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Impact of devaluation on service sector exports in Saudi Arabia: non-linear ARDL approach

Abstract
Devaluation policy is considered as operative in raising the exports' performance in any country. This paper had investigated this issue in the non-linear Autoregressive Distributed Lag (ARDL) setting developed by Shin et al. (2014) to differentiate the devaluation and appreciation policy, and to verify symmetrical or asymmetrical effects. We investigated a period of 1970-2016 for the six major service sector exports of Saudi Arabia. In each model, world income, as well as positive and negative variables of exchange rate are independent variables. The exports of construction services (CONST), financial services (FIN), insurance services (INS), transport services (TRANS), telecommunication services (TELE), and travel and tourism services (TRAV) are dependent variables. We found the long run relationship in all service sector exports' models. Further, we have found that appreciation is responsible for depressing exports in 5 out of 6 sectors, and devaluation helps in raising exports in 4 out of 6 sectors in the long run. We have found the asymmetrical effects of devaluation and appreciation in 5 out of 6 sectors. In the symmetry analysis, the effects of positive and negative real ER variables are found to be asymmetrical in nature for all sectors except telecommunication sector. The effects of devaluation on the service sector exports are found elastic in the most part of service sectors than those of appreciation. Further, J-curve hypothesis has been validated in 3 out of 6 sectors (it means, in transport, telecommunication, and travel and tourism sectors). Based at the findings of the undertaken study, it is recommended to conduct the devaluation policy to raise service sector exports in Saudi Arabia in the context of the realised course on the diversification of the economy.
Keywords: Devaluation; J-Curve; Service Sector Exports; Asymmetry; Saudi Arabia
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Вплив девальвації на експорт послуг Саудівської Аравії: застосування нелінійної авторегресійної моделі з розподіленим лагом (ARDL)

Анотація. Політику девальвації вважають дієвим інструментом для збільшення ефективності експорту. У статті вплив девальвації досліджено із застосуванням нелінійної авторегресійної моделі з розподіленим лагом (ARDL) з метою відмежування політики девальвації від політики підвищення курсу, а також для визначення симетричних та асиметричних ефектів застосування. Розглянуто експорт шести основних секторів послуг Саудівської Аравії в період з 1970 до 2016 р. Було віднайдено довготермінову залежність в усіх моделях експорту. Доведено, що зростання курсу національної валюти призвело до пригнічення експорту в 5 з 6 секторів, тоді як девальвація, навпаки, сприяла довготерміновому зростанню експорту у 4 секторах з 6. Ми виявили асиметричний ефект девальвації та зростання курсу у 5 секторах із 6. Ефект джей-кривої спостерігався у 3 секторах із 6. У дослідженні рекомендовано проведення девальвації для сприяння зростанню експорту послуг із Саудівської Аравії.
Ключові слова: девальвація; джей-крива; експорт послуг; асиметрія; Саудівська Аравія.

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Влияние девальвации на экспорт услуг Саудовской Аравии: применение нелинейной авторегрессионной модели с распределенным лагом (ARDL)

Аннотация. Политика девальвации считается действенным инструментом для повышения эффективности экспорта. В статье влияние девальвации исследовано с использованием нелинейной авторегрессионной модели с распределенным лагом (ARDL) с тем, чтобы отделить эффекты политики девальвации от влияния повышения валютного курса, а также для определения симметричных и асимметричных эффектов. В работе рассмотрен экспорт услуг в шести секторах экономики Саудовской Аравии в период с 1970 по 2016 г. Была обнаружена долговременная зависимость во всех моделях экспорта. Доказано, что рост валютного курса привел к замедлению экспорта в 5 из 6 секторов, в то время как девальвация содействовала долговременному росту экспорта в 4 из 6 секторов. Выявлен асимметрический эффект девальвации и роста валютного курса в 5 секторах из 6. Эффект джей-кривой наблюдался в 3 секторах из 6. На основе проведенного исследования рекомендовано проведение девальвации с целью содействия росту экспорта услуг Саудовской Аравии.

Ключевые слова: девальвация; джей-кривая; экспорт услуг; асимметрия; Саудовская Аравия.

1. Introduction

The Exchange Rate (ER) devaluation policy is generally adopted to enhance the export performance in every country. Devaluation could reduce the price of exports, and exports become competitive with lower prices. Further, the impact of devaluation on exports is depending on the price elasticity of demand. In case of elastic demand, the devaluation might be able to raise the exports revenues. Further, the analysis of both devaluation and appreciation is very pertinent to differentiate their effects on exports in deciding the timely importance of a devaluation policy. Devaluation policy is not always desirable if it is unable to enhance the exports, or it could raise exports with a very little magnitude with a heavy loss in decreasing the value of local currency. Further, the impact of devaluation is not so immediate but might have the time lag effect. For example, a recent devaluation may not be helpful in raising exports in the same period but could have positive effects in the subsequent periods advocated by J-curve hypothesis.

The analysis of J-curve is very important for a successful ER policy, and elasticity of exports' demand is crucial in this regard. The Marshal-Lerner (ML) condition states that sum of ER elasticity of exports and imports must be greater than one to have positive effects of devaluation on the balance of trade. Further, the relatively higher elasticity of exports would be very helpful in achieving the higher exports revenues with devaluation. By achieving the ML condition, the ER devaluation could be able to raise the exports revenues which in turn would be helpful in correcting balance of trade. J-curve hypothesis explains that ER elasticity could be low in the short run, and therefore the ER policy objectives cannot be reaped. Moreover, devaluation in short run may reduce the exports revenues due to inelastic behaviour. The ER elasticity is relatively higher in the long run, and devaluation could increase the exports revenues in the long run. Therefore, devaluation policy might be harmful in decreasing exports in short run, but it could be positive in improving exports' revenue in long run as stated by J-curve hypothesis.

The sectoral analysis of J-curve is very important as aggregation biasness may provide us misleading results. The service sector of Saudi Arabia is progressing nowadays due to the policy of diversification of economy from oil-dependence in the recent years, as shown in Figure 1. Most of services sectors showed progress from 1970 to 1983, then felt during 1984-1995, and got back to the positive trend after 1995. The overall trend of these sectors exports can be claimed as positive. The shares of transport, travel and tourism are relatively higher than other service sectors.

The analysis of devaluation on the aggregate exports could be biased due to ignoring the sectoral analysis, as some of the sectors are more exchange rate sensitive than the others (Bahmani-Oskooee & Wang, 2007). On the other hand, Bahmani-Oskooee & Fariditavana (2015) proposed to test the effects of positive and negative change of ER on exports in the non-linear ARDL settings outlined by Shin et al. (2014). The test highlighted the importance of non-linear ARDL as it can cater simultaneously effects of both positive and negative variable of ER, and it can also be very useful to verify the symmetry or asymmetry effects. Furthermore, a linear model of exchange rate may produce bias results in symmetrical analysis. If ER variable has a significant effect on the exports, then it means that devaluation is helping in raising the exports, and appreciation is responsible for depressing the exports. But the beauty of non-linear ARDL is that it can accommodate both positive and negative variables of ER, and we can test whether both variables have significant effect on exports or only one of these is affecting the exports. Furthermore, symmetrical or asymmetrical effects can also be tested.

Based on the above discussion, we are going to investigate the effect of ER policy on the service sector exports' performance by considering the possible asymmetrical effects of

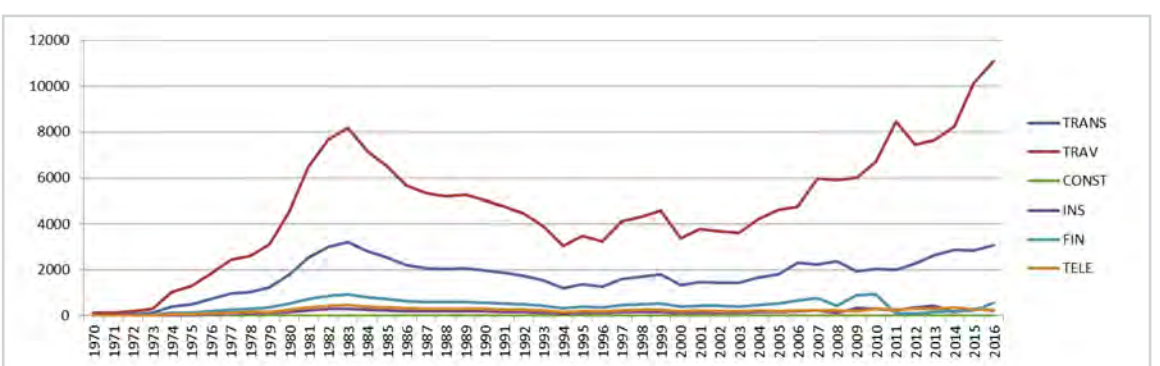

Fig. 1: **Service Sector Exports, in Million US Dollars**
Source: Saudi Arabian Monetary Agency (2017)

devaluation and appreciation using non-linear ARDL proposed by Shin et al. (2014). Further, the objectives of our study also include the test J-curve hypothesis in the service sector exports under both devaluation and appreciation variables, and investigation of the symmetries or asymmetries in the effects of devaluation and appreciation policies on the service sector exports.

2. Brief Literature Review

Impact of ER on the trade under J-curve effect has been studied by Magee (1973). J-curve hypothesis shows that devaluation may be harmful for the exports in the short run by reducing the present exports revenues, but its subsequent impact might be positive due to high ER elasticity in the next period. Theoretically, devaluation policy is not effective in the short run due to inelastic exports demand. But over the time with elastic exports demand, it becomes effective in raising exports.

Testing the effect of ER on the disaggregated trade is common in literature. For instant, Bahmani-Oskooee & Wang (2008) explore the existence of J-curve hypothesis by short run analysis, and they also test the long run impact of ER on commodity bilateral trade of 88 industries at 2-digit and 3-digit levels between China and the USA. They argue that effect of ER on the aggregate exports may produce biased results, and industries analysis could provide the evidence for the effect of exchange rate on each industry separately to avoid aggregation biasness. From analysis, they find the evidence of cointegration for 34 industries' models, and 22 industries out of 34 also provide the evidence for presence of J-curve hypothesis. Doroodian et al. (1999) investigate the J-curve for disaggregated data of US agriculture and industrial trade. They find the evidence of J-curve in the agriculture trade, but not in industrial trade.

Bahmani-Oskooee et al. (2014a) investigate the impact of ER on trade between Brazil and the USA for 92 industries by using ARDL cointegration. They claim that the analysis of aggregate exports at national level produce the biasness in estimation. They find the J-curve phenomena for some of the investigated industries i.e. for 31 out of 92 industries-specific exports. Bahmani-Oskooee et al. (2014b) investigate the J-curve hypothesis for the disaggregated data of industrial trade of Azerbaijan by using quarterly series from the period of 2000-2009. They corroborate the existence of Marshal-Lerner condition for 3 out of 10 industries. In these industries, J-curve hypothesis has also been validated by long and short run results comparisons. In the short analysis only, J-curve is also found in almost all industries by analysing the lags of ER variable.

Bahmani-Oskooee & Harvey (2014) investigate the impact of ER on bilateral industrial trade between the USA and Indonesia. They investigate US 108 in-payments exports industries and Indonesian 31 out-payments importing industries. They find that exporting and importing industries are affected in the long run by devaluation of dollar. However, one-third of exporting industries and one-half of importing industries are affected by a devaluation of dollar in the short run as well. ER elasticity of exports has been observed negative with coefficient of -0.54, and ER elasticity of imports has been found at +1.3 on the averaging of all industries' exports and imports models respectively. In the overall industrial trade balance, the devaluation has been played an elastic impact with coefficient of 1.8. Further, Atif et al. (2017) also uphold the positive impact of devaluation on the agriculture exports in Pakistan.

Hsing (2010) investigates the ML condition for Asian countries' trade with the USA after converting the nominal ER into real ER by using CPI and PPI as deflators. He finds that ML condition is not validated for Singapore's and Malaysian trade by using both real exchange rate definitions. ML condition is also found as invalid in case of Pakistani and Indian trade by using the PPI as deflator. But, ML condition is found valid in all countries under analysis by using relative CPI as deflator. Sweidan (2015) employs the ARDL cointegration in the relationship between real ER and Jordanian exports and imports at aggregate level. He corroborates the ML condition only in the short run. He also finds the Dutch disease effect due to workers' remittances inflows. This effect releases a negative influence on the export competitiveness due to the currency appreciation. Baek (2013) explores the effect of ER on industrial trade between Republic of Korea and Japan. He finds the significant contribution of ER in determining the exports between two countries in most industries in the short run. He also corroborates the evidence of J-curve in long and short run analyses. Furthermore, income variable also plays an important role in determining the exports. Yazici & Klasra (2010) work on Turkish industrial exports, and find the evidence for J-curve in the mining as well as in the manufacturing sectors.

In context of non-linear ARDL approach to find the impact of positive and negative ER variables on trade, Bahmani-Oskooee & Fariditavana (2015) investigate the influence of ER on the trade balance of the USA, Japan, China and Canada. They corroborate the evidence of J-curve for the USA only in the linear ARDL, but J-curve hypothesis is validated in cases of the USA and China in the non-linear ARDL models. Further, they find the asymmetrical effects of appreciation and devaluation in case of all countries under analysis. Mahmood et al. (2017) explore the influence of ER on the industrial exports of Saudi Arabia in the non-linear ARDL settings. They find the positive impact of devaluation on all industrial exports except plastic products and food exports. Furthermore, they find a significant and depressing impact of appreciation on all industries' exports except food products and metal products. They also find the J-curve hypothesis only in the electrical products' exports, and the effects of positive and negative ER are found asymmetrical in all industries.

In the particular context of service sector trade Moshirian (1993) finds the significant effect of exchange rate devaluation on the travel and passenger services sector. Sichei et al. (2007) also corroborate the positive effect of devaluation on the intra-service sector trade of South Africa and the USA. They argue that devaluation of Rand in South Africa was helpful in enhancing of the competitive position of service sector trade, and it remained as such in increasing the service sector exports in turn.

The literature signifies the importance of effect of ER on the industries' exports and service sector exports. The importance of non-linear ARDL approach to test the J-curve hypothesis in the literature has also been evident, yet limited. This paper contributes in the trade literature by exploring the asymmetrical effects of exchange rate on the service sector exports of Saudi Arabia.

3. Data, Model and Estimation Strategy

3.1 Data Source

This paper employs the yearly data of exports in USD millions from all service sectors of Saudi Arabia for period of 1970-2016. World GDP is used as a proxy for world income in USD millions, and real exchange rate of Saudi Riyal have been utilized for the same time period. All data except world GDP is sourced from Saudi Arabian Monetary Agency (SAMA), and world GDP is sourced from World Development Indicators (WDI). All nominal data is converted into real by dividing respective years' price deflator (base year is 2010). All series has been taken in logarithm form to capture the elasticity parameters.

3.2 Model and Estimation Strategy

This paper aims to explore the effect of ER movements on the service sector exports of Saudi Arabia. We are investigating the J-curve hypothesis to check the short and long run impacts of ER on the service sector exports. We are employing six models, where each model is carrying the J-curve analysis of every service sector separately in the log-log linear form. The simple model can be described as follows:

$$SX_{it} = \alpha + \beta RER_t + \gamma WGDP_t + \varepsilon_t \quad (1)$$

SX_{it} is representing a log of particular service sector exports (i), namely construction services (CONST), financial services (FIN), insurance services (INS), transport services (TRANS), telecommunication services (TELE), and travel and tourism services (TRAV), at time (*t*). The analysis is performed on each service sector separately, and therefore equation (1) is supposed to test by time series technique, not by panel data analysis techniques. RER_t is a log of real ER, and is defined as value of one Saudi Riyal in USD multiplied by the ratio of consumer price index of the USA and Saudi Arabia. Thus, a negative

movement of RER_t is showing devaluation and could have positive impact on service sector exports. Therefore, a negative sign is expected in the relationship of RER_t and service sector exports. $WGDP_t$ is denoting a log of world income, and it is used as proxy for world demand for Saudi services exports. Rising world income could attract more demand for Saudi services exports, and therefore its positive impact is expected.

The equation (1) can be represented as a linear model as it is not carrying the positive and negative movements in ER separately. Further, the model (1) can be extended for a non-linear model by incorporating these movements in ER. Following Shin et al. (2014), we can express positive and negative series of ER as follows:

$$RER_t^+ = \sum_{h=1}^{j} \Delta RER_j^+ = \sum_{h=1}^{j} \max(\Delta RER_h, 0) \quad (2)$$

$$RER_t^- = \sum_{h=1}^{j} \Delta RER_j^- = \sum_{h=1}^{j} \min(\Delta RER_h, 0) \quad (3)$$

Where, RER_t^+ is a partial summation of only positive changes in exchange rate and RER_t^- is a partial summation of only negative changes in exchange rate.

Equations (2) and (3) can be incorporated in equation (1) for a claim of non-linear model:

$$SX_{it} = \alpha + \beta^+ RER^+_t + \beta^- RER^-_t + \gamma WGDP_t + \xi_t \quad (4)$$

The equation (4) can be converted into non-linear ARDL model of Shin et al. (2014) as follows:

$$\Delta SX_{it} = \alpha_0 + \alpha_1 SX_{t-1} + \alpha_2 WGDP_{t-1} + \phi^+ RER^+_{t-1} + \phi^- RER^-_{t-1} + \sum_{i=1}^{p} \eta_{1i} \Delta SX_{t-i} + \sum_{i=0}^{q} \eta_{2i} \Delta WGDP_{t-i} + \sum_{i=0}^{r} \left(\theta^+_i \Delta RER^+_{t-i} + \theta^-_i \Delta RER^-_{t-i}\right) + \zeta_t \quad (5)$$

The equation (5) can be tested for a possible cointegration by following the bound testing procedure. The null hypothesis, $\alpha_1 = \alpha_2 = \phi^+ = \phi^- = 0$, of no-cointegration can be tested by comparing the F-value generated from bound test with upper critical F-value. A cointegration can be claimed if calculated F-value shows higher magnitude than that of critical F-value. After verifying a cointegration, we can calculate the long run elasticity parameters of $WGDP_t$, RER_t^+ and RER_t^- as $\alpha_2/\alpha_1, \phi^+/\alpha_1$ and ϕ^-/α_1 respectively. After having long run elasticity, we can apply the Wald test on the null hypothesis of symmetry, and rejection of null hypothesis can be claimed for the presence of asymmetry in the impacts of RER_t^+ and RER_t^- on service sector exports.

After doing long run analysis, we can proceed to short run analysis. Short run model can be represented as:

$$\Delta SX_{it} = \sum_{i=1}^{p} \upsilon_{1i} \Delta SX_{t-i} + \sum_{i=0}^{q} \upsilon_{2i} \Delta WGDP_{t-i} + \sum_{i=0}^{r} \left(\varpi_i^+ \Delta RER^+_{t-i} + \varpi_i^- \Delta RER^-_{t-i}\right) \tau EC_{t-1} + \psi_t \quad (6)$$

In equation (6), the estimated negative coefficient of EC_{t-1} can be claimed for the presence of short run relationship in the model and speed of convergence as well. The short run elasticity can be estimated by coefficients of differenced variables in equation (6).

4. Results and Discussions

In the time series analysis, testing the unit root problem is the first step. But, ARDL cointegration is even efficient in the case of mix order of integration, if no variable is differenced on the second order to be stationary. Observing this condition, we are proceeding for cointegration analysis. Table 1 shows the F-values from bound test and diagnostic tests of all estimated models of service sector exports. In each model, world income, and positive and negative variables of exchange rate are independent variables. The exports of construction services (CONST), financial services (FIN), insurance services (INS), transport services (TRANS), telecommunication services (TELE), and travel and tourism services (TRAV) are dependent variables in the models 1 to 6 respectively. In every model (from 1 to 6), F-values from bound tests are larger than the upper critical value, and we can claim the presence of strong cointegration in all models. Furthermore, p-values from all diagnostic tests in the models (1 to 6) are larger than 0.1. Therefore, we can claim that our models are out of any econometric problem at 10% level of significance at least. The stability of estimated parameters has been verified by applying the CUSUM and square of CUSUM tests, and these tests are proving the stability of estimates.

In the discussion of long run results presented in table (2), RER_t^+ has an expected negative and statistically significant effect on the service sector exports of all sectors, except the financial sector. It is showing that an appreciation in Saudi Riyal has an adverse effect on most of service sector exports. A positive change of exchange rate (RER_t^+), and a positive movement of RER_t^+ has a negative impact on the most of service sector exports by the estimated negative coefficients of RER_t^+. It is also seconding the argument of inverted J-curve as appreciation is expected to depress the exports in the long run. On the other hand, a real devaluation (RER_t^-) has positive and statistically significant effect on all service sector exports, except TRANS and TRAV sectors. It means that devaluation, represented in the negatively increasing variable of RER_t^- and an absolute negative movement of RER_t^- brings in the increase of service sector exports in the most of service sectors, shown by the negative coefficients of RER_t^-. Therefore, we can claim for existence of J-curve that devaluation in the long run has been improving exports. In the symmetry analysis, the null hypotheses of symmetry in the Wald test have been rejected in all models except the TELE sector. Therefore, we can claim the presence of asymmetrical effects of RER_t^+ and RER_t^- in all service sector exports except telecommunication sector, and that appreciation and devaluation do not have same effects on exports in the long run. The effects of RER_t^+ and RER_t^- on TELEC sector are observed as symmetry, and we can claim that effects of appreciation and depreciation on exports have same magnitude and direction in the long run. Further in the asymmetrical analyses, we have found that devaluation have greater elasticity parameters than that of appreciation in case of CONST, FIN and INS. Furthermore, the effects of RER_t^- are found elastic as elasticity parameters are greater than one in case of CONST, FIN and INS. Here, we can also claim the presence of ML condition due to high elasticity parameters. Therefore, the devaluation has improved the exports with greater magnitude than own proportion of devaluation, and devaluation policy can be claimed as more effective in raising exports of the mentioned sectors. The effects of RER_t^+ are found inelastic as elasticity parameters are lesser than one in the CONST, FIN and INS sectors. The findings suggest that devaluation policy can achieve its objectives to the greater extent in the mentioned sectors, and even an appreciation policy, as it has

Tab. 1: **Bound Tests and Diagnostics**

Sub-Sector	CONST	FIN	INS	TRANS	TELE	TRAV
Bounds Test	12.5487	7.2541	8.5874	6.3214	6.1256	5.5478
Breusch-Godfrey LM Test	0.0124 (0.9785)	1.2645 (0.2897)	0.7875 (0.4854)	0.1254 (0.8875)	0.2145 (0.8025)	0.1698 (0.8489)
Breusch-Pagan-Godfrey Test	0.3154 (0.9154)	1.1954 (0.3254)	1.6254 (0.1314)	0.9587 (0.4957)	1.3154 (0.2715)	0.8689 (0.5465)
Jarque-Bera Test	1.5142 (0.4658)	1.5564 (0.4795)	3.8971 (0.1697)	4.1542 (0.1278)	1.4265 (0.4897)	4.4589 (0.1164)
Ramsey RESET Test	2.1654 (0.1154)	0.0875 (0.9154)	1.1542 (0.2897)	1.3954 (0.1696)	2.1654 (0.1325)	1.2145 (0.2459)
CUSUM	S	S	S	S	S	S
CUSUMsq	S	S	S	S	S	S

Note: Upper bound critical values are 4.29 at 1%.
S is for stability in the CUSUM and CUSUM square tests.
p-values are shown in parentheses.
Source: Authors' own research

inelastic effect, is not very harmful for the 50% of service sector exports of Saudi Arabia. For the TRANS and TRAV sectors, the appreciation policy could be harmful as RER_t^+ is showing highly elastic effects on these sectors exports, and devaluation policy is not helpful in raising the exports of these sectors because of insignificant results. In case of TELE sector, elasticity parameters of both RER_t^+ and RER_t^- are lesser than one and symmetrical. It means that devaluation could have positive effect, and appreciation could have negative effect in equal magnitudes on the TELE sector exports. World income has positive and statistically significant effects on the insurance and travel and tourism sectors. Therefore, the world income as a proxy for demand for exports has positive effects on the demand and revenues of these service sector exports of Saudi Arabia.

As shown in the short run results of the second portion of Table 2, all models demonstrate the presence of short run relations as coefficients of EC_{t-1} are negative and statistically significant. Though, the speed of convergence of CONST, FIN and INS has been found significantly higher than TRANS, TELE and TRAV. The negative and statistically significant short run effects of RER_t^+ have been found in case of TRANS, TELE and TRAV. It means that appreciation is also harmful for exports of these sectors in short run. For rest of sectors, this effect has been found statistically insignificant, and appreciation could not harm the exports of CONS, FIN and INS sectors. The coefficient of RER_t^- is negative for FIN sector thus devaluation also improve the exports of FIN sector in the short run. For the rest of sectors, coefficient of RER_t^- is showing statistically insignificant effect but its lags are showing negative and statistically significant effects on the exports of TRANS, TELE and TRAV. These are very valid evidences for the presence of J-curve hypothesis in the TRANS, TELE and TRAV sectors. In those sectors devaluation is not affecting exports immediately, but after one time period it is producing exports growth. World income has a positive contribution in the exports of INS, TRANS and TRAV sectors in the short run. Therefore, the world income can be claimed an effective demand factor for determining the exports of INS, TRANS and TRAV sectors in the short run.

Tab. 2: **Non-Linear ARDL Results**

Variables	CONST	FIN	INS	TRANS	TELE	TRAV
Long Run Estimates						
RER_t^+	-0.4251 (0.0546)	0.1154 (0.9546)	-0.6154 (0.0554)	-1.8458 (0.0807)	-0.8795 (0.0845)	-2.4215 (0.0895)
RER_t^-	-1.2144 (0.0000)	-1.4597 (0.0000)	-1.1178 (0.0000)	-0.2654 (0.7987)	-0.9259 (0.0915)	0.0795 (0.9254)
$WGDP_t$	0.2458 (0.4165)	-1.0065 (0.1756)	0.7928 (0.0487)	1.4958 (0.1478)	0.1278 (0.8452)	2.4154 (0.0845)
Constant	-4.5874 (0.2182)	14.8542 (0.1875)	-10.2574 (0.0573)	-16.8716 (0.2457)	0.0238 (0.9729)	-24.4368 (0.1816)
Wald Test (H_0:Symmetry)	2.7892 (0.0873)	3.4598 (0.0591)	4.5248 (0.0285)	2.8754 (0.0886)	0.0154 (0.9347)	4.2145 (0.0418)
Short Run Estimates						
ΔSX_{t-1}				-0.2148 (0.1546)	-0.2579 (0.0782)	-0.2542 (0.0754)
ΔRER_t^+	0.6017 (0.2278)	0.03942 (0.9951)	0.9184 (0.2462)	-0.3345 (0.0000)	-0.2687 (0.0092)	-0.3642 (0.0000)
ΔRER_t^-	-0.1649 (0.3842)	-0.6154 (0.0016)	-0.1492 (0.5058)	0.4462 (0.1924)	0.3085 (0.4987)	0.5247 (0.0842)
ΔRER_{t-1}^-				-0.5924 (0.0007)	-0.4549 (0.0451)	-0.7054 (0.0000)
$\Delta WGDP_t$	0.1318 (0.4521)	-0.4158 (0.1154)	0.4652 (0.0287)	0.2547 (0.0092)	0.0318 (0.8452)	0.3518 (0.0008)
EC_{t-1}	-0.5125 (0.0000)	-0.4248 (0.0004)	-0.5528 (0.0000)	-0.1821 (0.0429)	-0.3218 (0.0005)	-0.1582 (0.0624)

Note: p-values are shown in parentheses.
Source: Authors' own research

5. Conclusions

This paper has investigated the influence of positive and negative changes in the real ER on the services exports. It has explored the J-curve hypothesis, and concluded about the symmetrical or asymmetrical effects of exchange rate. This study concludes the presence of long run relationships in all the service sector exports' models. Appreciation is found to be responsible for declining services exports of all sectors under investigation except the financial one in the long run. Furthermore, devaluation is found helpful in raising exports of construction, financial, insurance, and telecommunication sectors. In the symmetry analysis, the effects of positive and negative real ER variables are found to be asymmetrical in nature for all sectors except telecommunication sector. The effects of devaluation on the service sector exports are found elastic in the most part of service sectors than that of effects of appreciation. Therefore, this present study encourages the Saudi government to adopt devaluation policy in order to enhance the service sector exports in large. In the short run analyses, the presence of J-curve has been found in the transport, telecommunication, and travel and tourism sectors. In the short run, appreciation is found responsible for depressing the exports of transport, telecommunication, and travel and tourism sectors, while devaluation has been helpful in raising exports of all sectors except the insurance one.

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