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Revealed Comparative Advantage of Saudi's Exports

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Abstract

Saudi Arabia is an oil based economy, getting about 40% of its GDP and around 90% of its export earnings from oil and gases. This paper aims at identifying the products in which country has comparative advantage using Balassa's method of revealed comparative advantage, and to examine their long run and short run relationship with export price and world income. The paper found that Saudi Arabia has comparative advantage in exporting mineral fuels, oil, distillation products; non-mineral products like organic chemicals; fertilizers; and plastic and articles threof. The study further finds that mineral fuels, oil, distillation products and plastic and articles threof have significant relationship with world income and export price. Organic chemicals is found to be significantly related to world income but not to export price.

Key Words: Export, comparative advantage, bound test

Introduction

The Kingdom of Saudi Arabia (KSA) is one of the largest economies in the Middle East and North Africa (MENA) region. The KSA's economy is heavily dependent on Oil with Oil revenues making up around 85-90% of total KSA export earnings. Its contribution in GDP happened to be around 35-40% of the country's GDP but in recent years has increased to more than 50 percent of GDP at current prices. Oil wealth has made possible rapid economic development, which began in earnest in the 1960s and accelerated spectacularly in the 1970s. Since then the Kingdom's economic fortunes have been closely tied to that of Oil. Oil was discovered in Saudi Arabia in the 1930s, and large-scale production started after World War II. The KSA Oil reserves are the largest in the World, and the country is the World's leading Oil producer and exporter. Proven reserves are estimated at more than 260 billion barrels which constitute about one-quarter of World Oil reserves. More than 95% of the entire Kingdom's Oil is produced on behalf of the government by the parastatal giant, ARAMCO and production generally varies in the range of 2.5 – 8 million barrels per day according to World demand, quota policies and other exogenous factors.

Due to the sharp rise in Oil revenues in 1974, the KSA became one of the fastest-growing economies in the World. It enjoyed a substantial surplus in its overall trade with other countries, imports increased rapidly; and ample government revenues were available for development and aid to other Arab and Islamic countries. Despite such rise in income, government of the region including that of Saudi Arabia were increasingly aware of the finite nature of their oil supplies and were concerned about an end to the oil boom. This was the first incentive for economic diversification.

Higher Oil prices led to a backlash in the form of the development of more Oil fields around the World, the development of other energy substitutes, and reduced global Oil consumption. The result was a worldwide Oil glut that started to form in the mid 1980s. The KSA Oil production, which had increased to almost 10 million barrels per day during 1980-81, fell to a mere 2 million in 1985. Revenues dropped sharply introducing an element of uncertainty for the planning authorities in the Kingdom for the first time in a decade. Massive budgetary deficits ensued, and the government drew down its foreign assets to meet its ever-growing expenditure obligations.

Following this painful experience, the rationale and urgency of economic diversification became much clearer to GCC governments. They were now seeking to reduce their dependence on oil long before oil resources were due to run out, in order to limit the effect of oil price fluctuations on their economies (ESCWA 2001). From the late 1980s and throughout the 1990s, in addition to the continuous expansion of the hydrocarbon sector and physical infrastructure, heavy government subsidies were directed at the expansion of non-oil sectors, including manufacturing, agriculture, basic metal industries, and, more recently services such as banking and tourism.

Further emphasis was also to be given to diversify its export sector so that stability in export earnings can be achieved in order to foster investment and economic growth.

It is in this context the paper intends to identify the products in which Saudi Arabia has comparative advantage. Further the study also tries to estimate the nature of relationship of these products with world economic growth and export price.

The paper is organized as follows. Next section describes the methodology to be used to identify the potential products in which country has comparative advantage and also to examine their relations with world economic activity and export price. In section three empirical results has been explained. At the end conclusion is presented.

Methodology

Identification of Products

In order to proceed with the empirical analysis, the conventional concept of Revealed Comparative advantage developed by Balassa (1965) has been used. According to Balassa (1965), since pre-trade relative prices are unobservable, analysis on trade patterns often needs to depend on post-trade data; the pattern of international trade broadly reflects relative costs and differences in non-price factors. Among a variety of such ex-post trade indices, the most commonly used is the export index of revealed comparative advantage (XRCA) popularised by Balassa and Noland (1989). The XRCA index is simply the ratio of the share of country i in world exports of commodity k to its share of total commodity exports. This index is represented as

XRCA = (Xki / Xk w)/(Xi / Xw)

Where,

Xki = exports by country i of commodity k;

Xk w = world exports of commodity k;

Xi = total exports of country i;

Xw = total world exports.

The weighted average of XRCAs of all commodities equals unity. An individual XRCA index value, greater than one indicates an ex-post or a revealed comparative advantage in the goods, and if less than one, it indicates comparative disadvantage. This index can be computed for commodities classified by product groups as well. However, a major limitation of this index is that at any point in time it takes into account only one side of the trade flows, i.e. exports or imports.

Nonetheless, this index has been widely used to explain the export performance and similarity of trade patterns among the East Asian countries (for instance, see Chow, 1990 and Rana, 1990). The XRCAs have been computed at the HS 2-digit product level for products. The indices are worked out for the years from 1991 to 2011. The data has been taken from International Trade Centre and UN Database.

Econometric Methodology

The study involves three steps to estimate the relationship between growth of these products, world economic activity and exchange rate. In the first step the nature of the data or order of integration of the variables, is examined. This is because if the data is found to be non stationary, as most of the macroeconomic data happen to be, then application of OLS technique may give spurious results. In order to avoid that, stationary test of the variables is required. For the purpose, Augmented Dicky-Fuller test (ADF-test) and Philips-Perron test (PP test) have been applied. The ADF test is based on the assumption that the error term is statistically independent and has a constant variance.

Philips and Perron (1988) developed a generalization of the ADF test procedure that allows for fairly mild assumptions concerning the distribution of errors. While the ADF test corrects for higher order serial correlation by adding the lagged difference term on the right hand side, the PP test makes a correction to the t-statistics of the coefficient from the AR(1) regression to account for the serial correlation in residual term. So, the PP statistics are just modification of the ADF t-statistics that takes into account less restrictive nature of the error process. For the reason, the present study has also conducted PP test to examine the stationary nature of the variables under consideration.

Once the order of integration is known and it is found that all the variables are not stationary but integrated of order equal to or less than one, the presence of long run relationship is examined with the help of bound test approach to cointegration developed by Pesaran et al (2001). This method has some advantages. One, bound test approach is robust for small size sample. Mah (2000) used Pesaran's approach to estimate disaggregated import demand function for Korea with 18 annual observations. Other examples are from Pattichis (1999) and Tang and Nair (2002). Second, failure to test hypothesis due to endogeneity problem under Engle-Granger method can be resolved through this method. Another advantage associated with it is that it can be used even if all the variables are not integrated of same order. So long as the dependent variable is integrated of order one and explanatory variables are integrated of order not higher than one i.e. integrated of order zero or order

one or mix of integrated of order zero and order one, there can still be a long run relationship between these variables provided that they are cointegrated.

In order to investigate the presence of long run equilibrium relationship (cointegration) among these variables through bound test approach, following unrestricted error correction model (UECM) (equation 2) can be estimated.

$$\Delta lX_{jt} = \propto_0 + \sum_{i=1}^{n} \propto_{1i} \Delta lX_{jt-i} + \sum_{i=0}^{n} \propto_{2i} \Delta lPx_{t-i} + \propto_{3i} \sum_{i=1}^{n} \Delta lGDPW_{t-1} + \beta_1 lX_{t-1} + \beta_2 lPx_{t-1} + \beta_3 lGDPW_{t-1} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Where, Δ represents first difference operator and l is natural log of respective variables. βi represents the long run parameters, while $\propto_{ji}$ represent the short run parameters. RGDPw is world gross domestic product in real terms; Px is unit value of export; and Xj refers to export of j^{th} commodity in real terms. To estimate the above equation, the maximum number of lags for the variables in level is set equal to two. The appropriate number of lags for the first differenced variables is determined on the basis of Akaike Information Criterion (AIC), from maximum of three lags. After estimating equation 2 by ordinary least square (OLS) method, the null hypothesis of no cointegartion is examined on the basis of the Wald or F- statistic used to assess the significance of the lagged level explanatory variables included in the equation, i.e.

H0: $\beta 1 = \beta 2 = \beta 3 = 0$; (no cointegration exists) and

HA: $\beta 1 \neq \beta 2 \neq \beta 3 \neq 0$. (cointegration exists)

Pesaran et al (2001) have provided two sets of critical value bounds. At conventional level of significance of 1 percent, 5 percent or 10 percent, if the calculated F-value falls outside the critical bound values, a conclusive inference can be made about accepting or rejecting the null hypothesis of no cointegration among the variables. If the F-value is greater than the upper limit of the bound values, we reject the null hypothesis of no cointegration among the variables under study. If the F-value is less than the lower limit of the bound value, then we accept the null hypothesis of no cointegration among these variables. However, if the calculated F-value falls within the critical bound limits, then the order of integration of the explanatory variables needs to be known before drawing any conclusion.

From the estimated UECM, the long run elasticities are measured from the coefficients of the one lagged level explanatory variables divided by the coefficient of the lagged level dependent variable and then multiplied by minus one. Short run elasticities are measured from the coefficients of the first differenced lagged variables in estimated UECM. To ascertain the goodness of fit of the ARDL model, relevant diagnostic tests are conducted. The diagnostic tests examine the normality, serial correlation and heteroskedasticity associated with the model.

Empirical Results and Analysis

In order to identify the products in which the country has comparative advantage, RCA index has been calculated for all the HS 2 digit products. The data has been taken from UN Database and International Trade Centre (ITC). It is important to repeat here that the RCA index may take values between zero to infinity. Value above one may mean that country has comparative advantage in the product. The result shows that the country has comparative advantage in mineral fuels, oils, distillation products etc; non-mineral products like organic chemicals; fertilizers; and plastic and articles threof.

Estimation of Long Run Relationship

Following Ender's (1995) suggestion, the paper has used both the methods (ADF test or PP test) to examine the stationary nature of the variables at level and at first difference. The result is reported in table 2a and 2b. The ADF result in table 2a shows that all the variables are non-stationary at level but are stationary at first difference. The Philips-Perron unit root test shown in table 2b also confirms the ADF test result. Thus, we may conclude that all the variables included in the model are integrated of order one i.e. I(1).

In order to examine the relationship between the Saudi's export of selected products, world economic activity, export price, the UECM version of ARDL model (Pesaran et al, 2001) with maximum lag of two (due to small size of the sample) is estimated. Then following Hendry's general to specific modeling approach, a parsimonious model is selected for equation by gradually deleting the insignificant coefficients. The result of the equation is not shown here to economise the use of paper. The diagnostic tests like Breusch-Godfrey serial correlation LM test, the ARCH test, Breusch-Pagan-Godfrey test and White test for heteroskedasticity, Jarque-Bera test for normality of the residual term confirm that the equation is correctly specified and error term behaves normally. There is no problem of serial correlation, heteroskedasticity. Random terms are normally distributed and model is correctly specified.

The result of the bound test to examine the presence of long run relationship of exports of different products with world income, real effective exchange rate is given in table 3. The result shows that the computed F-statistics for mineral fuels, oil, distillation products; plastic and articles thereof; organic chemical; and

wadding felt, non woven, yarn, twine, cordage etc are more than the critical value. This shows that these products have long run relationship with world economic activity and exchange rate. Fertilizer does not show any long term relation with these variables.

The result of UECM shows that in the long run, exports of mineral fuels, oil, distillation products (27); organic chemical (29), and plastic and articles thereof (39) are significantly related to world economic activity and they are income elastic too. Mineral fuels, oil, distillation products (27) and plastic and articles thereof (39) are significantly related to export price also. Further, these products other than organic chemicals and fertilizers are price elastic also. This implies that if the country is able to manage to control exchange rate appreciation and devalue its currency, the price of these products in the world market will be reduced and make it more competitive. This will boost the demand for these products. Similarly in the short run, mineral fuels, oil, distillation products (27); and plastic and articles thereof (39); are significantly and positively related to world economic activity. They are highly elastic too. Similarly with respect to price, mineral fuels, oil, distillation products (27); and plastic and articles thereof (39) are also significantly related and they are more than unit elastic. Organic chemical and plastics and articles thereof are inelastic in the short run.

Conclusion

Thus from the above analysis we find that the Saudi has comparative advantages in exporting mineral fuels, oil, distillation products; non-mineral products like organic chemicals; fertilizers; and plastic and articles threof. But except in plastic and articles thereof in which has recently achieved comparative advantage, all products in which country has comparative advantage, this index is showing a declining trend. This is a point of concern for the government who is trying to diversify its export base. Since the products in which country has comparative advantage are both, income and price elastic, the country needs to take care of exchange rate appreciation as this would reduce demand in the world market by increasing their prices. To diversify export, government should promote these sectors besides taking care of exchange rate appreciation.

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Table 1 RCA Index

HS 2 digit Code		2001	2005	2009	2010	2011	2012
27	Mineral fuels, oils, distillation products, etc	8.83	6.53	5.90	5.54	4.85	4.77
29	Organic chemicals	1.61	1.01	0.99	1.21	1.35	1.80
39	Plastics and articles thereof	0.79	0.81	0.91	1.41	1.28	1.40
73	Articles of iron or steel	0.23	0.19	0.13	0.21	0.17	0.04
31	Fertilizers	1.94	1.29	1.61	1.38	1.06	1.30
72	Iron and steel	0.14	0.10	0.06	0.10	0.09	0.03
89	Ships, boats and other floating structures	0.10	0.36	0.74	0.22	0.32	0.00
48	Paper and paperboard, articles of pulp, paper and board	0.14	0.18	0.21	0.35	0.29	0.08
04	Dairy products, eggs, honey, edible animal product nes	0.44	0.49	0.41	0.78	0.63	0.01
28	Inorganic chemicals, precious metal compound, isotopes	0.70	0.27	0.18	0.17	0.22	0.39
76	Aluminium and articles thereof	0.17	0.16	0.17	0.21	0.14	0.11
32	Tanning, dyeing extracts, tannins, derivs, pigments etc	0.11	0.25	0.21	0.34	0.27	0.11
56	Wadding, felt, nonwovens, yarns, twine, cordage, etc	0.02	0.08	0.16	0.28	0.21	0.18
34	Soaps, lubricants, waxes, candles, modelling pastes	0.56	0.37	0.43	0.68	0.50	0.05
20	Vegetable, fruit, nut, etc food preparations	0.25	0.28	0.21	0.41	0.31	0.03
70	Glass and glassware	0.33	0.18	0.02	0.19	0.14	0.06
57	Carpets and other textile floor coverings	0.65	0.75	0.12	0.75	0.71	0.11
33	Essential oils, perfumes, cosmetics, toileteries	0.17	0.11	0.12	0.18	0.12	0.03
25	Salt, sulphur, earth, stone, plaster, lime and cement	0.72	0.29	0.23	0.40	0.28	0.56

Computed from the data taken from ITC

Table 2a: Unit Root Test Result (ADF test)

Variables		Level			First Difference		
		C	C&T	None	C	C&T	None
27		-0.874934	-3.041909	1.818624	-4.146564	-4.040208	-3.746071
29		-0.858635	-3.276832	1.403181	-3.054102	-2.101439	-5.060740
31		-1.244651	-2.409073	1.657961	-7.549319	-7.278519	-6.110591
39		-1.502751	-1.626052	-0.248107	-4.163120	-2.604243	-4.284664
lGDPw		-0.540688	-1.749561	8.711929	-3.919124	-3.885599	-1.384280
lPx		-0.040555	-4.052061	2.402357	-6.015966	-5.859163	-4.861022
Critical Values	1%	-3.788030	-4.886426	-2.679735	-3.808546	-4.498307	-3.808546
	5%	-3.012363	-3.828975	-1.958088	-3.020686	-3.658446	-3.020686
	10%	-2.646119	-3.362984	-1.607830	-2.650413	-3.268973	-2.650413

- Critical values are of Mc Kinnon (1996)
- * and ** represent significant at 1% and 5% level.

Number of lags based on Schwarz information criteria (SIC) criteria.

Table 2b: Unit Root Test Result (PP test)

Variables		Level			First Difference		
		C	C&T	None	C	C&T	None
27 Mineral fuels, oils, distillation products, etc		-0.839970	-3.065993	2.177178	-4.199440	-4.070700	-3.738862
29 Organic chemicals		-0.102855	-5.090477	4.434044	-6.353832	-6.406603	-5.063820
31 Fertilizers		-1.006866	-2.326434	4.926022	-10.73779	-10.19576	-5.874905
39 Plastics and articles thereof		-1.481508	-1.264685	-0.251113	-4.163120	-3.996639	-4.284664
lGDPw		-0.583119	-1.749561	9.308201	-3.900918	-4.202049	-1.200259
lPx		0.151121	-4.345662	2.708171	-5.536200	-5.615470	-4.145501
Critical Values	1%	-3.788030	-4.467895	-2.679735	-3.808546	-4.498307	-2.685718
	5%	-3.012363	-3.644963	-1.958088	-3.020686	-3.658446	-1.959071
	10%	-2.646119	-3.261452	-1.607830	-2.650413	-3.268973	-1.607456

- Critical values are of Mc Kinnon (1996)

Table 3: Bound Test for Cointegration

Products	F Statistics
27. Mineral fuels, oils, distillation products, etc	18.64
29. Organic chemicals	12.19
31. Fertilizers	2.14
39. Plastics and articles thereof	15.8

Table 4: Long Run Income and Price Elasticity

Products	**Income Elasticity**	**Price Elasticity**
27. Mineral fuels, oils, distillation products, etc	5.43	-4.26
29. Organic chemicals	3.56	0.0
31. Fertilizers	0	0
39. Plastics and articles thereof	6.31	-3.09

Table 5 : Short Run Income and Price Elasticity

Products	**Income Elasticity**	**Price Elasticity**
27. Mineral fuels, oils, distillation products, etc	9.8	-1.4
29. Organic chemicals	32.8	-0.03
31. Fertilizers	0	0
39. Plastics and articles thereof	3.2	-0.41