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Explaining grain and oilseed price volatility: The role of export restrictions

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ABSTRACT

This study examines the impact that export restrictions have had on price volatility. Food price volatility causes planning problems for policy makers and is disruptive to the food supply chain. An increasingly common response to stabilizing domestic prices is to implement export restrictions. However, if the country is a large enough exporter, the restriction can exacerbate global price volatility. Using price data on maize, wheat, rice and soy, we estimate the effect of export taxes and quantitative restrictions – as well as other macroeconomic variables – on price volatility. First, we use a univariate structural time series approach to remove regularities such as cycles and trends to yield an estimate of filtered price volatilities. Second, we regress the estimated volatilities from the first stage on a set of explanatory variables using a generalized method of moments (GMM) approach. The results from the GMM regression show that export restrictions implemented between 2006 and 2011 increased price volatility for wheat and rice but not maize and soybean. Simulation results show that the contribution of export restrictions to price volatility is the same order of magnitude as key macroeconomic variables.

Introduction

In the past decade, agricultural grains and oilseeds prices have experienced spikes in 2007–2008, late in 2010 and again in mid-2012. In the five year period between 2003 and 2008, wheat and maize prices doubled while rice prices tripled; much of the increase occurred over a few short months in 2007–2008 (Piesse and Thirtle, 2009; von Braun and Tadesse, 2012). Higher international prices stoked fears of rising domestic inflation rates and the potential for another food crisis and the risks associated with increased price volatility. At a macroeconomic level, price volatility may have a negative impact on growth and may contribute to increased poverty (Ramey and Ramey, 1995). The dramatic increase in agricultural commodity prices has attracted the attention of policy makers and analysts, especially those in less developed countries (LDCs) where the income share of food is highest and the poor are disproportionately affected. The biggest risks are for LDCs that are food importers. De Hoyos and Medvedev (2009) estimated that 155 million people in LDCs were driven into poverty (defined as living on less than $1.25 a day) due to changes in food prices between 2005 and 2007.

Food price volatility causes planning problems for policy makers and is disruptive to the food supply chain. Domestic agriculture policy reform across many developed economies has reduced the instruments available to assist primary agricultural producers in managing risks; e.g., price support programs have been replaced by direct payments. An increasingly common response to stabilizing domestic prices is to implement trade restrictions. Countries that are net exporters of commodities whose prices are quickly rising can mitigate these price spikes by temporarily enacting an export ban. However, if the country is a large enough exporter, the export ban can have the unintended consequence of exacerbating global price volatility. Despite the growing prevalence of these types of trade actions, there is surprisingly little empirical work in this area. The purpose of this study is to investigate the impact that export restrictions have had on price volatility.

At this point it is useful to make a distinction between price spikes (short term price variations) and price volatility (the dispersion of prices away from a central tendency). The month-to-month changes in prices in recent years are examples of price spikes whereas volatility is a directionless measure of price variability that indicates how much and how quickly prices change over time (Prakash, 2011). There has always been some price volatility, but the recent price spikes suggest that there may be new forces underlying this recent wave of increased volatility. There are different potential measures of the volatility for any series, and

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these differences in measurement result in varying estimates of how much agricultural commodity price variability has changed.

A number of recent studies have investigated the determinants behind the recent price spikes (see Piesse and Thirtle (2009) for a review). These factors include *inter alia* variable yields (Janzen et al., 2014), low stock levels (Wright, 2011), the depreciation of the U.S. dollar (Abbott et al., 2008), high crude oil prices (Tadesse et al., 2014), the diversion of food crops into bio-fuels (Mitchell, 2008), speculative influences (Cooke and Robles, 2009; Tadesse et al., 2014) and rapid economic growth (Gilbert, 2010). These studies provide intriguing analyses of particular markets, but – with the exception of Gilbert (2010) and Tadesse et al. (2014) – do not estimate empirically the relationship between these factors and price spikes. Even fewer studies have explored the factors affecting price volatility (Tadesse et al. (2014) is an exception).

Gilbert (2010) conducted quantitative analysis of the long term determinants (dollar depreciation, crude oil prices and futures index positions) of food price changes. Balcombe (2009, 2011) examined the nature and causes of volatility in agricultural prices using a Bayesian approach that addressed the volatility of trends and cyclical components across a wide variety of agricultural prices. Tadesse et al. (2014) examined the effects of a vector of factors (e.g., oil prices, supply and demand shocks, and speculative activity) on price spikes and price volatility (specifically, annualized monthly food price variability) using seemingly unrelated regression, OLS, and FGLS methods. They found that several exogenous shocks led to price spikes and greater price volatility, and that speculative behavior played an especially important factor. What is missing from all of these studies is the role of government intervention.

Headey (2011) argued that few observers have emphasized government-led trade shocks as a cause of recent price volatility and that only a few of the explanations could be linked to trade events. Exceptions include Dollive (2008), who first documented the implications of export restrictions for wheat and maize; and Slayton (2009), who examined the effect of government policies on rice markets. Headey (2011) expanded on these two studies by examining the effects of export restrictions and import surges on multiple commodities and carefully considered the timing of the events. However, none of these studies econometrically tested the empirical relationship between price volatility and trade policy measures.[2] As consumers and producers become increasingly vocal in demanding government intervention, and governments become increasingly motivated to appease their constituents in times of crises, it is important to ask whether or not these interventions have any effect. In other words, do trade policy actions mitigate price volatility? Surprisingly, there is very little empirical evidence that addresses this fundamental question. One exception is Martin and Anderson (2011) who found that trade barriers implemented with the intention of reducing domestic price volatility contributed 45% and 30% of the increase in the world prices of rice and wheat, respectively, in the period 2006–2008. They derived this result using a simple analytical equation and strong assumptions about the elasticities of demand and price transmission.

Our paper builds on the work by Martin and Anderson (2011) and Tadesse et al. (2014) by econometrically estimating the effect of export restrictions while controlling for the effect of other key explanatory variables. The first objective is to measure the volatility of world prices for wheat, rice, maize and soybeans. To this end, we estimate a structural time series model that removes regularities from the data (trends and cycles) and calculate a 12-month moving standard deviation of the remaining variations in the price series. The second objective is to estimate econometrically the relationship between remaining price volatility and key macroeconomic and policy variables, including export restrictions. Since export restrictions are likely endogenous to price volatility, we use instrumental variables (IVs) and estimate the model using a generalized method of moments (GMM) approach. Lastly, we conduct simulations to quantify the contribution of each factor to the price volatility of each crop. We contribute to the large literature on commodity price shocks and stabilization mechanisms by focusing on the role of government trade restrictions and utilizing an approach that accounts for confounding factors, which results in a more accurate measure of price volatility.

The remainder of the paper proceeds as follows: in the next section, we briefly discuss the recent history of trade policy measures used to stabilize price shocks. The third section describes the conceptual framework, while the fourth section outlines the empirical strategy and data. The fifth section of the paper describes the key empirical findings, and the final section of the paper provides a summary and concluding comments.

Background on trade policy measures

We are primarily interested in investigating the effectiveness of export restrictions on stabilizing commodity prices. However, there are a variety of trade policy measures that governments can implement in response to price shocks. Border measures (including import and export taxes and quotas) are appealing methods for national governments to buffer their domestic markets from price surges, because they come at low cost to the treasury. Both import-based and export-based instruments can be used to depress domestic prices in the short term. Export-based measures, however, have the added attraction that they are not subject to WTO disciplines. Regardless of whether the measures target imports or exports, government motivations remain the same: to prevent price surges and ensure food security; to benefit the domestic processing industry through lower raw material prices; to generate additional government revenues through taxes; and to affect a favorable terms of trade through optimal import tariffs or export taxes. Moreover, for a border measure to affect international prices the country imposing the measure must have some degree of market power in international markets.

Liberalizing trade by lowering tariffs and expanding import quotas puts downward pressure on domestic prices. When in place these measures impede price transmission of world prices into domestic markets, which in turn reduces the responsiveness of demand and supply. Liberalizing markets will have the opposite effect. During the 2006–2008 price surge, approximately half of the countries surveyed by the FAO lowered or eliminated import tariffs on cereals (Prakash, 2011). However, Konandreas (2011) argued that the applied tariffs for basic foodstuffs in LDCs were already relatively low – on the order of 8–14% – and that tariff reductions likely had little effect on world price volatility. Furthermore, since imports are not concentrated in the hands of few buyers,[3] adjustments in import tariffs are less likely to have a significant effect on international grains and oilseed prices. For these reasons we focus our attention on investigating the effectiveness of export restrictions for stabilizing commodity prices.

The contribution of export restrictions to price volatility is quite different. Countries implementing the restrictions are trying to

[2] Several studies have used trade models to examine the effect of trade policies. Recent examples include Bouët and Laborde (2012) who looked at the effects of export taxation on prices during a food crisis using a computable general equilibrium approach; and Yu et al. (2011) who estimated a multi-country multi-commodity partial equilibrium model to examine the effects of shocks to export and import measures on world prices and trade.

[3] This is generally true for wheat and maize, but is arguably less true for rice (a small international market) and soybean (where China is a large buyer).