the hypothesis that geopolitical uncertainty significantly affects market expectations about future wheat prices, although its relevance as a pricing factor varies considerably over time. The inspection of such time-variation suggests that geopolitical developments involving Russia and Ukraine have become an important driver of such dynamics on a global scale in parallel with the increase in the export shares of both countries.

4.1 Introduction

Geopolitical disruptions can have profound consequences for commodity markets as they affect not only production and trade, but also the expectations and risk assessments that underpin price formation. The Russian invasion of Ukraine provides a particularly salient

example. The conflict generated extensive disruptions in global commodity supply chains, due to capacity constraints and supply bottlenecks associated with the suspension of commercial shipping at Ukrainian ports and bans against imports from Russia, leading to an impressive increase in energy and food prices (Baffes and Nagle, 2022). The impact on wheat production and trade was particularly pronounced, as both Russia and Ukraine are key exporters (Izzeldin et al., 2023). The turmoil reverberated into wheat futures markets, where price levels and volatility reached their highest points since the bursting of the early 2000s commodity super-cycle (Erten and Ocampo, 2013).

The repercussions of these events extended across diverse domains, affecting food security, inflation dynamics, and financial markets across multiple regions, illustrating how geographically localized shocks can propagate through globally integrated commodity systems and underscoring the interlinkages and feedback loops between the physical and financial dimensions of commodity markets. Wheat futures markets played a central role in this process by incorporating changing expectations regarding future supply conditions, trade flows and market risks into prices. From this perspective, the connection between agricultural production and financial markets is less surprising than it may initially appear. Commodity futures markets emerged precisely to facilitate the management of risks associated with agricultural production and trade, and their functioning remains closely linked to developments in underlying physical markets. Nevertheless, growing financial participation in commodity derivatives markets over recent decades has raised concerns that agricultural prices may increasingly respond to macroeconomic and financial forces in addition to traditional supply and demand fundamentals (Chen et al., 2010; Gilbert, 2010; Cheng and Xiong, 2014; Goldstein and Yang, 2022).

Geopolitical uncertainty represents a particularly relevant but still insufficiently understood source of such influences. By affecting expectations about future production, trade and policy responses, geopolitical developments may shape agricultural futures prices even before their consequences materialize in physical markets. Research connecting geopolitical risk and asset pricing has expanded considerably in recent years (Cheng et al., 2023), in parallel with efforts by authorities and other public bodies to better assess the implications of geopolitical risk for commodity markets (International Monetary Fund, 2023). Although many studies have focused on stock markets (Choudhry, 2010; Chesney et al., 2011; Lo et al., 2022; Niu et al., 2023), a growing body of research has also addressed commodity markets. Oil and precious metals have received the greatest attention (Das et al., 2019; Baur and Smales, 2020; Mei et al., 2020), but research on agricultural commodities, as well as on the linkages between energy and agricultural markets, is advancing rapidly (Tiwari et al., 2021; Aizenman et al., 2023; Bossman et al., 2023).

While previous studies have examined the effects of geopolitical risk on commodity markets as an aggregate asset class or in relation to specific events, systematic evidence on the role of geopolitical uncertainty in agricultural futures markets remains limited. We address this gap by providing a comprehensive analysis of wheat futures markets over the period 2000–2022, encompassing multiple episodes of geopolitical tension and major structural changes in global grain trade. To the best of our knowledge, we are the first to document and extensively analyze the impacts of geopolitical uncertainty on agricultural futures prices over such a long time horizon, examining how these effects vary across marketplaces and over time. In doing so, we contribute to the aforementioned strands of literature, as well as to the flourishing literature on the impact of news on financial

markets and the cross-border propagation of market impulses (Berger et al., 2020; Aizenman et al., 2023; Hao et al., 2023; Hassan et al., 2024).

We focus on the most liquid core of wheat futures trading, which revolves around two marketplaces, Chicago and Paris. Historically, Chicago has been the leading financial center for wheat futures trading, being home to the Chicago Board of Trade (CBOT) since 1848. After merging with the Chicago Mercantile Exchange (CME) in 2007, the CBOT became part of the CME Group and continues to operate as a major regulated derivatives exchange, notably for Chicago soft red winter (SRW) and Kansas City hard red winter (HRW) wheat futures. Paris has emerged as a second major center, especially after the surge of the EU as a wheat exporter worldwide, witnessing the growth of Euronext MATIF (*Marché à Terme International de France*), which progressively established itself as the leading exchange for agricultural commodities in continental Europe and, in the process, attracted an increasing share of European wheat futures trading away from other established centers such as London. In 2022, trading volumes in wheat futures reached 32.3 million contracts in Chicago and 14.3 million in Paris (Cyclope, 2023). Wheat futures are also traded in London (UK),[9] Minneapolis (US),

[9] As suggested above, available data point to a sustained shift in trading activity from London to Paris. In 2000, daily traded volumes in Paris were, on average, 4 times higher than in London; by 2022, they were 5445 times higher. Although Brexit may have accelerated this process, the underlying shift towards the concentration of wheat futures trading in Paris was already clearly underway well before the UK's withdrawal from the EU and appears to reflect a longer-term process of market centralization. The expansion of the French market, largely outpacing the UK, began around 2007-2008 and accelerated from 2010, when wheat supply shocks in Russia and Ukraine prompted investors to turn to the MATIF (Paris) wheat futures market for better hedging effectiveness. The reasons for Paris' success over London can likely be attributed to several

Buenos Aires (Argentina), Sydney (Australia), Zhengzhou (China) and Johannesburg (South Africa), but their cumulative trading volumes are several orders of magnitude lower, as Chicago and Paris account for a combined market share higher than 90%.

We construct a novel dataset compiling monthly observations from 2000 to end-2022 on prices, trading volumes and open interest for the main wheat futures contracts traded in Chicago and Paris, alongside the various determinants of futures prices offered by the literature, an indicator of financial stress, and two indices of uncertainty relating to geopolitical events and economic policy. Using this dataset, we estimate a set of multivariate dynamic regression models to investigate the effects of geopolitical uncertainty on wheat futures prices across contracts and markets. Our baseline analysis focuses on both the contemporaneous and lagged impact of geopolitical uncertainty. For each of the three futures contracts considered, we estimate a sequence of single-equation regressions in which the dependent variable is measured contemporaneously and from 1 to 7 months ahead relative to the explanatory variables.

To isolate the effect of geopolitical uncertainty, we augment the regression specification with a comprehensive set of controls, including economic policy uncertainty (Baker et al., 2016), a financial systemic risk indicator (Chavleishvili and Kremer, 2023), wheat production variables, prices of other commodities, spot prices, exchange rates and

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factors, including the significance of France as a wheat producer (ranking 5th worldwide during the period under study, according to FAOSTAT data), political and historical legacies (historically, French banks have been closely involved in commodities trading), and eventually a preference for having liquidity concentrated in one place (Cuny, 1993). Given our interest in the European market, we still consider the London wheat futures contract traded on ICE Futures Europe for the purpose of our robustness checks; see Appendix – Section E.

contract-specific financial variables such as open interest and trading volume. This allows us to minimize potential omitted variable bias and identify the effects of changes in geopolitical uncertainty that are exogenous to broader economic developments. We then test whether the US market anticipates developments more effectively than the EU market by examining futures price reactions to exogenous changes in geopolitical uncertainty affecting major wheat exporters other than the US and the EU (namely Argentina, Canada, Australia, Russia and Ukraine). Finally, we quantify the contribution of shocks that are native of the geopolitical domain and inspect the historical periods where these shocks were relatively more important than others in explaining wheat futures price movements, respectively by means of a forecast error variance decomposition and a historical decomposition analysis based on a Factor-Augmented Vector Autoregressive (FAVAR) model. The model includes the geopolitical uncertainty index, the prices of the three futures contracts considered, and the first five principal components extracted from the full set of control variables. Identification relies on a recursive ordering in which geopolitical uncertainty is placed first, allowing us to identify exogenous shocks originating in the geopolitical domain.

Our results show that geopolitical uncertainty exerts a positive, statistically significant and persistent effect on all wheat futures prices considered. For every contract, we can reject the null hypothesis that geopolitical uncertainty has no contemporaneous effect on wheat futures prices at the 1% confidence level. The effect remains statistically significant over subsequent months, at either the 5% or 1% confidence level. Impulse response functions indicate a hump-shaped response, with prices continuing to rise after the initial shock, peaking after two or three months, and dissipating after four to five months. The forecast error variance decomposition further shows that exogenous shocks to geopolitical uncertainty account for a meaningful share of wheat futures price

variability, ranging from 6% to 16% depending on the market and forecast horizon. Through the historical decomposition analysis, we are able to pin point four periods during which geopolitical developments played a particularly important role in driving wheat futures price dynamics compared to other shocks: 2004-2005, 2009-2011, 2016 and 2022. Notably, the latter three periods coincide with major geopolitical developments involving Russia and Ukraine. We find no evidence of systematic differences in market efficiency between the US and the EU.

Overall, our findings demonstrate that geopolitical developments have significant ramifications for wheat futures markets. Geopolitical uncertainty emerges as a quantitatively important and statistically significant determinant of wheat futures prices. Increases in geopolitical uncertainty positively affects market expectations of future prices, suggesting that market participants cannot fully hedge against geopolitical developments as they unravel. At the same time, the influence of geopolitical shocks is not constant: not all geopolitical developments affect wheat futures prices, nor do they do so with the same intensity. The Russian invasion of Ukraine stands out as the single most significant event driving a rise in both geopolitical uncertainty and wheat futures prices since 2000. More broadly, our analysis suggests that geopolitical tensions involving Russia and Ukraine influenced global wheat markets on a global scale well before the 2022 invasion. By contrast, other major geopolitical events, such as the 9/11, appear to have had little discernible impact on wheat futures prices.

The remainder of the paper is organized as follows. Section 4.2 discusses related literature, especially providing further insight into the concept and measurement of geopolitical uncertainty. Section 4.3 sets out relevant information on the structure of wheat futures markets, having regard both to the Chicago and to the Paris market. Section 4.4 describes the econometric methodology. Section 4.5 presents the data. Section 4.6

discusses the empirical results. Section 4.7 concludes outlining potential policy implications.

4.2 Related literature

The distinction between risk and uncertainty has been central to economics since Knight (1921). Whereas risk refers to situations in which possible outcomes and their probabilities are known, enabling measurement and hedging, uncertainty arises when probabilities cannot be meaningfully assigned because of novel events or unpredictable behavioral responses. Not surprisingly, there are no consensual and objective methodologies for measuring uncertainty, but rather proxies (Jurado et al., 2015; Ozturk and Sheng, 2018). In practice, drawing a line between risk and uncertainty is not always straightforward, leading the empirical literature in economics to somewhat blur the distinction between the two concepts (Carney, 2016). This becomes evident in the literature on geopolitical uncertainty (or risk).

For our empirical analysis, we employ the index developed by Caldara and Iacoviello (2022) as a proxy for geopolitical uncertainty. The index is constructed by applying a text-analysis algorithm to leading newspapers in the US, UK and Canada, measuring the share of articles referring to adverse geopolitical events. Specifically, Caldara and Iacoviello define geopolitical risk as the "*threat, realization, and escalation of adverse events associated with wars, terrorism, and any tensions among states and political actors that affect the peaceful course of international relations*" (Caldara and Iacoviello, 2022, 1197). They show that increases in the index are associated with a higher probability of economic disasters and declines in investment, employment and stock prices. Since its introduction, the index has been widely adopted in empirical

research, including Zhang et al. (2023), which documents a significant positive relationship between geopolitical risk and stock market volatility across 32 countries and regions.

While resolving the conceptual distinction between risk and uncertainty exceeds the scope of this paper, we nevertheless prefer the term geopolitical uncertainty. Caldara and Iacoviello themselves acknowledge a slight abuse of the term "risk" in their work, justified by journalistic convention and measurement considerations, noting that their measure captures "*a wide range of adverse geopolitical events, from their threat, to their realization, to their escalation*" (2022, 1197). Indeed, the usage of "risk" in this context, as well as in numerous other existing studies, seems to align with the approach – diffused in industry practice (Hassan et al., 2024) and even adopted by policymakers (Reisinger et al., 2020) – according to which "risk" signifies the potential for negative outcomes (see also Kahneman and Tversky, 1979), while "uncertainty" carries a more neutral connotation. Here we adhere more closely to the work by Lo and Mueller (2010), which uses the term uncertainty to denote a lack of quantifiable knowledge about potential occurrences. At least two elements make it difficult to establish well-defined probability-outcome associations when dealing with geopolitical events: first, ambiguity arising from limitations in the reliability or adequacy of probability information (Ellsberg, 1961; Camerer and Weber, 1992); second, complexity related the multiplicity of potential causes or outcomes.[10] Accordingly, we refer throughout the rest of the paper to geopolitical uncertainty and denote the Caldara and Iacoviello index by GPU.

[10] It is no surprise that Lo and Mueller used the following example to clarify the difference between risk and uncertainty: "*An example of the former is the odds of winning at the roulette table, and an example of the latter is the likelihood of peace in the Middle East*" (2010, 23).

A large literature documents the effects of geopolitical events on financial markets, particularly equities. Studies have shown that wars, terrorism, military escalation and politically disruptive events generate structural breaks in returns, increase volatility and affect asset prices through changes in investors' expectations (Choudhry, 2010; Chesney et al., 2011; Lo et al., 2022; Niu et al., 2023; Hassan et al., 2024). Together, these findings suggest that financial markets rapidly incorporate geopolitical information into prices. Likewise, research on commodity markets has expanded rapidly, particularly following the Russian invasion of Ukraine. While early work focused primarily on oil and precious metals (Das et al., 2019; Baur and Smales, 2020; Mei et al., 2020), more recent studies have examined agricultural commodities. Existing evidence suggests that geopolitical developments affect both commodity price dynamics and cross-market linkages (Tiwari et al., 2021; Bossman et al., 2023; Cheng et al., 2023). Studies focusing on the Russia–Ukraine conflict further show that wheat has been among the commodities most affected, exhibiting pronounced increases in volatility and prices (Cui and Maghyereh, 2023; Izzeldin et al., 2023; Aizenman et al., 2023).

However, isolating the effect of geopolitical uncertainty requires accounting for the many other factors known to influence wheat futures prices. Agricultural futures prices primarily reflect expected supply and demand conditions, with weather-related shocks representing a key source of variation in growing conditions (Hennessy and Wahl, 1996; Fleming et al., 2006). Relatedly, especially for grains, seasonality plays an important role (Sørensen, 2002; Arismendi et al., 2016): a substantial amount of information regarding the supply of wheat and its substitutes enters the market during the harvest season (Anderson, 1985), while seasonal fluctuations in production and demand may generate corresponding fluctuations in inventories (Fama and French, 1987; Gorton et al., 2013). In a seminal paper, Samuelson (1965) proposed the so-called “maturity effect”, according

to which futures price volatility decreases with time to maturity, although subsequent empirical research has found little evidence in support of this claim (Daal et al., 2006). Exchange rates may also possess predictive power insofar as they incorporate expectations regarding future commodity export prices (Chen et al., 2010). Lastly, similar to other financial markets, price formation is influenced by market structure and trading behavior, including the degree of market concentration and the balance between hedging and speculative activity (Goodwin and Schnepf, 2000; Asness et al., 2013).

Besides these market-specific determinants, broader macroeconomic uncertainty stemming from changes in monetary policy, fiscal policy, and trade policy may also affect agricultural futures prices. We control for economic policy uncertainty (EPU) using the newspaper-based index developed by Baker et al. (2016)[11]. The index has been widely used in studies of both financial and commodity markets, where higher policy uncertainty is consistently associated with increases in market turbulence (Antonakakis et al., 2013; Pastor and Veronesi, 2013; Arouri et al., 2016; Kelly et al., 2016; Bakas and Triantafyllou, 2018; Bossman et al., 2023). Importantly, while economic policy uncertainty is likely to affect the *ex ante* variability of futures prices, interventions by regulators to dampen volatility and/or provide reassurance to markets are themselves important signals that affect the pathway of prices and the propagation of shocks (Kelly et al., 2016). In this respect, Bloom (2009) noted a trade-off between policy "correctness" and "decisiveness", suggesting that it may be better to act decisively (but occasionally incorrectly) than to deliberate on policy, generating policy-induced uncertainty. The EPU index is expected to capture this form of uncertainty as well.

[11] The robustness of the index was tested against other measures, such as the market-based VIX measure of uncertainty in equity returns, which is firmly grounded in option pricing theory.

The use of newspaper-based indicators also creates a link between our analysis and the literature on information diffusion and market efficiency (Fama, 1970). In particular, our paper connects to the flourishing body of research that looks at the impact of news on financial markets and the cross-border propagation of market impulses, typically by means of information diffusion models and event studies (Beaudry and Portier, 2006; Berger et al., 2020; Aizenman et al., 2023; Hao et al., 2023; Hassan et al., 2024). This line of research builds on the premise that news concerning future states of the world influences the current behavior of market participants by altering their expectations, and is gaining special significance given the growing interconnectedness of financial markets and advancements in technology allowing the use of real-time information. Although our monthly data do not allow us to study the intraday incorporation of news into prices, they enable us to examine how geopolitical information is reflected in wheat futures over longer horizons in a globally important but comparatively underexplored market. Unlike other financial markets, the wheat futures market does not operate continuously around the clock and across the globe, with liquidity primarily concentrated in two trading places. However, its cross-border relevance has increased since 2000 and can be expected to further increase in the coming years.

Against this background, this paper contributes to several strands of the literature concerned with the impacts of geopolitical developments on agricultural markets as it compares the responses of similar contracts traded across different markets to the same shocks and covers a long time span and a broad range of geopolitical events. This differs from much of the existing literature, which typically considers commodities as a homogeneous asset class and/or focuses on individual events, and allows us to detect how the impacts of geopolitical events vary across markets (and thus across regions) as well as, importantly, over time.

4.3 Wheat futures markets: institutional details

Wheat stands among the top cereal grains produced and consumed globally and has been central to human food consumption for centuries, with cultivated areas steadily expanding over time (Curtis, 2002). Based on data from the US Department of Agriculture (USDA), over the past two decades the major wheat exporters worldwide, including the US, the EU, Canada, Russia and Australia, have collectively contributed to over 60% of global wheat exports. Notably, the historical dominance of the global wheat market by the US has seen a decline in both relative and absolute terms in recent years (from a share of 27% of total global exports in 2000/2001 to 9% in 2022/2023), in parallel with the increase in exports from the EU, Russia and Ukraine (from 15% to 39% over the same period, collectively).

Recognizing the close link between export regions and futures trading, it is not surprising that Chicago and Paris have emerged as the leading centers for wheat futures trading. The Chicago Board of Trade (CBOT), established in 1848 as a central grain exchange, introduced wheat forward contracts in the 1850s and standardized futures in the 1860s. France also has a longstanding tradition in commodities trading, although the MATIF has a more recent history. Founded in 1986 with the support of the French government and regulated in 1987, it became France's principal agricultural futures exchange.

Both exchanges followed similar ownership trajectories. Originally member-owned, they demutualized and became publicly traded companies, now part of internationally active groups, enabling access to capital markets and international expansion. Demutualization of the CBOT commenced in the early 2000s and culminated with its IPO in October 2005. The CBOT merged with the Chicago Mercantile Exchange

(CME) in 2007 and was joined by the Kansas City Board of Trade (KCBT) in 2012, uniting the KCBT suite of HRW wheat products with CBOT SRW wheat products. MATIF became part of Euronext in 2000 through the consolidation of some major European exchanges.

Over the decades, both exchanges diversified beyond agricultural futures. The CBOT expanded into financial futures and commodity options in the 1970s and '80s and much more recently, between 2013 and 2022, launched a wide suite of wheat derivatives contracts having Black Sea, Australian, Ukrainian and Canadian wheat as underlying. Similarly, the MATIF specialized in agricultural commodities such as wheat, corn, and rapeseed before its merger with the Paris Bourse and the creation of Euronext Paris, where a wider franchise of financial instruments is traded. This strategic diversification enabled the exchanges to cater to a broader range of market participants.

As of today, both the CBOT and MATIF offer trading opportunities in a wide list of products, although trading is primarily concentrated in three main wheat futures contracts: Chicago SRW and Kansas City HRW wheat futures at CBOT, Milling wheat No. 2 futures (also known as European wheat) at MATIF. These contracts are considered benchmarks for the underlying physical markets in the US and the EU, each meeting specific minimum requirements, and reflect different wheat classes with distinct origins, protein content and applications. SRW wheat is mainly grown east of the Mississippi River, has relatively low protein content, and is commonly used for specialty products (USW, 2023). HRW wheat is the most widely grown class in the US (with a growing area spanning across the Great Plains, Pacific Northwest and California), has medium to high protein, and is known to be a versatile wheat (ibid.). Finally, the MATIF contract covers milling wheat from EU origins, which tends to have lower gluten levels (with its prominent white wheat – rather than red wheat – variety) and is mostly used in flours and

breads. Crop calendars are aligned, with planting between September and November and harvest in June or July. Table 4.1 provides additional insight into the characteristics of these three contracts.

Table 4.1 *A comparison between the most liquid CBOT and MATIF wheat futures contracts*

	Chicago SRW wheat futures	**Kansas City HRW wheat futures**	**Milling wheat No. 2 futures**
Trading venue	CBOT	CBOT	MATIF/Euronext Paris
Central counterparty	CME Clear	CME Clear	LCH SA (until 2024); Euronext Clearing (since 2024)
Contract unit	5,000 bushels	5,000 bushels	50 tons
Currency of denomination	USD	USD	EUR
Wheat origin	United States	United States	European Union
Trading hours	Sunday-Friday: 7PM – 7:45AM CT Monday-Friday: 8:30AM – 1:20PM CT[1]	Sunday-Friday: 7PM – 7:45AM CT Monday-Friday: 8:30AM – 1:20PM CT[1]	10:45AM – 6:30 PM CET
Trading platform	CME Globex	CME Globex	Optiq
Listed contracts	15 monthly contracts of Mar, May, Jul, Sep, Dec listed annually following the termination of trading in the Jul contract of the current year.	Monthly contracts (Mar, May, Jul, Sep, Dec) listed for 15 months.	Sep, Dec, Mar, May such that 12 delivery months are available for trading.
Settlement method	Deliverable	Deliverable	Deliverable
Termination of trading	Business day prior to the 15° calendar day of the contract month.	Business day prior to the 15° calendar day of the contract month.	18:30 on the 10° calendar day of the delivery month (if not a business day, then the following business day).
Grade and quality	No. 2 SRW at contract price, No. 1 SRW at a 3 cent premium.	No. 2 SRW at contract price with a maximum of 10 IDK per 100 grams; No. 1 HRW at a 11/2-cent premium.	Sound, fair and merchantable quality of: - the following minimum specifications:

	Shipping certificates marked as 2 parts per million vomitoxin at contract price, 3 parts per million vomitoxin at a 20 cent per bushel discount. Wheat which contains moisture in excess of 13.5% is not deliverable.	Deliverable grades of HRW shall contain a minim 11% protein level. However, protein levels of less than 11%, but equal to or greater than 10.5%, are deliverable at a 10 cent discount. Protein levels of less than 10.5% are not deliverable. Shipping certificates marked as 2 parts per million vomitoxin at contract price, 3 parts per million vomitoxin at a 20 cent per bushel discount. Wheat which contains moisture in excess of 13.5% is not deliverable.	Hagberg falling number: 220 seconds Protein content: 11% dry matter Specific weight: 76 kg/hl and - the following basis specifications: Moisture content: 15% Broken grains: 4% Impurities: 2% Discounts apply to reflect any difference between the delivered and standard quality. Mycotoxins not to exceed, at the time of delivery, the maximum levels specified under EU legislation in force with respect to unprocessed cereals intended for use in food products.

[1] Trading on CME Globex. The same contracts are also available through the platform CME ClearPort for off-exchange cleared transactions with the following trading hours: Sunday 5:00 p.m. - Friday 5:45 p.m. CT, with a daily maintenance break Monday - Thursday from 5:45 p.m. - 6:00 p.m. CT.

Regarding market microstructure, both exchanges employ fully electronic, order-driven trading platforms using central limit order books: CME Globex for CBOT and Optiq for MATIF. Electronic trading significantly increased trading volumes and market accessibility. At the CBOT, electronic trading was introduced in 1987 – coinciding with the establishment of MATIF – and surpassed open-outcry trading by 2006 (Martinez et al., 2011). The remaining trading pits closed in 2015, by which time open outcry accounted for less than 1% of grain futures volume (CME Group, 2015).

Lastly, wheat futures trading at both exchanges is subject to price controls, position limits and delivery limits. At the CBOT, price controls take the form of daily hard price limits which cap the maximum price movement from the prior day's settlement. They are reset twice a year for the first trade dates in May and November, looking at the average

settlement prices over a 45-day period. MATIF instead uses circuit breakers based on price collars, which temporarily restrict the execution of orders exceeding predefined price or volume thresholds. Position limits cap the size of net derivative positions, while delivery limits restrict the number of shipping certificates or warehouse receipts that a participant may hold. These limits are reviewed and published regularly by the exchanges.

4.4 Methodology

To investigate the effects of geopolitical uncertainty on wheat futures prices, we employ a large array of time-series models. We first start by estimating the contemporaneous and 1-month ahead effects of geopolitical uncertainty through the following linear regression model:

$$P_{m,t}^{h} = \alpha + \beta_1^h\, GPU_t + \beta_2^h EPU_t + \beta_3^h CISS_{EA,US,t} + \gamma_1^h X_t^D + \gamma_2^h X_t^S + \gamma_3^h X_t^F + \sum_{s=1}^{11} \gamma_{4,s}^h D_{s,t} + \delta_0^h\, S_{m,t} + \sum_{l=1}^{L} \rho_l^h\, P_{m,t-l} + \sum_{l=1}^{L} \rho_l^h\, P_{-m,t-l} + \varepsilon_{m,t}^h \quad (1)$$

In the regression equation *t* indexes time, *m* indexes markets (we distinguish between Paris, Chicago and Kansas City, even though Kansas City wheat futures have been traded on the same marketplace as Chicago contracts starting from 2012) and *h* is

either 0 or 1 depending on whether the price is contemporaneous or 1-month ahead.[12] $P_{m,t}^{h}$ is our main dependent variable, namely the price of the nearest expiry future contract retrieved from Bloomberg for the three products (Chicago SRW wheat futures, Kansas City HRW wheat futures, Milling wheat No. 2 futures).

Geopolitical uncertainty (GPU) is our main regressor of interest. We proxy it using the index developed by Caldara and Iacoviello (2022), which measures geopolitical tensions as perceived by market participants calculating the monthly share of articles related to adverse geopolitical events in ten leading international newspapers from the US, the UK, and Canada. The index is constructed using a dictionary-based method that identifies news coverage of geopolitical threats and acts through a carefully defined set of keywords and synonyms derived from the authors' definition of geopolitical risk. A potential limitation is that the underlying news sources are exclusively English-language newspapers and may therefore not fully reflect the perspectives of media outlets from non-English speaking countries. However, while the sample does not include newspapers from major European wheat-producing countries such as France, the selection of internationally prominent newspapers is intended to capture geopolitical events with global significance and repercussions. Indeed, the index is specifically designed to identify coverage of developments such as war and peace threats, military build-ups, nuclear threats, terrorist threats, and the outbreak or escalation of armed conflicts. Events of this nature, particularly those with the potential to affect global commodity markets, can reasonably be expected to receive coverage in major international media regardless

[12] This is because prices might indeed react to a rise in geopolitical uncertainty with a lag depending on market structure, availability of alternative sources of provision or information frictions.

of where they originate. By contrast, more localized developments, such as domestic political disputes or sector-specific protests, are less likely to be captured by the index by construction, rather than as a consequence of the exclusion of European newspapers. While the inclusion of additional European news sources could enhance the measurement of region-specific developments, it is less clear that it would materially alter the identification of major geopolitical shocks. Accordingly, notwithstanding this limitation, we consider the index to be an appropriate proxy for the phenomenon of interest.

Turning to the other regressors, EPU is the index of economic policy uncertainty developed in Baker et al. (2016). $CISS$ is the composite indicator of systemic financial stress recently developed by Chavleishvili and Kremer (2023), measuring the degree of interconnectedness of various aggregate market segments (money, bond, equity and foreign exchange markets) and how this contributes to the level of systemic stress in the financial system as a whole. The inclusion of a financial stress variable in our model acquires special significance against the backdrop of financialization of commodity markets and high integration across the global market (Gilbert, 2010; Cheng and Xiong, 2014; Büyükşahin and Robe, 2014; Goldstein and Yang, 2022); in fact, financial sector variables are gaining more and more significance in the literature on commodity markets (Bossman et al., 2023). X_t^D, X_t^S and X_t^F are three vectors of relevant variables, as suggested by past literature, capturing respectively demand, supply and financial market factors, either specific to the wheat commodity market or concerning other relevant commodity markets. As concerns supply variables, we primarily consider data on world wheat production and the Vegetation Health Index (VHI) to account for crop growth conditions. As to demand variables, we include spot and futures prices for crude oil, gold

and corn.[13] These variables should capture any variation in specific demand for cereals (grain) and variation in demand due more generally to the business cycle (oil and gold). To avoid losing too many degrees of freedom in the time-series analysis, we do not directly introduce the prices of these three commodities in the specification. As these prices' correlation is relatively high across time, we, instead, extract the first two principal components from these time series, which provide us with two general factors summarizing most of the variation across time of all the underlying price time-series.[14] Examples of financial market variables are exchange rates, stock market indices and relative volatility indices, risk free rates for the US and the Euro Area respectively in the form of the US and German 1-Year treasury yield, as well as volume of trades and open interest for the futures contracts considered. Monthly fixed effects are introduced through the term $\sum_{s=1}^{11} \gamma_{4,s} D_{s,t}$ to account for time-to-maturity and other seasonal components (Anderson, 1985; Fama and French, 1987; Gorton et al., 2013). $S_{m,t}$ is the wheat spot price corresponding to the specific market of the dependent variable and $\sum_{l=1}^{L} \rho_l P_{m,t-l}$ are the lags of the dependent variable. To control for possible spillovers from one of the wheat markets considered to the others, we also include lags of the wheat futures prices of the other markets, $\sum_{l=1}^{L} \rho_l P_{-m,t-l}$. Finally, $\varepsilon_{m,t}$ is the regression residual. For the independent variables, the indices are available at either global or jurisdiction level, as relevant.

[13] On the relationship between agricultural commodities and oil, see Tiwari et al. (2021). Gold is largely considered a safe haven and a hedging instrument against other asset price fluctuations. Finally, corn is a substitute for wheat, especially for animal feed and ethanol production.

[14] The results of the principal component analysis are contained in the Appendix – Section C.

The regression equation is estimated using the Ordinary Least Squares (OLS) method. Our primary focus centers on the estimation of the β_1 coefficient of GPU.[15] Within the regression equation with dependent variable $P^0_{m,t}$, β_1 quantifies the strength of the immediate impact of GPU on wheat futures prices. Within the regression equation with dependent variable $P^1_{m,t}$, β_1 quantifies the strength of the impact of GPU on wheat futures prices one month after the GPU index has changed. The first regression enables us to assess the strength of the contemporaneous relationship between wheat futures prices and GPU while controlling for any potential confounding factors. The second set of regressions allows us to quantify any possible predictive power of GPU above and beyond controls in predicting movements in wheat futures prices. All variables are in level. One possible concern might be the presence of a trend in the dependent variables, giving rise to spurious regression concerns. We specifically address this concern through the inclusion of the corresponding spot price for each of the wheat futures markets considered, acknowledging that, according to future-spot price parity, the two prices should be co-integrated.[16]

[15] Given our geopolitical focus, our specification is tailored to identify exogenous variations in geopolitical uncertainty. This is not necessarily the case for the other variables included as controls. Most notably, while we saturated our regression specification in order to control for virtually all potential sources of omitted variable bias in the estimated coefficient of GPU, we believe that the absence of additional controls relating, for instance, to fiscal policy and trade policy prevents a meaningful interpretation of the coefficient of EPU as an indicator of economic policy uncertainty *per se.*

[16] Alternatively, one could consider taking the difference between the futures price and the spot price, which should in turn be stationary. However, this would amount to a regression

In the second part of the analysis, we aim to provide a comprehensive assessment of the dynamic properties of the effects of GPU on wheat futures prices by re-estimating the aforementioned regression specification with h varying between 0 and 7 months. Although the dependent variable is defined as the price of the nearest-expiry contract and therefore refers to a sequence of contracts over time, this does not imply that the analysis follows unrelated instruments. Rather, futures prices continuously incorporate market participants' expectations regarding future market conditions, with these expectations being progressively reflected in the nearest-expiry contract as contracts approach maturity and market positions are rolled forward. The analysis thus captures how the effects of geopolitical shocks persist as they are incorporated into the benchmark contract traded at each horizon (which remains unchanged in terms of its underlying characteristics). We collect the estimated β_1^h coefficients for each different horizon h and market m into a vector, which we then plot together with 0.2, 0.10 and 0.05 confidence levels. These plots allow us to investigate the average magnitude, month of peak and length of the effect of an exogenous change in GPU for each of the wheat futures prices considered, along with the horizon at which the effect dies out. The underlying identification assumption we make in order to interpret these relationships as causal is that the vast array of controls saturating the regression equation contain all the other potentially competing exogenous shocks, such as shocks to demand for and supply of wheat or other relevant commodities, economic policy shocks, or shocks arising from the financial sector.

The GPU index is a broad measure of global geopolitical uncertainty. However, because it is constructed from articles published in major newspapers headquartered in

specification where the coefficient of the wheat spot price is restricted to be 1, which is far more restrictive than our regression specification.

North America and Europe, one concern could be that it places disproportionate weight on geopolitical developments affecting these regions relative to the rest of the world. Consistent with this concern, the global GPU index is highly correlated with the US-specific GPU index. To address this potential bias, we construct an indicator of geopolitical uncertainty for countries that are major wheat exporters but do not host the trading infrastructures of the futures markets we analyze (thereby excluding the US and the EU). To do so, we extract the first principal component of the country-specific GPU indices[17] for the following countries: Argentina, Canada, Australia, Russia and Ukraine. We hence re-estimate the regression equation above for h varying between 0 and 7 months with the only difference that we use the newly constructed GPU index of "external countries" in place of the more general GPU index.[18]

In this third step of the analysis, we test for the presence of anticipation in the responsiveness of the US markets with respect to the EU market by comparing the dynamic beta plots of the three markets to an exogenous change in geopolitical uncertainty for countries other than the US or the EU. For this task, it is indeed crucial to exclude the US and EU countries from the index used as a regressor, due to the fact that markets typically do have an advantage in incorporating the effects of shocks happening near where they are geographically located, and as we argued above, the

[17] Caldara and Iacoviello provide country-specific indicators where news is sorted depending on the country to which it refers.

[18] To ensure that regression coefficients are comparable to the baseline results, the principal components extracted here are rescaled to match the sample variance and mean of the global GPU index.

general GPU index is abnormally correlated to the US-specific GPU.[19] The inference in the contemporaneous response coefficients for the three markets allows us to conclude whether one market incorporates information on geopolitical developments sooner than the other. The magnitude and length of the significant part of the remaining coefficients for the horizons h varying from 1 to 7 months enables the assessment of how quickly all of the information on geopolitical events is fully incorporated in wheat futures prices.

The first three steps of the analysis are aimed at testing the significance and quantifying the magnitude and extension of the effects of geopolitical uncertainty to wheat futures prices. A further point of enquiry is however on the general contribution of geopolitical uncertainty to the dynamics of wheat futures prices. Indeed, geopolitical uncertainty might have relevant effects on wheat futures prices, yet still contribute only marginally to their fluctuations with respect to other factors. In the fourth step of our analysis, we address this question through a forecast error variance decomposition. In order to have a unified and parsimonious representation of wheat futures prices dynamics and the factors affecting them while still maintaining the estimation efficient, we encompass the above regression equations estimated market by market into a unified multivariate linear time-series model of the FAVAR type. FAVAR are widely used time-series models to explore the implications and contribution to aggregate dynamics of relevant shocks, while accounting for the complex feedback loops and relationships among economic variables and maintaining a low number of variables through the use of factors. We adapt a FAVAR model to our question at hand in the following way. First, we extract the first five principal components from the vast array of controls employed

[19] Admittedly the scope of the analysis is here limited by the fact that data observations are at the monthly frequency, while daily frequency would be much more well suited.

also in our above regression. These are variables exercising a relevant role for wheat futures markets, which is important to account for, but are not directly of interest *per se*. Second, we include all futures prices, the GPU index and the so constructed five components into the following dynamic system of simultaneous equations:

$$Y_{i,t} = \sum_{l=1}^{L} \beta_l GPU_{t-l} + \sum_{m} \sum_{l=1}^{L} \gamma_{m,l} P_{m,t-l} + \sum_{j=1}^{5} \sum_{l=1}^{L} \delta_{jl} PCA_{j,t-l}$$

$$for\ Y_{i,t} = \left[GPU_t, P_{paris,t}, P_{chicago,t}, P_{kansas,t}, PCA_{1,t}, PCA_{2,t}, PCA_{3,t}, PCA_{4,t}, PCA_{5,t} \right]$$

(2)

Which can be compactly re-written in the following matrix form:

$$\begin{matrix} GPU_t \\ P_{paris,t} \\ P_{chicago,t} \\ P_{kansas,t} \\ PCA_{\{1,5\},t} \end{matrix} = C + B_1 \times \begin{matrix} GPU_{t-1} \\ P_{paris,t-1} \\ P_{chicago,t-1} \\ P_{kansas,t-1} \\ PCA_{\{1,5\},t-1} \end{matrix} + \ldots + B_L \times \begin{matrix} GPU_{t-L} \\ P_{paris,t-L} \\ P_{chicago,t-L} \\ P_{kansas,t-L} \\ PCA_{\{1,5\},t-L} \end{matrix} + \begin{matrix} \varepsilon_t^1 \\ \varepsilon_t^2 \\ \varepsilon_t^3 \\ \varepsilon_t^4 \\ \varepsilon_t^5 \end{matrix}$$

(3)

By means of this model, we identify exogenous increases in geopolitical uncertainty by isolating those movements in the GPU index which are orthogonal to the lags of each

of the other 8 variables included in the system.[20] Finally, we perform a forecast error variance decomposition analysis. Such analysis measures the contribution to the errors of the model in forecasting when setting the exogenous movements in GPU to 0. In other words, it allows us to quantify the contribution of shocks that are native of the geopolitical domain to the movements of prices.

In the fifth and final step of the analysis we perform an historical decomposition of the three wheat futures prices time-series. This type of decomposition allows us to plot the historical time-series of wheat futures prices as the sum of exogenous shocks, each contributing with a different magnitude. Differently from the analysis in the preceding step, the historical decomposition allows us to inspect the historical periods in which geopolitical shocks were relatively more important than others in explaining changes in futures prices.

4.5 Data

We use a novel dataset compiling together monthly data spanning the period from 2000 to end-2022. The data can be broadly categorized into five groups. First, we utilize data on prices, volumes and open interest relevant to the main wheat futures contracts traded in the US and Europe[21] retrieved from Bloomberg. Second, we employ data on the two

[20] Formally this hinders the identifying assumption that geopolitical uncertainty is not moved contemporaneously by any of the variables included in the VAR.

[21] Chicago SRW wheat futures, Kansas City HRW wheat futures and Paris Milling wheat No. 2 futures. We also consider the London wheat futures contract for the purpose of our robustness checks; see Appendix – Section E.

indices of uncertainty presented in Section 4.2 – the geopolitical uncertainty index developed by Caldara and Iacoviello (2022) (GPU), either global or country-specific, and the economic policy uncertainty index by Baker et al. (2016) (EPU) – as well as the new composite indicator of systemic stress in the financial system ($CISS$) for the US and the Euro Area available via the ECB's Statistical Data Warehouse. Third, we include wheat spot prices drawn from USDA, the International Grains Council or the International Monetary Fund, data on wheat production and on area harvested also from USDA,[22] and data on the Vegetation Health Index (VHI) for the US and France disseminated by the National Oceanic and Atmospheric Administration (NOAA) of the US Department of Commerce. Fourth, we retrieve spot and futures prices data relating to crude oil, corn and gold from either Bloomberg, for futures, or the International Monetary Fund, for spot prices. Finally, we collect data on several financial variables, namely US and Euro Area nominal broad exchange rates, S&P 500 and EUROSTOXX market indices, and risk free rates in the form of US and German 1-year treasury yields respectively from the Bank for International Settlements, the ECB's and the Federal Reserve's data warehouses, and the Bundesbank treasury yield database. Table 4.2 provides more details on the variables used.[23]

[22] Data on area harvested is available only at the yearly level; we hence converted them to monthly frequency through simple linear interpolation and then only used them as control to perform robustness checks; see Appendix – Section D.

[23] Please refer to the Appendix – Section B for descriptive statistics, including mean, standard deviation, minimum, maximum, and the Dickey Fuller test (for unit roots both t-statistic and p-values based on MacKinnon (1994)).

Table 4.2 *Variables descriptions*

Name	Description	Label	Source
Wheat futures price	Price of nearest expiry Paris Milling wheat No. 2 futures *or* Chicago SRW wheat futures *or* Kansas City HRW wheat futures *or* London UK Feed wheat futures	$P_{m,t}^{h}$	Bloomberg
Volume	Volume of trades in Paris Milling wheat No. 2 futures *or* Chicago SRW wheat futures *or* Kansas City HRW wheat futures *or* London UK Feed wheat futures	X_t^F	Bloomberg
Open interest	Open interest of Paris Milling wheat No. 2 futures *or* Chicago SRW wheat futures *or* Kansas City HRW wheat futures *or* London UK Feed wheat futures	X_t^F	Bloomberg
Geopolitical uncertainty	Geopolitical risk indicator by Caldara and Iacoviello (2022), either global or by country (Argentina, Australia, Canada, Russia, Ukraine, US)	GPU_t	www.matteoiacoviello.com
Economic policy uncertainty	Global economic policy uncertainty index by Baker et al. (2016)	EPU_t	www.policyuncertainty.com
Financial stress	Composite indicator of systemic stress as in Chavleisvili and Kremer (2023) for the Euro Area *or* US	$CISS_{EA,US,t}$	ECB Statistical Data Warehouse
Wheat spot price (local)	Export price of US No. 2 SRW wheat	$S_{m,t}$	US Department of Agriculture (USDA)
	Export prices of US No. 2 HRW wheat *or* French wheat *or* UK wheat	$S_{m,t}$	International Grains Council
Wheat supply	World wheat production	X_t^S	US Department of Agriculture (USDA)
Wheat spot price (global)	Global benchmark price of wheat determined by the largest exporter	X_t^S	International Monetary Fund[1]
Area harvested	Area harvested for wheat, either global or by jurisdiction (EU *or* US). Monthly interpolation of yearly observations.	X_t^S	US Department of Agriculture (USDA)
Vegetation Health Index	Index illustrating the severity of drought based on the vegetation health and the influence of temperature on plant conditions, by country (France *or* US)	X_t^S	National Oceanic and Atmospheric Administration (NOAA) – US Department of Commerce
Corn futures price	Price of nearest expiry Paris corn futures *or* Chicago corn futures	X_t^D	Bloomberg
Corn spot price	Global benchmark price of corn determined by the largest exporter	X_t^D	International Monetary Fund[1]
Crude oil futures price	Price of nearest expiry NYMEX WTI crude oil futures	X_t^D	Bloomberg

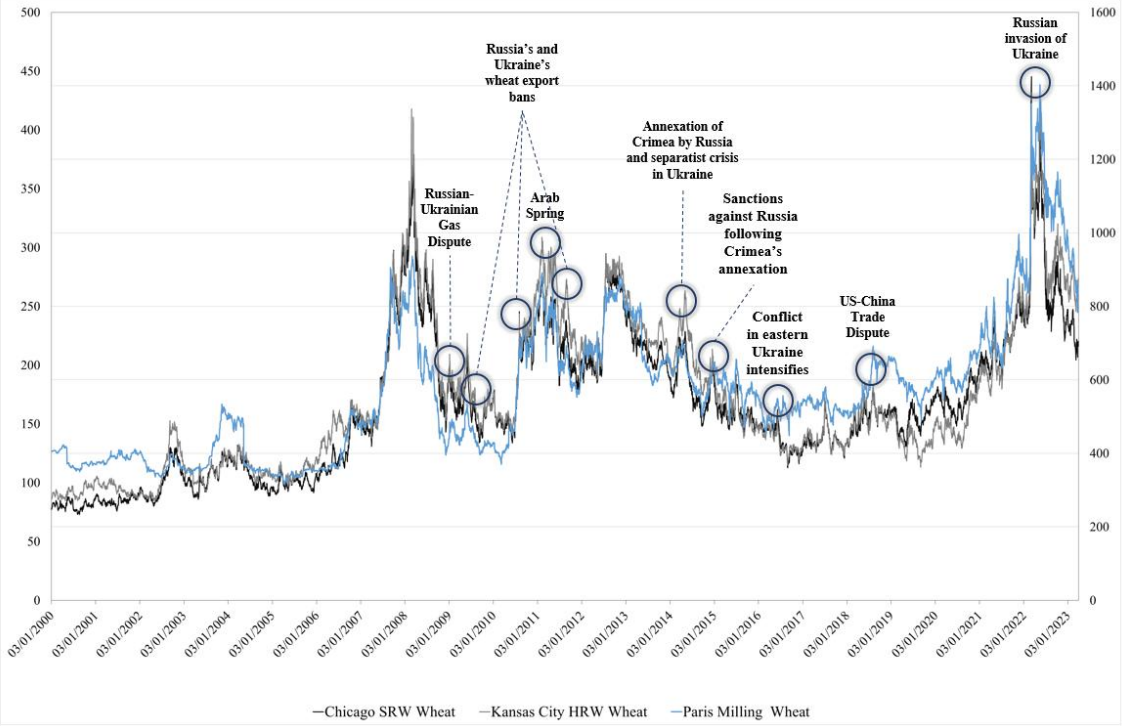
Crude oil spot price	Global benchmark price of Brent crude oil determined by the largest exporter	X_t^D	International Monetary Fund[1]
	WTI crude oil spot price (inflation adjusted)	X_t^D	Bloomberg
Gold futures price	Price of nearest expiry COMEX gold futures	X_t^D	Bloomberg
Gold spot price	Global benchmark price of gold determined by the largest exporter	X_t^D	International Monetary Fund[1]
USD foreign exchange rate	Nominal broad exchange rate for USD	X_t^F	Board of Governors of the Federal Reserve System[1]
EUR foreign exchange rate	Nominal broad exchange rate for EUR	X_t^F	Bank for International Settlements
VIX	Stock market volatility index	X_t^F	Chicago Board Options Exchange[1]
EURO STOXX	EURO STOXX 50 equity index	X_t^F	European Central Bank
S&P 500	S&P 500 equity index	X_t^F	S&P Dow Jones Indices[1]
German yield 1Y	Yield on outstanding Germany public debt with residual maturity between 1 and 2 years	X_t^F	Deutsche Bundesbank
US yield 1Y	Market yield on US Treasury Securities at 1 year constant maturity	X_t^F	Board of Governors of the Federal Reserve System[1]

[1] Via FRED, Federal Reserve Bank of St. Louis.

By way of a preliminary analysis, in Figure 4.1 we plot daily wheat futures prices, showing major geopolitical events coinciding with price increases of varying magnitudes during our reference period. While disregarding spikes that can be ascribed to factors unrelated to geopolitical developments (such as the bursting of the commodities super-cycle of the early 2000s in 2008 and poor harvests either in the US or in Eastern Europe in 2002, 2012, and 2017), the figure suggests that geopolitical events affecting countries that are most active in the global wheat market may influence price formation in the related futures markets. In fact, most events involve Russia and Ukraine, whose weight in global wheat exports has significantly increased over the last decade. From this perspective, the absence of any significant wheat price movements in correspondence with the 9/11 events, which according to Caldara and Iacoviello (2022) have caused the

biggest spike in GPU since 1985, can appear striking, especially considering that the US was the largest wheat exporter worldwide at the time, based on USDA figures. Possible explanations for this may have to do with the lack of concerns regarding relevant impacts on the wheat supply chain (different from the events that have taken place in Russia and Ukraine), and also with the fact that the financialization tendency in the commodity futures market was just beginning then.

Figure 4.1 *Wheat futures prices and major geopolitical events*



Notes: Prices for Chicago SRW and Kansas City HRW futures contracts are in US dollar/bushel and are shown on the right-hand axis. The price of the Paris-based wheat futures contract is in euro/metric ton and is shown on the left-hand axis.

Data source: Bloomberg.

4.6 Empirical results

In this section we explore the results of the analysis outlined in Section 4.4. The next subsections follow the order of the methodology.

4.6.1 Contemporaneous effects and 1-month ahead effects

Tables 4.3 and 4.4 present the results for the contemporaneous and 1-month ahead effects of GPU on wheat futures prices, respectively from the estimation of the regression equation (1) with selected lag order of three.[24] As can be seen from the first line of Table 4.3, the estimated coefficients appear positive and significantly different from zero at the 1% confidence level for all contracts.[25] The point estimate suggests that, on average, a 100-point increase in GPU in a certain month (roughly 20% probability event in the GPU time series) tends to be paralleled, in the same month, by an increase in wheat futures prices of 100x0.046=4.6 euro/metric ton for the Paris contract, 100x0.133=13.3 US dollar/bushel for the Chicago contract, and 100x0.101=10.1 US dollar/bushel for the Kansas City contract on average. Table 4.4 shows a far stronger relationship: one month after a 100-point rise in GPU, the increase in wheat futures prices is equal to 11.9 euro/metric ton for the Paris contract, 32.6 US dollar/bushel for the Chicago contract, and 28.5 US dollar/bushel for the Kansas City contract. Again, β_1 coefficients turn out to be statistically significant for all products, at either the 1% (Paris and Chicago) or 5%

[24] The tables report only a subset of the controls used in the regression. See Appendix for full set of controls.

[25] The estimates are virtually unchanged in a specification that excludes economic policy uncertainty; see Appendix – Section F.

(Kansas City) confidence levels. The magnitude of the impacts turns out to be consistent across contracts considering their differing sizes, with the Chicago and Kansas City contracts being nearly three times larger than their French equivalent (5000 bushels *versus* 50 metric tons). The lower impact observed for Kansas City HRW compared to Chicago SRW wheat futures may at least in part be explained by the fact that HRW wheat has a higher protein content and is more versatile relative to Chicago SRW wheat (Balsamo, 2022), making it more robust against geopolitical uncertainty. In fact, even after the Russian invasion of Ukraine in February 2022, both Kansas City HRW and Chicago SRW wheat sustained extraordinary spikes in price, but the spike for SRW wheat was higher despite having greater market liquidity (ibid).[26]

Table 4.3 *Contemporaneous effect of geopolitical uncertainty on wheat futures prices*

VARIABLES	(1) Paris	(2) Chicago	(3) Kansas City
Geopolitical Uncertainty (GPU) (global)	0.046***	0.133***	0.101***
	[0.014]	[0.040]	[0.037]
Economic Policy Uncertainty (EPU) (global)	-0.029**	-0.118***	-0.112***
	[0.014]	[0.036]	[0.035]
EA CISS	19.869***		
	[4.327]		
US CISS		109.568***	94.409***
		[20.172]	[19.233]
Other Commodity Prices (First PC)	0.898	3.324*	4.764***
	[0.692]	[1.853]	[1.776]
Other Commodity Prices (Second PC)	-0.116	-1.137	-1.924
	[0.915]	[2.516]	[2.351]

[26] We incidentally note here that the regressions yield consistently negative and statistically significant estimates for the coefficient of EPU. Different possible explanations for this result can be provided – economic policy uncertainty may lead to changes in investor behavior, diverting demand for wheat futures, or could be associated with export restrictions leading to oversupply in domestic markets. As hinted above, however, further analysis, including additional controls, would be necessary to provide a meaningful explanation for this coefficient.

Constant	-63.603***	-230.221***	-133.930*
	[22.961]	[77.038]	[71.232]
Observations	247	247	247
Month FE	YES	YES	YES
Full Controls	YES	YES	YES
R^2	0.991	0.994	0.995
Adj. R^2	0.990	0.993	0.994
d.o.f.	207	207	207

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table 4.4 *Effect of geopolitical uncertainty on wheat futures prices 1-month after*

VARIABLES	(1) Paris	(2) Chicago	(3) Kansas City
Geopolitical Uncertainty (GPU) (global)	0.119***	0.326***	0.285**
	[0.036]	[0.125]	[0.124]
Economic Policy Uncertainty (EPU) (global)	-0.075**	-0.324***	-0.318***
	[0.034]	[0.114]	[0.115]
EA CISS	24.486**		
	[10.739]		
US CISS		184.160***	187.630***
		[63.043]	[64.000]
Other Commodity Prices (First PC)	6.962***	15.245***	16.655***
	[1.718]	[5.792]	[5.909]
Other Commodity Prices (Second PC)	0.534	6.620	9.265
	[2.271]	[7.863]	[7.823]
Constant	-6.857	314.699	418.863*
	[56.984]	[240.762]	[237.035]
Observations	247	247	247
Month FE	YES	YES	YES
Full Controls	YES	YES	YES
R^2	0.948	0.941	0.949
Adj. R^2	0.938	0.930	0.939
d.o.f.	207	207	207

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Overall, the abovementioned results corroborate our main hypothesis that geopolitical uncertainty is an important pricing factor in wheat futures markets, suggesting that market participants tend to consider geopolitical factors when forming their expectations about future wheat prices. Generally speaking, the greater magnitude of the 1-month ahead effects suggests that there is some time lag before prices fully react

to information concerning geopolitical developments, as further shown in the next paragraph.[27]

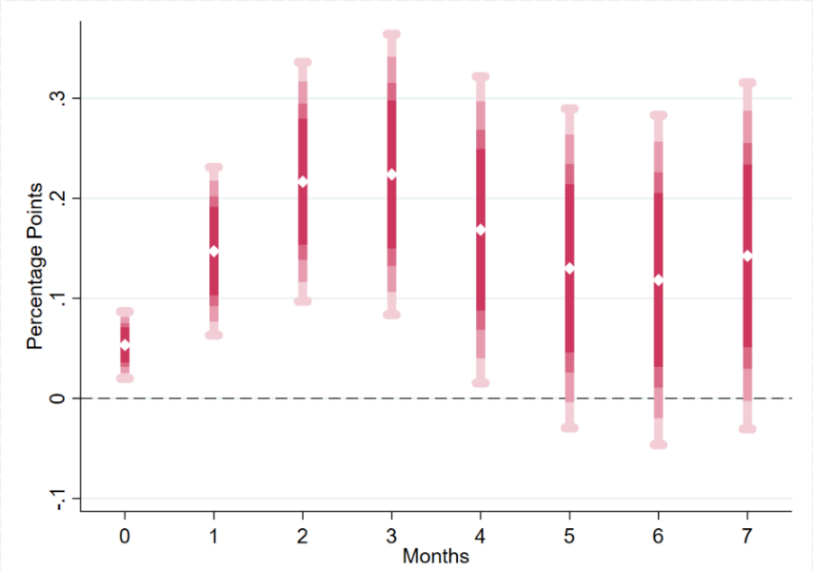
4.6.2 Full dynamic response of wheat futures prices to GPU

Figures 4.2, 4.3 and 4.4 present the results of the full dynamic response of wheat futures prices to GPU.[28] For all contracts, a rise in geopolitical uncertainty seems to reach its peak impact on average around 3 months after. The total dynamic effect lasts for 5 months, including the contemporaneous, for Paris and Chicago wheat futures, for 4 months in the case of Kansas City wheat futures. Beyond those time horizons, the confidence bands cross the zero line, indicating that the effects are not significantly different from zero in a statistical sense at the 5% confidence level.

[27] Repeating the regression analysis splitting the sample into before- and after- 2009 (roughly coinciding with the beginning of the tremendous growth experienced by the MATIF; see footnote 1) reveals no evidence of structural breaks in the GPU coefficient.

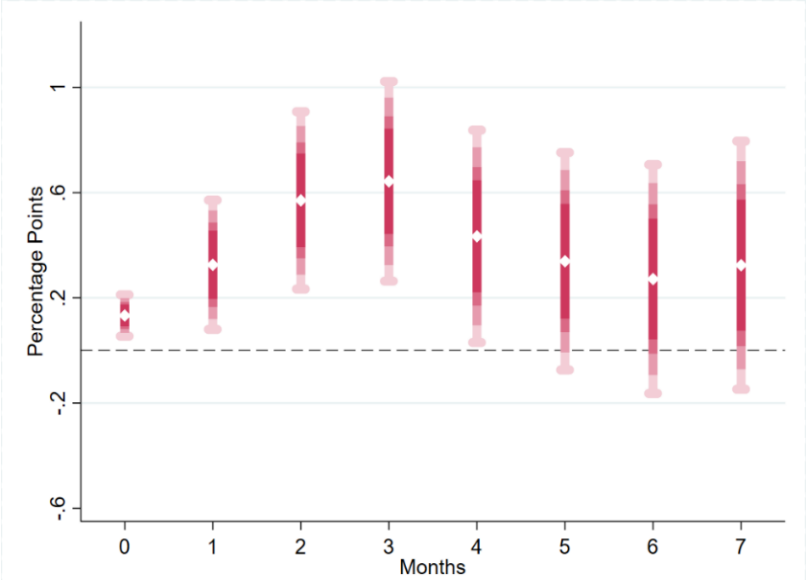
[28] Note that the first two points in each graph coincide with the estimates presented in Tables 4.3 and 4.4. See Appendix – Section G for robustness with respect to heteroscedasticity across years.

Figure 4.2 *Impulse response function for Paris wheat futures*



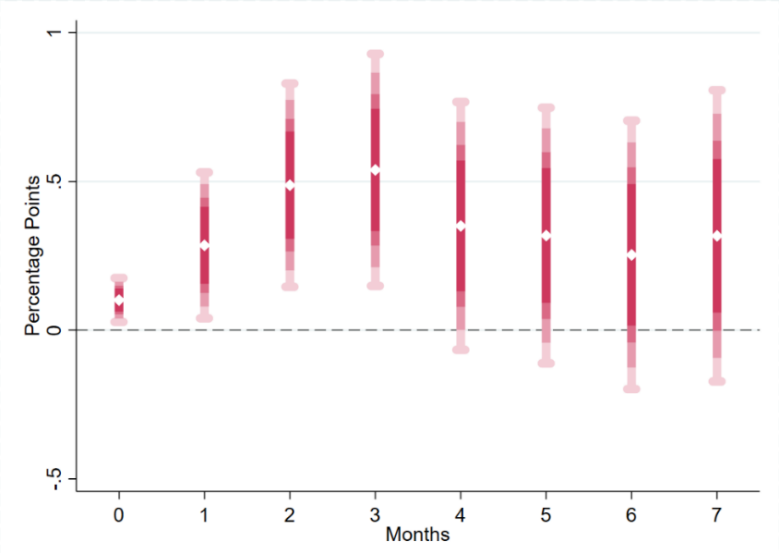
Notes: Full dynamic response of Paris wheat futures price to GPU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure 4.3 *Impulse response function for Chicago SRW wheat futures*



Notes: Full dynamic response of Chicago SRW wheat futures price to GPU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure 4.4 *Impulse response function for Kansas City HRW wheat futures*



Notes: Full dynamic response of Kansas City HRW wheat futures price to GPU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Overall, the effects of geopolitical uncertainty on wheat futures prices are found to be slightly more persistent than those estimated by Aizenman et al. (2023), who showed that the impact of relevant events associated with the Russian invasion of Ukraine on Chicago wheat futures prices elapses around day 70. The difference in results could partly stem from variations in the overall time horizon considered and event selection. Specifically, one could argue that, due to faster information diffusion in the most recent period (covered by Aizenman et al.'s analysis), wheat futures prices now incorporate information surrounding geopolitical events more rapidly. Additionally, while Aizenman et al. focus solely on specific realized geopolitical events, our analysis relies on a broad measure that captures both geopolitical "acts" and "threats". Although disentangling these components falls beyond the scope of this study, the distinction is conceptually important: threats are likely to operate primarily through uncertainty and expectations channels, whereas realized acts may also affect market fundamentals directly. Moreover,

recent evidence suggests that geopolitical threats are a key driver of the geopolitical risk premium in commodity futures markets (Cheng et al., 2023). The greater persistence observed in our results may therefore stem from the inclusion of anticipated geopolitical developments, allowing for a more comprehensive assessment of the channels through which geopolitical risk affects commodity markets.

4.6.3 Market efficiency: full dynamic response of wheat futures prices to composite GPU of wheat exporting countries other than the US and EU

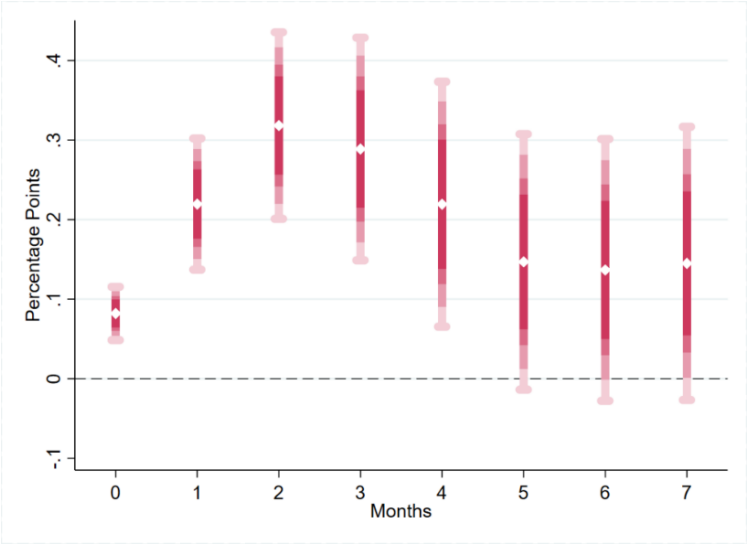
Figures 4.5, 4.6 and 4.7 present the results of the full dynamic response of wheat futures prices to the first principal component of country-specific GPUs for Argentina, Canada, Australia, Ukraine and Russia.[29] These responses are largely consistent with our baseline presented in the previous subsection. Compared to the responses to global GPU, prices seem slightly quicker to react to news regarding geopolitical events, with geopolitical uncertainty reaching its peak impact on wheat futures prices after 2 months on average; looking at the peak coefficients, the magnitude of the impact looks more powerful for the Paris contract, broadly similar for the US contracts. A cross-contract comparison indicates that the lagged impact of geopolitical uncertainty originating from countries other than the US and EU on the Paris wheat futures endures a bit longer – at least up to the fifth month, including the contemporaneous. These differences[30] could be explained by a relatively higher exposure of the Paris market to shocks originating from Russia and

[29] See Appendix – Section C for details on the computation of the principal component.

[30] More differences could arise if we run regression equations at the daily level. The current evidence at the monthly level allows to rule out harsh forms of market inefficiency, but not milder forms close to perfect efficiency.

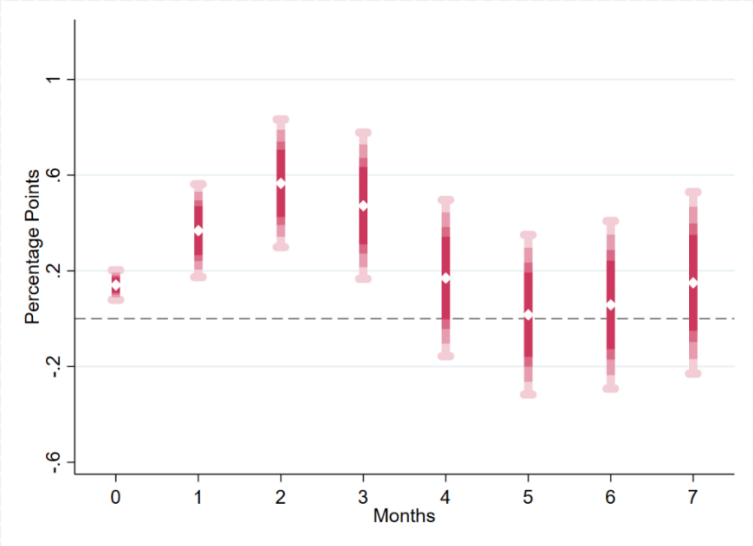
Ukraine, especially in light of the significance of the increase in GPUs for these two countries after Russia invaded Ukraine in 2022. In any event, there does not seem to be any major differences across markets in how quickly they react and all of the information on geopolitical events is incorporated in wheat futures prices.

Figure 4.5 *Impulse response function for Paris wheat futures considering geopolitical uncertainty of non-US and non-EU countries*



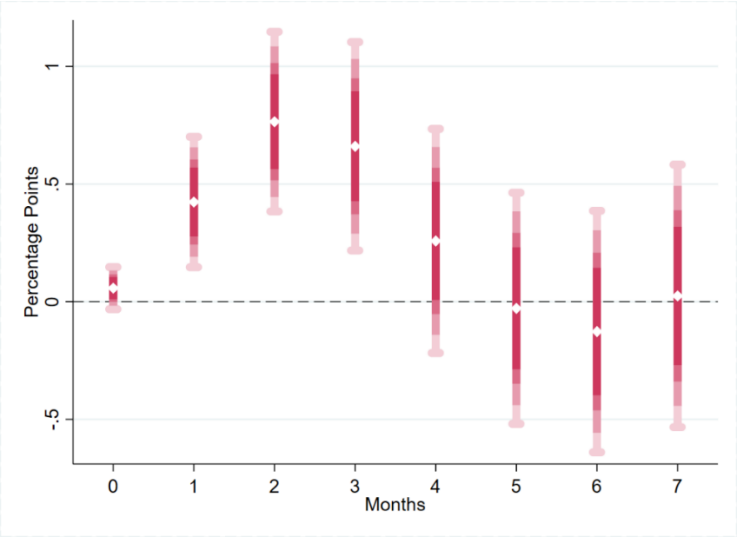
Notes: Full dynamic response of Paris wheat futures price to first principal component of country-specific GPU indices for Argentina, Canada, Australia, Russia and Ukraine. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure 4.6 *Impulse response function for Chicago SRW wheat futures considering geopolitical uncertainty of non-US and non-EU countries*



Notes: Full dynamic response of Chicago SRW wheat futures price to first principal component of country-specific *GPU* indices for Argentina, Canada, Australia, Russia and Ukraine. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure 4.7 *Impulse response function for Kansas City HRW wheat futures considering geopolitical uncertainty of non-US and non-EU countries*



Notes: Full dynamic response of Kansas City HRW wheat futures price to first principal component of country-specific *GPU* indices for Argentina, Canada, Australia, Russia and Ukraine. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

4.6.4 Forecast error variance decomposition analysis

Table 4.5 contains the results of the forecast error variance decomposition analysis obtained through the fitting of the FAVAR(3) model as explained in the previous methodology section.[31] Across the nine columns, the first three columns represent respectively the point estimate, lower and upper confidence bounds of the share of forecast error in unconditional forecasts of Paris wheat futures prices explained by exogenous changes in GPU components. The rows correspond to different forecast horizons, 1 being the simple 1-month ahead forecast and the last row being the 4-month ahead forecast. The following two sets of three columns repeat the exercise for Chicago and Kansas City wheat futures contracts. As it is possible to observe, GPU shocks tend to explain a percentage comprised between 6% and 10% of wheat futures prices variations in 1-month period. The percentage tends to increase considering longer time horizons, up to 9% or 10% for the US contracts, and 16% for the Paris contract. In short, for all contracts considered exogenous changes in geopolitical uncertainty do account for a non-negligible portion of the monthly observed variation in wheat futures prices. The aim of the following section will be to investigate whether the portion of variation explained by geopolitical uncertainty is evenly allocated throughout the sample or rather concentrated around certain time periods.

[31] See Appendix – Section C for details on the computation of the principal components used in the FAVAR and for impulse response functions of GPU shocks identified through zero restrictions as explained in the methodology section.

Table 4.5 *Forecast error variance decomposition*

	Wheat Futures Prices								
	Paris			Chicago SRW			Kansas City HRW		
Horizon	Point Estimate	Lower Bound	Upper Bound	Point Estimate	Lower Bound	Upper Bound	Point Estimate	Lower Bound	Upper Bound
1	10.47%	7.27%	12.96%	6.59%	4.36%	8.72%	6.39%	4.10%	8.46%
2	14.54%	7.98%	18.24%	8.95%	4.01%	12.56%	9.65%	4.60%	12.91%
3	15.78%	6.96%	20.49%	8.80%	3.03%	13.39%	10.03%	3.63%	14.22%
4	15.30%	5.63%	20.83%	7.82%	2.77%	13.00%	9.23%	2.96%	14.12%

Notes: Forecast error variance decomposition analysis based on FAVAR(3) with endogenous variables: Paris, Chicago and Kansas City wheat futures prices, GPU, first 5 principal components of all controls included in the regression in Table 4.2. 95% lower and upper bounds reported. Estimation through OLS and identification through zero restrictions on contemporaneous effects of other endogenous variables on GPU.

4.6.5 Historical decomposition analysis

Figures 4.8, 4.9 and 4.10 contain respectively the decompositions of the historical dynamic profile of each of the three wheat futures prices into contributions from GPU shocks (identified) and other unidentified shocks based on the estimation of the FAVAR(3) model as explained above. The graphs display a very similar pattern for the three contracts.

We note immediately that, in each of the three figures, exogenous changes in GPU significantly contributed to the run up in wheat futures prices at the beginning of 2022. This is expected as the dates coincide with the burst of the Ukraine-Russia war, which saw two major wheat exporters involved in a war with consequent huge scale downs in all sectors of the economy included the agricultural sector.[32] Other periods when exogenous changes in GPU had a noticeable role in explaining wheat futures price variations were 2004-2005, 2009-2011 and 2016. Looking back at Figure 4.1, and

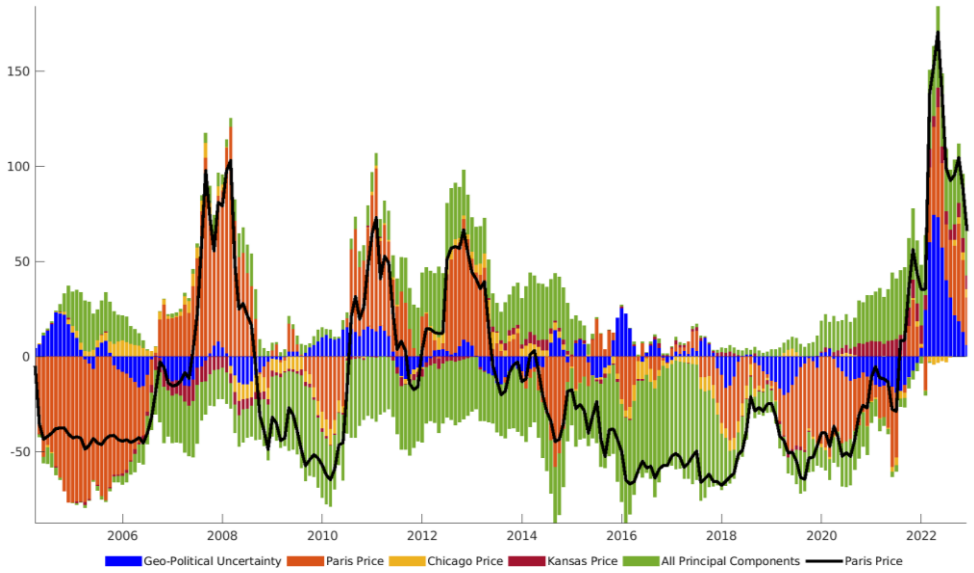
[32] Not to mention the heavy import/exports bans imposed by the US and the EU onto Russia.

adhering to a narrative approach, major geopolitical developments that may help explain wheat futures price movements in the latter two periods are once again linked to the Russia-Ukraine relationship. The period from 2009 to 2011 witnessed political instability and conflicts in both countries, which disrupted supply chains, alongside severe droughts and wildfires leading to wheat export restrictions. Similarly, in 2016, the ongoing conflict in eastern Ukraine, particularly in regions where significant wheat production takes place, led to disruptions in wheat exports and heightened market uncertainty. As to 2004-2005, both the conflict in Iraq and the so-called Orange Revolution in Ukraine, which opened up the way for deterioration in the relationship with Russia, may have contributed to sustaining wheat prices higher than they would otherwise be along their general declining path observed over the period 2004-2006.[33]

While it is outside the scope of our analysis to determine the extent to which the GPU index reflects these events and any resulting causal links, the overall trend suggests that geopolitical developments involving Russia and Ukraine, coupled with an increase in their wheat export shares, have gained relevance in explaining wheat futures price dynamics.

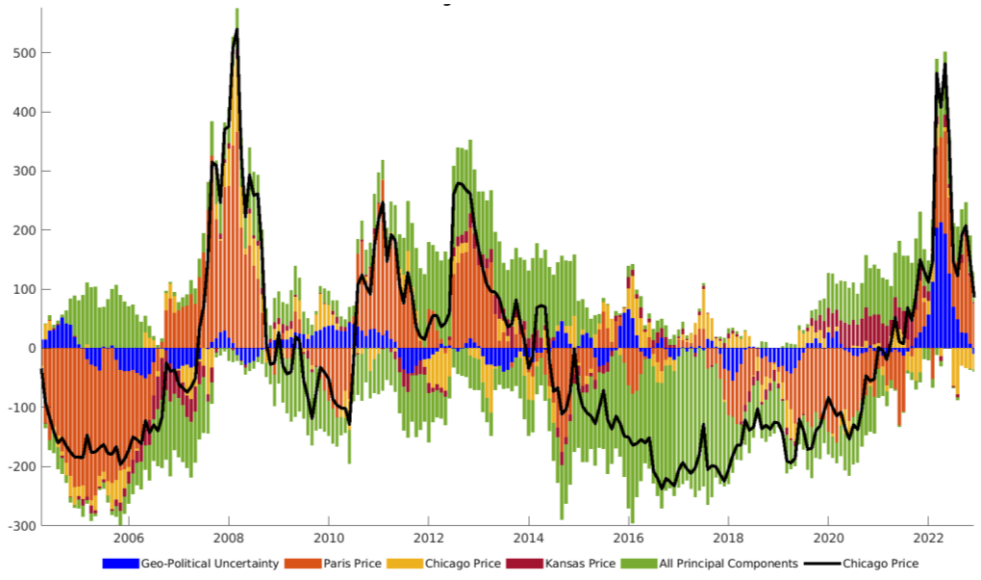
[33] It should be noted that the first two years of the historical decomposition are largely affected by the initial values (not reported in the figure for clarity) and should therefore be interpreted with caution.

Figure 4.8 *Historical decomposition analysis for Paris wheat futures*



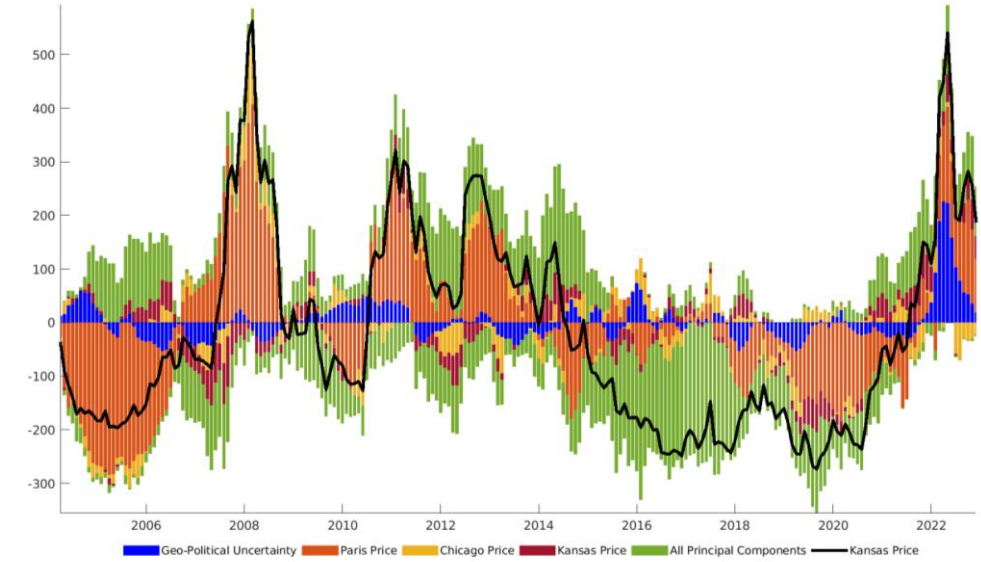
Notes: Historical decomposition of Paris wheat futures price based on FAVAR(3) with endogenous variables: Paris, Chicago SRW and Kansas City HRW wheat futures prices, GPU, first 5 principal components of all controls included in the regression in Table 4.2. Estimation through OLS and identification through zero restrictions on contemporaneous effects of other endogenous variables on GPU.

Figure 4.9 *Historical decomposition analysis for Chicago SRW wheat futures*



Notes: Historical decomposition of Chicago SRW wheat futures price based on FAVAR(3) with endogenous variables: Paris, Chicago SRW and Kansas City HRW wheat futures prices, GPU, first 5 principal components of all controls included in the regression in Table 4.2. Estimation through OLS and identification through zero restrictions on contemporaneous effects of other endogenous variables on GPU.

Figure 4.10 *Historical decomposition analysis for Kansas City HRW wheat futures*



Notes: Historical decomposition of Kansas City HRW wheat futures price based on FAVAR(3) with endogenous variables: Paris, Chicago SRW and Kansas City HRW wheat futures prices, GPU, first 5 principal components of all controls included in the regression in Table 4.2. Estimation through OLS and identification through zero restrictions on contemporaneous effects of other endogenous variables on GPU.

4.7 Conclusions

Prompted by recent geopolitical developments involving Russia and Ukraine, in this study we investigate geopolitical uncertainty as a potentially significant factor influencing the dynamics of wheat futures prices. Specifically, our primary aim is to assess the extent to which geopolitical events influence wheat futures markets after controlling for key real and financial drivers identified in the literature. To this end, we estimate a comprehensive set of time-series models using the index developed by Caldara and Iacoviello (2022) as a proxy for geopolitical uncertainty, while also accounting for economic policy uncertainty (Baker et al., 2016) and financial stress against the backdrop of increasing financialization of commodity markets and possible feedback loops between real and

financial markets (Goldstein and Yang, 2022). In doing so, the paper speaks to three central themes in economic geography: geopolitics, institutional and policy change, and financialization.

Focusing on the main wheat futures markets globally, namely Chicago and Paris, from year 2000, we find compelling evidence supporting the hypothesis that geopolitical uncertainty is a crucial pricing factor in the wheat market. Across all contract considered, increases in geopolitical uncertainty are associated with higher wheat futures prices and explain a meaningful share of their variation. The effect is persistent, remaining significant for up to five months, with no systematic differences between the Chicago and Paris markets. This implies that geopolitical uncertainty is an often omitted, yet relevant, pricing factor for agricultural commodities with effects that are independent from other sources of uncertainty and difficult to hedge or diversify in advance.

In terms of the magnitude of the impacts, we find mild evidence suggesting that the Paris contract has been more affected by changes in geopolitical uncertainty originating from countries other than the US and EU. Moreover, historical decompositions show that exogenous geopolitical uncertainty shocks played an especially prominent role during periods market by major developments involving Russia and Ukraine, particularly over the past fifteen years. Together with the growing importance of these countries in global wheat exports, this suggests that their evolving geopolitical relationship, culminating in the war in Ukraine, has become a key driver of wheat futures price dynamics globally.

Our findings contribute to the growing literature documenting the importance of geopolitical uncertainty for financial markets, and particularly for commodity derivatives markets. They demonstrate that news regarding geopolitical events can significantly influence wheat futures prices, with implications that span across the globe. From a

normative standpoint, while policymakers may be able to contain economic policy uncertainty, by acting decisively (Bloom, 2009) and carefully controlling the timing and content of their statements, mitigating geopolitical uncertainty is much more challenging. Hence, new methods for monitoring and addressing this type of uncertainty need to be identified. This is especially relevant given the growing interconnectedness of financial markets and advancements in technology, which facilitate the seamless transmission of news worldwide. At the same time, market infrastructures and participants should expressly account for the implications of geopolitical developments, adapting their risk management frameworks where necessary.

Another implication stems from observing that not all shocks to geopolitical uncertainty translate into rises of wheat futures prices or do so to the same extent. From this perspective, assessing the potential impacts of geopolitical events on futures price dynamics requires developing a thorough knowledge of the underlying spot market and paying attention not only to global, but also to country-specific indicators of geopolitical uncertainty. In particular, the effects of geopolitical events may also be transmitted indirectly through other commodity markets and production costs. For instance, a geopolitical conflict affecting major fertilizer producers or exporters can lead to a sharp increase in fertilizer prices, potentially raising the cost of wheat production even when the conflict does not directly affect wheat supply. The recent increase in fertilizer prices associated with the US–Iran conflict provides a concrete example of this type of transmission (Draper, 2026). While the timing and magnitude of such effects may be difficult to predict ex ante, understanding the underlying channels through which geopolitical shocks propagate across commodity markets can help anticipate their potential implications for wheat prices. This points again to the significance of the

interlinkages between the physical reality and the financial dimension of commodity markets.

Future applications may further uncover the dynamics of agricultural futures markets in response to geopolitical events, and news more generally, using daily or intraday data.

Chapter 5: Unilateral trade actions and adaptation in Global Production Networks

Abstract

This paper applies and extends the Global Production Network (GPN) 2.0 framework to advance understanding of unilateral trade decisions amid heightened trade uncertainty. It critically examines the 2023 import bans on Ukrainian wheat imposed by five EU Member States, an unprecedented challenge to the EU's Common Commercial Policy, showing how trade decision-making is shaped by multi-scalar dynamics that go beyond purely market-driven considerations. While Member States acted in a largely short-term manner to safeguard domestic value-generating sectors, EU institutions were compelled to adapt in order to preserve their power and legitimacy. Moving beyond firm-centric approaches, the analysis demonstrates how tensions between states and supranational institutions actively shape GPNs and emphasizes adaptation as a central, yet underexplored, strategy in extra-firm bargaining that increasingly governs production networks in an era of recurrent, politically driven disruptions.

5.1 Introduction

The shift towards unilateralism in trade decision-making, particularly in the wake of increasing geopolitical tensions, has become an urgent concern for understanding the

processes of global production and value creation and capture. In 2018 and 2019, the US-China trade conflict intensified as the US imposed tariffs on hundreds of billions of dollars in Chinese goods and China adopted retaliatory measures, sparking a tit-for-tat escalation that disrupted global supply chains and heightened economic uncertainty. Beginning in 2022, the Russian invasion of Ukraine further compounded the trend as Western sanctions, including a phased ban on Russian oil imports, and Russia's export restrictions, particularly on natural gas, forced Europe to seek alternative energy sources and destabilized global energy markets. Between mid-October 2023 and mid-October 2024, 169 new trade-restrictive measures were introduced worldwide, covering an estimated $887.6 billion in trade – more than double the $337.1 billion recorded the previous year (WTO, 2024). In July 2025, Trump's announcement of a 30% tariff on European imports ignited a new wave of discussions that continue to unfold.

As trade policy decisions are increasingly shaped by political rather than purely economic considerations and trade uncertainty escalates, the New Economic Geography (NEG) framework that has long underpinned much research on trade (Krugman, 1991; Fujita et al., 2001; Venables, 2019) struggles to fully capture these dynamics. NEG tends to focus on gradual, industry-specific strategic coupling and decoupling, but is not well-equipped to address the abrupt geopolitical ruptures that are reshaping global production and trade. In fact, Krugman (1987) himself acknowledged that trade policies driven by strategic concerns are inherently challenging due to the uncertainty surrounding the actions and reactions of other players. Unilateral trade measures, such as those seen in the US-China dispute and the Russia-Ukraine crisis, highlight how sudden geopolitical events can reshape global networks in ways that market-driven models cannot anticipate. These disruptions introduce significant uncertainty, which can affect trade flows as much as tariff levels themselves.

In this paper, I aim to demonstrate that the Global Production Network (GPN) approach in its 2.0 version (Coe and Yeung, 2015) offers a more suitable analytical framework for understanding these shifts. By incorporating a multi-scalar perspective, the GPN framework reveals how trade decisions are the results of dialectic dynamics between actors at different levels – local, national, regional, global – and are best understood when factors at all these levels are considered holistically and in the context of the spatial relations between them. Context matters (Bathelt and Glückler, 2018; Clark, 2011, 2018) as decisions made by economic agents are contingent on the situation, with power asymmetries influencing how choices are made at particular points in time. Crucially, the GPN approach situates these decisions with a wider political economy, highlighting the socio-political structures in which production networks are embedded and by which they are shaped.

Grounding this discussion in recent developments, the paper offers a theoretically-driven critical analysis of the 2023 unilateral import bans on Ukrainian wheat initiated by Poland and Hungary and later joined by Bulgaria, Slovakia and Romania. The bans marked an unprecedented challenge to the EU's Common Commercial Policy, a cornerstone of its unified trade framework. As could be foreseen, tensions quickly ensued, with the European Commission (EC) committed to maintaining the integrity of the EU's trade policies and condemning the actions, at least initially. Ultimately, however, the political and economic pressures exerted by the five Member States forced the Commission into a delicate balancing act, and particularly into the adoption of a series of concessions to stop their infringement.

These events raise critical questions about trade governance, the balance of power between the EU and its Member States and more generally the juxtaposition of national vs supranational institutional forms (Gertler, 2018; Yeung, 2024). Specifically, I address

two key questions: (*i*) What do the abovementioned events reveal about the role of the EU and its Member States within the wheat GPN, and (*ii*) How does the analysis of these events enhance our understanding of state action and its influence on the evolving geographies of GPNs. Methodologically, the paper advances an interpretive and critical political economy analysis grounded in the GPN 2.0 heuristic framework. The analysis draws on a comprehensive range of materials, including policy documents, institutional statements, secondary sources and data from the US Department of Agriculture (USDA), the EC, the United Nations (UN) and the International Grains Council.

The analysis offers two key related contributions. First, focusing on the role of states, the unilateral bans on Ukrainian grain imports reflect how countries prioritize protecting the value generated by sectors that are deeply embedded and politically sensitive at the national level (like agriculture in Poland), serving the immediate interests of domestic powerful actors while potentially undermining broader and longer-term collective geopolitical objectives – a manifestation of short-termism. While the EU holds significant regulatory power within the wheat GPN (e.g., by regulating trade relations with Ukraine and imposing sanctions), Member States maintain the ability to assert their national interests and fragment established networks, reducing the predictability of the regulatory landscape and adding a layer of complexity to the geography of GPNs.

Second, the chosen case illustrates a scenario characterized by a misalignment between supranational policies and national-level preferences. From this perspective, while the EU's initial facilitation of imports from Ukraine shows a lack of consideration of the interests of Eastern Member States, the EU's eventual compromise demonstrates institutional adaptation to an emerging crisis. Challenging the conventional view that adjustments are primarily required at the national level to achieve collective goals, it is also essential that supranational institutions remain flexible to prevent individual states

from exerting their agency in ways that undermine those objectives. While efforts to rebuild regional resilience through institutional initiatives are ongoing (Yeung, 2024), the EU's capacity to adapt to incorporate the evolving preferences of its parts is likely to prove essential to its long-term legitimacy and survival.

Theoretically, the analysis not only contributes to research on trade by demonstrating the value of the GPN framework but also advances GPN 2.0 literature by emphasizing the often-overlooked agency of states and supranational institutions. Much of the existing GPN research has focused on firm-level decision making, particularly how lead firms organize and govern production networks and the impacts of this on local producers' ability to upgrade or achieve "strategic coupling" (Coe and Yeung, 2015). However, only superficial attention has been paid to the role of trade policy (despite the importance of trade relations in these networks; Curran et al., 2019), decision-making by states (Yeung, 2020), and more generally to the institutional contexts within which networks operate and evolve (Coe et al., 2008; Eckhardt and Poletti, 2018).

At the same time, the unpredictability of unilateral trade restrictions underscores the need for GPN research to expand beyond economic and organizational factors, integrating geopolitics (see Glassman, 2011). This need was supported by Harvey's (2003) work on oil, which explored how the production and consumption of key commodities is inherently globally networked and influenced by geopolitical developments. More recently, Pavlínek (2024) has advanced this line of inquiry by introducing the concept of geopolitical decoupling (as opposed to strategic decoupling) within the GPN framework. Geopolitical decoupling can reshape global supply chains in real-time, creating new uncertainties in the production and trade of goods like wheat.

Ultimately, the paper advances adaptation as a central, yet underexplored, concept, situating it within the GPN 2.0 framework as a distinctive strategy used in negotiation and accommodation processes across firm and non-firm actors, thus shaping the evolving geography of GPNs. While conventional economic geography literature tends to emphasize gradual, firm-led transformations such as strategic coupling, the unilateral grain import bans reveal how sudden geopolitical disruptions can trigger rapid and multi-scalar responses. The traditionally path-dependent nature of GPN evolution is being challenged by politically driven shifts that increasingly require firms, states and supranational institutions to swiftly adapt – not only economically, but also politically and institutionally.

The remainder of this paper is structured as follows. The next section reviews the relevant literature and sets out the theoretical framework for the analysis. This is followed by a critical discussion of the 2023 import bans and the factors that have influenced the observed course of action, illustrating the broader contributions of this case to the understanding of changes in the wheat GPN. The final section concludes by drawing implications and proposing directions for future inquiry.

5.2 Literature review and theoretical framework

Economic geography has long explored how geographic factors shape economic outcomes, especially regarding trade. The emergence of NEG in the 1990s, most notably through the work of Paul Krugman (1980, 1987, 1991), transformed the field by integrating elements of trade theory and spatial economics. NEG emphasizes the role of agglomeration economies, transportation costs, and market size in determining the location of economic activity. Central to NEG is the idea that firms and workers tend to

cluster in regions where they can exploit economies of scale and market access. Krugman's work demonstrates how these forces create "core" and "peripheral" regions, as trade expands markets and strengthens agglomeration in cores while locking peripheries into disadvantage. Thus, trade liberalization can reinforce spatial inequality by favoring regions with established clusters. These ideas have already been applied in the context of the EU (Krugman, 1993; Cutrini et al., 2022).

When applied specifically to the 2023 unilateral bans imposed by certain EU Member States on Ukrainian wheat imports, NEG can provide valuable insights into their spatial and economic implications. From a NEG perspective, increased price competition from Ukrainian imports under the Solidarity Lanes Initiative would likely exacerbate economic divergence within the EU, reinforcing existing core-periphery dynamics. Peripheral Member States like Poland, Hungary, and the others (see Sokol, 2001) could become further marginalized as cheaper imports encourage a shift in the geography of production towards agricultural regions with a pre-existing competitive advantage (Ukraine) or core areas with stronger market access and production capabilities (like France). The unilateral bans are therefore consistent with strategic trade policy arguments (Krugman, 1987), whereby regions or sectors facing competitive pressures will seek to secure excess returns for domestic firms and reduce the market size for competing goods, particularly when they are unable to match the lower production costs of external suppliers. On the other hand, the EC's final response can be seen as an attempt to stabilize local economies while maintaining the principles of the Common Commercial Policy, mitigating the centripetal forces of market integration.

This account, however, is subject to limitations that have already been noted in broader critiques of the NEG approach by economic geographers (Martin and Sunley, 1996; Garretsen and Martin, 2010; Sheppard, 2011). Most notably, by abstracting from

the historical and institutional factors that shape the development of real places, it oversimplifies the dynamics behind changes in trade patterns, attributing them primarily to shifts in transportation costs and market-size effects while downplaying the role of institutions, politics, and the social dimension of economic activity. States are portrayed largely as reactive to market pressures, with little attention paid to action-reaction dynamics or to the tensions between national sovereignty and supranational policies. This limits the framework's ability to capture endogenous change and account for actual evolutionary and adjustment paths. Relatedly, the social and political vulnerabilities of peripheral regions are largely neglected – vulnerabilities that can trigger populism, protectionism, or political interventions (see Leyshon, 2021, on uneven development and political backlash in the UK context)[34].

Relational economic geography, particularly approaches like the GPN inaugurated in the early 2000s (Ernst and Kim, 2002; Henderson et al., 2002), seek to address these limitations. The GPN perspective highlights the networked organization of economic activities across multiple scales and recognizes that GPNs are simultaneously economic, political, and cultural constructs determined by the decisions and strategies of a diverse range of actors – firms, states, labor, consumers, and civil society organizations (CSOs) (Coe et al., 2008) – not just impersonal economic forces. The concepts of embeddedness, power and value serve as the foundation for GPN analysis. Embeddedness refers to the ways in which economic activities are situated in social, cultural and institutional contexts

[34] In more recent columns (2022a, 2022b), Krugman acknowledges that while deep economic integration has reduced the likelihood of conflict in Europe's core, this is not necessarily the case at its periphery, and that national security considerations may now justify trade interventions to a greater extent than previously recognized.

(Granovetter, 1985). Power relates to the ability of actors to shape or control the dynamics within global production processes. It can take different forms (such as power over resources, organizational power or distributive power) and is typically asymmetrical, with certain actors (e.g. transnational corporations – TNCs or key institutional players) having more influence over the network than others. Value refers to the benefits, especially economic, that are generated, captured and distributed across different actors involved in global production.

Crucially, the very emergence of GPNs is rooted in the outsourcing and offshoring of production activities made possible by the shift toward export-oriented industrialization in most parts of the developing world, particularly from the 1970s onward. As a result of trade and financial market liberalization, a new international division of labor took shape, enabled by advances in transport, information, and communication technologies, allowing production processes to be fragmented and reorganized on a global scale. Against this background, examining the current retreat from trade liberalization through the lens of GPNs offers valuable insights into how such shifts may reshape global production and trade dynamics.

Over time, the GPN framework has evolved. Most notably, Coe and Yeung's (2015) GPN 2.0 theory advanced a significant conceptual step by theorizing the organizational dynamics of GPNs, enhancing the framework's ability to explain the causal links between global production network configurations and uneven territorial development within the global economy. GPN 2.0 highlights the competitive pressures or "drivers" confronting global lead firms and their suppliers, emphasizing the substantial risks of operating within an unpredictable transnational environment. It also advocates a clear focus on actor strategies, therefore capturing intentionality and agency while avoiding the simplistic assumption that firm behavior can be directly inferred from their

position within the network. Political context is not constrained to the regional scale – rather, regions must be placed and understood within different national (and indeed macro-regional) political and regulatory contexts.

In this vein, a brief overview of the wheat GPN provides essential context for the 2023 events (see Di Luigi et al., 2025). Since the nineteenth century, cross-border wheat trading has been dominated by four vertically and horizontally integrated trading houses ranking among the world's most profitable TNCs – Archer Daniels Midland, Bunge, Cargill, and Louis Dreyfus. These firms play a central coordinating role within the network, linking production, storage, transportation, processing and trade across jurisdictions, and their decisions shape the distribution of economic value and risk throughout the network. On the public side, key governments include major wheat producers and exporters such as the US, Russia, France, Argentina, Australia, and Canada. These countries also host the headquarters of key TNCs and financial and business services (FABSs) as well as the main financial centers for wheat derivatives trading. Ukraine also emerges as a critical note in the network, given its rapidly expanding export capacity over the past two decades. In this respect, the wheat GPN has undergone a significant rebalancing, with the EU, Russia, and Ukraine together more than doubling their combined share of global wheat exports between 2000 and 2022, approaching 50% based on USDA data. Labor consists primarily of agricultural workers in key production regions, with the majority of EU workers concentrated in Romania and Poland, which together accounted for over 35% of the EU workforce in crop and animal production in 2023 according to Eurostat data. CSOs operate at both local and global scale, reflecting the centrality of wheat to food security and its implications for less developed, wheat-importing regions worldwide.

The emphasis on states and relevant governments is crucial: while early formulations of Global Commodity Chains (GCCs) aimed to transcend state-centric accounts of production by illustrating how commodity chains cut across national borders (Hopkins and Wallerstein, 1986), more recent research has reasserted the critical role of the state in both Global Value Chains (GVCs) and GPNs. This focus – revitalized by the rise of "state capitalism" after the 2008-09 Global Financial Crisis and reinforced during the Covid-19 pandemic (Yeung, 2020) – echoes the longstanding argument that "*the state really does matter*" under economic globalization (Dicken, 1994, 2015) and draws on political economy approaches emphasizing the intertwined nature of economic and political processes in constituting GPNs (Jessop, 2007). States are actively and directly involved in the formation and functioning of GPNs (Smith et al., 2002; Gereffi and Mayer, 2006; Glassman, 2011; Smith, 2015; Horner, 2017) and are increasingly being recognized as "*a key actor in GPNs*" (Coe et al., 2008, 282).

In practice, however, many GPN analyses tend to underestimate these issues, with the role of the state often emerging as a missing dimension in the framework (Yeung, 2020). The complex negotiation dynamics between states and firms have largely been explored through approaches like the "developmental state" literature, which remains state-centric and territorially trapped – although recent efforts to reframe the developmental state from strategic-relational and multi-scalar perspectives are noteworthy (Glassman, 2018; Glassman and Choi, 2014; Hwang, 2016; Sonn and Hsu, 2022). Eckhardt and Poletti (2018) argue that while significant attention has been devoted to intra-chain governance – that is, how organize cross-border production –, the influence of external institutional forces on structuring chain dynamics remains surprisingly underexplored. According to Yeung (2020), a comprehensive analysis of GPNs must

explicitly examine how state actions influence, disrupt, or reshape the competitive logics underpinning these networks.

To address this, leveraging the GPN 2.0 framework, the subsequent analysis takes states as its analytical node and treats them as active agents rather than mere contextual factors, focusing on the motivations for their behaviors and the implications thereof. While doing so, it considers both domestic politics and the international political economy of cross-border production networks, thus reinforcing the growing recognition of geopolitics as a central dimension in GPN research and regional studies (Harvey, 2003; Pavlínek, 2024; Yeung, 2024; Selwyn et al., 2025). As Yeung (2023) argues, the global economy can no longer be analyzed without acknowledging the deep entanglements between geopolitics, state power, and economic organization. Responding to this call, this paper adopts a "geopoliticized" perspective that considers not only the state, but also the ways in which international governance and supranational institutions shape GPNs.

Importantly, the paper extends the analysis of extra-firm relationships introduced by Coe and Yeung (2015), emphasizing adaptation as a distinctive strategic response. Within the GPN 2.0 framework, strategic coupling is not a static or predetermined equilibrium. Rather, firm-level value capture trajectories emerge empirically from the strategies pursued by individual firms and other non-firm actors within specific GPNs. These strategies, in turn, reflect collective responses to dynamic drivers, including the imperative to manage risk in an increasingly uncertain global economy. Adaptation – defined as "*a movement towards a pre-conceived path in the short run, characterized by strong and tight couplings between social agents in place*" (Pike et al., 2010, 62) – represents a strategic option available to different actors navigating these challenges, although the capacity to adapt and the effectiveness of such strategies vary across scales and actor types – a gradient that will be explored in greater detail below. While the

concept of adaptation has been widely employed by evolutionary economic geographers (ibid.; Boschma, 2014), it has not been previously applied within the GPN approach as far as is known.

5.3 A GPN perspective on the bans against Ukrainian imports

The Russian invasion of Ukraine in February 2022 disrupted exports, destroyed infrastructure, and displaced workers, causing immediate shortages and sharp spikes in global food prices. The impact was particularly pronounced in the international wheat market, given the combined significance of Ukraine and Russia, which together account for a substantial share of global wheat exports as noted earlier. The resulting logistical bottlenecks and market uncertainties – compounded by already elevated food prices in early 2022 due to high fertilizer costs and pandemic-related supply chain disruptions – pushed the global wheat price for the 2022 trade year up by 31.8% compared with the 2000–2020 average (Kuhla et al., 2024). As traditional trade routes were disrupted, benchmark price providers such as Platts played an increasingly important role in price discovery and supporting commercial decision-making by providing a common pricing reference for market participants navigating fragmented supply chains and alternative sources of supply. This function was particularly relevant to over-the-counter (OTC) transactions, which remain important in Eastern European grain markets, where physical trades are often negotiated bilaterally and market conditions can vary considerably across locations. At the same time, exchange-traded derivatives, including those listed in Paris, provided market participants with instruments to hedge price exposure and manage the heightened uncertainty associated with rapidly changing trade flows.

Wheat prices began to stabilize around June 2022, coinciding with the wheat harvest season in the US and the EU. Strong harvests helped relieve pressure on international markets (Hopewell and Margulis, 2023), while two multinational initiatives dampened the decline in Ukrainian exports. The UN- and Turkey-brokered Black Sea Grain Initiative allowed Ukraine to resume shipments from the Black Sea ports of Odesa, Chornomorsk and Yuzhne starting in July 2022. At the same time, the EU's Solidarity Lanes Initiative launched in May 2022 by the EC facilitated exports via rail, road, and river routes, including the Danube, through its western borders. According to UN and EC data, until Russia withdrew from the Black Sea Grain Initiative in July 2023, these channels enabled Ukraine to export more than 32 million metric tons of grains and other agricultural products within a year; meanwhile, between May 2022 and January 2024, the Solidarity Lanes Initiative facilitated exports of grain, oilseeds, and related products totaling nearly 64 million metric tons over the period.

Figure 5.1 *Global grain prices from 2021 to mid-2023 (basis January 2000 = 100)*



Source: European Council, using International Grains Council data.

While both initiatives helped mitigate global wheat price spikes (see Figure 5.1), the Solidarity Lanes Initiative in particular faced opposition from some EU Member States, prompting them to pursue unilateral measures. The following paragraphs provide a detailed account of these actions – summarized in Figure 5.2 – and examine the underlying political and institutional factors.

Figure 5.2 *Timeline of major events in EU-Ukraine wheat trade, 2022-2023*

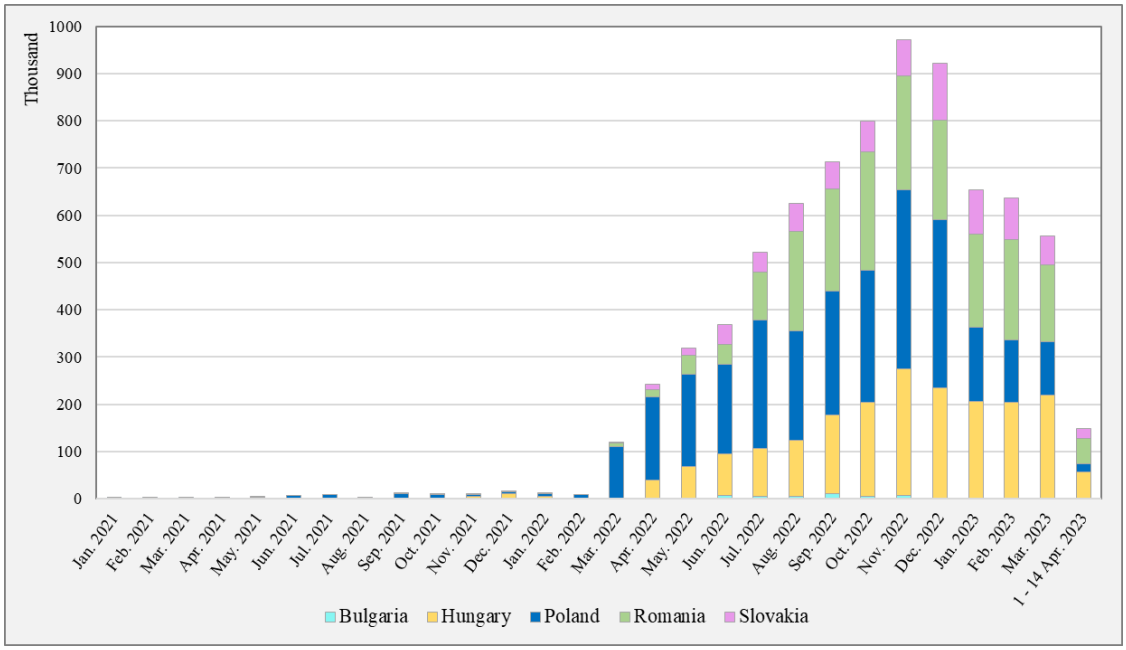


5.3.1 EU Member States' unilateral actions

At the end of March 2023, at the initiative of Poland's Prime Minister Mateusz Morawiecki, the heads of government of Poland, Hungary, Romania, Bulgaria, and Slovakia sent a joint letter to the EC calling, amongst others, for additional EU funding to support domestic agricultural producers affected by market disruptions caused by a surge in Ukrainian imports (Radev et al., March 2023). Following the lifting of tariffs under the Solidarity Lanes Initiative, Ukrainian agricultural products had flooded their markets (Figure 5.3). In the letter, the five Prime Ministers warned that "*difficulties have*

arisen in disposing of the surplus cereals in storage, thus destabilizing the cereals […] market, especially for wheat […], and imposing additional costs on agricultural producers", and urged the Commission to approve their proposed measures without delay. However, without waiting for the Commission's full response, Poland was the first to move unilaterally by introducing an immediate import ban on 15 April 2023, a few days after widespread farmers' protests in the country, and was soon followed by Hungary and the other concerned Member States.

Figure 5.3 *Imports of cereals from Ukraine into frontline Member States (tonnes)*



Source: European Commission.

As a matter of fact, while lower restrictions to trade could benefit major actors like TNCs controlling wheat trade and help stabilize the global wheat price to the benefit of importing regions, the unilateral bans on Ukrainian grain imports reflect first and foremost how the abovementioned countries prioritized protecting the value generated by

their agricultural sectors, which are deeply embedded and politically sensitive at the national level. The farm sector holds significant economic relevance in many Eastern European countries. According to Eurostat data, in 2020 the five concerned Member States accounted for approximately 34% of EU cereal production for grain (a share that has remained largely stable in subsequent years). The proportion of the workforce employed in agriculture was notably high in Romania (20.9%), Bulgaria (16.6%) and Poland (9%), compared with the EU average (4.2%).

This goes hand in hand with the disproportionate political weight of the agricultural sector: agricultural lobbies are highly organized in the EU and farmers represent an important electoral constituency in Eastern Europe (Savage et al., 2024). Especially in Poland, with parliamentary elections approaching, the ruling Law and Justice Party (PiS), long associated with a pro-rural attitude, faced mounting pressure to protect domestic agriculture, which plays a critical role in Poland's economy and political landscape (Minder and Erling, 2023). The import bans were intended to stabilize domestic markets and secure support from farming communities, representing a key voter base. The logic is hardly new: as Eichengreen (2001) observed in his account of the Smoot-Hawley tariffs, agricultural protectionism often emerges when politically influential rural sectors mobilize to defend their livelihoods[35].

Another relevant insight on the origins of the ban emerges from considering why Member States did not wait for a response from the EC before introducing the bans. This appears to be linked to increased uncertainty around the role of the EU as a supranational institution, and particularly to the process of political fragmentation and the strengthening of nationalist movements after the Eurozone and Global Financial crises (Crescenzi et al.,

[35] See also Krugman (2025a, 2025b).

2020). These crises eroded confidence in the EU as a supranational entity capable of integrating national concerns in a timely and systematic manner to deliver economic and political stability. Perceptions that supranational institutions both inadequately deliver public goods and contribute to the reproduction of unequal economic and political structures have brought their legitimacy into question – where legitimacy is understood as being conferred by society and/or its representatives in line with desired goals and objectives (Clark and Dear, 1984).

Consequently, Member States have increasingly prioritized national policy agendas over collective EU initiatives, particularly when these are perceived to undermine domestic interests. Signs of hyper-nationalism have long been evident across the former communist states of Eastern Europe (Brenner, 1993). In Hungary and Poland, nationalist and populist governments have consistently framed their policies as defenses of national sovereignty against Brussels' interference. Prime Minister Orbán's national-populist adaptation of neoliberalism (Scheiring, 2022) fits within this narrative, as does the PiS' discourse on food sovereignty. In Slovakia and Bulgaria, too, the rise of populist parties (such as Smer-SD and Revival) has heightened political sensitivity to EU influence. Against this backdrop, unilateral trade measures became an opportunity to assert national leadership and reclaim policy autonomy amid perceived EU inaction.

Nationalist impulses were further reinforced by social unrest and historical grievances. The influx of Ukrainian agricultural products triggered protests from local farmers, who argued that unfair competition was threatening their livelihoods. These protests often highlighted deeper concerns about the sustainability of local farming practices and the long-term viability of rural communities under global competition (Vigani et al., 2024). Governments justified the bans as necessary to prevent social instability and protect vulnerable economic sectors. In Poland, farmers' protests drew

widespread attention, with many accusing the government of failing to defend national interests against external pressures. The tensions also underscored the broader societal challenges posed by the war in border regions where economic and social ties with Ukraine are most pronounced. Prime Minister Morawiecki's remarks on the unresolved legacy of the Volhynia massacres exemplify how national identity and historical memory can resurface in contemporary policy debates (Chancellery of the Polish Prime Minister, 2023). Likewise, Hungary's strained relations with Ukraine – exacerbated by disputes over minority rights in Transcarpathia – fed into narratives of national victimhood and external interference.

Overall, this reconstruction supports the view that, among the various competing interests shaping policy, those of national representatives are particularly relevant. These representatives tend to pursue electorally rewarding arrangements that favor specific constituencies, often without fully accounting for broader or longer-term consequences, which frequently results in excessive or poorly targeted intervention. From this perspective, governments are not neutral custodians of the national interest but arenas in which contending social forces and interest groups negotiate and consolidate influence. By strategically navigating competing pressures, including domestic political imperatives and constraints imposed by EU norms, and determining which interests are prioritized, governments actively shape the direction of economic intervention.

While resting on the simplifying – yet analytically useful – assumption of a partial conflation between governments and states, it follows that states retain significant agency in shaping economic outcomes. The unilateral bans imposed by EU Member States are a clear manifestation of extra-firm bargaining involving actors at different scales of governance and authority (Coe and Yeung, 2015), and particularly exemplify how states continue to leverage their regulatory capacity to protect strategically important domestic

sectors despite institutional constraints (see Horner, 2017, on the resurgence of state's regulatory role in GPNs after the neoliberal era), as well as how distributional conflicts at the national level can translate into fragmentation and contestation within the regional and global economy.

5.3.2 The EU-level response

Right after their introduction, the EC reacted by strongly criticizing the unilateral measures adopted by Poland and the other Member States, which threatened to undermine both the Single Market's legal framework and the solidarity measures taken to support Ukraine. The Commission emphasized that trade policy decisions, especially involving non-EU countries like Ukraine, must be coordinated at the EU level to ensure the consistency and effectiveness of the Common Commercial Policy (Minder et al., 2023). Nonetheless, intense political pressure in the five concerned Member States forced the EC to balance enforcement of EU law with the need to maintain political cohesion.

In response to escalating tensions, the Commission eventually sought a pragmatic solution. On 19 April 2023 it announced a second tranche of agricultural financial support for affected farmers, exceptional safeguard measures on key products and measures to facilitate the transit of Ukrainian grain exports via the solidarity lanes subject to Member States lifting their unilateral bans (European Commission, 2023a). Following the deal reached with Poland, Hungary, Romania, Bulgaria and Slovakia on 28 April, on 2 May 2023 transit measures were introduced under the exceptional safeguard of the Autonomous Trade Measures Regulation as "*necessary given the exceptional circumstances of serious logistical bottlenecks experienced in five Member States*" (European Commission, 2023b). These measures permitted the continued flow of

Ukrainian agricultural products (including wheat) through the EU, but restricted their final sale within the five affected countries, preserving the Solidarity Lanes Initiative while protecting domestic markets. According to European Commissioner for Agriculture J. Wojciechowski (2024), this was the first such regional ban in the history of the EU's common market. The day after, on 3 May 2023, the Commission further proposed a €100 million support package for cereal and oilseed producers in the five frontline States (European Commission – Agriculture and rural development D.G., 2023), aimed at compensating farmers for their losses and mitigating the economic impact of the market imbalances.

As much as the unilateral bans reflect a struggle over value capture at the national level, the negotiation on compensation packages for farmers and the introduction of transit measures reflect a broader contest for influence between Member States and the EC, highlighting how power relations are negotiated and renegotiated in global and regional networks. Agriculture has always been a particularly sensitive issue in the history of European integration (Josling and Swinbank, 2013), at the center of contestation between states and the EU, as the territorial embeddedness of agricultural activities is difficult to reconcile with the supranational cross-border vision. As an example, recall the so-called empty chair crisis of 1965, where the proposal to increase the powers of the European Parliament and the Commission itself in the context of the Common Agricultural Policy reform was seen by France (a top wheat producer) as undermining its national sovereignty. After a boycott of intergovernmental meetings in Brussels by French ministers for seven months, the crisis was resolved with the 1966 Luxembourg Compromise, which allowed Member States to retain an informal veto on important national interests. About thirty years later, in 1997, another case arose when the European Court of Justice ruled that France had failed to fulfill its obligations under

EU law by not taking adequate and proportionate measures to prevent private individuals, including farmers, from violently obstructing the free movement of agricultural goods from other Member States. The judgment underscored Member States' responsibility to protect the free movement of goods, even when disruptions arise from the actions of private citizens.

Now, thirty more years have passed, and the EU's reaction has been markedly different. By compensating farmers and managing trade flows, the EC attempted to stabilize local economies while maintaining the principles of the Common Commercial Policy. Two key explanations help to account for why the Commission chose this pragmatic approach, which ultimately sets a risky precedent for the functioning of the EU by establishing a form of reversed conditionality, whereby Member States violating their obligations are granted concessions to end their infringements.[36]

First, while unilateral decisions by EU Member States largely reflected multi-scalar influences involving local farmer lobbies, it is well possible – although evidence is lacking – that large TNCs lobbied relevant institutions and trade bodies to mitigate the impacts of the bans, pushing for smoother trade regulations and policy clarity. As key global food supply chain players, TNCs have a vested interest in avoiding prolonged disruptions that could complicate logistics in European grain markets or generate

[36] A concurrent factor may have been the role of J. Wojciechowski, the Polish Commissioner for Agriculture, whose national background may have lent additional weight to the position of the five Member States and softened the Commission's response. Wojciechowski publicly supported extending the import bans and voiced strong concern for farmers in those countries, going so far as to draft his own, unsolicited food security law in an apparent effort to appeal to agricultural constituencies (Ford and Wax, 2024) – though this cannot be taken as conclusive evidence of bias.

financial losses, and generally favor predictability and uniformity in trade policies to ensure efficient operations and reduce risks. Major grain traders such as Cargill and Bunge have invested billions of dollars since the early 2000s in storage, processing and logistics facilities in Ukraine (Olearchyk, 2012; Cargill, 2021). Given their scale and influence, these companies may have engaged in behind-the-scenes discussions with national governments and the EU, advocating a coordinated EU-wide policy. This would align with the argument that "*pressures exerted by TNCs on states for greater integration of regional economic spaces may, in some cases, help to speed up the process of political integration*" (Coe et al., 2008, 284). Once more, this interpretation rests on the simplifying assumption of conflating the EU as a supranational institution with its constituent bodies.

Above and beyond that, however, devising a swift solution to address the concerns of the complaining Member States was essential to avoid internal divisions and to protect the EU's legitimacy – and, by extension, its survival as an institution. From this perspective, the 2023 events expose the limitations of supranational governance in managing regional disparities and their ability to adapt. The EC's adaptation should here be interpreted as an effort to offer more flexibility to national policies, especially towards countries that face asymmetric shocks or challenges, while maintaining clear boundaries and objectives and managing underlying legitimacy pressures arising from perceptions of distance from societal and national concerns – a key factor for its future success according to Crescenzi et al. (2020). More broadly, the basic architecture and scope of regional trade agreements are generally agreed by single political leaderships, with few, if any, planned occasions to revisit the status quo. As Keohane (1984) argues, such design reflects deliberate "lock-in" choices, whereby participants accept certain negative effects in the light of larger positive ones. However, it is almost inevitable that, over time,

(temporal) misalignments will emerge between individual Member States' objectives and the larger collective interests on certain issues, requiring revision by the supranational institution (see also Duina and Buxbaum, 2008).

As noted above, the political fragmentation and growth of nationalistic movements that emerged after the Eurozone and Global Financial crises have raised doubts about the EU's effectiveness as an internationalization initiative capable of providing supranational stability, reducing uncertainty and ensuring the growth of its members (Crescenzi et al., 2020). To reconcile the national protectionist policies with the need for collective action in support of Ukraine, the EC opted to accommodate the interests of the five affected Member States by adopting measures in their favor (rather than penalizing them for going against critical tenets of EU law) while pretending that they lifted their unilateral measures, reaffirming its commitment to sustaining Ukraine's grain exports to ensure global food security and reiterating in multiple occasions the importance of the core value of solidarity (European Commission, 2023b; 2023c) – "*not only with our international partners, but also within the European Union*" (Wojciechowski, 2023).

The Commission's response looks also aligned with broader institutional initiatives aimed at enhancing the ability to withstand external shocks (Yeung, 2024) and, in particular, with the EU's efforts to strengthen its economic resilience under the "open strategic autonomy" doctrine – itself an outcome of increased uncertainty determined by the Covid-19 pandemic and mounting geopolitical tensions (European Commission, 2021b). At its core, the doctrine seeks to ensure that the EU builds domestic capacities to guard against external shocks and disruptions to established GPNs while remaining open to international opportunities. The concept of open strategic autonomy highlights the need for the EU to leverage its strengths – in this case, the agricultural sectors of Eastern Member States – while engaging constructively with global partners.

Recent developments reinforce the validity of this interpretation. In June 2025, the EU announced new quotas resulting in an up to an 80% cut in imports of Ukrainian wheat to address mounting concerns from farmers, again mostly in Poland and Hungary, struggling with rising production costs, strict environmental rules and fears about competition from the planned EU-Mercosur trade deal (Payne and Trompiz, 2025). This move set the stage for renewed negotiations between the EC and Ukraine over the terms of the 2016 EU-Ukraine Deep and Comprehensive Free Trade Area, which culminated in October 2025, when the Council of the EU (2025) announced a revised agreement reducing or eliminating customs duties on several agri-food products. The outcome represents a delicate middle ground – balancing the full tariff suspension introduced after Russia's 2022 invasion with the restrictions reinstated under pressure from Eastern Member States – and, again, reflects the EU's effort to sustain political and economic support for Kyiv while managing domestic tensions within the Union.

5.3.3 Adaptation as a strategy

Building on the preceding analysis, Table 5.1 illustrates how the 2023 bans on Ukrainian imports introduced an additional layer of fragmentation to the wheat GPN, compounding the disruptions caused by the war in Ukraine, and how actors across multiple scales adapted in the short term. Global trading firms navigated successive revisions to trade routes and rapidly adjusted their logistics to maintain continuity in supply chains. EU institutions initially adopted policies to preserve trade flows from Ukraine and subsequently revised them to accommodate the needs of Eastern Member States. The unilateral import bans themselves constituted a rapid response by these states to mounting domestic pressure from agricultural producers confronted with a sudden and massive influx of Ukrainian wheat.

Table 5.1 *Multi-scalar responses to the 2023 Ukrainian wheat import bans: a GPN disruption-adaptation matrix*

Scale / Level	Key actors	Type of disruption	Capacity for adaptation
Global	Global traders (e.g. Cargill, Bunge)	Russia–Ukraine war disrupting Black Sea routes and creating volatility in global grain prices; sanctions and import bans	🟡 🟢 **Medium–High** Global networks and logistical flexibility allow adjustment, despite some structural reliance on Black Sea routes; significant lobbying capacity
Regional (EU)	EU institutions	Russia-Ukraine war disrupting trade routes and established norms of international cooperation; unilateral import bans challenging EU trade competence	🟡 🟡 **Medium** Initially implemented measures supporting global trade and later crafted temporary compensation and derogation mechanisms to address Member States's concerns (need for consensus)
National	Governments of Poland, Hungary, Romania, Bulgaria, Slovakia	Social unrest; pressures from farmers' lobbies; domestic political gains vs. breach of EU trade unity	🟡 🔴 **Medium-Low** Quick political responsiveness and enforcement of bans, but measures are driven by domestic politics rather than long-term economic optimization; constraints placed by EU norms
Sub-national	Farmers and their associations	Sharp increase in grain prices; market access disruption	🔴 🔴 **Low** Some adaptation possible through storage, stock management and lobbying, but highly dependent on policy decisions (responses are mostly reactive); protests as coping mechanisms

The reconstruction of the 2023 events presented in Table 5.1 reveals a declining gradient of capacity for adaptation from the supranational to the local level. Large trading firms and supranational institutions exhibited the highest capacity for adaptation, benefiting from extensive resources and institutional leverage allowing them to absorb shocks and reconfigure operations efficiently. By contrast, national governments and local producers faced constraints imposed by higher levels of governance and immediate market pressures, limiting the range and flexibility of their responses. At the same time, this reconstruction highlights the agency of states to reassert their regulatory influence –

not just as merely reactive, but as shaping the environment in which supranational institutions operate. Supranational adaptation thus emerges as a strategic process, balancing regulatory objectives with the need to preserve consensus across Member States.

Recognizing the interactive, multi-scalar nature of adaptation and the uneven distribution of adaptive capacity is essential for devising effective strategies to enhance the resilience of GPNs in the face of systemic shocks. From this perspective, moving beyond a lead-firm focus and paying closer attention to extra-firm bargaining becomes crucial: under conditions of heightened uncertainty and risk, effective adaptation across sourcing, production, and value creation requires integrating the actions of the entire network, not solely those of dominant actors (see Völlers et al., 2023; Di Luigi et al., 2025).

5.4 Conclusions

This paper draws on the GPN framework to offer new insights into trade decision-making amid growing trade uncertainty, offering a critical analysis of the 2023 unilateral import bans on Ukrainian wheat imposed by five EU Member States. By adopting a multi-scalar approach, it foregrounds the inherent tensions within multi-level governance – particularly the interplay between national and supranational institutions – and highlights the role of various actors in influencing trade decisions, while situating them within broader geopolitical contexts. In doing so, it addresses key limitations of traditional NEG approaches while contributing to the ongoing theoretical and empirical development of GPN research.

The analysis emphasizes the agency of states, portraying them not merely as reactive to market pressures, but as active decision-makers influenced by concurrent contextual factors. A primary driver behind the actions of EU Member States has been the willingness to preserve a deeply embedded, politically sensitive, and value-generating sector like agriculture, under immediate domestic pressures. In contrast, the EC's response illustrates the complex position of supranational institutions, which must simultaneously navigate national interests, broader geopolitical agendas, and the imperative to foster regional resilience and to safeguard their legitimacy.

Uncertainty emerges not only as a structural condition shaping both the skepticism among Member States toward the EU as an institution and the EU's own strategies for navigating an increasingly volatile environment, but also as a by-product of the observed dynamics. Specifically, the case demonstrates how states can reconfigure GPN topologies in a multipolar world, introducing greater unpredictability into global trade patterns. While Member States may act to protect their domestic value chains, the fragmentation resulting from unilateral actions weakens the EU's bargaining power and centrality within the wheat GPN. The paper thus underscores the need for supranational institutions to strike a balance between fostering regional resilience and remaining responsive to national level pressures.

The resilience of GPNs represents a promising and necessary direction for future research. As unilateral trade measures reshape globalization, the idea of networked global production systems risks losing meaning, making this issue central to economic geography. The ability not only of firms and industries but also of institutions to adapt to political disruptions, including sudden trade policy shifts, highlights the inherently dynamic and flexible nature of GPNs. These adaptive processes, however, are difficult to predict, have uncertain long-term consequences and raise important questions about

distributional outcomes – particularly, who benefits and who is left vulnerable in moments of disruption. Further empirical studies could investigate the mechanisms of network adaptation, the formation of new trade routes, and the socio-economic distributional effects of such disruptions across actors and regions.

Regarding the specific case addressed in this paper, while future EU accession negotiations concerning the Common Agricultural Policy chapter are likely to prove highly contentious, the wheat trade may undergo significant reconfiguration if Ukraine becomes increasingly disconnected from the EU market. This could spur the development of new trade routes or partnerships, potentially reshaping the geography of wheat trade. In such a scenario, the EU's centrality in this sector may decline, while Ukraine could strengthen its commercial ties with non-EU regions such as Africa or the Middle East, reflecting a broader shift in both trade patterns and geopolitical alignments. At the same time, the recent EU-Mercosur trade deal could create new incentives for EU Member States further affecting network configurations and the strategic calculus of national and supranational actors.

These processes of geographical and political reconfiguration also bring the institutional architecture of agricultural market coordination in Eastern Europe into sharper focus. While OTC transactions can provide flexibility during periods of disruption and may draw on established benchmark providers such as Platts, their reliance can also increase opacity, making price formation and market conditions more difficult to observe across increasingly fragmented markets. This points to the potential value of a more publicly accessible benchmark for wheat and other strategically important agricultural commodities. Such a development, however, needs to be considered alongside the longstanding debate over the relative merits of decentralized OTC trading and greater centralization of price discovery, including through established European

commodity-market centers such as Paris. Consistent with the analysis presented in this paper, this is not merely a technical or market-design question, but also an inherently political one. Greater centralization of price discovery could be perceived by national governments and market actors as a further transfer of influence away from domestic markets and institutions. The institutional organization of price discovery can thus itself become a site of political contestation, in which questions of market transparency and efficiency intersect with broader concerns over sovereignty, bargaining power and control.

More broadly, the growing fragmentation of global production, driven in part by the rise of unilateral policies, raises serious questions about the future of multilateralism. The increasing tendency of states to prioritize national or regional interests over global cooperation reflects a structural transformation in the governance of international trade. This dynamic is particularly visible in the evolving trade relations of major powers such as the US and China. While the broader implications of this geopolitical shift and the evolving role of institutions like the WTO fall beyond the scope of this paper, they remain critical to understanding the future of global economic governance.

Finally, the role of coalition-building within fragmented regulatory and political landscapes emerges as another relevant area for further inquiry. The collective action taken by Eastern Member States achieved what individual states – such as Poland – could not accomplish alone. This example illustrates the growing importance of regional coalitions within larger supranational frameworks like the EU. It also underscores the need for EU institutions to more fully account for intra-regional dynamics and the strategic behavior of Member State coalitions when designing and implementing policy responses.

Chapter 6: Conclusions

6.1 Restatement of findings

This thesis sets out to examine commodities markets, and particularly the global wheat market, though an analytical lens situated at the intersection of economic geography and finance. Across the three papers, the findings collectively highlight the centrality of risk and uncertainty in shaping both the structural configuration and temporal evolution of the wheat Global Production and Financial Network (GPFN).

The first paper demonstrates that the wheat GPFN can be conceived as a means to manage transaction costs, risk, and uncertainty. The observed concentration of key nodes and the dense interlinkages within and between production and financial networks are not incidental but rather reflect deliberate strategies by market actors to stabilize exchanges in a volatile environment. The paper also shows that the configuration of the wheat GPFN is dynamic and historically contingent. Structural transformations – most notably the shift of futures trading from Chicago to Paris – are interpreted as outcomes of both exogenous geopolitical developments and endogenous adjustments by market participants. These changes reflect efforts to enhance spatial and functional integration while improving the management of risk and uncertainty. The rise of Paris as a core financial hub for wheat futures trading illustrates the importance of proximity to production regions (such as France, Ukraine and Russia) and underscores the predominantly supply-driven nature of the wheat network. At the same time, it highlights

the growing centrality of the EU in global wheat trading within the broader trajectory of European financial integration. More broadly, this finding challenges the presumed enduring dominance of traditional Anglo-American financial centers and points to a more fluid and contested global financial geography.

The second paper complements this structural perspective by empirically demonstrating the significant role of geopolitical uncertainty in shaping wheat futures prices. The results indicate that increases in geopolitical uncertainty exert a positive, statistically significant, and persistent effect on prices across markets. The temporal dynamics of this relationship are characterized by a hump-shaped response, with effects peaking within two to three months and dissipating after approximately four to five months. Furthermore, geopolitical shocks account for a meaningful share of price variability, underscoring their quantitative importance. Importantly, the analysis reveals that the impact of geopolitical uncertainty is uneven across time and events. This variation suggests that not all geopolitical events are equally relevant for commodity markets. Events that directly or indirectly affect the supply side of the wheat market – such as the war between Russia and Ukraine, both major wheat exporters – have far greater consequences than those primarily affecting demand. At the same time, the findings indicate that market participants are unable to fully hedge against uncertainty, which becomes embedded in price expectations. There is no evidence of a significant difference in market efficiency between the US and EU markets, which is consistent with a high degree of financial integration.

The third paper reinforces the political dimension by examining the role of state actors and institutional dynamics within the wheat Global Production Network (GPN). The case of unilateral import bans on Ukrainian grain illustrates how national

governments may prioritize short-term domestic interests – particularly in politically sensitive sectors such as agriculture – over broader collective or geopolitical objectives. This behavior highlights the continued importance of state agency in shaping network configurations and reveals how national interventions can fragment established trade relations, thereby increasing regulatory uncertainty and complexity. Moreover, the analysis points to a misalignment between supranational governance and national preferences within the EU: while the EU initially pursued policies aimed at facilitating Ukrainian exports, the subsequent need for compromise reflects an adaptive institutional response to internal tensions. This finding challenges the assumption that adjustment pressures operate primarily at the national level and instead emphasizes the reciprocal need for flexibility at the supranational level. The EU's ability to reconcile divergent interests among its member states emerges as a critical factor in maintaining both the coherence of the network and the legitimacy of the institution, while also reflecting ongoing efforts to preserve the benefits of integration.

Taken together, these findings underscore the multifaceted nature of the global wheat market. Its structure and evolution are shaped not only by economic and financial considerations, but also by geopolitical forces and political decision-making across multiple scales. The interaction between these dimensions produces a network that is both highly interconnected and potentially vulnerable to disruption, requiring strategic responses by market participants and policymakers alike. Such responses may take the form of adaptation, particularly in the face of heightened uncertainty, but can also involve more structured efforts to anticipate, manage and reduce exposure to disruptions. This includes seeking to transform uncertainty into more assessable and manageable forms of risk through improved information, monitoring and scenario planning, while simultaneously strengthening the resilience of the wheat GPFN through, for instance,

diversification of supply sources and trade routes and redundancy in critical network connections. In this respect, resilience-building need not be conceived as a response to an imminent systemic shock, particularly over the short to medium term, but rather as a gradual and cumulative process through which the network's existing flexibility can be strengthened over time.

6.2 Contributions to the literature

This thesis contributes to several interconnected strands of literature in economic geography and finance, particularly those concerned with GPNs, Global Financial Networks (GFNs), market governance, and the spatial organization of risk and uncertainty. Rather than treating these bodies of work as separate, it brings them into dialogue through an empirically grounded analysis of the global wheat market.

First, the thesis contributes to the literature at the intersection of GPNs and finance by advancing understanding of how production and financial networks are co-constituted in practice. While the GFN literature conceptualizes global finance as operating through a distinct set of network structures, and GPN research has traditionally focused on the organization of production, this thesis demonstrates that these two domains are deeply intertwined. Following Grote, Wójcik, and Zook (2023), it shows that global commodity markets are better understood through an integrated GPFN perspective, where financial and productive logics interact continuously rather than operate in parallel. By extending the GPFN framework with institutionalist concepts, this thesis strengthens its explanatory capacity in the spirit of GPN 2.0 research, seeking to uncover the causal mechanisms through which institutions and informational infrastructures shape interactions between physical and financial circuits.

Second, the thesis extends Global Value Chain (GVC) and GPN research on commodity markets by offering a detailed, sector-specific analysis of wheat. While previous studies have examined the role of derivatives trading in tropical agricultural commodities (Bargawi and Newman 2017), less attention has been given to temperate staple crops such as wheat, despite their systemic importance for global food security and macroeconomic stability. By focusing on wheat, the thesis shows that commodity-specific characteristics – such as storage conditions, production cycles, geopolitical sensitivity, and the structure of global trade flows – matter significantly for how production and financial networks interact. This sectoral focus also reveals how different commodity regimes generate distinct forms of market organization, risk exposure, and institutional governance, thereby reinforcing the importance of moving beyond generalized accounts of "commodity markets" within economic geography. More broadly, the analysis highlights the continued relevance of a commodity that has long occupied a central place in the historical evolution of economic and financial systems, yet has received surprisingly limited attention within contemporary economic and financial geography.

Third, the thesis makes a significant contribution to GPN 2.0 debates by foregrounding the role of states and supranational institutions in shaping the evolution of global networks. Much of the GPN literature has focused on firm-level governance, particularly how lead firms coordinate production and influence upgrading processes in supplier regions (Coe and Yeung, 2015). However, less attention has been paid to the active role of states, trade policy, and institutional environments in shaping network dynamics (Coe et al., 2008; Eckhardt and Poletti, 2018; Yeung, 2020). This thesis addresses this gap by demonstrating how state interventions – particularly in the form of trade policy measures – directly reshape commodity flows and reconfigure network

relations. It also highlights the importance of supranational institutions, particularly the EU, in mediating these processes. In doing so, it emphasizes that GPNs are not only firm-led but also deeply embedded in evolving political and institutional contexts.

Fourth, the thesis makes a conceptual contribution by developing adaptation as a central analytical category within GPN 2.0. While existing literature has largely emphasized incremental change, strategic coupling, and firm-led upgrading, this research shows that contemporary commodity networks are increasingly shaped by abrupt, politically induced shocks that require rapid and multi-scalar responses. Adaptation, in this context, is not merely reactive but constitutive of how actors navigate uncertainty across interconnected production and financial systems. By situating adaptation alongside risk and uncertainty, the thesis highlights how firms, financial intermediaries, and public institutions continuously adjust strategies in response to evolving geopolitical and market conditions. This reframes GPN evolution as a more dynamic and politically contingent process than traditionally assumed.

Fifth, the thesis contributes to the literature on Global Wealth Chains (GWC). A key insight from this body of work is that global economic networks are not only systems of production and exchange but also mechanisms through which wealth is created, captured, and redistributed across space (Seabrooke and Wigan, 2014; Wigan et al., 2024). By focusing on commodity derivatives markets, this thesis shows how financial instruments linked to wheat function as channels for wealth accumulation, concentrating value in a limited number of nodes within global networks. In doing so, it extends existing GWC analysis beyond its traditional emphasis on corporate structures and tax planning, demonstrating how financial market participation itself can shape distributional outcomes. This perspective highlights that commodity futures markets are not neutral

price discovery mechanisms, but also sites of asymmetric value capture embedded within broader global financial architectures.

Finally, the thesis contributes to emerging research on asset pricing, geopolitical risk, and the informational dynamics of financial markets. In particular, it engages with literature examining how geopolitical uncertainty and news flows affect asset prices and the cross-border transmission of financial shocks (Aizenman et al., 2023; Hao et al., 2023; Hassan et al., 2024). By focusing on wheat futures markets, the analysis shows how geopolitical developments – such as conflicts, trade restrictions, and policy interventions – become embedded in price formation processes and how uncertainty is translated into market behavior. In this sense, the thesis connects political economy perspectives with financial market microstructure, showing how global political events are continuously incorporated into commodity pricing dynamics.

These contributions collectively advance an integrated understanding of commodity markets as socio-spatial systems where production and finance are tightly interwoven. The thesis demonstrates that risk, uncertainty, and value are not evenly distributed, but are instead continuously produced and reshaped through the interactions of firms, financial actors, and states, all operating against the backdrop of existing and evolving institutional arrangements across global networks.

6.3 Implications for public policy

This thesis carries important implications for public policy, particularly in relation to the governance of commodity markets, the regulation of financial infrastructures, and the broader evolution of global trade and institutional frameworks. In reflecting on these

implications, I am mindful both of their wider significance for policymakers and of the specific insights they offer from the perspective of a central bank professional.

One key set of considerations concerns the organization and distributive consequences of global commodity networks. The wheat GPFN is characterized by a distinctive spatial configuration in which major producing and exporting countries – such as the US and France – also host key transnational corporations (TNCs), financial and business service (FABS) firms, and major financial centers where price discovery and derivatives trading occur. This differs from many other agricultural commodity networks, where value extraction is concentrated in financial hubs located outside producing regions. In the case of wheat, the primary concern is therefore not much on inter-country inequality in value capture, but also the high degree of concentration of market power within a limited set of advanced economies over a commodity that is central to global food security. This raises important normative and distributive questions, particularly concerning market governance and the accountability of key intermediaries and financial market infrastructures, with trading houses at the forefront.

The analysis further underscores the dynamic nature of the geography of GPFNs. Taking a forward-looking perspective, further integration within financial infrastructures – particularly through initiatives such as the EU's Savings and Investments Union – is likely to reinforce the centrality of hubs such as Paris in commodity-related financial activities. The thesis also highlights the continued strategic importance of the Black Sea region for global wheat markets. Ongoing negotiations over Ukraine's potential accession to the EU could significantly reshape wheat trade patterns: deeper integration might strengthen the role of European financial centers, whereas a looser integration could foster new trade routes toward regions such as Africa and the Middle East, altering

existing production and financial networks. Complementary developments, such as the EU–Mercosur trade agreement, may introduce additional incentives that further influence the configuration of these networks. Collectively, these dynamics point to a broader reconfiguration of global commodity trade, in which geopolitical considerations increasingly shape trade flows and the strategic behavior of actors across networks. At the same time, the thesis shows that what matters for the wheat GPFN is not only territorial change but also uncertainty surrounding production, exports, logistics, and policy responses. From this perspective, even a prolonged stalemate in the Russia-Ukraine conflict may continue to generate pressures for network adaptation and reconfiguration as long as uncertainty over these supply-side factors persists.

A third implication concerns the evolving balance between forces of integration and pressures toward fragmentation in global economic governance. The rise of unilateral policy measures and increasingly regionally oriented strategies suggests a structural shift away from multilateralism. This is particularly visible in the changing trade relations of major economic powers, including the US and China, and has renewed debate about the future role of institutions such as the World Trade Organization (WTO). At the same time, key empirical findings of this thesis point to the persistence – and in some cases even deepening – of political, economic and financial integration. Commodity markets, production systems and financial linkages remain highly interconnected, even as the governance frameworks that regulate them become more contested and selectively reconfigured. While a full analysis of these dynamics lies beyond the scope of this thesis, the discussion nonetheless highlights important issues of institutional legitimacy and adaptability. In particular, it underscores the need for supranational and global institutions to more fully account for and incorporate the preferences of their constituent

actors if they are to sustain their coordinating function within an increasingly complex and contested global economy.

The analysis also carries implications that are of direct relevance to both policymakers and market participants. One such implication concerns the management of uncertainty in an increasingly interconnected global economy. While economic policy uncertainty may, at least in principle, be mitigated through credible and timely policy interventions (Bloom, 2009), geopolitical uncertainty is far more difficult to contain using conventional policy tools. It is shaped by exogenous political and security dynamics and is increasingly transmitted rapidly through globally integrated financial and informational systems. In this context, there is a clear need for more robust mechanisms to monitor geopolitical uncertainty, alongside more systematic approaches for incorporating such uncertainty into policy design. At the same time, financial market participants and infrastructure providers should explicitly integrate geopolitical uncertainty into their governance and risk management frameworks, given its growing influence on commodity price formation. Another implication relates to the heterogeneous transmission of geopolitical shocks into commodity markets. The analysis shows that geopolitical events do not translate mechanically into price movements in commodity derivatives, and that the magnitude and direction of effects depend on the structure of the underlying physical market. This highlights the importance for financial authorities and market participants to strengthen analytical capacity on the real economy side of commodity systems, including production structures and trade dependencies.

From a central bank perspective, these findings carry particular significance for the analysis of inflation dynamics, financial stability and systemic risk. Commodity derivatives markets function as integral components of the macro-financial transmission

system rather than merely as venues for hedging or price discovery. The interplay between physical supply conditions and financial trading underscores the need for central banks to monitor how global financial centers, trading platforms, and institutional investors amplify and diffuse shocks that originate in real markets. This is particularly relevant during periods of heightened geopolitical tension, when markets may react sharply to news, sentiment and shifts in expectations. As a matter of fact, commodity prices are increasingly influenced by geopolitical shocks transmitted through tightly interconnected physical and financial networks. Inflationary pressures in food and energy components cannot be fully understood without considering the role of such uncertainty and the mechanisms through which it propagates across global markets and derivatives trading.

The findings also highlight the limitations of traditional model-based forecasting in environments characterized by geopolitical uncertainty, which is often non-linear and context-specific, and the importance of incorporating political and strategic considerations into macroeconomic analysis. Consistent with the analytical approach adopted in this thesis, which leverages a mixed research strategy, complementary tools – such as scenario analysis, stress testing, and more granular indicators of geopolitical risk that distinguish between global and country-specific sources – are essential for effective monitoring and policy design. Effective policymaking in the context of inflation surveillance and financial stability assessments, in turn, requires a comprehensive and multidimensional analytical framework capable of capturing the interdependencies between physical and financial commodity markets, as well as the evolving institutional and geopolitical environment.

Finally, having considered the implications of this analysis for central banks in terms of monitoring and policymaking, two further dimensions warrant consideration: the role of monetary policy and, where relevant, that of financial supervision. Regarding the former, central banks can contribute to stabilizing the macroeconomic and financial consequences of commodity-market turbulence, although usually not with the primary objective of stabilizing commodity prices themselves. Understanding the structure and interdependencies of the wheat GPFN can nevertheless help central banks assess how shocks originating in commodity markets may propagate through inflation, inflation expectations and financial markets, thereby informing the calibration of monetary policy responses. As regards supervision, central banks have levers to ensure that market participants not only comply with applicable regulatory requirements but also adopt effective and proportionate approaches to risk management. In this respect, supervisory expectations can influence the behavior of market actors by encouraging them to internalize risks that may otherwise remain external to their individual decision-making. The GPFN perspective can contribute to this process by highlighting the interconnectedness and potential propagation of commodity-market risks, thereby encouraging market participants to consider not only their direct exposures but also their indirect dependencies and vulnerabilities arising from their position within the wider network.

6.4 Limitations

The limitations affecting this thesis can be broadly grouped into three categories: those inherent in the chosen methodology, those stemming from the availability and quality of information, and those related to the scope of the study. The latter are only briefly noted

here, as they point toward avenues for future research and are therefore discussed more fully in the subsequent section. The present discussion instead focuses primarily on methodological and data-related constraints, reflecting on how they shape the interpretation and robustness of the findings.

First, as outlined in Chapter 1, the thesis relies in part on case study and interpretive research strategies, particularly in Chapters 3 and 5. These approaches are well suited to capturing the relational, institutional, and context-specific dynamics emphasized in the broader conceptual framework. However, they are also commonly associated with a set of well-known limitations. Among these, concerns regarding internal validity and the potential subjectivity of qualitative interpretation are particularly relevant. The reconstruction of actors' motivations, strategies, and relationships inevitably involves a degree of interpretive judgment, which may introduce bias in the selection, weighting, and framing of empirical material. To mitigate these risks, the thesis employs triangulation across multiple sources, including documentary evidence, secondary literature, and publicly available statements and communications by relevant actors. This strategy allows for cross-validation of key claims and helps reduce the likelihood that findings are driven by any single source or perspective. Nevertheless, while providing a means of strengthening the plausibility and consistency of the analysis, triangulation does not fully eliminate interpretive subjectivity.

Turning to the quantitative analysis presented in Chapter 4, additional methodological limitations arise. The use of longitudinal regression analysis enables the identification of statistical relationships over time and provides a systematic basis for examining patterns in wheat futures prices. However, this approach is less well equipped to account for the relational and social dimensions that are central to this thesis. In

particular, regression-based methods tend to abstract from the networked interactions, institutional contexts, and heterogeneous expectations that shape market behavior. As a result, important aspects of how information is produced, circulated, and interpreted among market participants may remain underexplored within the quantitative framework. Efforts have been made to address this limitation by embedding the quantitative findings within the broader qualitative and theoretical discussion. This integrative approach allows the analysis to retain sensitivity to social and institutional dynamics, even where these cannot be directly modeled. Nonetheless, the tension between methodological abstraction and the complexity of real-world market processes remains a constraint, and the quantitative results should be read as partial rather than exhaustive accounts of price dynamics.

A further set of limitations relates to the availability and accessibility of information. One of the central empirical challenges concerns the opacity of TNCs active in the wheat market. These actors play a significant role in shaping market outcomes, yet their operations, strategies, and internal decision-making processes are often not publicly disclosed. As a result, the analysis can only infer certain aspects of their behavior, for instance with regard to lobbying activities and influence over regulatory frameworks. Such inferences are necessarily indirect, relying on secondary sources, reported outcomes, and observable policy shifts rather than direct evidence of intent or strategy. This limitation has important implications for the analysis of power and influence within commodity markets. While the thesis advances arguments about asymmetries in access, information, and institutional leverage, the empirical substantiation of these claims is constrained by the partial visibility of key actors. Consequently, some dimensions of market power may be underrepresented or only approximated, rather than fully captured.

Data limitations are also relevant in the quantitative domain. The analysis in Chapter 4 relies on monthly data, due to the unavailability of more granular intraday or daily datasets. While monthly data allow for the identification of broader trends and relationships, they are less suitable for capturing the immediate incorporation of new information into prices. High-frequency data would be necessary to more precisely assess how news events, market signals, or exogenous shocks are reflected in wheat futures prices over short time horizons. The absence of such data therefore limits the ability to directly test hypotheses related to information efficiency and the timing of price adjustments.

Relatedly, the empirical focus on the most liquid markets introduces another constraint. Highly liquid markets are often assumed to be the most informative and representative, given their depth and volume of trading activity. However, this focus may overlook dynamics present in less liquid or more regionally specific markets, where informational frictions, institutional differences, and relational structures may play a more pronounced role. Including a broader range of markets could potentially reveal additional variation in price formation processes and provide a more differentiated picture of global commodity dynamics.

Finally, the temporal scope of the thesis constitutes an additional limitation. The analysis focuses primarily on the period from 2000 onwards. This choice is deliberate and reflects both data availability and the specific dynamics of interest, including the increasing financialization of commodity markets, integration dynamics within the EU and the evolution of global trading networks in the early 21st century. However, this temporal framing necessarily excludes longer-term historical developments that may have shaped contemporary market structures and institutional arrangements. As such, the

findings should be interpreted within the context of relatively recent transformations, rather than as a comprehensive account of long-run trends.

6.5 Directions for future research

This thesis opens several avenues for further empirical and conceptual inquiry to deepen understanding of the wheat GPFN and global commodity networks more broadly. While each chapter outlines specific extensions, a coherent research agenda can be organized around a set of interrelated priorities.

An overarching priority is the empirical testing of key hypotheses developed in Chapters 3 to 5. In particular, future research should assess the extent to which increasing integration within GPFNs reduces transaction costs while simultaneously reinforcing market power and generating adverse distributional effects – especially for final consumers. This tension between efficiency gains and unequal outcomes is particularly salient given wheat's central role in global food consumption and food security.

A distinct line of inquiry concerns the geography of price discovery in the global wheat market. Further empirical investigation is needed to clarify the relative importance of Paris as a price discovery center compared to Chicago, and whether location-based advantages persist in an increasingly integrated and financialized environment. As arbitrage across markets for homogeneous goods becomes more seamless, it remains unclear whether proximity to physical production continues to confer informational or strategic benefits, or whether financial centrality is becoming the dominant factor.

Infrastructure and logistics bottlenecks represent another critical dimension. This thesis has only briefly engaged with the role of logistics – particularly in relation to

storage – but the findings suggest that infrastructures such as ports, inland transport corridors, and warehousing systems are not merely passive conduits. Rather, they may act as strategic assets through which market power is exercised and rents are captured. Future research should therefore conceptualize infrastructure as an integral component of governance within GPFNs, examining how control over logistical nodes shapes price transmission, access to markets, and vulnerability to shocks.

From a conceptual standpoint, further research should expand the analytical lens to include peripheral actors within the wheat GPFN. While the present analysis has focused on major firms and central countries to uncover patterns of concentration and asymmetry, incorporating smaller firms and less central regions would provide a more granular account of how gains are distributed across the network. This would help illuminate inequalities not only between countries but also within them.

The institutional and political dimensions of the network also warrant closer examination. It has been argued that the governance of global agricultural markets is deeply shaped by international and regional institutions. Future research should examine how evolving rules and norms particularly within international organizations such as the WTO interact with the strategies of private actors, states and supranational institutions like the EU, shaping market outcomes. Also, at the regional level, the dynamics of coalition-building within fragmented regulatory environments also warrant closer attention. For instance, the experience of Eastern European EU Member States illustrates how coordinated action can influence policy outcomes, underscoring the importance of intra-regional political strategies and alliances.

Finally, the growing impact of climate change introduces an additional layer of complexity and uncertainty. Increasingly frequent extreme weather events are likely to

have profound implications for agricultural production and commodity markets. While this thesis has addressed uncertainty primarily in relation to geopolitical developments and economic policy interventions, climate-related risks warrant more systematic integration into the analysis.

Above all, extending the analytical framework developed here to other commodities and markets would provide a useful basis for comparison, helping to assess the generalizability of the findings and refine theoretical insights across different GPFNs.

Bibliography

Aalbers, M. B. (2019), Financial geography III: The financialization of the city, *Progress in Human Geography*, 42:916-927.

Aizenman, J., Lindahl, R., Stenvall, D., and Uddin, G. S. (2023), Geopolitical shocks and commodity market dynamics: new evidence from the Russian-Ukraine conflict, *NBER Working Paper Series*, 31950.

Agnew, J. (2000), From the political economy of regions to regional political economy, *Progress in Human Geography*, 24(1):101-110.

Amin, A. (2002), Spatialities of globalization, *Envorinment and Planning A: Economy and Space*, 34(3): 385-399.

Amin, A., and Thrift, N. (1992), Neo-Marshallian nodes in global networks, *International Journal of Urban and Regional Research*, 16(4):571-587.

_____ (2002), *Cities: Reimagining the Urban*. Cambridge: Polity Press.

Anderson, R. W. (1985), Some determinants of the volatility of futures prices, *The Journal of Futures Markets*, 5(3):331-348.

Antonakakis, N., Chatziantoniou, I., and Filis, G. (2013), Dynamic co-movements of stock market returns, implied volatility and policy uncertainty, *Economics Letters,* 120(1):87-92.

Aoyama, Y., and Ratick, S. J. (2007), Trust, transactions, and information technologies in the U.S. logistics industry, *Economic Geography*, 83(2):159-180.

Arismendi, J., Back, J., Prokopczuk, M., Paschke, R., and Rudolf, M. (2016), Seasonal stochastic volatility: Implications for the pricing of commodity options, *Journal of Banking and Finance*, 66:53-65.

Arouri, M., Estay, C., Rault, C., and Roubaud, D. (2016), Economic policy uncertainty and stock markets: Long-run evidence from US, *Finance Research Letters*, 18:136-141.

Asness, C. S., Moskowitz, T. J., and Pedersen, L. H. (2013), Value and momentum everywhere, *The Journal of Finance*, 68(3):929-985.

Bacidore, J., and Sofianos, G. (2002), Liquidity provision and specialist trading in NYSE listed non-U.S. stocks, *Journal of Financial Economics*, 63:133-158.

Baffes, J., and Nagle, P. (eds.) (2022), *Commodity Markets. Evolution, Challenges, and Policies.* World Bank Group.

Bair, J., Ponte, S., Seabrooke, L., and Wigan, D. (2023), Entangled chains of global value and wealth, *Review of International Political Economy*, 30(6):2423-2439.

Bakas, D., and Triantafyllou, A. (2018), The impact of uncertainty shocks on the volatility of commodity prices, *Journal of International Money and Finance*, 87:96-111.

Baker, S. R., Bloom, N., and Davis, S. J. (2016), Measuring Economic Policy Uncertainty, *Quarterly Journal of Economics,* 131(4):1593-1636.

Balsamo, E. (2022), *The Evolving Dynamic Between Chicago and Kansas City Wheat*, The Evolving Dynamic Between Chicago and Kansas City Wheats - CME Group

Bardhan, P. K. (1983), Labour-tying in a poor agrarian economy: a theoretical and empirical analysis, *Quarterly Journal of Economics*, 98(3):501-514.

Bargawi, H. K., and Newman, S. A. (2017), From futures markets to the farm gate: A study of price formation along Tanzania's coffee commodity chain, *Economic Geography*, 93(2):162-184.

Bathelt, H., and Glückler, J. (2003), Toward a relational economic geography*, Journal of Economic Geography*, 3:117-144.

_____ (2011), *The Relational Economy: Geographies of Knowing and Learning*. Oxford: Oxford University Press.

_____ (2018), Relational research design in economic geography. In Clark, G. L., Feldman, M., Gertler, M. S., and Wójcik, D. (eds.), *The New Oxford Handbook of Economic Geography*, 179-195. Oxford: Oxford University Press.

Bathelt, H., Malmberg, A., and Maskell, P. (2004), Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation, *Progress in Human Geography*, 28(1):31-56.

Baur, D. G., and Smales, L. A. (2020), Hedging geopolitical risk with precious metals, *Journal of Banking and Finance*, 117, 105823.

BCBS-CPMI-IOSCO (2023), *Margin dynamics in centrally cleared commodities markets in 2022.* Margin dynamics in centrally cleared commodities markets in 2022 (bis.org)

Beaudry, P., and Portier, F. (2006), Stock prices, news, and economic fluctuations, *American Economic Review*, 96(4):1293-1307.

Beckert, J. (2011), Where do prices come from? Sociological approaches to price formation, *Socio-Economic Review*, 9:757–86.

Berger, D., Dew-Becker, I., and Giglio, S. (2020), Uncertainty shocks as second-moment news shocks, *Review of Economic Studies*, 87:40–76.

Bernstein, A., Hughson, E., and Weidenmier, M. (2019), Counterparty risk and the establishment of the New York Stock Exchange Clearinghouse, *Journal of Political Economy*, 127(2):689-729.

Blas, J., and Farchy, J. (2021), *The World for Sale: Money, Power and the Traders Who Barter the Earth's Resources.* London: Penguin Random House UK.

Bloom, N. (2009), The impact of uncertainty shocks, *Econometrica*, 77(3):623-685.

Bookstaber, R. (2017), *The End of Theory: Financial Crises, the Failure of Economics, and the Sweep of Human Interaction.* Princeton: Princeton University Press.

Boschma, R. (2014), Towards and evolutionary perspective on regional resilience, *Regional Studies*, 49(5):733-751.

Boschma, R., Miguelez, E., Moreno, R., and Ocampo-Corrales, D. B. (2023), The role of relatedness and unrelatedness for the geography of technological breakthroughs in Europe, *Economic Geography*, 99(2):117-139.

Bossman, A., Gubareva, M., and Teplova, T. (2023), Asymmetric effects of market uncertainties on agricultural commodities, *Energy Economics*, 127(B), 107080.

Brenner, J. M. (1993), EC: Confidence lost, *Foreign Policy*, 91:24-43.

Brousseau, E., and Glachant, J. (2008), *New Institutional Economics: A Guidebook*. Cambridge: Cambridge University Press.

Bryman, A. (2015), *Social Research Methods*. Oxford: Oxford University Press.

Bunge, and Viterra (2023), Bunge and Viterra to Combine to Create a Premier Diversified Global Agribusiness Solutions Company. Press release, June 13. Bunge and Viterra to Combine to Create a Premier Diversified Global Agribusiness Solutions Company

Büyüksahin, B., and Robe, M. A. (2014), Speculators, commodities and cross-market linkages, *Journal of International Money and Finance,* 42:38-70.

Caldara, D., and Iacoviello, M. (2022), Measuring geopolitical risk, *American Economic Review,* 112(4):1194-1225.

Çalişkan, K. (2010), Market threads: *How Cotton Farmers and Traders Create a Global Commodity*. Princeton: Princeton University Press.

Çalişkan, K., and Callon, M. (2010), Economization, part 2: A research programme for the study of markets, *Economy and Society*, 39:1–32.

Camerer, C., and Weber, M. (1992), Recent developments in modeling preferences: uncertainty and ambiguity, *Journal of Risk and Uncertainty*, 5:325-370.

Cargill (2021), Cargill becomes majority shareholder of its joint venture Neptune at Port Pivdennyi on the Black Sea. Press release, July 16. Cargill becomes majority shareholder of its joint venture Neptune at Port Pivdennyi on the Black Sea | Cargill

_____ (2023), Reimagine what's possible. Cargill Annual Report. 2023 Annual Report | Cargill

Carney, M. (2016), *Uncertainty, the economy and policy*, speech at the Bank of England, June 30, Mark Carney: Uncertainty, the economy and policy

Chancellery of the Polish Prime Minister (2023), Prime Minister Mateusz Morawiecki: there will be no Polish-Ukrainian reconciliation to the end without finding all the remains of the victims of the Volhynia Massacre. Press release, July 11. Prime Minister Mateusz Morawiecki: there will be no Polish-Ukrainian reconciliation to the end without finding all the remains of the victims of the Volhynia Massacre - Chancellery of the Prime Minister - Portal Gov.pl (www.gov.pl)

Chavleishvili, S., and Kremer, M. (2023), Measuring systemic financial stress and its risk for growth, *ECB Working Paper Series*, No 2842.

Chen, Y., Rogoff, K. S., and Rossi, B. (2010), Can exchange rates forecast commodity prices?, *The Quarterly Journal of Economics*, 125(3):1145-1194.

Cheng, D., Liao, Y., and Pan, Z. (2023), The geopolitical risk premium in the commodity futures market, *The Journal of Futures Markets*, 43(8):1069-1090.

Cheng, I., and Xiong, W. (2014), Financialization of commodity markets, *Annual Review of Financial Economics*, 6:419-441.

Chesney, M., Reshetar, G., and Karaman, M. (2011), The impact of terrorism on financial markets: An empirical study, *Journal of Banking and Finance*, 35(2):253–267.

Choudhry, T. (2010), World War II events and the Dow Jones Industrial Index, *Journal of Banking and Finance*, 34(5):1022–1031.

Christophers, B. (2015), Geographies of finance II: Crisis, space and political-economic transformation, *Progress in Human Geography*, 39:205-213.

Clapp, J., and Helleiner, E. (2012), Troubled futures? The global food crisis and the politics of agricultural derivatives regulation, *Review of International Political Economy*, 19(2):181-207.

Clapp, J., and Isakson, S. R. (2018), Risky returns: the implications of financialization in the food system, *Development and Change*, 49(2):437-460.

Clark, G. L. (1983), Spatial labor markets and the distribution of transaction costs, *Environment and Planning D: Society and Space*, 1:305-322.

_____ (2011), Myopia and the global financial crisis: Context-specific reasoning, market structure, and institutional governance, *Dialogues in Human Geography*, 1(1):4-25.

_____ (2015), The geography of the European Central Bank: form, functions and legitimacy, *Journal of Economic Geography*, 15:855-881.

_____ (2018), Behaviour in context. In Clark, G. L., Feldman, M., Gertler, M. S., and Wójcik, D. (eds.), *The New Oxford Handbook of Economic Geography*, 196-212. Oxford: Oxford University Press.

Clark, G. L., and Dear, M. J. (1984), *State Apparatus: Structures and Language of Legitimacy*. New York: Routledge.

Clark, G. L., Dixon, A. D., and Monk, A. H. B. (eds.) (2009), *Managing Financial Risks: From Global to Local*. Oxford: Oxford University Press.

Clark, G. L., Hoefer, M., and Innocenti, S. (2024), Geographical variations in risk tolerance and the use of financial instruments: evidence from a multi-jurisdictional survey, *Finance and Space*, 1(1): 431-459.

Clark, G. L., and Monk, A. H. B. (2014), The geography of investment management contracts: the UK, Europe, and the global financial services industry, *Environment and Planning A: Economy and Space*, 46:531-549.

Clark, G. L., Strauss, K., and Knox-Hayes, J. (2012), *Saving for Retirement: Intention, Context, and Behaviour*. Oxford: Oxford University Press.

Clark, G. L., and Tracey, P. (2004), *Global Competitiveness and Innovation: An Agent-Centred Perspective*. Basingstoke: Palgrave McMillan.

Clark, G. L., and Wójcik, D. (2007), *The Geography of Finance: Corporate Governance in the Global Marketplace.* Oxford: Oxford University Press.

Clark, G. L., Wójcik, D., and Bauer, R. (2006), Geographically dispersed ownership and inter-market stock price arbitrage – Ahold's crisis of corporate governance and its implications for global standards, *Journal of Economic Geography*, 6(3):303-322.

Clifford, N., Cope, M., Gillespie, T., and French, S. (eds.) (2016), *Key Methods in Geography*. London: Sage.

CME Group (2015), *CME Group to Close Most Open Outcry Futures Trading in Chicago and New York by July; Most Options Markets to Remain Open*, Press release, February 4, CME Group to Close Most Open Outcry Futures Trading in Chicago and New York by July; Most Options Markets to Remain Open | CME Group Inc.

Coase, R. H. (1937), The nature of the firm, *Economica*, 4:386-405.

Coe, N. M., Dicken, P., and Hess, M. (2008), Global production networks: realizing the potential, *Journal of Economic Geography*, 8(3):271-295.

Coe, N. M., Lai, K., and Wójcik, D. (2014), Integrating finance into global production networks, *Regional Studies*, 48:761-777.

Coe, N. M., and Yeung, H. W. (2015), *Global production networks: Theorizing economic development in an interconnected world*. Oxford: Oxford University Press.

_____ (2019), Global production networks: mapping recent conceptual developments, *Journal of Economic Geography*, 19:775-801.

Council of the EU (2025), EU-Ukraine trade: Council agrees to reduce or eliminate customs duties for several agri-food products, Press release, October 13. EU-Ukraine trade: Council agrees to reduce or eliminate customs duties for several agri-food products - Consilium

Crescenzi, R., Fratesi, U., and Monastiriotis, V. (2020), Back to member states? Cohesion Policy and the national challenges to the European Union, *Regional Studies*, 54(1):5-9.

Cui, J., and Maghyereh, A. (2023), Higher-order moment risk connectedness and optimal investment strategies between international oil and commodity futures markets: Insights

from the COVID-19 pandemic and Russia-Ukraine conflict, *International Review of Financial Analysis*, 86, 102520.

Cuny, C. J. (1993), The role of liquidity in futures market innovations, *Review of Financial Studies*, 6(1):57-78.

Curran, L., Nadvi, K., and Campling, L. (2019), The influence of tariff regimes on global production networks (GPNs), *Journal of Economic Geography*, 19(4):873-895.

Curtis, B. C. (2002), Wheat in the world. In Curtis, B. C., Rajaram, S. and Macpherson, H. G. (eds.), *Bread Wheat Improvement and Production*, Plant Production and Protection Series 30, 1-18, FAO, Roma.

Cutrini, E., Gardiner, B., and Martin, R. (2022), EU integration and the geographies of economic activity: 1985-2019, *Environment and Planning A: Economy and Space*, 55(2):274-302.

Cyclope (2023), *World Commodities Markets 2023. The Four Horsemen of the Apocalypse*. Paris: Economica.

Daal, E., Farhat, J., and Wei, P. P. (2006), Does futures exhibit maturity effect? New evidence from an extensive set of US and foreign futures contracts, *Review of Financial Economics*, 15:113-128.

Dahlman, C. J. (1979), The problem of externality, *Journal of Law and Economics*, 22(1):141-162.

Dalio, R. (2021), *Principles for dealing with the changing world order*. London: Simon & Schuster.

Das, D., Kannadhasan, M., and Bhowmik, P. (2019), Geopolitical risk and precious metals, *Journal of Economic Research*, 24(1):49–66.

Delgado, M., Porter, M., E, and Stern, S. (2016), Defining clusters of related industries, *Journal of Economic Geography*, 16(1): 1-38.

Di Luigi, C., Clark, G. L., and Wójcik, D. (2025), Taming transaction costs, risk and uncertainty in global production and financial networks: The case of wheat futures markets, *Economic Geography*, 101(4):268-294.

Di Luigi, C., Perrella, A., and Ruggieri A. (2024), The fundamental role of the repo market and central clearing, *Journal of Financial Market Infrastructures*, 11(4): 1-45.

Di Luigi, C., and Perrella, A. (2026), The architecture of cross-border finance: Fifty years of evolution from national segmentation to fragmented globalization, *Bank of Italy - Markets, Infrastructures, Payment Systems Series,* forthcoming.

Dicken, P. (1994), Global–local tensions: firms and states in the global space-economy, *Economic Geography*, 70:101–128.

_____ (2015), *Global Shift: Mapping the Changing Contours of the World Economy*. New York: Guilford Press.

Dicken, P., and Thrift, N. (1992), The organization of production and the production of organization: why business enterprises matter in the study of geographical industrialization, *Transactions of the Institute of British Geographers*, 17(3):279-291.

Donadelli, M., Gufler, I., and Paradiso, A. (2024), Financial market integration: A complex and controversial journey, *International Review of Financial Analysis*, 103100.

Draper, K. (2026), War Hangs Over American Farmers as Fertilizer Prices Rise, *The New York Times*, June 16. nytimes.com/2026/06/16/business/fertilizer-farming-iran.html

Duffie, D., Dworczak, P., and Zhu, H. (2017), Benchmarks in search markets, *The Journal of Finance*, 72(5):1983-2044.

Duina, F., and Buxbaum, J. (2008), Regional trade agreements and the pursuit of state interests: institutional perspectives from NAFTA and Mercosur, *Economy and Society*, 37(2):193-223.

Dunning, J. H., and Lundan, S. M. (2008), *Multinational enterprises and the global economy*. 2n ed. Cheltenham: Edward Elgar.

Eckhardt, J., and Poletti, A. (2018), Bringing institutions back in the study of Global Value Chains, *Global Policy*, 9(S2):5-11.

Eichengreen, B. (2001), The political economy of the Smoot-Hawley tariff, *NBER Working Paper Series*, No. 2001.

Ellsberg, D. (1961), Risk, ambiguity, and the Savage axioms, *The Quarterly Journal of Economics,* 75(4):643-669.

Engel, A. (2015), Buying time: futures trading and telegraphy in nineteenth-century global commodity markets, *Journal of Global History*, 10(2):284-306.

Engel, J. (2019), The Politics of Commodity Derivatives Reform in the EU and the USA. In Avgouleas, E., and Donald, D. C. (eds.), *The Political Economy of Financial Regulation*, 310-344. Cambridge: Cambridge University Press.

_____ (2020), Regulation, financialization and fraud in Chinese commodity markets after the Global Financial Crisis, *Regional Studies*, 54(2):219-228.

Ernst, D., and Kim, L. (2002), Global production networks, knowledge diffusion, and local capability formation, *Research Policy*, 31:1417–1429.

Erten, B., and Ocampo, A. (2013), Super cycles of commodity prices since the mid-nineteenth century, *World Development*, 44:14-30.

Euronext (2023), Euronext confirms the expansion of Euronext Clearing to derivatives markets for Q3 2024. Press release, January 16. Euronext confirms the expansion of Euronext Clearing to derivatives markets for Q3 2024 | euronext.com

European Central Bank (2001), Consolidation in central counterparty clearing in the euro area. *ECB Monthly Bulletin August 2001,* 69-77.

European Commission (2021a), Commission takes further steps to foster the openness, strength and resilience of Europe's economic and financial system. Press release, January 19. Europe's economic and financial system (europa.eu)

_____ (2021b), Trade Policy Review – An Open, Sustainable and Assertive Trade Policy. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, February 18. resource.html (europa.eu)

_____ (2023a), Statement by Executive Vice-President Dombrovskis and Commissioner Wojciechowski following today's meeting on agricultural imports from Ukraine, Statement, April 19. STATEMENT_23_2370_EN.pdf (europa.eu)

_____ (2023b), Commission adopts exceptional and temporary preventive measures on limited imports from Ukraine. Press release, May 2. IP_23_2562_EN.pdf (europa.eu)

_____ (2023c), Press statement by President von der Leyen with Ukrainian President Zelenskyy. News Article, May 9. Press statement by President von der Leyen with Ukrainian President Zelenskyy - European Commission (europa.eu)

European Commission – Agriculture and rural development D.G. (2023), €100 million to support farmers from Bulgaria, Hungary, Poland, Romania and Slovakia. News article, May 3. €100 million to support farmers from Bulgaria, Hungary, Poland, Romania and Slovakia - European Commission (europa.eu)

Fama, E. F. (1970), Efficient capital markets: A review of theory and empirical work, *The Journal of Finance*, 25(2):383-417.

Fama, E. F., and French, K. R. (1987), Commodity futures prices: Some evidence on forecast power, premiums, and the theory of storage, *The Journal of Business*, 60(1):55-73.

Faulconbridge, J. R. (2008), Managing the transnational law firm: A relational analysis of professional systems, embedded actors, and time-space sensitive governance, *Economic Geography*, 84(2):185-210.

Field, S. (2016), The financialization of food and the 2008-2011 food price spikes, *Environment and Planning A: Economy and Space*, 48(11):2272-2290.

Fischer, K., Jakobsen, J., and Westengen, O. T. (2022), The political ecology of crops: From seed to state and capital, *Geoforum*, 130:92-95.

Fleming, J., Kirby, C., and Ostdiek, B. (2006), Information, trading, and volatility: Evidence from weather-sensitive markets, *The Journal of Finance*, LXI(6):2899-2930.

Ford, A., and Wax, E. (2024), EU farm chief drafts secret law on food security in last hurrah, *POLITICO*, August 27. EU farm chief drafts secret law on food security in last hurrah – POLITICO

French, S., Leyshon, A., and Wainwright, T. (2011), Financializing space, spacing financialization, *Progress in Human Geography*, 35(6):798-819.

FSB (2023), *The Financial Stability Aspects of Commodities Markets.* The Financial Stability Aspects of Commodities Markets - Financial Stability Board (fsb.org)

Fujita, M., Krugman, P. R., and Venables, A. J. (2001), *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge, MA: MIT Press.

Garretsen, H., and Martin, R. (2010), Rethinking (New) Economic Geography models: Taking geography and history more seriously, *Spatial Economic Analysis*, 5(2): 127-160.

Gereffi, G., Humphrey, J., and Sturgeon, T. (2005), The governance of global value chains, *Review of International Political Economy*, 12(1):78-104.

Gereffi, G., and Mayer, F. (2006), Globalisation and the demand for governance. In Gereffi, G. (ed.), *The New Offshoring of Jobs and Global Development*, 329-360. Geneva: International Institute for Labour Studies.

Gertler, M. S. (2018), Institutions, geography, and economic life. In Clark, G. L., Feldman, M., Gertler, M. S., and Wójcik, D. (eds.), *The New Oxford Handbook of Economic Geography*, 230-242. Oxford: Oxford University Press.

Gibson, R. (2024), *International Trade Fairs and Inter-Firm Knowledge Flows: Understanding Patterns of Convergence-Divergence in the Technological Specializations of Firms*. New York: Springer.

Gilbert, C. L. (2010), How to understand high food prices, *Journal of Agricultural Economics*, 161(2):398-425.

Glassman, J. (2011), The geo-political economy of global production networks, *Geography Compass*, 5(4):154–64.

_____ (2018), Geopolitical economies of development and democratization in East Asia: Themes, concepts, and geographies, *Environment and Planning A: Economy and Space*, 50(2):407–415.

Glassman, J., and Choi, Y. J (2014), The chaebol and the US military–industrial complex: Cold War geopolitical economy and South Korean industrialization, *Environment and Planning A: Economy and Space,* 46(5):1160–1180.

Goldstein, I., and Yang, L. (2022), Commodity financialization and information transmission, *The Journal of Finance*, 77(5):2613-2667.

Gomez, B., and Jones, J. P. (2010), *Research Methods in Geography: A Critical Introduction*. Malden, Mass: Wiley-Blackwell.

Goodwin, B. K., and Schnepf, R. (2000), Determinants of endogenous price risk in corn and wheat futures markets, *The Journal of Futures Markets*, 20(8):753-774.

Gorton, G. B., Hayashi, F., and Rouwenhorst, K. G. (2013), The fundamentals of commodity futures returns, *Review of Finance*, 17(1):35-105.

Granovetter, M. (1985), Economic action and social structure: The problem of embeddedness, *American Journal of Sociology*, 91(3):481-510.

Grossman, S. J. (1977), The existence of futures markets, noisy rational expectations and informational externalities, *Review of Economic Studies*, 44(3):431-449.

Grote, M., Wójcik, D., and Zook, M. (2023), Sticky substance with sticky power: oil in global production and financial networks, *Environment and Planning A: Economy and Space*, 56(2):436-453.

Haberly, D., and Wójcik, D. (2022), *Sticky Power: Global Financial Networks in the World Economy*. Oxford: Oxford University Press.

Hall, P. A., and Soskice, D. (eds.) (2001), *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage.* Oxford: Oxford University Press.

Hall, S. (2010), Geographies of money and finance I: Cultural economy, politics and place, *Progress in Human Geography,* 35:234-245.

Hao, J., He, F., Ma, F., and Fu, T. (2023), Trading around the clock: Revisit volatility spillover between crude oil and equity markets in different trading sessions, *The Journal of Futures Markets*, 43:771-791.

Harris, J. L., and Menzel, M. (2023), Entrepreneurial ecosystems and clusters: How can economic geographers advance debates for regional development?, *Progress in Human Geography*, 47(6):813-832.

Harvey, D. (2006), *The Limits to Capital.* London: Verso.

Hassan, T. A., Hollander, S., Van Lent, L., and Tahoun, A. (2024), The global impact of Brexit uncertainty, *The Journal of Finance*, LXXIX(1):413-458.

Henderson, J., Dicken, P., Hess, M., Coe, N. M., and Yeung, H. W. C. (2002), Global production networks and the analysis of economic development, *Review of International Political Economy*, 9:436–464.

Hennessy, D. A., and Wahl, T. I. (1996), The effects of decision making on futures price variability, *American Journal of Agricultural Economics,* 78:591-603.

Herod, A., and Wright, M. W. (2002), *Geographies of Power.* Oxford: Blackwell.

Hopewell, K., and Margulis, M. E. (2023), World Trade Organization rules hamper public food stockholding, *Nature Food*, 4:196-198.

Hopkins, T. K., and Wallerstein, I. (1986), Commodity chains in the world-economy prior to 1800, *Review*, X(1):157-170.

Horner, R. (2017), Beyond facilitator? State roles in global value chains and global production networks, *Geography Compass*, 11(2):1-13.

Hwang, J. T. (2016), Escaping the territorially trapped East Asian developmental state thesis, *The Professional Geographer*, 68(4):554–560.

International Monetary Fund (2023), *Global Financial Stability Report: Safeguarding Financial Stability amid High Inflation and Geopolitical Risks*, Washington DC, April.

InVivo (2021), InVivo Group completes the acquisition of Soufflet Group: birth of a French agricultural and agri-food champion of international standing. Press release,

December 9. InVivo completes the acquisition of Soufflet Group | InVivo (invivo-group.com).

IOSCO (2016), *The Impact of Storage and Delivery Infrastructure on Commodity Derivatives Market Pricing*. Final Report. FR03/2016 The Impact of Storage and Delivery Infrastructure on Commodity Derivatives Market Pricing (iosco.org)

_____ (2019), *Commodity Storage and Delivery Infrastructures: Good or Sound Practices*. Final Report. FR03/2019 Commodity Storage and Delivery Infrastructures: Good or Sound Practices

Irwin, H. S. (1954), *Evolution of futures trading*. Madison, Wisconsin: Mimir Publishers.

Izzeldin, M., Muradoglu, Y. G., Pappas, V., Petropoulou, A., and Sivaprasad, S. (2023), The impact of the Russia-Ukrainian war on global financial markets, *International Review of Financial Analysis*, 87:102598.

Janzen, J. P., and Adjemian, M. K. (2017), Estimating the location of world wheat price discovery, *American Journal of Agricultural Economics*, 99(5):1188-1207.

Jessop, B. (2007), *State Power: A Strategic-Relational Approach*. Cambridge: Polity.

Josling, T. W., and Swinbank, A. (2013), EU Agricultural Policies and European Integration: A Thematic Review of the Literature. In Verdun, A., Tovias, A. (eds.), *Mapping European Economic Integration*, 18-37. London: Palgrave McMillan.

Jurado, K., Ludvigson, S. C., and Ng, S. (2015), Measuring uncertainty, *American Economic Review*, 105(3):1177-1216.

Kahneman, D. (2003), Maps of bounded rationality: Psychology for behavioral economics, *The American Economic Review*, 93(5):1449-1475.

Kahneman, D., and Tversky, A. (1979), Prospect theory: An analysis of decision under risk, *Econometrica*, 47(2):263-291.

Kelly, B., Pastor, L., and Veronesi, P. (2016), The price of political uncertainty: Theory and evidence from the option market, *The Journal of Finance*, 71(5):2417-2480.

Knight, F. H. (1921), *Risk, Uncertainty and Profit.* New York: Houghton Mifflin.

Krugman, P. R. (1980), Scale economies, product differentiation, and the pattern of trade, *American Economic Review*, 70(5):950-959.

_____ (1987), Is free trade passé?, *Economic Perspectives*, 1(2):131-144.

_____ (1991), *Geography and Trade*. Cambridge, MA: MIT Press.

_____ (1993), Lessons of Massachusetts for EMU. In Torres, F., Giavazzi, F. (eds.) *Adjustment and Growth in the European Monetary Union*, 241-261. Cambridge: Cambridge University Press.

_____ (2022a), Trade and Peace: The Great Illusion. *The New York Times*, April 11. Opinion | Putin, Ukraine and the Illusion That Trade Brings Peace - The New York Times

_____ (2022b), Is This the End of Peace Through Trade. *The New York Times*, December 13. Opinion | Does World Trade Promote Peace? Maybe Not. - The New York Times

_____ (2025a), The Economics of Smoot Hawley 2.0, Part I: Tariffs will be very high as far as the eye can see. What does that mean?, *Substack*, August 3. The Economics of Smoot-Hawley 2.0, Part I - Paul Krugman

_____ (2025b), The Economics of Smoot Hawley 2.0, Part II: This trade war is really a class war, *Substack*, August 10. The Economics of Smoot Hawley 2.0, Part II

Kuhla, K., Puma, M. J., and Otto, C. (2024), International cooperation was key to stabilize wheat prices after the Russian Invasion of Ukraine, *Communications Earth & Environment*, 5:481.

Labban, M. (2010), Oil in parallax: Scarcity, markets, and the financialization of accumulation, *Geoforum; Journal of Physical, Human, and Regional Geosciences*, 41:541-552.

Laulajainen, R. (1995), The geographical reach of a commodity exchange, *Resources Policy*, 21(2):133-141.

_____ (2003), *Financial Geography. A Banker's View.* London: Routledge.

Leyshon, A. (2021), Economic geography I: Uneven development, 'left behind places' and 'levelling up' in a time of crisis, *Progress in Human Geography*, 45(6):1678-1691.

Lo, A. W., and Mueller, M. T. (2010), WARNING: Physics envy may be hazardous to your wealth!, *Journal of Investment Management*, 8(2):13-63.

Lo, G. D., Marcelin, I., Bassène, T., and Sène, B. (2022), The Russo-Ukrainian war and financial markets: the role of dependence on Russian commodities, *Finance Research Letters*, 50, 103194.

MacKinnon, J. G. (1994), Approximate asymptotic distribution functions for unit-root and cointegration tests, *Journal of Business & Economic Statistics*, 12(2):167-176.

Martin, R. (2000), Institutional approaches in economic geography. In Sheppard, E., Barnes, T. J. (eds.), *A Companion to Economic Geography*, 77-94. Oxford: Blackwell.

_____ (2011), The local geographies of the financial crisis: From the housing bubble to economic recession and beyond, *Journal of Economic Geography*, 11:587-618.

Martin, R., and Sunley, P. (1996), Paul Krugman's geographical economics and its implications for regional development theory: a critical assessment, *Economic Geography*, 72(3):259-292.

Maskell, P., and Malmberg, A. (2007), Myopia, knowledge development and cluster evolution, *Journal of Economic Geography*, 7:603-618.

McGill, S. (2018), The Financialization Thesis Revisited: Commodities as an Asset Class. In Clark, G. L., Feldman, M., Gertler, M. S., and Wójcik, D. (eds.), *The New Oxford Handbook of Economic Geography*, 645-664. Oxford: Oxford University Press.

Mei, D., Ma, F., Liao, Y, and Wang, L. (2020), Geopolitical risk uncertainty and oil future volatility: Evidence from MIDAS models, *Energy Economics*, 86.

Minder, R., and Erling, B. (2023), Warsaw seeks to win back farmers after Ukrainian grain fiasco, *Financial Times*, May 21. Warsaw seeks to win back farmers after Ukrainian grain fiasco

Muellerleile, C. (2013), Turning financial markets inside-out: Polanyi, performativity and disembeddedness, *Environment and Planning A: Economy and Space*, 45:1625-1642.

_____ (2017), Calming speculative traffic: an infrastructural theory of financial markets, *Economic Geography*, 94(3):279-298.

Murphy, S., Burch, D., and Clapp, J. (2012), Cereal secrets – The world's largest grain traders and global agriculture. *Oxfam Research Report.*

Neilson, J., Pritchard, B., Fold, N., and Dwiartama, A. (2018), Lead firms in the cocoa-chocolate Global Production Network: An assessment of the deductive capabilities of GPN 2.0, *Economic Geography*, 94(4):400-424.

Nelson, S. R. (2022), *Oceans of Grain: How American Wheat Remade The World.* New York: Basic Books.

Niu, Z., Wang, C., and Zhang, H. (2023), Forecasting stock market volatility with various geopolitical risks categories: New evidence from machine learning models, *International Review of Financial Analysis*, 89, 102738.

North, D. C. (1990), *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.

_____ (1991), Institutions, *Journal of Economic Perspectives*, 5(1):97-112.

_____ (1994), Economic Performance Through Time, *The American Economic Review*, 84(3):359-368.

_____ (2005), *Understanding the Process of Economic Change*. Princeton: Princeton University Press.

North, D. C., and Davis, L. E. (1971). *Institutional Change and American Economic Growth*. Cambridge: Cambridge University Press.

O'Brien, R. (1992), *Global Financial Integration: The End of Geography.* London: Pinter Publishers.

Olearchyk, R. (2012), Basket of promise, *Financial Times*, December 17. Basket of promise

Orenstein, D. (2019), *Out of Stock: The Warehouse in the History of Capitalism*. Chicago: Chicago University Press.

Ozturk, E. O., and Sheng, X. S. (2018), Measuring global and country-specific uncertainty, *Journal of International Money and Finance*, 88:276-295.

Pastor, L., and Veronesi, P. (2013), Political uncertainty and risk premia, *Journal of Financial Economics*, 110(3):520-545.

Pavlínek, P. (2024), Geopolitical decoupling in Global Production Networks, *Economic Geography*, 100(2):138-169.

Payne, J., and Nikolaeva, M. (2019), BNP Paribas to overhaul commodity finance team. *Reuters,* December 19. BNP Paribas to overhaul commodity finance team | Reuters

Payne, J., and Trompiz, G. (2025), EU to cut Ukrainian wheat, sugar imports by 70-80% under new quotas. *Reuters*, July 4. EU to cut Ukrainian wheat, sugar imports by 70-80% under new quotas | Reuters

Pike, A., Dawley, S., and Tomaney, J. (2010), Resilience, adaptation and adaptability, *Cambridge Journal of Regions, Economy and Society*, 3:59-70.

Pike, A., and Pollard, J. (2010), Economic geographies of financialization, *Economic Geography*, 86(1):29-51.

Plume, K. (2023), Cargill fiscal 2023 revenue rises 7% to record $177 billion. *Reuters*, August 3. Cargill fiscal 2023 revenue rises 7% to record $177 billion | Reuters

Polanyi, K. (1957), The Economy as Instituted Process. In Polanyi, K., Arensberg, C. M., and Pearson, H. W. (eds.), *Trade and Market in the Early Empires*, 243-270. Chicago: Henry Regnery Company.

Porter, M. E. (1990), The competitive advantage of nations, *Harvard Business Review*, 90211.

Radev, R., Orbán, V., Morawiecki, M., Ciucă, N., and Heger, E. (March 2023), Joint letter by Bulgaria, Hungary, Poland, Romania, and Slovakia on measures counteracting the negative effects of the increased imports of agricultural products from Ukraine on the EU market. Premier - Kancelaria Prezesa Rady Ministrów - Portal Gov.pl (www.gov.pl)

Rafiqui, P. S. (2009), Evolving economic landscapes: Why new institutional economics matters for economic geography, *Journal of Economic Geography*, 9:329-353.

Reisinger, A., Howden, M., Vera, C. et al. (2020), *The Concept of Risk in the IPCC Sixth Assessment Report: A Summary of Cross-Working Group Discussions*, Intergovernmental Panel on Climate Change, Geneva, Switzerland, 15.

Reuters (2016) CME says has 16 French silos ready for EU wheat futures launch. *Reuters*, September 9. CME says has 16 French silos ready for EU wheat futures launch | Reuters

Robbins, P. (2004), *Political Ecology: A Critical Introduction.* Oxford: Blackwell.

Rosenthal, S. S., and Strange, W. C. (2020), How close is close? The spatial reach of agglomeration economies, *Journal of Economic Perspectives*, 34(3):27-49.

Rosso Alba, C. E. (2022), Argentine Tax Court ruling on “Cargill” transfer pricing case, *WTS Transfer Pricing Newsletter*, 3:4-5.

Samuelson, P. A. (1965), Proof that properly anticipated prices fluctuate randomly, *Industrial Management Review*, 6:41-49.

Savage, S., Hancock, A., and Pooler, M. (2024), The global power of Big Agriculture’s lobbying, *Financial Times*, August 22. The global power of Big Agriculture’s lobbying

Sayer, A. (2000), *Realism and Social Science*. London: Sage.

Scheiring, G. (2022), The national-populist mutation of neoliberalism in dependent economies: the case of Viktor Orbán’s Hungary, *Socio-Economic Review*, 20(4):1597-1623.

Schindler, S., Alami, I., DiCarlo, J., et al. (2024), The Second Cold War: US-China competition for centrality in infrastructure, digital, production, and finance networks, *Geopolitics*, 29(4):1083-1120.

Schwartz-Shea, P., and Yanow, D. (2012), *Interpretive Research Design: Concepts and Processes*. New York: Routledge.

Scott, J. C. (2017), *Against the Grain: A Deep History of the Earliest States*. New Haven: Yale University Press.

Seabrooke, L., and Wigan, D. (2014), Global wealth chains in the international political economy, *Review of International Political Economy*, 21(1):257-263.

_____ (eds.) (2022), *Global Wealth Chains: Asset Strategies in the World Economy*, Oxford: Oxford University Press.

Selwyn, B., Bernhold, C., and Leyden, D. (2025), The geopolitical underpinning of global value chains and production networks: US-China technological rivalry in a longer-range perspective, *Journal of Economic Geography*, 1-18.

Sheppard, D. (2014), Influence of banks, hedge funds on commodities lowest since 2008. *Reuters*, April 16. Influence of banks, hedge funds on commodities lowest since 2008 | Reuters

Sheppard, E. (2002), The spaces and times of globalization: place, scale, networks, and positionality, *Economic Geography*, 78:307-330.

_____ (2011), Geographical political economy, *Journal of Economic Geography*, 11:319-331.

Smith, A. (2015), The state, institutional frameworks and the dynamics of capital in global production networks, *Progress in Human Geography*, 39(3):290-315.

Smith, A., Rainnie, A., Dunford, M., Hardy, J., Hudson, R., and Sadler, D. (2002), Networks of value, commodities and regions: Reworking divisions of labour in macro-regional economies, *Progress in Human Geography*, 26(1):41–63.

Sonn, J. W., and Hsu, L. F. (2022), Geopolitics and economic geography: a commentary on Andy Pike's geographical political economy, *International Journal of Urban Sciences*, 26(1):36-44.

Sørensen, C. (2002), Modeling seasonality in agricultural commodity futures, *The Journal of Futures Markets,* 22(5):394–426.

Staritz, C., Newman, S., Tröster, B., and Plank, L. (2018), Financialization and global commodity chains: distributional implications for cotton in Sub-Saharan Africa, *Development and Change*, 49(3):815-842.

Staritz, C., Tröster, B., Grumiller, J., and Maile, F. (2023), Price-setting power in global value chains: The cases of price stabilisation in the cocoa sectors in Côte d'Ivoire and Ghana*, The European Journal of Development Research*, 35:840–868.

Sunley, P. (2008), Relational economic geography: A partial understanding or a new paradigm?, *Economic Geography*, 84(1):1-26.

Thrift, N., and Olds, K. (1996), Refiguring the economic in economic geography, *Progress in Human Geography*, 20:311-337.

Tirmizey, K. A. (2023), The geometry of (anti)imperialism in food regime analysis, *Environment and Planning A: Economy and Space*, 56(3):849-864.

Tiwari, A. K., Boachie, M. K., Suleman, M. T., and Gupta, R. (2021), Structure dependence between oil and agricultural commodities returns: The role of geopolitical risks, *Energy*, 219.

U.S. Department of Justice (2014), BNP Paribas Agrees to Plead Guilty and to Pay $8.9 Billion for Illegally Processing Financial Transactions for Countries Subject to U.S. Economic Sanctions. Press release, June 30. Office of Public Affairs | BNP Paribas Agrees to Plead Guilty and to Pay $8.9 Billion for Illegally Processing Financial Transactions for Countries Subject to U.S. Economic Sanctions | United States Department of Justice

U.S. Wheat Associates (USW) (2023), *Crop Quality Report. High Quality Wheat for Every Need*, https://www.uswheat.org

Venables, A. J. (2019), Economic geography and trade, *Oxford Research Encyclopedias, Economics and Finance*, https://doi.org/10.1093/acrefore/9780190625979.013.332

Vigani, M., Fellmann, T., Porcella Cpkovicova, A., and Ferrari, E. (2024), Harvesting resilience: adapting the EU agricultural system to global challenges, *Nature - Npj Sustainable Agriculture*, 2:21.

Visco, I. (2013), The aftermath of the crisis: Regulation, supervision and the role of central banks, *Center for Economic and Policy Research (CEPR) Policy Insights*, 68.

Völlers, P., Neise, T., and Schumacher, K. P. (2023), Revisiting risk in the Global Production Network approach 2.0 – Towards a performative risk narrative perspective, *Environment and Planning A: Economy and Space*, 55(8):1838-1858.

Vuillemey, G. (2020), The value of central clearing, *The Journal of Finance*, 75(4):2021-2053.

Wigan, D., Seabrooke, L., Ponte, S., and Bair, J. (2024), Global value and wealth chains in contemporary capitalism: Editorial introduction, *Environment and Planning A: Economy and Space*, 56(8):2169-2173.

Williams, J. (2009), *The Economic Function of Futures Markets.* Cambridge: Cambridge University Press.

Williamson, O. E. (1971), The vertical integration of production: Market failure considerations, *American Economic Review*, 61:112–123.

_____ (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Wojciechowski, J. (2023), *Four Cornerstones for the Future of Food and Farming in the EU*, Address delivered at the 2023 State of the Union Conference, organized by the European Institute University, Florence, May 4, 2023 State of the Union conference, Florence (europa.eu)

_____ (2024), *Preliminary Activity Report of Mr Janusz Wojciechowski, European Commissioner for Agriculture, 2019-2024*, Statement, Brussels, July 25, Mr Janusz Wojciechowski: Preliminary Report, 2019-24 (europa.eu)

Wójcik, D. (2018), The global financial networks. In Clark, G. L., Feldman, M., Gertler, M. S., and Wójcik, D. (eds.), *The New Oxford Handbook of Economic Geography*, 557–574. Oxford: Oxford University Press.

_____ (2022), Financial geography III: Research strategies, designs, methods and data, *Progress in Human Geography*, 46(1): 254-254.

_____ (2025), Finance and economic geography: where does money come from and where is it going?, *Journal of Economic Geography*, 00:1-9.

WTO (2024), *Overview of developments in the international trading environment. Annual report by the Director General*, 62-report.pdf

Yeung, H. W. (2005), Rethinking relational economic geography, *Transactions of the Institute of British Geographers*, 30(1):37-51.

_____ (2020), The trouble with global production networks, *Environment and Planning A: Economy and Space*, 53(2):428-438.

_____ (2023), Troubling economic geography: New directions in the post-pandemic world, *Transactions of the Institute of British Geographers*, 48:672-680.

_____ (2024), From regional to global and back again? A future agenda for regional evolution and (de)globalised production networks in regional studies, *Regional Studies*, 58(7):1480-1491.

Yin, R. K. (2014), *Case Study Research: Design and Methods*. Los Angeles, CA: Sage.

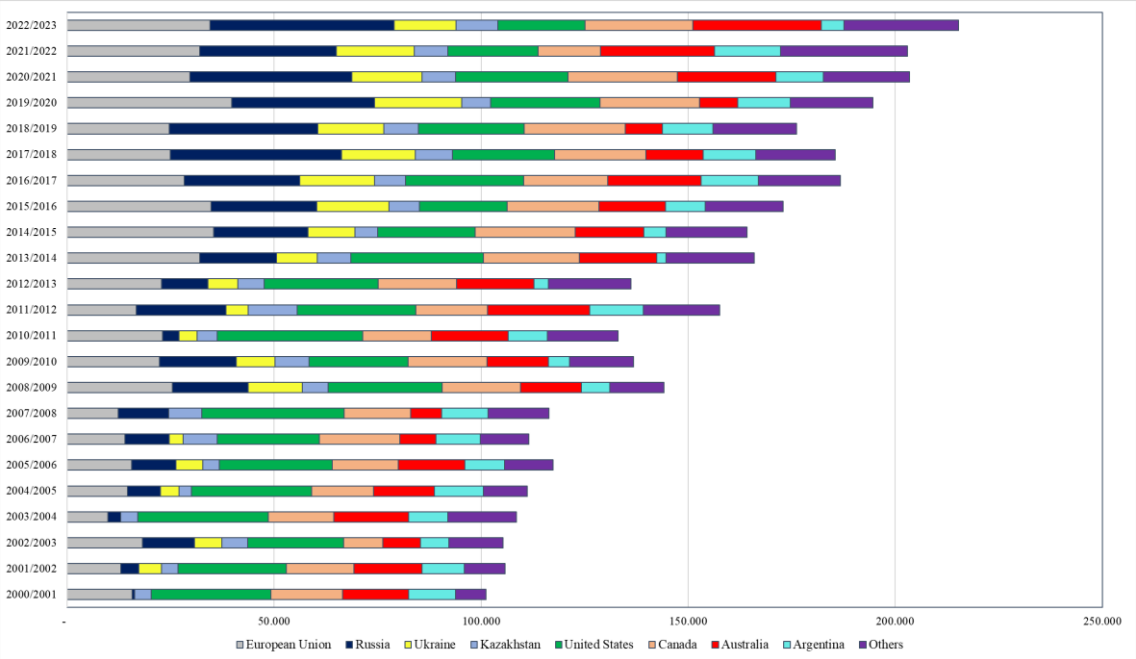
Young, H. P., and Burke, M. A. (2001), Competition and custom in economic contracts: a case study of Illinois agriculture, *The American Economic Review*, 91(3):559-573.

Zhang, Y., He, J., He, M., and Li, S. (2023), Geopolitical risk and stock market volatility: A global perspective, *Finance Research Letters*, 53.

Appendix

Section A. Supporting data

Figure A1. *Wheat exports by exporting country (1000 MT)*



Source: USDA, Foreign Agricultural Service.

Section B. Descriptive statistics

Table B1. *Variables summary statistics*

					Augmented Dickey-Fuller		Augmented Dickey-Fuller on cointegrating relationship	
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**t-stat**	**p-val**	**t-stat**	**p-val**
Paris wheat futures price	178	58	101	411	-1,88	0,34	-16,4	0,00
Chicago wheat futures price	528	189	240	1142	-2,33	0,16	-16,5	0,00
Kansas City wheat futures price	554	204	279	1219	-1,97	0,30	-16,8	0,00
London wheat futures price	133	54	59	334	-1,63	0,47	-17,0	0,00
Paris volume	8154	8994	2	38139	-4,36	0,00		
Chicago volume	34970	19450	3731	87492	-10,66	0,00		
Kansas City volume	10917	7581	973	37010	-9,43	0,00		
London volume	125	117	1	515	-9,92	0,00		
Paris open interest	51676	51808	64	217763	-4,63	0,00		
Chicago open interest	105016	52532	20273	292525	-11,01	0,00		
Kansas City open interest	47918	29358	6572	174710	-8,78	0,00		
London open interest	1803	2189	1	10360	-8,18	0,00		
Geopolitical uncertainty	105	52	45	513	-6,50	0,00		
Economic policy uncertainty	146	75	49	428	-3,52	0,01		
Financial stress_US CISS	0,11	0,15	0,00	0,87	-3,63	0,01		
Financial stress_EA CISS	0,18	0,19	0,00	0,92	-3,52	0,01		
French wheat spot price	219	80	87	440	-2,18	0,21		
US HRW spot price	244	85	112	516	-2,09	0,25		
US SRW spot price	210	72	90	442	-2,37	0,15		
UK wheat spot price	142	67	60	291	-1,37	0,60		
Wheat supply	2023	228	1606	2500	-2,99	0,04		
Wheat spot price (global)	200	74	94	444	-2,20	0,20		
Area harvested_EU	25	1	23	27	-0,86	0,80		

Area harvested_US	19	2	14	23	0,64	0,99		
Area harvested_global	218	4	208	226	-0,75	0,83		
Vegetation Health Index_France	49,31	9,54	-1,00	70,43	-7,54	0,00		
Vegetation Health Index_US	50	9	-1	71	-6,90	0,00		
USD foreign exchange rate	105	10	86	127	-0,59	0,91		
EUR foreign exchange rate	93,67	7,19	71,75	104,91	-1,85	0,35		
VIX	20	8	10	63	-4,89	0,00		
EURO STOXX	331	74	183	479	-1,42	0,57		
S&P 500	1985	1074	757	4712	1,76	1,00		
German yield 1Y	1,82	1,82	-0,50	5,40	-1,28	0,64		
US yield 1Y	1,90	1,84	0,05	6,33	-1,67	0,45		
GPU_Argentina	0,03	0,03	0,00	0,26	-9,61	0,00		
GPU_Australia	0,11	0,07	0,01	0,53	-8,68	0,00		
GPU_Canada	0,22	0,17	0,06	1,72	-7,63	0,00		
GPU_Russia	0,84	0,83	0,22	8,98	-5,05	0,00		
GPU_Ukraine	0,34	0,89	0,00	8,88	-4,08	0,00		
GPU_US	2,42	1,36	0,82	13,23	-6,49	0,00		
Paris corn futures price	211,4	66,37	105,26	368,42	-2,51	0,11		
Chicago corn futures price	4	2	2	8	-2,27	0,18		
Corn spot price	180	71	75	349	-1,74	0,41		
Crude oil futures price	63	26	19	140	-2,23	0,19		
Crude oil spot price_WTI	27,9	10,62	7,30	64,63	-2,29	0,17		
Crude oil spot price_Brent	67	29	19	134	-1,93	0,32		
Gold futures price	1082	536	258	1999	-0,69	0,85		
Gold spot price	1083	538	260	2000	-0,39	0,91		

Notes: The table displays mean, standard deviation, minimum value, maximum value, and the Dickey Fuller test for unit roots (both t-statistic and p-values based on MacKinnon (1994)). As it is possible to observe, our dependent variables (first four rows in the table) cannot reject the null hypothesis of unit root. The last two columns report the results of the Dickey-Fuller test performed on the residual of a regression of each of the wheat futures prices onto their corresponding spot price (and three lags of both). These tests all reject the null hypothesis at a 1% confidence level providing evidence that there exists indeed a cointegrating relationship with the corresponding spot price introduced among the controls in all the specifications.

Section C. Supporting data to the principal component analysis presented in the main text

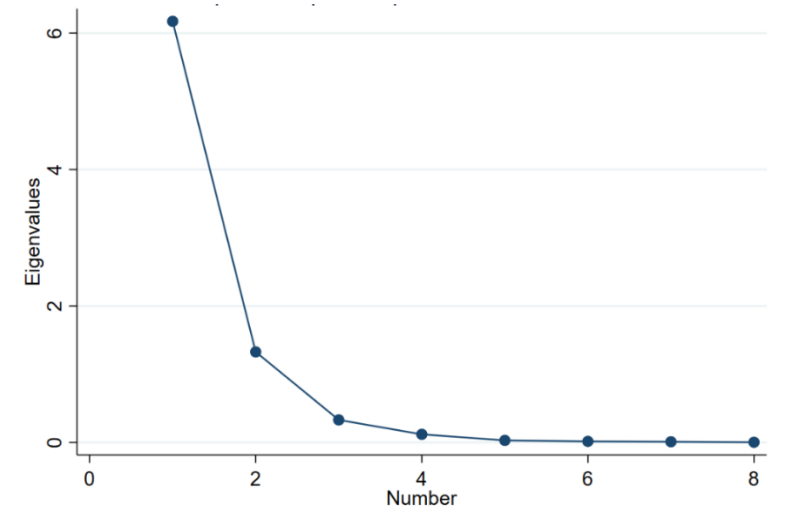
Table C1. *Principal component extraction from vector of other commodity futures and spot prices*

Principal components/correlation — Number of obs = 279
Number of comp. = 8
Trace = 8
Rotation: (unrotated = principal) — Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	6.17339	4.84692	0.7717	0.7717
Comp2	1.32647	.997375	0.1658	0.9375
Comp3	.329093	.211697	0.0411	0.9786
Comp4	.117396	.0886086	0.0147	0.9933
Comp5	.0287878	.0145079	0.0036	0.9969
Comp6	.0142798	.00533267	0.0018	0.9987
Comp7	.00894717	.00730839	0.0011	0.9998
Comp8	.00163879	.	0.0002	1.0000

Notes: Principal components extraction table. Commodities considered include oil, corn and gold.

Figure C2. *Principal component extraction from vector of commodity futures and spot prices*



Notes: Scree plot of the eigenvalues associated with each of the 8 principal components extracted from the 8 time-series of commodity prices in order of magnitude.

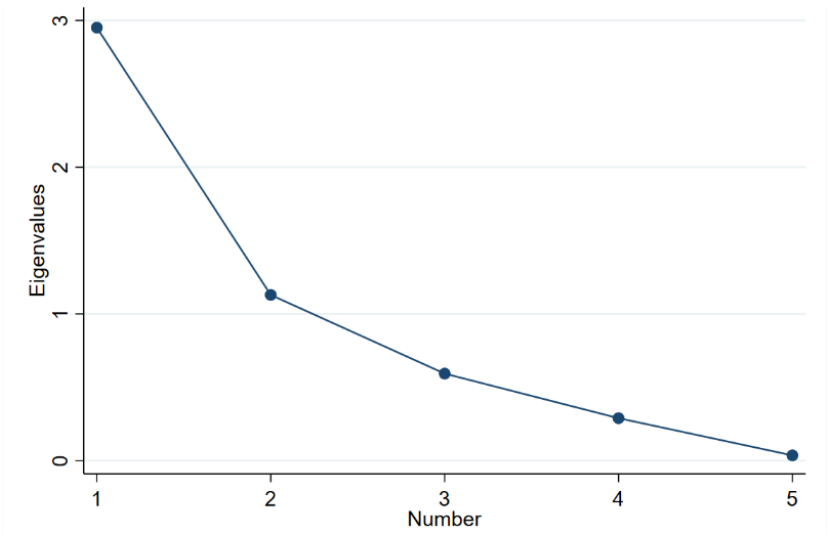
Table C3. *Principal component extraction from vector of non-US and non-EU geopolitical uncertainty indices*

Principal components/correlation — Number of obs = 283; Number of comp. = 5; Trace = 5; Rotation: (unrotated = principal); Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.95127	1.82176	0.5903	0.5903
Comp2	1.12951	.536078	0.2259	0.8162
Comp3	.593436	.303789	0.1187	0.9348
Comp4	.289647	.253515	0.0579	0.9928
Comp5	.0361324	.	0.0072	1.0000

Notes: Principal components extraction table from the 5 time-series of geopolitical risk indices for Argentina, Canada, Australia, Russia and Ukraine.

Figure C4. *Principal component extraction from vector of non-US and non-EU geopolitical uncertainty indices*



Notes: Scree plot of the eigenvalues associated with each of the 5 principal components extracted from the 5 time-series of geopolitical risk indices for Argentina, Canada, Australia, Russia and Ukraine in order of magnitude.

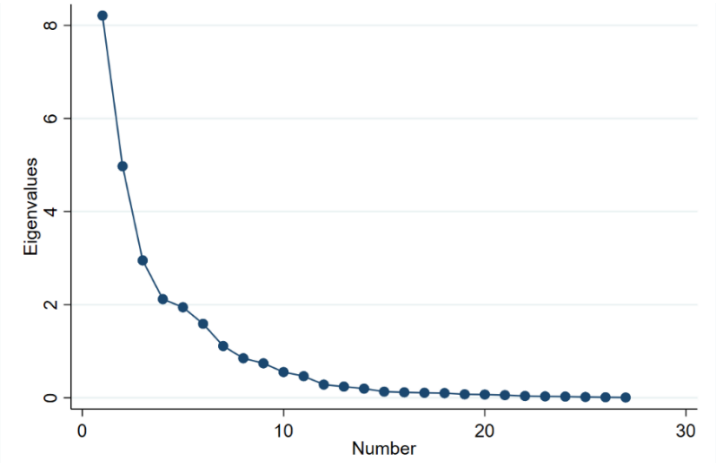
Table C5. *Principal component extraction from vector of controls used in the FAVAR(3) model*

Principal components/correlation — Number of obs = 246
Number of comp. = 27
Trace = 27
Rotation: (unrotated = principal) — Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	8.20964	3.23585	0.3041	0.3041
Comp2	4.97379	2.02396	0.1842	0.4883
Comp3	2.94983	.831281	0.1093	0.5975
Comp4	2.11855	.175243	0.0785	0.6760
Comp5	1.94331	.353885	0.0720	0.7480
Comp6	1.58942	.47862	0.0589	0.8068
Comp7	1.11081	.261782	0.0411	0.8480
Comp8	.849023	.108933	0.0314	0.8794
Comp9	.74009	.188271	0.0274	0.9068
Comp10	.551819	.0881212	0.0204	0.9273
Comp11	.463698	.180884	0.0172	0.9444
Comp12	.282814	.0440571	0.0105	0.9549
Comp13	.238757	.0426726	0.0088	0.9638
Comp14	.196085	.0646643	0.0073	0.9710
Comp15	.13142	.0147948	0.0049	0.9759
Comp16	.116625	.0102008	0.0043	0.9802
Comp17	.106425	.00655834	0.0039	0.9842
Comp18	.0998664	.0250747	0.0037	0.9879
Comp19	.0747916	.00479956	0.0028	0.9906
Comp20	.0699921	.0135584	0.0026	0.9932
Comp21	.0564337	.0188246	0.0021	0.9953
Comp22	.0376091	.00762202	0.0014	0.9967
Comp23	.0299871	.00412163	0.0011	0.9978
Comp24	.0258654	.00921907	0.0010	0.9988
Comp25	.0166464	.00593655	0.0006	0.9994
Comp26	.0107098	.00473178	0.0004	0.9998
Comp27	.00597802	.	0.0002	1.0000

Notes: Principal components extraction table from the 27 time-series of controls used in the FAVAR(3) specification.

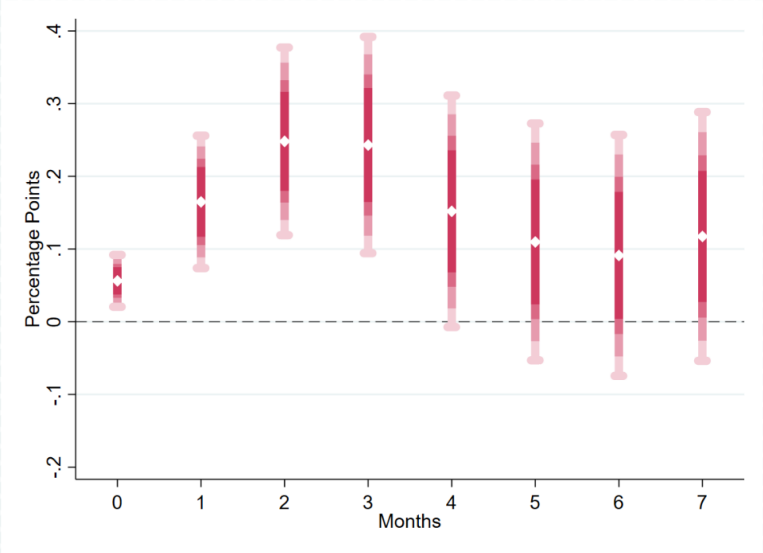
Figure C6. *Principal component extraction from vector of controls used in the FAVAR(3) model*



Notes: Scree plot of the eigenvalues associated with each of the 27 principal components extracted from the 27 time-series of controls used in the FAVAR(3) specification in order of magnitude.

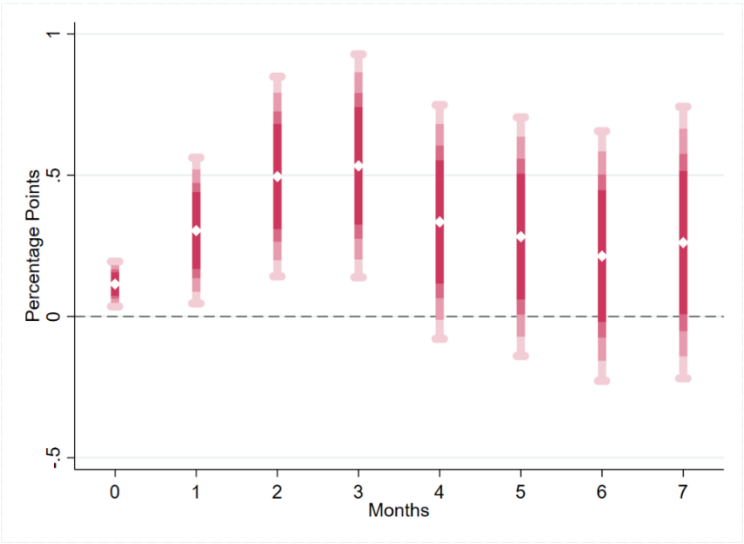
Section D. Robustness of baseline impulse response functions considering area harvested

Figure D1. *Impulse response function for Paris wheat futures considering area harvested*



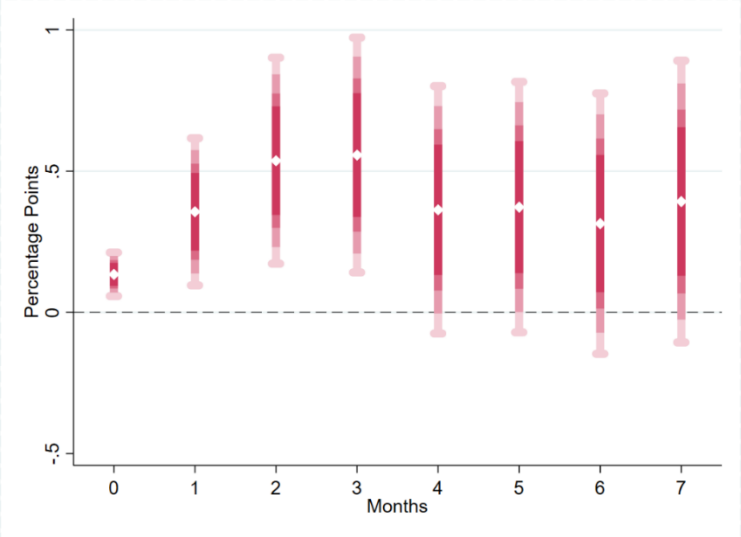
Notes: Full dynamic response of Paris wheat futures price to GPU. Specification extended with indicators of area harvested globally and in the EU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure D2. *Impulse response function for Chicago SRW wheat futures considering area harvested*



Notes: Full dynamic response of Chicago SRW wheat futures price to GPU. Specification extended with indicators of area harvested globally and in the US. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

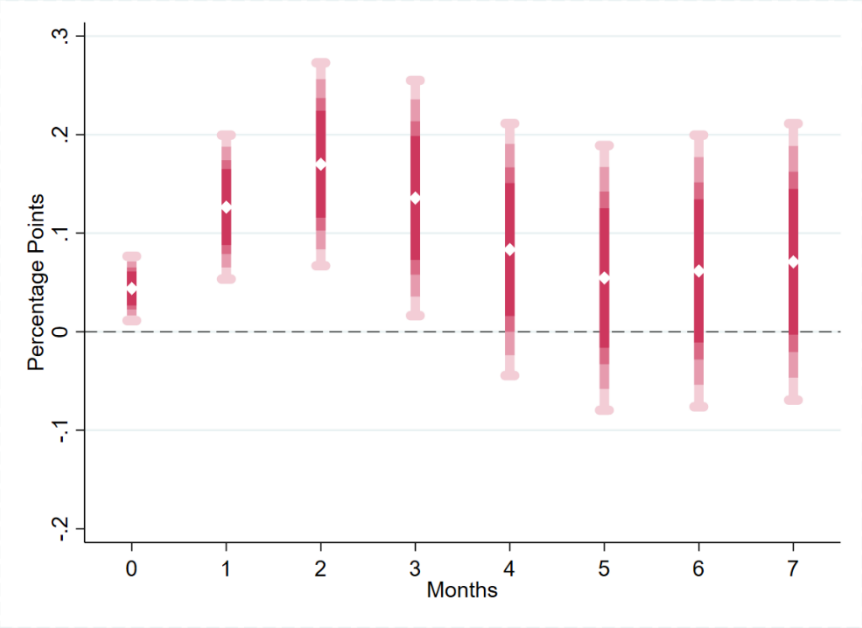
Figure D3. *Impulse response function for Kansas City HRW wheat futures considering area harvested*



Notes: Full dynamic response of Kansas City HRW wheat futures price to GPU. Specification extended with indicators of area harvested globally and in the US. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

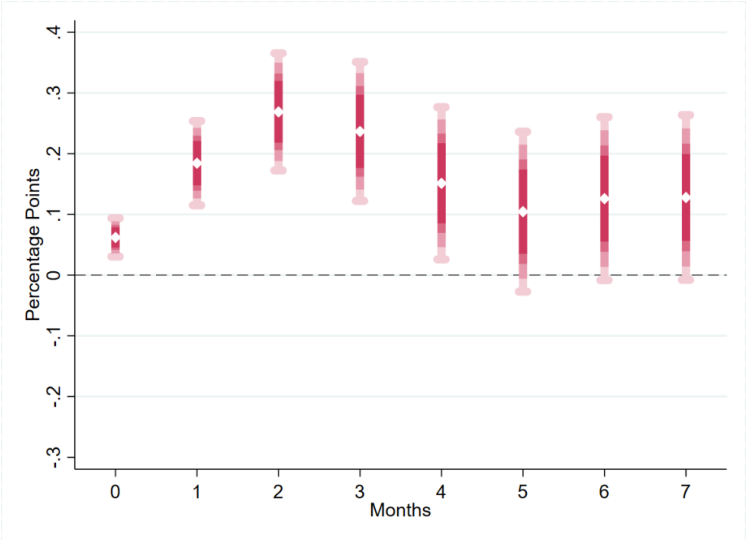
Section E. Robustness of baseline impulse response functions for London market

Figure E1. *Impulse response function for London wheat futures*



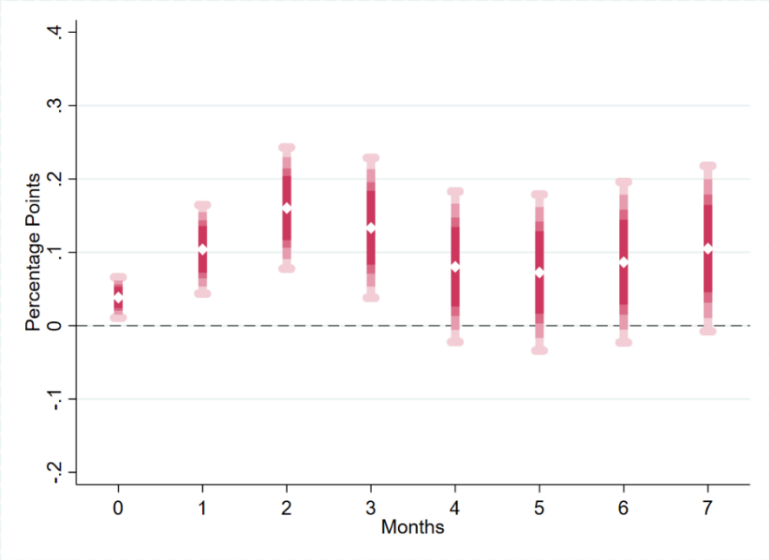
Notes: Full dynamic response of London wheat futures price to GPU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure E2. *Impulse response function for London wheat futures considering geopolitical uncertainty of non-US and non-EU countries*



Notes: Full dynamic response of London wheat futures price to GPU index for non-US and non-EU countries. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Figure E3. *Impulse response function for London wheat futures considering area harvested*



Notes: Full dynamic response of London wheat futures price to GPU. Specification extended with indicator of area harvested globally and in the EU. Point estimate is displayed as a white diamond. Confidence bands at 20% (red), 10% (mild red), 5% (pink) are displayed. Estimation through OLS with monthly fixed effects.

Section F. Robustness of baseline regression excluding economic policy uncertainty

Table F1. *Contemporaneous effect of geopolitical uncertainty on wheat futures prices excluding economic policy uncertainty index*

VARIABLES	(1) Paris	(2) Chicago	(3) Kansas City
Geopolitical Uncertainty (GPU) (global)	0.049***	0.149***	0.114***
	[0.014]	[0.040]	[0.038]
EA CISS	21.003***		
	[4.326]		
US CISS		124.876***	108.420***
		[20.061]	[19.164]
Other Commodity Prices (First PC)	0.234	0.393	2.066
	[0.618]	[1.656]	[1.604]
Other Commodity Prices (Second PC)	0.105	0.577	-0.444
	[0.916]	[2.516]	[2.358]
Constant	-45.383**	-130.231*	-39.820
	[21.360]	[72.240]	[66.516]
Observations	247	247	247
Month FE	YES	YES	YES
Full Controls	YES	YES	YES
$ R^2 $	0.991	0.994	0.995
Adj. $ R^2 $	0.990	0.993	0.994
d.o.f.	208	208	208

Standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Section G. Robustness of baseline regressions with respect to clustering standard errors at the yearly level

Table G1. *Contemporaneous effect of geopolitical uncertainty on wheat futures prices. Errors clustered at the yearly level*

VARIABLES	(1) Paris	(2) Chicago	(3) Kansas City
Geopolitical Uncertainty (GPU) (global)	0.046**	0.133**	0.101***
	[0.019]	[0.054]	[0.035]
Economic Policy Uncertainty (EPU) (global)	-0.029**	-0.118***	-0.112***
	[0.011]	[0.027]	[0.026]
EA CISS	19.869***		
	[4.962]		
US CISS		109.568***	94.409***
		[27.461]	[31.768]
Other Commodity Prices (First PC)	0.898	3.324	4.764*
	[1.238]	[2.337]	[2.612]
Other Commodity Prices (Second PC)	-0.116	-1.137	-1.924
	[1.192]	[3.963]	[2.970]
Constant	-63.603*	-230.221**	-133.930
	[31.122]	[107.333]	[103.553]
Observations	247	247	247
Month FE	YES	YES	YES
Full Controls	YES	YES	YES
Yearly Clustered Errors	YES	YES	YES
R^2	0.991	0.994	0.995
Adj. R^2	0.990	0.993	0.994
d.o.f.	20	20	20

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1

Table G2. *Effect of geopolitical uncertainty on wheat futures prices 1 month after. Errors clustered at the yearly level*

VARIABLES	(1) Paris	(2) Chicago	(3) Kansas City
Geopolitical Uncertainty (GPU) (global)	0.119**	0.326**	0.285**
	[0.054]	[0.131]	[0.118]
Economic Policy Uncertainty (EPU) (global)	-0.075	-0.324**	-0.318**
	[0.046]	[0.153]	[0.139]
EA CISS	24.486**		
	[8.882]		
US CISS		184.160**	187.630**
		[70.166]	[66.992]
Other Commodity Prices (First PC)	6.962***	15.245**	16.655**
	[2.330]	[5.830]	[7.019]
Other Commodity Prices (Second PC)	0.534	6.620	9.265
	[2.794]	[6.793]	[7.381]
Constant	-6.857	314.699	418.863**
	[68.606]	[231.309]	[179.368]
Observations	247	247	247
Month FE	YES	YES	YES

Full Controls	YES	YES	YES
Yearly Clustered Errors	YES	YES	YES
$ R^2 $	0.948	0.941	0.949
Adj. $ R^2 $	0.938	0.930	0.939
d.o.f.	20	20	20

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1