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(prices) security: Evidence from targeted
countries**

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Abstract

Our paper examines economic sanctions' impact on food prices and security. Anecdotal evidence suggests food security is threatened in nations subjected to sanctions. However, the causal link has not been proven. We employ a two-way fixed-effects approach and leverage the entropy balancing technique to ascertain the existence of a causal link. Our analysis relies on the Global Sanctions Database for sanctions and the FAOSTAT database for food security proxies: food prices and prevalence of undernourishment (PoU). Sanctions increase food prices: during the sanctions period, real food prices are higher by 1.24% compared to the non-sanctions period. Although the increase in food prices is marginal, overall food security is threatened, as the PoU is 2.1 percentage points higher during sanctions compared to periods without sanctions.

Keywords

Economic sanctions; food prices, prevalence of undernourishment, food security

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1 Introduction

Economic sanctions are a common foreign policy tool used by senders to restrict relations with a target, aiming to pressure dissenting regimes into changing their objectionable policies. (Hufbauer et al., 2007; Morgan et al., 2014). Economic sanctions (hereafter sanctions) have become increasingly favored as an alternative to military interventions, which can lead to direct property damage and the loss of human lives. Although the effectiveness of sanctions in altering the behavior of targeted countries has been debated (Peksen, 2019), there is consensus that sanctions would have unintended consequences on economic outcomes such as trade (Afesorgbor, 2019; Larch et al., 2024), economic growth (Neuenkirch and Neumeier, 2015), poverty (Neuenkirch and Neumeier, 2016), and income inequality (Afesorgbor and Mahadevan, 2016) for countries targeted. While sanctions are imposed to marginalize the political regime and diminish its political support, they tend to create vulnerable and food-insecure civilian populations that become more dependent on the state (Koc et al., 2007).

Food and agricultural products are central to most sanctions cases (Larch et al., 2024). Thus, it is not unusual to link sanctions to food insecurity. Anecdotal evidence links extended periods of sanctions to significant challenges such as severe food insecurity, hunger, and famine. An illustrative example is the North Korean famine during the 1990s: the death of about 600,000 to 1 million people can, in part, be ascribed to the prolonged imposition of sanctions on the dictatorial regime (Noland, 2022). The United Nations Security Council (UNSC) has acknowledged the practice of utilizing food as a weapon of warfare during periods of conflict or sanctions. This recognition prompted the passage of Resolution 2417 in 2018, which aims to ensure civilians have access to food and humanitarian assistance during international conflicts (Maxwell et al., 2023).

The FAO et al. (2022) argue that increasing food prices is a crucial factor leading to more people lacking access to a healthy diet. The number of individuals without access to nutritious food has grown by 112 million, reaching nearly 3.1 billion in 2022. Despite this, the direct connection between sanctions, food prices, and food security remains unproven. Building upon existing literature that examines the impact of sanctions on targeted countries (see, e.g., Neuenkirch and Neumeier, 2015, 2016; Afesorgbor and Mahadevan, 2016; Afesorgbor, 2021; Gutmann et al., 2021; Hinz and Monastyrenko, 2022), we explore a potential unintended consequence of sanctions on food security. We aim to measure the causal link between sanctions and food prices and evaluate how this affects the prevalence of undernourishment (PoU) in the affected nations.

One major consequence of sanctions is their potential to worsen food security in targeted nations (Afe-

[sorgbor, 2021](#)). A primary way sanctions impact food security is through higher food prices. For instance, [Hinz and Monastyrenko \(2022\)](#) provide robust empirical evidence that Russian counter-sanctions, which involved restricting imports of agri-food products from Western nations, resulted in a substantial upsurge in food prices, subsequently diminishing consumer welfare in Russia. Food prices, a critical food security indicator, directly affect affordability, a key aspect of food security related to access to food ([Anríquez et al., 2013](#)). Food price spikes can greatly impact poverty and food security, especially in developing countries, since food expenditure accounts for a substantial proportion of household income ([Afesorgbor and Lim, 2022](#); [Amolegbe et al., 2021](#); [Martin and Anderson, 2012](#)). Food security remains a global concern, evident in the transition from the United Nations Millennium Development Goals (MDG 1) to the Sustainable Development Goals (SDG 2).

The impact of sanctions on food prices and its implication for food security is a pertinent issue, as anecdotal evidence suggests that food security concerns are more severe in countries under sanctions. For example, according to the Global Hunger Index, [Afesorgbor \(2021\)](#) identifies Afghanistan, Burundi, Chad, Ethiopia, Eritrea, Somalia, Sudan, and North Korea as some of the most food-insecure countries. Interestingly, these countries have also faced extended periods of sanctions imposed by Western nations. In a broader context, research has demonstrated that the imposition of sanctions has a notably adverse impact on the global trade of agricultural and food products, as highlighted by [Afesorgbor \(2019\)](#), [Larch et al. \(2024\)](#), and [Flach et al. \(2023\)](#). This effect contradicts the principles outlined in the Geneva Convention, which mandate unhindered passage for essential commodities, such as food, even during sanctions.¹

Historically, sanctions have often been linked to higher food prices and insecurity. For instance, the United States Embargo Act of 1807, which restricted agricultural trade between the United States (US) and the United Kingdom (UK), contributed to a rise in corn prices in the UK ([Pond, 2017](#)). Similarly, the Grain Embargo of 1980 saw the US imposing an embargo on grain exports to Russia. In 1994, the Glenn Amendment restricted US agricultural exports to countries with nuclear enrichment programs. More recently, sanctions and counter-sanctions related to Russia's annexation of Crimea and the invasion of Ukraine have been blamed for surges in global food prices. More recently, [Hinz and Monastyrenko \(2022\)](#) noted that these actions led to increased consumer prices in Russia and a decline in welfare.

The imposition of sanctions on targeted countries such as Venezuela, Iran, and Russia has led to a conspicuous surge in consumer prices, as highlighted by [Demarais \(2022\)](#). [Demarais](#) points out that these nations experienced a significant and exponential increase in consumer prices after sanctions. For

¹[Garfield and Santana \(1997\)](#) cite the example in which the Cuban Democracy Act of the US made it more stringent for Cuba to import food and medicines.

instance, she underscores the impact of sanctions on Iran due to its nuclear enrichment program led to a 30% rise in consumer prices during 2012-2013. Likewise, sanctions imposed on Russia for annexing Crimea resulted in a notable inflation spike of approximately 15%

Theoretically, sanctions can directly alter food prices in sanctioned countries, impacting food security, income levels, and inequality (Caracciolo and Santeramo, 2013). This mechanism may involve trade restrictions and the suspension of agricultural development assistance, including technology transfer and food aid. Sanctions often limit the exchange of food and agricultural products between the sanctioning countries and their targets. Although the Geneva Convention mandates free passage for essential products like food and medicine, this requirement is not consistently observed in most sanctions cases. For instance, during Russia's counter-sanctions against Western nations, 48 products, including basic food items like meat, dairy, fruits, and vegetables, were banned (Hinz and Monastyrenko, 2022).

Additionally, sanctions can drive up food prices when agricultural inputs and technology transfers from more developed sender countries to target countries are disrupted. Many target countries depend on developed nations for new agricultural technology to enhance productivity. Furthermore, most target countries are major food assistance recipients from donor (developed) countries. For example, the US, a frequent user of sanctions, is also a major food assistance donor.

We investigate the ramifications of sanctions on real food prices [inflation-adjusted food price index (FPI)] and food security. Food prices serve as a critical indicator of food security, and any deleterious effect of sanctions on food prices would also exacerbate food security challenges in targeted nations. The impact of sanctions on food prices holds significant relevance, given anecdotal evidence indicating heightened food security concerns in countries subjected to sanctions. To explore whether a causal relationship exists between food prices and sanctions, we employ a two-way fixed-effects approach and utilize the entropy balancing technique, which mimics randomization in observational studies. Our analysis relies on two primary datasets: the recently developed Global Sanctions Database (GSDB) to measure sanctions and the Food and Agricultural Organization Statistical Database (FAOSTAT) for assessing food prices and security in targeted developing countries.

Our paper contributes significantly to the literature on the unintended consequences of sanctions in three key ways. First, while numerous studies have concentrated on the determinants of food prices or food inflation (see, e.g., Afesorgbor and Lim, 2022; Agyei et al., 2021; Gilbert, 2010; Irz et al., 2013), they have not undertaken a comprehensive examination of the impact of sanctions. A related study conducted by Hinz and Monastyrenko (2022) examined the relationship between sanctions and consumer prices,

but their primary focus was on a single-country case study, primarily Russia. This study looked into Russia's counter-sanctions or embargo imposed on specific food and agricultural imports from Western countries, which was a response to the sanctions imposed on Russia for its annexation of Crimea and eastern Ukraine in 2014. In contrast to our paper, we analyze the impact of sanctions imposed by 30 Western nations and multilateral organizations on food prices and security in 99 developing countries subject to sanctions.

Second, our paper expands the existing literature by examining whether the adverse effects of sanctions on food prices ultimately lead to implications for food security. We assess food security through the PoU. As per the FAO, the PoU estimates the proportion of the population whose regular food consumption is insufficient to provide the necessary dietary energy levels for maintaining a normal, active, and healthy life. This indicator is the primary measure for monitoring progress toward MDG 1c and SDG 2.1 targets (Mary et al., 2018). These targets are centered on eradicating hunger and ensuring food security for all individuals.

Lastly, we explore the various channels and mechanisms through which sanctions impact food prices and security. This exploration is essential because sanctions can trigger multiple effects within the food sector. Sanctions can create demand and supply shocks in the targeted country, influencing food prices and security. These effects can manifest through several channels, such as trade restrictions on food imports, production, agricultural productivity, and technology adoption. Understanding these different channels will help policymakers devise programs to mitigate the adverse consequences of sanctions on the food sector.

To preempt our results, our analysis reveals that the imposition of sanctions significantly contributes to higher food prices. Food prices are 1.24 percent higher during sanctions than in non-sanctioned years. The adverse effects of sanctions are not limited to food prices; our research also identifies a positive and statistically significant impact of sanctions on the PoU. Undernourishment is higher by 2.1 percentage points during the sanctions period compared to the non-sanctioned period.

The remainder of the paper is structured as follows. Section 2 offers insights into potential channels through which sanctions might influence food prices and security. Section 3 details information about the data and the empirical strategy, focusing on entropy balancing. In Section 4, we present our results and engage in discussions. Finally, Section 5 serves as the conclusion, offering policy implications and suggesting directions for future research.

2 Possible channels sanctions affect food (prices) security

The imposition of sanctions on a country may significantly affect many aspects of the economy of the sanctioned country. For instance, they reduce the availability of imported goods, negatively affect export earnings, and make financial transactions more costly and difficult. As such, they are very likely to impact food security and its many dimensions ([Santeramo, 2015](#)).

In particular, sanctions may influence food prices regarding levels and variability. The impacts often ripple through the value chains, affecting producers, wholesalers, and final consumers. The consequences can be multifaceted and vary depending on the targeted country's characteristics, the sanctioning entities, and the specific types of sanctions employed. We identify four major channels through which economic sanctions may impact food prices. The mechanisms through which sanctions affect food prices are diverse.

First, sanctions may limit imports of food ([Bélin and Hanousek, 2021](#)). More specifically, [Larch et al. \(2024\)](#) argue that sanctions would increase transport costs and thus contribute to trade patterns and comparative advantage disruption. In addition, they may provoke supply disruption by threatening a country's ability to import essential items (e.g., upstream products) and, therefore, limiting the agro-processing industry in the sanctioned country. The lack of availability of final goods increases prices. The sanctions may also impact the availability and affordability of energy and transportation modes ([Moteng et al., 2023](#)). Energy poverty tends to have a synergistic (negative) effect on the functioning of the value chains, with detrimental effects on the final consumers, who are exposed to higher prices.

Second, sanctions may directly affect production by limiting access to major physical inputs, such as fertilizers or pesticides. Furthermore, they may constrain the availability of seasonal workers and the emergence of black markets, with distortionary effects (e.g., shortage and price spikes) on the supply of agricultural products. Emblematic examples of these mechanisms have been recently provided by the COVID pandemic, which has seriously disrupted agri-food value chains (see, e.g., [Aday and Aday, 2020](#)).

Third, the sanctions may threaten the economic, social, and political stability, and the initial conditions of the target country play a relevant role ([Dashti-Gibson et al., 1997](#)). The instability may reduce the purchasing power of consumers, exacerbating the inflationary phenomena, especially for goods with an inelastic demand (e.g. food). A side effect of instability and loss of purchasing power is the tendency of consumers to opt for cheaper and less nutritious food, further increasing their demand (and their prices).

On the other hand, the economic uncertainty and the scarcity caused by sanctions facilitate the onset of speculative behaviors through storage, long-term contracts, and financial instruments. The speculation can further exacerbate price hikes.

A fourth mechanism through which sanctions may alter prices is via food aid dependency. Sanctioned countries may have to rely on international food aid programs. While the short-run effects of the aid programs may be positive, they come with long-run unintended consequences (Moore and Stanford, 2010): dependency on food aid tends to weaken the domestic agricultural sectors and distort local markets, potentially leading to higher long-term food prices.

The effects of sanctions on food prices are complex and interconnected. In short, they can lead to higher prices, reducing food accessibility and increasing food insecurity. The channels through which these effects are created are diverse, with effects that are certainly more evident in the most vulnerable populations.

3 Empirical Strategy and Data

3.1 Data

Our analysis uses data from three major sources. First, we obtain FPI from the FAOSTAT Food Consumer Price Index (CPI) database. We deflated nominal FPI using CPI to obtain real (inflation-adjusted) FPI. FAO computes overall food CPI based on five food groups. The FPI tracks the fluctuations in the overall prices of food and non-alcoholic beverage items that households acquire, consume, or expend money on. This is achieved by assessing the expenses of purchasing a consistent selection of consumer food and beverage items, maintaining constant quality and similar attributes. The items included in this basket are chosen to accurately reflect the typical spending patterns of households during a respective period.

[Insert Figure 1 here]

The FAO food price indices data has the added advantage of spanning a larger number of countries and a longer period (1990-2022) by giving our results a stronger external validity. Anecdotal evidence of the relationship between food prices and sanctions is depicted in Figure 1. The relationship shows mixed evidence. However, on average, real food prices tend to be slightly higher during sanctions than periods without sanctions.

We also use the PoU sourced from the FAOSTAT to measure food security. According to the FAO, the PoU estimates the proportion of the population whose habitual food consumption is insufficient to provide the dietary energy levels required to maintain a normal, active, and healthy life. It is expressed as a percentage. Anecdotally, unlike the food price indicator, undernourishment is consistently higher during the sanctions period compared to the non-sanctions period. This is illustrated in Figure 2.

[Insert Figure 2 here]

The second major data set is sourced from the recently introduced Global Sanctions Database (GSDB) by [Felbermayr et al. \(2020\)](#). They define sanctions as binding restrictive measures senders or international organizations take to influence the target's behavior in response to international norm violations. The GSDB offers comprehensive data on 1101 sanction cases from 1950 to 2022. This new dataset encompasses all forms of sanctions worldwide, including bilateral, multilateral, and plurilateral sanctions. The GSDB holds a distinct advantage over previously prevalent sanctions datasets like the Sanctions Reconsidered dataset by [Hufbauer et al. \(2007\)](#) and the Threat and Imposition of Economic Sanctions dataset by [Morgan et al. \(2014\)](#). The GSDB is more up-to-date and includes a broader range of sanction cases than its predecessors.

Third, we use the World Bank's World Development Indicators (WDI) on economic conditions, encompassing factors such as agricultural production or yield and agricultural trade openness. To capture political and conflict-related variables, we use the Varieties of Democracy (V-Dem) datasets.

[Insert Table 1 here]

Overall, we have data on 90 countries (mostly developing economies) from 2000 to 2022. Comprehensive details, including data sources and summary statistics for all primary variables of interest and the control variables, are presented in Table 1. We provide the list of targeted countries in Table A1 in the appendix.

3.2 Empirical strategy

To assess the impact of sanctions on food prices, we combine the two-way fixed effect estimation with a matching technique. Our outcome variables are two main indicators of food security: the FPI and the PoU.

The FPI measures the price change between the current and reference periods of the average basket of goods and services purchased by households. The FPI consists of the average of 5 commodity group

price indices weighted with the average export shares of each group for 2014-2016. According to the FAO, the overall FPI contains 95 price quotations of food commodities. The PoU is the percentage of the undernourished population in the sanctioned country. We are interested in exploring the effects of sanctions on price dynamics (price increases) and its ultimate effect on food security, as measured by PoU. The effects of the imposition of sanctions are estimated using Eqn. (1).

$$Y_{it} = \alpha_0 + \gamma X_{it} + \beta \text{Sanctions}_{ijt} + \alpha_i + \alpha_j + \alpha_{ij} + \alpha_t + \epsilon_{it} \quad (1)$$

Y_{it} measures the FPI and the PoU in the sanctioned country i at the time, t , while Sanctions_{ijt} is an indicator variable that takes the value 1 when a target i has been sanctioned by the sender j . The study by [Felbermayr et al. \(2020\)](#) shows that sanctions effects differ depending on the sender; thus, we define our sanction variable by the sanctioning country. Because senders utilize various sanctions, our analysis delves deeper into differentiating the effects of trade, financial, and travel sanctions. X_{it} captures an exhausting set of time-varying covariates, including economic, political, conflict, and institutional factors. Table 1 presents all the variables and their summary statistics. Without a comprehensive set of control variables, our model may be susceptible to omitted variable bias, as these variables could be correlated with the sanctions variable. We include a battery of country-fixed effects, including target (α_i), sender (α_j), and bilateral (α_{ij}) fixed effects to capture observed and time-invariant heterogeneity. Time-fixed effects (α_t) are included to control global events common to the sanctioned countries.

Applying an OLS estimator to estimate Eqn.(1) can introduce potential bias since the imposition of sanctions is not exogenous. A significant endogeneity concern due to simultaneity bias, as highlighted by [Neuenkirch and Neumeier \(2016\)](#), is that the reasons for imposing sanctions on targets, such as conflicts, human rights violations, or coup d'états, could be intertwined with the political and economic conditions of the target country. These conditions, in turn, might be connected to our primary outcome variables. This is particularly important since increasing food prices may be influenced by past socioeconomic conditions in the target country, which can be a contributing factor leading to the imposition of sanctions.²

For a robust causal identification strategy, we estimate Eqn. (1) using a conditional difference-in-difference (DiD) as in Eqn. (2), as recommended by [Neuenkirch and Neumeier \(2016\)](#). We use entropy balancing to obtain a control group (countries without sanctions) comparable to the treatment group (countries with sanctions). In the entropy balancing, a reweighting scheme based on pre-specified balanced constraints from the sample moments of pre-treatment characteristics is used to obtain a close control group comparable to treatment ([Hainmueller,](#)

²From an econometric standpoint, resolving endogeneity concerns is essential to establish any causal inference between sanctions and food prices. This endogeneity concern requires the use of instrumental variables (IV). However, finding an IV that meets the exclusion restriction criterion is daunting; thus, we employ an alternative approach.

2012).

Using entropy balancing mimics randomization and leads to estimating the average treatment effect on the treated (ATT). The ATT will be the estimated impact of sanctions on food prices. This is imputed by the difference between the expected outcome (E) of specific food prices (FP_{it}) when sanctions are imposed on countries and not imposed (or lifted), conditioned on a vector of pre-treatment characteristics (X_{it}) in the treatment period ($Sanctions_{ijt} = 1$), when sanctions were imposed) and the control period ($Sanctions_{ijt} = 0$), when no sanctions were imposed).

$$\tau_{ATT} = \mathbf{E}[Y_{ijt}(1)|Sanct = 1, X = x] - \mathbf{E}[Y_{ijt}(0)|Sanct = 0, X = x] \quad (2)$$

where the first component in Eqn. (2) is the average outcome conditioned on the pre-treatment characteristics in the sanctions period, and the second is the proxy estimate of the unobserved counterfactual. Pre-treatment characteristics are chosen based on the factors determining treatment selection (sanctions) and outcome variables. Neuenkirch and Neumeier (2016) provide useful information on factors associated with sanctions, while the inverse demand function provides information on the determinant of food prices. Gutmann et al. (2021) suggest that incorporating pre-treatment characteristics in Equation (2) is akin to introducing control variables in a randomized experiment to enhance estimation efficiency. A mean comparison of the pre-treatment characteristics before and after sanctions is presented in Table A2 in the appendix.

4 Empirical results and discussions

4.1 Baseline results

Our baseline results, which estimate the impact of sanctions on real food prices, are presented in Table 2. We conduct a series of regression analyses, varying the inclusion of different fixed effects in the model and employing our covariate balancing technique. We consistently observe sanctions' positive and statistically significant effects on real food prices. During the sanctions period, real food prices are higher by 1.24% [Column 6] compared to non-sanction years across the different models. Although marginal, the increase in food prices explained by the sanctions may still have substantial food security implications for most people in poor countries. This is because the proportion of income spent on food is high in low-income countries. For instance, Nigeria spends 56.4% of its income on food, and this is similar in most developing countries (41% for Pakistan, 47% for Kenya, 41% for Guatemala).³

[Insert Table 2 here]

³ Accessed from <https://www.weforum.org/agenda/2016/12/this-map-shows-how-much-each-country-spends-on-food/> on June 9, 2024

We limit the interpretation of control variables to Column 6, where we control for an exhaustive set of fixed effects. For the economic variables, we observe the significance of trade openness and exchange rates on food prices. Trade openness, measured by the trade-to-GDP ratio, exhibits a positive and significant relationship with food prices. This suggests that countries with higher levels of trade openness also tend to experience higher food prices, possibly due to imported food inflation. Conversely, the exchange rate demonstrates a negative effect, indicating that an increase in the exchange rate is associated with a decrease in real food prices.

Regarding variables measuring agricultural and rural conditions, agricultural productivity, the agriculture-to-GDP ratio, and the rural population are statistically significant in explaining the variance in food prices. As anticipated, increased agricultural productivity correlates with lower food prices. Likewise, an increase in the proportion of the population residing in rural areas exhibits a negative correlation with food prices. However, we discover that the agricultural value added as a percentage of GDP positively and significantly affects food prices as part of the structural transformation toward a more developed agri-food system (Herrendorf et al., 2014). For political and conflict-related factors, we observe that the number of successful coups and human rights abuses are positively associated with real food prices.

[Insert Table 3 here]

Although our baseline results establish that sanctions lead to an increase in food prices, it is necessary to examine if this increase in food prices thus deteriorates overall food security. Thus, we present the empirical results of the effect of sanctions on the PoU in Table 3. The imposition of sanctions worsens food insecurity. Undernourishment is higher by 2.1 percentage points (p.p.) during the sanctions period compared to the non-sanctioned period. Considering there are millions of people who suffer from hunger, a marginal increase of 2p.p. in PoU is likely to result in a substantial increase in the number of people undernourished, and this will further push millions into hunger and starvation.

4.2 Impact of different types of sanctions

The sender of sanctions employs various types or combinations thereof, and it is crucial to evaluate whether these different forms of sanctions exert distinct effects on food prices and food security. Financial sanctions entail restricting the targeted countries' access to international financial markets, imposing bans on using SWIFT codes, freezing foreign assets, and reducing or withdrawing foreign/food aid. Trade sanctions encompass bans on importing and/or exporting specific goods, or even a comprehensive embargo on trade. Meanwhile, travel sanctions forbid members of the elite in the target country from visiting the sender countries. According to Felbermayr et al. (2020), the proportion of trade sanctions is declining relative to smart (financial and travel) sanctions.

[Insert Table 4 here]

Hufbauer et al. (2007) contend that various types of sanctions would yield heterogeneous effects, contingent upon the target's capacity to circumvent the specific type of sanctions. They further argue that financial sanctions are expected to have a greater impact than trade sanctions, as they can disrupt trade even without explicit trade sanctions.

[Insert Table 5 here]

We focus on financial, trade, and travel sanctions and investigate the effects of different types and combinations of sanctions on food prices in Table 4 and the PoU in Table 5. Various types of sanctions exert statistically significant effects. The magnitude of these effects varies across different types of sanctions. We observe a more pronounced effect on food prices when a combination of financial, trade, and travel sanctions is imposed on the target, compared to when a single or two types of sanctions are applied. Implementing these three types of sanctions collectively results in a 3.62% increase in real food prices. Different types of sanctions contribute to both economically and statistically significant effects on undernourishment. More specifically, undernourishment increases the most when trade sanctions are imposed, as we see 2.51p.p. increases in PoU. This compares with 2.38p.p. when a combination of financial, trade, and travel sanctions is imposed.

4.3 Impact of different senders of sanctions

In addition to the various types of sanctions, there is heterogeneity regarding different senders. Our analysis centers on sanctions imposed by Western countries (specifically, the US), a group of countries (including the European Union - EU and other Western OECD countries), and the United Nations (UN). We present the results of the effects of sanctions on food prices by different senders in Table 6, and the impact of sanctions by different senders on the PoU is demonstrated in Table 7.

[Insert Table 6 here]

Our findings highlight the significance of sanctions imposed by the EU and other Western countries in explaining the variation in real food prices. Specifically, EU sanctions are associated with a 3.07% increase in real food prices, while sanctions by other Western senders lead to a 1.93% rise in food prices ⁴.

[Insert Table 7 here]

Regarding undernourishment, except for US sanctions, we observe economically and statistically significant effects of EU, UN, and other Western sanctions. Notably, UN sanctions have the most pronounced impact, resulting in a 5.7 p.p. higher PoU compared to 2.7 p.p. for EU sanctions⁵ and 2.6 p.p. for other Western sanctions.

⁴However, we do not observe a significant effect of sanctions by the US and the UN on food prices. This lack of causality does not exclude a correlation between US sanctions and the rise in food prices. Nonetheless, the causality and the statistical significance are not proven for reasons that need to be further investigated.

⁵This is probably linked to the tight links across the two continents, as recently pointed by [Santeramo and Kang \(2022\)](#).

5 Transmission channels

Sanctions are likely to affect food prices and security through different channels. We test these channels for the effects of sanctions by following a similar approach used in [Gutmann et al. \(2021\)](#). Their study tested transmission channels by regressing sanctions on those transmission variables, treating them as dependent variables. We focus on factors that can plausibly affect food security. The sanctions-trade literature has established that sanctions reduce trade between sender and target (see, e.g., [Afesorgbor, 2019](#); [Larch et al., 2024](#)). We investigated food trade as a potential channel by analyzing the effects separately for food imports (exports), as proportions of total imports (exports). Insofar as the food security of a sanctioned country depends on its global food trade rather than trade with the sender, we focus on trade with the entire world.

[Insert Table 8 here]

We also evaluate food production using the FAOSTAT food production index, which measures the relative level of the aggregate volume of agricultural production each year as compared to the base period of 2014-2016. The analysis of the transmission channels is detailed in Table 8. Our findings indicate that, during sanctions, food exports increase while food imports remain largely unchanged. A possible reason for this observation could be that food trade is often less sanctioned than other sectors. In consequence, sanctioned countries may shift to food exports when export revenues from other sectors decline. At same time, we do not find an effect of sanctions on food production. Increasing net exports and constant food production mean more food is leaving the country without a corresponding increase in food for domestic consumption. Consequently, this imbalance in food trade could lead to a decline in domestic food availability and a deleterious effect on food security, particularly as many developing countries heavily rely on food imports.

Another potential channel is agricultural productivity. We examine it using cereal yield, technology adoption, and the percentage of irrigated land relative to total agricultural land. Agricultural productivity and technology are important channels through which sanctions could impact food security. The structural problems of agricultural technology in developing countries ([Suri and Udry, 2022](#)) would likely be exacerbated during the sanctioning periods. [Abay et al. \(2023\)](#) also highlight how sanctions, specifically on Russia, have affected global fertilizer prices, thus affecting fertilizer use in developing countries. Notably, most countries imposing sanctions are major sources of inputs, innovation and technology diffusion within the agri-food sector.

Agricultural productivity and technology adoption are important channels [Columns (4)-(5)]. Sanctions significantly reduce the target's agricultural productivity and farmland irrigation. This suggests that food security in developing countries can be most effectively improved through domestic policies that focus on increasing agricultural productivity by employing research and development or technology diffusion.

6 Conclusion

The direct effects of sanctions have been widely studied, and their impacts on agri-food trade is well established (Larch et al., 2024). Yet, the potential unintended consequences of sanctions on food price and security are postulated, but poorly understood or lack thorough investigation. The rationale why sanctions would affect food prices and security is simple: sanctions alter the commercial and political relationships of the sanctioned countries; the whole economy of the sanctioned country is affected, and the status of food security, which depends on several dimensions and the overall efficiency of the economic system (Santeramo, 2015), is likely to worsen. Although the logical flow is clear, the causal link has not been proved yet.

We address a specific research question: do sanctions increase food prices and exacerbate food insecurity? Our findings indicate that after sanctions are imposed, food prices rise. Even a marginal increase in food prices directly attributable to sanctions can have substantial implications for food security in developing countries. In the least developed economies, a significant portion of income is spent on food. As a result, sanctions can significantly increase the number of undernourished people, which will translate to thousands of newly starving individuals in densely populated countries. These effects are more pronounced when sanctions are imposed by multilateral entities, such as the EU or the UN.

We further examine the potential channels through which sanctions affect food prices in target countries. We find that net food exports of sanctioned countries increase during sanction periods, while production remains unchanged. The observed increase in real food prices could be caused by reduced food availability in target countries. Furthermore, we observe a reduction in per-land productivity and irrigation area during sanction periods, likely caused by a reduction in input imports. Increased transaction costs could be the reasons for the decline in input imports during sanction periods, given that export rules in sender countries (to target countries) are often unaffected by the sanctions.

The implications of our paper are straightforward. Sanctions are responsible for economic losses, food insecurity, and all the associated phenomena (e.g., dependency on external resources, social tensions, and governance instability) that are more severe on the most vulnerable groups. The increase in food prices and undernourished people seriously threaten the country's stability. Furthermore, the imposition of sanctions has the most severe impacts on vulnerable groups that are also the least responsible for the imposition of the sanctions, raising questions on the morality of sanctions (Pattison, 2015).

This double unfairness calls for mitigation measures. When countries implement sanctions, the imposing nations and the affected ones must establish measures to alleviate the effects on food prices and security. This becomes especially pertinent considering complaints by the World Food Program about how sanctions disrupt their operations, hindering the seamless distribution of food assistance in sanctioned regions.

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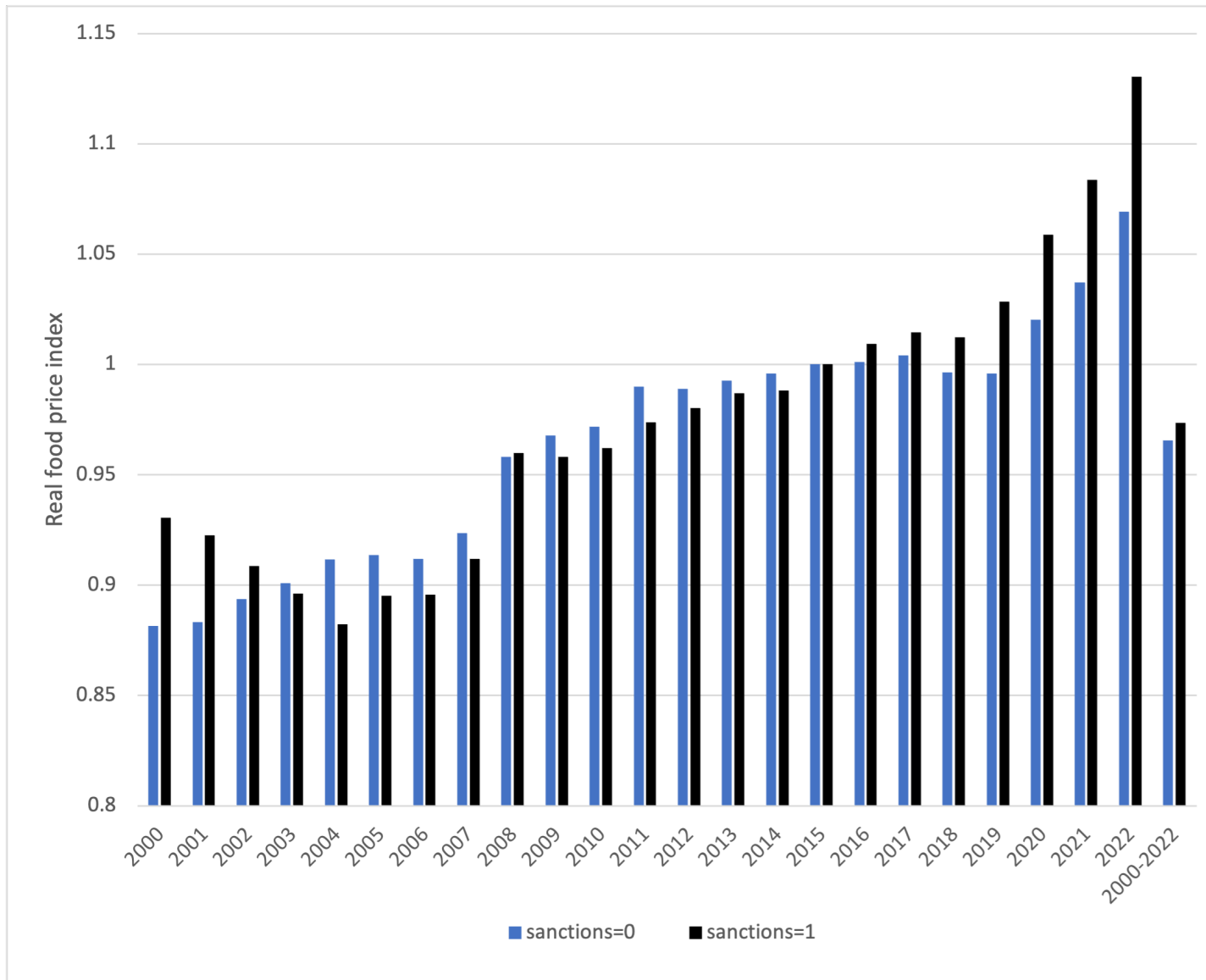


Figure 1: Real food prices between sanctioned and non-sanctioned periods

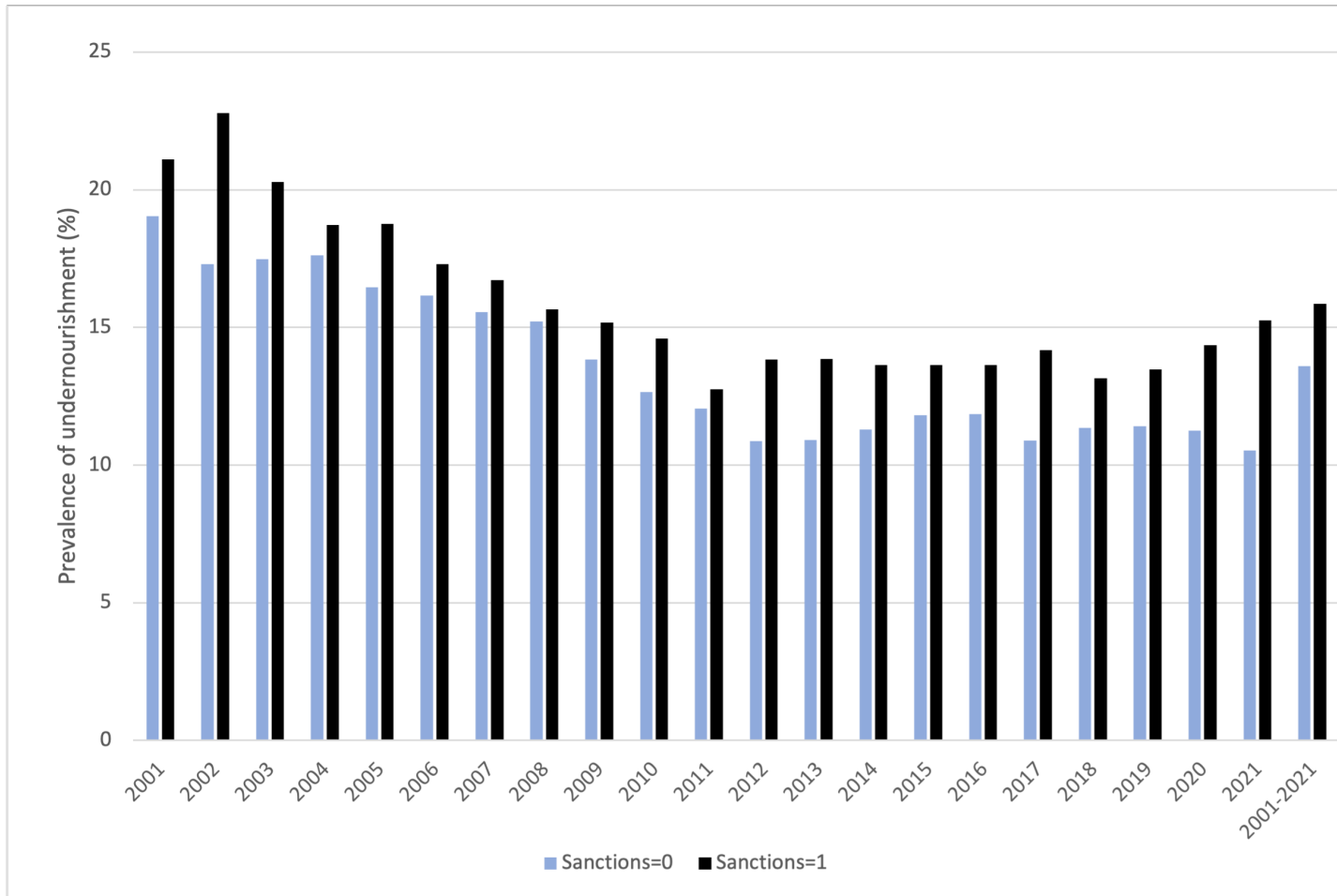


Figure 2: Prevalence of undernourishment between sanctioned and non-sanctioned periods

Table 1: Definition of the variables and summary statistics

Variable	Definition	Sources of Data	Obs	Mean	Std. Dev.
Real food price index	nominal food price index deflated by consumer price index	FAOSTAT	7724	.971	.140
PoU	Prevalence of undernourishment (%)	FAOSTAT	6840	14.6	12.8
Sanctions	An indicator variable that indicates the presence or absence of sanctions	GSDB	8240	.208	.410
Trade sanctions	An indicator variable that indicates the presence or absence of trade sanctions	GSDB	6180	.086	.281
Financial sanctions	An indicator variable that indicates the presence or absence of financial sanctions	GSDB	6180	.166	.372
Travel sanctions	An indicator variable that indicates the presence or absence of travel sanctions	GSDB	6180	.110	.313
GDPpc	GDP per capita at current prices	WDI	7712	8357.7	6845.7
Trade openness	Trade (% of GDP)	WDI	8240	62.4	36.7
Food export	Food export as %o total export	FAO	5956	25.5	22.8
Food import	Food import as %o total import	FAO	5940	14.1	7.06
Food production	Food production index (2014-2016=100)	FAO	7380	89.6	20.0
Irrigated agric. land	Agricultural irrigated land (% of total agricultural land)	FAO	2604	13.496	
Exchange rate	Official exchange rate (LCU per US\$, period average)	WDI	7808	3445206	1.52e+08
Popn. growth	Population growth (annual %)	WDI	8240	1.62	1.38
Agric. productivity	Cereal yield (kg per hectare)	WDI	7680	2275.3	1273.8
Agric. stress index	Agricultural Stress Index (% of area with Mean VHI below 35)	FAOSTAT	6980	9.90	9.91
Agric. GDP	Agriculture, forestry, and fishing, value added (% of GDP)	WDI	7756	16.0	11.6
Rural popn.	Rural population (% of total population)	WDI	8240	50.8	19.8
Violence	Physical violence index	V-Dem	7776	.566	.270
Coups	Number of successful coup attempts in a year	V-Dem	7124	.014	.122

Table 2: The impact of economic sanctions on food prices

VARIABLES	(1) Real FPI	(2) Real FPI	(3) Real FPI	(4) Real FPI	(5) Real FPI	(6) Real FPI
Sanctions	0.0210*** (0.00362)	0.00938*** (0.00332)	0.0120*** (0.00375)	0.0100*** (0.00341)	0.00769* (0.00409)	0.0124*** (0.00449)
lnGDPpc	0.00928** (0.00399)	0.0211* (0.0115)	-0.0187*** (0.00495)	0.0212* (0.0115)	0.00976 (0.0140)	0.0130 (0.0140)
Trade openness	9.17e-06 (5.15e-05)	0.000337*** (6.59e-05)	0.000101 (7.47e-05)	0.000337*** (6.59e-05)	0.000405*** (0.000114)	0.000433*** (0.000114)
lnExchange rate	-0.00424*** (0.000742)	-0.0149*** (0.00238)	-0.00213** (0.000835)	-0.0149*** (0.00238)	-0.00928*** (0.00161)	-0.00890*** (0.00161)
Popn. growth	0.00648*** (0.00192)	0.00580** (0.00283)	0.00125 (0.00266)	0.00580** (0.00284)	0.00417 (0.00312)	0.00400 (0.00315)
lnAgric. productivity	-0.000891 (0.00286)	-0.114*** (0.00997)	-0.0178*** (0.00339)	-0.114*** (0.00998)	-0.147*** (0.0175)	-0.147*** (0.0178)
Agric. stress index	-0.000489*** (0.000168)	0.000482*** (0.000125)	0.000726*** (0.000224)	0.000481*** (0.000125)	0.000142 (0.000179)	0.000113 (0.000178)
Agric. GDP	0.00108*** (0.000280)	0.00423*** (0.000491)	-0.000835*** (0.000294)	0.00423*** (0.000491)	0.00144*** (0.000446)	0.00163*** (0.000426)
Rural popn.	-0.000140 (0.000149)	-0.00307*** (0.000672)	-0.000161 (0.000186)	-0.00307*** (0.000672)	-0.00583*** (0.00100)	-0.00596*** (0.00101)
Coups	-0.0296*** (0.00900)	-0.00234 (0.00581)	-0.00946 (0.00769)	-0.00249 (0.00582)	0.0140** (0.00552)	0.0127** (0.00567)
Violence	0.0172*** (0.00661)	0.0560*** (0.0116)	0.0112 (0.00718)	0.0560*** (0.0116)	0.0722*** (0.0138)	0.0727*** (0.0136)
Constant	0.877*** (0.0476)	1.727*** (0.120)	1.268*** (0.0609)	1.725*** (0.120)	2.211*** (0.174)	2.184*** (0.172)
Observations	5,992	5,992	5,992	5,992	5,992	5,992
R-squared	0.028	0.557	0.257	0.557	0.527	0.543
Target FE	NO	YES	NO	YES	YES	YES
Sender FE	NO	NO	NO	YES	YES	YES
Target-Sender FE	NO	NO	NO	NO	NO	YES
Year FE	NO	YES	YES	YES	YES	YES
Balancing	NO	NO	YES	NO	YES	YES

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 3: The impact of economic sanctions on the prevalence of undernourishment

VARIABLES	(1) PoU	(2) PoU	(3) PoU	(4) PoU	(5) PoU	(6) PoU
Sanctions	1.495*** (0.296)	0.966*** (0.187)	1.484*** (0.290)	1.033*** (0.199)	1.386*** (0.216)	2.102*** (0.295)
lnGDPpc	-10.46*** (0.281)	-10.21*** (0.545)	-10.61*** (0.369)	-10.20*** (0.545)	-10.96*** (0.634)	-10.76*** (0.632)
Trade openness	0.0162*** (0.00383)	0.0628*** (0.00480)	0.00441 (0.00592)	0.0629*** (0.00480)	0.0834*** (0.00767)	0.0846*** (0.00748)
lnExchange rate	-0.571*** (0.0398)	-0.456*** (0.0645)	-0.298*** (0.0362)	-0.456*** (0.0645)	-0.490*** (0.0586)	-0.498*** (0.0541)
Popn. growth	1.715*** (0.141)	1.126*** (0.175)	0.908*** (0.154)	1.125*** (0.175)	0.780*** (0.168)	0.779*** (0.167)
lnAgric. productivity	-0.522* (0.268)	-0.964** (0.459)	-2.158*** (0.293)	-0.957** (0.459)	-0.571 (0.533)	-0.579 (0.529)
Agric. stress index	0.00527 (0.0126)	0.0180* (0.0101)	-0.0370* (0.0202)	0.0180* (0.0101)	0.00638 (0.0119)	0.00515 (0.0117)
Agric. GDP	-0.153*** (0.0194)	-0.166*** (0.0203)	-0.0225 (0.0220)	-0.166*** (0.0204)	-0.170*** (0.0222)	-0.164*** (0.0213)
Rural popn.	-0.0924*** (0.00940)	-0.0656* (0.0361)	-0.141*** (0.0117)	-0.0656* (0.0361)	-0.0431 (0.0547)	-0.0510 (0.0543)
Coups	-5.732*** (0.811)	-1.099** (0.474)	-6.467*** (0.985)	-1.115** (0.473)	-1.576** (0.634)	-1.631** (0.637)
Violence	-2.998*** (0.470)	-5.388*** (0.787)	-2.029*** (0.594)	-5.377*** (0.787)	-6.689*** (0.827)	-6.370*** (0.807)
Constant	115.6*** (3.511)	114.5*** (6.067)	130.3*** (4.644)	114.3*** (6.069)	117.3*** (6.736)	115.4*** (6.752)
Observations	5,816	5,816	5,816	5,816	5,816	5,816
R-squared	0.502	0.871	0.587	0.871	0.890	0.893
Target FE	NO	YES	NO	YES	YES	YES
Sender FE	NO	NO	NO	YES	YES	YES
Target-Sender FE	NO	NO	NO	NO	NO	YES
Year FE	NO	YES	YES	YES	YES	YES
Balancing	NO	NO	YES	NO	YES	YES

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4: The impacts of different types of sanctions on real food prices

VARIABLES	(1) Real FPI	(2) Real FPI	(3) Real FPIi	(4) Real FPI	(5) Real FPI	(6) Real FPI	(7) Real FPI
trade	0.0313** (0.0125)						
financial		0.0284*** (0.00723)					
travel			0.0208* (0.0107)				
trade_financial				0.0171* (0.00930)			
trade_travel					0.0229 (0.0147)		
financial_travel						0.0289** (0.0134)	
trade_travel_financial							0.0362** (0.0176)
Constant	2.138*** (0.192)	2.054*** (0.199)	2.121*** (0.193)	2.174*** (0.196)	2.166*** (0.196)	2.092*** (0.191)	1.597*** (0.227)
Observations	4,494	4,494	4,494	4,494	4,494	4,494	4,494
R-squared	0.545	0.546	0.542	0.527	0.542	0.544	0.465
Target FE	YES	YES	YES	YES	YES	YES	YES
Sender FE	YES	YES	YES	YES	YES	YES	YES
Target-Sender FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES	YES

Notes: All covariates are included. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 5: The impacts of different types of sanctions on the prevalence of undernourishment

VARIABLES	(1) PoU	(2) PoU	(3) PoU	(4) PoU	(5) PoU	(6) PoU
trade	2.506*** (0.514)					
financial		1.991*** (0.344)				
trade_financial			1.508*** (0.401)			
trade_travel				2.518*** (0.563)		
financial_travel					1.906*** (0.467)	
trade_travel_financial						2.382*** (0.650)
Constant	116.6*** (7.629)	111.9*** (7.597)	117.7*** (7.689)	118.2*** (7.636)	116.2*** (7.791)	137.6*** (7.272)
Observations	4,362	4,362	4,362	4,362	4,362	4,362
R-squared	0.896	0.897	0.893	0.896	0.895	0.891
Target FE	YES	YES	YES	YES	YES	YES
Sender FE	YES	YES	YES	YES	YES	YES
Target-Sender FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES	YES

Notes: All the covariates are included. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: The impacts of different senders of sanctions on real food prices

	(1)	(2)	(3)	(4)
VARIABLES	EU	US	UN	Other western
Sanctions	0.0307*** (0.00827)	0.00237 (0.00735)	0.000292 (0.0147)	0.0193* (0.0103)
Constant	2.206*** (0.342)	1.890*** (0.328)	2.550*** (0.369)	2.243*** (0.349)
Observations	1,498	1,498	1,498	1,498
R-squared	0.550	0.564	0.511	0.554
Target FE	YES	YES	YES	YES
Sender FE	NO	NO	NO	NO
Year FE	YES	YES	YES	YES
Balancing	YES	YES	YES	YES

Notes: All the covariates are included. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 7: The impacts of different senders of sanctions on the prevalence of undernourishment

	(1)	(2)	(3)	(4)
VARIABLES	EU	US	UN	Other western
Sanctions	2.738*** (0.428)	0.421 (0.518)	5.682*** (1.090)	2.685*** (0.533)
Constant	123.7*** (12.89)	111.2*** (13.07)	91.42*** (14.81)	113.4*** (13.79)
Observations	1,454	1,454	1,454	1,454
R-squared	0.896	0.900	0.902	0.883
Target FE	YES	YES	YES	YES
Sender FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Balancing	YES	YES	YES	YES

Notes: All the covariates are included. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Channels through which sanctions affect food prices and prevalence of undernourishment

VARIABLES	(1)	(2)	(3)	(4)	(5)
	lnfood_exp	lnfood_imp	lnfood_prod	lnyield_cereal	lnirr_agrland
Sanctions	0.239*** (0.0459)	0.0254 (0.0181)	0.00222 (0.00765)	-0.0292*** (0.00886)	-0.0729*** (0.0223)
Constant	14.19*** (2.055)	5.634*** (0.525)	2.426*** (0.244)	6.581*** (0.217)	8.647*** (0.760)
Observations	5,128	5,104	6,032	6,060	1,760
R-squared	0.897	0.784	0.722	0.953	0.983
Target FE	YES	YES	YES	YES	YES
Sender FE	YES	YES	YES	YES	YES
Target-Sender FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Balancing	YES	YES	YES	YES	YES

Notes: All the covariates are included. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A1: List of targeted countries in our sample

(1)		(2)		(3)	
S/N	Targeted countries	S/N	Targeted countries S/N	Targeted countries	
1	Afghanistan	31	Eritrea	61	Nepal
2	Albania	32	Fiji	62	Nicaragua
3	Algeria	33	Georgia	63	Niger
4	Angola	34	Ghana	64	Nigeria
5	Antigua and Barbuda	35	Gibraltar	65	Pakistan
6	Argentina	36	Grenada	66	Panama
7	Armenia	37	Guatemala	67	Paraguay
8	Azerbaijan	38	Guinea	68	Peru
9	Bangladesh	39	Guinea-Bissau	69	Philippines
10	Belarus	40	Haiti	70	Romania
11	Belize	41	Honduras	71	Rwanda
12	Benin	42	India	72	Sierra Leone
13	Bolivia	43	Indonesia	73	Somalia
14	Bosnia and Herzegovina	44	Iran	74	South Africa
15	Brazil	45	Iraq	75	South Sudan
16	Burkina Faso	46	Jamaica	76	Sudan
17	Burundi	47	Kazakhstan	77	Suriname
18	Cambodia	48	Kenya	78	Syria
19	Cameroon	49	Kyrgyzstan	79	Tajikistan
20	Central African Republic	50	Laos	80	Tanzania
21	Chad	51	Lebanon	81	Thailand
22	China	52	Lesotho	82	Togo
23	Colombia	53	Liberia	83	Tunisia
24	Costa Rica	54	Libya	84	Turkey
25	Cuba	55	Malawi	85	Turkmenistan
26	Dominica	56	Mali	86	Uganda
27	Dominican Republic	57	Mauritania	87	Ukraine
28	Ecuador	58	Mexico	88	Uzbekistan
29	El Salvador	59	Moldova	89	Zambia
30	Equatorial Guinea	60	Mozambique	90	Zimbabwe

Table A2: Mean comparisons of covariates before and after entropy balancing

Variables	Before balancing			After balancing		
	Sanctions	No sanctions	Diff	Sanctions	No Sanctions	Diff
lnGDPpc	8.65	8.61	0.036	8.645	8.645	0.000
Trade openness	60.8	66.0	-5.220 ***	60.8	60.8	0.000
lnExchange rate	4.36	3.91	0.452 ***	4.358	4.358	0.000
Popn. growth	1.66	1.65	0.018	1.664	1.664	0.000
lnAgric. productivity	7.53	7.64	-0.108	7.528	7.528	0.000
Agric. stress index	9.69	9.18	0.508 *	9.689	9.689	0.000
Agric.GDP	17.3	16.3	0.980 **	17.32	17.32	0.000
Rural popn.	49.0	51.7	-2.680 ***	48.97	48.97	0.000
Coups	0.03	0.01	0.023 ***	0.03136	0.03136	0.000
Violence	0.53	0.63	-0.099 ***	0.5304	0.5304	0.000
observation	1116	4876		1116	4876	

Notes: T-test of the differences between covariates with and without sanctions. *** p<0.01, ** p<0.05, * p<0.1.

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