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Effect of Change in Indian Rice Price on Nepalese Rice Market: A Partial Equilibrium Model

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Abstract

Using a partial equilibrium model, this study has investigated cross-border price effect on the rice demand and supply in Nepal. Due to bigger market and close proximity, Indian rice price is likely to affect Nepalese rice price. This study has examined the effect of Indian rice price on Nepalese rice demand, and supply by making projections for the next 10 years period using the baseline data from 1992 to 2013. The model has estimated that the per capita rice demand will decrease from 130 kg/capita to 128 kg/capita between 2013 and 2023. The model has also introduced 3 per cent price shock (increase) in Indian rice price, a trend in past five years, to examine the scenario of rice import and export for Nepal. Due to increase in price in the Indian market, Nepalese rice price would also increase which will give an incentive to the farmers to produce more rice and Nepal will stop importing rice from India by the year 2019.

Key words: Partial equilibrium model, Nepalese rice market, rice import, rice export, Nepal

JEL Classification: Q11, Q17, Q18

Introduction

Rice is the staple food of nearly half of the world's 7.2 billion inhabitants (IRRI, 2014). Almost 40 per cent of the world's rice is harvested in South Asia (Gumma *et al.*, 2011). In Nepal, rice is grown on about 1.42 million hectares, which is almost 46 per cent of land cultivated in the year 2012-13 (MoAD, 2013). As a result, rice is a major source of food and plays a major role in food security of Nepalese households (Prasad *et al.*, 2011). Despite an increasing trend, the rice production is still not sufficient to meet the demand of many Nepalese households (MoAD, 2013). Therefore, rice is imported both formally and informally in Nepal through porous border between India and Nepal. The price of Indian rice plays an important role in the rice

trade between these two countries. Nepalese rice market is an open market with no tariff; however, rice is mostly bought formally by the state-owned corporation to meet its demand in the food deficit districts (Tobias *et al.*, 2012). The Indian policy allows exporting of only fine-grade rice, but recently, India has changed the policy by allowing export of other rice grades with quantitative restrictions (Tobias *et al.*, 2012). But, the export ban or quantitative restrictions on rice has no noticeable effect on quantities imported in Nepal due to a porous border between these two countries (World Bank, 2010). Due to the bigger market size, rice price shocks originated from India are likely to affect the Nepalese rice market. Therefore, it is essential to examine the factual situation. If the Indian rice price affects the Nepalese rice market, then what would be the possible scenarios on the demand and import of rice in future under the current trend or

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possible price shock scenario. This study has examined these questions. The results of this study are likely to help to the policy makers to understand the price effect of export and import on the Nepalese rice market. Additionally, rice being a major food commodity for Nepalese households, examining cross border price effect on rice demand and supply would provide insights into the household food security in Nepal (Sanogo and Amadou, 2010).

Study Framework

The unequal sizes of Indian and Nepalese rice markets make a perfect example of international trade theory between small and large country case studies. Under this framework, the price of a large country is determined by the demand and supply of rice in its domestic market. But, the large country's price is exogenous for a small country and affects the small country's price. Therefore, large country's price plays a role in determining the demand and supply of a small country. After trade with no restrictions between the two countries, the Indian rice price equals the Nepalese rice price (Figure 1).

This equilibrium price relationship can be expressed by Equation (1):

$$P^{\text{Nep}} = P^{\text{Ind}} = P^T \quad \dots(1)$$

where, P^{Nep} is Nepalese domestic rice price, P^{Ind} is Indian domestic rice price, and P^T is equilibrium price after trade occurs. In addition, income, current production level, and population affect the demand and

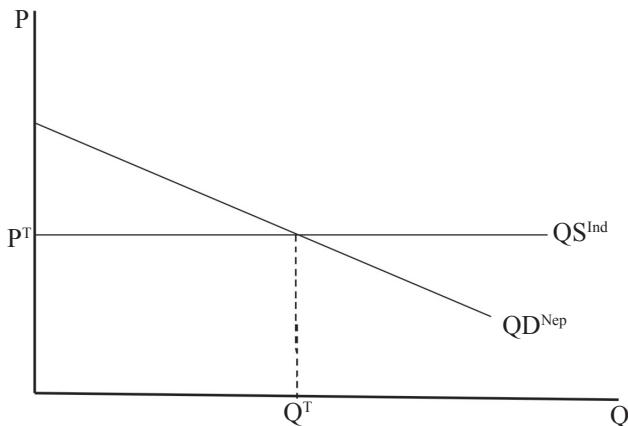


Figure 1. Equilibrium rice price after trade between India and Nepal

Note: In figure QS^{Ind} denotes quantity supply of India, QD^{Nep} denotes quantity demand in Nepal, and Q^T denotes quantity at the equilibrium price P^T .

supply of rice. Therefore, these factors should be included in estimating the model and making future projections.

Data and Methodology

The information on rice price was collected from Food and Agriculture Organization (FAO). Rice production, supply, and distribution data were collected from the Ministry of Agricultural Development, Nepal; and United States Department of Agriculture, Foreign Agricultural Service (USDA-FAS). Macroeconomic variables such as GDP and population were collected from the World Bank and from United Nations, Department of Economic and Social Affairs, respectively.

This study has used a partial equilibrium model to examine the effect of change in Indian rice price on Nepalese rice demand and supply. A partial equilibrium model is a useful tool to study sector specific policy. The Indian domestic price model acts as a connector between Nepalese rice model and Indian rice model. In order to project the effect of Indian rice price, many auxiliary regression models were estimated with exogenous explanatory variables. This method was used by the Food and Agricultural Policy Research Institute (FAPRI), University of Missouri, Columbia, for baseline projections. Due to amount or quality of data, auxiliary regression models were used rather than other methods, such as 2SLS. The following model components were used to estimate the effect of Indian rice price on Nepalese rice demand and supply.

Domestic Rice Supply

$$\text{Production Supply} = f(\text{lagged price, lagged production, trend})$$

$$\text{Beginning Stock} = \text{Ending stocks of lagged time}$$

$$\text{Total Supply} = \text{Production} + \text{Beginning Stocks} + \text{Import}$$

Domestic Rice Demand

$$\text{Domestic per capita demand} = f(\text{domestic rice price, income, trend})$$

$$\text{Ending Stock} = \text{Beginning stock} + \text{Production} - \text{Consumption} - \text{Export}$$

$$\text{Total Demand} = \text{Domestic consumption} + \text{Ending stocks} + \text{Export}$$

Domestic Rice Price

$$\text{Domestic Rice Price} = f(\text{Real rice price in India with exchange rate})$$

Model Closure

$$\text{Imports} = \text{Total demand} - \text{Production} - \text{Beginning stocks}$$

$$\text{Export} = \text{Beginning stock} + \text{Production} - \text{Consumption} - \text{Ending stock}$$

The partial equilibrium models equate the supply and demand in one or more markets so that the markets clear at their equilibrium price levels.

Results and Discussion

The partial equilibrium model can provide answer to two objectives. One, it makes a projection of baseline data such as price, import, demand, and supply of rice for Nepal. Two, it also examines the 3 per cent Indian rice price shock effect on Nepalese rice price, demand and supply. In order to make projection, we estimated the demand, supply and market closure equations. The model also included trend variable to capture secular trend in addition to usual variables income, price, and production in the previous year. Coefficients of those regression models showed the expected signs (Table 1). In the supply equation, own price supply elasticity was taken from the other study (World Bank, 2010).

Most of the variables used in the model had baseline up to the year 2013 and the year 2014 was the first year of the projection. Due to unavailability of data, some of the variables like Indian rice price from 2009 were projected earlier than 2013. The model estimates that total rice demand will increase by 1.1

Table 1. Coefficient estimates of auxiliary models

Demand Equation	Coefficient
Intercept	0.152589*
Trend	-0.001056
GDP per capita	0.000023
Real domestic rice price (Nepal)	-0.000247**
Supply Equation[®] (In production supply)	
Intercept	0.681477
ln (Real lagged price Nepal)	0.300000 ^s
ln (lagged prod)	0.418948
Trend	0.003690*
Market Closure (Domestic rice)	
Intercept	5529.865374*
Indian domestic rice price	0.261917*

Notes: ^sOwn price supply elasticity is the lower end value and was taken from the other study.

[®] Supply equation has been estimated in natural logarithmic form.

* and ** denote significance at 5 per cent and 10 per cent levels, respectively.

Source: Authors' estimates

per cent in Nepal (Table 2). Similarly, real producers' rice price in India will grow by 0.2 per cent from 2013 to 2023. However, during the past five years, it was around 3 per cent. Under the current trend, there is no prospect of rice export until 2023 to India, despite a higher price in India.

Based on the current trend, the rice production will continue to grow from 3361 thousand tonnes to 3603 thousand tonnes during the projection period, 2014 to 2023 (Figure 2). Rice production is likely to increase

Table 2. Summary of average estimate of rice demand, export, import, supply, and producer price

Particulars	2003 to 2013	2014	2015	2014 to 2023
	Average			Average
GDP per capita (constant US\$ 2001)	292	315	321	344
Total demand ('000 Mt)	3041	3640	3680	3821
Exports ('000 Mt)	0	0	0	0
Total supply ('000 Mt)	3041	3640	3680	3821
Milled production ('000 Mt)	2896	3293	3340	3464
Imports ('000 Mt)	145	347	340	356
Real Indian producer rice price (constant US\$ 2001)	310	341	342	344

Source: USDA, World Bank, FAO, and authors' estimate (2014)

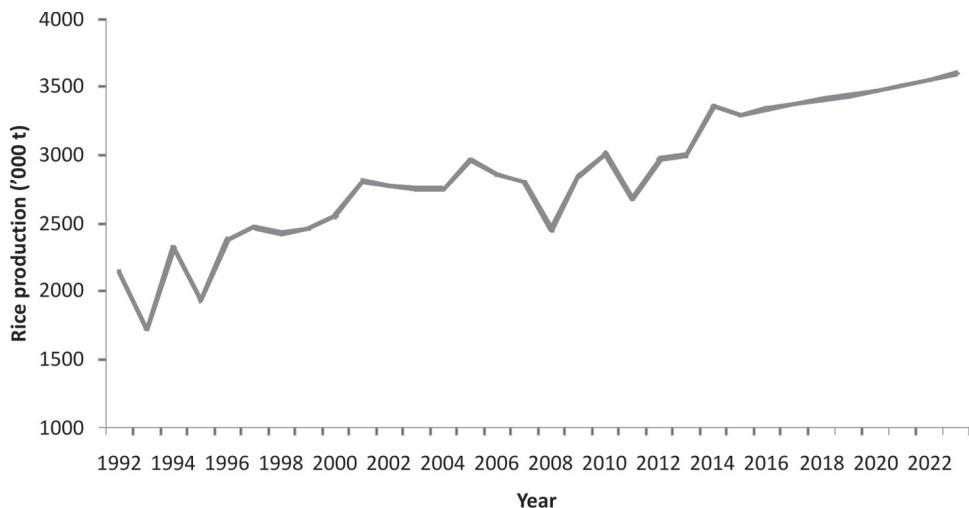


Figure 2. Rice production (milled) in Nepal: 1992-2023

Source: USDA and authors' estimates (2014)

only slowly during the projection period. Due to higher Indian rice price, Nepalese farmers have a strong incentive to produce more rice. The increase in rice demand in Nepal is mostly due to the population pressure.

Based on the current trends, the domestic rice demand will decrease from 129 kg to 128 kg per capita by 2023 despite the increasing total demand shown in Table 2 (Figure 3). The total demand is increasing and per capita demand is decreasing which indicates that population growth or increase in real income might have contributed to the increasing total demand.

Nepal will continue to import rice from India under the current scenario of population growth, income, and shortfall in domestic rice production. However, a higher Indian rice price gives an incentive to the Nepalese farmers to produce more rice. Under the current scenario, there will be an increase in import of rice from India till 2021 and then there would be a decrease in import due to decreasing trend of per capita rice demand and increase in domestic rice production due to price increase as shown earlier (Figure 4). The trend also shows that rice export will be zero in the projection period 2013 to 2023 under the current scenario.

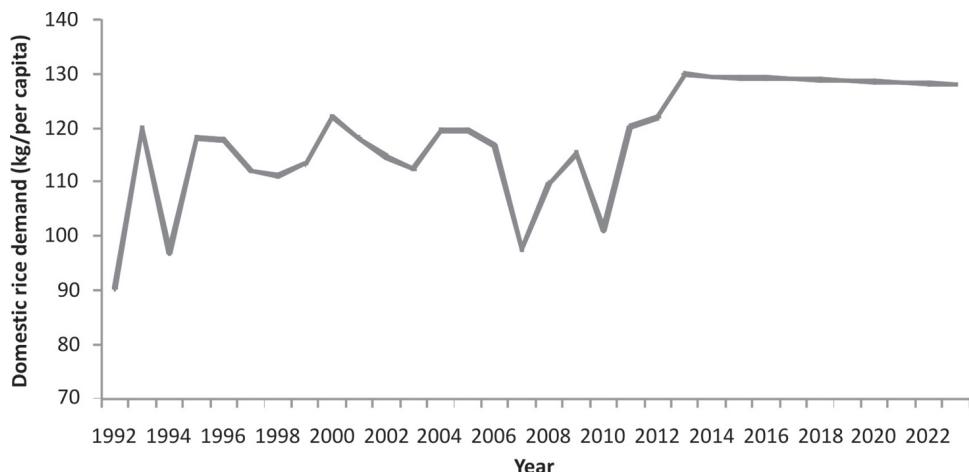


Figure 3. Per capita demand of rice in Nepal, 1992-2023

Source: USDA and authors' estimates (2014)

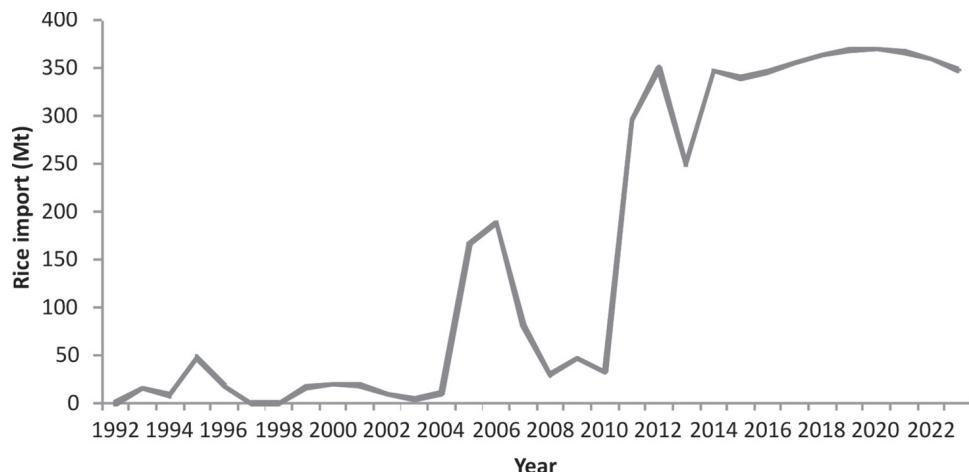


Figure 4. Rice import from India, 1992-2023

Source: FAO and authors' estimates

As Sanogo (2008) explained, the price fluctuation in India is transmitted, in both short- and long-run, across the border. Therefore, Nepal's rice import and potential export are likely to depend largely on Indian rice price. The trend shows that Indian nominal rice price is increasing by 15 per cent per year on average during the projection period (2014-2023), whereas domestic rice price is increasing by 8 per cent per year on an average in the same period. Despite a higher price signal from the Indian market, which is an incentive for more rice production at the domestic market, Nepal still imports rice from India. This could be the combination of lag in the adjustment of production, increasing population pressure, and income in Nepal. The price differential between India and Nepal is also due to market inefficiencies and relative transportation costs in Nepal (Sanogo, 2008).

In addition to the current trend, we have also examined the effect of 3 per cent price increase in the Indian rice market. Presently, the real domestic price is increasing at a slower rate of about 1 per cent per year, but after the 3 per cent increase in rice price in India, the domestic price will also rise sharply on an average by 10 per cent per year (Figure 5). This provides a strong evidence of strong price transmission signal from India to Nepal and is likely to have a large impact on the Nepalese rice market.

After imposing a 3 per cent shock in Indian rice price, the domestic demand of rice in Nepal will decrease from 130 kg/capita to 123 kg/capita between 2013 and 2023 (Figure 6). However, under the current trend, the per capita demand decreases from 130 kg/capita to 128 kg/capita only.

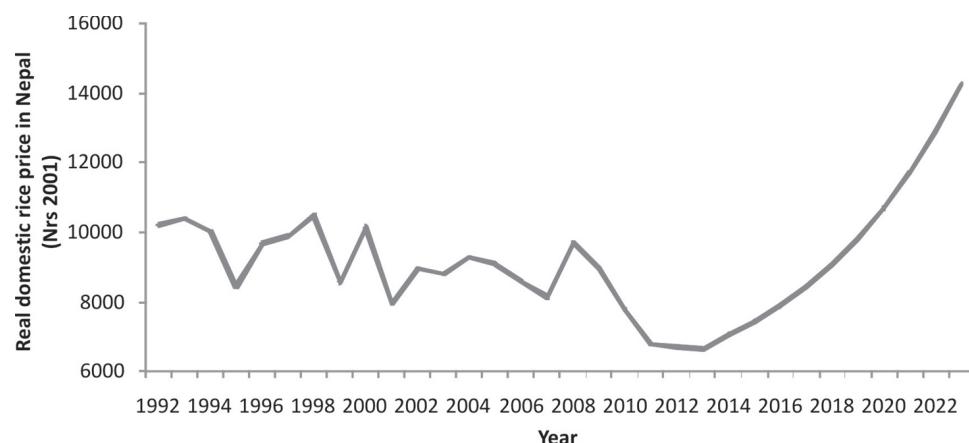


Figure 5. Real domestic rice price (NRs 2001) after 3 per cent shock on the Indian rice price

Source: FAO and authors' estimates

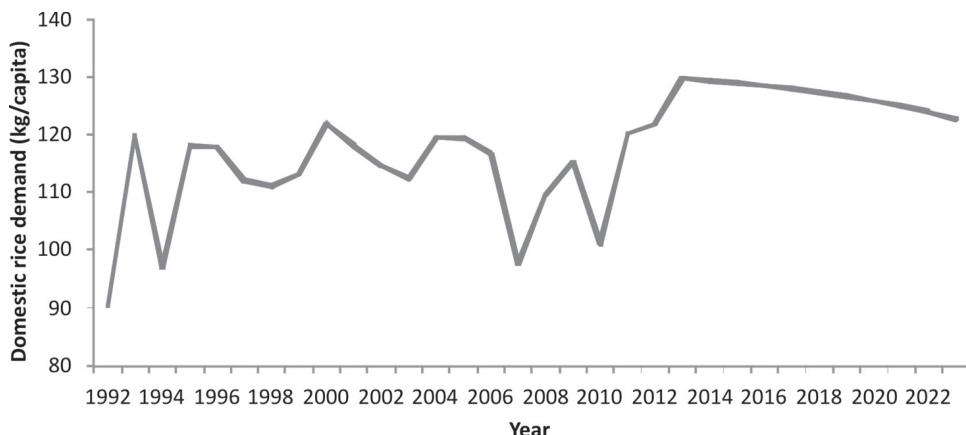


Figure 6. Per capita demand of rice in Nepal after 3 per cent shock on Indian rice price

Source: USDA and authors' estimates (2014)

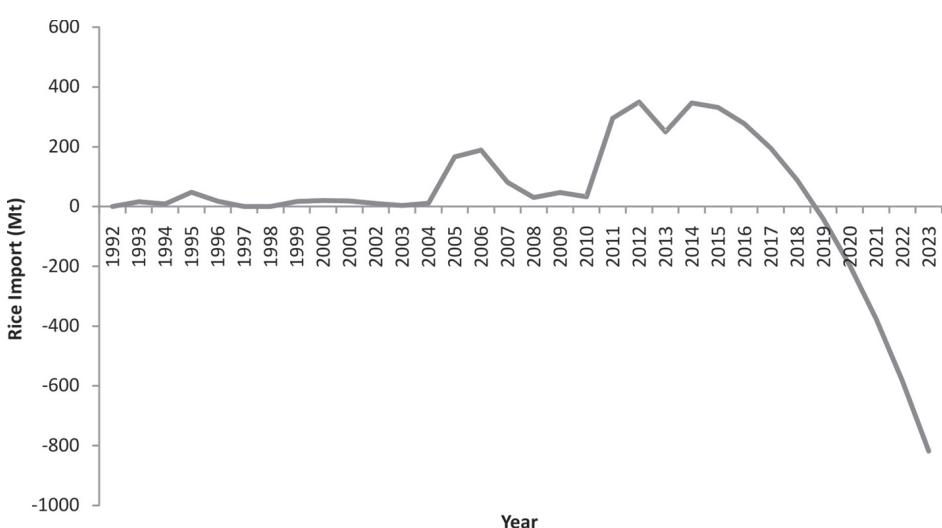


Figure 7. Rice import from India after 3 per cent price shock in Indian rice market

Source: FAO and authors' estimates (2014)

Due to the effect of 3 per cent increase in Indian rice price, the demand from Nepalese consumers would reduce and there would be an incentive to produce more rice. Consequently, the import of rice from India is projected to be zero by the year 2019 (Figure 7).

Conclusions

The paper has measured the cross border price effect on rice demand and supply using partial equilibrium model. Any change in the Indian rice price is transmitted to Nepal and thereby affects the demand and supply scenario in Nepalese rice market. The analysis has been done under two scenarios: (a) current trend, and (b) 3 per cent increase in the Indian rice price. To examine the effect of Indian rice price,

projections of rice demand, supply, import, and export have been made for the next 10 years using the baseline data from 1992 to 2013. The study has found that under the current trend, domestic price will increase slowly in the projection period. Under the current trend scenario, there will not be rice export but import of rice will also increase until 2021 and then it will decrease. The current trend has also shown that Indian rice price is increasing at a higher rate than Nepalese rice price in Nepal. The study has also introduced a 3 per cent price shock to examine the change in domestic rice price. The results show that 3 per cent increase in Indian rice price would increase 10 per cent price in the domestic market. Due to this effect, farmers have a strong incentive to produce more rice and Nepal is

likely to stop importing rice from India from the year 2019. The per capita demand has also shown a decreasing trend during the projection period. Thus, the study has estimated the future export, import, demand, and supply scenarios of rice in Nepal.

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