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The J-Curve between Pakistan and the SAARC Region: Empirical Evidence from Aggregated and Commodity Level Trade Flows

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Abstract

The present study attempts to investigate the J-curve phenomena at aggregate level as well as at commodity level between Pakistan and the SAARC (South Asian Association for Regional Cooperation) region by utilizing the trade data of 87 industries. For testing the J-curve phenomena, we rely on traditional definition (the negative coefficients at shorter lags should be followed by positive coefficients at higher lags) as well the latest definitions (short run deterioration followed by long run improvement). As far the aggregate level industries are concerned, we do not find the evidence of J-curve when we rely on traditional definition but we do find evidence of J-curve at aggregate level when we rely on latest definition of J-curve. Likewise, in case of industry level estimates, the J curve phenomena were confirmed in 13 industries considering the traditional definition. While using the new definition, the J curve has been confirmed in 14 industries. We suggest that depreciation is less effective to improve Pakistan's trade balance as the trade shares of the industries showing J curve is very low.

Keywords: J-Curve, Commodity Trade, Bounds Testing, Pakistan, SAARC region.

1. INTRODUCTION

Economies attempt to smooth out their trade deficits through the adoption of expenditure reducing policies, such as contractionary fiscal or monetary policies; or via expenditure switching policies such as devaluation of the currency or real depreciation [Bahmani-Oskooee and Ratha (2008)]. The policy makers devalue the currency under fixed exchange rate system and depreciate under the flexible exchange rate to make the trade balance surplus or to remove the trade balance deficit. In measuring the response of the changes in exchange rate on the trade balance, in the past the policy makers and researchers had to see the elasticities of exports and imports and had to check whether they satisfy the Marshall-Learner condition or not. The Marshall-Learner condition states that the devaluation/depreciation will improve the

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trade balance if the sum of export and import elasticities in absolute term is greater than unity. There are less possibilities of holding Marshall-Learner condition in the short run due to the small elasticities. However, with the passage of time, these elasticities are supposed to grow and will ultimately cross the threshold level as mentioned by the Marshall and Learner and will ultimately lead towards improvement in the trade balance (Kulkarani, 2007).

By using this theory and the common concept of the effect of currency's devaluation/depreciation, the economists developed a new concept which is known as the J-curve hypothesis. This hypothesis states that the trade balance of that country will deteriorate following the depreciation, but will show improvement as the elasticities grow [Magee (1973)]. Thus economists called it J-curve as its graph looks like a J. This improvement (J-curve) occurs due to the competitiveness of exports because of the currency's devaluation. After devaluation/depreciation, the home country's products will be cheaper in foreign country relative to the prices of foreign goods, and the foreign goods become expensive in home country relative to the prices of the domestically produced goods. The devaluation/depreciation will raise the exchange rate. The high exchange rate will raise the cost of the imports and will decrease the value of exports which will lead to widen the deficit or will reduce the trade surplus. The home country's export will start to rise due to the competition. The residence of the home country will buy the domestically produced goods which has relatively low price and this situation will lead to improve the trade balance. This hypothesis received a special attention after the introduction of flexible exchange rate in particular after the failure of Breton Woods system in 1973.

There exists vast literature on J-curve and ML condition. The former studies have used the trade data at aggregate level between a country and the rest of the world [Felmingham (1988); Gupta-Kapoor and Ramakrishna (1999); Zhang (1996); Khatoon and Rehman (2009); Kaur Suri and Shome (2013); and Kyophilavong, *et al.* (2013)]. However, there is another group of studies that relied on bilateral level trade data [Rose and Yellen (1989); Klein and Marwah (1996); Bahmani-Oskooee, Goswami and Arora (2003); Bahmani-Oskooee (2004); Bahmani-Oskooee and Harvey (2006) and Bahmani-Oskooee and Ratha (2008)]. However, both of these bilateral as well as aggregate level studies were criticized for their aggregation bias. Hence, in order to deal with the aggregation bias, most of the recent studies have disaggregated the trade data at industry level while investigating the J-curve phenomena. It includes the studies of [Meade (1988); Boyd, *et al.* (1999); Bahmani-Oskooee and Satawatananon (2010) and Baek (2013)].

As far as Pakistan is concerned; different studies have investigated the J-curve phenomena for Pakistan. However, the empirical studies have investigated the J-curve phenomena at aggregate level against the rest of the

world or at bilateral level against the major trading partners of Pakistan. The studies that have used aggregate level trade data for investigating the J-curve in case of Pakistan include the study of [Hameed and Kanwal (2009); Awan, *et al*. (2009); Jalil, *et al.* (2010); Rehman, *et al*. (2012) and Shahbaz, *et al*. (2012)]. On the other hand, the studies that have investigated the J-curve for Pakistan against her bilateral trade partners include [Akhtar and Malik (2000); Aftab and Aurangzeb (2002); Husain, *et al*. (2013); Aftab and Khan (2008) and Bahmani-Oskooee and Cheema (2009)]. The findings of these studies are mixed. These studies are suspected to have an aggregation bias both at aggregate level and at bilateral level. For this purpose, Bahmani-Oskooee, *et al.* (2016) have disaggregated the trade data at commodity level between Pakistan and the United States while using the data for 45 industries. The empirical results show the existence of J-curve in 17 industries only. Similarly, Bahmani-Oskooee, *et al*. (2017) have investigated the J-curve between Pakistan and the EU at commodity level for 77 industries. The study shows the evidence of J-curve in case of 22 industries.

The present study is important from a policy perspective. First, Pakistan is the member of SAARC. Like other successful trading blocs such as the EU and ASEAN, SAARC can be a potential area for increasing trade among the member countries. It has a great potential for trade, though it has not been realized yet, thanks to many political consideration and disputes among the member countries.

This study contributes to the literature in many ways. First, unlike the previous studies that relied on aggregate level trade data, we utilize the disaggregated level trade data at commodity level in order to account for the aggregation bias. Secondly, the earlier studies that investigated the J-curve phenomena at commodity level in case of Pakistan covered the major trading partners such as the United States and the EU [Bahmani-Oskooee, *et al.* (2015) and Bahmani-Oskooee, *et al.* (2017)]. However, the SAARC region that can be a potential area of trade among the trading partners has been ignored. Hence we test for the J-curve between Pakistan and the SAARC regions. Thirdly, the earlier studies that investigated the J-curve at commodity level for Pak-US and Pak-EU used commodity level trade data for 45 and 77 industries respectively, whereas in the present study, we use the trade data of 87 industries.

Hence the main objectives of this study are to:

i. Investigate the J-curve at aggregate level between Pakistan and the SAARC while using both the traditional and new definition of the J-curve.

ii. Investigate the J-curve at commodity level between Pakistan and the SAARC while using both the traditional and new definition of the J-curve.

Rest of the study is divided in four sections. Section 2 pertains to methodology of the study. Section 3 shows estimation of results. Section 4 reports diagnostic statistics while section 5 concludes the study.

2. METHODOLOGY

Theoretically, the increase in the economic activity in SAARC region is supposed to affect Pakistan's trade balance both positively and negatively. If increasing income in the SAARC region results in an increase in imports from Pakistan, it is supposed to improve the trade balance of Pakistan. However, it is also possible that with increasing economic activities, SAARC region begins to produce the import substitute goods. In this case, the increase in economic activity of the SAARC region is expected to affect Pakistan's trade balance negatively. Similarly, one of the major determinants of Pakistan's trade balance is Pakistan's own GDP. An increase in economic activities in Pakistan, may affect negatively the trade balance as Pakistan is supposed to increase volume of her imports. Alternatively, an increase in economic activities in Pakistan may improve the trade balance as Pakistan can now produce more of that commodity at domestic level. Finally, an important indicator of trade balance is the exchange rate. Since we are focusing on the SAARC region, we therefore, use the effective exchange rate instead of bilateral exchange rate. An increase in effective exchange rate indicates real depreciation. So, the depreciation will improve the trade balance of the i_{th} industry while a decrease will show strengthening of the domestic currency which is supposed to worsen the trade balance of the i^{th} industry.

After the introduction of the technique for the search of J-curve by Bahmani-Oskooee (1985), most of the studies have employed the reduced form model of trade balance. Thus, following the studies of Bahmani-Oskooee (1985) and Rose and Yellen (1989), we identify that the income of Pakistan and SAARC region along with the real affective exchange rate are the main determinants of Pakistan's trade balance.

As this research study is concerned with the industry level estimation, by following the studies of Bahmani-Oskooee and Wang (2007); and Bahmani-Oskooee and Xu (2012), we choose the following identification for the i^{th} industry.

$$\text{Ln } TB_{i,t} = \alpha_0 + \beta_1 \text{Ln} Y_{SA,t} + \beta_2 \text{Ln } Y_{Pak,t} + \beta_3 \text{Ln } REER_t + \mu_t \quad \ldots (1)$$

The term $TB_{i,t}$ represents the trade balance of the i^{th} industry at time t. As the model is in Log form, the trade balance is defined as the ratio of Pakistan's exports of the i^{th} industry to the SAARC region over its imports of the i^{th} industry from SAARC region. Y_{SA} denotes the impact of SAARC region income on the trade balance of the i^{th} industry. Theoretically, the increase in the economic activity in SAARC region is supposed to boost up the export of i^{th} industry and it is expected to have a positive sign of β_1. However, it is also expected that SAARC region can start to produce the import substitute goods when its income rises. In this case β_1 will be negative. Similarly, it is also expected that Y_{Pak} (β_2) which indicates the economic activities in Pakistan, has a positive impact on the trade balance of the i_{th} industry as it can now produce more of that commodity. This impact can be negative as when Pakistan's income increases, they start to import this commodity instead of producing that commodity. At last, the real effective exchange rate denoted by REER is defined in such a way that an increase shows real depreciation. So, the depreciation will improve the trade balance of the i_{th} industry and we expect a positive sign for β_3.

The estimation of equation (1) will yield only the long run estimates. But as the J-curve is a short run phenomenon, we have to incorporate short run estimates in equation (1). For this purpose, the equation (1) can be expressed in the format of error correction modeling, so that we can give the short run dynamics for searching the J-curve. In light of the literature, the bound testing approach of [Pesaran, *et al.* (2001)] and the error correction modeling shown by equation (2) is used in this research study.

$$\Delta LnTB_{i,t} = \alpha + \sum_{j=1}^{n} \beta_{t-j} \Delta LnTB_{t-j} + \sum_{j=0}^{n} \delta_{t-j} \Delta LnY^{SA}_{t-j} + \sum_{j=0}^{n} \gamma_{t-j} \Delta LnY^{PAK}_{t-j} + \sum_{j=0}^{n} \pi_{t-j} \Delta LnREX_{t-j} + \Omega_1 LnTB_{t-1} + \Omega_2 LnY^{SA}_{t-1} + \Omega_3 LnY^{PAK}_{t-1} + \Omega_4 LnREEX_{t-1} + e_t \quad (2)$$

Here, the $TB_{i,t}$ represents the trade balance of i_{th} industry at time t, Δ shows the difference, n represents the lag length and (e_t) is the residual which is assumed to be serially uncorrelated. We can get the short run estimates along with long run estimates in one step by estimating equation (2). However, in order to ensure that the long run coefficients are not spurious, we have to ensure the joint significance of the lagged level variable suggested by [Pesaran, *et al.* (2001)]. According to the time series studies, if we use non-stationary data or non-stationary variables for estimation then our results will be spurious. To counter this problem, we use different techniques to make our variables

stationary. But the use of stationary variables provides short run information from the data and eliminates the long run information. Hence, there must be a technique which may capture whether the long run relationship between variables exists or not.

Most of the studies apply (Engle and Granger (1987) and Johensen-Juselius (1990)) approach for cointegration or long run analysis but for these tests, data must be integrated of the same order. Furthermore, the above mentioned models are not suitable for small data set. ARDL model developed by Shin and Pesaran (1999); Pesaran and Smith (1996) and Pesaran, *et al*. (2001) is preferable to these tests. Unlike the other tests, through ARDL, we can check long run relationship or existence of co-integration irrespective of the fact that whether a variable is stationary at level I(0) or stationary at I(1) or if it is a combination of both. ARDL test have many desirable properties. ARDL also incorporate the problem of endogeneity, means it is not necessary that focused variables are exogenous or not [Javed and Farooq (2009)]. This approach is best for both small and large sample.

First step of ARDL approach is Bound test. Bound test is used to calculate the long run relationship among the variables, by using F test with two sets upper and lower bounds. Critical region is given in the form of lower bound I(0) and upper bound I(1) Pesaran, *et al*. (2001). If the value of F.Stat exceeds from upper bound then null hypothesis of no co integration is rejected. If the value of F STAT is smaller than lower bound its means no existence of co integration or no long run relationship. On the other hand if the value of F STAT lies between upper and lower bound then result will inconclusive. For the selection of lag length model different criterion such as SBC and AIC are used. The SBC is popular criteria for a parsimonious model, which selects minimum lag length, whereas AIC is identified for the selection of maximum lags.

A pre-requisite for ARDL test is the unit root test which is used to check the stationary of variables. According to the Granger and Newbold (1974) any statistical test may find the relationship between two non-stationary variables but it leads to spurious results. So we have to check the stationary of variables and order of integration to ensure that no variable is integrated of I(2). If variable is integrated of I(2), it will invalidate the ARDL. So all variables must be integrated of I(0) and I(1). For this purpose, we applied augmented Dickey-Fuller to check stationary of variables. The detail is shown in Appendix Table 1, which indicates that some variables are integrated of I(0) and some are integrated of I(1); however, there is no variable that is integrated of I(2). Hence, we can apply ARDL model.

3. ESTIMATION RESULTS

The results of Bounds test are given in Appendix Table 2. It indicates industry wise long run relationship between trade balance and other independent variables for Pakistan and the SAARC region. The results show that out of 87 industries, in case of 40 industries, there is an evidence of long run relationship. The industries where long run relationship occurs are coded as 01, 31, 41, 42, 53, 71, 73, 74, 75, 99, 240, 512, 513, 561, 581, 599, 611, 6 12, 621, 632, 656, 663, 666, 667, 678, 712, 714, 715, 718, 719, 722, 723, 72 9, 731, 732, 812, 821, 841, 892, and 896. There are 30 industries where coint egration does not exist while in case of 16 industries, we have inconclusive results.

As we have to estimate both short run and long run impact of exchange rate on trade balance, so, we are now in a position to empirically estimate equation (2) for all the 87 industries that trade between Pakistan and SAARC region over the period of 1980 to 2017. These are the industries for which the continuous data are available and make 67% trade shares in 2016 between the trade of Pakistan and SAARC region. As we are dealing with annual data, so following the previous studies, we use maximum of three lags for each differenced variable and select the optimal lags through Akaike info criteria (AIC). The results obtained from the optimal models are given in Tables 1 and 2.

The coefficient estimates are given in Table 1, while the diagnostic statistics are given in Table 2. At the top of both tables, the estimates of equation (2) are given using the aggregate level bilateral trade between Pakistan and SAARC region. Here we only give the estimates of real effective exchange rate due to the volume of short run coefficients, so that we can capture the J curve. For the calculation of the J-curve, this study relies on two different definitions of the J-curve, traditional as well as the new definition. According to the traditional definition, for J-curve to exist, the negative coefficients of the exchange rate at shorter lags should be followed by positive coefficients at higher lags [(Bahmani-Oskooee 2004)]. While, according to the new definition, for J-curve to exist, short run deterioration is to be followed by long run improvement i.e., the negative short run coefficient of the exchange rate should be followed by positive long run coefficient of the exchange rate.

To begin with aggregate bilateral trade, the entire short run coefficients are negative and show deterioration. Hence, according to the traditional definition of J-curve, i.e., the negative short run coefficients followed by positive short run coefficients, the aggregate bilateral trade data shows the absence of J-curve. However, by considering new definition of J curve given

by Rose and Yellen (1989), i.e., short run deterioration followed by long run improvement, the aggregate trade data makes the shape of J-curve but the coefficients are insignificant. When we move to industries level results, there are 32 industries, whose trade balance deteriorate at the shorter lags and improve at higher lags in the short run. Out of these 32 industries, the 13 industries have negative coefficients followed by positive significant coefficient at higher lags. These industries are coded as 25, 31, 292, 581, 621, 629, 663, 665,694, 712, 894, 896, and 897. So according to traditional definition, the J curve can only be found in 13 industries out of 87 industries. However, if we consider the new definition of J-curve given by [Rose and Yellen (1989)], i.e., short run negative deterioration followed by long run improvement, there are 33 industries out of 87 that exhibit this property. Out of these 33 industries, there are 14 industries that has short run negative coefficient followed by positive and significant long run coefficient and fulfill the new definition of J-curve given by [Rose and Yellen (1989)]. These industries are coded as 52, 75, 221,240, 514, 551, 629, 661, 664, 714, 724, 732, 861 and 893.

To summarize the results, according to the traditional definition, we have the evidence on J-curve in selected industries such as Eggs; Fish, fresh and simply preserved; Crude vegetable materials, n.e.s.; Plastic materials, regenerd. Cellul; Materials of rubber; Articles of rubber, n.e.s.; Mineral manufactures, n.e.s.; Glassware; Nails, screws, nuts, bolts, rivets; perambulators, toys, games and sports; works of art, collectors pieces; jewellery and gold/silver and agricultural machinery and instruments. Whereas, according to the latest definition, we have evidence of J-curve in industries such as articles of rubber, n.e.s.; glass; other inorganic chemicals; dried fruit including artificially; spices; oil seeds, oil nuts and oil kernels; cheese and curd; office machines; telecommunications apparatus; road motor vehicles; scientific, medical, optical, articles of artificial plastic mate.

These are small industries as shown by their trade share. The existence of J-curve in these industries indicate that due to advanced contracts, adjustment to shocks and lag in exchange rate pass through, these industries may experience worsening of trade balance, however, over the course of time, the devaluation/deprecation policy is supposed to be successful for the mentioned industries.

Table 1. Short Run Coefficients Estimates

			Short Run Estimates			
SITC	INDUSTRY	T.SHARE	$\Delta LnREER_t$	$\Delta LnREER_{t-1}$	$\Delta LnREER_{t-2}$	$\Delta LnREER_{t-3}$
	Aggregate		-0.63(0.41)	-0.82(0.59)	-1.22(0.87)	-1.21(1.09)
1	Live animals	0.231	4.43(0.49)	1.29(0.13)	-4.90(0.69)	-
22	Milk and cream	1.799	2.11(0.20)	9.22(1.18)		
25	Eggs	0.0438	-6.16(0.61)	-0.17(0.01)	2.23(0.24)	9.94(1.81)
31	Fish, fresh and simply preserved	0.14	-7.88(1.16)	-0.75(0.10)	4.95(1.92)*	
41	Wheat including spelt and meslin	0.00194	-21.78(2.17)**	-5.15(0.44)	-12.22(1.24)	-7.51(0.96)
42	Rice	4.18731	-7.25(0.79)	3.23(0.37)	3.39(0.38)	0.57(0.08)
46	Meal and flour of wheat or of mesli	2.3957	9.58(0.93)	-2.60(0.24)	-1.17(0.14)	
51	Fruit, fresh, and nuts excl. Oil	2.657	0.85(0.31)	-3.04(1.16)	-2.98 (1.12)	-1.87(0.87)
52	Dried fruit including artificially	1.7134	-4.69(1.19)	-11.67(3.00)	-3.52(0.85)	-2.95(0.99)
53	Fruit, preserved and fruit preparation	0.337	-9.78(1.66)*			
54	Vegetables, roots and tubers, fresh	7.326	-4.38(0.85)	7.07(1.46)	-4.66(0.96)	2.58(0.68)
71	Machinery, other than electric	1.3092	2.88(1.17)			
73	Chocolate and other food preptns.	0.0187	-8.18(0.72)	-11.08(0.99)	-14.93(1.33)	2.79(0.33)
74	Tea and mate	2.02951	-2.59(0.75)	-2.67(0.96)		
75	Spices	0.316	0.83(0.23)	-5.12(1.53)	-11.1(3.14)***	-0.25(0.08)
99	Food preparations, n.e.s.	0.163	3.46(0.46)	8.95(1.24)	-6.34(1.17)	
121	Tobacco, unmanufactured	0.08647	-2.84(0.25)	8.17(0.71)	4.01(0.45)	
221	Oil seeds, oil nuts and oil kernels	0.686	-7.95(1.24)	-4.63(0.72)	-12.77(2.07)**	-7.45(1.47)
240	Cheese and curd	0.0009	-9.71(2.54)**	-0.41(0.12)	-9.81(2.91)**	0.92(0.36)

			Short Run Estimates			
SITC	INDUSTRY	T.SHARE	$\Delta LnREER_t$	$\Delta LnREER_{t-1}$	$\Delta LnREER_{t-2}$	$\Delta LnREER_{t-3}$
273	Stone, sand and gravel	0.291	-6.88(0.95)	0.19(0.02)	-0.27(0.03)	-7.86(1.48)
276	Other crude minerals	0.418	-4.88(1.35)			
292	Crude vegetable materials, n.e.s.	0.977	-2.58(1.39)	0.06(0.03)	0.36(0.20)	2.40(1.75)*
321	Coal, coke and briquettes	0.4225	14.81(0.86)	-10.23(0.61)	-6.74(0.40)	12.54(0.98)
512	Organic chemicals	4.749	-25.03(2.41)**	-19.21(1.73)*	-27.66(2.59)**	-7.97(0.88)
513	Inorg. chemicals elems., oxides,	0.244	-7.18(1.26)	-10.90(2.19)**		
514	Other inorganic chemicals	0.307	-4.05(0.55)	-8.48(1.20)	-10.32(1.44)	-0.85(0.14)
541	Medicinal and pharmaceutical products	1.767	1.42(0.36)	-8.35(2.28)**	-2.00(0.53)	1.66(0.52)
551	Essential oils, perfume and flavor	1.185	-10.00(1.21)	-12.30(1.62)	-4.29(0.52)	-3.74(0.66)
554	Soaps, cleansing and polishing prepar	0.1592	-5.93(0.71)	-0.48(0.48)	-4.32(0.54)	2.89(0.48)
561	Fertilizers manufactured	0.2409	32.98(1.79)*	42.43(2.53)**	31.36(1.71)	3.20(0.23)
581	Plastic materials, regenerd. Cellul	2.3431	2.71(0.32)	-1.43(0.17)	4.57(0.56)	10.19(1.69)*
599	Chemical materials and products,	0.921	-6.37(2.07)**	-6.30(2.40)**		
611	Leather	0.5397	-15.57(2.86)**	-17.72(4.10)***		
612	Manuf. of leather or of artif.	0.006	4.61(0.58)	1.06(0.13)	2.02(0.33)	
621	Materials of rubber	0.024	-11.81(1.36)	6.29(0.84)	10.06(1.67)	1.48(0.26)
629	Articles of rubber, n.e.s.	0.503	2.23(0.27)	-8.68(1.12)	-14.67(1.89)*	10.01(2.01)
632	Wood manufactures, n.e.s.	0.067	16.08(1.53)	-5.40(0.55)	24.07(2.41)**	-10.47(1.36)
641	Paper and paperboard	0.821	-2.14(0.24)	-2.37(0.28)	-7.89(0.97)	-1.74(0.29)

		Short Run Estimates				
SITC	INDUSTRY	T.SHARE	$\Delta LnREER_t$	$\Delta LnREER_{t-1}$	$\Delta LnREER_{t-2}$	$\Delta LnREER_{t-3}$
642	Articles of paper, pulp, paperboard	0.115	-5.43(0.65)	-3.58(0.44)	3.78(0.59)	
651	Textile yarn and thread	4.575	0.27(0.09)	2.07(0.76)	1.76(0.66)	2.87(1.43)
653	Text fabrics woven ex narrow, spec,	0.621	12.04(1.88)*	20.4(2.92)**	11.01(1.55)	9.88(1.96)
655	Special textile fabrics and related	0.30817	0.16(0.02)	-2.50(0.33)	-4.29(0.54)	4.79(1.79)*
656	Made up articles, wholly or chiefly	0.274	-0.85(4.63)***	1.06(0.13)	2.02(0.33)	
657	Floor coverings, tapestries, etc.	0.028	7.49(1.47)	-5.67(1.08)	4.48(1.18)	
661	Lime, cement and fabr. bldg. mat.	6.32	-16.88(1.02)	3.41(0.20)	5.03(0.39)	
662	Clay and refractory construction mat.	0.039	-3.31(0.34)	-6.78(0.88)		
663	Mineral manufactures, n.e.s.	0.058	-2.45(0.36)	16.56(2.61)**	18.40(2.40)	1.82(0.33)
664	Glass	0.139	2.52(0.29)	-2.08(0.25)	12.04(1.44)	-0.29(0.05)
665	Glassware	0.045	6.55(0.78)	-6.10(0.75)	-3.39(0.41)	-2.32(0.38)
666	Pottery	0.001	-7.24(0.82)	7.55(0.88)	-16.05(2.04)	3.17(0.48)
667	Pearls and precious and semi preci.	0.009	3.21(0.44)	-1.67(0.22)	-3.01(0.43)	-3.07(0.58)
673	Iron and steel bars, rods, angles	0.064	5.11(0.47)	10.34(1.01)	-2.58(0.33)	
674	Universals, plates and sheets	0.037	-12.30(1.13)	4.15(0.36)	-0.79(0.09)	
678	Tubes, pipes and fittings of iron	1.193	-8.96(0.99)	-2.60(0.28)	1.42(0.16)	1.10(0.16)
691	Finished structural parts and struc.	0.861	9.91(0.82)	2.37(0.20)	7.12(0.64)	-1.95(0.22)
694	Nails, screws, nuts, bolts, rivets	0.013	-6.68(0.59)	-3.13(0.28)	-8.45(0.77)	7.12(1.86)
695	Tools for use in the hand or in mac	0.007	0.95(0.07)	2.90(0.22)	15.08(1.17)	-4.72(0.49)
697	Household equipment of base metals	0.162	4.78(1.09)	0.63(0.13)	4.10(0.82)	4.80(1.37)
698	Manufactures of metal, n.e.s.	0.029	-1.23(0.13)	-1.38(0.18)		

			Short Run Estimates			
SITC	INDUSTRY	T.SHARE	$\Delta LnREER_t$	$\Delta LnREER_{t-1}$	$\Delta LnREER_{t-2}$	$\Delta LnREER_{t-3}$
711	Power generating machinery, other	2.542	-17.67(1.56)	-7.70(0.65)	-13.56(1.22)	-7.67(0.89)
712	Agricultural machinery and implement	0.1855	-8.48(1.13)	15.10(2.11)	1.21(0.16)	12.31(2.27)
714	Office machines	1.008	-4.40(0.66)			
715	Metalworking machinery	0.054	2.23(0.20)	5.89(0.58)	12.65(1.24)	5.60(0.73)
717	Textile and leather machinery	0.374	7.35(1.76)			
718	Machines for special industries	0.079	16.22(2.18)**	5.81(0.99)		
719	Machinery and appliances non electr.	0.612	2.93(0.82)	0.48(0.16)		
722	Electric power machinery and switch	0.06	5.08(0.81)	0.14(0.02)		
723	Equipment for distributing electric	0.115	-6.12(0.74)			
724	Telecommunications apparatus	0.016	-16.22(1.15)	0.11(0.01)	4.26(0.32)	-18.07(1.77)*
725	Domestic electrical equipment	0.65	-5.72(0.73)	2.08(0.27)	6.76(0.90)	-1.98(0.34)
729	Other electrical machinery and	0.389	7.05(1.02)	11.12(1.68)	2.33(0.35)	5.02(1.01)
731	Railway vehicles	0.03477	8.90(0.64)	13.85(1.03)	20.07(1.53)	15.88(1.44)
732	Road motor vehicles	0.175	-8.88(1.69)*	-2.39(0.45)	3.04(0.74)	
733	Road vehicles other than motor vehi.	0.012	5.61(0.51)	6.05(0.56)	8.80(0.84)	8.38(1.06)
812	Sanitary, plumbing, heating and light	0.034	10.98(1.26)	-5.61(0.66)	-6.82(0.81)	-2.57(0.39)
821	Furniture	0.019	-8.07(0.80)	2.16(0.22)	3.58(0.37)	-3.25(0.41)
841	Clothing except fur clothing	0.239	2.64(0.58)	3.50(0.77)	1.47(0.40)	
851	Footwear	1.06	-9.78(1.65)*			
861	Scientific, medical, optical, meas.	0.211	-1.56(0.46)	-1.85(0.57)	-4.08(1.26)	-3.56(1.38)
864	Watches and clocks	0.00994	6.17(0.44)	-1.55(0.11)	4.75(0.38)	7.55(0.80)

		Short Run Estimates				
SITC	INDUSTRY	T.SHARE	$\Delta LnREER_t$	$\Delta LnREER_{t-1}$	$\Delta LnREER_{t-2}$	$\Delta LnREER_{t-3}$
891	Musical instruments, sound recorder	0.001	-9.64(0.93)	10.51(1.07)	20.37(2.08)**	-1.44(0.18)
892	Printed matter	0.145	4.48(2.11)**	5.58(2.74)**	2.11(1.03)	-0.09(0.06)
893	Articles of artificial plastic mate	1.229	0.61(0.11)	-9.86(1.74)*	-8.29(1.85)*	
894	Perambulators, toys, games and sports	0.048	10.59(1.68)*	-3.64(0.60)	27.39(4.56)***	4.57(0.91)
896	Works of art, collectors pieces and antiques	0.9604	-6.62(0.39)	-9.91(0.61)	-1.30(0.08)	23.81(1.93)*
897	Jewellery & articles of precious material, n.e.s.	0.046	-7.01(0.82)	14.68(2.23)**		
899	Miscellaneous manufactured articles, n.e.s.	0.322	0.77(0.21)	3.38(1.01)	6.03(1.80)	4.55(1.77)

1. Numbers inside the parenthesis next to coefficient are the absolute values of t-ratios.

2. On the coefficients represents their significance at 10 percent.

3. T. Shares (trade shares) of each industry is calculated as the sum of export and import by that industry as a percent of sum of total export and import of Pakistan to SAARC region. These shares are only for 2016. For example, 42-Rice is 4.18%.

These findings indicate that devaluation policy is effective only in few industries. Out of these industries, agricultural related products, plastic, rubber medical instruments are the prominent industries that are supposed to have been positively affected by exchange rate depreciation/devaluation.

As for income effect, the SAARC region income carries positive coefficients for 58 industries but is significant only for 17 industries. These 17 industries are coded as: 1, 54, 71,513, 541, 561, 581, 612, 632, 651, 663, 698, 711, 712, 722, 731 and 733. This means that as the SAARC region economies grow, they increase their imports from Pakistan to meet their higher demand. There are 29 industries in Table 1 that are negatively affected by the size of the SAARC region economy. This means that as SAARC region economies grow, they produce these import substitutes goods instead of importing it which ultimately decreases Pakistan's export of these goods to the SAARC region. Out of theses 29 industries, only in 5 industries, it has significant coefficient at 10% significance level. These industries are coded as: 75, 240, 514, 551 and 611. As far, Pakistan's income effect is concerned, there are 29 industries in Table 1, which grow with the growth of Pakistan's economy and it carries positive coefficients. This means that as the economy of Pakistan grows, the trade balance of these industries improve as they now produce more and export more to SAARC region. The coefficient is significant only in 5 cases out of these 29 industries at 10% level of significance. These five industries are coded as: 221, 240, 514, 551 and 611. In Table 1, there are 58 industries that are negatively affected by the size of Pakistan's economy as Pakistan's GDP carries negative sign. This indicates that as Pakistan's GDP increases, it imports these commodities to meet its higher demand instead of producing more of these commodities. So, the exports of these commodities reduce while imports increase, which leads toward worsening of trade balance of these industries. The coefficients are significant in 14 industries out of these 58 industries. These 14 industries are coded as: 1, 54, 71, 541, 561, 581, 612, 651, 663, 711, 712, 731, 733 and 896.

4. DIAGNOSTIC STATISTICS

Appendix Table 3 shows the diagnostic statistics. The ECM_{t-1} value of every industry is given in Appendix Table 3. This value measures the speed of adjustment. These values are negative and significant which shows convergences toward long run equilibrium. As the value of ECM for industry coded as 1 is 0.8692 that means that speed of adjustment is 86% annually as we have annual data. If we consider industry 31, the value is 1.054 and indicates that 52.7% adjustment takes place in six months since we are using annual data. Other diagnostics are also given in the above table. LM test (Langrange multiplier) is used for the detection of autocorrelation which is the chi square distribution test with one degree of freedom.

Considering the critical values of 3.84 at 5% level of significance, most of the values are insignificant indicating the absence of autocorrelation. The value is significant in 9 cases indicating autocorrelation. These industries are coded as: 1, 31, 42, 53, 221, 321, 561, 723 and 821.

For the model specification, Ramsey's Reset test is used which is also a chi square distribution test with one degree of freedom. In most cases, the model is correctly specified. In 12 cases, the values are significant indicating the incorrect specification of optimum lag through the Akaike information criteria (AIC). Following [Bahmani-Oskooee, *et al.* (2005)], the CUSUM and the CUSUMSQ test are applied to the residuals in order to check the stability of the long run and short run estimate of error correction model (ECM). The stables models are denoted by S and the unstable one by US in this study. The results of these tests show that most models are stable. Lastly, the value of adjusted R square is given which shows the goodness of fit of each optimum model. In majority of the cases, our results are satisfactory. In case of most of the results, we have no serial correlation, the results are stable and fulfills the condition of normality as shown by the Ramsey's Reset test.

Appendix Table 3 indicates that it almost satisfies majority of the diagnostic tests in terms of autocorrelation, stability, and model specification as reflected by the LM test, Ramsey's Reset test, CUSUM and the CUSUMSQ test as well.

5. CONCLUSION AND POLICY IMPLICATIONS

Analyzing the response of trade flows to the changes in exchange rate is a very important topic in the literature of Economics. The earlier studies had to analyze the export and import elasticities and to check whether it satisfies the Marshall-Learner condition or not. After the introduction of the J-curve, the researchers used to estimate the short run as well as the long run impact of exchange rate on trade balance for estimating the J-curve empirically. In the earlier studies, the researchers have employed the aggregate trade data, which is supposed to be suffering from the aggregation bias. Another group disaggregated the data to some extent by using the bilateral trade data of one country with another country or with a group of countries. The recent studies have disaggregated the data at the industry/commodity level by analyzing the response of different industries trade to the changes in exchange rate. In the present research work, 87 industries are selected which has 67% of trade share in Pakistan's trade with SAARC region. The bounding testing approach to cointegration is used to check the long run relationship among the variables. Cointegration is found in 40 industries out of 87 industries, no cointegration is found in 30 industries and 16 industries result shows inconclusiveness. By using error correction model, the study found J-curve in 13

industries considering old definition and found J-curve in 14 industries considering the new definition of J-curve given by [Rose and Yellen (1989)]. The SAARC region income has positive significant coefficients in 17 cases and has negative significant impact on the trade balance of 5 industries. Pakistan's income has positive significant impact on the trade balance of 5 industries and has significantly negative impact on the trade balance of 14 industries.

The empirical results tend to have important policy implications. Since we have the evidence of J-curve only in few industries, it indicates that the devaluation policy is less effective in case of Pakistan. Furthermore, nominal exchange rate devaluation does not always translate into the real exchange rate devaluation. Thus, a policy of nominal devaluation will only be successful if it translates into real devaluation, which can only occur if the domestic prices do not increase significantly relative to the foreign prices. We also need to focus domestically on supply side bottlenecks so that to provide suitable environment to the exportable sector and to develop import substitutes at the domestic level. Finally, though in case of many industries, devaluation policy is not that effective, yet currency devaluation remains a significant policy instrument to improve trade balance for many of the industries in trade between Pakistan and its trading partners in the SAARC region.

Table 2. Long Run Coefficients Estimates

SITC	INDUSTRY	CONSTANT	LnYsa	LnYpak	lnREER
	Aggregate	-5.78(0.38)	0.06(0.03)	0.33(0.14)	0.66(0.57)
1	Live animals	144.19(1.66)*	20.43(1.99)**	7.43(1.91)*	-10.53(1.49)
22	Milk and cream	45.20(0.44)	0.68(0.06)	4.33(0.23)	-2.79(0.35)
25	Eggs	37.10(0.34)	-0.68(0.05)	-1.75(0.08)	-4.74(0.57)
31	Fish, fresh and simply preserved	44.50(0.68)	6.60(0.86)	-10.84(0.82)	-2.25(0.42)
41	Wheat including spelt and meslin	-100.89(0.85)	-4.95(0.38)	13.17(0.57)	7.51(0.81)
42	Rice	76.39(0.77)	10.09(0.88)	-16.81(0.85)	-6.15(0.81)
46	Meal and flour of wheat or of mesli	108.84(1.10)	15.20(1.27)	-24.87(1.23)	-8.58(1.07)
51	Fruit, fresh, and nuts excl. Oil	-8.219(0.29)	0.77(0.27)	-0.26(0.05)	0.96(0.45)
52	Dried fruit including artificially	-48.56(1.17)	-1.12(0.21)	4.74(0.54)	4.87(1.74)*
53	Fruit, preserved and fruit preparation	-33.02(0.56)	-5.65(0.76)	8.83(0.72)	1.78(0.34)
54	Vegetables, roots and tubers, fresh	78.78(1.50)	9.97(1.83)*	-17.09(1.74)	-4.87(1.23)
71	Machinery, other than electric	40.24(1.68)*	6.15(1.98)**	-9.85(1.93)*	-2.79(1.34)
73	Chocolate and other food preparation	-79.44(0.68)	-3.46(0.27)	9.52(0.42)	7.94(0.86)
74	Tea and mate	-26.15(0.88)	-2.68(0.71)	4.99(0.80)	1.66(0.66)
75	Spices	-62.91(1.67)*	-5.01(1.86)*	10.41(1.53)	4.06(1.78)*
99	Food preparations, n.e.s.	7.91(0.11)	0.93(0.11)	-1.93(0.14)	1.06(0.19)
121	Tobacco, unmanufactured	51.17(0.47)	7.06(0.54)	-11.67(0.53)	-3.67(0.42)
221	Oil seeds, oil nuts and oil kernels	-221.73(1.94)*	-12.70(1.18)	31.00 (1.84)*	15.90(1.83)*
240	Cheese and curd	-143.31(4.08)***	-19.49(4.69)***	32.95 (4.64)***	7.19(2.64)**
273	Stone, sand and gravel	-45.11(0.63)	-4.01(0.55)	7.88 (0.59)	3.09(0.56)
276	Other crude minerals	92.20(1.34)	9.77(1.25)	-17.85(1.31)	-6.36(1.19)
292	Crude vegetable materials, n.e.s.	4.65(0.22)	-0.18(0.08)	-0.10(0.02)	-0.65(0.40)

SITC	INDUSTRY	CONSTANT	LnYsa	LnYpak	lnREER
321	Coal, coke and briquettes	113.09(0.65)	14.45(0.71)	-24.58(0.71)	-7.98(0.59)
512	Organic chemicals	24.65(0.73)	3.58(0.84)	-5.78(0.83)	-2.02(-0.68)
513	Inorg. chemicals elems., oxides, halides	42.44(0.86)	10.09(1.91)*	-14.37(1.75)*	-2.46(0.59)
514	Other inorganic chemicals	-123.25(1.43)	-13.97(1.69)*	24.89(1.68)*	8.06(1.77)*
541	Medicinal and pharmaceutical products	186.18(1.74)8	17.07(1.68)*	-32.87(1.67)*	-14.04(1.72)*
551	Essential oils, perfume and flavor	-129.03(1.56)	-11.80(1.82)*	23.12(1.75)*	7.66(1.74)*
554	Soaps, cleansing and polishing preparation	-41.68(0.49)	-4.97(0.51)	8.56(0.51)	3.42(0.52)
561	Fertilizers manufactured	511.44(2.88)**	57.89(2.87)**	-104.10(2.98)**	-29.83(2.15)**
581	Tubes, pipes & hoses of plastics	71.90(1.70)*	12.76(2.32)**	-19.46(2.16)**	-5.39(1.46)
599	Chemical materials and products, n.	-17.50(0.64)	0.38 (0.11)	0.90 (0.16)	1.39 (0.61)
611	Leather	-136.60(2.93)**	-12.40(2.12)**	24.07(2.47)**	10.10(2.58)**
612	Manuf. of leather, n.e.s.	72.69(2.06)**	5.35(1.72)*	-11.43(1.77)*	-5.355(1.97)**
621	Materials of rubber	-5.64(0.14)	1.35(0.34)	-1.13 (0.15)	0.97 (0.31)
629	Articles of rubber, n.e.s.	-100.86(1.21)	-7.65(0.92)	16.19(1.06)	7.01(1.89)*
632	Wood manufactures, ,n.e.s.	155.28(1.50)	16.86(1.69)*	-30.60(1.60)	-9.82(1.25)
641	Paper and paperboard	-2.03(0.02)	0.30(0.040)	-0.45(0.03)	1.60(0.28)
642	Articles of paper, pulp, paperboard	19.65(0.26)	3.89(0.522)	-5.67(0.42)	-1.85(0.31)
651	Textile yarn and thread	180.04(1.33)	19.80(1.78)*	-35.59(2.34)**	-12.39(1.19)
653	Text fabrics woven ex narrow, spec.	134.72(2.08)**	3.32(0.50)	-13.61(1.14)	-12.17(2.40)**
655	Special textile fabrics and related	15.26(0.17)	4.78(0.51)	-6.54(0.39)	-0.27(0.04)
656	Made up articles, wholly or chiefly	-11.48(0.15)	-3.39 (0.39)	4.62 (0.31)	0.67(0.11)
657	Floor coverings, tapestries, etc.	-32.97(0.71)	-4.88(0.90)	7.62(0.82)	3.82(1.01)
661	Lime, cement and fabr. bldg. mat.	48.23(0.30)	3.28(0.19)	-6.86(0.23)	-5.95(0.46)

SITC	INDUSTRY	CONSTANT	LnYsa	LnYpak	lnREER
662	Clay and refractory construction mat.	75.23(0.91)	12.87(1.27)	-19.76(1.16)	-6.04(0.87)
663	Mineral manufactures, n.e.s.	152.3(2.01)**	12.11(1.68)*	-25.01(1.84)8	-10.79(1.86)*
664	Glass	-33.69(0.31)	-6.27(0.723)	9.53(0.60)	8.94(2.19)**
665	Glassware	-88.20(1.02)	-8.63(0.99)	16.22(1.02)	6.32(0.96)
666	Pottery	-50.12(0.42)	2.52(0.21)	0.94(0.04)	4.63(0.51)
667	Pearls and precious & semi-precious stones	113.61(1.34)	13.82(1.45)	-23.95(1.44)	-7.80(1.17)
673	Iron and steel bars, rods, angles	45.26(0.45)	5.83(0.57)	-9.97(0.54)	-2.52(0.32)
674	Universals, plates and sheets of iron	59.38(0.56)	11.62(1.09)	-17.43(0.90)	-3.19(0.38)
678	Tubes, pipes and fittings of iron	45.63(0.49)	-9.02(1.29)	-20.19(1.21)	-9.02(1.29)
691	Finished structural parts and struc.	-33.95(0.29)	-5.48(0.46)	8.43(0.39)	3.36(0.37)
694	Nails, screws, nuts, bolts, rivets	-64.55(0.98)	-6.67(0.91)	12.21(0.97)	4.91(0.86)
695	Tools for use in the hand or in mach.	39.38(1.40)	2.65(0.93)	-5.91(1.14)	-2.98(1.38)
697	Household equipment of base metals	70.56(1.30)	7.02(1.23)	-12.99(1.27)	-5.80(1.38)
698	Manufactures of metal, n.e.s.	108(1.38)	12.06(1.73)	-21.69(1.51)	-6.64(1.10)
711	Power generating machinery, other	58.62(2.65)**	6.33(2.75)**	-11.39(2.75)**	-4.38(2.62)**
712	Agricultural machinery and implement	194.08(2.60)**	19.74(2.29)**	-36.21(2.43)**	-16.03(2.75)**
714	Office machines	-114.82(1.75)*	-7.10(1.07)	16.31(1.36)	9.39(1.86)*
715	Metalworking machinery	98.03(1.14)	8.59(0.92)	-16.89(1.03)	-7.28(1.02)
717	Textile and leather machinery	16.50(0.42)	2.82(0.64)	-4.45(0.59)	-0.63(-0.18)
718	Machines for special industries	38.96(0.60)	3.47(0.50)	-6.94(0.57)	-1.93(0.36)
719	Machinery and appliances non electric	29.67(0.94)	4.267(1.24)	-6.95(1.17)	-2.02(0.77)
722	Electric power machinery and switch	74.83(1.39)	8.96(1.73)*	-15.48(1.51)	-5.70(1.28)
723	Equipment for distributing electric	59.06(0.72)	8.82(0.85)	-14.13(0.82)	-4.61(0.64)

SITC	INDUSTRY	CONSTANT	LnYsa	LnYpak	lnREER
724	Telecommunications apparatus	-181.23(1.31)	-18.93 (1.36)	34.97 (1.38)	11.10(1.70)*
725	Domestic electrical equipment	18.47(0.23)	2.48(0.27)	-4.19(-0.27)	-1.00(0.16)
729	Other electrical machinery and appa.	-77.56(1.02)	-3.91(0.52)	10.07(0.73)	6.65(1.13)
731	Railway vehicles	269.64(1.95)**	20.51(1.70)*	-42.37(1.75)*	-24.41(2.27)**
732	Road motor vehicles	7.51(0.08)	2.82(0.32)	-3.78(0.23)	7.15(2.02)**
733	Road vehicles other than motor vehicles	171.06(1.57)	18.14(1.67)	-33.06(1.69)*	-11.78(1.40)
812	Sanitary, plumbing, heating, n.e.s.	-39.43(1.15)	-3.61(1.04)	7.16(1.13)	1.89(0.72)
821	Furniture	23.05(0.21)	0.11(0.01)	-1.37(0.06)	-4.62(0.55)
841	Clothing except fur clothing	34.11(0.78)	3.94(0.77)	-7.15(0.82)	-1.37(0.39)
851	Footwear	-33.02(0.56)	-5.65(0.76)	8.83(0.72)	1.77(0.35)
861	Scientific, medical, optical, meas.	-38.15(0.93)	-3.92(0.77)	7.12(0.84)	3.33(1.83)
864	Watches and clocks	99.27(0.72)	6.63(0.42)	-14.58(0.53)	-9.10(0.87)
891	Musical instruments, sound recorder	-26.95(0.21)	1.45(0.10)	0.41(0.01)	2.49(0.26)
892	Printed matter	45.62(0.91)	7.38(1.43)	-11.65(1.26)	-2.71(0.67)
893	Articles n.e.s. of plastic	-9.80(0.18)	3.70(0.67)	-3.58(0.36)	6.44(1.87)*
894	Baby carriages, toys, games, n.e.s.	96.97(1.45)	6.92(1.02)	-15.20(1.24)	-6.078(1.17)
896	Works of art, collectors pieces and antiques	148.13(0.86)	21.51(1.07)	-34.81(1.91)	-11.43(0.85)
897	Jewellery and articles of precious mat.	33.60(0.47)	0.31(0.04)	-2.90(0.21)	-2.75(0.46)
899	Manufactured articles, n.e.s.	2.91(0.03)	2.02(0.23)	-2.46(0.16)	0.08(0.01)

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APPENDIX

The sources and definition of Data.
We have selected data from World Development Indicator (WDI) and World Integrated Trade Solutions (WITS) over 1980-2017,

Definition of Variables

$\boldsymbol{TB_i}$ = indicates the trade balance of ith industry. It is defined as the ratio of Pakistan's export of that industry to SAARC region over the Pakistan's imports of that industry from SAARC region. The data of industries trade flows come from source (WITS).

$\boldsymbol{Y_{PAK}}$ = It indicates the real GDP of Pakistan. The data of Y_{PAK} come from source (WDI).

$\boldsymbol{Y_{SA}}$ = Y_{SA} indicates the real GDP of SAARC region. Data come from source (WDI).

REEX = It indicates the Real Effective Exchange Rate. The real effective exchange rate is defined as the weighted average of the country currency against the index or the box of the other major currencies which are adjusted for the effect of inflation. Thus, an increase in REEX is a reflection of real depreciation of Pakistani currency. The data of REER come from WDI.

Table 1. Unit root Test

Variable	ADF Test		Conclu-sion	Variable	ADF Test		Conclu-sion
	Level	1st diff.			Level	1st diff.	
LNY_{Pak}	-1.3399	-5.1564	I(1)	LNTB655	-4.23065	-7.4871	I(0)
LNY_{SAARC}	-2.4221	-5.7955	I(1)	LNTB656	-0.574	-3.7959	I(1)
LNREER	-1.9221	-5.6469	I(1)	LNTB657	-2.8825	-6.3561	I(1)
LNTBAGG	-2.1955	-5.3934	I(1)	LNTB661	-2.6825	-6.6044	I(1)
LNTB01	-1.9955	-5.3649	I(1)	LNTB662	-2.8825	-6.2089	I(1)
LNTB22	-2.1955	-6.1862	I(1)	LNTB663	-2.4237	-6.0996	I(0)
LNTB25	-1.7367	-5.2904	I(1)	LNTB664	-2.7886	-6.0889	I(1)
LNTB31	-2.1016	-5.2639	I(1)	LNTB665	-3.0992	-6.8178	I(1)
LNTB41	-4.4122	-7.8663	I(0)	LNTB666	-2.2901	-5.8116	I(0)
LNTB42	-3.6031	-6.9208	I(0)	LNTB667	-2.4901	-6.0408	I(1)
LNTB46	-1.8031	-5.5422	I(1)	LNTB673	-1.9719	-5.5807	I(1)
LNTB51	-1.2849	-5.3972	I(1)	LNTB674	-3.0274	-6.3716	I(0)
LNTB52	-2.3404	-5.8562	I(1)	LNTB678	-2.5269	-6.3186	I(1)
LNTB53	-1.8399	-5.9117	I(1)	LNTB691	-2.4269	-6.0265	I(1)
LNTB54	-1.7399	-5.3697	I(1)	LNTB694	-2.3269	-5.9936	I(1)
LNTB71	-1.6399	-5.2307	I(1)	LNTB695	-1.2308	-5.3299	I(1)
LNTB73	-0.5438	-3.7148	I(1)	LNTB697	-1.6034	-5.6064	I(1)
LNTB74	-3.6629715	-7.0412	I(0)	LNTB698	-3.2446	-7.2130	I(1)
LNTB75	-5.0541975	-8.2159	I(0)	LNTB711	-2.1534	-6.0222	I(1)
LNTB99	-2.620588	-5.9623	I(0)	LNTB712	-1.6529	-4.9414	I(1)

Variable	ADF Test		Conclu-sion	Variable	ADF Test		Conclu-sion
	Level	1st diff.			Level	1st diff.	
LNTB121	-5.3397635	-8.6194	I(0)	LNTB714	-1.5529	-5.6384	I(1)
LNTB221	-4.7991852	-8.2250	I(0)	LNTB715	-1.4529	-4.7531	I(1)
LNTB240	-4.5943901	-8.5633	I(0)	LNTB717	-0.3568	-4.0059	I(1)
LNTB273	-4.7901788	-8.2117	I(0)	LNTB718	-0.7294	-4.6834	I(1)
LNTB276	-2.6016	-6.5204	I(1)	LNTB719	-2.3706	-5.7237	I(1)
LNTB292	-2.9122	-6.7550	I(1)	LNTB722	-3.2334	-6.4646	I(0)
LNTB321	-2.1031	-6.0223	I(1)	LNTB723	-2.5085	-6.2901	I(1)
LNTB512	-2.3031	-5.9951	I(1)	LNTB724	-4.3085	-8.3694	I(0)
LNTB513	-3.7849	-7.1724	I(0)	LNTB725	-2.5085	-5.6763	I(1)
LNTB514	-2.8404	-6.4760	I(1)	LNTB729	-2.0497	-5.2589	I(1)
LNTB541	-2.3399	-6.0507	I(1)	LNTB731	-2.4146	-6.0356	I(1)
LNTB551	-3.2399	-6.5289	I(0)	LNTB732	-2.7252	-6.7195	I(1)
LNTB554	-2.1399	-5.9222	I(1)	LNTB733	-3.9161	-7.4772	I(0)
LNTB561	-1.0438	-4.9183	I(1)	LNTB812	-2.30553	-5.7072	I(1)
LNTB581	-1.4164	-5.4832	I(1)	LNTB821	-1.88067	-5.2705	I(1)
LNTB599	-3.0576	-6.1956	I(1)	LNTB841	-2.47037	-5.5915	I(1)
LNTB611	-1.7901	-4.9298	I(0)	LNTB851	-2.6757	-5.5096	I(1)
LNTB612	-1.9901	-5.9184	I(0)	LNTB861	-1.16805	-4.2049	I(1)
LNTB621	-1.4719	-5.2680	I(1)	LNTB864	-2.29538	-5.4452	I(1)
LNTB629	-2.5274	-5.8685	I(1)	LNTB891	-1.34205	-4.4474	I(1)
LNTB632	-2.0269	-6.0427	I(1)	LNTB892	-2.76389	-5.7505	I(1)
LNTB641	-1.9269	-5.1442	I(1)	LNTB893	-3.01439	-6.5550	I(0)
LNTB642	-3.4323822	-6.9268	I(0)	LNTB894	-2.14479	-5.4141	I(1)
LNTB651	-2.1386024	-6.1119	I(0)	LNTB896	-2.02068	-5.2040	I(1)
LNTB653	-2.0363487	-5.3444	I(0)	LNTB897	-0.30624	-3.1345	I(1)
-	-	-	-	LNTB899	-0.64457	-3.4835	I(1)

Note: Variables LNTB1, LNTB22,… LNTB653 indicate log of the trade balance variable for an industry with the specified code. Details regarding code and industry are shown in the subsequent tables. After checking stationarity of all variables, we make sure that no variable is I(2) and we apply bound test. The value of F-test for each model is given in Table 2.2

Table 2. Results of F-Test

SITC	INDUSTRY	F.STAT	I(0)	I(1)	COINTEGRATION
	Aggregate	5.46	3.23	4.53	YES
01	Live animals	6.33	3.23	4.53	YES
22	Milk and cream	3.84	3.23	4.53	INCON
25	Eggs	1.32	3.23	4.35	NO
31	Fish, fresh and simply preserved	8.11	3.23	4.35	YES
41	Wheat including spelt and meslin	6.01	3.23	4.35	YES
42	Rice	10.68	3.23	4.35	YES
46	Meal and flour of wheat or of mesli	2.36	3.23	4.53	NO
51	Fruit, fresh, and nuts excl. Oil	3.43	3.23	4.53	INCON
52	Dried fruit including artificially	3.59	3.23	4.53	INCON
53	Fruit, preserved and fruit preparat	9.15	3.23	4.53	YES
54	Vegetables, roots and tubers, fresh	1.45	3.23	4.53	NO
71	Machinery, other than electric	6.56	3.23	4.53	YES
73	Chocolate and other food preptns.	6.1	3.23	4.53	YES
74	Tea and mate	6.12	3.23	4.53	YES
75	Spices	7.6	3.23	4.53	YES
99	Food preparations, n.e.s.	6.06	3.23	4.53	YES
121	Tobacco, unmanufactured	2.47	3.23	4.53	NO
221	Oil seeds, oil nuts and oil kernels	2.08	3.23	4.53	NO
240	Cheese and curd	4.99	3.23	4.53	YES
273	Stone, sand and gravel	2.36	3.23	4.53	NO
276	Other crude minerals	1.01	3.23	4.53	NO
292	Crude vegetable materials, n.e.s.	4.33	3.23	4.53	INCON
321	Coal, coke and briquettes	3.7	3.23	4.53	INCON
512	Organic chemicals	7.27	3.23	4.53	YES
513	Inorg. chemicals elems., oxides, ha	7.21	3.23	4.53	YES

SITC	INDUSTRY	F.STAT	I(0)	I(1)	COINTEGRATION
514	Other inorganic chemicals	2.74	3.23	4.53	NO
541	Medicinal and pharmaceutical products	1.79	3.23	4.53	NO
551	Essential oils, perfume and flavor	3.96	3.23	4.53	INCON
554	Soaps, cleansing and polishing prepar	3.1	3.23	4.53	NO
561	Fertilizers manufactured	6.98	3.23	4.53	YES
581	Plastic materials, regenerd. Cellul	10.9	3.23	4.53	YES
599	Chemical materials and products, n.	10.55	3.23	4.53	YES
611	Leather	17.39	3.23	4.53	YES
612	Manuf. of leather or of artif	8.45	3.23	4.53	YES
621	Materials of rubber	9.21	3.23	4.53	YES
629	Articles of rubber, n.e.s.	0.62	3.23	4.53	NO
632	Wood manufactures,n.e.s.	6.78	3.23	4.53	YES
641	Paper and paperboard	2.56	3.23	4.53	NO
642	Articles of paper, pulp, paperboard	1.55	3.23	4.53	NO
651	Textile yarn and thread	2.74	3.23	4.53	NO
653	Text fabrics woven ex narrow, spec,	3.66	3.23	4.53	INCON
655	Special textile fabrics and related	2.54	3.23	4.53	NO
656	Made up articles, wholly or chiefly	5.32	3.23	4.53	YES
657	Floor coverings, tapestries, etc.	2.61	3.23	4.53	NO
661	Lime, cement and fabr. bldg.mat. Ex g	2.85	3.23	4.53	NO
662	Clay and refractory construction ma	3.19	3.23	4.53	NO
663	Mineral manufactures, n.e.s.	15.03	3.23	4.53	YES
664	Glass	0.43	3.23	4.53	NO
665	Glassware	3.75	3.23	4.53	INCON
666	Pottery	4.8	3.23	4.53	YES
667	Pearls and precious and semi precio	6.29	3.23	4.53	YES
673	Iron and steel bars, rods, angles	1.04	3.23	4.53	NO

SITC	INDUSTRY	F.STAT	I(0)	I(1)	COINTEGRATION
674	Universals, plates and sheets of ir	1.13	3.23	4.53	NO
678	Tubes, pipes and fittings of iron o	6.35	3.23	4.53	YES
691	Finished structural parts and struc	2.66	3.23	4.53	NO
694	Nails, screws, nuts, bolts, rivets	3.98	3.23	4.53	INCON
695	Tools for use in the hand or in mac	1.85	3.23	4.53	NO
697	Household equipment of base metals	3.36	3.23	4.53	INCON
698	Manufactures of metal, n.e.s.	4	3.23	4.53	INCON
711	Power generating machinery, other	4.14	3.23	4.53	INCON
712	Agricultural machinery and implement	7.58	3.23	4.53	YES
714	Office machines	5.2	3.23	4.53	YES
715	Metalworking machinery	7.65	3.23	4.53	YES
717	Textile and leather machinery	2.98	3.23	4.53	NO
718	Machines for special industries	12.73	3.23	4.53	YES
719	Machinery and appliances non electr	4.68	3.23	4.53	YES
722	Electric power machinery and switch	11.45	3.23	4.53	YES
723	Equipment for distributing electric	14.05	3.23	4.53	YES
724	Telecommunications apparatus	3.51	3.23	4.53	INCON
725	Domestic electrical equipment	3.94	3.23	4.53	INCON
729	Other electrical machinery and appa	6.36	3.23	4.53	YES
731	Railway vehicles	8.4	3.23	4.53	YES
732	Road motor vehicles	6.21	3.23	4.53	YES
733	Road vehicles other than motor vehi	3.85	3.23	4.53	INCON
812	Sanitary, plumbing, heating and light	5.5	3.23	4.53	YES
821	Furniture	7.17	3.23	4.53	YES
841	Clothing except fur clothing	6.61	3.23	4.53	YES
851	Footwear	2.26	3.23	4.53	NO
861	Scientific, medical, optical, meas.	4.28	3.23	4.53	INCON

SITC	INDUSTRY	F.STAT	I(0)	I(1)	COINTEGRATION
864	Watches and clocks	3.1	3.23	4.53	NO
891	Musical instruments, sound recorder	4.14	3.23	4.53	INCON
892	Printed matter	6.18	3.23	4.53	YES
893	Articles of artificial plastic mate	0.14	3.23	4.53	NO
894	Perambulators ,toys, games and spor	0.98	3.23	4.53	NO
896	Works of art, collectors pieces and	10.42	3.23	4.53	YES
897	Jewellery and gold/silver smiths wa	2.68	3.23	4.53	NO
899	Manufactured articles, n.e.s.	1.98	3.23	4.53	NO

Note: 1(0) upper bound (3.23) and I(1) (4.53) are critical values of F-test, and these critical values comes from Pesaran, *et al. (2001).*

Table 3. Diagnostic Statistics

SITC	INDUSTRY	F at opt lags	ECM_{t-1}	LM	RESET	CUSUM	CUSUMS-Q	Adj R2
	Aggregate	5.46	-0.83 (3.91)	1.38	0.047	S	S	0.28
1	Live animals	6.33	-0.86 (4.89)	6.14	1.02	S	S	0.42
22	Milk and cream	3.84	-0.54 (3.05)	1.51	0.98	S	S	0.19
25	Eggs	1.32	-0.35 (1.71)	2.19	3.42	S	S	2.19
31	Fish, fresh and simply preserved	8.11	-1.05 (4.98)	4.22	1.81	S	S	0.49
41	Wheat including spelt and meslin	6.01	-1.05 (4.11)	1.79	2.87	S	S	0.44
42	Rice	10.68	-1.24 (4.58)	6.18	3.58	S	US	0.38
46	Meal and flour of wheat or of mesli	2.36	-0.34 (2.22)	0.25	3.91	S	S	0.07
51	Fruit, fresh, and nuts excl. Oil n	3.43	-0.53 (2.90)	3.17	0.03	S	S	0.10
52	Dried fruit including artificially	3.59	-0.80 (3.44)	1.26	0.42	S	S	0.56
53	Fruit, preserved and fruit preparat	9.15	-0.66 (3.67)	4.37	0.00	S	S	0.54
54	Vegetables, roots and tubers, fresh	1.45	-0.50 (2.75)	1.10	1.17	S	S	0.17
71	Machinery, other than electric	6.56	-0.60 (4.62)	0.97	0.81	S	S	0.47

SITC	INDUSTRY	F at opt lags	ECM_{t-1}	LM	RESET	CUSUM	CUSUMS-Q	Adj R2
73	Chocolate and other food preptns. Con	6.10	-0.96 (4.19)	0.99	0.30	S	S	0.35
74	Tea and mate	6.12	-1.08 (6.07)	0.08	0.07	S	S	0.56
75	Spices	7.60	-0.92 (4.57)	0.83	0.01	S	S	0.50
99	Food preparations, n.e.s.	6.06	-0.73 (4.05)	1.17	2.34	S	S	0.41
121	Tobacco, unmanufactured	2.47	-0.65 (2.54)	1.11	0.05	S	S	0.03
221	Oil seeds, oil nuts and oil kernels	2.08	-0.78 (3.89)	5.34	1.17	S	S	0.30
240	Cheese and curd	4.99	-0.82 (4.90)	0.14	0.39	S	S	0.67
273	Stone, sand and gravel	2.36	-0.47 (2.44)	0.14	0.03	S	S	0.16
276	Other crude minerals	1.01	-0.60 (3.31)	0.38	2.06	US	US	0.18
292	Crude vegetable materials, n.e.s.	4.33	-0.63 (2.83)	1.32	0.53	S	S	0.19
321	Coal, coke and briquettes	3.70	-0.79 (2.57)	4.38	0.41	S	S	0.26
512	Organic chemicals	7.27	-0.97 (4.59)	3.31	0.28	S	S	0.42
513	Inorg. chemicals elems., oxides, ha	7.21	-0.61 (4.90)	0.45	1.02	S	S	0.44
514	Other inorganic chemicals	2.74	-0.69 (3.26)	0.59	2.88	S	US	0.21
541	Medicinal and pharmaceutical products	1.79	-0.19 (1.10)	1.92	7.53	US	S	0.11
551	Essential oils, perfume and flavor	3.96	-0.99 (4.61)	3.71	1.59	S	S	0.38
554	Soaps, cleansing and polishing prepar	3.10	-0.93 (3.94)	0.36	0.63	S	S	0.27
561	Fertilizers manufactured	6.98	-0.47 (2.33)	5.59	0.24	S	S	0.39
581	Plastic materials, regenerd. Cellul	10.90	-1.02 (6.94)	1.24	1.16	S	US	0.62
599	Chemical materials and products, n.	10.55	-1.15 (6.98)	0.30	2.91	S	S	0.63
611	Leather	17.39	-1.01 (6.94)	0.82	0.41	S	S	0.73
612	Manuf. of leather or of artif. Or	8.45	-1.04 (4.89)	0.22	2.43	S	S	0.45

SITC	INDUSTRY	F at opt lags	ECM_{t-1}	LM	RESET	CUSUM	CUSUMS-Q	Adj R2
621	Materials of rubber	9.21	-1.46 (6.88)	1.35	0.15	S	S	0.62
629	Articles of rubber, n.e.s.	0.62	-0.45 (2.18)	1.97	0.37	US	S	0.09
632	Wood manufactures, n.e.s.	6.78	-0.49 (2.54)	1.10	1.70	S	S	0.34
641	Paper and paperboard	2.56	-0.73 (3.52)	0.11	1.49	S	S	0.29
642	Articles of paper, pulp, paperboard	1.55	-0.49 (2.40)	0.27	0.28	S	S	0.08
651	Textile yarn and thread	2.74	-0.58 (2.24)	0.06	0.72	S	US	0.10
653	Text fabrics woven ex narrow, spec,	3.66	-0.63 (3.46)	0.02	0.07	S	S	0.35
655	Special textile fabrics and related	2.54	-0.58 (2.62)	3.67	0.52	S	S	0.24
656	Made up articles, wholly or chiefly	5.32	-0.85 (4.63)	0.63	0.13	S	S	0.38
657	Floor coverings, tapestries, etc.	2.61	-0.47 (2.70)	2.50	3.98	S	S	0.40
661	Lime, cement and fabr. Bldg. mat.	2.85	-0.79 (4.02)	0.70	3.05	S	S	0.27
662	Clay and refractory construction ma	3.19	-0.82 (4.42)	0.92	0.29	S	S	0.33
663	Mineral manufactures, n.e.s.	15.03	-1.20 (5.25)	0.82	3.00	S	S	0.57
664	Glass	0.43	-0.31 (1.72)	0.66	0.22	US	S	0.07
665	Glassware	3.75	-0.97 (4.52)	0.60	1.49	S	US	0.34
666	Pottery	4.80	-0.57 (2.32)	0.29	4.70	S	S	0.22
667	Pearls and precious and semi precio	6.29	-0.99 (4.30)	2.31	1.37	S	U S	0.39
673	Iron and steel bars, rods, angles	1.04	-0.50 (2.64)	2.28	2.81	S	S	0.18
674	Universals, plates and sheets of ir	1.13	-0.39 (2.30)	1.82	1.00	S	S	0.15
678	Tubes, pipes and fittings of iron o	6.35	-0.95 (4.21)	2.35	0.33	S	US	0.36
691	Finished structural parts and struc	2.66	-0.87 (4.05)	3.06	2.12	S	US	0.35
694	Nails, screws, nuts, bolts, rivets	3.98	-0.60 (2.57)	0.90	0.39	S	S	0.18
695	Tools for use in the hand or in mac	1.85	-0.45 (2.50)	0.77	0.80	S	S	0.13
697	Household equipment of base metals	3.36	-0.05 (0.33)	0.23	3.07	S	S	0.43

SITC	INDUSTRY	F at opt lags	ECM_{t-1}	LM	RESET	CUSUM	CUSUMS-Q	Adj R2
698	Manufactures of metal, n.e.s.	4.00	-0.55 (2.88)	0.16	0.17	S	US	0.10
711	Power generating machinery, other	4.14	-0.88 (4.18)	0.93	2.09	S	S	0.32
712	Agricultural machinery and implement	7.58	-1.16 (6.44)	0.03	1.56	S	S	0.68
714	Office machines	5.20	-0.79 (4.46)	0.43	0.10	S	S	0.33
715	Metalworking machinery	7.65	-0.90 (4.54)	0.93	2.19	S	S	0.41
717	Textile and leather machinery	2.98	-0.45 (2.88)	0.32	1.13	S	S	0.30
718	Machines for special industries	12.73	-1.31 (6.93)	0.36	0.33	S	S	0.60
719	Machinery and appliances non electr	4.68	-0.62 (3.42)	0.11	1.95	S	S	0.24
722	Electric power machinery and switch	11.45	-1.34 (6.79)	2.11	0.65	S	US	0.57
723	Equipment for distributing electric	14.05	-1.23 (6.56)	3.87	0.23	S	S	0.55
724	Telecommunications apparatus	3.51	-0.67 (3.28)	2.47	1.11	S	S	0.36
725	Domestic electrical equipment	3.94	-1.08 (4.89)	1.98	0.03	S	S	0.40
729	Other electrical machinery and appa	6.36	-0.58 (3.12)	0.15	0.01	S	S	0.39
731	Railway vehicles	8.40	-0.88 (4.19)	0.55	0.07	S	S	0.40
732	Road motor vehicles	6.21	-1.19 (5.88)	0.81	0.04	S	S	0.54
733	Road vehicles other than motor vehi	3.85	-1.12 (4.28)	1.43	1.96	S	S	0.35
812	Sanitary, plumbing, heating and light	5.50	-1.10 (4.70)	1.99	0.17	S	S	0.41
821	Furniture	7.17	-1.07 (4.77)	4.48	1.66	S	S	0.50
841	Clothing except fur clothing	6.61	-1.13 (5.56)	0.55	5.24	S	S	0.46
851	Footwear	2.26	-0.66 (3.83)	0.75	0.75	S	S	0.32
861	Scientific, medical, optical, meas.	4.28	-0.71 (3.56)	0.54	0.59	S	S	0.17
864	Watches and clocks	3.10	-0.67 (2.36)	0.72	0.11	S	US	0.07

SITC	INDUSTRY	F at opt lags	ECM_{t-1}	LM	RESET	CUSUM	CUSUMS-Q	Adj R2
891	Musical instruments, sound recorder	4.14	-0.76 (3.64)	1.86	0.49	S	S	0.38
892	Printed matter	6.18	-0.42 (2.79)	0.41	3.31	S	S	0.51
893	Articles of artificial plastic mate	0.14	-1.24 (6.54)	0.68	0.04	S	S	0.56
894	Perambulators ,toys, games and spor	0.98	-0.21 (1.53)	0.40	4.41	S	S	0.43
896	Works of art, collectors pieces and	10.42	-1.06 (5.24)	1.11	4.52	S	S	0.48
897	Jewellery and gold/silver smiths	2.68	-0.73 (4.12)	1.50	2.10	S	US	0.33
899	Manufactured articles, n.e.s.	1.98	-0.23 (1.77)	0.28	3.96	S	S	0.10

Note: 1. LM: Lagrange multiplier test of residual serial correlation. It is chi square distribution test with one degree of freedom.
2. RESET: Ramsey Reset test for functional form. It is also chi square distribution test with one degree of freedom.
3. CUSUM: Cumulative sum of recursive residual.
4. CUSUM: Cumulative sum of squares of recursive residual.
5. Number inside the parenthesis next to the coefficients are the absolute values of t-ratios.

S= stable, US= unstable