Political Instability, Food Supply Disruptions and Food Security in a Highly Import-Dependent Economy

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Abstract

This study assesses the impact of political instability in food exporting countries on food imports in a wealthy Gulf Arab state with heavy reliance on food imports for its food security. As a solution, we develop a set of preferences and import substitution elasticities for the country’s four most important food categories, meats, dairy, vegetables and cereals, which constitute some of the food items Qatar imports from more than 100 countries each year. Based on our analyses, India, Australia and the Netherlands emerge as the country’s most competitive sources of food, followed by Brazil, Jordan and Argentina.

Keywords: Political instability; food import substitution elasticity; restricted source-differentiated almost ideal demand system; Qatar

JEL: F14, Q18
1. Introduction

With a population of nearly 54 million and large tracts of desert land that is too dry for sustainable agriculture, the Gulf region is the world’s largest food importer largely buttressed by their enormous hydrocarbon wealth. The heavy dependence on imports leaves these countries highly susceptible to supply disruptions in food markets. Among the causes of food supply disruptions is political instability in food exporting countries which tend to have significant impact on food security in net food importing countries in general. This is especially true for Qatar, a small wealthy country which depends on food imports from more than one hundred countries each year, including large amounts of specific food types from its neighbors the Kingdom of Saudi Arabia (KSA) and United Arab Emirates (UAE).

In June 2018, KSA and UAE led the imposition of strict land, air and sea blockades on Qatar, further exacerbating Qatar’s food security problem, despite immense hydrocarbon wealth. With no end in sight, the current blockade has precipitated an unprecedented change in aggregate imports patterns for goods and services, and especially food imports, hitherto unforeseen in Qatar.

Additional shocks to current levels of instability in some food exporting countries is likely to introduce both covariate and idiosyncratic food supply risks in Qatar, which may lead to major swings in food supply and prices and threaten Qatar’s own food security (Kaitibie, et al., 2019). Furthermore, Qatar’s geographical location threatens its food imports. For example, Qatar relies mainly on two shipping routes for its imports, i.e., the Suez Canal and the Strait of Hormuz. Recent political instability in Egypt and terrorism-related activities in the Sinai region have raised concerns about the safety and reliability of commercial shipping through the Suez Canal. Similarly, persistent political and military tensions in the Strait of Hormuz put that route in peril too. Therefore, it is important to understand the relationship between political instability in food exporting countries and its effect on the food security of a highly import-dependent economy like
Qatar’s. This study provides results that may help to refine and further develop the country’s food import strategy.

We used an extended system of generalized method of moments (GMM) estimator of Blundell and Bond (1998) to examine the relationship between political instability in food exporting countries and the food security of Qatar. The study employed the restricted source-differentiated almost ideal demand system (RSDAIDS) to estimate food import substitution elasticities for Qatar. We estimated food import elasticities for the State of Qatar to identify a set of alternative food source markets that Qatar can tap into as a way to hedge against the risk of food supply disruption.

Against this background, this study addresses two important questions for Qatar: one, how does political instability in food source countries affect Qatar’s food imports? And two, what leverage does Qatar have to guarantee its long-term import-based food security?

2. Methods and data

For the first question, the study used an extended system generalized method of moments (GMM) estimator of Blundell and Bond (1998) to examine the relationship between political instability in food exporting countries on Qatar’s national food security. Previous studies on political instability vs food security have mainly concentrated on the casual effect of food insecurity as a trigger for political crises and instability. Our model used the contemporaneous first differences as instruments to account for endogeneity in the country effect.

The literature identifies several factors that influence trade. These include, inter alia, factor endowments, export/import prices, distance between trading partners, real exchange rates and tariffs (e.g., Helpman, 1987; Serlenga & Shin, 2007). To this set of variables, this present study
innovatively adds the degree of political stability in exporting countries as an influencer of international trade. Based on equation (1), the following empirical model was fitted

\[ \ln M_{ijt} = \beta_0 + \beta_1 \ln(M)_{ijt-1} + \beta_2 \ln(FDI)_{jt} + \beta_3 \ln(GDP)_{it} + \beta_4 \ln(GDP)_{jt} + \beta_5 \ln(UP)_{ijt} + \beta_6 PS_{jt} + \beta_7 IND_{j} + \beta_8 OIC_{j} + \omega_{ij} + \nu_{ijt}. \]  

(1)

The variables are described in Table 1.

For the second question, we employed a restricted source-differentiated almost ideal demand system (RSDAIDS) model of Deaton and Muellbauer (1980) on 2004Q1-2017Q3 Qatar’s food import data to compute import substitution elasticities of different meat types (the most imported food commodity in Qatar) imported from different countries.

The study used quarterly data obtained from Qatar’s Foreign Trade System for the period 2004-2017. The data comprised 8-digit HS code with 22 chapters of food imports showing commodity weight and value, port of import, year and source country. The study focused on four important food import categories in Qatar, i.e., meats (Chapter 2), dairy (Chapter 4), vegetables (Chapter 7), and cereals (Chapter 10). Population and consumer price index (CPI) data were obtained from quarterly returns of Qatar’s Ministry of Development Planning and Statistics. Commodity import prices were obtained by dividing import values by their corresponding weights and then deflated using the CPI. The real per capita expenditure on each commodity was obtained by dividing total import value in each quarter by the population and then deflating by the CPI.

A country was identified as an eligible food exporter to Qatar if it accounted for 10 percent of the food import value in each food type (see Yang and Koo, 1994). All countries which did not meet this criterion in each food type were lumped together in the food import source called “rest of the world [ROW]”. The food import data were then offered to the restricted source-
differentiated almost ideal demand system (RSADAIDS) model written in SAS to derive Marshallian and expenditure elasticities for each commodity type.

3. Results

We found that until the June 2017 economic blockade, KSA and UAE were the leading food exporters to Qatar accounting for 27.6 percent of total food imports with about 40 percent of these imports being trucked overland through KSA from the Suez Canal. After the blockade, KSA’s and UAE’s value of food exports to Qatar fell by 99.3 and 91 percent respectively in 2017Q3. That of Turkey rose by 149.7 percent over the same period.

Political instability and food security

The study found that political instability in food source countries indeed has a large negative impact on Qatar’s food imports. Further, Qatar has an extremely slow speed of recovery of 11.52 months in the event of a sudden shock to its food import supply chain. Overall, Qatar’s food import demand is price inelastic but highly income elastic. While the region-of-origin and religious affinity matters in Qatar’s food import decisions, the stabilization of food supply seems to be the overriding motivation in its import diversification strategy.

In the extended system GMM, all the regressors were statistically significant (see Table 2). This demonstrates asymptotic efficiency in the estimator and therefore utility in parameter estimation using dynamic panel data (Blundell & Bond, 1998). As expected, the coefficient on the lagged dependent variable, $M_{t-1}$, was positive and significant at the 1 percent level. This suggests the existence of a latent long-term target food import demand in Qatar that is highly dependent on habit formation. The food import demand exhibits a moderate speed of adjustment of 0.51, indicating that Qatar’s food import demand would adjust to the target level only after 0.96 years in case of an unexpected shock in the import supply chain. This implies that Qatar faces the risk
of almost a year of food shortages if there was a substantial disturbance in the food import supply system.

The coefficient of the political stability indicator \((PS_{jt})\) was negatively but significantly associated with Qatar’s food import demand. Hence, a unit change in the political stability index would reduce Qatar’s food import demand by approximately 18.7 percent. This means that Qatar obtains its food imports mainly from politically unstable countries. The apparent propensity of Qatar to source food from politically unstable countries could be explained by proximity. For example, India, Saudi Arabia and Pakistan are in Qatar’s neighborhood and are major food suppliers to Qatar. Other variables such as FDI, GDP, unit price, and membership in the OIC were statistically significant.

The dummy capturing Qatar’s importation of food from the Indian subcontinent was significant and had the expected positive sign. This suggests that Qatar’s food import demand is strongly influenced by the country origin. A shift from being outside the Indian subcontinent would, all else being equal, lead to a 1.43 percent increase in food import demand by Qatar. This finding reveals an underlying bilateral affinity between Qatar and countries in the Indian subcontinent.

*Import source diversification as food security strategy*

*Meats*

Beef, goat, pork, poultry and sheep were the most important meat types imported in Qatar during the study period. Pork had many missing observations, and together with other meat types such as frog, offal, rabbit, horses and reptile, was classified as “other meats”. Poultry was the most demanded meat and accounted for 53.6 percent of total import value. It was followed by sheep, beef and goat in that order.
The main source of poultry was Brazil while that of beef, goat and sheep meat was Australia. Goat meat had the most diverse sources compared with poultry, beef and sheep.

*Marshallian price and expenditure elasticities of demand for various meats imported into Qatar*

Table 3 presents the Marshallian price and expenditure elasticities as well as the parameters for seasonal demand shifters. Notably, all the own-price country of origin elasticities were negative as expected from theory. Within each meat group, Australian beef, goat and sheep meat as well as poultry from all the three sources were price elastic with an absolute own-price elasticity of more than unity. Positive (negative) cross-price elasticities reveal whether a commodity is a substitute (complement). Accordingly, Australian beef is a substitute for that from the USA and ROW but a complement for Indian beef probably due to its high (grass-fed) quality (see Mutondo and Henneberry, 2007). Indian beef is a complement to that from USA and ROW.

In the goat meat market, Australian goat is a substitute for all the other goat meat sources, i.e., Brazil, India, UAE and ROW, suggesting its high competitiveness in the Qatar meat market. Interestingly, this substitution is symmetric. Brazilian goat meat is a substitute for UAE’s but a complement for India’s and ROW’s. At the same time, Indian goat meat substitutes that of UAE and ROW. These findings suggest that Australian goat meat is the most preferred in the Qatar meat market followed by that from Brazil, India and UAE in that order. This may reflect quality differences. The poultry market is dominated by Brazilian meat, which dwarfs that from KSA and ROW. Nevertheless, poultry meat from KSA is a substitute for that from ROW. Indian sheep is a strong substitute for Australian one but a complement to that from ROW.

All the expenditure elasticities are positive. The results suggest that as beef imports increase, Qatar imports more from India, Australia and ROW in that order than from the USA. This could be explained by the close proximity that India and Australia are to Qatar relative to the
USA. It could reflect the close cultural ties that Qatari residents have with the Indian subcontinent. Surprisingly, goat meat from all sources has an expenditure elasticity of less than unity. Nonetheless, given that all the expenditure elasticities are positive suggests a high preference for goat meat from ROW, India and UEA in that order. Among poultry meat sources, Qatari residents seem to have a higher preference for poultry meat from KSA and ROW than from Brazil. In the sheep market, meat from Australia and ROW is more preferred than that from India.

Only a few quarterly dummies were statistically significant at $\alpha = 0.05$. The expenditure share of beef imports from Australia increased in quarter 1 but declined in quarter 3 relative to quarter 4. Likewise, expenditure share of beef from ROW, goat from UAE and sheep from India increased significantly in quarter 2 relative to quarter 4 while that of goat from ROW decreased in quarter 3. These changes in expenditure shares could be associated with shifts in consumer tastes and preferences as well as surges in the demand for particular meat types during religious, cultural and social festivities in Qatar over those periods.

*Dairy products*

Milk, cheese, yoghurt and butter were the most important dairy products imported in Qatar between 2004 and 2017 by import value. Buttermilk, cream, edible products of animal origin, ghee, laban, other fats and oil derived from milk and whey were lumped into “Other” products. As shown, milk accounted for almost half of dairy product imports. It was followed by cheese and yoghurt at 22.6 and 15.3 percent respectively. Butter was the least important product. Before June 2017, KSA was the leading dairy product exporter to Qatar accounting for 45.1 percent of the dairy imports, followed by Netherlands (11.5%), UAE (5.1%) and Turkey (4.2%)

Following the June 2017, KSA and UAE completely ceased exporting dairy products to Qatar. Accordingly, the Qatari dairy industry was hard hit by the sudden withdrawal particularly
of products originating from KSA. Turkey took over from KSA and UAE as leading dairy product exporter to Qatar in 2017Q3. However, that role has abated somewhat with a sharp drop of imports from all countries in 2017Q4 and 2018Q1, perhaps reflecting an increase in domestic production.

*Marshallian price and expenditure elasticities of demand for various dairy products imported into Qatar*

As shown in Table 4, all own-price elasticity of demand for dairy products were negative as expected from theory. The fact that cheese’s own-price elasticities were less than unity suggests inelastic demand for cheese from all sources. It also indicates that cheese from KSA is a gross complement to that of ROW and vice versa. In the milk market, the demand for milk from Netherlands and ROW is highly elastic as indicated by their high absolute own-price elasticity. However, that for milk from KSA is inelastic perhaps reflecting the strong economic and cultural ties that KSA had with Qatar before the blockade. Milk from KSA is a substitute for that from Netherlands and ROW while that from Netherlands substitutes that from ROW. The latter is a gross complement to milk imports from the other two sources.

With respect to the yoghurt market, the demand for yoghurt from KSA is inelastic, again suggesting a high preference for it among Qatari consumers. On the other hand, the demand for yoghurt from ROW is highly elastic as expected, owing to diverse sources of yoghurt in ROW with quality and seasonal differences. As in the case of milk, yoghurt from KSA is a gross substitute for that from ROW, highlighting its high preference among Qatari consumers.

All expenditure elasticities for the three dairy products were positive suggesting that dairy products are considered a luxury in Qatar (Table 4). Within specific commodity groups, dairy products from ROW were more preferred to those from KSA and Netherlands. In addition, milk from Netherlands was more preferred to that from KSA, perhaps reflecting perceived quality differences.
Of the three quarterly dummies evaluated in the model, Q1 was statistically significant for cheese from ROW; Q2 was statistically irrelevant for all the dairy products, while Q3 was statistically significant for four out of eight products considered (Table 4). Notably, Q3 was negative for all dairy products sourced from KSA. This probably reflects the negative effect of the blockade on Qatar’s dairy imports from KSA.

**Vegetables**

The most important vegetables imported in Qatar between 2004 and 2017 were leeks, parsley, onions and potatoes. The “other vegetable” category comprised capsicum, cabbage, garlic, chickpeas, cauliflower, beans and cucumber, among others. India was the leading vegetable exporter to Qatar accounting for 19.7 percent of vegetable imports value. It was followed by KSA and Jordan with 10.5 and 10.1 percent respectively. India was the major source of onions, leeks and parsley which accounted, respectively, for 31.2, 28.2 and 15.3 percent of its vegetable export value in Qatar. KSA, on the other hand, was the leading source of potatoes, which accounted for 14.2 percent of its vegetable export value in Qatar followed by cucumber (9.1%), and Brussels sprouts (8.9%). Jordan was the major source of tomatoes which comprised 59.8 percent of its vegetable export value in Qatar followed by capsicums and cabbages at 8.8 percent each.

*Marshallian price and expenditure elasticities of demand for vegetable imports in Qatar*

As expected from theory, all the own-price elasticities of demand were negative (Table 5). The fact that the own-price elasticity of demand for onions is greater than unity suggests that the demand for onions is highly elastic relative to that for potatoes and tomatoes whose own-price elasticity is less than one. Onions from India are gross substitutes for those from ROW.

With regard to potatoes, Egyptian potatoes are gross complements those from Lebanon but substitutes for potatoes from Netherlands and ROW. Additionally, potatoes from Lebanon are
gross substitutes for those from Netherlands but complements for potatoes from ROW. As well, potatoes from Netherlands complement those from ROW. Jordanian tomatoes are gross substitutes for tomatoes from ROW and vice versa.

Based on the Marshallian income elasticity of demand, onions from India are more preferred to those from ROW. As well, potatoes from Netherlands are more preferred to those from Egypt, which in turn are more preferred to those from ROW. For some unknown reasons, potatoes from Lebanon were least preferred by Qatari consumers. Finally, Jordanian tomatoes were more preferred to those from ROW.

Most of the seasonal dummies were positive and statistically significant in Q1 except for potatoes from Lebanon whose coefficient was negative but significant (Table 5). However, in Q3, all the positive dummy coefficients in Q1 turned out to be negative probably reflecting the negative effect of the blockade on vegetable imports in Qatar. Interestingly, the coefficient on Q3 for Lebanese potatoes turned out positive. Lebanon became the biggest beneficiary after the exit of UAE and KSA in 2017Q2. In fact, it was the second most important source of vegetables after India in 2017Q3 and 2017Q4, replacing UAE which was in second position in 2017Q1.

Cereals

Rice accounted for 64.2 percent of the total cereal import value in Qatar between 2004 and 2017. It was followed by wheat (17.8%), barley (10.3%) and corn (2.8%). Some of the cereals in the “other cereals” category were oats, meslin, millet and sorghum, among others. India was the leading cereal exporter to Qatar accounting for 34.9 percent of the total cereal import value over the study period. It was followed by Pakistan and Australia at 25.9 and 11 percent respectively. India and Pakistan were the major sources of rice imports while Australia and Ukraine were the major suppliers of wheat and barley respectively.
Marshallian price and expenditure elasticities of demand for various cereals imported into Qatar

All the own-price elasticities of the three cereals were negative as expected from theory (Table 6). In corn, all own-price elasticities were greater than unity in absolute terms indicating elastic demand for corn in Qatar. On the other hand, all cross-price elasticities were less than unity. Argentinian corn was a gross substitute for corn from ROW but a gross complement for Indian corn. The latter was a gross substitute for corn from ROW.

In the rice market, all own-price elasticities were less than unity in absolute terms indicating inelastic demand for rice in Qatar. This suggests that rice is a major food staple in Qatar. Indian rice was a gross complement for both Pakistani rice and rice from ROW and vice versa, suggesting lack of product differentiation. In other words, Qatari consumers consider rice from the three sources as being similar in all respects.

With regard to wheat, both Australian and wheat from ROW were own-price elastic while Canadian wheat was price inelastic. Australian wheat was a gross complement for Canadian wheat while at the same time Canadian wheat was a gross substitute for both Australian wheat and wheat from ROW, probably reflecting its high quality.

The Marshallian expenditure elasticities for all cereals were all positive except those for Indian corn and Canadian wheat. Therefore, ceteris paribus, an increase in income of Qatari consumers will raise the demand for all cereals but diminish that for Indian corn and Canadian wheat. In other words, both Indian corn and Canadian wheat are inferior goods. Within each cereal group Qataris preferred corn from ROW followed by that from Argentina. They however “disliked” corn from India. Pakistani rice was more preferred to that from ROW and India; the latter was least preferred. As well, wheat from ROW was more preferred to that from Australia.
Canadian wheat was “disliked” although it had the lowest unit price, which is rather counterintuitive.

Only Q1 and Q2 quarterly dummies were statistically significant and in Pakistani rice and rice from ROW. The coefficient on Q1 for both rice types were negative suggesting that the demand for Pakistani rice and rice from ROW decreased in the first quarter. However, the demand for rice from ROW increased in Q2. The lack of statistical significance of Q3 dummy is testimony to the lack of effect of the blockade on cereal imports. This could be due to the fact that none of the blockading quartet is a major exporter of the three cereals considered in the study.

4. Conclusion

The uniqueness of this study is in its attempt to marry different analytical and theoretical frameworks to elucidate the role of geopolitics in Qatar’s food supply. It provides evidence-based and policy-actionable information on how a small agriculturally-poor country can leverage its immense natural wealth to ward off the pernicious effects of external politics in its food supply. At the same time, the study adds to the growing literature on the impact of politics on food security, a construct that economic orthodoxy has largely ignored often terming it exogenous to the system under analysis. It is worth noting that Qatar, despite being the richest country on earth on a per capita basis, is an information-scarce country. This study is the first of its kind to comprehensively assess the impact of political events in the country – a rather a sensitive subject in this part of the world – on food security. These issues make this paper particularly interesting and we expect it to induce huge discussion among the audience attending the conference.

The results revealed that Qatar can actually diversify its meat sources away from politically unstable countries. For example, the results show that Australia, a politically stable country, is the most competitive source of beef, goat and sheep meat. In addition, USA has overtaken India, a
relatively politically unstable country, in terms of meat supply to Qatar since 2013Q2. On the other hand, Indian beef and Brazilian goat meat are complements in their respective commodity markets while in the poultry market, Brazil, KSA and the rest of the world (ROW) are equally competitive. Expenditure elasticities indicate that Indian beef is more preferred to that from Australia, ROW and USA in that order. In the goat meat market, the order of preference is ROW, India, UAE and Australia. Qatari residents have a higher preference for poultry meat from KSA (which has however banned all trade with Qatar) followed by ROW and Brazil in that order. In the sheep market, meat from Australia is more preferred to that from ROW and India.

Based on these results, India, Australia and Netherlands emerge as food import sources of major importance for Qatar. Minor suppliers include Brazil (poultry), Jordan (tomatoes) and Argentina (Corn). It would be advisable for Qatar to look into ways of enhancing good bilateral relations with these countries for a more sustainable and mutually beneficial food trade.
References


Table 1. Definition and Signs of Factors Hypothesized to Influence Qatar’s Food Import Demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Data source</th>
<th>Hypothesized sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln M</td>
<td>Natural log of annual total Qatar’s food import quantity</td>
<td>Qatar Statistics Authority</td>
<td></td>
</tr>
<tr>
<td>lnM&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>Natural log of lagged annual total Qatar’s food import quantity</td>
<td>Qatar Statistics Authority</td>
<td>+</td>
</tr>
<tr>
<td>lnFDI</td>
<td>Natural log of FDI net inflows (BoP, current US$)</td>
<td>World Development Indicators (WDI)</td>
<td>+</td>
</tr>
<tr>
<td>lnGDP&lt;sub&gt;t&lt;/sub&gt;</td>
<td>Natural log of GDP per capita of Qatar at constant prices</td>
<td>World Development Indicators (WDI)</td>
<td>+</td>
</tr>
<tr>
<td>lnGDP&lt;sub&gt;j&lt;/sub&gt;</td>
<td>Natural log of GDP per capita of exporters at constant prices</td>
<td>World Development Indicators (WDI)</td>
<td>+</td>
</tr>
<tr>
<td>lnUP</td>
<td>Natural log of nominal unit price of food imports (US$)</td>
<td>Qatar Statistics Authority</td>
<td>-</td>
</tr>
<tr>
<td>PS</td>
<td>Political stability indicator (−2.5=least politically stable; +2.5=most politically stable)</td>
<td>World Governance Indicators (WGI)</td>
<td>+</td>
</tr>
<tr>
<td>IND</td>
<td>Dummy for importing food from the Indian subcontinent</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>OIC</td>
<td>Dummy for Qatar’s membership in the OIC</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Variable</td>
<td>Estimator</td>
<td>Fixed-effects</td>
<td>Random effects</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------</td>
<td>---------------</td>
<td>----------------</td>
</tr>
<tr>
<td>lnM_{i,t-1}</td>
<td>0.325*** (0.0603)</td>
<td>0.651*** (0.0486)</td>
<td>0.490*** (0.00295)</td>
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<tr>
<td>lnFDI_{j}</td>
<td>0.0778 (0.0627)</td>
<td>0.0953* (0.0497)</td>
<td>0.0730*** (0.00629)</td>
</tr>
<tr>
<td>lnGDP_{i}</td>
<td>2.328*** (0.679)</td>
<td>0.296*** (0.0842)</td>
<td>0.763*** (0.0223)</td>
</tr>
<tr>
<td>lnGDP_{t}</td>
<td>-0.594 (1.694)</td>
<td>1.998*** (0.839)</td>
<td>2.458*** (0.137)</td>
</tr>
<tr>
<td>lnUP_{ij}</td>
<td>-0.712*** (0.192)</td>
<td>-0.715*** (0.145)</td>
<td>-0.825*** (0.00733)</td>
</tr>
<tr>
<td>PS_{j}</td>
<td>-0.492** (0.235)</td>
<td>0.151(0.110)</td>
<td>-0.187*** (0.0355)</td>
</tr>
<tr>
<td>IND_{j}</td>
<td>-</td>
<td>0.475 (0.485)</td>
<td>1.430*** (0.312)</td>
</tr>
<tr>
<td>OIC_{j}</td>
<td>-</td>
<td>0.647*** (0.198)</td>
<td>1.332*** (0.113)</td>
</tr>
<tr>
<td>Constant</td>
<td>-47.08*** (12.23)</td>
<td>-26.34*** (9.443)</td>
<td>-41.32*** (1.685)</td>
</tr>
<tr>
<td>N</td>
<td>699</td>
<td>699</td>
<td>699</td>
</tr>
<tr>
<td>σ_{a}</td>
<td>3.112</td>
<td>0.634</td>
<td></td>
</tr>
<tr>
<td>σ_{u}</td>
<td>1.154</td>
<td>1.154</td>
<td></td>
</tr>
<tr>
<td>Rho (ρ)</td>
<td>0.879</td>
<td>0.231</td>
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<tr>
<td>$R^2$ (overall)</td>
<td>0.477</td>
<td>0.837</td>
<td></td>
</tr>
<tr>
<td>Cluster-Robust Hausman Test</td>
<td>$x^2(7) = 20.77$ Prob. ($x^2$) = 0.0041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sargan-Hansen statistic</td>
<td>$x^2(6) = 84.574$ Prob. ($x^2$) = 0.000</td>
<td>$x^2(266) = 84.50$ Prob. ($x^2$) = 1.000</td>
<td></td>
</tr>
<tr>
<td>Correlation 2 (p-values)</td>
<td>0.7862</td>
<td></td>
<td></td>
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The symbols ***, **, * denote statistical significance at 1%, 5% and 10%, respectively. Robust standard errors are in parenthesis.
Table 3. Marshallian and expenditure elasticities and seasonality parameters of Qatar’s meat import demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beef</th>
<th>Goat</th>
<th>Poultry</th>
<th>Sheep</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aus</td>
<td>Ind</td>
<td>USA</td>
<td>ROW</td>
<td>Aus</td>
</tr>
<tr>
<td>PbeefAus</td>
<td>-1.147</td>
<td>-0.0308</td>
<td>0.0020</td>
<td>0.04245</td>
<td></td>
</tr>
<tr>
<td>PbeefInd</td>
<td>-0.0532</td>
<td>-0.3366</td>
<td>-0.4362</td>
<td>-0.4052</td>
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<tr>
<td>PbeefUSA</td>
<td>0.03498</td>
<td>-0.4956</td>
<td>-0.5071</td>
<td>-0.2036</td>
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<tr>
<td>PbeefROW</td>
<td>0.04521</td>
<td>-0.2076</td>
<td>-0.970</td>
<td>-0.8496</td>
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</tr>
<tr>
<td>PGoatAus</td>
<td>-1.398</td>
<td>0.2532</td>
<td>0.4670</td>
<td>0.1980</td>
<td>0.1338</td>
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<td>PGoatBra</td>
<td>0.3378</td>
<td>-0.5251</td>
<td>-0.0377</td>
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<td>-0.0970</td>
</tr>
<tr>
<td>PGoatInd</td>
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<td>-0.9499</td>
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<tr>
<td>PGoatUAE</td>
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<td>0.3089</td>
<td>0.0257</td>
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<td>-0.0255</td>
</tr>
<tr>
<td>PGoatROW</td>
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<td>0.1642</td>
<td>-0.0136</td>
<td>-0.4595</td>
</tr>
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<td>PPoulkBRA</td>
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<tr>
<td>PPoulkBRA</td>
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<td>PSheepAus</td>
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<td>-0.0856</td>
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</tr>
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<td>2.125</td>
<td>3.789</td>
<td>1.878</td>
</tr>
<tr>
<td>PSheepROW</td>
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<td>-2.214</td>
<td>-3.1434</td>
<td>-0.8193</td>
<td>-2.602</td>
</tr>
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<td>POther</td>
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<td>0.2358</td>
<td>0.1391</td>
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<td></td>
</tr>
<tr>
<td>PBeef</td>
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<td>-0.6976</td>
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<td>1.509</td>
</tr>
<tr>
<td>PGoat</td>
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<td>0.2594</td>
<td>0.3367</td>
<td>0.1374</td>
<td>-0.8336</td>
</tr>
<tr>
<td>PPoulk</td>
<td>0.3712</td>
<td>0.6876</td>
<td>0.8491</td>
<td>0.3597</td>
<td>-3.294</td>
</tr>
<tr>
<td>PSheep</td>
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<td>1.299</td>
<td>0.1589</td>
<td>1.023</td>
<td>0.3234</td>
</tr>
<tr>
<td>Expenditure</td>
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<td>0.005</td>
<td>-0.014</td>
<td>0.013**</td>
<td>-0.000</td>
</tr>
<tr>
<td>Q1</td>
<td>0.004</td>
<td>-0.005</td>
<td>0.010</td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Q2</td>
<td>-0.01**</td>
<td>-0.001</td>
<td>0.008</td>
<td>-0.008</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

Aus = Australia; Ind = India; Bra = Brazil; UAE = United Arab Emirates; Pbeef = price of beef; PGoat = price of goat meat; PPoulk = price of poultry meat; PSheep = price of sheep meat; Q1-3 = Quarter 1 to 3. **= significance at 5% level.
Table 4. Marshallian price and expenditure elasticities and seasonality parameters of Qatar’s dairy product import demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cheese</th>
<th>Milk</th>
<th>Yogurt</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KSA</td>
<td>ROW</td>
<td>KSA</td>
<td>Net</td>
</tr>
<tr>
<td>PCheese_KSA</td>
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<td>-0.1090</td>
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<tr>
<td>PCheese_ROW</td>
<td>-0.0798</td>
<td>-0.9919</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PMilk_KSA</td>
<td></td>
<td>-0.6108</td>
<td>0.15914</td>
<td>0.22070</td>
</tr>
<tr>
<td>PMilk_Net</td>
<td></td>
<td>-0.2778</td>
<td>-1.0130</td>
<td>0.17061</td>
</tr>
<tr>
<td>PMilk_ROW</td>
<td></td>
<td>-0.3694</td>
<td>-1.1297</td>
<td>-1.39986</td>
</tr>
<tr>
<td>PYogurt_KSA</td>
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<td>0.01558</td>
</tr>
<tr>
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<td>-0.8786</td>
<td>-1.2771</td>
</tr>
<tr>
<td>Pother</td>
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<td>0.14361</td>
<td>0.04650</td>
<td>-0.5534</td>
</tr>
<tr>
<td>PCheese</td>
<td></td>
<td></td>
<td>0.38562</td>
<td>0.27617</td>
</tr>
<tr>
<td>PMilk</td>
<td>-0.7065</td>
<td>-0.3054</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PYogurt</td>
<td>0.44394</td>
<td>0.12903</td>
<td>0.36152</td>
<td>0.21724</td>
</tr>
<tr>
<td>Expenditure</td>
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<td>1.12911</td>
<td>0.09666</td>
<td>1.25474</td>
</tr>
<tr>
<td>Q1</td>
<td>0.004844</td>
<td>0.025586**</td>
<td>-0.012</td>
<td>-0.01724</td>
</tr>
<tr>
<td>Q2</td>
<td>0.001563</td>
<td>-0.00307</td>
<td>-0.0028</td>
<td>-0.00608</td>
</tr>
<tr>
<td>Q3</td>
<td>-0.006**</td>
<td>-0.0165*</td>
<td>-0.0238</td>
<td>0.007142</td>
</tr>
</tbody>
</table>

KSA = Kingdom of Saudi Arabia; Net = Netherlands; ROW = Rest of the world; PCheese = Price of cheese; PMilk = Price of milk; PYogurt = Price of yogurt; Q1-3 = Quarters 1 to 3; **, * = significance at 5% and 10% levels respectively.
Table 5. Marshallian price and expenditure elasticities and seasonality parameters of Qatar’s vegetable import demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Onion</th>
<th>Potato</th>
<th>Tomato</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ind</td>
<td>ROW</td>
<td>Egy</td>
<td>Leb</td>
</tr>
<tr>
<td>POnion_Ind</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>POnion_ROW</td>
<td>0.55763</td>
<td>-1.0958</td>
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<tr>
<td>PPotato_Egy</td>
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<td>0.1279</td>
<td>0.35980</td>
<td>0.04908</td>
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<tr>
<td>PPotato_Leb</td>
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<td>-0.4325</td>
<td>0.11791</td>
<td>-0.0499</td>
</tr>
<tr>
<td>PPotato_Net</td>
<td>0.35531</td>
<td>0.08282</td>
<td>-0.9459</td>
<td>-0.1566</td>
</tr>
<tr>
<td>PPotato_ROW</td>
<td>0.02874</td>
<td>0.00034</td>
<td>-0.0331</td>
<td>-0.8332</td>
</tr>
<tr>
<td>PTomato_Jor</td>
<td>-0.8987</td>
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<tr>
<td>PTomato_ROW</td>
<td>0.17034</td>
<td>-0.7911</td>
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</tr>
<tr>
<td>Pother</td>
<td>-0.1743</td>
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<td>POnion</td>
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</tr>
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<td>-0.0603</td>
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</tr>
<tr>
<td>PTomato</td>
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<td>3.52147</td>
</tr>
<tr>
<td>Expenditure</td>
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<td>0.71976</td>
<td>1.00525</td>
<td>0.56029</td>
</tr>
<tr>
<td>Q1</td>
<td>0.03**</td>
<td>-0.01112</td>
<td>0.02***</td>
<td>-0.02**</td>
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<tr>
<td>Q2</td>
<td>-0.01016</td>
<td>-0.00992</td>
<td>-0.00327</td>
<td>0.009482</td>
</tr>
<tr>
<td>Q3</td>
<td>-0.02**</td>
<td>0.02**</td>
<td>-0.01**</td>
<td>0.012**</td>
</tr>
</tbody>
</table>

Ind = India; Egy = Egypt; Leb = Lebanon; Net = Netherlands; Jor = Jordan; ROW = Rest of the world; POnion=Price of onion; PPotato = Price of potato; PTomato = Price of tomato; Q1-3 = Quarters 1 to 3; ***, **, * = significance at 1%, 5% and 10% levels respectively.
Table 6. Marshallian price and expenditure elasticities and seasonality parameters of Qatar’s cereal import demand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corn</th>
<th>Rice</th>
<th>Wheat</th>
<th>Other</th>
</tr>
</thead>
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<td>Arg</td>
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<td>ROW</td>
<td>Ind</td>
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<tr>
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<td>-0.9919</td>
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<tr>
<td>PWheat</td>
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<td>0.269</td>
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</tr>
<tr>
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<td>0.996</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>-0.006</td>
<td>0.001</td>
<td>-0.00</td>
</tr>
</tbody>
</table>

Arg = Argentina; Ind = India; Pak = Pakistan; Aus = Australia; Can = Canada; PCorn = Price of corn; PRice = Price of rice; PWheat = Price of wheat; Q1-3 = Quarters 1 to 3; **, * = significance at 5% and 10% levels respectively.