ANALYZING COLLECTIVE TRADE POLICY ACTIONS IN RESPONSE TO CYCLICAL RISK IN AGRICULTURL PRODUCTION

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INTRODUCTION

The strong demand for agricultural crops decreased major grain stocks in the global market (USDA FAS, 2016). The resulting price increase also results in an unstable global market. Furthermore, recent studies show that climate change has an adverse effect on crop yields (Auffhammer, Ramanathan, and Vincent, 2012). This uncertainty in crop production adds to the instability of food prices in the international market.

A common result of food price spikes is that agricultural exporting countries try to isolate their domestic price from the international market by restricting exports (or imposing an export tax) while agricultural importing countries seek to promote imports to stabilize domestic price by financing import subsidies or reducing existing import tariffs (Kulyk and Herzfeld, 2015). These collective trade policy actions in response to food price spikes exacerbate price instability in the international market (Martin and Anderson, 2011).

A REVIEW OF THE LITERATURE

The price spike between 2006-2008 and 2010-2011 in the global agricultural market was the focus of many research studies to illustrate the effect of such price spikes.

Tanaka and Hosoe (2011) analyzed the effects of productivity shocks and export restrictions on food security in Japan. By using a Computational General Equilibrium (CGE) model with a Monte Carlo simulation, they quantified the welfare impacts of productivity shocks and export quotas by major exporters of rice to Japan and found little evidence of Japan suffering from such shocks.

Yu, et al., (2011) analyzed the potential impacts of these collective trade policy actions in response to cyclical shock on world prices and trade flow of major agricultural commodities using a set of multi-country, multi-commodity, and partial-equilibrium models. The study found that the collective trade policy actions increased prices of all agricultural commodities and that the impact on the total net trade varies by commodity.

Martin and Anderson (2011) introduced a general conceptual framework to provide at least a rough way to illustrate the contribution of domestic market-insulating policy actions to international price spikes for rice and wheat. The study showed that changes in trade policies contributed substantially to the increases in world prices of these staple crops.

Although studies have shown that these insulating trade policies have had nontrivial effects on the world price surge and welfare (Götz, Djuric, and Nivievskyi, 2016; and Liefert and Westcott, 2015), none of previous studies focus on identifying causal relationship between price spike and collective trade policy actions in response to cyclical shock in a specified conceptual framework. For this reason, this study is motivated to develop a specified conceptual framework to theoretically examine the causal relationship between price and collective trade policy actions in response to cyclical risk.

CONCEPTUAL FRAMEWORK

Eaton and Kortum (2002) obtained the aggregate price for the CES utility function, assuming $\sigma < 1+\theta$, as follows:

$$(1)\quad p_i = \Theta\left(\sum_{j=1}^{N} \lambda_j (p_w d_{ij}\eta_{ij})^{-\theta} \vartheta_{ij}^{\theta}\right)^{-1/\theta}, \quad \Theta = \left[\Gamma\left(\frac{\theta+1-\sigma}{\theta}\right)\right]^{1/(1-\sigma)}.$$

Also, trade flow from country j to country i is the probability that country j exports good x at the lowest price in country i because country i's average expenditure per good x does not vary by source. Thus, trade flow can simply be expressed as country j's contribution to country i's price parameter as follows:

$$(2)\quad \frac{X_{ij}}{X_i} = \frac{\lambda_j (p_w d_{ij}\eta_{ij})^{-\theta} \vartheta_{ij}^{\theta}}{\Phi_i} = \frac{\lambda_j (d_{ij}\eta_{ij})^{-\theta} \vartheta_{ij}^{\theta}}{\sum_{l=1}^{N} \lambda_l (d_{il}\eta_{il})^{-\theta} \vartheta_{ij}^{\theta}}.$$

Equations (1) and (2) represent the effect of productivity and insulating trade policy actions on price and trade flow given a base price with geographic distances and degree of comparative advantage.

Since the objective of trade policy in country i is to maximize the sum of its own economic welfare, this study defines the global trade objective function as follows:

$$\max_{p_{w,t}} GTPF_t = \sum_{i=1}^{n} \left\{ \begin{array}{l} \int_0^{\infty} q_{i,t}^{s}(p_{i,t})dp_{i,t} + \int_0^{\infty} q_{i,t}^{d}(p_{i,t})dp_{i,t} + \left[\delta_{i,t} p_{i,t} q_{i,t}^{s}(p_{i,t}) - \psi_{i,t} p_{i,t} q_{i,t}^{d}(p_{i,t})\right] \\ + \left(\eta_{i,t}^{0} - \vartheta_{i,t}^{0}\right) p_{i,t} \left[q_{i,t}^{s}(p_{i,t}) - q_{i,t}^{d}(p_{i,t})\right] \end{array} \right\}$$

By solving the global optimization problem, this study obtains optimal base price as follows:

$$(3)\quad p_{w,t}^{*} = \sum_{i=1}^{n} \left\{ \frac{\left[\left(\alpha_i^{d} + \gamma_i^{d} Y_{i,t}\right) + \alpha_i^{s}\right]}{\beta_i^{d} - \beta_i^{s}} \right\}$$

As equation (3) shows, the optimal base price is independent of cyclical and policy variables. Therefore, the effects of collective trade policy actions in response to cyclical risk on price and trade can be theoretically examined by equations (1) and (2), respectively, given the base price which is determined by market preference of n number of countries in the world economy.

THEORETICAL EXAMINATION

1. Effect of Cyclical Shock on Price and Trade Flow

Now, let us examine the effect of a cyclical shock on price and trade flow by differentiating equations (1) and (2) in terms of λ_j as follows:

$$(4)\quad \frac{\partial p_i}{\partial \lambda_j} = \frac{-\vartheta_{ij}^{\theta} p_w^{*}}{\theta (d_{ij}\eta_{ij})^{\theta}} . \qquad (5)\quad \frac{\partial X_{ij}}{\partial \lambda_j} = \left(\frac{\vartheta_{ij}}{d_{ij}\eta_{ij}}\right)^{\theta}.$$

Equation (4) shows a negative relationship between p_i and λ_j. As a result, a decrease in agricultural productivity in exporting country j increases price in importing country i. Equation (5) shows a positive relationship between X_{ij} and λ_j. As a result, this study can confirm that a decrease in agricultural productivity in exporting country j decreases trade flow from exporting country j to importing country i.

2. Effect of Export Restriction on Price and Trade Flow

The effect of an export restriction implemented by exporting country j on price and trade flow can be examined by differentiating equations (1) and (2) in terms of η_{ij} as follows:

$$(6)\quad \frac{\partial p_i}{\partial \eta_{ij}} = \frac{p_w^{*}}{\eta_{ij}} X_{ij} \quad \text{and} \quad \frac{\partial p_j}{\partial \eta_{ij}} = -\frac{p_w^{*}}{\eta_{ij}} X_{ij},$$

$$(7)\quad \frac{\partial X_{ij}}{\partial \eta_{ij}} = -\frac{\theta}{\eta_{ij}} X_{ij}.$$

Equation (6) shows a positive relationship between p_i and η_{ij} and negative relationship between p_j and η_{ij}. As a result, an export restriction implemented by exporting country j increases the price in importing country i and decreases the price in exporting country j. Equation (7) shows a negative relationship between X_{ij} and η_{ij}. Therefore, export restriction implemented by exporting country j decreases trade flow from exporting country j to importing country i.

3. Effect of Import Incentive on Price and Trade Flow

The effect of an import incentive policy implemented by importing country i on price and trade flow can be examined by differentiating equations (1) and (2) in terms of ϑ_{ij} as follows:

$$(8)\quad \frac{\partial p_i}{\partial \vartheta_{ij}} = -\frac{p_w^{*}}{\vartheta_{ij}} X_{ij} \quad \text{and} \quad \frac{\partial p_j}{\partial \vartheta_{ij}} = \frac{p_w^{*}}{\vartheta_{ij}} X_{ij},$$

$$(9)\quad \frac{\partial X_{ij}}{\partial \vartheta_{ij}} = \frac{\theta}{\vartheta_{ij}} X_{ij}.$$

Equation (8) shows a negative relationship between p_i and ϑ_{ij} and a positive relationship between p_j and ϑ_{ij}. An import incentive policy implemented by importing country i decreases the price in importing country i and increases the price in exporting country j. Equation (9) shows a positive relationship between X_{ij} and ϑ_{ij}. Thus, an import incentive policy implemented by importing country i increases trade flow from exporting country j to importing country i.

CONCLUSION

The results of this study offer the following conclusions. First, the cyclical shock in agricultural productivity can cause price spikes in international agricultural and food markets. Second, following collective trade policy actions in response to the shock will worsen food price spikes and trade flow.

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