



INTERNATIONAL  
FOOD POLICY  
RESEARCH  
INSTITUTE

**IFPRI Discussion Paper 02246**

March 2024

**Role of International Price and Domestic Inflation in Triggering Export  
Restrictions on Food Commodities**

Abdullah Mamun

David Laborde

Markets, Trade, and Institutions (MTI) Unit

## **INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE**

The International Food Policy Research Institute (IFPRI), established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

### **AUTHORS**

Abdullah Mamun ([A.Mamun@cgiar.org](mailto:A.Mamun@cgiar.org)) is a Senior Research Analyst in the Markets, Trade, and Institutions (MTI) Unit of the International Food Policy Research Institute (IFPRI), Washington, DC, USA.

David Laborde ([david.laborde@fao.org](mailto:david.laborde@fao.org)) is the Director of Agrifood Economics Division of the Food and Agriculture Organization (FAO), Rome, Italy.

### **Notices**

<sup>1</sup> IFPRI Discussion Papers contain preliminary material and research results and are circulated in order to stimulate discussion and critical comment. They have not been subject to a formal external review via IFPRI's Publications Review Committee. Any opinions stated herein are those of the author(s) and are not necessarily representative of or endorsed by IFPRI.

<sup>2</sup> The boundaries and names shown and the designations used on the map(s) herein do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI) or its partners and contributors.

<sup>3</sup> Copyright remains with the authors. The authors are free to proceed, without further IFPRI permission, to publish this paper, or any revised version of it, in outlets such as journals, books, and other publications.

## CONTENTS

Abstract	iii
Acknowledgments	iv
1. Introduction	1
2. Literature Review	6
3. Food Price and Trade Policy: Theory and Stylized Facts	11
3.1 Optimal Trade Policies as World Price Diverges	11
3.2 Food Price and Export Restriction Coverage	14
4. Methodology	16
4.1 Econometric Model	16
4.2 Estimation Approach	19
5. Data and Summary Statistics	20
5.1 Export Restrictions Data	20
5.2 Inflation and Price Data	21
World price changes at commodity level	21
General and food price inflation	22
Control variables	22
5.3 Summary Statistics of Explanatory Variables	22
6. Results	25
6.1 Regression results	25
7. Conclusions	31
References	34

## TABLES

Table 1: Export restriction data by episode .....	20
Table 2: Descriptive statistics for export restrictions.....	21
Table 3: Descriptive statistics on explanatory variables.....	23
Table 4: Probit model, with general and food price inflation and world price change at commodity level: Marginal effects on export restrictions .....	27

## FIGURES

<b>Figure 1:</b> Trade policy of export tax as world price diverges from reference level.....	13
<b>Figure 2:</b> Food price index and export restriction coverage in 2008, 2020, and 2022 crises.....	15

## ABSTRACT

This paper investigates the drivers of export restrictions on agricultural products based on an original dataset developed at IFPRI. We focus on four food price crises when export restrictions (e.g., ban, tax, licensing etc.) were applied: the 2008 and 2010 food price crises, the COVID-19 pandemic, and the 2022 crisis associated with the Russia-Ukraine war. Although the justifications for such trade policies have been discussed in the literature, the ability to forecast their implementation remains understudied. The probit model used in this study suggests that the inflation rate has a higher power to predict export restrictions than do international commodity prices. The probability of export restrictions increases more when price change is measured from a reference level in the long interval than the short interval. Among the covariates, agricultural land per capita, commodity share in production and export, weather condition increases the chances of imposing export restrictions. Per capita income, population density, share of agriculture in GDP, urbanization rate, political economy indicators - all have a negative influence on this likelihood.

**Keywords:** Exports, Free Trade, International Trade

*JEL classifications:* F13, F14

## ACKNOWLEDGMENTS

The paper was prepared with funding from the European Commission, the Foreign, Commonwealth, and Development Organization (FCDO) of the United Kingdom, and the United States Agency for International Development (USAID) under the joint project “Ukraine Crisis and Monitoring and Analysis of Food Crisis and Policy Responsiveness.” It is designed to accompany and describe the [Food and Fertilizer Export Restriction Tracker](#) of IFPRI’s Food Security Portal. Authors are grateful to Antoine Bouët, Director, CEPI for his review and insightful comments on the paper. The authors wish to thank Rob Vos, Director, MTI; Fousseini Traoré, Senior Research Fellow; Will Martin, Senior Research Fellow; and Joe Glauber, Senior Research Fellow, for their feedback on earlier version of the paper presented during RISE Conference 2023.

# 1. INTRODUCTION

Export restrictions on food commodities are often used by net food-exporting countries either amidst commodity price booms (for example, the 2007–2008 and 2010–2011 food price crises) or in response to sudden shocks, such as an extreme weather-related reduction in food stocks or domestic inflation Russia-Ukraine. The most common objective of these trade policy tools is to insulate domestic prices from the world price level and thus avoid political repercussions of external shocks in the adopting countries (Tadesse et al. 2014; Bouët and Laborde 2010; Martin and Anderson 2012). While their impact is well documented, the determinants of export restrictions and their predictability are understudied. With sustained high inflation rates and high world prices at commodity level, policymakers often implement short-term trade policy measures such as bans, taxes, licenses, and quotas. Thus, we investigate (1) whether the general inflation rate as well as global price changes at the commodity level influence decisions regarding export restrictions, and (2) if so, how predictable are these restrictions? We study four past episodes of food price crisis and supply shocks: the 2007–2008 and 2010–2011 food price crises, the COVID-19 pandemic, and the Russia- Russia-Ukraine war started in 2022.

Giordani, Rocha, and Ruta (2016) present an important paper on theoretical rationale for the observed use of food trade policies during 2008–2011 food price crisis. They investigate the impacts of international price movements and global trade policy utilization on the probability of imposing export restrictions. Their empirical model did not consider domestic inflation as a determinant of export restriction. Our observations indicate that policymakers in the net food exporting countries take note of domestic inflation, particularly food price inflation, and impose restrictions on the key commodities. The objective of these policy measures is to increase domestic supply of those commodities and depress price, which is expected to decrease overall food inflation rate. He (2021) provides a similar study and builds a fixed effect probit model to explore the impact of market power of specific commodity and its downstream sector, and of country's number of regional trade agreement partners on export restriction. Nevertheless, none of these papers discussed the role of domestic inflation in determining export restriction. Moreover,

these studies use data of export restrictions up to 2015 and did not cover the extensive use of these measures during the COVID-19 pandemic and following Russia-Ukraine war in 2022.

Exporting countries are often concerned about high domestic inflation. We noted that many net food exporting countries like India, Indonesia, and Kazakhstan, frequently use food trade policies on staple commodities (e.g., rice, wheat, vegetable oils, etc.) to fight domestic inflation. Because these commodities are key components of food price inflation rates, any reduction in the price of these commodities is likely to help contain inflation rate. Policymakers hope to reduce increases in domestic prices that might exacerbate price spirals. Therefore, we hypothesize that concern about domestic inflation may play an important role in the decision regarding export barriers.

We use a fixed effect probit model to identify the drivers of export restriction using a rich dataset on trade measures implemented by exporting countries. Our extensive database covers all use of these measures between 2007 and 2022, yielding monthly data of 16,405 observations on export restriction measures tracked by country at the four-digit Harmonized System (HS) code level.

During the global food price crisis of 2006–2008, many governments, particularly in exporting countries, imposed export restrictions in response to the impending food price shocks. Bouët and Laborde (2010) built an initial database compiling restriction measures that various governments put in place to bar the export of cereals and vegetable oils. Later, Laborde, Mamun, and Parent (2020) added complementary data on the volume of exports and calories of traded commodities affected by those restrictions. During the COVID-19 pandemic, countries implemented export restrictions to secure their food supply, causing global supply shocks and severe disruptions to the food supply chain. Laborde, Mamun, and Parent (2020) continued to gather and validate data on export restrictions on agricultural commodities.

As the world began returning to normal after the COVID-19 pandemic, the Russia-Ukraine war sent shockwaves across the world in February 2022, in large part because these two countries account for 12 percent of total calories traded globally (Glauber and Laborde 2022). Russia and Ukraine are also the top suppliers of wheat, barley, sunflowers, and maize. Laborde and Mamun (2022) extended the tracking of export restrictions related to the ongoing crisis, finding that as many as 28 countries implemented

restrictive measures on a range of products, including food and fertilizers. This situation is exacerbated by the increasing number of countries that, while not particularly dominant in the world market, have imposed their own restrictions, creating a domino effect (Bouët and Laborde 2012).

One key question remains: why are these trade measures so frequently implemented during food crises?

Their economic rationale has been discussed extensively in the literature, both theoretically and empirically (Bouët and Laborde 2010; Giordani, Rocha, and Ruta 2016). Bouët and Laborde (2010) suggest that imposing export taxes during food crisis justifies the use of export restriction measures. More common justifications include terms of trade, food security, and price insulation. The terms of trade (TOT) argument explains export restrictions as seeking to raise export prices. This rationale is likely more important for countries with large shares in world markets for specific commodities. Noncooperative behavior also arises between large net food-exporting countries and large net food-importing countries when food prices spike (Bouët and Laborde 2012). In the absence of international coordination, this behavior hurts small net food-importing countries, which usually respond by reducing import tariffs.

Another potential motivation for export restrictions is concerns about domestic food stock levels (Koo, Mamun, and Martin 2021). When these are low, governments may be cautious about allowing exports.

Whereas low food stocks, concerns about food availability, and price stabilization in domestic markets are the major drivers for governments to undertake various export restrictions, many countries, including Bangladesh, India, Indonesia, and Pakistan, adopted these policies amid growing fear of price surges for products including wheat, rice, and palm oils between 2006 and 2008. They either implemented a complete ban on exports of commodities or used variable tax rates to limit exports. Adjemian, Petrott, and Robe (2022) present the political economy of export bans and argue, both theoretically and empirically, that the likelihood of export bans increases forward-looking price volatility. They use option-implied volatilities (IVols) as a measure of price volatility and show that wheat and corn IVols were higher on the day and week the ban is imposed.

Fear of domestic inflation amid rising international prices for various staple commodities rattles governments in developing countries as they try to contain the price spirals and avoid consumer welfare

losses. Their immediate reactions are often focused on staple crops, particularly cereals and vegetable oils. However, as seen in past crises, restrictions spread across other commodities as well. Uncertainty about future world prices of staple commodities can increase the likelihood of export bans and suggest that implied volatilities can be predicted ahead of export bans on grains (Adjemian, Petrott, and Robe 2022).

All these factors lead us to ask whether the inflation rate signals imminent implementation of export restrictions and how policymakers take international price rises into account when deciding to impose restrictions. Also, of interest is whether policymakers take note of short-term (3-month) price volatility or long-term (12-month) or sustained price changes. Understanding the dynamics of export restrictions is important to achieving international coordination and avoiding unilateral withdrawal from trading.

This can be done by investigating a country's food system structure, such as its trade position for a given product, the role of other crops, and their share in global markets. For a given product, variability in stocks across countries and the concentration of exports is also important. Notably, some products are more frequently targeted under export bans than others. Timing is another issue; often a few countries start imposing restrictions, with additional countries following suit in a span of weeks.

Our study contributes to the existing literature in several ways. Firstly, it extends data to all the export restriction regimes: the food price crises of 2007/08 and 2010/11, COVID-19 (2020) and the 2022 Russia-Ukraine war. Therefore, our dataset has greater coverage in terms of time, countries, and products.

Secondly, the paper tests the important hypothesis of whether both international price movement at the commodity level and domestic inflation influence policymakers in controlling exports and which price phenomena have more predictive power. Thirdly, instead of relatively longer-term price movement (price changes from a three-year moving average) as done in the study by Giordani, Rocha, and Ruta (2016), we pay attention to short-term price changes such as 3-month price or 12-month movement.

Several interesting findings are revealed in this study. First, we find that domestic inflation drives policymakers to impose export restrictions more than commodity price movements at the international level. In this scenario, the policymakers seem more worried about the food inflation rate than general

inflation presumably due to the rising cost of essentials. The fixed effect probit models suggest that for a 22.9 percent increase in food inflation (in  $t-1$ ), the probability of export restriction (in time  $t$ ) increases by 5.2 percent, and this is valid when the model considers international price change over a short interval. For a model with price change at 12-month interval, this likelihood is 4.6 percent. The marginal effect of the general inflation rate reveals the same magnitude of impact on the chances of export restrictions in both scenarios.

Regarding the impact of world price change on trade policy utilization, we find that one standard deviation increase in the price change from the reference price in  $t-1$  (over three months) increases the likelihood of export restrictions in time  $t$  by 0.2 percent. However, this likelihood increases by 0.5 percent when the price change is measured from the reference level 12 months prior. Among the covariates, commodities' production and export share, precipitation, and agriculture land per capita positively affect decisions regarding utilization of trade policies, while per capita income, population density, rate of urbanization, agricultural share in GDP, the voice and accountability index, and the government effectiveness index are all negatively associated with imposition of restrictions.

The study is organized into several sections. Section 2 reviews the relevant literature. Section 3 presents some stylized facts on food prices and export restrictions. Section 4 describes the methodology used. Section 5 discusses the data used and the summary statistics. Results and discussion are presented in Section 6, with concluding remarks in Section 7.

## 2. LITERATURE REVIEW

Understanding export restrictions as the outcome of a process is important for improving trade policies. This can help limit the spread of restrictions and allow coordination between net food-exporting and net food-importing countries. Instead of examining the outcomes of export restrictions, which are widely studied in trade literature, this study investigates the forecasting power of various economic variables—including price changes at the international level, domestic inflation rate, the share of exports in the global market, population density, percent share of agriculture in GDP, agricultural land per capita, urbanization rate, political economy indicators, among others—in predicting adoption of export restrictions. In this section, we discuss previous studies that identified drivers of export restriction and the economic models used. This section also reviews studies on the impacts of export restriction, particularly focusing on trade patterns and price transmission.

Until recently, economic rationales for export restrictions have been studied more from a political economy perspective. Importantly, Giordani, Rocha, and Ruta (2016) investigate the role of international price changes in the use of food trade policies during a large positive price shock. Their paper applies loss aversion theory to trade policy, as studied by Freund and Ozden (2008) and Tovar (2009), and argue that governments used food trade policy as a strategy to compensate for the losses from the price shock. Their study tests the hypothesis of whether policymakers in the exporting countries respond to measures imposed by other countries to insulate domestic food markets—a multiplier effect during trade protectionism. The study employs both logit and linear probability (LP) models to predict export restriction induced by international price changes. The econometric model used also includes global trade policy utilization<sup>1</sup> as an important indicator.

They find that a positive deviation from the reference price has a significant impact on the use of export restrictions (e.g., ban, tax, licensing, etc.). For a 20 percent increase in prices from their reference values they conclude that there is a 1.4 percent increase in the likelihood of using trade policy. The study

---

<sup>1</sup> Global trade policy utilization is calculated as the weighted sum, in terms of export and import shares of countries imposing export restrictions.

indicates a positive and significant coefficient for global trade policy utilization, which means that governments respond to the actions of other exporters by restricting their products in the global market. The paper by Giordani, Rocha, and Ruta (2016) provides strong theoretical background and empirical understanding about the drivers of export restrictions. However, the study is limited to only one instance of export restrictions, namely 2008/11, and did not consider domestic inflation—both general and food price inflation—into modeling. Any trade policy model will suffer from biases due to the omission of domestic inflation as the policy makers will be equally concerned about a price spiral, not just the price of one commodity. Domestic inflation captures a mix of economic pains resulting from aggregate demand exceeding supply and involves multitude of factors and policies including monetary policies, exchange rates, and more. Policymakers in a large exporting country are expected to be concerned about increased inflation rate, particularly food inflation rate, and can opt for the use of trade policies on food staples where they have leverage over both large export shares and domestic consumptions. Importers, on the other hand, can respond to the high food inflation crisis by reducing or removing import tariffs and making sufficient availability of key food items. Therefore, we argue that the model for explaining trade protection should also consider this important economic indicator along with world price changes at commodity level.

Policymakers have both fiscal and monetary policy tools to fight inflation. The most recent trend in export control by India on several key food commodities between 2022 and 2023 shows how the country responded to growing concern about inflation (Glauber and Mamun, 2023). At times, India's food inflation rate was as high as 11.5 percent between May and June 2023 (Mamun and Glauber, 2023). India began by banning wheat and wheat flour and broken rice in 2022, and later imposed a set of export restrictions including bans and export taxes on non-basmati white rice (excluding parboiled), sugar, and onion in 2023 (Laborde and Mamun, 2022; Laborde and Mamun, 2023). On the other hand, the authors used price movement from the reference price, calculated as 3-year moving average price. Therefore, the paper does not account for any short-term price fluctuations at the international level.

In an interesting paper, He (2021) presents a probabilistic model for predicting export restrictions with a six-digit HS product and uses a set of political and economic indicators as explanatory variables. Among these indicators, the most important were the market power of a commodity, the number of a country's regional trade agreement partners, and the market power of the downstream sector that purchases inputs. He's (2021) study uses export restriction data from 2005 to 2015 and does not cover the most recent upsurge in the use of these policies. Moreover, past episodes of export restriction were often driven by either production shocks or significant price spikes. Therefore, there is a need to include more recent periods of export restrictions, such as during COVID-19 and the ongoing Russia-Ukraine war. Moreover, He's study did not include any domestic price variable as an explanatory variable and thus suffers from an omitted variable bias problem.

A large body of literature exists on the impacts of export restrictions on increased price volatility, food security, and poverty (Bouët and Laborde 2010, 2012; Ivanic and Martin 2008, 2014; Laborde, Lakatos, and Martin 2019; Martin and Anderson 2012; Pieters and Swinnen 2016; Nguyen et al. 2023). Several of these papers attempt to understand why countries resort to trade policies that hinder the flow of goods across borders and explain the spread of such restrictions to other countries (Bouët and Laborde 2010, 2012; Anderson, Ivanic, and Martin 2014; Ivanic and Martin 2014; Adjemian, Petrott, and Robe 2022). Nguyen et al. (2023) include an insightful discussion on the interconnected issues of conflict and food insecurity and emphasize global policy actions for mitigating the challenges caused by war.

Adjemian, Petrott, and Robe (2022) examine the market reaction to export restrictions and propose a theoretical model for examining risk associated with future price shocks in staple food products. They use IVols for corn and wheat as an indicator of price uncertainty and present econometric estimation results based on a daily dataset of export restrictions for predicting price volatility. They show that when an export ban is imposed, IVols rise on the day and immediately after the ban is announced. This study focuses mainly on the power of export restriction measures on market instability instead of what determines the imposition of export restriction in the first place. Moreover, the paper only studies a few staple foods, not a complete set of commodities.

Bouët and Laborde (2010) illustrate all possible reasons for the popular use of export taxes during price spikes during the 2006–2008 episode of export restriction use. They show that with the implementation of export taxes, countries engage in trade retaliation and thus face a noncooperative policy equilibrium that hurts world welfare. Nonetheless, their study does not address the predictive power of economic and production variables in export restriction. Data on export restriction now include four important time periods and a more robust dataset can be used to investigate the forecasting power of economic indicators to shed light on when a particular export restriction measure is likely to be used.

Governments often introduce export bans or export taxes to insulate domestic prices from world market prices. Ivanic and Martin (2014) present the nature of price transmission during the 2006–2008 and 2010–2011 food price spikes and show how these protectionist policies exacerbate the situation by increasing world prices, which are further magnified by the subsequent adjustment in trade policies. More recently, Martin and Minot (2022) investigate the impact of price insulation on world wheat markets during the 2022 food price crisis induced by the Russia-Ukraine war. They show that export restrictions almost doubled world wheat prices and increased price volatility.

Rude and Henry (2015) also examine the price volatility of grain and oilseeds during the 2006–2008 and 2010–2011 food price crises and how export restrictions created price instability. Their results indicate increased price volatility for wheat and rice during these periods but show no evidence of volatility in maize and soybean prices. Estrades, Flores, and Lezama (2017) analyze the period from 2005–2014 and estimate a disaggregated gravity model of trade to study the role of export restrictions and reduced import tariffs in price increases. They find that export restrictions have a price effect on a limited number of sectors, namely, a positive price effect for vegetables, fats, and oils and a strong effect of export taxes for oilseeds. Ivanic and Martin (2014) conclude that sustained higher prices tend to lower poverty, as small, poor producers increase their output and receive higher revenue. This helps explain why governments might initially resist higher prices but are willing to allow prices to rise over a sustained period.

Our study examines the impact of inflation rates on the use of export restrictions, a phenomenon not discussed in earlier literature. During various episodes of food price crisis, countries have had highly

different experiences with inflation. In some countries, combinations of spending and monetary laxity during the COVID-19 pandemic resulted in a rapid acceleration of inflation. In others, domestic inflation remained subdued. It seems logical that policymakers seeking to avoid a transition from jumps in food prices to sustained inflation might attempt to introduce a break by reducing the level of food prices. Thus, we examine the role of both general inflation and food price inflation in the introduction of export restrictions.

The available literature identifying the drivers of export restrictions and their predictive power fall short on: (1) accounting for all recent episodes of export restrictions (2007/08, 2010/11, COVID-19, and the 2022 food crisis due to the Russia-Ukraine war); and (2) considering all possible explanatory variables, such as world price changes at the commodity level, the inflation rate (general and food), and a country's trade share in gross domestic product (GDP). We use an econometric model to fill this gap in the literature.

### 3. FOOD PRICE AND TRADE POLICY: THEORY AND STYLIZED FACTS

This section discusses optimal trade policies when prices of commodities at the international level diverge and presents a situation when policymakers decide whether to export taxes. In the following sub-section, the relationship between food price indexes and export restriction coverage are graphically shown, covering three major food price crises since 2007/08.

#### 3.1 Optimal Trade Policies as World Price Diverges

When answering the question why countries opt to implement export restrictions in the wake of large price increases at the international level, it is relevant to understand how trade policies react to price shocks. Giordani, Rocha and Ruta (2016) provide an excellent representation of optimal trade policies that are micro-founded. They introduce loss aversion in their trade policy model,<sup>2</sup> first formalized in the papers by Freund and Ozden (2008) and Tovar (2009) and show that a welfare maximizing government may opt for export tax/import subsidy or export subsidy/import tariff depending on positive and negative shock in international prices of commodities. This paper only briefly describes the case of export tax as the international price rises from the reference level.

In a small open economy, the utility function of loss averse consumers can be represented in a separable form as follows:

$$U = g_0 + u(g) - I \cdot h(U - g_0 - u(g)) \quad (1)$$

where  $g_0$  is the consumption of the numeraire good and  $g$  is food commodity. Function  $u(\cdot)$  has the standard properties ( $u'(\cdot) > 0$ ,  $u''(\cdot) < 0$ ). The behavioral feature of the model is captured in function  $h(\cdot)$ . In particular,  $h(\cdot)$  is increasing in the difference between a reference level  $\bar{U}$  and the actual utility from consumption (i.e.,  $h'(\cdot) > 0$ ), and displays diminishing sensitivity to losses (i.e.,  $h''(\cdot) < 0$ ). Here,  $I$  is an indicator variable that takes the value 1 whenever the utility falls strictly below the reference level and 0

---

<sup>2</sup> Gouel and Jean (2015) assume market incompleteness and argue that the consumers are risk averse, having no insurance against price shocks. They show that trade policies with storage combined with storage are optimal strategies to stabilize domestic food prices. However, this paper focuses only on the trade policies that the policy makers find optimal when large and positive price shock occurs.

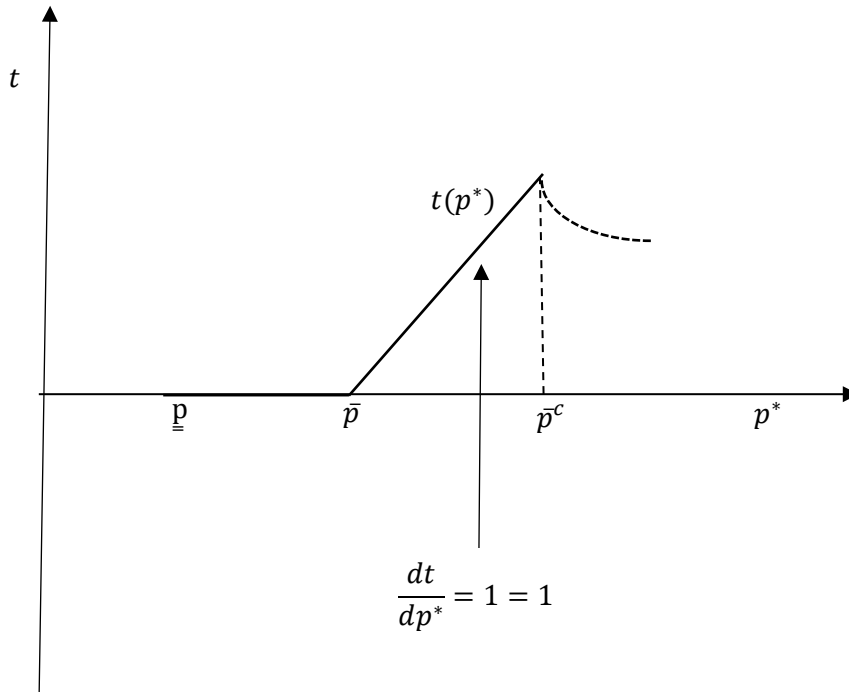
otherwise. This form of utility function supports the idea that individuals experience a welfare loss when they face a utility level inferior to what they are accustomed to (due to large price divergence from the reference price when we consider export control), but they do not perceive any additional welfare gain when utility is higher than usual.

Now, consider the agents face domestic price  $p$  of food commodity  $g$  and the government uses trade policy such that  $p = p^* - t$ , where  $p^*$  is the international price of the commodity  $g$ . Here  $t$  represents export tax or import subsidy.

There can be three different cases where the international price  $p^*$  diverges from the domestic price  $p$ . The international price  $p^*$  can go up from the reference price level  $\bar{p}$  (upper bound). The price  $p^*$  can go below the lower bound of the reference price,  $\underline{p}$ . Finally, an intermediate case can be considered here:  $p^* \in (\underline{p}, \bar{p})$ . Since we are interested in first case ( $p^* > \bar{p}$ ), we pay attention only to the region of compensating protectionism, as described by Giordani, Rocha, and Ruta (2016). Here the government aims to compensate consumers as they face welfare losses due to high domestic prices resulting from high international prices.

Giordani, Rocha, and Ruta (2016) show that for  $p^* > \bar{p}$ , the optimal policy is export tax or import subsidy and  $t$  becomes a function of  $p^*$  ( $t = p^* - \bar{p}$ ), the case shown in the right-most side of the Figure 1. Here, the derivative of the function  $t$  with respect to change in  $p^*$  equals 1. This means the increase in export tax corresponds equally to the increase in  $p^*$  until the critical level of international price  $\bar{p}^c$  when the marginal cost of compensating consumers by implementing export tax exceeds the marginal benefit. After the peak  $\bar{p}^c$ , implementing more tax becomes unattractive to the policymakers. In the region  $p^* \in (\underline{p}, \bar{p})$ , the government will choose free trade.

**Figure 1: Trade policy of export tax as world price diverges from reference level<sup>3</sup>**



There are several points missing in the above trade policy analysis framework. Firstly, the empirical data on export restrictions show that exporting countries also implement other distortive measures such as export bans, licensing, quotas, and more. These trade measures, termed as random policy shocks,<sup>4</sup> are often the result of policies concerning the availability of food stocks.

Secondly, governments in the large food exporting countries will choose to control the export of specific commodities to reduce domestic inflation. This is the case when those commodities account for a large share of global exports or for a large share in food consumption. Staple commodities such as wheat, rice, maize, and vegetable oil are thus found to come under export control frequently. Therefore, in our fixed effect probit model, we also consider domestic inflation along with international price changes. Domestic inflation is a macro phenomenon that captures movements in other economic indicators such as exchange rate, monetary policies, and more at the aggregate level.

<sup>3</sup> Adapted from Giordani, Rocha, and Ruta (2016)

<sup>4</sup> Martin, Mamun, and Minot (2023) show that these random policy shocks increase price volatility relative to world price volatility.

### **3.2 Food Price and Export Restriction Coverage**

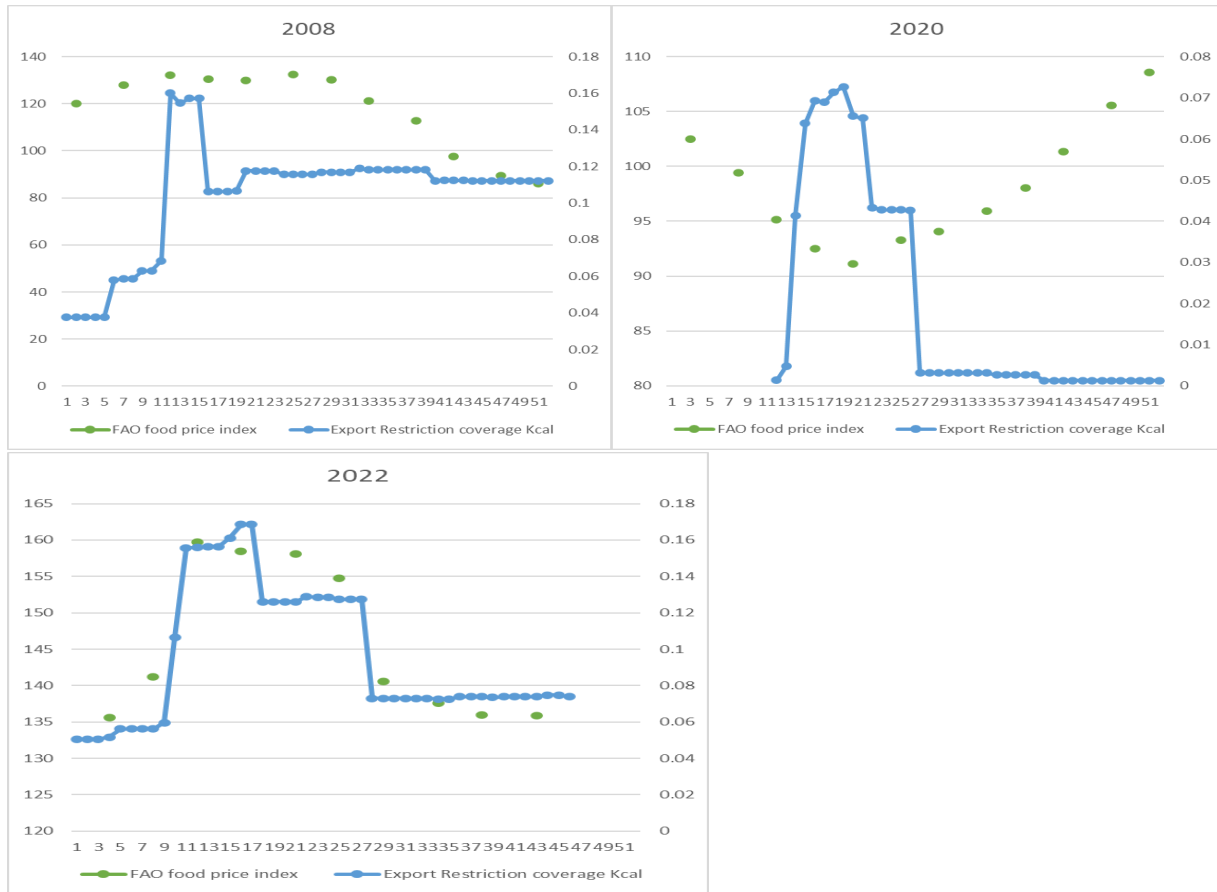
Export restrictions of agricultural and food commodities are often seen as a response to rising food prices that many other factors—including supply shock, extreme weather, and high fuel prices—can trigger. We provide a graphical presentation of the food price index and coverage of export restrictions measured in kilocalories. This presentation reflects any co-movement between food prices and export restrictions.

In general, price inflation in any given country is a leading indicator of export restriction; however, price inflation can impact export restrictions when all countries try to insulate their own economy from rising international prices, thereby exacerbating the situation. Figure 2 plots the global food price index (FAO 2022) and export restriction coverage measured in kilocalories (Laborde and Mamun 2022) by week.

Three episodes—the 2008 food price crisis, COVID-19 (2020), and the Russia-Ukraine war of 2022—are depicted separately.

Across these episodes, a clear pattern emerges between food prices and export restrictions in 2008 and 2022, but not in 2020. In the first two cases, when food prices are high or peaking, export restriction coverage is also high; as prices recede, countries relax their borders and open their markets, so export restriction coverage drops quickly. This relationship is more evident in 2022. In 2008, food prices dropped more slowly than export restrictions over time. Interestingly, export restriction coverage stays at almost the same level from weeks 19–20 and thereafter.

**Figure 2: Food price index and export restriction coverage in 2008, 2020, and 2022 crises**



Source: Authors' calculations based on data from FAOSTAT Consumer Price Index Data (2022) and Food and Fertilizer Export Restriction Tracker (Laborde and Mamun 2022).

Note: In this graph, week number is on the x-axis, the food price index is on the left y-axis, and the percent share of exports restricted (of total kilocalories) is on the right y-axis.

COVID-19 presents a unique case because both supply and demand shocks occurred during the period. Many countries responded quickly by shutting their borders. Export restriction coverage rose quickly from week 11, reached a peak at week 20, and dropped significantly in week 27. On the other hand, food prices dropped sharply in week 21, when export restriction was at its peak, but global demand was collapsing. Prices later rose until the end of the year. Importantly, the rise in the later period reflected the global supply chain shock. In the 2008 and 2022 episodes, the food price level played a significant role in the decision to impose export restrictions. Data suggests that some countries quickly shut their export markets, with other countries following thereafter (Bouët and Laborde 2010). As food prices declined, trade resumed and export restriction coverage dropped.

## 4. METHODOLOGY

One empirical question this study addresses is how price plays a role in the decision to impose an export restriction of any type. We test this in a probit model that employs general prices, food price inflation, and world price changes at the commodity level as explanatory variables. A second question is which price has a larger role—the overall domestic or international food price or the world price of the commodities being restricted?

Because we aim to forecast countries' implementation of export restrictions, this study uses an extensive database on export restrictions compiled over various episodes of food price crises, supplemented with data from various sources on trade volume, production forecasts, a consumer price index for food, and other macroeconomic indicators. This section describes these data and their sources. The econometric model considered for forecasting implementation of export restrictions is described below, and the determinants of implementation are identified.

### 4.1 Econometric Model

Following Giordani, Rocha, and Ruta (2016) and He (2021), we propose a simple fixed effect probit model to predict the export restriction of a commodity by country. Our objective is to examine how inflation and commodity prices at the world level influence decisions regarding export restrictions. We use a dynamic panel dataset comprising country, commodity, and time as dimensions.

$$\Pr(er_{ijt} = 1) = \alpha_0 + \alpha_1 PCh_{jt-1} + \alpha_2 Inf_{it-1} + x'_{ijt}\beta + \gamma_i + \mu_j + \epsilon_{ijt} \quad (2)$$

where  $\beta$  is a vector of parameters,  $i$  is the country,  $j$  is the commodity (HS4), and  $t$  is time (monthly). The dependent variable, export restrictions,  $er_{ijt}$ , is directly observable and takes a value of either 1 or 0.  $PCh_{jt-1}$  denotes the quarterly or yearly price change for commodity  $j$  in time  $t-1$ .  $Inf_{it-1}$  is the monthly inflation rate in country  $i$  and time  $t-1$ . The terms  $\gamma_i$ ,  $\mu_j$  represent country, and commodity fixed effects respectively, which can capture the unobserved impact of country- and product-specific characteristics. We have not considered time fixed effects as we use high frequency (monthly) trade data. Moreover, countries and products capture variability in export restrictions significantly.

We use both general and food price inflation, separately in the models because food price inflation poses the classical endogeneity problem. If export barriers are introduced to lower inflation, the food price goes down which may spuriously indicate that lower food inflation drives export barriers. The introduction of export restrictions may come through several channels. One possible channel is sustained general price inflation. Another channel may come from a rise in the price of food relative to non-food prices.

Policymakers worried about general inflation may try to hold down food prices in hopes that this will result in a leap to lower inflation. Policymakers worried about higher prices of food relative to non-food are more likely to be responding to concerns about access to food. These are quite different motivations. Moreover, food inflation is a result of a combination of overall inflation and any changes in the price of food relative to the overall price level. To deal with this endogeneity problem, we have used general inflation.

This empirical model also includes a vector of covariates,  $x$ . We look at the influences of several macro indicators and after reviewing related literature on export restrictions (Rude and Henry, 2015; Giordani, Rocha, and Ruta, 2016; He, 2021), we choose the following covariates: population density (log), export share of commodity in world trade volume in time  $t-1$ , production share of commodity in time  $t$ , per capita income (constant, purchasing price parity [PPP]), share of agriculture in GDP, agricultural land per capita, urbanization rate, voice and accountability index, government effectiveness index, and monthly precipitation data. For precipitation and export share data we introduce one period lag, and both come at monthly frequency.

The rationale for using these covariates comes with various hypotheses and justifications. We consider those factors and economic indicators that increase or decrease the probability of export restrictions. Share of agriculture in GDP, agricultural land per capita, per capita income, and political economy indicators are assumed to have negative influence on export restrictions. These factors will allow producers to have more power in the decision regarding export restrictions. On the other hand, production share of a commodity, export share globally, and weather variables such as precipitation are likely to increase the probability of export restrictions. Other demographic indicators such as population density

and urbanization rate can be associated with both directions of trade regimes—either increasing or decreasing the likelihood of export restriction use. A densely populated country may control exports to increase supply of commodity but may also opt for policies that facilitate trade. Similar arguments can be made for urbanization rate.

A country's market power, measured in terms of export share of individual commodity, is an important indicator in the usages of trade policies in the event of a food price crisis. We hypothesize that the higher the share of an exported commodity is, the higher is the likelihood that the country will use export restrictions on that product to tame domestic inflation. Large food exporting countries such as India, Indonesia, Kazakhstan, and Ukraine frequently adopt export restrictions. Similarly, a higher share of a commodity in a country's domestic production can increase the chances of export control measures, as the government will tend to use these to contain food inflation by increasing domestic supply of the dominant commodity. On the other hand, countries with high per capita income tend to restrict trade less because of their lower risk of food insecurity and their capacity to rely on non-price-based policies (for example, social safety nets).

Population density is relevant because it can expose a country's vulnerability to food insecurity. Countries with high population density will have comparative disadvantages in agriculture. Therefore, they can either opt to keep trade open to ensure food security of the population or shut down borders from food availability concerns. Our export restrictions database shows several densely populated countries such as Bangladesh, Pakistan, and Nigeria imposing export bans on certain products during the food price crises from 2008 to 2023.

Political economy variables help capture a country's policy environment and the influence of producers and other actors in food systems. The voice and accountability index reflects perceptions of the extent to which a country's citizens can participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. On the other hand, government effectiveness measures perceptions of the quality of public services, the quality of the civil service and the degree of its

independence from political pressures, the quality of policy formulation and implementation, and the credibility of a government's commitment to such policies.

A country's climatic condition is highly relevant because crop production depends on it. The most relevant weather indicator is precipitation, measuring condensation of atmospheric water vapor that falls from clouds. We have introduced precipitation in the regression model as this indicator alone impacts crop production. High precipitation means high rainfall, which can negatively affect crop production and thus impact international prices through supply shock. Therefore, we expect higher precipitation to lead to the use of export restrictions following bad harvests in a country.

## **4.2 Estimation Approach**

Estimating equation (2) requires several considerations due to a wide range of probabilistic models including probit, logit, instrument variable (IV) probit, and more. We have considered all these models and attempted to check for robustness of the results. To deal with binary response or outcomes as in our study, we estimate the equation (2) using a fixed effect probit model because it fits well in a Generalized Linear Models (GLMs) framework (Giordani, Rocha, and Ruta, 2016).

As specified in the equation (2), we seek to address any unobserved product and country fixed effects. Therefore, the equation introduces product (HS4), and country-fixed effects. Since we use high frequency, monthly export restriction data, we do not assume year-month fixed effect in estimation. We consider product- and country-fixed effects to be sufficient to isolate the impact of explanatory variables. Endogeneity in model estimation is another concern, and we have addressed this by introducing general inflation rate separately in model. Food price inflation poses the classical endogeneity problem; therefore, we pay attention to the general inflation rate as this is often the policy target of a country's monetary authority and involves less endogeneity. The use of general inflation and food inflation rate separately in models allows us to observe any differences in coefficient estimates and may indicate biases. Given the interdependence of prices generally it follows that this is hardly a compelling test for endogeneity.

## 5. DATA AND SUMMARY STATISTICS

In this section, we provide summary statistics of export restrictions data used in this study, followed descriptives on international price changes, inflation rate as well as key explanatory variables.

### 5.1 Export Restrictions Data

In this paper, we use a food and fertilizer export restrictions database that covers all four food price crisis episodes: 2006–2008, 2010–2011, COVID-19, and the 2022 Russia-Ukraine war, compiled by Laborde, Mamun and Parent (2020), and Laborde and Mamun (2022). The database tracks all types of export restrictions imposed by countries—bans, licenses, quotas, and taxes—at the four-digit HS code level, with starting and end date of restrictions. Authors of the database use a combination of systematic and ad hoc data gathered from official and unofficial sources to track food trade policy responses to the three crises.

Table 1 summarizes the trade restrictions data used for this study.

**Table 1: Export restriction data by episode**

Episode	Number of countries	Number of products <sup>a</sup>	Number of trade measures <sup>b</sup>	Number of trade measures × time <sup>c</sup>
2008 food price crisis	33	194	868	12,327
2010–2011 food price crisis	13	31	65	832
COVID-19	23	151	329	638
2022 Russia-Ukraine war	38	83	329	4,894

Source: Authors' calculations. Data taken from Laborde, Mamun, and Parent (2020) and Laborde and Mamun (2022).

a. Products at HS4 level; b. Country-product-trade measures tuple; c. Trade measures (active policies) are multiplied by the time (month)

The export restrictions database reveals a varied number of trade measures by episode, as shown in Table 1. The 2007–2008 food price crisis saw the largest number of trade restrictions—868 different measures imposed by as many as 33 countries on 194 different products. If we count the number of months that were covered by the various country-product-trade measures, we see the 2007–2008 period had the longest export restriction regime—a total of 12,327, calculated as the number of restrictions multiplied by the number of months each was in effect; that is, the products were restricted for a longer period during the 2007–2008 crises than during the other crises. Compared to the 2007–2008 episode, 2010–2011 and

COVID-19 were short-lived, with fewer countries placing restrictions on fewer products for a shorter period of time. The 2022 episode caused by the Russia-Ukraine war had the highest number of countries involved (38) among all episodes, which imposed restrictions on 83 different products, for a total of 329 different trade measures.

Table 2 presents descriptive statistics on export restrictions for selected commodities and at the aggregate level. Our final database has 106,524 observations.

**Table 2: Descriptive statistics for export restrictions**

	Countries imposing ER		
	Mean	Std. dev.	Obs.
$Prob(ER_{ijt} = 1)$	0.064	0.246	106,524
Rice	0.102	0.303	6,534
Wheat	0.108	0.311	5,346
Palm oil	0.061	0.239	1,782

Source: Authors' calculations. Data taken from Laborde and Mamun (2022).

The frequency in use of export restrictions was much higher. The incidence of export restrictions at aggregate level is 6.4 percent, with the use of export restrictions at 10.8 percent for wheat, followed by rice at 10.2 percent.

## 5.2 Inflation and Price Data

### ***World price changes at commodity level***

To construct world prices for commodities, we assemble monthly trade data sourced from the Trade Data Monitor (TDM), starting from 2007 and ending in June 2023. To construct price changes at the commodity level, we use value and quantity data on exports and derive a unit value at the HS6 commodity level and by time. We then derive a price index relative to the mean unit price at the HS6 commodity level and compute a weighted mean of the price index at the HS4 commodity level (weighted by the value of exports at the HS6 commodity level). Finally, we compute the price change at 3- and 12-month intervals at the HS4 commodity level. Using two periods allows us to see if policymakers are concerned about short- or long-term price changes at the world level.

### **General and food price inflation**

Empirically, when a country's consumer price index (CPI) (both general and food prices) rises rapidly, governments have a higher tendency to impose restrictions as a response to contain inflation. For both general and food price inflation, we rely on FAOSTAT's monthly CPI data covering 2007–2023.

### **Control variables**

We consider several control variables that include both macro and political economy variables.

Macroeconomic indicators such as agriculture as a share of GDP, agricultural land per capita, and per capita income are downloaded from the World Bank's World Development Indicators (WDI) database.

Commodities' share in global export volume is computed from export data of TDM. Demographic indicators such as population density and urbanization rate are also taken from the WDI. We use two political economy variables from the World Bank's World Governance Indicators (WGI) database:<sup>5</sup> the voice and accountability index and the government effectiveness index. Monthly precipitation data is sourced from Global Historical Climatology Network project of NOAA.<sup>6</sup> Yearly production data by commodity and country is obtained from FAOSTAT.<sup>7</sup>

### **5.3 Summary Statistics of Explanatory Variables**

We present descriptive statistics for explanatory variables in Table 3 over the whole period—2007 to 2023. We pay attention to changes in domestic inflation and price changes at the international level, as these are two important indicators in our regression model. One statistic reveals that the countries imposing export restrictions experienced relatively high general and food inflation rates.

On the other hand, price change data measured at the international level (considering product and time only) show that wheat prices are much more volatile both in the short-term (change from 3 months prior) and long-term period (change from over 12 months prior). Over the whole period, on average, the wheat

---

<sup>5</sup> World Bank's WGI data is aggregated from various think tanks, international organizations, NGOs, and private firms. For details, please see <https://www.worldbank.org/en/publication/worldwide-governance-indicators>

<sup>6</sup> National Oceanic and Atmospheric Administration (NOAA), under its Global Historic Climatology Network maintains monthly precipitation data. For details, please see <https://www.ncei.noaa.gov/>

<sup>7</sup> FAO provides yearly crop and livestock production by country. For details, please see <https://www.fao.org/faostat/en/#data/QCL>

price at the world level increased by 12.7 percent over the 3-month period and 15.1 percent over the 12-month period. The volatility of wheat prices at the international level is more pronounced in the longer term, as indicated by the standard deviations from Table 3 for the respective indicators.

**Table 3: Descriptive statistics on explanatory variables**

	Countries imposing ER		
	Mean	Std. dev.	Obs.
General inflation (%), monthly	9.4	15.4	106,524
Food inflation (%), monthly	11.1	22.9	106,524
<i>Price change (%) from 3-month weighted average</i>			
Rice	4.1	34.5	579
Wheat	12.7	61.9	579
Palm oil	7.6	55.3	579
<i>Price change (%) from 12-month weighted average</i>			
Rice	3.4	44.2	552
Wheat	15.1	72.7	552
Palm oil	11.4	72.9	552
Agricultural GDP (% share)	11.2	8.2	106,524
Agricultural land per capita (sq. km)	0.02	0.03	106,524
Urbanization rate	60.1	19.1	106,524
Per capita GNI (PPP, const. 2017, Int. \$)	14,516.2	11,367.4	106,524
Population density	106.7	136.2	106,524
Voice and accountability index	-0.63	0.66	106,524
Government effectiveness index	-0.32	0.45	106,524

Source: Authors' calculations. Price change data is based on Trade Data Monitor (TDM). For details, see section 5.2. Inflation data is taken from FAOSTAT. Data on control variables is taken from WDI.

Among the control variables, we observed that agriculture has a higher share in GDP in the export restricting countries. Share of agriculture in GDP accounted for 11.2 percent in the sample. This shows that the countries imposing ER have relatively increased dependence on agriculture. Per capita agriculture land is 0.02km<sup>2</sup> of land per person. The countries imposing restrictive trade policies have a low urbanization rate, meaning they are more rural. Population density is also low in these countries. Per capita income is an indicator of a country's relative income status in the world. High-income countries, such as Japan, the United States, and the EU countries, tend to impose any export restrictions on food commodities less often than developing countries. The average annual per capita income of

USD\$14,516, measured as gross national income (GNI) at the purchasing power parity (PPP) level (2017, constant international dollars), in the export restricting countries indicates that they are mostly developing countries.

## 6. RESULTS

We present the results for the countries who implemented trade restrictions in any form including ban, export tax, licensing, etc. during 2008–2023.

### 6.1 Regression results

We use the data for only those countries that imposed some form of export restriction for commodities.

We have presented four models (columns 1 through 4)—one with general inflation and one with food price inflation for price change over 3–month and 12–month period—and the same set of control

variables appears in all models. We fit fixed effect probit models with product and country as fixed

effects. For the results in Table 4, we specifically pay attention to the marginal effects of the explanatory

variables under each model (columns labeled as “Marg. eff.”). Summary statistics are presented at the

bottom of the table. The Wald test for overall effect of coefficients shows all four models are well fitted.

Adjusted pseudo-R square results indicate moderate explanatory power of the independent variables.

These models capture: (1) how policymakers respond to short-term (3–month price change) and long-

term (12–month price change) price movements; and (2) which of the two types of inflation (general or

food price) has a greater influence on the decision by frequent implementers of export restrictions, such as

export bans, raised taxes, or licensing. All four models are statistically significant overall, as indicated by

the Wald test. All adjusted pseudo-R squared values reveal that the regressors better predict the

outcomes—that is, the probability of export restrictions.

The models with short-term price changes have better predictive power: their pseudo-R squared values

are higher than those in the long-term price change models. However, lower Bayesian Information

Criteria (BIC) values for models under the 12–month price change mean that the predictability of export

restrictions is better fitted than under the 3–month price change models. Based on overall fit and model

selection criteria, we see that international price changes over a 12–month period are a better predictor of

export restrictions than short-term price changes. This implies the importance of reference price of

commodities at the international level. Governments do take note of rises in world price over a relatively long horizon and worry about the spiraling effect on domestic inflation.

In models (1) through (4), all regressors for both general and food inflation rate have statistically significant and positive coefficients. The coefficient on the general inflation rate is higher under the 12-month price change than under the 3-month price change. If the general inflation rate in time  $t-1$  increases by 1 percent, the corresponding increase in possibility of implementing export restriction in time  $t$  is 0.3 percent. Thus, we can say that the probability of export restriction increases by 3.5 percent for a one standard deviation increase in the general inflation rate (15.4 percent in this case) when short-term price change is considered, and this is almost the same with long-term price change.

On the other hand, the coefficients, and their statistical significance for food inflation rate in  $t-1$  period indicate greater significance and influence over export restriction. In the short-term price change scenario, the probability of export restriction is a 5.2-percent increase for one standard deviation increase in food inflation, which our sample indicates at 22.9 percent. When we model price change at 12-month interval, we find that this likelihood is slightly lower at 4.6 percent. In this case, we can interpret that the influence of international price becomes relatively higher, yet the statistical significance is found to be lower (only at 10 percent level of significance).

Our results show that the coefficients of world price change at the commodity level are statistically significant at 5 percent level of significance and positive under both the 3-month and 12-month price change scenarios. However, the marginal effects of the coefficients (models (1) and (3)) indicate that the probability of export restriction is higher under the 12-month price change scenario. The probability of export restriction increases by only 0.2 percent for one standard deviation increase from the reference price 3 months prior and 0.5 percent for one standard deviation increase in the price of 12 months prior.

**Table 4: Probit model, with general and food price inflation and world price change at commodity level: Marginal effects on export restrictions**

Dependent variable: Export restriction	3-month price change				12-month price change			
	Model (1)	Marg. eff. in (1)	Model (2)	Marg. eff. in (2)	Model (3)	Marg. eff. in (3)	Model (4)	Marg. eff. in (4)
General inflation rate <sub>t-1</sub> (%)	0.294*** (0.051)	0.035***			0.283*** (0.050)	0.032***		
Food inflation rate <sub>t-1</sub> (%)			0.439*** (0.062)	0.052***			0.420*** (0.062)	0.046***
Price change at global level <sub>k,t-1</sub> (%)	0.017* (0.008)	0.002*	0.016* (0.008)	0.002*	0.044+ (0.022)	0.005+	0.038+ (0.022)	0.004+
Population density <sub>i,t</sub> (people per sq. km)	-2.963*** (0.510)	-0.355***	-2.990*** (0.508)	-0.351***	-3.873*** (0.611)	-0.432***	-3.854*** (0.610)	-0.422***
Per capita income <sub>i,t</sub> (\$ PPP 2017)	0.024 (0.191)	0.003	0.057 (0.188)	0.007	-0.247 (0.194)	-0.028	-0.228 (0.193)	-0.025
Share of agriculture in GDP <sub>i,t</sub> (%)	-0.496*** (0.118)	-0.059***	-0.525*** (0.121)	-0.062***	-0.484*** (0.116)	-0.054***	-0.504*** (0.119)	-0.055***
Agricultural land per capita <sub>i,t</sub> (sq. km)	0.761+ (0.430)	0.091	0.764+ (0.414)	0.090	0.227 (0.403)	0.025	0.275 (0.394)	0.030
Urbanization rate <sub>i,t</sub> (%)	-2.149*** (0.358)	-0.257***	-2.121*** (0.350)	-0.249***	-1.612*** (0.362)	-0.180***	-1.631*** (0.364)	-0.179***
Voice and accountability index <sub>i,t</sub> (-25,2.5)	-0.670*** (0.089)	-0.08***	-0.666*** (0.088)	-0.078***	-0.806*** (0.109)	-0.090***	-0.806*** (0.111)	-0.088***
Government effectiveness index <sub>i,t</sub> (-2.5,2.5)	-0.072 (0.059)	-0.009	-0.063 (0.059)	-0.007	-0.089 (0.063)	-0.010	-0.082 (0.062)	-0.009
Precipitation <sub>i,t-1</sub>	0.022* (0.011)	0.003*	0.022* (0.011)	0.003*	0.013 (0.010)	0.001	0.012 (0.010)	0.001
Production share <sub>k,t</sub>	0.092** (0.034)	0.011*	0.092** (0.035)	0.011**	0.082* (0.033)	0.009*	0.081* (0.033)	0.009**
Export share <sub>i,k,t-1</sub>	0.002 (0.022)	0.000	-0.001 (0.021)	0.000	0.021 (0.023)	0.002	0.018 (0.022)	0.002
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS-4 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	56,776		56,776		53,639		53,639	
Adj. Pseudo R <sup>2</sup>	0.164		0.178		0.165		0.178	
Prob>Chi <sup>2</sup> (Wald test)	0.000		0.000		0.000		0.000	
BIC	26,594		26,150		23,415		23,058	

Source: Authors' estimation.

Note: Marginal effects (mean dy/dx), abbreviated as Marg. eff., are given for the explanatory variables on the probability of export restrictions estimated from Equation (2) when independent variables are standardized. Columns (2), (4), (6), and (8) present the marginal effects at the sample mean corresponding to the estimates in models 1, 2, 3, and 4. Standard errors based on Z-statistics are reported in parentheses. + < 0.1, \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

We find that the factors such as population density, agriculture share in GDP, urbanization rate, the voice and accountability index, and the government effectiveness index—all have statistically significant negative coefficients, and the results hold for the case of both general and food inflation rates in the model. Population density and urbanization rate both have negative coefficients, suggesting that countries with very high population density and a high urbanization rate are likely to keep their borders open for trade. Conversely, countries with a relatively lower population density and urbanization rate fear domestic inflation and international price rises, and thus tend to have a higher probability of imposing export restrictions. The per capita income variable also yields a negative coefficient, though they all lack statistical significance. However, the negative coefficient for this variable suggests that the probability of export restriction decreases as per capita income rises.

Political economy variables tend to play a large role in shaping food trade policies. The policymakers are influenced by the bargaining power of farmers or producer's associations, traders, among others. They also take consumers' aversion to loss in the event of high food prices more seriously when considering any barriers to trade, as described in Giordani, Rocha, and Ruta (2016). Our probit models produce a negative coefficient for both the voice and accountability index and government effectiveness index. This means the higher the index value, the less likely it is that governments will impose export restrictions. Similar interpretation can be made in the case of government effectiveness index.

Negative coefficient and marginal effect values on agriculture's share of GDP suggest that the countries with relatively higher dependence on the agriculture sector have a lower likelihood of imposing export bans or taxes. Farmers or producers in these countries will have more power in the decisions regarding export controls. For example, Ukraine, Kazakhstan, India, Indonesia, Pakistan, and Bangladesh implemented export restrictions frequently over all episodes studied here. Surprisingly, the countries with high agricultural land per capita (that is, those with a large farm sector) are more likely to impose export restrictions, as indicated by the positive coefficient of this variable. These two findings are in contradiction with He's (2021) study.

As hypothesized in the methodology section, positive coefficients are revealed for production share, export share of commodity, and precipitation. The positive coefficient of the production share of a commodity indicates that commodities that have a large share in total agriculture production have a high probability of being subject to export restriction. For one standard deviation increase in production share at the commodity level, the likelihood of export restriction is increased by almost 1 percent, as revealed in all models. This suggests that commodity's share in total production in a country plays a significant role when deciding about export restriction. This result signifies our inclusion of the food inflation rate in modeling export restrictions. We argue that from the fiscal policy perspective the exporting country gives weight on a dominant commodity when imposing bans or raising taxes because they think controlling exports can reduce inflation rate.

For the export share of commodity indicator we did not find any statistical significance across all models. A positive coefficient for precipitation in models (1) to (4) supports the argument that precipitation impacts export policies through the price channel since high rainfall or snow can cause decreased crop production, though it may not be the case for livestock production.

To summarize, the fixed effect probit model yields some interesting results. First, we find that food inflation has more power in predicting export restriction than general inflation. Concern for domestic food prices plays a larger role in the decision to impose food trade restrictions, though inclusion of this indicator does present an endogeneity issue. Second, commodity price changes at the international level do play a role in trade measures. However, the price change from a reference price of 12 months prior influences the decision regarding export restrictions more than that of 3 months prior. This tells us that the policymakers in the export controlling countries do take note of longer-term price movements over short-term ones.

The countries characterized by different socioeconomic indicators respond differently to food price shocks. Developing countries often want to ensure food security for all, and they pay considerable attention to appeasing consumers. High population density and urbanization rates push governments to keep the market open. On the other hand, the countries with large agriculture sectors tend to keep borders

closed when the price of food goes up, as the regression results indicate. The net food-exporting countries also leverage the products that account for a large share in total production and have large export volume. Those countries tend to place restrictions on export of these dominant commodities when there is considerable surge in domestic inflation and international commodity prices.

## 7. CONCLUSIONS

During a global food price crisis, trade policy responses are often governments' first response as they try to cool down the domestic market and relieve consumers' inflation anxiety. Export restrictions seemingly help to keep local prices low in the short term but exacerbate the global crisis, as the collective actions of the major exporting countries heavily distort world prices (Martin and Anderson 2012; Anderson, Ivanic, and Martin 2014; Ivanic and Martin 2014). While key cereal products such as wheat, rice, and maize and vegetable oil products remain the main staples of many poor people in net food-importing countries, they often tend to come under different forms of export restriction.

Governments tend to either levy high taxes on exports or impose a quota on export volume, leading to moderate and often predictable price responses. When countries ban food and feed exports, markets react quickly and strongly. Building on the works by Giordani, Rocha, and Ruta (2016) and He (2021), we delve into which price and economic variables influence the likelihood of policymakers implementing export restrictions and examine which price indicators exert more influence than others and to what extent. Sixteen years of export restrictions data (2007–2023) helps us study the likelihood of export restrictions on commodities by fitting a fixed effect probit model. This paper extends the existing works on identifying the determinants of trade policy utilization in broadly two ways: (i) coverage of all episodes of export controls and (ii) introduction of inflation rate and additional demographic and economic indicators in the model.

Regression results suggest that the domestic inflation rate has greater predictive power for export restrictions than the international price changes at the commodity level. Inflation rate in a country captures various factors, since it reflects not only consumers' sensitivity to specific food items, but also several structural elements (institutional, macroeconomic stability, level of complexity of the food system) that create an idiosyncratic situation at the country level.

The model suggests that there is increased likelihood of the use of export bans, taxes, or licensing for sustained inflation rate in a country. In the case of food inflation rate, the probit model suggests that for

an increase of about 22.9 percent in food inflation rate in  $t-1$ , the probability of export restrictions increases in time  $t$  by 5.2 percent. We find somewhat lower influence of the general inflation rate, which suffers less from simultaneity bias, on export restrictions. Still, the influence of inflation appears to be dominant when deciding whether a country takes trade controls to avoid consumer loss aversion. The policymakers in exporting countries attempt to control export of the staple commodities whose production shares are large. The significance of the regression coefficient of production share provides further credence to this argument.

On the other hand, world price deviation from the reference level in the short interval (3–months ago) and long interval (12–months ago) at the commodity level plays a different role on export controls. At the short interval, probability of export restriction increases by 0.2 percent for one standard deviation increase in the international price change, while at the long interval, this probability is 0.5 percent. These results are slightly higher than what is revealed in the study of Giordani, Rucha, and Ruta (2016), though they considered price changes using a 3–year moving average, whereas we attempt to capture price change within a one–year period.

Among the control variables, per capita income, population density, urbanization rate, agriculture share in GDP, the voice and accountability index, and the government effectiveness index decrease the likelihood of export control. Weather variable, commodities' production and export share, and per capita agriculture land increases the chances of export restrictions. The model presents strong evidence of the predictive power of inflation rate and international price change in the countries that exercise restrictive trade policies.

Most trade literature and empirical studies argue strongly for trade coordination whenever a global food crisis emerges. Export restrictions in different periods, particularly the 2008 food price crisis, have been well studied from the perspective of impact outcomes. This study (1) investigates how the inflation rate and price changes at short and long intervals—along with other macro, demographic, and political economy variables—influence export restrictions, and (2) evaluates their forecasting power. With the help of panel data on export restriction coverage, we find that inflation and global price changes highly

influence export restrictions. This knowledge can help policymakers responsible for implementing restrictions follow the key price variables and better coordinate with trade partners.

## REFERENCES

- Adjemian, M. K., C. Petrott, and M.A. Robe. 2022. “The Political Economy of Export Bans and Commodity Price Volatility: Theory and Evidence from Agricultural Markets.” [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4117628](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4117628)
- Anderson, K., M. Ivanic, and W. Martin. 2014. “Food Price Spikes, Price Insulation, and Poverty.” In *The Economics of Food Price Volatility*, edited by J.-P. Chavas, D. Hummels, and B. Wright. Chicago and London: University of Chicago Press for the NBER.
- Bouët, A., and D. Laborde Debucquet. 2010. *Economics of Export Taxation in a Context of Food Crisis: A Theoretical and CGE Approach Contribution*. IFPRI Discussion Paper 00994. Washington, DC: International Food Policy Research Institute.
- Bouët, A., and D. Laborde Debucquet. 2012. Food Crisis and Export Taxation: the Cost of Non-Cooperative Trade Policies. *Review of World Economics*, 148(1): 209–233. JSTOR, [www.jstor.org/stable/41485792](http://www.jstor.org/stable/41485792).
- Estrades, C., M. Flores, and G. Lezama. 2017. *The Role of Export Restrictions in Agricultural Trade*. International Agricultural Trade Research Consortium, Washington DC. <https://ageconsearch.umn.edu/record/256421>
- FAO (Food and Agriculture Organization of the United Nations). 2022. FAOSTAT Statistical Database, Consumer Price Indices. Rome. <https://www.fao.org/faostat/en/#data/CP>.
- Freund, C., and Ozden, C. 2008. Trade policy and loss aversion. *American Economic Review*, 98(4), 1675–1691.
- Glauber, J., and Mamun, A. 2023. “India’s new ban on rice exports: Potential threats to global supply, prices, and food security.” IFPRI Issue Post. IFPRI, Washington DC.
- Giordani, P. E., Rocha, N., and Ruta, M. 2016. Food prices and the multiplier effect of trade policy. *Journal of International Economics*, 101, 102–122. <https://doi.org/10.1016/j.jinteco.2016.04.001>
- Gouel, C., and Jean, S. 2015. Optimal food price stabilization in a small open developing country. *World Bank Economic Review*, 29 (1): 72–101.
- Grossman, G.M., and Helpman, E. 1994. Protection for sale. *American Economic Review*. 84(4): 833-850.
- Glauber, J., and D. Laborde. 2022. *How Will Russia’s Invasion of Ukraine Affect Global Food Security?* IFPRI Issue Post. Washington, DC: International Food Policy Research Institute. <https://www.ifpri.org/blog/how-will-russias-invasion-ukraine-affect-global-food-security>
- Glauber, J., and Mamun, A. 2023. India’s new ban on rice exports: Potential threats to global supply, prices, and food security. IFPRI Issue Post. IFPRI, Washington DC. <https://www.ifpri.org/blog/indias-new-ban-rice-exports-potential-threats-global-supply-prices-and-food-security>
- He, X. 2021. Political and Economic Determinants of Export Restrictions in the Agricultural and Food Sector. *Agricultural Economics*, 53(3): 439–453. <https://doi.org/10.1111/agec.12684>

- Ivanic, M., and W. Martin. 2008. Implications of Higher Global Food Prices for Poverty in Low-Income Countries. *Agricultural Economics*, 39(Suppl 1): 405–416. <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1574-0862.2008.00347.x>
- Ivanic, M., and W. Martin. 2014. Implications of Domestic Price Insulation for Global Food Price Behavior. *Journal of International Money and Finance*, 42(C): 272–288.
- Koo, J., A. Mamun and W. Martin. 2021. From Bad to Worse: Poverty Impacts of Food Availability Responses to Weather Shocks in Zambia. *Agricultural Economics*, 52(5): 1–15. <https://onlinelibrary.wiley.com/doi/10.1111/agec.12657>
- Laborde Debucquet, D., C. Lakatos, and W. Martin. 2019. “Poverty Impacts of Food Price Shocks and Policies.” In *Inflation in Emerging and Developing Economies: Evolution, Drivers and Policies*, edited by J. Ha, M.A. Kose, and F. Ohnsorge. Washington, DC: World Bank.
- Laborde, D., A. Mamun, and M. Parent. 2020. *Documentation for the COVID-19 Food Trade Policy Tracker: Tracking Government Responses Affecting Global Food Markets During the COVID-19 Crisis*. IFPRI Working Paper 1. Washington DC: International Food Policy Research Institute.
- Laborde, D., and A. Mamun. 2022. *Documentation for Food and Fertilizers Export Restriction Trackers: Tracking Export Policy Responses Affecting Global Food Markets During Crisis*.” IFPRI Working Paper 2. Washington, DC: International Food Policy Research Institute.
- Laborde, D., and A. Mamun. 2023. *When Policy Responses Make Things Worse: The case of Export Restrictions on Agricultural Products*. Asian Development Bank Institute. Tokyo, Japan (forthcoming)
- Mamun, A., and Glauber, J. (2023). “Rice markets in South and Southeast Asia face stresses from El Niño, export restrictions”. IFPRI Issue Post. IFPRI, Washington DC.
- Martin, W., and K. Anderson. 2012. “Export Restrictions and Price Insulation During Commodity Price Booms. *American Journal of Agricultural Economics*, 94(2): 422–427.
- Martin, W., and N. Minot. 2022. The impacts of price insulation on world wheat markets during the 2022 food price crisis. *Australian Journal of Agricultural Resource Economics*, 66: 753–774.
- Martin, W., A. Mamun, and N. Minot. 2023. *Food Trade Policy and Food Price Volatility*. IFPRI Mimeo (forthcoming)
- Nguyen, T. T., R. R. Timilsina, T. Sonobe, and D. B. Rahut. 2023. Interstate War and Food Security: Implications from Russia’s Invasion of Ukraine. *Frontiers in Sustainable Food Systems*, 7: 1080696. <https://www.frontiersin.org/articles/10.3389/fsufs.2023.1080696/full>
- Pieters, H. and Swinnen, J. 2016. Trading-off Volatility and Distortions? Food Policy During Price Spikes. *Food Policy*, 61(C): 27–39.
- Rude, J. and A. Henry. 2015. Explaining Grain and Oilseed Price Volatility: The Role of Export Restrictions. *Food Policy*, 57 (C): 83–92. <https://doi.org/10.1016/j.foodpol.2015.09.002>

Tadesse, Getaw, Bernardina Algieri, Matthias Kalkuhl, and Joachim von Braun. 2014. Drivers and Triggers of International Food Price Spikes and Volatility. *Food Policy*, 47(C): 117–128.

## **ALL IFPRI DISCUSSION PAPERS**

All discussion papers are available [here](#)

They can be downloaded free of charge.

**INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE**

[www.ifpri.org](http://www.ifpri.org)

### **IFPRI HEADQUARTERS**

1201 Eye Street, NW  
Washington, DC 20005 USA  
Tel.: +1-202-862-5600  
Fax: +1-202-862-5606  
Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org)