



Testing Asymmetrical Effect of Exchange Rate on Saudi Service Sector Trade: A Non-linear Auto-regressive Distributive Lag Approach

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ABSTRACT

Present study explores the impact of devaluation and appreciation (negative and positive movements of exchange rate) on services sector trade by applying nonlinear auto-regressive distributive lag technique of Shin et al. (2014). This study confirms asymmetrical effects in case of all sectors in short run and long run effects may improve the trade balance of all sectors. Overall devaluation confirms existence of J-curve after some lag. This study also found that appreciation of a Saudi currency may put up adverse effects on trade balance in all services sectors except travel, construction and tourism sectors. The increase in world income may support to enhance exports of Saudi Arabia, while rise in Saudi Arabia's income may have negative effects on trade balance of all services sectors except travel and tourism.

Keywords: Devaluation, Trade, Asymmetry

JEL Classifications: F31, F14, D82

1. INTRODUCTION

The theoretical and empirical effects of depreciation or devaluation of currency have been debated in literature extensively for last many years. A devaluation or depreciation of a currency decreases domestic prices of goods thus increases exports and reduce imports which ultimately improves country's balance of trade. However, due to obligations of previous contracts, its immediate effects on imports does not occur, similarly depreciation or devaluation makes domestic market more competitive and foreign buyers do not immediately adjust accordingly (Yarbrough and Yarbrough, 2000). If devaluation effects differently across products then economies may have opposite behaviors of devaluation in trade patterns. So, country's portfolios or pattern of export must care of to know the real and accurate analysis of devaluation. There are two views of devaluation of domestic currency, one is shifting of spending from foreign to domestic goods due to devaluation, consequently improves trade balance and second view is concerned with judgment of influence of devaluation through Marshall-

Lerner condition. Both conditions are necessary to take care of while devaluation. However in few cases, we see devaluation instead improving trade balance, deteriorates it. So this phenomena is called J-curve.

It can observed through lag structure behavior of currency devaluation, first deteriorates and later improves balance of trade to confirm J-curve. Thus, there are controversial effects of devaluation in the literature, therefore present paper aims to analysis the effects of devaluation of Saudi Arabia's currency on balance of trade of services industry, which includes construction, financial, transport and communication, insurance and telecom sector. Each sector is separately taken in analysis to know influence of devaluation. For making commercial policy or exchange rate policy, policy makers must care of net effect of due to relative changes in price level as a result of currency devaluation. In empirical testing, very few has been focused the service sector particularly. For example, Marquez (2006) determine the income and price elasticities of services trade in travel, fares, and passenger and transportation services. Mann

(2004) calculated income elasticities of trade in services and other private's services, the results revealed that income elasticities on exports and import are same. Therefore, knowing the significance of this present study wants to explore the impact of devaluation on services sector in Saudi Arabia.

Services sector is the fastest growing sector of the global economy that contributes significantly in total gross domestic product (GDP) and employment of the most developed economies. Services sector share of low income countries in their total GDP has been lowest than other countries but financial and insurance is growing rapidly with the yearly rate of 11% almost, in low income countries.

Saudi Arabia banking sector grew rapidly and transformed from infancy to modernize financial system. Till now 24 commercialized banks are working, out of which 13 banks are nationally licensed and 11 are foreign licensed holder. These institutions showed remarkable growth in recent years with increase in aggregate assets by 12.4% almost SR 2.1 trn (\$559.7 bn). This is due to liberalized regulations in capital markets by Saudi Arabian Monetary Agency (SAMA). The shift towards e-banking and use of technology is not only cost saving for financial institutions but also demand driven by growing population. According to information from Communication and Information Technology Commission broadband user reached to 48% by the end of second quarter of 2014. While insurance sector of Saudi Arabia reached close to its rival giant UAE in the region, with rapid progress. Despite the presence of sharia laws in daily business of life and some prohibited act like interest (riba), gambling (maisir), uncertainty (gharar) senior Ulema of kingdom's council permitted those some forms of insurance which comply with sharia. This has opened new avenues for local companies to function their business on the takaful model. In one of the studies by Saudi Hollandi Capital, reveals that insurance market grew with 18% compound annual growth rate between the period of 2008 and 2012. According to SAMA, there were 35 insurance companies in the market till 2014, giving tough competition to insurance market. Gross written profit of this sector increased from SR 10.9bn in 2008 to SR21.2bn in 2012 (SAMA, 2012). In such an intensive growth, major contribution is from health insurance sector and on second auto insurance industry. In rest of the services sector, transport sector is also contributing in growth, particularly after the slowdown of 2008, Saudi Arab started paying attention towards infrastructure development. We have seen unprecedented level of investment in rail system, transport infrastructure, aviation and on port facilities. Government is also initiating of few new projects for this purpose. Saudi Authorities are planning to invest \$64.9bn on citywide metro system, \$14.4bn on intercity rail lines and \$8.7bn on bus projects, by 2025. Further, government is also focusing on investment and anticipating of \$190bn in ports, sea transport and on aviation. Another sector is construction industry, struggling hard to divert economy from oil export by huge investments in education, health and constructing infrastructure to support economic growth. Saudi's construction industry is growing rapidly with government participation as an industry's output value is expected to increase by 7.05% till 2020 as compared with 6.3% during period of 2011-2015. The residential construction is expected to increase with share of 29.3% of the total construction

industry value by 2020. Saudi Telecom sector is another sector facing new challenges of high subscriber penetration level in voice data, biometric registration of SIM cards and limited growth avenues. Mobile subscribers are growing rapidly in Saudi Arabia. Internet penetration level in Saudi Arabia has also improved in 2015. With more than 55 million users from 3 key players of the total market, it is not easy to interpret their market share. A year before Saudi Telecom Company announced 3 year dividend policy i.e., quarterly dividends of SAR 1/share. Total outstanding amount of dividend on current numbers of shares is SAR 8bn. In short services sector is fastest growing and has importance in emerging economic circumstances of Saudi Arabia (SAIGA, 2016).

2. LITERATURE REVIEW

Ample empirical literature available on impact of devaluation of currency or exchange rate variation on the trade balances of goods traded but deficiency has been found in exploring the impact of devaluation on trade balances of services sector. Various studies explored influencing factors of services' trade through gravity equation (see i.e., Walsh, 2008). Some studies have explored the J-curve application, but we can hardly find any study which explores J-curve in services exports, though mixed goods and services exports have been explored. Existence of J-curve has been a part of debate due to its contradictory results. Lefort (1988) in order to enhance exports for Chile suggested devaluation policy from his empirical research. He is of the view rise in relative prices due to devaluation helps to improve balance of trade. He observed that lags play significant role in determining the positive effects on trade balance because of time requirement to take decision about changes in real variables, replacement inventories and delivery time. The research of Noland (1989) reported the evidence of J-curve for Japan's balance of trade and suggested devaluation policy parallel with demand management to enhance exports. Rose (1991) used monthly data to investigate J-curve of US, UK, Germany, Japan and Canada. This study found contradictory results to that of economic theory, moreover neither cointegration holds nor Marshall-Lerner condition exists thus negate the researchers argument of demand management policy with exchange rate.

Moshirian (1993) analyzed travel and passenger services sector and found the evidence of effectiveness of devaluation on services' trade. Sichei et al. (2007) analyzed influencing determinants of intra-industry trade in services of South African-US. Considering Rand-Dollar exchange rate results indicated positive and significant impact of nominal depreciation of Rand on services' trade. It means, in the same sector both countries are trading their services which seems competitive situation particularly for South African industry. If devaluation is objective, then it is to see whether it is in best interest of an economy and effects truly can be spread to whole economy.

Bahmani-Oskooee et al. (2006) investigates the impact of devaluation using quarterly data of 1973-2001 for UK with its trading partners trade balance in the bilateral setting. They use the auto-regressive distributive lag (ARDL) cointegration test for this purpose and find that exchange rate is not affecting the trade

for most of UK trade partners in the short run however they finds the desired impact for Australia, Austria, Greece, South Africa, Singapore and Spain in the long run. therefore, J-curve hypothesis is found for these countries. Bahmani-Oskooee and Hajilee, (2011) investigate the effect of exchange rate between US and Sweden on 87 industry-specific imports and exports. They claim the inappropriateness of aggregate data and investigate this issue in disaggregated analysis. They find the desired impact of exchange rate in the 59 industries in the short run and in the 30 industries in the long run. Further they find that devaluation has been effective in improving overall trade balance.

In differentiating the modern and old literature of J-curve analysis, we can see the problem of aggregation in concluding the J-curve or influence of devaluation on trade balance. In the disaggregated analysis, service sector has not also been found in the most of reviewed studies. Therefore, this research is motivated to pay attention of services sector by taking the case of Saudi service trade. Further, the use of non-linear ARDL is also not very common in the estimation and our paper is contributing and guiding further research for the future research on that area.

3. DATA AND METHODOLOGY

3.1. Data

This study utilizes the annual time series of service sector exports and imports. These are financial, insurance, transport, telecom and travel and tourism services sector for which time period of 1970-2015 has been taken. The selection of sample was based on maximum availability of data. The data on service sector exports and imports, GDP, exchange rate of Saudi Riyal is collected from SAMA. The data on real world GDP and consumer price index of Saudi Arabia and US is taken from World Development Indicators. All variables are transformed in logarithm. If devaluation is objective, then it is to see whether it is in best interest of an economy.

3.2. Methodology

This study wants to capture the impacts of devaluation or appreciation on the service sector’s trade balance of Saudi Arabia. For this purpose, we study uses the log-linear model in which dependent variable is taken as service sector’s balance of trade by taking each service separately in a model. GDP of Saudi Arabia proxy for demand for Saudi imports, GDP of world as proxy for demand for Saudi exports and real exchange rate are taken as independent variables. The model of this study is as follows:

$$BOT_t = \alpha + \gamma RER_t + \beta WRY_t + \eta SAY_t + \varepsilon_t \quad (1)$$

Here, BOT_t is balance of trade of each service category. BOT_t is defined as exports divided by imports and an increase in this variable reflects the improvement in balance of trade. Real exchange rate (RER) is defined as one Saudi Riyal equals to numbers of US dollars multiplied by CPI of Saudi Arabia and divided by CPI of US. An increase in this variable reflects the appreciation in Saudi Riyal in real terms and vice versa for a devaluation. The coefficient of RER is expected to have negative sign as a devaluation is expected to have favorable impact on

BOT in long run. World GDP (WRY) is expected to have positive influence on trade balance. As its increment is expected to raise Saudi services’ demand and thus BOT will improve. Saudi Arabian GDP is likely to carry negative impact as it is likely to increase Saudi imports and consequently BOT will be worsened.

The above discussed model is symmetrical in nature as exchange rate has a single variable and it can be differentiated into two variables by taking a separate positive variable for partial sum of positive changes in exchange rates and in the same way a negative variable can be developed by negative movements. These two variables can be defined as follows:

$$PRER_t = \sum_{j=1}^t \Delta RER_j^+ = \sum_{j=1}^t \max(\Delta RER_j, 0) \quad (2)$$

and,

$$NRER_t = \sum_{j=1}^t \Delta RER_j^- = \sum_{j=1}^t \min(\Delta RER_j, 0) \quad (3)$$

Shin et al. (2014) used these variable as defined in equations (2) and (3) so called linear ARDL model to make it non-linear or asymmetrical ARDL model. The non-linear ARDL model for our equation (1) can be expressed as follows:

$$\begin{aligned} \Delta BOT_t = & \alpha + \phi BOT_{t-1} + \beta WDY_{t-1} + \gamma^+ PRER_{t-1} \\ & + \gamma^- NRER_{t-1} + \sum_{i=1}^p \delta_i \Delta BOT_{t-i} \\ & + \sum_{i=0}^q v_i \Delta WDY_{t-1} + \sum_{i=0}^r (\theta_i^+ \Delta PRER_{t-i} + \theta_i^- \Delta NRER_{t-i}) + \psi_t \end{aligned} \quad (4)$$

The estimated equation (4) will be tested for a cointegration. $\phi = \beta = \gamma^+ = \gamma^- = \theta = 0$ is showing no-cointegration and can be tested by bound test. If estimated F-value is found greater than that of upper critical bound value then null hypothesis can be rejected. After cointegration, long run effects can be estimated by normalizing the coefficients of WDY_{t-1} , $PRER_{t-1}$ and $NRER_{t-1}$ normalized by coefficient of BOT_{t-1} . The negative effects of $PRER_{t-1}$ and $NRER_{t-1}$ are expected like symmetrical model. The effect of exchange rate can be considered symmetrical if estimated coefficients of $PRER_{t-1}$ and $NRER_{t-1}$ carries the same signs and magnitudes and a change in sign or magnitude of coefficients can be considered an evidence for asymmetrical effects.

Further, after testing the long run asymmetry, we can also test the short run asymmetry by using error correction model (ECM) of non-linear ARDL. The ECM model can be expressed as follows:

$$\begin{aligned} \Delta BOT_t = & \sum_{i=1}^p \delta_i \Delta BOT_{t-i} + \sum_{i=0}^q v_i \Delta WDY_{t-1} \\ & + \sum_{i=0}^r (\theta_i^+ \Delta PRER_{t-i} + \theta_i^- \Delta NRER_{t-i}) \\ & + \kappa ECT_{t-1} + \xi_t \end{aligned} \quad (5)$$

The coefficients of lagged differences variables are capturing the short run influences in (5). If coefficients of $PRER_{t-1}$ and $NRER_{t-1}$ are found different in signs or magnitude then short run asymmetry can also be claimed. Further, the short run relationship and a speed of convergence can be found with a negative parameter of electroconvulsive therapy. This evidence is

also alternatively claim for long run relationship if it is not found with bound test.

4. DATA ANALYSES

Usually time series data has a unit root problem; therefore it is required to test the stationarity of data. The level of stationarity i.e. order of integration determines the use of technique for long run relationship but ARDL has an advantage to use without any order of integration except second difference stationarity level. Therefore study confirmed that all of our tested series are stationary at their levels or at their first difference and none of series is needed to test at their second difference. Therefore, we can precede our analyses without presenting the unit root tests. At first, we perform the bound test on the services exports and run some necessary diagnostic tests to ensure the validity of results from estimated models. The results of Table 1 clearly indicate presence of cointegration because F-value increases upper bound values in all sectors.

Long and short run results have been stated in Table 2. World income has positive and significant impacts on balance of trade

of all sectors as expected in long run. It means that a rising world income helps in increasing exports and improves trade balance of service sector in Saudi Arabia. The Saudi Arabia's income has negatively influenced the trade balance of all service sectors except travel and tourism sector, as devaluation has negative but insignificant impact. PRER has negatively influenced the trade balance as expected for all sectors except construction, travel and tourism. It means that an appreciation is worsening the balance of trade for the most of service sectors. Further, NRER has negatively influenced the trade balance in all types of service sectors as expected. A devaluation of Saudi Riyal has the favorable impacts in all service sector. The impacts of positive and negative exchange rate have observed asymmetrical in all cases except Insurance where coefficients are very close to each another and can be claimed as symmetrical effect.

In the short run analyses, world income is positively influenced the trade balance in case of insurance, transport and telecom sectors. Saudi Arabian income is negatively influenced trade balance in all sector except insurance and travel and tourism sectors. PRER is positively influenced the balance of trade only in financial service sector and its positive impact is only observed as an inverse

Table 1: Bound tests and diagnostics

Industries	Construction	Financial services	Insurance	Transport	Telecom	Travel and tourism
F-value (bound test)	5.8112	5.1170	5.4797	5.0330	4.1918	5.4247
Serial correlation tests	0.3713 (0.6931)	0.7580 (0.4750)	1.2112 (0.3111)	0.7395 (0.4853)	0.1413 (0.8688)	1.0327 (0.3192)
Heteroscedasticity test	0.4007 (0.9451)	2.6404 (0.01)	1.5569 (0.1810)	1.3564 (0.2505)	0.5364 (0.8627)	2.1555 (0.0438)
Normality test	4.4415 (0.1085)	0.1962 (0.9066)	1.0401 (0.5945)	0.9949 (0.6081)	3.1484 (0.2072)	1.3988 (0.4969)
Ramsey RESET test	0.6462 (0.5230)	3.2058 (0.00)	0.2339 (0.8165)	1.5480 (0.1312)	2.6866 (0.0447)	1.0553 (0.3014)
CUSUM	S	S	S	S	S	S
CUSUMsq	S	S	S	S	S	S

Upper bond critical values are 3.2, 4.08 and 4.66 at 10%, 5% and 1% respectively. Brackets keep P values of respective tests. S is showing stability of estimated parameters through CUSUM and CUSUM square tests

Table 2: Non-linear ARDL results

Variables	Construction	Financial services	Insurance	Transport	Telecom	Travel and tourism
Long run results						
PRER _t	-0.6279 (0.7160)	-4.5809 (0.0153)	-2.3626 (0.0908)	-3.6253 (0.0025)	-3.8911 (0.0540)	-2.2337 (0.1012)
NRER _t	-1.7769 (0.0038)	-1.7284 (0.0119)	-2.3184 (0.0002)	-2.2969 (0.0000)	-2.3043 (0.0048)	-2.7161 (0.0000)
WRY _t	2.6017 (0.0284)	3.6115 (0.0052)	4.1796 (0.0004)	4.5207 (0.0000)	5.0218 (0.0010)	4.1448 (0.0001)
SAY _t	-0.5642 (0.0422)	-1.4205 (0.0010)	-0.7058 (0.0287)	-1.1540 (0.0001)	-1.8622 (0.0002)	-0.3037 (0.2965)
Intercept	-31.4334 (0.0355)	-32.0654 (0.0411)	-48.2829 (0.0006)	-47.5383 (0.0875)	-46.1409 (0.0105)	-51.7986 (0.0002)
Short run results						
ΔBOT _{t-1}	0.2982 (0.0245)	0.5629 (0.0016)	0.2486 (0.1074)	0.3384 (0.0054)	0.2434 (0.0989)	
ΔBOT _{t-2}		0.2101 (0.0855)			0.1145 (0.3811)	
ΔPRER _t	0.5226 (0.7976)	1.1689 (0.0035)	-1.7371 (0.5410)	-0.6514 (0.6752)	-0.0950 (0.9669)	2.4082 (0.1604)
ΔPRER _{t-1}	4.7303 (0.0266)	-0.2343 (0.3894)			-3.1422 (0.1501)	2.9771 (0.1052)
ΔPRER _{t-2}		1.0836 (0.0148)				
ΔNRER _t	0.4316 (0.5541)	-1.9418 (0.1869)	1.3729 (0.1777)	1.1978 (0.0416)	1.4437 (0.0895)	0.7208 (0.3026)
ΔNRER _{t-1}	-2.9828 (0.0026)	-1.0460 (4695)	-3.6985 (0.0007)	-2.5944 (0.0001)	-1.7946 (0.0340)	-2.3163 (0.0060)
ΔNRER _{t-2}		-2.0097 (0.1115)				-1.7597 (0.0424)
ΔWRY _t	1.5111 (0.3077)	-2.3414 (0.3929)	3.3586 (0.0909)	2.6290 (0.0303)	3.6773 (0.0316)	0.7464 (0.5333)
ΔWRY _{t-1}		-7.3077 (0.0172)				-0.9194 (0.4749)
ΔWRY _{t-2}						-2.8288 (0.0264)
ΔWRY _{t-3}						-3.2689 (0.0232)
ΔSAY _t	-1.1209 (0.0223)	-1.8880 (0.0320)	-0.8890 (0.1487)	-1.2646 (0.0014)	-1.8272 (0.0019)	-0.2307 (0.5957)
ECT _{t-1}	-0.8899 (0.0000)	-1.3070 (0.0000)	-1.0325 (0.0000)	-0.7917 (0.0000)	-0.6589 (0.0002)	-0.8094 (0.0000)

Brackets keep P values based on t-test. ARDL: Auto-regressive distributive lag, ECT: Electroconvulsive therapy

(inverse to negative) sign and this is not confirming the J-curve hypothesis. NRER has a J-curve effect in case of service sectors except Financial services. As initial currency devaluation has opposite sign as observed positive and then its further lag carries negative signs. It means devaluation has a favorable impact after some lags but not immediately. In comparison of the influences of devaluation and appreciation, the coefficients carry different signs and therefore, it can be concluded the asymmetrical effects in case of all sectors.

5. CONCLUSION

Finally, by concluding discussion study extracts the confirmation of positive and significant relationship of world income and services exports, eventually affects positively balance of trade of all sectors, while increase in Saudi Arabia's income has negative impact on trade balance of all service sectors except travel and tourism sector because it will increase import demand. It is also observed that appreciation adversely affects balance of trade of all sector except construction, travel and tourism sector, while devaluation has significantly influence the trade balance of all service sectors. Long run results also indicate that devaluation is improving the trade balance of all service sectors. Short run results depict that world income is positively determining the trade balance of insurance, transport and telecom sectors and negative and significant impact in all sectors except insurance and travel and tourism sectors. The negative exchange rate variable approves the presence of J-curve in all services' trade balance except financial sector. Overall devaluation confirms existence of J-curve after some lag and asymmetrical effects are presence in short run. Therefore, on the basis of above results study can suggest devaluation of Saudi currency as it may improve the trade balance of services sector of Saudi Arabia.

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