Effects of domestic rice market interventions

The effects of domestic rice market interventionsoutside business-as-usual conditions for imported rice prices

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Abstract

The Philippine government intervenes in the domestic rice market through the imposition of import tariffs and the provision of producer and consumer subsidies. While policy makers are aware that these programs come with allocative efficiency costs, they justify the programs on the grounds that they insulate the domestic economy from unexpected price spikes in the international rice market. An interesting matter for policy evaluation is to quantify the insulation benefit that the programs provide in circumstances of sudden severe import price spikes. To examine this question, we undertake a dynamic CGE simulation in which the Philippines is subject to an external rice price shock. We find that the insulation benefit of the support programs under a 2008-like event is worth approximately 0. 10 per cent of real consumption. However the cost of insuring against these price spikes is significant. We estimate the annual cost of the rice market interventions at approximately 0. 40 per cent of real consumption.

JEL classifications: C68, Q18, H12, H21

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1. Introduction

The Philippine government intervenes in the domestic rice market through the imposition of import tariffs and the provision of producer and consumer subsidies. Local policy makers are aware that these programs carry allocative efficiency costs. Trade analysts such as Magno and Yanagida (2000), Salehezadeh and Henneberry (2002), Dawe (2006), Briones (2013) and Layaoen (2014) have argued for reductions in tariff and non-tariff trade barriers on both the rice sector and the broader Philippine agricultural sector to promote economic efficiency. Similarly, there have been many proposals for the abolition or re-design of the Philippine government's rice/paddy subsidy programs, on the grounds that they promote allocative inefficiency, are poorly targeted, and have high budgetary costs (see Sombilla *et al* ., 2006; Jha and Mehta, 2008; Cororaton and Corong, 2009; Intal *et al* ., 2010; Briones and Parel, 2011). Despite the substantial body of policy analytic work favouring reductions in Philippine rice market support, the continued maintenance of the programs has been justified by government on food security grounds (Department of Agriculture, 2012: 8).[3]However, under business-as-usual conditions, the food security benefits of the Philippine's programs look small. For example, Mariano and Giesecke (2014) find that Philippines producer and consumer rice subsidy programs have only a small positive effect on domestic food security, as calculated by comparing the effects of removing the programs on food security indices, relative to a business as usual baseline in which the programs are retained. However, in examining the public justifications for maintaining these programs, it is apparent that Philippine policy concern for food security is motivated in part by fears of events *beyond* business-as-usual conditions (Department of

Agriculture, 2012). For example, in 2008 global rice prices spiked upwards. For the Philippines, the c. i. f price of imported rice increased by approximately 60 per cent relative to trend (Figure 1).

The causes of recent volatility in world food markets have been examined by Naylor and Falcon (2010), Timmer (2010), Headey *et al* . (2010), and Gorter *et al* . (2013), among others. An important strand of recent research has been the examination of the volatility amplifying role played by endogenous changes in agricultural interventions. For example, Martin and Anderson (2011) and Anderson and Nelgen (2012) examine how efforts by individual countries to insulate their economies from spikes in world prices for food staples, through the varying of existing barriers to agricultural trade in response to price movements, may have contributed to the severity of these price events. Such adjustments to support measures in the face of volatile food prices by a single country might augment the local insulation benefits provided by its existing interventions, notwithstanding simultaneous activity in this regard might be amplifying for global price movements. However, the maintenance of a given level of pre-existing support for domestic food production will also provide baseline insulation of the economy from spikes in world prices. An interesting matter for policy evaluation is quantification of the insulation benefit provided by maintenance of in situ rice interventions in circumstances of sudden severe import price spikes. There is some evidence that considerations of this type are in the minds of policy makers when making the food security case for maintenance of rice market interventions. For example, in providing counterarguments to the efficiency case for liberalisation, Department of Agriculture (2012) expresses concern that concentration and thinness in the global trade for rice contribute to the vulnerability of world rice prices to speculation and panic. Similar policy concerns are expressed in SEPO (2010), which notes that disruptions to world rice markets in the late 2000s led the Arroyo government to direct the Department of Agriculture to increase domestic rice self-sufficiency, an instruction re-affirmed by the new Aquino administration. These policy concerns are not unique to the Philippines. Volatility in world rice prices, caused in part by the thinness of trade, has led many rice importing countries to seek to insulate their economies from this volatility through protection of their domestic rice producers and consumers (Intal *et al.* , 2012).

To our knowledge, the insulating effect played by existing pre-event interventions has not been examined. In this paper, we examine the question for the Philippines using a dynamic economy-wide model with detailed treatment of agricultural activity, land use, and food security measures. We undertake a simulation in which the Philippines is subject to an external rice price shock of a magnitude similar to that experienced in 2008. We run this scenario against two alternative baselines: one in which current rice market interventions are in place (the “ with support” case), and one in which they have been removed (the “ without support” case). Broadly, we find that the rice market interventions provide insulation benefits in the event of a spike in the imported price of rice. However, these insulation benefits come at the cost of the economic gains that are foregone by retaining ongoing distortions in the rice market. In the paper’s final section, we quantify this cost by examining the economic benefit of removal of the rice market interventions.

2. The CGE model, macroeconomic closure and database

1. 12. 1. Key features of PHAGE – an applied general equilibrium model of the Philippines

Our simulations are undertaken with a dynamic computable general equilibrium (CGE) model of the Philippines (hereafter PHAGE)[4]with a high level of sectoral and user disaggregation.[5]The core structure of PHAGE begins with the model of Dixon and Rimmer (2002), but extends this with a number of additions to better reflect the characteristics of the Philippine agricultural sector. In particular, PHAGE has a detailed treatment of agricultural activities, land use, and food security measures.

The PHAGE model comprises 52 industries and 52 commodities. The agricultural sector is represented by 22 industries, while the manufacturing and service sectors are comprised of 19 and 11 industries respectively. Three primary factors are identified in the model, namely: labour, capital and land. Labour is further distinguished by skill, and land is differentiated based on agricultural use. The model carries the assumptions of constant returns to scale (CRS) production functions, utility-maximising households and price-responsive export demands. Industries and households make decisions based on optimising behaviour. Given input prices, each industry minimises costs subject to a CRS production function. Households maximise utility, which is described by a nested Klein-Rubin utility function. Capital is industry-specific, with new units of capital allocated to industries on the basis of expected rates of return. New units of capital are formed from local and imported goods in a cost-minimising way, subject to CRS capital production functions. The model recognises imperfect substitutability between domestic and imported goods via the Armington CES assumption. Aside from domestic use, local goods are also demanded by foreign agents. The export demand for each Philippine-made product is inversely related to its foreign currency export price. PHAGE recognises the consumption of commodities by the government, and contains detailed treatment of direct and indirect taxes. The model carries the assumptions that all sectors are competitive, and that zero pure profit conditions hold in all commodity markets. The purchasers' price of a given commodity is equal to its basic price plus the value of any associated indirect taxes and margin services.

Four types of dynamic adjustment are implemented in the model. The first three follow Dixon and Rimmer (2002), and the fourth is a dynamic structure for land use change. First, net investment in year t is installed as physical capital in year $t+1$. Second, changes in the net liability positions of the public and private sectors are determined by the investment/savings imbalances of these sectors. Third, the labour market follows a lagged adjustment path, allowing a transition from a short-run environment in which wages are sticky and employment adjusts, to a long-run environment in which employment is given and wages are fully flexible.

As detailed in Mariano and Giesecke (2014), we combine within PHAGE two approaches to modelling land supply: Horridge and Ferreira (2014) and Giesecke *et al.* (2013). With these approaches implemented in PHAGE, the land allocation process is divided into a two-tier problem. The first tier models the gradual adjustment of land across seven broad land types:

paddy, annual crops, perennial crops, animal farming, aquaculture, forestry and unused agricultural land. Following Horridge and Ferreira (2014), land can gradually move between these alternative types from one year to the next. These movements are governed by a land transition matrix, the elements of which describe the annual proportion of land type *i* in year *t* that becomes land type *j* in year *t* +1.[6]The changes in these proportions are positively related to changes in relative land rental rates. Once year-to-year changes in broad land types have been determined in the first tier, we follow Giesecke *et al.* (2013) in allowing optimisation problems in the second tier, specific to each of the seven broad land types, to allocate land within each year across 22 competing agricultural users according to relative land rental rates.[7]

Lastly, PHAGE adopts a nested structure for modelling food demand. At the top level, household utility is Klein-Rubin in 5 broad food bundles, and 29 disaggregated non-food commodities. Each of the broad food types are modelled as CRESH composites of disaggregated food types.[8]For example, the staples bundle is a CRESH composite of rice, unmilled corn, milled corn, and legumes, tubers and root vegetables.[9]

1. 22. 2. Macroeconomic environment

We outline in this section the important features of the model's macroeconomic closure as they relate to our rice price spike simulation. First, our modeling of the labour market follows the wage theory of Dixon and Rimmer (2002). Under this approach, short run real wages are sticky, with short-run labour market pressures largely expressed as movements in employment. Over the medium to long-run, wage flexibility returns employment to its baseline level. The rate of gradual wage adjustment is set such that the employment effects of exogenous shocks are largely eliminated after about five years.[10]

Second, we assume that nominal economy-wide (private plus public) consumption spending is a fixed proportion of nominal gross national disposable income (GNDI). The ratio of real private to real public consumption spending is assumed to be exogenous. The model's GNDI calculation tracks annual movements in net foreign liabilities and the net interest payments thereon. Aggregate economy-wide investment is determined as the sum of industry-specific investment.

Third, the values of all technology variables are held at their baseline forecast levels. That is, primary-factor technical change and various types of input-saving technical change in intermediate use, capital creation and provision of margin services are not affected by the rice price spike.

1. 32. 3. Database

Construction of the model's database begins with the latest input-output (IO) data for the Philippines published by the National Statistics Coordination Board (NSCB, 2000). Before using this IO data as an initial solution to our CGE model, we first subject it to two types of adjustment, using the method described in Horridge (2004). The first set of adjustments updates the data to a recent year (2010). These adjustments update expenditure and income-side macro aggregates, and selected industry and commodity variables, particularly those relating to the paddy and rice markets.

The second set of database adjustments puts in place the 2010 database values for relevant subsidies and taxes in the rice market. The many policy interventions in the Philippines rice market include subsidies on prices received by farmers for paddy, subsidies on the consumer price of rice, and tariffs on rice imports. More broadly, public financing of agricultural R&D, irrigation infrastructure and agricultural extension services also benefits paddy agriculture (Balisacan and Ravago, 2003). In adjusting our database, we use data from Bureau of Agricultural Statistics (BAS), the Philippine Rice Research Institute (PRRI) and the National Food Authority (NFA) to calculate the values for the four largest direct interventions in the rice market: a subsidy on prices paid by rice consumers, a subsidy on prices received by paddy farmers, a subsidy on prices paid for seeds by paddy farmers, and a tariff on rice imports. We estimate the 2010 value of the subsidy on retail purchases of rice at 6. 7 billion pesos, the value of the seed subsidy at 1. 2 billion pesos, and the value of the subsidy on paddy purchases at 1. 1 billion pesos. These are recorded in the 2010 database as subsidies on sales by rice milling to households, sales of paddy to paddy agriculture, and sales of paddy to rice milling, respectively. The 2010 database value of tariff revenue from rice imports was adjusted to reflect the rice tariff rate of 50 per cent (Philippine Tariff Commission, 2010).

3. Simulation design

1. 43. 1. Simulation shocks

Our aim is to examine the economic and food security implications of a temporary spike in the price of imported rice of a magnitude similar to that experienced by the Philippines in 2008. In Figure 1, the 2008 c. i. f. foreign currency price of imported rice to the Philippines is approximately 60 per cent above the trend line. Hence we adopt 60 per cent as the value for our temporary rice price shock. PHAGE is dynamic, tracking annual values from the model's initial solution for 2010 through to a 2025 forecast. Consistent with the approach outlined in Dixon and Rimmer (2002) we report the effects of the price shock in terms of percentage deviations in results for key variables in the presence of the price shock away from baseline forecast values. Recall that our aim is to quantify the effect of domestic food security policies on the economic and food security implications of a temporary rise in the c. i. f. foreign currency price of imported rice. To do this, we require two alternative baselines:

1. one in which the four interventions supporting the domestic rice market discussed in Section 2. 3 (a consumer rice price subsidy, a producer paddy price subsidy, a farmer seed subsidy, and a rice import tariff) remain at their initial levels throughout the baseline forecast (hereafter, referred to as " with support" scenario), and
2. one in which the four rice market interventions are permanently removed in 2013 of the baseline forecast (hereafter, referred to as " without support" scenario).

We undertake two counterfactual simulations. These counterfactual simulations are identical to simulations (1) and (2) above in all respects other than that a once-off temporary spike in the c. i. f. foreign currency price of imported rice is imposed in 2016.[11]We report the outcomes under the two counterfactual simulations in terms of percentage deviations in results away from baseline forecast values. We examine how the same price shock has different impacts on the economy depending on whether the price support mechanisms are in place (baseline 1) or have been removed three years prior to the price shock (baseline 2). In this way, we elucidate the insulation effects of the rice market interventions in the face of a 2008-like spike in imported rice prices. Then in Section 5, we undertake a simulation in which we examine the economic benefits of removing the four support mechanisms. This allows us to make comparisons between the insulation benefits that the programs provide, and the costs of the programs in terms of the foregone potential gains from their removal.

1. 53. 2. Analytical framework

Following Dixon and Rimmer (2002: 243), we make use of a simple back-of-the-envelope (BOTE) model (Table 1) to guide us in explaining the main routes of causation via which the price shock affects the macro economy.

Equation (E1) describes the GDP expenditure-side identity in constant price terms, consisting of real private and public consumption, real investment, export volumes and import volumes. Equation (E2) is a constant returns to scale production function, linking real GDP to effective units of labour, capital and land inputs. Equation (E3) defines real GNDI equal to real GDP multiplied by a positive function of the terms of trade less interest payments on foreign debt plus overseas income transfers to household and government. In equation (E4), total consumption (C+G) is determined by GNDI via a given propensity to consume (APC). Equation (E5) defines real public consumption as a fixed proportion (RCG) of real private consumption. In (E6), import volumes are positively related to the level of domestic production (proxied by GDP) and the real exchange rate (proxied by the terms of trade). (E7) relates export prices to export volumes via a downward sloping export demand schedule. In (E8), the terms of trade is defined by the ratio of export prices to import prices. Because (E2) is constant returns to scale, the marginal products of labour and capital (MPL and MPK) are functions of the capital–labour ratio. This accounts for (E9) and (E10) which are based on the profit maximising first-order conditions for the use of labour and capital inputs. (E11) indicates that investment expenditure is positively related to rates of return on capital. Lastly, (E12) relates the start-of-year capital stock to investment in the previous year plus the depreciated value of existing capital.

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[3]The Philippines is not alone in equating support for domestic rice production with food security. As Alavi *et al.* (2012) note, the position is held widely in Southeast Asia.

[4]PHAGE – Philippines Applied General Equilibrium model

[5]The model is solved using the GEMPACK economic modelling software (Harrison and Pearson, 1996).

[6]We base our estimates of these proportions on the study of Mataia and Francisco (2010), the Census of Philippine Agriculture of NSO (2002), and land data from BAS (2013).

[7]For detailed description of land modelling in PHAGE, see Mariano and Giesecke (2014).

[8]CRESH: Constant ratios of elasticities of substitution, homothetic (Hanoch 1971). Modelling of each disaggregated food type follows the Armington assumption of CES aggregation over imported and domestic varieties.

[9]The remaining broad groups are modelled as follows. Fruits and vegetables is a CRESH composite of vegetables, pineapple, other annual crops, coconut, banana, mango, citrus and other perennial crops. Meat and fish is a CRESH composite of hog, poultry, other livestock, fish, and processed meat and fish. Other foods is a CRESH composite of sugar, coffee and other processed foods.

[10]This is consistent with the macroeconometric model of the Central Bank of the Philippines, in which changes in employment under various simulations are largely eliminated after five to seven years (see Majuca, 2011).

[11]In the " without support" scenario, rice market support policies are removed in 2013. By imposing the temporary rice price spike shock in 2016, we have allowed the rice market three years to adjust resource allocation in response to the permanent removal of the rice market support policies.