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Dairy Product Trade Potentials between Gulf Cooperation Council Countries, European Union Selected Countries and the United States

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Abstract

The objective of this research is to investigate the potentials trade of dairy products between origin countries including selected EU countries and the U.S. on one hand, and Gulf Cooperation Council (GCC) countries, on the other hand. Results showed that when destination country's real GDP increases by 1% value of dairy products exports increases by 0.28%. The model also showed that when destination country's population increases by 1% dairy products exports increase by 0.32 %. Further, the gravity model is found to be sensitive to the set of selected independent variables.

Keywords: dairy products trade, Gravity Model, Gulf Cooperation Council Countries, European Union, United States.

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Background

The Gulf Cooperation Council is a group of six Gulf States; namely, Kingdom of Saudi Arabia, United Arab Emirates, Oman, Kuwait, Qatar, and Bahrain (hereafter denoted by GCC). Total population is estimated at 44.5 million in 2010. This total population is distributed between the GCC countries as follow: Kingdom of Saudi Arabia 27.3 million (or 60% of the region's population), United Arab Emirates 8.4 million, Kuwait 3.0 million, Oman 2.8 million, Qatar1.8 million, and Bahrain 1.2 million (World Bank 2013). The region is located east to both of the Arabian Gulf and the Gulf of Oman, provided with an advantageous global location so as to be a hub for trade between the west and east sides of the worldwide countries. Nowadays, many of the countries in this region receive and ship millions of merchandized trade that varies from spices to automobiles to airplanes parts. Such location, accompanied with the increasing economic growth in the region and increasing demand for dairy products, make it a highly potential destination for dairy exports from major dairy products' producers and exporters in the European Union countries (e.g. Denmark, France, Germany, and the Netherland), as well as the United States. This research selected such major dairy-products exporting countries to be the origin of dairy products. Meanwhile, this research is considering the GCC countries to be the destination countries for dairy products. GCC countries face a challenging environment and a declining stock of natural resource endowment that is preventing local supply from meeting the increasing demand for livestock products, including dairy products. In such condition, investigation of the factors that influence trade in food products, especially protein products, becomes of a high interest to research community as well as policy-makers on both sides of the trade origins and destinations.

Gross Domestic Product (GDP), adjusted by purchasing power parity for each of the GCC countries, the importing countries of dairy products in this research, were reported to be $564, $318, $125, $123, $68, and $27 billion for Saudi Arabia, United Arab Emirates, Kuwait, Qatar, Oman, and Bahrain, respectively in 2010 (World Bank 2013). Per capita of these GDP values in the GCC countries are widely different from one country to another. Per capita GDP for the GCC countries were estimated to be $78, $46, $42, $27, $24, and $23 thousand for Qatar, Kuwait, United Arab Emirates, Oman, Bahrain, and Saudi Arabia, respectively in 2010. Per capita GDP in the exporting countries were estimated to be $47, $42, $41, $38, and $34 in the United States, Netherlands, Denmark, Germany, and France, respectively in 2010 (World Bank 2013).

Total Imports of dairy products from the selected EU origin countries (Denmark, Netherlands, Germany, and France) to the GCC countries are estimated to be about 250 thousand ton of milk equivalent products and worth about $800 million in 2010. Meanwhile, dairy products' imports from the United Sates to the GCC countries are estimated to be 28 thousand tons valued at $94 million in 2010 (UNCOMTRADE 2013). This research main objective is to explore the relationship between factors such population, per capita GDP changes as well as the distance between dairy products exports from origin countries and the GCC countries to provide insight into future trading potentials. And to further develop future findings about the best fit econometric model to represent such important relations.

Research Objectives

The goal of this research is to explore demand for imports' characteristics of dairy products' imports by GCC countries from the selected EU countries (Denmark, France, Germany, and Netherlands) and U.S. To achieve this goal, this research identified threefold objective which is:

- To identify best fit gravity model's specifications for modeling dairy products trade between the three trade blocks (U.S., selected EU, and GCC countries) in order to estimate model's parameters under the gravity model approach (including the distance as an explanatory variable in the gravity logarithmic model). Model detailed description is described in the methodology section of this document;
- To discuss socio-economic drives (explanatory variables) for such demand for dairy products in the GCC countries using gravity model 2000-2010 panel data model for dairy products trade model that illustrates the relationship between value of exports and the selected explanatory variables; and
- To measure responsiveness of dairy products trade changes due to changes in the gravity model's explanatory variables (e.g. population and GDP).

Previous Studies Review

Gravity model approach has been used intensively to analyze trade flow between counties including trade on food products. Kay Cao and Robin Johnson (2004 and 2006) published two studies that apply the gravity model's theoretical framework. In their first study in 2004, the authors stated that the commodity-specific gravity model, as derived by Bergstrand (1985 and 1989), explains bilateral trade flows as a function of the two countries' income, per-capita income (or population), transportation costs, and other factors that may be aiding or restricting trade such as tariffs, exchange rate, prices, and health regulations (Cao and Johnson 2004). Their second study published in 2006 defines the gravity model as a model that adapts the gravitational concept to the form of any exchange between two groups. In its basic form, the amount of trade between two countries is a function of their national incomes and the distance between them, which is used as a proxy for transportation costs. Any flow from country i to country j can be explained by economic forces at the flow's origin, economic forces at the flow's destination, and the economic forces, either aiding or resisting the flow's movement from origin to destination (Bergstrand 1985). These models commonly uses dummy variables in order to capture contiguity effects, cultural and historical similarities, common languages, regional integration, political blocs, and patent rights (Cao and Johnson 2006).

A relatively recent study by Sarker and Jayasinghe (2007) showed that the proliferation of regional trade agreements in recent years has intensified the debate on the desirability of these agreements in themselves and their coexistence with multilateral free trade under the WTO. This study contributes to this debate by analyzing trade creation and trade diversion effects of the European Union on trade flows of six major agri-food products from 1985 to 2000. An extended gravity model is estimated employing pooled data and generalized least squares methods. The results show that the economic developments in the EU countries since the mid-1980s have served to boost agri-food trade significantly among the members. Some of the growth in intra-

EU trade in agri-food products came at the expense of nonmembers as the EU reduced the degree of relative openness to trade with nonmembers during this period and diverted trade from the rest of the world into the intra-EU block of trade channels.

Previous studies showed that Gravity model is a suited econometric model to illustrate the trade flows of merchandise trade between the trade partners. However, these studies show wide range of models specification. This research explores the above issue using four models that are different from each other on the set of included explanatory variables in each model as specified below in the methodology section.

The Gravity Model

The gravity model used for this research includes value of dairy product exports from the origin to the destination countries as the dependent variables. Origin countries are selected EU countries (Denmark, France, Germany, and Netherlands) and the U.S. Destination countries on the other side are the six GCC countries (Saudi Arabia, United Arab Emirates, Kuwait, Oman, Qatar, and Bahrain). The following equation (1) defines the dependent variable as well as the set of independent/explanatory:

$$(1)\quad \ln EXP_{ijt} = \alpha_i + \lambda_j + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln P_{jt} + \beta_4 \ln DIST_{ij} + \mu_{ijt}$$

Where

$\ln EXP_{ijt}$ = *log value of dairy products exports from origin country* $_i$ *to destination country* $_j$ *at time* $_t$
α_i = *Constant*
λ_j = *annual* time effect for 2000 – 2010 time period
Y_{it} = GDP or Per Capita GDP in country i at time t
Y_{jt} = GDP or Per Capita GDP in country j at time t
P_{jt} = Population in country j or Population under 14 years
$DIST_{ij}$ = *is the distance between the countries (*Appendix*)*
μ_{ijt} = *Disturbance term*

Dairy Products Gravity Model Scenarios

Four gravity model scenarios are selected for this research as illustrated in in Table 1. The first model, Model 1 is different from the other three models in including nominal value of GDP variable along with total population for the destination countries as independent variables in the gravity model. The second model, Model 2 used nominal value of GDP along with population under 14 years for the destination countries as independent variables in the gravity model. The third model, Model 3 used GDP values adjusted with purchasing power parity with the population under 14 years combination at the destination countries. Results showed that R^2 of 0.81 or 0.82 indicate overall strong models fitness of the data describing the relationships between the dependent and selected independent variables. Furthermore, F test results of all four models showed very small P–values that approaching zero values which again indicate high

models fitness. However, these results of each model's independent variables significance and magnitude are different as described in the results section of this document.

Table 1. Dairy Products Gravity Model Scenarios

Item	Model 1	Model 2	Model 3	Model 4
Model's Basic Features	Independent Variables Include: Destination Country's Nominal GDP and Total Population	Independent Variables Include: Destination Country's Nominal GDP and =< 14 Yrs Population	Independent Variables Include: Destination Country's GDP PPP Adjusted and =< 14 Yrs Population	Independent Variables Include: Destination Country's GDP PPP and All Population - Best Model
R^2	0.82	0.81	0.82	0.82
F Test Value	151.9	140.9	151.5	154.4
P – Value	0.000	0.000	0.000	0.000

Results

Table 2 below shows the four gravity models results. In the first model, Model 1 the log of nominal GDP is not significant (0.5 T test value and 0.596 P-Value) which indicates model's failure to represent the relationship because the GDP variable is essential variable in the model specification. Model 2 results showed that both log of nominal GDP and log of population under 14 years old are significant variables showing T values 6.2 and 2.1 values respectively. Model 3 which included log of GDP adjusted with purchasing power parity (PPP) and log of population under 14 years old independent variables also failed because the direction (negative sign) between the population under 14 years old as independent variable and the dependent variable (value of exports) is not correct. It is expected that when the number of people under 14 years old increases the value of exports increases. The best model representing the relationship between the value of exports and the independent variables was found to be Model 4. Model 4 was selected to be the best model due to presence of larger number of significant variables compared to the other three models, Models 1 to 3. Model 4 results also show no-misspecification of variables direction similar to what occurred in Model 3. Both major independent variables (log of GDP – adjusted by PPP and log of all population) are found to be significant in Model 4. The distance variables which used to approximate the level of shipment costs between the origin country and the destination country were found to be significant in all four models. Interpretations of the best model results are included in the conclusions section of this paper.

Table 2. Gravity Model for Dairy Products between Selected EU[1], U.S. and GCC Countries

	Model 1			**Model 2**			**Model 3**			**Model 4**		
Model Fitness (R^2)	0.8			0.8			0.8			0.8		
F Test	151			141			152			154		
Explanatory Variable	B	T	P	B	T	P	B	T	P	B	T	P
Constant	11.8	8.7	0.0	16.4	12.0	0.0	17.5	15.6	0.0	14.1	1.0	0.0
Log GDPj (Billion $)	0.0	0.5	0.6	0.4	6.2	0.0						
Log GDPj (Billion $) – adjusted by PPP							0.6	8.5	0.0	0.3	2.7	0.0
Log All Population (by thousands)	0.5	6.2	0.0							0.3	3.0	0.0
Log Population =<14 Yrs old				0.2	2.1	0.0	-0.1	-0.8	0.4			
Log Distance (Km)	-1.2	-9.7	0.0	-1.2	-9.4	0.0	-1.1	-9.2	0.0	-1.2	-9.8	0.0
Pair Trading Countries (Dummy)	0.0	-13.6	0.0	0.0	12.8	0.0	0.0	-13.4	0.0	0.0	-13.6	0.0.
Border Countries (Dummy)	1.4	7.6	0.0	1.4	7.2	0.0	1.4	7.7	0.0	1.4	7.6	0.0
EU Countries[1] (Dummy)	-1.3	-4.8	0.0	-1.3	-4.7	0.0	-1.2	-4.4	0.0	-1.3	-4.8	0.0
Year 0 – 2000	-0.1	-0.6	0.6	-0.1	-0.3	0.8	-0.1	-0.4	0.7	-0.1	-0.7	0.5
Year 1 – 2001	0.0	-0.1	0.9	0.1	0.3	0.8	0.0	0.1	0.9	0.0	-0.2	0.9
Year 2 – 2002	-0.1	-0.3	0.8	0.0	0.1	1.0				-0.1	-0.3	0.7
Year 3 – 2003				0.0	0.2	0.8	0.1	0.3	0.7			
Year 4 – 2004	0.1	0.4	0.7	0.0	0.2	0.8	0.1	0.7	0.5	0.1	0.4	0.7
Year 5 - 2005	0.1	0.5	0.6	0.0	-0.1	0.9	0.2	0.4	0.1	0.6	0.6	
Year 6 – 2006	0.1	0.4	0.7	0.2	0.9	0.4	0.1	0.7	0.5	0.1	0.4	0.7
Year 7 - 2007	0.3	1.5	0.1	0.4	2.1	0.0	0.4	1.9	0.1	0.3	1.6	0.1
Year 8 – 2008	0.6	3.0	0.0	0.1	0.5	0.6	0.6	3.4	0.0	0.6	3.2	0.0
Year 9 – 2009	0.2	1.0	0.3	0.2	1.0	0.3	0.2	1.2	0.2	0.2	1.0	0.3
Year 10 - 2010	0.4	1.9	0.1				0.2	1.0	0.3	0.2	1.0	0.3

[1]Selected EU Countries are Denmark, France, Germany, and Netherlands
GCC countries are: Kingdom of Saudi Arabia, United Arab Emirates, Kuwait, Qatar, and Bahrain
PPP = Purchasing Power Parity which is defined to be rates of currency conversion that eliminate the differences in overall price levels between countries

Conclusions

Recent data sources provided by the UN COMTRADE and USDA, foreign agricultural services food trade extraction tool made it possible to aggregate dairy products trade in one commodity (i.e. milk equivalent). Such aggregation was not possible without such data and the tools. The following is the interpretation of the gravity Model 4 responsiveness, the best model shows that when destination country's real GDP (PPP adjusted) increases by 1% value of dairy products' exports increases by 0.28%. The model also shows that when destination country's total population increases by 1% values of dairy products' exports increases by 0.32%. As anticipated, if the distance between the origin and destination countries increases by 1% the value of dairy exports decrease by 1.19%. Dairy products' trade between U.S. and selected EU countries (Netherlands, Denmark, Germany, and France) one on side and the GCC countries (KSA, UAE, Kuwait, Bahrain, Oman, and Qatar) one the other side, is expanding due to the exponential

economic growth as well as population increases in the GCC countries' trade block. Gravity model is a suitable economic model to predict changes in dairy products' trade between the trading blocks. However, the model is sensitive to explanatory variables' choices. The set of log GDP adjusted by purchasing power parity, log of population, log of distance, and binary variables to represent each pair country, and countries' geographic adjacency (sharing borders) are found to be the best combination of independent variables in the gravity model for dairy products' trade between origin countries and destination countries. These research findings can be useful to policy makers assessing the potential for dairy products' trade between the three trading partners EU, the U.S., as the exporting countries, and the GCC countries as the importing countries in the future.

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Appendix

Gravity Model Distance Matrix between Selected Origin and Destination Countries.

Distance (in Km)	United Arab Emirates	Kuwait	Bahrain	Oman	Saudi Arabia	Qatar	U.S.	Netherlands	France	Denmark	Germany
United Arab Emirates	0	861	428	470	768	300	11,337	5,126	3,238	3,120	4,782
Kuwait	861	0	457	1,324	549	599	10,493	4,259	4,344	4,170	3,917
Bahrain	428	457	0	875	421	142	10,950	4,731	4,799	2,885	4,388
Oman	470	1,324	875	0	1,122	734	11,807	5,579	5,663	5,469	5,235
Saudi Arabia	768	549	421	1,122	0	485	10,842	4,479	4,460	4,450	4,142
Qatar	300	599	142	734	485	0	11,091	4,822	4,898	4,730	4,479
U.S.	11,337	10,493	10,950	11,807	10,842	11,091	0	7,782	8,035	7,734	8,098
Netherlands	5,126	4,259	4,731	5,579	4,479	4,822	7,782	0	771	477	343
France	3,238	4,344	4,799	5,663	4,460	4,898	8,035	771	0	1,242	871
Denmark	3,120	4,170	2,885	5,469	4,450	4,730	7,734	477	1,242	0	501
Germany	4,782	3,917	4,388	5,235	4,142	4,479	8,098	343	871	501	0

Source. Map Crow. http://www.mapcrow.info/