

The Ties That Bind: The Ukraine War and African Food Dependency

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Abstract

The Ukraine war had severe but uneven effects on African food markets. I argue that corridor dependency, defined as reliance on Russian and Ukrainian cereals, drove this variation. I develop a Black Sea Corridor Dependence (BSCD) metric, which captures the three-year prewar share of cereals imported from Russia and Ukraine in a country's total cereal supply, and contrast it with the FAO Cereal Import Dependency Ratio (CIDR). Using a difference-in-differences design with country and year fixed effects and the FAO Indicator of Food Price Anomalies (IFPA) as the outcome, I compare countries above and below the median on each metric. Countries with higher BSCD experienced a 0.78 standard-deviation larger post-2022 increase in IFPA, while CIDR shows no effect. Mechanism checks indicate that the result is corridor-level, rather than driven by either supplier alone, and robustness checks support the design. Effects are strongest where supplier concentration and limited substitution capacity coincide, clarifying the scope conditions for external validity. Empirically, this study quantifies the conflict's realized impact in Africa. Theoretically, it offers an empirical operationalization of relational dependency and links that structure to observed price outcomes.

Keywords: food security, dependency theory, Ukraine war, cereal trade, Africa

1 Introduction

The February 2022 Russian invasion of Ukraine transformed the Black Sea from a vital artery of the global cereal trade into a war zone. Food supply chains stalled and prices surged, causing severe food insecurity for African countries that previously relied on Russian and Ukrainian cereals (Hatab and Lagerkvist 2024). Consequently, in 2022 the number of severely food insecure people in Africa increased to 342 million, prompting the UN Economic Commission for Africa to warn of a “food crisis of unprecedented proportions” (FAO et al. 2023, p. v). However, the crisis’s impacts were uneven, even among net-importers, raising the central question: what prewar factors explain cross-country differences in post-invasion food price anomalies?

I argue that corridor dependence, defined as reliance on Russian and Ukrainian cereals, drove this variation. Prior to wartime disruption of the Black Sea grain corridor, many African countries relied on Russian and Ukrainian cereals for the majority of their grain imports; for example, Eritrea and Somalia sourced over 90% of their cereals from this dyad (ITC 2025b,a). Why would governments accept such concentrated exposure despite the clear risks of relying on two geopolitical rivals shipping through a blockade-prone corridor? Dependency theory offers a simple answer: peripheral countries’ systemic constraints.

Neo-dependency theory suggests that Black Sea producers leveraged their agricultural economies of scale and spatial proximity to African importers, whose domestic production and procurement options were limited by infrastructural, geographic, and fiscal constraints (Kunaka et al. 2025). The Black Sea grain corridor stabilized supply but deepened dependence by pricing out alternative suppliers. When the corridor fractured, dependent countries struggled to reroute because of their limited substitution capacity, which produced price shocks (FAO 2022c). Essentially, African countries’ dependency constrained their ability to adapt. This article develops an empirical neo-dependency framework and tests it against the 2022 shock.

This paper addresses two gaps. First, to my knowledge, it offers the first continent-wide retrospective quantitative analysis of how prewar trade structures shaped African countries' exposure to the Ukraine war's food price shocks. Second, it offers a novel response to [de Oliveira and Kvangraven's \(2023\)](#) call to look "back to Dakar", by employing traditionally normative, qualitative dependency theory concepts alongside quantitative IPE methods. Specifically, I use dependency theory to identify structural vulnerability, and then employ empirical methods to explain how a shock translated that vulnerability into price anomalies. I hypothesize that African countries with greater prewar dependence on the Black Sea grain corridor experienced larger post-invasion food price anomalies than countries with lower dependence.

To test my hypothesis, I estimate a two-way fixed-effects difference-in-differences (DiD) model leveraging the exogenous 2022 invasion. The outcome is the FAO Indicator of Food Price Anomalies (IFPA) at the country-year level. The key pre-treatment predictor is Black Sea Corridor Dependence (BSCD), the 3-year average of African countries' pre-war imports of Russian and Ukrainian cereals as a proportion of total cereal supply, which I contrast with generalized import dependence (CIDR), the cereal import-to-supply ratio. I form treatment and control groups via a median split on each dependency measure and estimate the interaction between treatment and IFPA, with country and year fixed effects. The interaction coefficient captures the additional post-2022 change in IFPA associated with treatment assignment.

I find that BSCD is associated with a 0.78 standard deviation increase in post-invasion food price anomalies, whereas generalized import reliance had no significant effect. Results are robust to event study modeling, placebo tests, sample restrictions, and population cutoffs. Additionally, the treatment effect is only significant when I aggregate countries' combined trade with Russia *and* Ukraine, indicating that vulnerability is associated with dyadic, corridor-level exposure, rather than a specific supplier. Lastly, I find a significant treatment effect only within Africa, the region

where acute dependency is currently most prevalent. This finding reinforces this article's use of a critical dependency theory lens, as it is precisely in peripheral contexts that the framework's explanatory power is most relevant.

This paper proceeds as follows. Section 2 develops a relational, corridor-based application of dependency theory to food trade, and situates it within the literature. Section 2.2 frames the Ukraine war as a test of that mechanism, while Section 2.3 addresses the gap in the Ukraine war literature that this study fills. Section 3 defines Black Sea Corridor Dependence (BSCD) metric, describes the data, and outlines the difference-in-differences design. Section 4 presents the main finding: BSCD significantly predicts post-invasion price volatility, while general import reliance (CIDR) does not. Section 4.1 conducts robustness checks, and Section 4.2 considers external validity and scope conditions. Finally, Section 5 concludes by summarizing the paper's theoretical and empirical implications.

2 Neo-dependency Revisited

Contemporary dependency is best understood as a relational condition between importers and exporters, not a simple function of trade direction. A country is dependent when critical imports flow through a volatile corridor and viable substitutes are scarce or costly. This reframing addresses a tension in the literature by advancing the neo-dependency interpretation of dependency as a relational condition shaped by global power asymmetries (McMichael 2009), rather than the classical definition of dependency as a directional, extractive process rooted in trade imbalances (dos Santos 1970). Pre-war Black Sea corridor dependence offers a practical proxy for the relational perspective because it captures exposure to a single, shock-prone route. Additionally, focusing on Africa proxies substitution constraints, due to the continent's well-documented logistics, financing, and geographical constraints.

To contextualize my theoretical argument, section [2.1](#) delineates dependency theory's foundational principles, explains how globalization diminished its popularity, and details how neo-dependency theory seeks to adapt to globalization. It then identifies a lacuna: the lack of empirically grounded applications of neo-dependency theory to international food trade. Section [2.2](#) argues that the effect of the 2022 food supply shock on African food markets provides a unique opportunity to address this lacuna by directly testing alternative conceptions of dependency. Section [2.3](#) positions this approach within the broader Ukraine war literature.

2.1 Dependency Perspectives

Classical dependency theory dichotomizes the global system between a small core of wealthy developed nations and a vast periphery of developing countries ([Prebisch 1950](#)). Under this radial structure, the center extracts natural resources from the periphery, subordinating peripheral states and constraining their paths to development ([Frank 1966](#)). Colonial extraction, it argues, evolved into modern technological-industrial dependency, where multinational corporations exploit developing nations by promoting capital-intensive imports and raw material exports ([dos Santos 1970](#)). Because export dependency interacts with internal class inequality, peripheral development proceeds only in alignment with elite interests and global power asymmetries ([Cardoso 1972](#)). Dependency theorists further assert that export-dependent economies are disproportionately vulnerable to shocks to the price and demand [Singer \(1950\)](#). Thus, while core countries can diversify their trade partnerships, trade liberalization in peripheral countries can increase exposure to global shocks ([Genave et al. 2020](#)). Economic volatility then depresses investment and weakens countries' adaptive capacities, compounding the severity of shocks ([Guillaumont 2008](#)).

However, the ascendancy of peripheral East Asian economies, late 20th-century globalization, and unprecedented prosperity in the Global North led many to question the validity of dependency theory as a development framework (Amsden 2001). Neoliberalism seemed to show that integration into global markets could, under certain conditions, yield rapid growth and rising living standards (Balassa 1986). Globalization blurred the core-periphery dichotomies that structured earlier debates (Beck et al. 2024; Kim et al. 2024). For example, global value chains (GVCs) transcend national distinctions (Gereffi et al. 2005). Consider how U.S. companies market Chinese-assembled, Korean-designed laptops comprised of Chilean lithium, Congolese cobalt, and Japanese LCD screens (Baldwin 2019). Multinational corporations increasingly expanded their global influence, in some cases rivaling the authority and regulatory power of states (Strange 1996). Markets grew increasingly financialized, abstracting capital from tangible referents and increasing transaction volumes (Clapp 2014). Further complicating matters, some developing countries' leftist governments adopted extractive economic strategies to fund welfare spending, challenging traditional dependency theory assumptions regarding the structure of exploitation and extraction (Burchardt and Dietz 2014).

Neo-dependency theory adapts and reconceives dependency in response to these developments. Wibbels (2006) shows how the increased market volatility associated with developing countries lowering international trade barriers persists in financial markets. Burchardt and Dietz (2014) coin the term "neoextractivism" to explain how both externally imposed and internally motivated resource extraction can produce similar outcomes. Even the previous example of globally sourced electronic devices subtly illustrates the enduring relevance of dependency theory: while peripheral states supply the raw materials, core states capture value through design, marketing, and

distribution (Selwyn 2012). Thus, within finance, extractivism, and GVC analysis, neo-dependency theory retains its value as a lens on how economic power is structurally and relationally exercised.

Despite theoretical innovations in other sectors, dependency theory has not sufficiently addressed recent developments in the agriculture sector, particularly in food-importing peripheral countries. Many core and semi-core countries now sell substantial volumes of agricultural products to peripheral countries. For example, Russia and Ukraine export massive amounts of wheat and maize to Africa. The fact that many African states are net food importers emphasizes how global production dynamics can invert classical expectations (Jayne et al. 2010). Some recent analyses explain agricultural dependency in terms of supply chain control rather than the directionality of extraction (McMichael 2009). While the “food regime” argument makes intuitive sense, its proponents often eschew empirical validation in favor of normative and theoretical argumentation (Patel 2009). Indeed, despite theoretical adaptation in other sectors, dependency theory has left empirical analysis of agricultural trade largely under-examined—a striking omission, given the agrarian sector’s centrality to many peripheral economies.

Having clarified this article’s relational dependency perspective, the following section contextualizes how the Russia-Ukraine war disrupted the Black Sea grain corridor, and why that disruption constitutes an exogenous shock that can be leveraged to test dependency dynamics.

2.2 Empirical Setting

The 2022 Russian invasion of Ukraine provides a unique exogenous shock that I use to empirically investigate neo-dependency dynamics. Africa is an ideal setting because many countries relied on the Black Sea grain corridor, leaving them exposed to its disruption (Otsuka et al. 2024). Prior to the invasion, approximately half of Africa’s

caloric intake came from cereals, while domestic production accounted for only a third of consumption (Silva et al. 2023). To offset production shortfalls, many African countries imported heavily from Russia and Ukraine—before the war, Russia was Africa’s largest wheat supplier, and Ukraine was the third largest (Chandler 2022); in 2021, eighteen African countries obtained over 30 percent of their total wheat supply from the two combined (FAO 2022b).

The invasion turned the Black Sea corridor into a chokepoint. Russia’s blockade effectively halted Ukrainian maritime grain exports, which previously accounted for nearly all of Ukraine’s cereal shipments (Kormych and Averochkina 2022). The UN-brokered Black Sea Grain Initiative temporarily restored grain flows, but Russia’s repeated interruptions culminated in the agreement’s termination in July 2023. Meanwhile, Ukraine shifted its exports towards European markets via rail; by late 2023, roughly half of its cereals were destined for Europe (Welsh and Glauber 2024). Consequently, in 2022 Ukrainian cereal exports to Africa dropped by about 54 percent (\$2.1 billion USD), and Russian cereal exports by about 31 percent (\$1.34 billion USD). Countries with the most concentrated reliance on Russia and Ukraine felt the shock most acutely (Vos et al. 2025).

Research on the crisis suggests a sudden, externally-timed disruption rather than a protracted, anticipated adjustment. For key crops, Ukraine’s marketing season was mostly complete when the conflict escalated, limiting scope for pre-invasion scarcity to affect prices. Indeed, most market reactions were contemporaneous with the invasion or followed shortly after (FAO 2022c). Notably, shipping costs surged by over 50% in the four months immediately following the invasion, compounding food prices (UNCTAD 2022). The shock amplified other crises. A severe, multi-season drought in the Horn of Africa deepened food insecurity in Ethiopia, Kenya, and Somalia (FAO 2022a). Additionally, in May 2022, India banned wheat exports due to supply concerns (FAS 2022). Disruptions to Russian and Ukrainian energy, vegetable oil, and

fertilizer exports also affected food production costs (WB 2022). To preempt concerns about anticipation and co-occurring shocks, I demonstrate flat pretrends using event study estimation and a joint-F test, while country and year fixed effects absorb common global pressures; details appear in Section 3 and Appendix I.

This setting yields a clear, testable implication:

H1: Following the Russian invasion of Ukraine, African countries' prior Black Sea corridor trade intensity conditioned their vulnerability to supply chain shocks, and therefore food price anomalies.

2.3 Gaps in the Ukraine War Literature

Although this hypothesis is conceptually consistent with the existing Ukraine War literature, it addresses a shortage in retrospective, continent-wide empirical research. Previous research identifies Black Sea corridor dependence as one among several factors projected to shape short, medium, and long-term food price dynamics (Balma et al. 2024; Hellegers 2022). Other scholars focus projecting the war's broad financial impacts (Izzeldin et al. 2023; Liadze et al. 2023). Mottaleb et al. (2022) highlights pre-war supplier-specific trade intensity as influential in shaping immediate shifts in consumption patterns.

This study is, to my knowledge, the first retrospective analysis of the factors that conditioned the Ukraine War's realized food price impacts across Africa. Bilali and Hassen's (2024) comprehensive literature review found that the vast majority of the existing Ukraine war literature is predictive and globally oriented, and found no retrospective analyses. The prevalence of predictive research is understandable, as many studies were written soon after the Ukraine war's outbreak when researchers sought to anticipate the conflict's global implications. In 2022, the observational data necessary to evaluate actual outcomes was simply not available, and retrospective

analysis was therefore impossible. However, as of 2025, new data has emerged, creating an opportunity, and a necessity, to complement predictive models with empirical validation.

Some recent studies do attempt retrospective assessments, but with varied methodologies and limited scope. For example, one study used social media sentiment analysis to assess perceptions of the war’s impacts, rather than quantifying realized outcomes (Aygün et al. 2025). Others simply record the global or regional occurrence of food price abnormalities (Arreyndip 2025; Shinoda and Fedorchenko-Kutyev 2025). Only a few studies empirically quantify impact, but only within specific subregions or individual countries (Davalos et al. 2025; Musyoka 2025; Randriamanantena 2025).

This article fills a gap in the literature by advancing a continent-wide retrospective analysis of realized impacts.¹ The next section outlines the research design I use to evaluate the ties between relational dependency and economic vulnerability during shocks.

3 Empirical Analysis

I use difference-in-differences (DiD) models to estimate how African countries’ pre-invasion dependency on Russian and Ukrainian cereals shaped post-invasion food price volatility. To do so, I compare outcomes between high and low-dependency countries and evaluate alternative operationalizations of dependency. This approach enables empirical comparison of countries with high and low pre-war dependency and facilitates theoretical comparison of the dependency metrics themselves.

By treating the 2022 Russian invasion of Ukraine as an exogenous shock, I use DiD models to evaluate which metrics most effectively capture dependency. In other words, while the war revealed the existence of trade-based vulnerabilities, this section

¹Appendix A discusses the supply chain mechanisms linking dependency to economic vulnerability.

investigates the structure of dependency, and which forms most shaped post-invasion outcomes.

3.1 Dependent Variable: Indicator of Food Price Anomalies

This study’s primary dependent variable is the FAO’s Indicator of Food Price Anomalies (IFPA), which identifies market prices that are abnormally high relative to historical and seasonal trends (Baquedano and Navarro 2023).² IFPA accounts for seasonal variation by calculating both quarterly and annual compound growth rates, smoothing the effects of volatility by assuming a steady rate of growth to enhance comparability and interpretability (Baquedano 2015). The FAO calculates IFPA as:

$$IFPA_{yt} = \gamma QIFPA_{yt} + (1 - \gamma) AIFPA_{yt}$$

where $IFPA_{yt}$ is the indicator of food price anomalies in year y for month t , $QIFPA_{yt}$ is the quarterly indicator of food price anomalies in year y and month t , $AIFPA_{yt}$ is the annual indicator of food price anomalies in year y and month t , and γ is a weight with a value of 0.4. IFPA is a continuous variable with a standard normal distribution, as visualized in Figure 1. The FAO interprets IFPA values as:

$$IFPA_y : \begin{cases} \text{Normal} & \text{if } -0.5 \leq IFPA_y < 0.5, \\ \text{Moderately High} & \text{if } 0.5 \leq IFPA_y < 1, \\ \text{Abnormally High} & \text{if } IFPA_y \geq 1. \end{cases}$$

IFPA does not directly measure the actual price of food or food Consumer Price Index (CPI) inflation but is essentially a z-score for food prices that captures how abnormal they are, given historical trends. I use IFPA because it captures relative

²I exclude two extreme values of the Indicator of Food Price Anomalies (IFPA) for the Democratic Republic of the Congo (-55.71 in 2017 and -14.48 in 2018) from the dataset due to their undue influence on model estimates. These values fall well outside the expected distribution of the standardized IFPA metric and are almost definitely the result of measurement anomalies. As noted in correspondence with FAO personnel, the distortion arises from the structure of the CPI in countries where food prices dominate the consumption basket and no core CPI is available for deflation (personal communication with Baquedano, April 2025).

price abnormalities, which are comparable between countries, rather than absolute price levels, which vary considerably. Whereas standard food price metrics like CPI represent overall food price inflation, IFPA focuses on deviations from expected price trends, which aligns with this study’s focus on market disruptions (Baquedano 2015). The FAO uses IFPA as the primary metric in the FAO Food Price Monitoring and Analysis system, a popular early warning system for food prices, underscoring the metric’s accuracy in identifying anomalous food price variation (FAO 2025b).

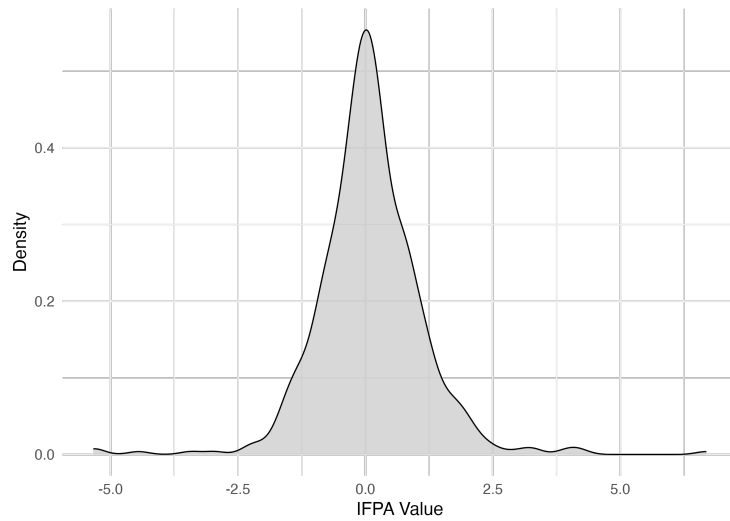


Fig. 1 IFPA Distribution

3.2 Independent Variable: Black Sea Corridor Dependence

This study introduces the Black Sea Corridor Dependence (BSCD) as its primary independent variable. Grounded in a neo-dependency framework, BSCD captures structural trade vulnerability by quantifying the extent of countries’ dependency on Russian and Ukrainian cereals prior to the 2022 invasion. Rather than measuring generalized import reliance, BSCD isolates corridor-specific trade intensity. It

thereby operationalizes dependency as an empirical extension of neo-dependency theory's emphasis on the relational vulnerabilities that arise from concentrated supplier reliance.

I calculate BSCD as the ratio of cereals imported from Russia and Ukraine to a country's total cereal supply, defined as:

$$BSCD_i = \frac{I_{cit}}{P_{it} + I_{it} - E_{it}}$$

where $BSCD_{it}$ represents the Black Sea corridor dependence for country i in year t ; I_{cit} , denotes total cereal imports from Ukraine and Russia c for country i in year t ; P_{it} is total domestic cereal production for country i in year t ; I_{it} is total cereal imports for country i in year t ; and E_{it} is total cereal exports for country i in year t . All variables are expressed in million metric tons.

Data are compiled from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) BACI database and the World Bank's cereal production statistics (Gaulier and Zignago 2010; WB 2025a). CEPII reconciles UN Comtrade data to enable precise measurement of supplier-specific flows. A higher BSCD reflects greater structural dependency on Russian and Ukrainian cereal exports and, by extension, greater vulnerability to disruption in those supply channels.

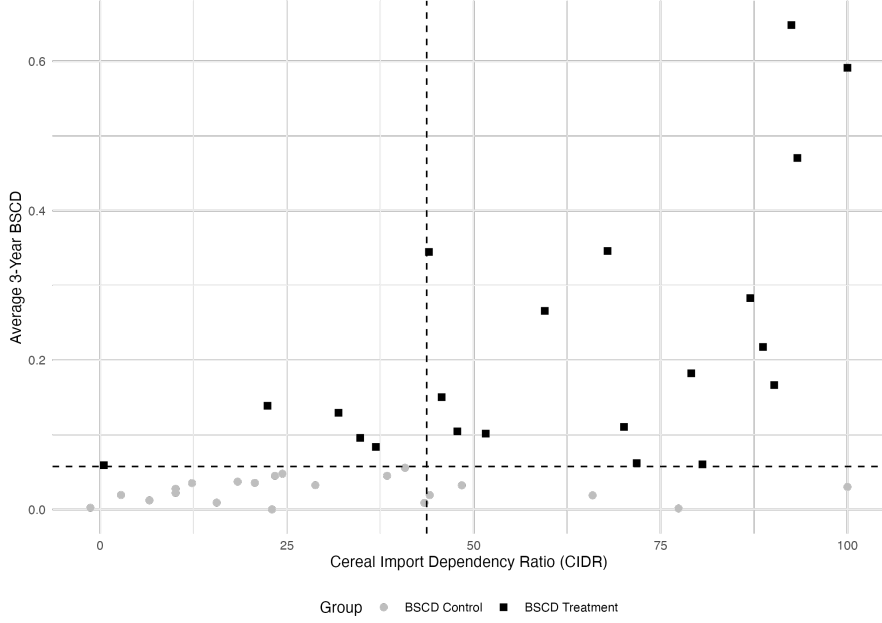


Fig. 2 Country-Level Comparison of CIDR and 3-Year BSCD

To assess the relative validity of BSCD, I also include the FAO’s Cereal Import Dependency Ratio (CIDR) as a comparative independent variable:

$$CIDR_i = \frac{I_i - E_i}{P_i + I_i - E_i} \times 100$$

where $CIDR_{it}$ is the cereal import dependency ratio for country i in year t ; I_{it} is the total cereal imports for country i in year t ; E_{it} is total cereal exports for country i in year t ; and P_{it} is the total domestic cereal production for country i in year t . All units in the CIDR calculation are expressed in metric tons, and higher CIDR corresponds to greater general reliance on cereal imports (FAO 2025a).³ Other empirical analyses use similar but distinct dependency metrics. For instance, Hellegers (2022) develops a

³Figure 2 illustrates that CIDR and BSCD capture distinct dimensions of dependency. Countries with similar levels of CIDR exhibit wide variation in BSCD, highlighting that overall import reliance does not necessarily imply concentrated supplier exposure

Wheat Dependency Ratio (WDR):

$$WDR_i = \left(\frac{I_{wit} - E_{wit}}{P_{wit} + I_{wit} - E_{wit}} \right) \times 100$$

where WDR_{it} is the wheat dependency ratio for country i in year t , I_{wit} is total wheat imports w for country i in year t , E_{wit} is total wheat w exports for country i in year t , and P_{wit} is total wheat w production for country i in year t . [Hellegers \(2022\)](#) also uses a cereal import dependency measure based on the value—rather than volume—of agricultural imports and exports.

These metrics are suitable for assessing broad food security trends, but they fail to capture supplier-specific exposure. For example, a country with a CIDR of 50% but sourcing exclusively from Australia would be less vulnerable to the Ukraine war shock than a country with a CIDR of 25% heavily reliant on Russian and Ukrainian cereals.

To identify treatment effects, I classify countries based on their average pre-war BSCD. I calculate a static, three-year average (2019-2021) to mitigate annual variation from weather events, production cycles, and COVID-19-related trade distortions:

$$\text{Avg. } BSCD_i = \frac{\sum_{t=2019}^{2021} BSCD_{it}}{3}$$

I assign countries with above-median average BSCD scores to the treatment group, while those below the median form the control group.⁴ I apply the same median-split classification to the CIDR variable, enabling a direct comparison of treatment effects across both metrics.

⁴Appendix H finds that continuous BSCD is not a significant predictor of IFPA, while BSCD rank and quartile are statistically significant. This finding is consistent with the literature, which suggests that substitution constraints are nonlinear, increasing substantially when reliance exceeds 60 to 70 percent.

Table 1: Independent, Dependent, and Control Variable Summary Statistics

	Control	Treatment	Mean	Median	SD
3-Year BSCD	0.03	0.22	0.12	0.06	0.15
Food Price Volatility (IFPA)	0.19	0.04	0.12	0.04	1.01
Log GDP Per Capita	7.11	7.45	7.28	7.18	0.85
Log Precipitation (mm)	6.76	5.89	6.33	6.84	1.25
Government Spending as % of GDP (Lagged)	16.84	15.67	16.24	14.69	8.06
Civil War	0.12	0.26	0.19	0.00	0.39
KOF Globalisation Index	49.74	53.77	51.67	50.36	7.02

Note: “Control” and “Treatment” are the means per variable per treatment group. Columns 3-5 encompass the full sample.

3.3 Control Variables

Extreme weather, armed conflict, and economic shocks are the primary drivers of acute food insecurity (FSIN 2024). To control for these factors, I utilize data from the World Bank, the UCDP/PRIO Armed Conflict Dataset, the Copernicus Climate Change Service, and the KOF Globalization index (Gygli et al. 2019; Service 2025; Davies et al. 2025; Gleditsch et al. 2002; WB 2025b). These control variables help isolate the effect of pre-invasion imports of Ukrainian and Russian cereals on subsequent food security outcomes.⁵

I first control for logged GDP per capita, which proxies a country’s micro-level capacity to absorb food price shocks. Similarly, I control for government spending as a percentage of GDP, which proxies a country’s fiscal capacity to stabilize markets and support food systems (Guillaumont 2008). Government consumption expenditure reflects the extent to which the state can intervene in domestic food supply, fund subsidies, or absorb global price shocks (Béné et al. 2016). I lag government consumption by one year to mitigate endogeneity and reverse causality, ensuring that fiscal behavior precedes food security outcomes.

⁵Appendix F Table F4 uses alternative control variables

Second, I control for civil wars as a proxy for domestic security. I mitigate potential endogeneity by strictly focusing on internal conflicts rather than internationalized conflicts.⁶ Extensive prior research documents the link between food insecurity and political instability (Bellemare 2015; Raleigh et al. 2015). Research indicates that internationalized conflict correlates with food price volatility and cereal import dependency, while localized conflicts correlate with individual-level dietary shortages (Brück et al. 2019, 2016). By specifically controlling for domestic conflicts without external intervention, this analysis reduces the risk of reverse causality.

Third, I control for annual precipitation, a major determinant of domestic food production and food price stability, especially in African countries reliant on rain-fed agriculture Geneti (2019). I log-transform precipitation to accurately weight countries with large amounts of rainfall and enhance interpretability.

Finally, I include the KOF Globalization Index (KOFGI) to control for broader patterns of global integration. KOFGI incorporates economic, political, interpersonal, cultural and trade dimensions of globalization (Gygli et al. 2019). Globalization can either cushion or exacerbate food insecurity depending on supply chain flexibility, diversification, and import reliance (Balassa 1986; McMichael 2009). Including KOFGI allows this analysis to distinguish supplier-specific dependency from the broader effects of trade openness.

3.4 Model Specifications

This study estimates a series of two-way fixed effects models to assess the impact of pre-invasion cereal import dependency on post-invasion food price anomalies. The dependent variable is the Indicator of Food Price Anomalies (IFPA) for country i in year t . Models vary based on whether the treatment indicator uses the Cereal Import Dependency Ratio (CIDR) or Black Sea Corridor Dependence (BSCD). The baseline

⁶Specifically, I use type 3 intrastate conflict from the UCDP/PRIO Armed Conflict Dataset v24.1, which captures civil wars without foreign involvement. This excludes type 4 internationalized intrastate conflicts.

model is:

$$IFPA_{it} = \alpha + \beta_1 \text{High Dependency}_i + \beta_2 \text{Post}_t + \beta_3 (\text{High Dependency}_i \times \text{Post}_t) + \delta_i + \lambda_t + \varepsilon_{it}$$

where High Dependency_i equals 1 if country i has above-median cereal dependency (defined by either CIDR or BSCD), and 0 otherwise. Post_t is a dummy equal to 1 for years 2022 and later. The interaction term ($\text{High Dependency}_i \times \text{Post}_t$) captures the causal effect of pre-invasion dependency on post-invasion food price anomalies. δ_i absorbs time-invariant heterogeneity across countries, such as geography, structural agricultural conditions, and baseline institutional capacity. λ_t denotes year fixed effects, which control for global shocks common to all countries in a given year, such as general global food price inflation. ε_{it} is the error term. This study uses country and time fixed effects to isolate within-country variation across time.

The full model adds time-varying covariates to control for weather shocks, political instability, globalization, and state capacity:

$$\begin{aligned} IFPA_{it} = & \alpha + \beta_1 \text{High Dependency}_i + \beta_2 \text{Post}_t + \beta_3 (\text{High Dependency}_i \times \text{Post}_t) \\ & + \gamma_1 \log(\text{Precipitation}_{it}) + \gamma_2 \text{CivilWar}_{it} + \gamma_3 \text{Globalization}_{it} \\ & + \gamma_4 \text{GovernmentSpending}_{it-1} + \delta_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

Each specification is estimated twice: once using CIDR as the treatment indicator (Models 1 and 3), and once using BSCD (Models 2 and 4). The interaction term coefficient, β_3 , is the primary quantity of interest and indicates whether countries with higher pre-war dependency experienced greater food price anomalies after the invasion.

Table 2: Regression Estimating the Impact of Different Dependency Metrics on Food Price Anomalies (IFPA).

	(1) BSCD No Controls	(2) BSCD Full Model	(3) CIDR No Controls	(4) CIDR Full Model
Interaction Term	0.775** (0.280)	0.982* (0.375)	0.264 (0.303)	0.201 (0.361)
Log Precipitation		-0.319 (0.371)		-0.416 (0.383)
Civil War		0.181 (0.292)		0.155 (0.277)
Globalization Index		-0.039 (0.054)		-0.042 (0.051)
Lagged Government Consumption		-0.055 (0.042)		-0.056 (0.039)
Log GDP Per Capita		1.020 (1.027)		0.918 (0.956)
Num.Obs.	418	333	418	333
R2	0.248	0.325	0.227	0.304
R2 Adj.	0.143	0.203	0.119	0.177
R2 Within	0.031	0.063	0.004	0.033
R2 Within Adj.	0.028	0.043	0.001	0.012
Std.Errors	by: country	by: country	by: country	by: country

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Robust standard errors clustered by country. Model 1: Black Sea Corridor Dependency (BSCD) without control variables. Model 2: BSCD with full control variables. Model 3: Cereal Import Dependency Ratio (CIDR) without control variables. Model 4: CIDR with full control variables.

4 Results

Table 2 presents the baseline results. Models 1-4 assess the relationship between cereal import dependency and IFPA after 2022. The results suggest that BSCD significantly predicts food price volatility, while CIDR does not.

In the baseline models (Models 1 and 2), only BSCD exhibits a statistically significant treatment effect: countries above-median BSCD score experienced a 0.78 standard deviation increase in IFPA after 2022 ($p < 0.01$). This finding persists in the fully specified model (Model 4), where the treatment effect remains significant ($p < 0.05$)

and increases in magnitude (0.98). By contrast, CIDR shows no significant effect in either the baseline or full model (Models 1 and 3).

Appendix D shows that pre-war trade through the Black Sea corridor, rather than any single supplier, drives the post-2022 effect. Median split by Russia-only and Ukraine-only reliance yields null interactions. This finding reinforces the hypothesis that vulnerability was corridor-specific: reliance on the Russia-Ukraine dyad, rather than single-supplier ties, explains post-invasion food price anomalies.

4.1 Robustness Checks

The difference-in-difference design relies on the parallel trends assumption: absent the 2022 invasion, countries with high and low pre-war reliance on Russian and Ukrainian cereals would have followed similar IFPA trends. I directly assess this assumption in two ways.

First, I estimate an event study model (see Figure 3) to illustrate the time-dynamic treatment effect of BSCD-defined dependency on IFPA variation (Miller 2023).⁷ This event study supports parallel trends by showing whether the pre-treatment coefficients are flat, meaning treated and control units moved similarly before the shock. I omit and normalize the reference period (2021) at 0 to isolate deviations relative to the last pre-invasion year. In pre-treatment years, the treatment indicator has no significant effect on IFPA, confirming that pre-trends do not diverge (Roth 2022).⁸ Figure 3 also shows that the estimated effect spikes in 2022 and persists in 2023, indicating that the invasion caused sustained disruption rather than temporary volatility.⁹

⁷Appendix B provides the event study estimation formula and further details on the model

⁸Appendix I performs a joint F-test, which confirms that pre-treatment event-time coefficients are jointly indistinguishable from zero ($p = 0.53$).

⁹Appendix I also demonstrates that post-treatment coefficients are jointly different from zero ($p = 0.045$), suggesting persistent treatment effects.

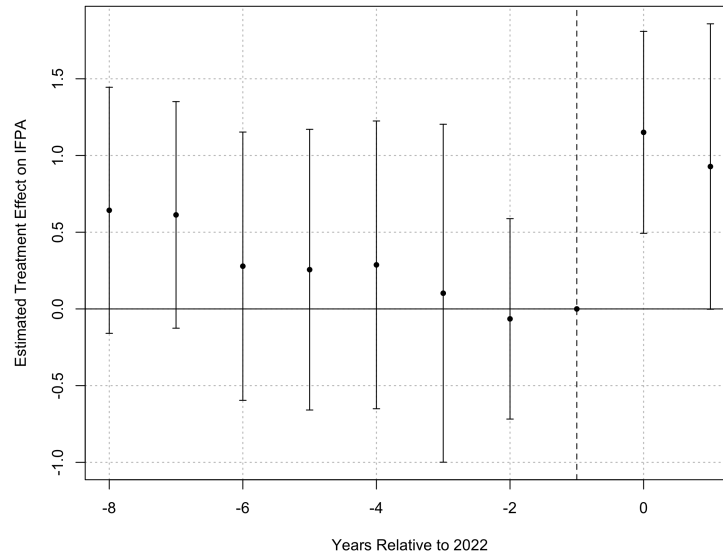


Fig. 3 Event Study Estimation

Second, I re-estimate the model using 2018-2021 as pseudo-event years (see Table 3). Null interactions across bivariate and controlled models further suggest that high- and low-dependency countries' IFPA trends did not diverge prior to the Russian invasion of Ukraine (Dette and Schumann 2024; Roth et al. 2023).¹⁰

Beyond parallel trends, I probe general robustness. First, to ensure robustness across different time frames, Appendix G Model 1 restricts the sample period to 2019-2023 while maintaining the actual event year (2022). This specification yields a strongly significant interaction term ($p < 0.01$), confirming that the main findings hold even when excluding earlier data, thus reinforcing the stability of the estimated effect. Model 2 imposes a population threshold of 1 million to filter out small countries. Due to their smaller economic bases, countries with lower populations are less resilient to the effects of external shocks (Guillaumont 2008). Thus, including small countries in the sample could have skewed the sample by introducing disproportionately high price

¹⁰Appendix C finds that the null result holds when introducing controls.

Table 3: Placebo Tests Using Alternative Treatment Years

	(1) Placebo 2018	(2) Placebo 2019	(3) Placebo 2020	(4) Placebo 2021
Interaction Term	-0.048 (0.228)	0.006 (0.213)	0.139 (0.255)	0.391 (0.273)
Num.Obs.	418	418	418	418
R2	0.224	0.224	0.225	0.232
R2 Adj.	0.116	0.116	0.117	0.125
R2 Within	0.000	0.000	0.001	0.010
R2 Within Adj.	-0.003	-0.003	-0.001	0.007
Std.Errors	by: country	by: country	by: country	by: country

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Robust standard errors clustered by country.

variability (Kuznets 1960). The model shows that the interaction term remains significant when small countries are omitted from the sample, indicating that the main findings are not driven by small country outliers.

Collectively, flat pre-treatment trends, null date-placebos, and consistent results under theoretically-grounded sample restrictions support the parallel trends assumption and reinforce the main finding that higher prewar reliance on Russian and Ukrainian cereals predicts larger post-invasion IFPA spikes.

4.2 External Validity

Given this article’s region-specific focus and its broader theoretical argument, it is essential to assess the external validity of its findings. Following Findley et al. (2021), I use external validity to mean both generalizability and transportability.

As shown in Table 4, the interaction term is statistically significant only in the African sample. As argued in Section 2.2 the crisis most affected (i) peripheral countries that (ii) intensively traded with Russia and Ukraine before the war. Unsurprisingly, in Europe, MENA, Asia, and globally, closer substitute suppliers, stronger logistics, and larger fiscal buffers eased one or more of these constraints, so the effects are smaller. This finding aligns with a relational view of dependency advanced in

Table 4: Regional Regressions to Evaluate External Validity

	Africa	Europe	MENA	Asia	Global
Interaction	0.775** (0.280)	0.368 (0.278)	-0.248 (0.525)	-0.064 (0.214)	-0.029 (0.190)
Num.Obs.	418	310	137	250	1115
R2	0.248	0.619	0.289	0.194	0.234
R2 Adj.	0.143	0.562	0.144	0.067	0.141
R2 Within	0.031	0.015	0.001	0.000	0.000
R2 Within Adj.	0.028	0.011	-0.008	-0.004	-0.001
AIC	1178.5	645.7	526.9	712.3	3316.3
BIC	1388.3	798.9	597.0	835.6	3928.3
RMSE	0.87	0.60	1.39	0.87	0.96
Std.Errors	by: country	by: country	by: country	by: country	by: country
FE: country	X	X	X	X	X
FE: year	X	X	X	X	X

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
Robust standard errors clustered by country.

Section 2: vulnerability arises when peripherality and limited substitution options interact with a supply shock (Kouandou and Zeh 2024).

Within Africa, the findings are highly generalizable. The main sample covers 42 countries, accounting for over 97% of the continent’s population. The study spans a decade of observational data and includes diverse geographies, regimes, and economic structures. Robustness checks confirm that the results hold when excluding smaller states and under alternative specifications. This study offers a strong basis for continent-wide inference about how concentrated trade relationships exacerbate exposure to exogenous shocks.

Crucially, this study’s theoretical mechanism, corridor disruption amplified by relational dependency, is transportable. Historical analogs like the 1973 OPEC oil embargo and semiconductor bottlenecks during the COVID-19 pandemic suggest that relational dependency is broadly applicable wherever market concentration and limited substitution options constrain resilience (Kilian 2008; Ramani et al. 2022).

Estimating effects outside of Africa is more difficult—not because the theoretical mechanism fails, but because supplier concentration is less entrenched, or because alternative suppliers are closer. For instance, although many Asian countries rely heavily on Australian cereals, they are closer to alternative suppliers. In Latin America, countries trade intensively with the U.S. but have greater production capacity (OECD/FAO 2024). In other regions, the opposite problem arises: there may exist structurally dependent countries, but no viable control group of countries that are similarly exposed but not dependent. For example, since most Pacific microstates rely on one or two Australian cereal supply chains and share the same freight and storage constraints, there is little meaningful intra-regional variation to compare (Thow et al. 2022).

In sum, this study’s main finding is generalizable, and also transportable under similar conditions. BSCD is best used as a diagnostic that can be applied to other region-commodity-corridor pairs to test dependency. Potential applications include oil supply chains that traverse the Strait of Hormuz, or food trade through the Strait of Malacca (Wellesley et al. 2017). Because effects are most pronounced when exposure interacts with peripherality, the metric should be (re)interpreted within its original theoretical framework.

5 Conclusion

The Ukraine war had severe but uneven effects on African food markets. I show that countries that relied more on Russian and Ukrainian cereals before 2022 experienced significantly larger post-invasion food price anomalies than less-dependent countries. This pattern supports a relational, corridor-based view of dependency in international trade.

This article's contribution is twofold. Empirically, it fills a gap by quantifying the conflict's realized impact in Africa. Theoretically, it offers an empirical operationalization of traditionally qualitative dependency theory concepts, and links that framework to observed price outcomes.

Future research can apply this study's design to other corridor-commodity pairs, regions, and shocks, testing when supplier concentration and limited substitution capacity translate into abnormal prices. The framework also travels to other developmental contexts and fragile corridors, providing a basis for studying how global power asymmetries shape trade.

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Declarations of interests

The author has no competing interests to declare.

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Biographical Note

Graham C. Goff is a Master of International Affairs student at the Texas A&M Bush School of Government and Public Service. His most recent research is featured in *Consumption Markets & Culture*.

Data Availability Statement

Replication data and code supporting the findings of this study are available for anonymous peer review at the following link: https://osf.io/u57ez/?view_only=cd56e1c9f7424c6a943502c87629346f. These materials will be deposited in a public repository and made openly available upon publication.

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