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Economic Sanctions and Food Consumption: Evidence from Iranian Households

RESEARCH NOTE

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Despite scholarly consensus on the harmful effects of economic sanctions on civilians, there is little micro-level empirical research on how and to what extent economic sanctions affect the food consumption of citizens in sanctioned countries. One of the methodological barriers to studying the micro-level dynamics of sanctions is the limited availability of reliable data in sanctioned countries, which are often governed by authoritarian leaders. Our study leverages an original dataset comprising approximately 1 million observations related to the income and expenses of Iranian households from 1991 to 2021. We assess the impact of economic sanctions on individual food consumption at the national level and among distinct demographic segments. To illustrate how and to what extent international sanctions affected citizens' eating habits, we pay particular attention to 2012–2015 and 2018–2021, when Iran was subject to the most severe sanctions. Our findings demonstrate that while all segments of society feel the effects of economic coercion, low-income citizens' food consumption is more likely to deteriorate due to sanctions. Nonetheless, the geographical impact of sanctions presents a mixed picture, with rural and urban areas each exhibiting specific vulnerabilities to certain food items. We discuss the implications of our findings for sanctions policy and human rights.

A pesar de que existe un consenso en el mundo académico sobre los efectos nocivos de las sanciones económicas sobre la población civil, existe poca investigación empírica a nivel micro sobre la forma y la medida en que las sanciones económicas afectan el consumo de alimentos de los ciudadanos en los países sancionados. Uno de los obstáculos metodológicos existentes para estudiar la dinámica a nivel micro de las sanciones es la limitada disponibilidad de datos fiables en los países sancionados, los cuales, con frecuencia, están gobernados por líderes autoritarios. Nuestro estudio utiliza un conjunto de datos original que comprende, aproximadamente, 1 millón de observaciones relativas a los ingresos y gastos de los hogares iraníes desde 1991 hasta 2021. Evaluamos el impacto que tuvieron las sanciones económicas sobre el consumo individual de alimentos, tanto a nivel nacional como entre distintos segmentos demográficos. Con el fin de ilustrar la forma y la medida en que las sanciones internacionales afectaron a los hábitos alimentarios de los ciudadanos, nos centramos, especialmente, en los años 2012–2015 y 2018–2021, cuando Irán fue objeto de las sanciones más severas. Nuestras conclusiones demuestran que, si bien todos los segmentos de la sociedad sienten los efectos de la coerción económica, resulta más probable que el consumo de alimentos por parte de los ciudadanos de bajos ingresos sufra un mayor deterioro debido a las sanciones. No obstante, el impacto geográfico de las sanciones presenta un panorama mixto, ya que tanto las zonas rurales como las urbanas presentan vulnerabilidades específicas con relación a determinados alimentos. Debatimos las implicaciones que nuestras conclusiones tienen sobre la política de sanciones y los derechos humanos.

Bien que les chercheurs s'accordent sur les effets néfastes des sanctions économiques pour les civils, il existe peu de travaux de recherche empirique au niveau micro sur la manière dont les sanctions économiques ont une incidence, ou la mesure de celle-ci, sur la consommation de nourriture des citoyens dans les pays visés par des sanctions. La limitation de la quantité de données fiables sur les pays sanctionnés, souvent gouvernés par des dirigeants autoritaires, constitue notamment une barrière méthodologique à l'étude des dynamiques des sanctions au niveau micro. Notre étude exploite un ensemble de données inédites comprenant environ 1 million d'observations relatives aux revenus et dépenses des ménages iraniens entre 1991 et 2021. Nous évaluons les effets des sanctions économiques sur la consommation de nourriture individuelle au niveau national et dans différents segments démographiques. Pour illustrer comment et dans quelle mesure les sanctions internationales ont eu un effet sur les habitudes alimentaires des citoyens touchés, nous nous concentrons plus particulièrement sur les années 2012 à 2015 et 2018 à 2021, périodes au cours desquelles les plus lourdes sanctions se sont appliquées à l'Iran. D'après nos résultats, bien que tous les segments de la société ressentent les effets de la coercition économique, la consommation alimentaire des citoyens aux plus faibles revenus a de grandes

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chances de se détériorer à cause des sanctions. Néanmoins, les effets géographiques des sanctions s'inscrivent dans un tableau compliqué ; chaque zone rurale ou urbaine présente des vulnérabilités spécifiques pour certains produits alimentaires. Nous traitons des implications de nos conclusions en matière de politique de sanction et de droits de l'homme.

Introduction

Economic sanctions as a foreign policy tool have increasingly become popular in the modern era. Economic sanctions are said to be preferable because they are less harmful to civilians than military conflict and can be selective rather than indiscriminate since they can be made to target particular individuals, organizations, or economic sectors rather than the country's entire population (Pattison 2018). Nevertheless, despite optimism regarding sanctions as a nonviolent and more humane form of coercion, numerous studies have shown their human costs. Both case studies, as well as cross-country findings, suggest that economic sanctions lead to the deterioration of public health services and increase child and adult mortality (Garfield et al. 1995; Alnasrawi 2001; Peksen 2011; Allen and Lektzian 2013; Neuenkirch and Neumeier 2016; Petrescu 2016; Blaydes 2018; Takian et al. 2020; Afesorgbor 2021; Gutmann et al. 2021).

While the literature on the humanitarian costs of economic coercion is fairly well established, there is little empirical research on how and to what extent economic sanctions, as a nonviolent foreign policy, affect the food security of citizens in sanctioned states (Zhiryaeva 2017). Moreover, previous studies usually rely on general case studies or cross-national analysis. As informative as they are, these studies do not provide a granular analysis to showcase how sanctions impact individuals' nutritional and overall health.

To bridge this empirical gap, our study employs a unique dataset containing one million observations pertaining to the income and expenditures of Iranian households between 1991 and 2021. Our objective is to examine the repercussions of economic sanctions on individual food consumption patterns, both at the national level and within specific demographic segments. While the existing literature on the effects of sanctions on Iran's economic and societal framework has explored domains such as its impact on the informal economy (Farzanegan 2013; Farzanegan and Hayo 2019), shifts in the macroeconomic environment and growth trajectories (Farzanegan et al. 2016; Gharehgozli 2017; Laudati and Pesaran 2023), defense expenditure (Dizaji and Farzanegan 2021; Farzanegan 2022), corporate performance (Cheratian et al. 2023), the overall health and well-being of its citizens (Mohammadi 2013; Moret 2015; Aloosh et al. 2019; Ghomi 2022), and international academic collaborations (Kokabisaghi et al. 2019), a more nuanced, micro-level examination focusing specifically on the impact of sanctions on dietary behavior of Iranian citizens are notably absent.

Our study makes three major empirical contributions. First, we use a large original database of Iranian households' expenditures over a fairly long time period—1991–2021. This is particularly important given the fact that sanctioned countries are often ruled by authoritarian leaders who have incentives to manipulate or suppress data in order to maintain power, control public opinion, or hide their failures. We employ the Iranian Household Expenditure and Income Survey (IHEIS) dataset published by the Statistical Center of Iran (SCI). While the SCI is a government institution, it is widely regarded as a reliable source of statistical data in Iran and is frequently consulted by social scientists. Second, our study offers micro-level evidence of the impact of economic sanctions across different demographic groups. To the best of our knowledge, this is the first systematic micro-level analysis of the effects of economic sanctions on food consumption across income levels and geographical areas. Third, our empirical analysis provides a nuanced picture of food consumption under severe sanctions regimes by classifying food items into various groups, such as flour, grain, bread, fruits and vegetables, red meat, poultry, seafood, and dairy and eggs. Our detailed analysis explains how the economic sanctions had the greatest impact on the consumption of certain food groups.

This study initially draws upon the literature on sanctions to articulate theoretical predictions concerning the effects of economic sanctions on food consumption among diverse groups. Subsequently, we conduct a descriptive analysis of food consumption trends in Iran from 1991 to 2021. Then, we employ regression analysis to investigate how severe economic sanctions during the 2012–2015 and 2018–2021 periods affected Iranian households' dietary behaviors. Our findings show while all sectors of the population feel the impact of economic coercion, the food consumption of low-income citizens is more likely to deteriorate under sanctions. Furthermore, our research demonstrates that sanctions had varying effects on people's consumption of various food groups with various nutritional qualities. Aligned with prior studies examining the societal and political impacts of fluctuations in food markets, our analysis further reveals that adverse disturbances within these markets can yield different outcomes for farmers and rural populations, who simultaneously act as both consumers and producers of food (Rezaeedaryakenari et al. 2020; Brown et al. 2023).

Theoretical Expectations

Economic sanctions, frequently employed by dominant global actors, serve more than just the overt aim of diplomatic and political coercion. At face value, these measures often appear as instruments tailored to curtail the ambitions of a country's political leadership or to exert pressure on its economic machinery. However, beneath this surface-level strategic maneuvering lies a complex web of consequences that extend far beyond the anticipated targets. While the immediate goal of sanctions may be to alter the behavior of a particular regime, their real-world implications are rarely so contained. A wide range of research has indeed highlighted the profound political, economic, and humanitarian consequences that can arise from sanctions (Jones and Whitworth 2014; Ozdamar and Shahin 2021; Meissner and Mello 2022; Drezner 2024).

Under the umbrella of general sanctions theory, comprehensive sanctions are recognized as major disruptors of a nation's economic stability. These sanctions typically result in widespread trade interruptions, scarcity of critical supplies, and rising inflation. Such economic disturbances directly affect food availability and affordability, leading to sig-

nificant changes in the population's dietary patterns. This broad impact contrasts with the approach of targeted sanctions, which are primarily intended to minimize unintended consequences by focusing on specific entities, individuals, or sectors (Drezner 2011). The effect of targeted sanctions is generally more localized and concentrated, affecting only certain areas or aspects of the economy. As discussed in the next section, economic sanctions against Iran have shifted increasingly towards comprehensive measures. This shift became more pronounced after 2012 when the European Union joined the United States in imposing sanctions that broadly targeted the Iranian economy. In this context, the question of how comprehensive economic sanctions impact food consumption is pivotal, primarily due to its significant humanitarian implications.

The literature on food security shows that economic sanctions can affect food consumption through both supply and demand sides. On the supply front, sanctions manifest in multiple ways. They can precipitate a downturn in the import of essential food and agricultural products, leading to potential food shortages. Notably, while many international sanctions ostensibly exempt food and medicine, the reality often belies this, with over-compliance issues frequently undermining such exemptions (Charron and Portela 2022). Additionally, sanctions can obstruct the inflow of critical agricultural and industrial technologies pivotal for food production, consequently impacting food productivity and accessibility. Moreover, the dampening effect of sanctions on foreign investments can further constrict food supply channels.

From a demand-side perspective, the repercussions predominantly originate from the macroeconomic disruptions elicited by sanctions. As nations wrestle with sanctions-induced economic setbacks, the erosion of individual incomes and purchasing capabilities becomes almost inevitable. This is starkly reflected in metrics such as GDP growth, where a nation's receding GDP *per capita* can serve as an illustrative gauge of the economic duress endured by its populace (Neuenkirch and Neumeier 2015), with direct implications for food affordability. This is further compounded by the fiscal challenges confronting national governments. In response, they might resort to fiscal tightening, often manifested in reductions to essential subsidies that previously buffered the populace against financial vicissitudes. Concurrently, sanctions might precipitate monetary instabilities, exemplified by currency devaluation and inflationary pressures, further eroding the common citizen's purchasing parity, especially in relation to essential food commodities.

As a result, economic sanctions are expected to engender significant disruptions in food supply and demand within the targeted nation. Therefore, we hypothesize that economic sanctions will reduce food consumption in the target nation.

While the overarching influence of economic sanctions tends to be discernible at the national level, it is crucial to recognize that their effects are not uniformly distributed across all sectors of society. The adverse consequences of these sanctions often manifest more acutely among the most vulnerable sections of the population. Specifically, low-income and rural communities, which typically operate on narrower economic margins, are more susceptible to the ripple effects of sanctions. These communities typically rely on a limited and less diversified array of income sources. Consequently, they possess fewer financial safeguards against the broader economic downturns induced by sanctions. Furthermore, any sanction-induced reductions in government support or subsidies can hit harder in these regions, where such assistance might have previously acted as a crucial economic lifeline. Consequently, we expect that economic sanctions will disproportionately affect the food consumption of less advantaged segments of society, particularly those in rural areas and individuals with lower incomes.

Data and Case Study

The limitation of reliable data in sanctioned countries, which are frequently governed by authoritarian leaders, is one of the methodological obstacles to studying the micro-level dynamics of sanctions. Research on the effects of sanctions on the citizens of sanctioned countries is frequently seen as having significant limitations due to the lack of data or data manipulation (Weiss 1999, 502). For example, studies show that the Iraqi government under Saddam Hussein manipulated survey data on child mortality for political purposes (Spagat 2010; Dyson and Cetorelli 2017).

We use the IHEIS as our data source to analyze the impact of sanctions on nutrition security. The IHEIS provides a rich source of information on Iranian citizens' diet expenses from 1991 to 2021. It also includes information on Iranian households' educational attainment, gender ratio, marital status, employment status, income, and other expenditures. The Statistical Central of Iran conducts the IHEIS. Among social scientists, this institution is considered to be one of the more independent and minimally politicized entities in Iran, with its data consistently viewed as reliable for research purposes (Harris 2017; Salehi-Isfahani 2017, 2020; Salehi-Isfahani and Mostafavi-Dehzooei 2018; Basu and Maitra 2020; Salamat and Sadeghian-Sharif 2021; Kadivar 2022).[1] The main purpose of IHEIS is to collect information on the socioeconomic features of Iranian households for public policy purposes. Overall, the IHEIS is a unique source of information on Iranian households over time and provides fine-grained data to explore the impact of economic sanctions on dietary consumption.

Iran is a suitable case study for the effects of economic sanctions due to the length of time the country has been subject to them. Iran has been subject to economic sanctions since 1979, although their severity has changed over time (O'Sullivan 2010, 11). The United States alone unilaterally imposed and carried out Iran's economic sanctions from 1979 to 2006. During this period, despite the sanctions, the Iranian government was able to circumvent them by strengthening its economic ties with nations in Asia and Europe. Nevertheless, the international community's concerns about Iran's nuclear ambitions led to a shift from unilateral to multilateral and more comprehensive sanctions. After the failure of the nuclear talks in 2006, the UN Security Council adopted its first resolution, calling on states to take the necessary measures to stop the supply of any materials, tools, or technologies that might support Iran's nuclear activities (Fayazmanesh 2008). In general, over the 2006–2010 period, the Security Council adopted six resolutions targeting Iran's nuclear program and missile activities. While these resolutions imposed significant restrictions against Iran's nuclear activities, they did not target Iran's financial sectors.

The most profound manifestation of comprehensive sanctions was evident in 2012. The European Union imposed

[1] Historically, an academic figure often occupies the leadership role within this center, and this tradition involves maintaining stability in leadership even during government transitions. As a result, it has been considered one of the least politicized institutions.

a full oil embargo on Iran and froze the Iranian Central Bank's assets. Simultaneously, the United States also implemented different types of sanctions, targeting not just one or two sectors but a vast swath of Iran's economic landscape, including its oil exports and the financial sector. By the end of 2011, a large international coalition, including the European Union, the United States, the United Nations, and other nations, imposed increasingly severe economic sanctions on multiple facets of Iran, including its trade, finance, and energy sectors. The move to cut off Iranian banks from the Society for Worldwide Interbank Financial Telecommunications (SWIFT), thereby preventing Iranian financial institutions from conducting international financial transactions, further exemplified the comprehensive nature of these sanctions (Samore 2015, 8).

The 2015 nuclear deal, the Joint Comprehensive Plan of Action, provided Iran with an opportunity to resume oil exports, access international financial markets, and attract foreign investment. As a result of the deal, Iran's economy began to recover after several years of decline due to the impact of the sanctions. Nevertheless, the United States' withdrawal from the the Joint Comprehensive Plan of Action (JCPOA) in 2018 and reimposing the sanctions as part of the Trump administration's maximum pressure policy caused another external shock to the Iranian economy as it was trying to recover after the 2015 nuclear deal. The maximum pressure policy included efforts to diplomatically isolate Iran as well as a number of sanctions aimed at Iran's banking sector, banking system, and other important areas of its economy. While European countries generally criticized the Trump administration's maximum pressure policy against Iran, they were unable to provide significant relief to Iran in the face of US sanctions. For instance, France, Germany, and the United Kingdom created a mechanism known as the Instrument in Support of Trade Exchanges (INSTEX), designed to facilitate non-dollar trade with Iran. However, INSTEX had little success because few European companies were willing to do business with Iran for fear of coming under US sanctions. The effects of the US sanctions during this period were remarkably similar to those of the harsh sanctions imposed between 2012 and 2015.

Overall, the sanctions regime against Iran has evolved, displaying elements of both targeted and comprehensive sanctions. Comprehensive sanctions, as described in the literature, are broad measures that impact an entire nation's economy and its general populace (Cortright and Lopez 2002; Drezner 2011). In the context of Iran, while sanctions initially appeared more selective or "targeted," they shifted towards a broader, comprehensive approach, particularly post-2011. These latter sanctions, although occasionally branded as "smart" or "targeted" by targeting financial sections and the oil industry, have undeniably impacted the entire Iranian economy and its broader population.

Our article focuses on the impact of economic sanctions during these two periods (2012–2015 and 2018–2021)[2] on Iranians' food consumption because of their severity and comprehensiveness during these years. Given the severity of the economic sanctions from 2012 to 2015 and from 2018 to 2021, we expect a significant change in the amount of food consumed by Iranian households during these periods.

Empirical Analysis

In our analysis, dependent variables are the average monthly consumption of household members for the eight main food groups according to the IHEIS: flour, grain, bread, fruit and vegetable, red meat, poultry, seafood, and dairy and eggs. Our independent variable, sanctions, is a categorical variable that is coded 1 for years between 2012 and 2015 as well as between 2018 and 2021, otherwise 0. We use a lead for this variable because the effects of economic sanctions can manifest in household budgets with a delay. Therefore, we anticipate that employing this lead variable will enable us to capture the realization of the impact of sanctions imposed on households' budgets more effectively. Also, we control for the number of employed members of the household (*HHemployed*), the number of male (*HHmale*) and female (*HHfemale*) members in the household, the average age of the household (*HHage*), whether they live in urban or rural areas (*HHurban*), and the log of household's annual income (*HHincome(log)*). We also include county[3] fixed effects to control for possible geographical changes in socioeconomic conditions that can affect households' budgets and decisions, but we lack data to control them directly. Furthermore, we have added a dummy variable to account for shifts in presidential periods. This addition helps to control for variations in government policies over time.[4] This approach reduces the risk of omitted variable bias. We also cluster the standard errors by counties to deal with spatial serial correlations. Online Appendix Table A1 summarizes the descriptive statistics of these variables.

Figure 1 shows the changes in the average monthly red meat consumption of Iranian households per person (kg) in urban and rural areas. The plot suggests that after 2012, when the comprehensive sanctions regime began to take effect, the average consumption of red meat began to decline in both urban and rural areas.

It also indicates that between 2018 and 2020, when Trump reinstituted economic sanctions against Iran and implemented his maximum pressure policies, the median amount of meat consumption in rural areas of Iran fell to its lowest level (nearly 0). The purple horizontal line displays the average monthly red meat consumption of households per person in the sample. While red meat consumption fell after 2009 for both urban and rural residents, the decline is more acute for the latter. Figure 2 also shows the change in Iranian households' average monthly red meat consumption per person (kg) across different income quartiles. Consistent with figure 1, figure 2 suggests that economically vulnerable households incur the major cost of economic sanctions. While all households, even those in the fourth income quartile, experienced a significant decrease in their red meat consumption, households in the lower income quartiles suffered more. The plots of the other seven food groups in our analysis are reported in the Online Appendix. We observe a similar decline in food consumption during sanction years with a more significant adverse effect among rural and low-income households in all plots.

Now, we use regression analysis to provide a more systematic assessment of how severe sanctions affect Iranian households' food consumption. The equation below specifies the

[2]The Persian and Gregorian calendars share a nine-month overlap, spanning from March to December. The IHEIS data is collected and reported using the Persian calendar, and we have converted it to the Gregorian calendar accordingly. During this conversion, we established that the year 1371 in the Persian calendar corresponds to the year 1991 in the Gregorian calendar, and so forth.

[3]"County" is the English translation of the Persian term "Shahrestan." A "shahrestan" is the second-largest administrative unit following the province, which is referred to as "Ostan" in Persian.

[4]We also conducted models incorporating year-fixed-effects. However, this approach can present challenges since our independent variable is derived from the year variable. When we use the year fixed-effects, our findings are not substantially different.

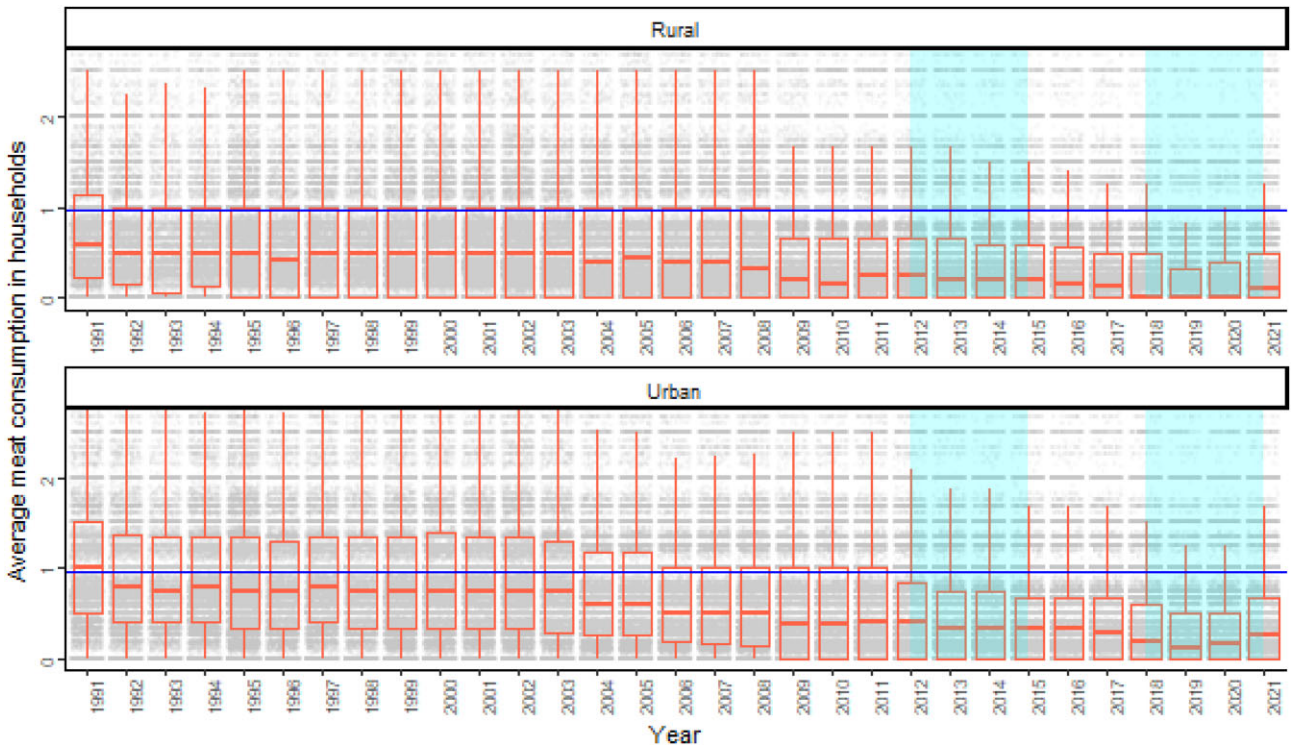

Figure 1. Changes in the average red meat consumption of Iranian households per person in urban and rural areas. The shaded areas show sanction years, and the horizontal line shows Iranian households' average red meat consumption per person.

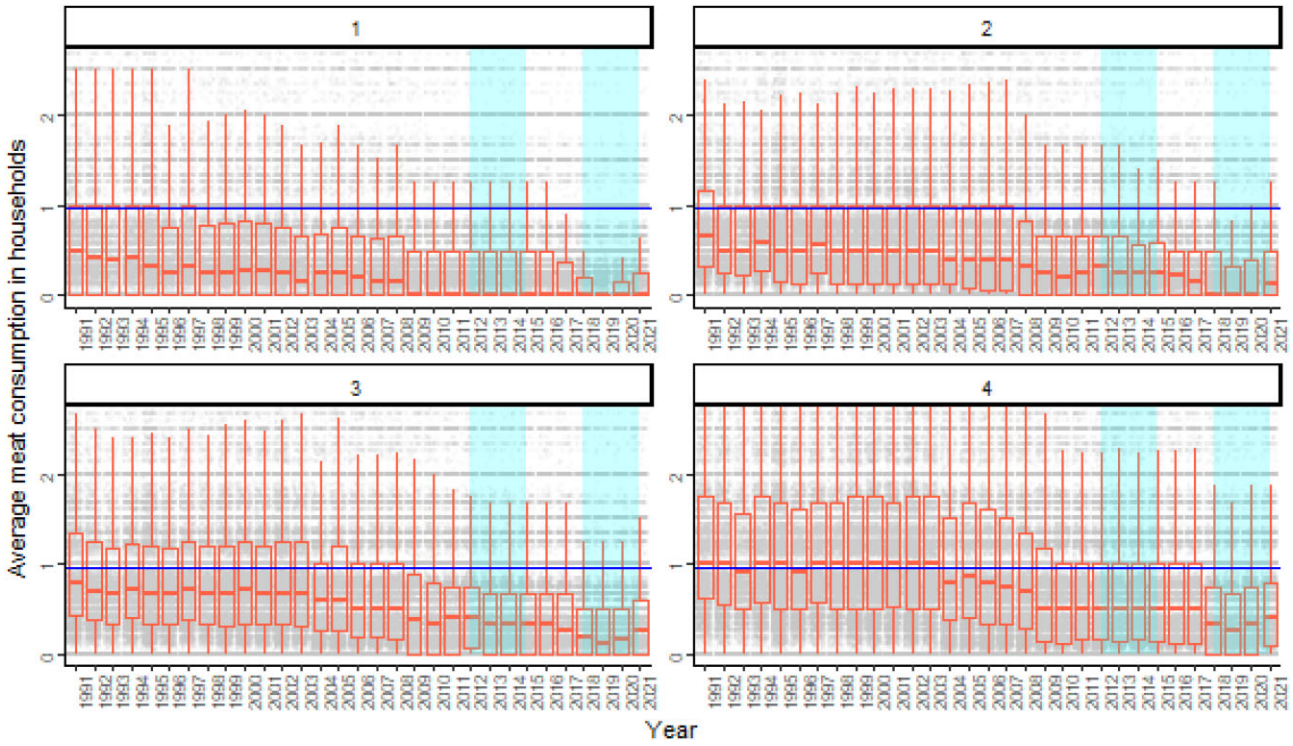

Figure 2. Changes in the average red meat consumption of Iranian households per person across different income quartiles. The shaded areas show sanction years, and the horizontal line shows Iranian households' average red meat consumption per person.

primary estimated model, with other estimated models derived from it.

$$y_{ij} = \beta_{0j} + \beta_{1j} Sanction_{\theta} + \beta_{2j} HHemployed_i + \beta_{3j} HHmale_i + \beta_{4j} HHfemale_i + \beta_{5j} HHage_i + \beta_{6j} HHincome_i + \beta_{7j} \text{HHurban}_i + \phi_k + \psi_t + \epsilon_{ij},$$

where i and j represent, respectively, the households and our eight food groups, and $Sanctions_{\theta}$ is the dummy variable for the sanction years. ϕk are county fixed-effects, and ψt are the presidential period fixed-effects. We used the Ordinary Least Squares method to estimate these regression models. The household data is collected annually, but they are not the same household every year, so we used pooled estimation methods while controlling for temporal and spatial variations accordingly. Since counties (ϕk) have many levels of fixed effects, we use the developed approach by Guimarães and Portugal (2010) and Correia (2014) for estimating a high-dimensional fixed effects model. In addition, this approach drops the singleton observations and the presidential period(s) that overlap significantly with our independent variable to mitigate the risk of a biased estimation (See Correia (2016) for a detailed technical discussion). Lastly, this approach is computationally faster in estimating the high-dimensional fixed-effects models.

Table 1 summarizes our estimation results. We observe consistently negative and statistically significant estimated coefficients for economic sanctions ($p_{value} < 0.001$) across all food groups in our study, with two exceptions—bread, which showed a positive and statistically significant coefficient ($p_{value} < 0.001$), and flour, which is negative but not statistically significant ($p_{value} > 0.05$). This suggests that periods affected by economic sanctions are linked to reduced food consumption in all food groups, while bread consumption increases. To better understand the impact of economic sanctions on food consumption, we have plotted the substantive effects in figure 3. These visualizations reveal a significant decrease in food consumption among Iranian households during comprehensive sanctions, with two noteworthy exceptions. The predicted marginal effect on flour consumption, although negative, is not statistically significant, and the increase in bread consumption is statistically significant. It's important to highlight that rice is a staple food that holds a central place in the Iranian diet and is often replaced by bread in cases of economic hardship. Although the reduction in grain consumption, which primarily includes rice, and the rise in bread consumption may not appear problematic, individuals familiar with Iranian culture and cuisine recognize this dietary transition as unfavorable. In addition to these observed trends, the decline in protein consumption raises concerns. While the reduction in red meat consumption, as a protein source, may be seen as an unintended positive outcome of economic sanctions, the consistent decrease in other protein sources like poultry, seafood, dairy, and eggs is worrisome. For instance, the Food and Drug Administration (FDA) recommends a minimum weekly intake of at least 8 ounces (0.26 kg) of seafood (Nutrition 2023). In periods without sanctions, this amount averaged around 0.27 kg per month for Iranian households, which was already below the FDA's recommended quantity. However, sanctions further reduced this figure to approximately 0.21 kg per month, marking a notable 22 percent decrease.

Furthermore, we assessed the impact of sanctions on food group consumption within two distinct population subgroups: rural vs. urban households and income quartiles. This can provide further insight into some of the vulnerable populations. We conducted these analyses similar to the previously described steps while adding the interaction of these variables with sanctions in our regression analysis. Specifically, we included interactions between sanctions and the urban–rural variable as well as sanctions and income quartiles separately in our models. The regression results can be found in the Online Appendix (Tables A2 and A3). While the regression tables offer valuable insights into our estimated models, we adopt the approach suggested by Brambor et al. (2006) to visualize the marginal changes in food consumption across the interacted variables. This visual representation (figures 4 and 5) provides a clearer insight into the practical implications of our findings.

While figure 3 illustrates the adverse impact of economic sanctions on food consumption among Iranian households at the aggregate level, figures 4 and 5 reveal distinct effects of these sanctions on different segments of the population. Specifically, the plots in figure 4 demonstrate divergent trends in the effects of economic sanctions on flour, grain, and bread consumption. In rural areas, there was a reduction in flour and grain consumption, while bread consumption increased. In contrast, urban households exhibited an increase in flour consumption but a decrease in bread consumption, with grain consumption remaining relatively stable. As previously mentioned, the decline in grain consumption, which includes rice as a significant component, represents a noteworthy adverse change for rural households. This is of particular concern as rural households in Iran are the primary producers of grains.

The adverse effects of sanctions on fruit and vegetable consumption are comparable for both urban and rural households. The monthly consumption of these food items decreased from 0.43 kg to approximately 0.39 kg, representing a roughly 9 percent reduction in average consumption within this food group.

Regarding protein consumption, we observe consistent decreases in food consumption from non-sanctioned periods to sanctioned periods, albeit at different magnitudes, for both urban and rural households. While urban households saw a significant decrease of about 100 g in red meat consumption, a 12 percent decline, the decrease in red meat consumption among rural households did not reach statistical significance. On the other hand, poultry consumption witnessed a statistically significant decrease for both urban and rural households, with the decline being more pronounced in urban areas. Economic sanctions also had an impact on seafood consumption for both urban and rural families. In addition, rural households experienced a statistically significant decrease in dairy and egg consumption, while such a decrease was not statistically significant for urban households.

Overall, the effects of sanctions on urban and rural communities are mixed. Interestingly, rural populations appear to have been less adversely affected by sanctions in terms of access to protein-rich foods like red meat and poultry, possibly due to their potential direct access to livestock and poultry farming. As a result, the geographical impact of sanctions across the urban–rural divide is complex, indicating that urban residents could be just as vulnerable.

Income level is another demographic factor that can reveal the impact of sanctions on vulnerable populations. Figure 5 provides a better understanding of how economic sanctions influenced food consumption across various income groups. Similar to the patterns observed between urban and rural households, there is evidence suggesting that Iranian households from diverse socio-

Table 1. Estimation results

	Flour	*Grain*	*Bread*	*Fruits and vegetables*	*Red meat*	*Poultry*	*Seafood*	*Dairies and eggs*
Sanctions	−0.02	−0.37***	0.31***	−0.03***	−0.08***	−0.11***	−0.06***	−0.52***
	(0.02)	(0.04)	(0.03)	(0.00)	(0.01)	(0.01)	(0.00)	(0.04)
HHemployed	0.67***	0.42***	−0.14***	0.02***	0.17***	0.03***	0.01***	0.90***
	(0.02)	(0.02)	(0.04)	(0.00)	(0.01)	(0.01)	(0.00)	(0.04)
HHmale	−0.16***	−0.34***	−0.16***	−0.04***	−0.12***	−0.16***	−0.04***	−0.73***
	(0.03)	(0.08)	(0.04)	(0.00)	(0.01)	(0.01)	(0.00)	(0.17)
HHfemale	−0.01	−0.27***	−0.44***	−0.04***	−0.12***	−0.13***	−0.04***	−0.61***
	(0.01)	(0.02)	(0.04)	(0.00)	(0.01)	(0.01)	(0.00)	(0.17)
HHagemean	0.03***	0.03***	0.04***	0.00***	0.01***	0.01***	0.00***	0.04***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
HHincome(log)	−0.65***	1.12***	0.39***	0.09***	0.42***	0.38***	0.12***	0.91***
	(0.03)	(0.13)	(0.06)	(0.00)	(0.02)	(0.01)	(0.00)	(0.09)
HHurban	−3.88***	−0.69***	2.15***	0.00	−0.06**	0.01	0.06***	−0.50*
	(0.07)	(0.15)	(0.09)	(0.01)	(0.02)	(0.02)	(0.00)	(0.25)
Intercept	6.62***	−1.07*	6.02***	0.07***	−0.96***	−0.16**	−0.19***	2.68***
	(0.15)	(0.47)	(0.31)	(0.02)	(0.11)	(0.06)	(0.01)	(0.65)
N	942,521	942,521	942,521	942,521	942,521	942,521	942,521	942,521
Log-likelihood	−4.42e + 06	−5.35e + 06	−4.76e + 06	−2.36e + 06	−3.39e + 06	−3.06e + 06	−1.79e + 06	−5.88e + 06
BIC	8838700.88	1.07e + 07	9522852.32	4711196.32	6787202.41	6115497.87	3579119.86	1.18e + 07
Location FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Presidential period FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors in parentheses.
*$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

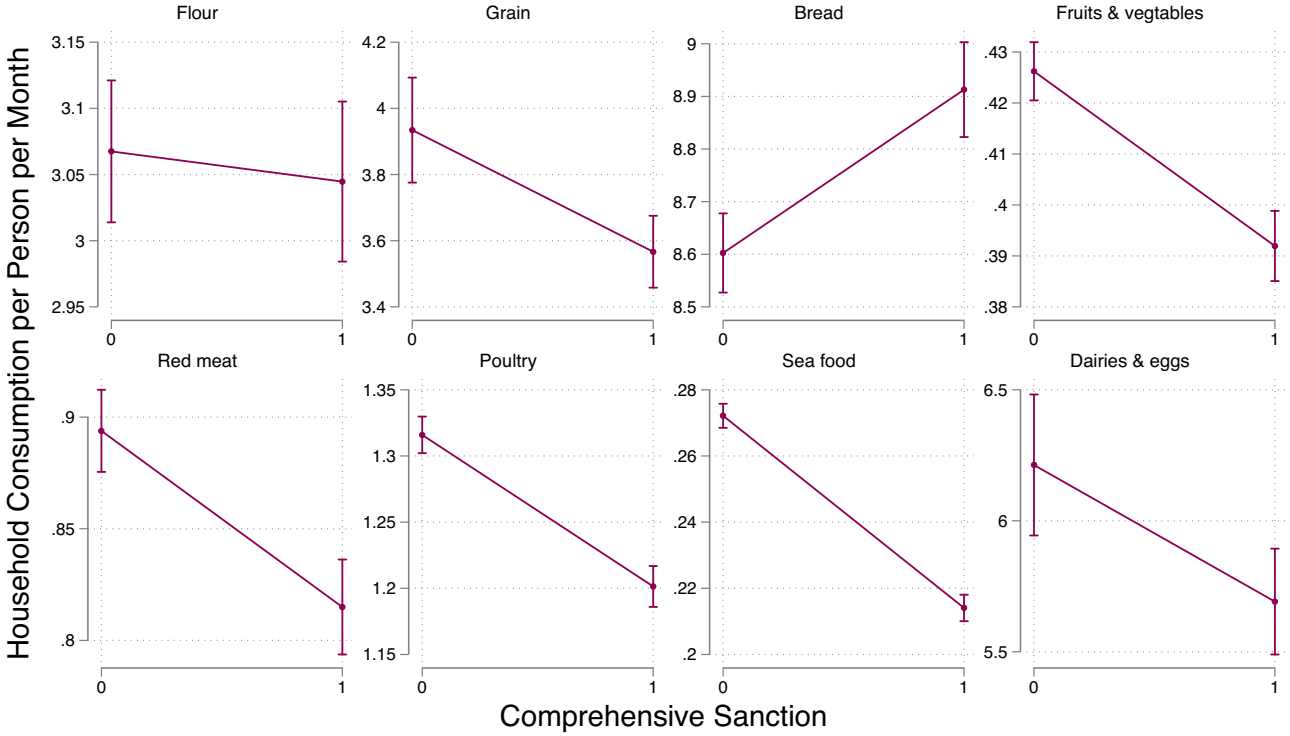

Figure 3. The predicted effect of economic sanctions on the average food consumption of Iranian households.

economic backgrounds developed new dietary habits as a coping mechanism in response to the adverse effects of sanctions. In the first income quartile, both during non-sanction and sanction periods, there appears to be a deficit in the consumption of red meat, dairy, and eggs. Notably, during sanctions, they further decreased their already low consumption of seafood protein in favor of poultry products. The second and third quartiles also exhibit declines in protein consumption, with statistically significant decreases observed in poultry and seafood food groups.

Households in the fourth income quartile also encountered reductions in food consumption across various food groups. However, the plots illustrate that their food intake remains relatively robust, significantly higher than the third

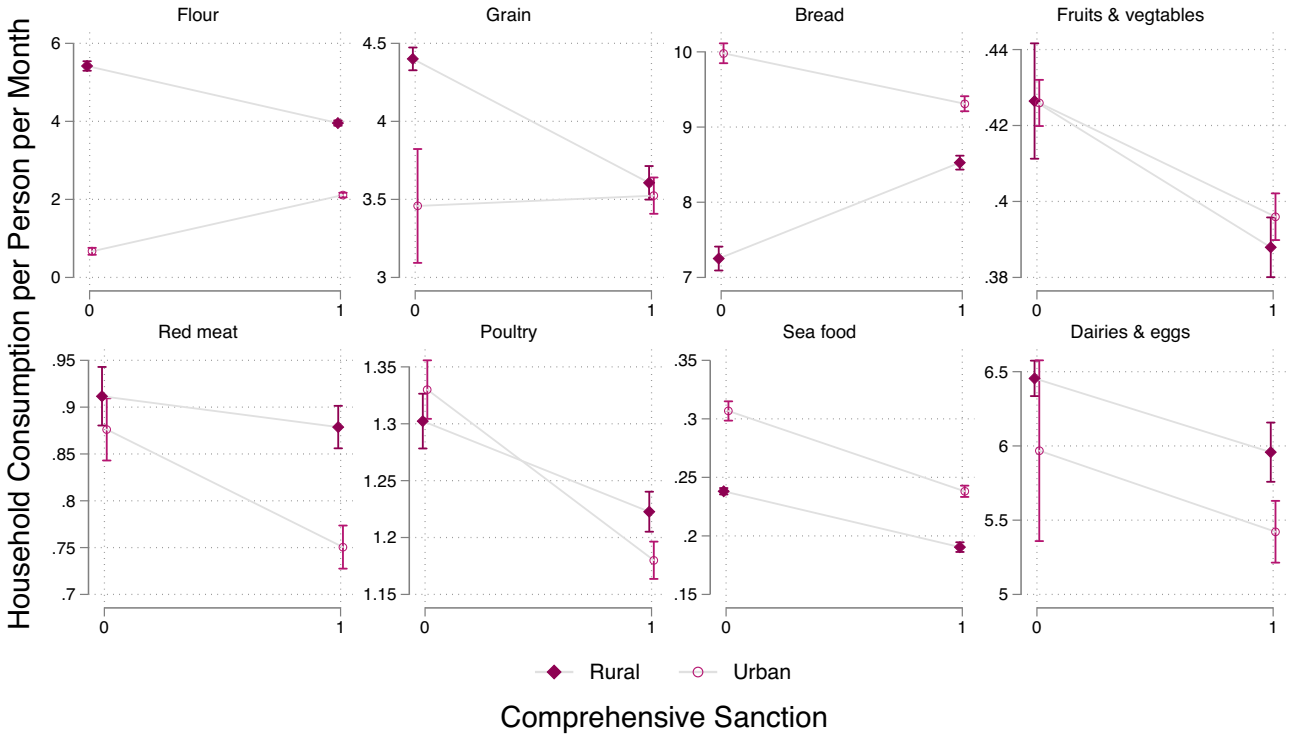

Figure 4. Predicted effect of economic sanctions on the average food consumption of Iranian households: urban vs. rural areas.

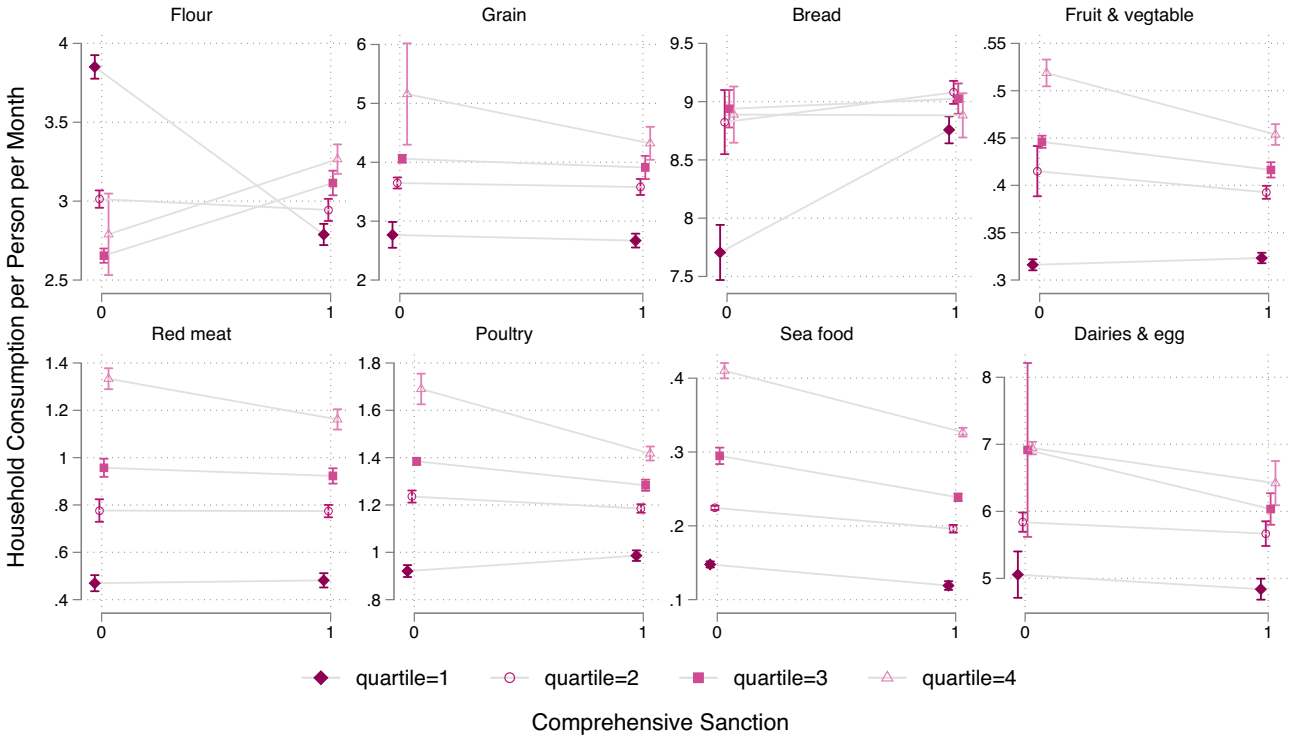

Figure 5. Predicted effect of economic sanctions on the average food consumption of Iranian households: different income quartiles.

quartile, which falls below their income category. Assuming that the political and economic elites of society primarily belong to the fourth quartile, the findings do not indicate a substantial disruption in their food consumption that would align them with lower-income households. In other words, high-income households experienced a decrease in their consumption of major food groups during sanction years. Despite this, these households still exhibited higher

average food consumption in most food groups compared to other income quartiles, suggesting that economic sanctions did not jeopardize their nutritional well-being. On the contrary, lower-income households already faced food consumption challenges, and economic sanctions, especially after 2018 (as shown in figure 2), led to a further disruption in their average food intake. This aligns with our theoretical expectations, indicating that economic sanctions can indeed have adverse effects on all socioeconomic groups in society, but the more vulnerable income groups predominantly bear these impacts.

Discussion

This article primarily aims to offer empirical evidence, yet it is crucial to comprehend the possible underlying mechanisms through which sanctions influence food consumption. In this segment, we present a succinct examination of the repercussions of global multilateral sanctions on Iran's food consumption patterns. As previously highlighted, studies related to food security indicate that economic sanctions have the potential to shape food consumption from both the supply and demand perspectives. On the supply front, sanctions can curtail food and agricultural imports, leading to shortages. Furthermore, these sanctions can inhibit the procurement of essential agricultural and industrial technologies, directly affecting food productivity and, subsequently, its availability. Moreover, diminished foreign investment due to sanctions can further constrict the food supply chain.

Nevertheless, Iran's decreased food consumption was not primarily caused by supply-side reasons. Iran's food industry is generally vast and mostly run by the private sector. It accounts for 12 percent of Iran's industrial sector (Mehr News 2021) and effectively meets domestic demand. The food industry is one of Iran's most important non-oil export industries, accounting for 11 percent of total exports (ISNA 2022). Despite severe economic sanctions, a wide variety of food products have been available in the Iranian market under the multilateral sanctions regime. Furthermore, as part of its larger goal of "neutralizing sanctions," Iran has reduced its dependence on foreign technology imports by ramping up domestic production (Carmi 2022). As a result, food availability has not been a major problem for Iranian households under multilateral sanctions. In other words, the decline in food consumption has little to do with the supply side.

The main mechanism that sanctions had an impact on food consumption is by altering demand as a result of the economy's general downturn. Economic sanctions have a detrimental effect on the target state's GDP growth, as evidenced by prior studies (Neuenkirch and Neumeier 2015). According to World Bank data, Iran's GDP per capita decreased from USD $8,329 in 2012 (when the global sanctions started) to USD $2,746 in 2020. With the exception of 2016, when the country saw a 6.8 growth as a result of the nuclear deal, the economy grew just slowly or declined, resulting in the decade being known as Iran's "lost decade" (Bank 2021, 1).

Sanctions impacted food affordability for citizens by constricting Iran's trade with the global market, reducing the government's export revenues (Salehi-Isfahani 2020). Faced with dwindling revenues, the Iranian government found itself compelled to recalibrate its financial support to the populace, leading to a reduction in subsidies that many citizens had previously relied upon. As an illustration, the government raised the price of gasoline by at least 50 percent in November 2019 to boost revenues and lessen the negative economic effects of US sanctions. This sequence of events ushered in a period of increased economic uncertainty, prompting individuals to redirect their spending toward more stable assets such as gold or foreign currencies to safeguard their savings from potential devaluation. This reallocation of spending away from consumption to stores of value assets, coupled with the decrease and devaluation of subsidies, can contribute to diminished household expenditure on food.

The mechanisms discussed above clarify why we observed a more distinct and consistent pattern of sanctions' impact on food consumption across various income groups, whereas exploring their effects on rural families reveals a higher degree of complexity. Rural regions are home to farmers who are simultaneously producers and consumers of food. On the one hand, the rise of food prices, driven by inflation and reduced imports due to sanctions, may increase the income for these families and improve their food intake. This is the income effect of sanctions on food consumption of farmer households. However, high inflation rates and other adverse economic shocks adversely affect farmer households' budgets, thus negatively impacting their food consumption. Therefore, even though farmers in rural areas have direct access to the food they produce, their intake of other food groups can suffer negatively, similar to other households. This is known as the price effect on consumption. These dynamics result in more complex findings regarding the effect of sanctions on food consumption when comparing urban and rural households.

Conclusion

Our study explored the impact of economic sanctions on food consumption patterns, utilizing a comprehensive database of Iranian households with around one million observations at the household level. Our findings suggest that economic sanctions lower the consumption of many nutritious food items, especially among low-income groups.

Sanctions are often viewed as a powerful tool to apply pressure on authoritarian leaders by targeting their sources of income and limiting access to resources. In some instances, sanctions may cause political unrest, eventually weakening authoritarian regimes. Indeed, economic hardship and a decline in living standards can exacerbate popular dissatisfaction, leading to protests and social unrest (Liou et al. 2021). However, as the results of this study show, severe economic sanctions also serve as a form of collective punishment that harms the civilian population, especially the most vulnerable. There is little evidence to suggest that the ruling elites in Iran have experienced a lack of access to healthcare and food or, more generally, economic hardship.

Furthermore, our analysis shows that while economic sanctions could cause discontent among higher-income households, they do not necessarily create food security issues for them. In contrast, economic sanctions can alter the dietary regimes of middle- and lower-income families and negatively impact their food security. For instance, our empirical analysis shows that households in the second and third income quartiles, comprising the economic middle class of society, experience significant reductions in their total protein consumption, as well as fruit and vegetable consumption. However, as studies have found (Allen 2005; 2008), whether this discontent can translate into exerting enough pressure on the incumbent government from within is not assured. Consequently, comprehensive sanctions can harm the lives of citizens in targeted countries,

particularly vulnerable populations, without necessarily resulting in policy change (Elliott 1995; Allen 2022). Indeed, economic hardships only cause grievance, and whether this discontent leads to successful anti-government movements depends on overcoming the collective action problem and possessing robust organizational capacity.

Moreover, our micro-level examination of the impact of economic sanctions on household food consumption underscores the complexity of studying these effects, particularly among rural populations. While our results indicate that sanctions adversely affect both rural and urban households in specific food categories, the reduction in food consumption was sometimes less pronounced among rural households. As producers and consumers of food, rural farmer households encounter both income and price effects due to sanctions, necessitating a deeper theoretical and empirical exploitation to understand these dynamics fully. This area presents a valuable opportunity for future research.

Exploring the negative implications of sanctions further, another possible area for research involves examining the military's role within the national economy. This could potentially hasten the militarization of economic policies or amplify state control over crucial industries (Izadi 2022), thereby intensifying economic difficulties.

Indeed, economic sanctions might prompt the securitization of food markets, where military and state actors justify their market interventions under the guise of sanctions, leading to further economic challenges. If these interventions result in economic gains for such actors, they may oppose resolving the underlying political disputes that necessitated the sanctions, fearing the loss of these benefits.

Additionally, the disruptions in dietary habits discussed above can potentially have mid and long-term repercussions on families' health. This suggests scholars explore and gather data that can be utilized to examine the enduring impact of sanctions on household diets and food consumption and how these factors influence their overall health.

Lastly, our study has focused on examining the direct impact of sanctions on households' food consumption in Iran. As discussed earlier, we found that the shocks induced by sanctions have influenced the dietary choices of Iranian households, particularly affecting the most vulnerable among them. However, it is crucial to recognize that sanctions can also have indirect repercussions by reducing employment opportunities and family incomes. Our empirical analysis does not encompass these indirect effects, which require dedicated economic modeling to untangle different direct and indirect mechanisms. Our analysis is an effort to provide micro-level empirical validation for certain previously untested assumptions regarding the adverse effects of economic sanctions.

Supplementary Information

Supplementary information is available in the *International Studies Quarterly* data archive.

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