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Competition in the Saudi Arabian rice market

Yosef Alamri[1*], Michael Reed[2] and Sayed Saghaian[3]

[1]*King Saud University, Department of Agricultural Economics, P.O. Box 2460, Riyadh 14511, Saudi Arabia*
[2,3]*University of Kentucky, Department of Agricultural Economics, Lexington, KY 40546-0276, USA*
[*]*Corresponding author*: yosef@ksu.edu.sa

Abstract

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This study aims to examine the intense competition in the Saudi Arabian rice market. The inverse residual demand methods, as proposed by Reed & Saghaian (2004), were estimated using 2SLS for rice exporters to Saudi Arabia during the period 1993-2014. After testing the model for various specifications, it was found that Australia, India, and Pakistan had market power in the Saudi market, while Egypt faced a perfectly elastic demand curve. India had the highest rice mark up and Australia had the lowest. We found Thailand and the US had positive inverse residual demand elasticity, which means no market power.

Keywords: inverse residual demand; Lerner index; rice; elasticity

Introduction

Rice is one of the leading foods in Saudi Arabia, and its consumption level is affected by culture and traditions. “Kabsah” is a traditional dish in Saudi Arabia, which contains rice and meat. Rice consumption was 47 kilograms per capita in 2016 (GASTAT, 2016). There are more than 1500 type of rice in the world (Baazeem, 2007). However, the “Basmati” classification is the most preferred type of rice in Saudi Arabia,followed by American rice and Calrose rice (Ahmed & Mousa, 2014; 2015). There were also several industries based on rice products, such as rice oil used in the manufacture of cosmetics and the lubrication of leather, in addition to baby food using short or medium grain rice (Baazeem, 2007).

Saudi Arabia cannot produce rice domestically due to the climate and water conditions (Baazeem, 2007; Ahmed & Mousa, 2014; 2015). Therefore, Saudi Arabia is forced to import all its rice. Saudi Arabia ranked fourth in terms of global rice import quantity and second in terms of global rice value during the average period of 2009 through 2013 (FAO, 2016; USDA, 2016). Saudi Arabia tends to import more expensive rice due to consumer preferences (Alamri & Saghaian, 2018). Therefore, countries exporting to Saudi market not only face a very large market for high-valued rice, but they also face intense competition for market share. A study of the competitiveness of various rice suppliers that estimates price decisions by exporters and their margins is appropriate because the market is large and growing.

During the study period, 1993-2014, the annual growth of rice import quantity and value were 1.0% and 1.1%, respectively, while the annual price increase was about 4%. This suggests that consumers in Saudi are looking for improved rice quality with their imports. During the same period, India was the leading supplier to the Saudi market, followed by the US, Pakistan, Thailand, Australia, and Egypt. These rice suppliers accounted for 99% of the total Saudi rice market. The preferred rice varieties in the Saudi market were Basmati, Parboiled, and Round grain (Ahmed & Mousa, 2014). India dominates the Saudi rice market because of consumer preferences shifting toward “Muzza Basmati Rice” (Al-Saffy & Mousa, 2012).

The aim of thispaper is to measure the intensity of competition in the Saudi Arabia rice market. It uses modern

econometric methods (including preliminary statistical tests) to choose the appropriate model. This paper updates the work of Alamri & Saghaian (2018) by including an additional country in the analysis. Second, we include more tests in our analysis. Third, we show the proven of our econometric models. Fourth, we include more economic logic interpretation to explain some unexpected results.

Previous studies of the Saudi Arabian rice market show the dominance of some countries. Ismail & Alzaaaki (1991), demonstrated that real GDP increases from 1971 to 1985, were a significant factor in the rise of imported food commodities, including rice. The study concluded that changes in the real price of imported rice, real national income, and population explained 86% of the variation in annual rice imports for Saudi Arabia. The demand and income elasticity on rice imports were -0.35 and 0.49, respectively. Al-Rwis (2004) studied and analyzed rice imports of Saudi Arabia during 1992-1998 using an AIDS model. The results showed that the demand for rice imports from India was price inelastic. While Pakistan, the US, and Thailand were price elastic and rice was a necessary commodity for India, Pakistan, and Thailand while complements for the US. The study shows there is a competitive relationship between the rice imports from India and the rice imported from the US, and between the rice imports from Pakistan and the US. He also found that there was competition between rice imports from the US and Pakistan, but no competition with rice imports from Thailand.

Baazeem (2007) and Ismaiel & Al-Rwis (2009) studied market power among rice exporters to Saudi Arabia. He described the Saudi rice market as controlled by a few importing companies. He suggested that they determine their marketing strategies, the quality of imported rice, and the sources of importation, to maximize profits. He found that rice imports were concentrated in six rice-exporting countries, India, Pakistan, the US, Thailand, Australia, and Egypt. Rice imports are also concentrated in the following varieties: Basmati, American, and Egyptian. The results of the residual demand models for rice exporters to Saudi Arabia indicate that both India and Pakistan enjoy market power in the Saudi rice importing market.

Through previous studies, there were no studies using market power in Saudi Arabia through the new rice classification. Therefore, this study is based on the use of inverse residual demand to demonstrate the factors that influence rice imports from major exporting countries.

Conceptual Framework

Many studies have focused on estimating inverse residual demand functions using different methods. To determine the degree of market power, two-stage least squared 2SLS were used for one specific importer and multiple exporters by Reed & Saghaian (2004), Tasdogan et al. (2005), Baazeem (2007), and Ismail and Al-Rwais (2009). Baker & Bresnahan (1988), Goldberg & Knetter (1999), Zhang et al. (2007), Pall et al. (2014), Evans & Ballen (2015), and Páll (2015), studied competition in multiple import markets with one supplier using methods such as three-stage least squares (3SLS), Instrumental variable GMM, and IVPPML.

The residual demand model for each exporter country could be described as (Baker & Brenhan, 1988; Goldberg & Knetter, 1999; and Zhang et al., 2007):

$$P_i = P_i(Q_i, Q_{i-1}, Q_{i-2}, Q_{i-3}, Q_{i-4}, Q_{i-5}, X), \quad (1)$$

where P_i is the import price from country i (i = Australia, Egypt, India, Pakistan, Thailand, or the US), is the import quantity from country i, and X represent the explanatory variables effecting the demand model.

We obtain the inverse residual demand function for each exporter country by profit maximization:

$$\pi_i = P_i(Q_i,..., Q_{i-5}, X)Q_i - C_i(Q_i, W_i)ER_i, \quad (2)$$

where C_i indicates the cost of exporter country i, W_i is the cost shifters for country i, and is the bilateral exchange rate between Saudi Arabia and country i. All exchange rates are converted to Saudi Arabia currency. Exchange rate movements offer ideal cost shifters in international markets because they move the relative costs of the exporting countries (Reed & Saghaian, 2004).

Because of the imperfectly competitive market, Reed & Saghaian (2004) explained the "the extent of competition is expressed as the relative markup of price over marginal cost" (Lerner index).

To maximize profit, $\pi_i = TR_i - TC_i$... (3)

$$\frac{\partial \pi_i}{\partial Q_i} = MR_i(Q_i,..., Q_{i-5}, X) - MC_i(Q_i, W_i)ER_i... \quad (4)$$

The monopolist i sets the output where the marginal revenue (MR) equals marginal cost (MC):

$$MR_i(Q_i,..., Q_{i-5}, X) = MC_i(Q_i, W_i)ER_i... \quad (5)$$

We know that MR is equal to

$$MR_i(Q_i,..., Q_{i-4}, X) = P_i +$$

$$+ Q_i\left[\frac{\partial P_i(Q_i,..., Q_{i-5}, X)}{\partial Q_i} + \frac{\partial P_i(Q_i,..., Q_{i-5}, X)}{\partial Q_{i-1}}\frac{\partial Q_{i-1}}{\partial Q_i} + ...\right.$$

$$\left. + \frac{\partial P_i(Q_i,..., Q_{i-5}, X)}{\partial Q_{i-5}} + \frac{\partial P_i(Q_i,..., Q_{i-5}, X)}{\partial Q_{i-5}}\frac{\partial Q_{i-5}}{\partial Q_i}\right]... \quad (6)$$

The perfectly competitive situation results when the expression within the parenthesis is equal to zero, which means price equals marginal cost. The Lerner index describes the markup price over marginal cost as:

$$\frac{P(Q) - MC(Q)}{P(Q)} = -\frac{\partial P(Q)}{\partial Q}\frac{Q}{P(Q)}$$

$$\frac{P(Q) - MC(Q)}{P(Q)} = -\frac{1}{E}, \ldots \quad (7)$$

where E is price elasticity. The Lerner index is equal to zero in the case of perfect competition, varies inversely with the elasticity of demand, and increases with increased market power (Alamri & Saghain, 2018).

Therefore, the residual demand function is obtained when equation (6) is substituted into equation (5):

$$P_i + Q_i\left[\frac{\partial P_i(\ldots)}{\partial Q_{i-1}} + \frac{\partial P_i(\ldots)}{\partial Q_{i-1}}\frac{\partial Q_{i-1}}{\partial Q_i} + \ldots + \frac{\partial P_i(\ldots)}{\partial Q_{i-5}} + \frac{\partial P_i(\ldots)}{\partial Q_{i-5}}\frac{\partial Q_{i-5}}{\partial Q_i}\right] = MC_i(Q_i, W_i)ER_i$$

$$Q_i = Q_i(Q_{i-1}, \ldots, Q_{i-5}, X, W_i ER_i)\ldots \quad (8)$$

The inverse residual demand for other competitive (P_{i-1}) country by substituting equation (8) in equation (1) as other competitors (i-1):

$$\begin{aligned} P_{i-1} = P_{i-1}[&Q_i(Q_{i-1}, \ldots, Q_{i-5}, X, W_i ER_i), Q_{i-1}, \\ &Q_{i-2}(Q_i, \ldots, Q_{i-5}, X, W_{i-2} ER_{i-2}), \\ &Q_{i-3} = (Q_i, \ldots, Q_{i-5}, X, W_{i-3} ER_{i-3}), \ldots, \\ &Q_{i-5}(Q_i, \ldots, Q_{i-4}, X, W_{i-5} ER_{i-5}), X], \\ P_{i-1} = P_{i-1}[&Q_{i-1}, X, W_i ER_i), \ldots \end{aligned} \quad (10)$$

The inverse residual demand function for other competitors is similar to equation (10).

To solve the unknown marginal cost, Goldberg & Knetterin (1999) developed a method that is measuring market power in the international market for an exporter (Alamri & Sagahain, 2018).

Therefore, using Two-Stage Least Squares (2SLS), we estimated the inverse residual demand of Said Arabian rice market during 1993-2014.

$$\begin{aligned} \text{Log}P_t^i = {} & \lambda_{\square} + \eta \text{Log}\hat{Q}_t^i + \alpha_{\square} T_t + \beta_{\square} \text{Log}(IPC) + \\ & + \sum_{j \neq i} \delta^j{}_{\square} \log e_t^j + \sum_{j \neq i} \omega^j{}_{\square} \log PPI_t^j + \gamma \text{Log}(POP) + \varepsilon_t, \end{aligned}$$

where P is imported price measured by Saudi Riyals, η is the residual demand elasticity, Q is the quantity of rice imports, t indexes time, i and j *indexes* countries that Saudi Arabia imported from, T is a time trend, *IPC* is Saudi Arabia real disposable income*, PPI* indicates the producer price index, *POP* indicates the non-citizen of Saudi Arabia population, and e is the bilateral exchange rate. However, the Saudi Arabian currency had a fixed exchange rate with the US dollar ($1 = 3.75 SR). Therefore, we converted all the exporter countries to the US dollar and then divided by 3.75 to convert to the Saudi currency market. In our model, we omit the US exchange rate due to perfect collinearity. The important coefficient is η, which represents the elasticity of the inverse residual demand. If η is significantly different from zero then the exporter has market power (a markup over marginal costs), otherwise the exporter faces perfect competition.

Our hypothesis is that rice products aredifferentiated by supplier region and so they face a downward sloping residual demand curve.

Data

The residual demand elasticity method is applied to six rice exporting countries to Saudi Arabia for the period 1993-2014.Data on Saudi rice imports weretaken fromCentral Department of Statistics & Information (CDSI) and General Authority for statistical (GASTAT) in Saudi Arabia, as well as USDA, UN-Comtrade, and FAO databases. The population, gross domestic product (GDP), and cost of living indices for Saudi Arabia came from the General Authority for Statistics. The producer price index came from the FAO, while rice production came from FAO and USDA. Finally, competitors' GDP and exchange rate data weretaken from the World Development Indicators.

Results and Discussion

We checked for the multicollinearity problem and we found some variables suffer from high collinearity. Therefore, we dropped the variables had high collinearity from the models. We then tested for heteroscedasticity and autocorrelation for all models. The Pagan- Hall test shows that we fail to reject the null hypothesis of homoscedasticity for all models. While the Cumby-Huizinga tests results indicate that we fail to reject the null hypothesis that the error term has no first order serial correlation for all models except for Pakistan and Thailand. Therefore, to solve both issues we used robust standard errors in our estimation. After that those adjustments, we found that the model had no problems with heteroscedasticity and autocorrelation.

We used the Hausman test to examine the endogeneity of the quantity variables. We rejected exogeneity for India at the 5% level of significance, and for the US and Australia

at the 10% level. Therefore, we could apply the OLS estimation for other exporter countries, but had to instrument variables for India, the US and Australia (Wooldridge, 2009). Yet for comparison purposes, we use instrumental variable estimations for all countries in order to compare the results with OLS. We used the one-year lagged import quantity, the country's GDP and production from the competitor countries as instrumental variables (Angrist & Alan, 2001; Páll, 2015). Lagged quantity variables are less likely to be affected by the current price ((Joshna et al., 2001). We failed to reject the null hypothesis of the Sargan test for the three countries, so we have good instrumental variables. The Sargan test statistic is significant for Thailand, indicating that there IVs are not as strong.

Both OLS and IV results are shown for comparisons. Table 1 shows the result of the OLS models for all competitors. None of the quantity coefficients were significantly different from zero except for India. When we compare the OLS results with inverse residual demand in Table 2, we find that the OLS results for quantity had lower standard errors,

Table 1. The OLS demand model

Variables	Australia	Egypt	India	Pakistan	Thailand	US
lnQ	-0.0103	-0.0335	-0.510**	-0.104	0.140	0.186
	(0.0397)	(0.0916)	(0.191)	(0.127)	(0.103)	(0.207)
Exchange rate						
Australia		0.880	-0.236	1.497	-1.482***	
		(1.271)	(1.031)	(2.083)	(0.460)	
Egypt	-0.410			-0.873		
	(0.344)			(0.805)		
India	-0.217	-0.234		0.447	0.885*	-1.410**
	(0.683)	(1.098)		(0.749)	(0.468)	(0.469)
Pakistan	0.598	2.439	1.301**			0.201
	(0.426)	(3.366)	(0.537)			(0.698)
Thailand	-0.283	-1.944		-0.516		
	(0.294)	(1.305)		(0.807)		
Per capita GDP	0.491	0.331	0.00723	0.468	-0.0777	-0.675
	(0.306)	(1.139)	(0.462)	(1.116)	(0.258)	(0.483)
Producer price index						
Australia		0.996	0.229	0.155	0.125	0.181
		(0.730)	(0.263)	(0.192)	(0.127)	(0.209)
Egypt	0.527		0.127	1.015	-0.789**	-0.598
	(0.308)		(0.537)	(1.341)	(0.279)	(0.584)
India	-0.268	-0.557	-0.0602	-0.0638	0.0511	0.243
	(0.163)	(1.141)	(0.390)	(0.192)	(0.121)	(0.354)
Pakistan	0.0894	0.294	-0.363		-0.174	-0.149
	(0.172)	(0.832)	(0.365)		(0.133)	(0.302)
Thailand	-0.316	0.155		-0.265		0.224
	(0.261)	(0.747)		(0.278)		(0.384)
US	-0.0610	0.471	0.443*	0.402*	0.369**	
	(0.158)	(0.590)	(0.226)	(0.217)	(0.128)	
Non-Saudi POP		-0.907		-0.165	1.123*	3.116**
		(2.381)		(2.143)	(0.534)	(1.253)
Time	-0.0415				0.0440	
	(0.106)				(0.0828)	
Constant	7.823***	2.931	5.484***	4.684**	2.829***	4.201***
	(1.852)	(4.423)	(1.763)	(2.039)	(0.882)	(1.255)
Observations	22	22	22	22	22	22
R-squared	0.954	0.586	0.791	0.876	0.978	0.896

Robust standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1

but some coefficients also had unexpected signs. However, if endogeneity is present then standard errors are not valid (Wooldridge, 2009).

The inverse residual demand equations in Table 2and the signs and significance of the quantity coefficients differ by country. The residual demand coefficients were significant at the 10% level for Australia, Pakistan, Thailand, and the US; and significant at the 5% level for India. All F statistic tests are significant at the 1% significance level. A negative sign for the coefficient on quantity is consistent with economic logic and the existence of market power. This was the case for Australia, India, and Pakistan with

Table 2. The Inverse residual demand model

Variables	Australia	Egypt	India	Pakistan	Thailand	US
lnQ	-0.0604*	-0.353	-0.933**	-0.446*	0.632*	0.480*
	(0.0304)	(0.511)	(0.357)	(0.214)	(0.311)	(0.243)
Exchange rate						
Australia		-0.135	-0.662	0.841	-0.160	
		(2.546)	(1.084)	(2.106)	(0.980)	
Egypt	-0.332			-1.410*		
	(0.461)			(0.731)		
India	0.403	1.069		1.481	2.484**	-0.579
	(0.693)	(3.019)		(1.146)	(1.096)	(0.782)
Pakistan	0.554	0.566	2.031***			-0.494
	(0.559)	(4.372)	(0.619)			(0.975)
Thailand	-0.148	-1.103		-0.551		
	(0.386)	(1.682)		(0.800)		
Percapita GDP	0.757	1.004	-0.0369	0.975	1.320*	-0.397
	(0.488)	(1.843)	(0.529)	(1.127)	(0.702)	(0.514)
Producer price index						
Australia		1.799	0.577	0.571	-0.179	0.356
		(1.279)	(0.323)	(0.341)	(0.318)	(0.249)
Egypt	0.439		0.0696	1.194	0.316	-0.664
	(0.301)		(0.619)	(1.231)	(0.770)	(0.649)
India	-0.351	-1.082	-0.156	-0.0198	-0.303	0.193
	(0.216)	(1.109)	(0.424)	(0.174)	(0.301)	(0.371)
Pakistan	0.106	0.536	-0.410		0.00844	-0.0396
	(0.159)	(0.852)	(0.325)		(0.240)	(0.308)
Thailand	-0.114	1.346		-0.332		0.220
	(0.205)	(1.797)		(0.335)		(0.365)
US	-0.0881	-0.0617	0.276	0.204	0.389**	
	(0.155)	(1.142)	(0.279)	(0.227)	(0.157)	
Non-Saudi POP		-2.921		-1.121	-1.684	3.026*
		(4.587)		(2.166)	(1.722)	(1.366)
Time	-0.323				-0.555*	
	(0.312)				(0.270)	
Constant	6.894**	0.169	5.750**	3.549	2.385	2.273
	(2.244)	(5.926)	(2.429)	(2.210)	(1.784)	(2.248)
Observations	21	21	21	21	21	21
R-squared	0.941	0.395	0.830	0.883	0.955	0.864
Pagan-Hall	0.95	0.99	0.75	0.71	0.99	0.90
Cumby-Huizinga	0.02**	0.17	0.11	0.03**	0.08	0.70
Wu-Hausman	0.09*	0.45	0.02**	0.21	0.11	0.09*
Sargan test	0.14	0.10	0.12	0.22	0.07*	0.13

Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

coefficients of -0.06, -0.93, -0.45, respectively. The high elasticity for India is related to the type of rice it produces and its preference among Saudi consumers. Egypt also had a negative sign, but it was not significantly different from zero, suggesting a perfectly elastic demand and no market power. Results show that Australia had small markups over marginal costs, while India had large markups due to the preferred type of "Basmatirice."Ismail & Al-Rwais (2009), and Baazeem (2007) showed that India and Pakistan had market power in their rice export to Saudi Arabia, while the US, Australia, Thailand, and Egypt faced a perfectly elastic demand.

The inverse residual demand coefficient was the only significant coefficient for the Australian price export model while the other variables had no impact. The statistically significant inverse residual demand coefficient indicates that Australia had market power in the Saudi rice market, but it was very small.

In the Egyptian model, none of the explanatory variables had significant coefficients, so they did not influence the Egypt price. The sign of the inverse residual demand coefficient was negative but not statistically different from zero, indicating that Egyptian rice faces a perfectly elastic demand in Saudi Arabia. Egypt cannot increase the price of its exports without losing its market to competitors.

In the India model, the quantity coefficient and the exchange rate of Pakistan were the important factors affecting the export price. There was no evidence that other variables had an influence on the model. The inverse residual demand coefficient had the expected negative sign, and it was statistically significant. The coefficient indicates that India had a large mark-up over marginal cost, approximately -0.93. This result is consistent with Al-Rwais's study in 2004, which found that Saudi demand for imported rice from India was price inelastic. This implies that India has large and significant market power. The exchange rate coefficient had a positive sign, as expected from theory. India's price is sensitive to the exchange rate of Pakistan because both produce the same variety of rice, "Basmati."

The Pakistan model shows that the amount of rice exports and the exchange rate of Egypt were the only variables significantly affecting price in the model. The quantity of export was negative, as expected, and statistically significant — it shows a 0.45 mark-up over marginal cost. The exchange rate of Egypt was statistically significant but had a negative sign, which was not expected. However, this could because the Egyptian pound depreciated against the US dollar than the Pakistani current did. Therefore, Pakistan modified their rice prices due to the changes happening to the Egyptian exchange rate.

The model for Thailand had a higher number of significant coefficients on explanatory variables. The important variables in the Thailand model were export quantity, the exchange rate of India, per capita GDP, producer price index of the US, and time trend. The positive inverse residual demand indicates that as Thai rice prices increase, their exports to Saudi Arabia grow. This is contrary to expectations. Thailand prices do rise as the exchange rate from India increases. The results also suggest that Thailand can increase its price as the producer price index in the US increases. Surprisingly, the coefficient of percapita of real disposable income for Saudi citizens was positive and significantly different from zero for Thailand only. An increase in per capita GDP by 1% leads to a 1.32% increase in the Thailand price in Saudi Arabia. Thailand is the largest rice exporter, so income increases for Saudi Arabia and worldwide demand for rice increases (as measured by world rice price) might force Saudi Arabia to import rice from Thailand. This might be related to the increase in the number of workers who came from South Asia during the study period. The time trend sign indicates that Thailand export prices are falling during the study period. Saudi Arabian income and consumption of Thailand rice are increasing (annual growth averaged 0.29% during the study period), so it might be difficult for the model to apportion variation in Thai rice prices to these correlated variables.

In the US model, the export quantity and the non-Saudi citizen population were the important variables that influence the US export price. The positive sign for the inverse residual demand was contrary to economic logic and demonstrated that the US had no market power in their rice shipments. As the US increases its rice price to SA, it sells more. This positive sign is similar to the finding of Zhang et al. (2007), who found that the US and Brazil exports of soybeans were competitive and had a positive sign on residual demand. They argued that the positive coefficient was related to the growth of world soybean demand. The number of non-Saudi residents had a positive coefficient, which shows that increased the number of non-Saudi lead to an increase in the export price. Al-Saffy & Mousa (2012) and Ahmed & Mousa (2014) show the rice of demand in Saudi Arabia will grow as the population grows and the number of visitors increase.

Conclusion and Recommendation

This paper examines the Saudi Arabian rice market. Due to the water scarcity and climate condition, Saudi Arabia imports all its rice from abroad. During the 2009-2013, the quality of rice required for consumer preference led Saudi Arabia to be the second-ranked importer of rice in value terms. This results in intense competition among exporters to obtain a

larger share of Saudi rice. Therefore, this paper examines the intensity of competition among these countries using an inverse residual demand function as used by Reed & Saghaian (2004), which was estimated using annual data from 1993 to 2014. The results indicate that Australia, India, and Pakistan enjoy a markup of price over marginal cost in the Saudi rice market. India had the highest rice mark up, and Australia had the lowest. Egypt, Thailand, and the US were found to be price takers in the market.

Saudi Arabia appears to be paying more for its rice imports from some suppliers due to their markup policies. Rice imports from India seem to have a particularly high markup. This could be due to the unique characteristics of India's rice, being long-grained, brown, Basmati rice. Saudi consumers seem to prefer this type of rice (Ahmed & Mousa, 2014, 2015). An analysis which uses data on rice characteristics might verify these ideas. This is certainly an area of future research but it requires more detailed data than we have available. Nonetheless, Saudi Arabia should consider diversifying its suppliers of rice to reduce its reliance on some suppliers, especially India (Baazeem, 2007; Ahmed & Mousa 2014). Egypt seems a reasonable supplier since it is a price taker.

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