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THE S-CURVES DYNAMICS OF TRADE: The Case Study of Pakistan

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The recent literature looks at correlation coefficients between the current exchange rate and the past and future values of trade balance. It is postulated that these coefficients are positive between the current exchange rate and the future trade balance values; but are negative between the current exchange rate and the past values of trade balance, resembling the S-curve pattern. For the first time this study, try to determine the existence of S-curve for aggregate trade and sixteen industries of Pakistan trading with the world. Industries representing the S-curve are less in number; hence, only the exchange rate depreciation is not a fruitful option to boost the trade balance.

I. Introduction

In an open economy, the exchange rate rests at the central position for policy making; and after exchange rate liberalization, it is able to affect various macroeconomic variables like investment determinations, foreign direct investment, trade fluxes, capital flows, international remittance and foreign exchange holding of the economy. Therefore, exchange rate is the most significant issue in the realm of economic research. The policy makers and researchers illuminated this issue after Bretton woods era, when foreign exchange rate was sharply random because of the genesis of the pliable exchange rate regime of 1973. A part of literature analyzing the success of competitive devaluation policy as a cure to chronic trade imbalances is available, e.g., [Harberger (1950), Meade (1951), Alexander (1952), and Mundell (1968)]. The recent studies include [Bahmani-Oskooee (1985), Upadhyaya and Dhakal (1997), Kale (2001), Bahmani-Oskooee, et al. (2005)].

To set an efficient exchange rate, it has always been a disputative issue in the policy formulation for developing countries. Pakistan, like many other country, have depreciated its exchange rate repeatedly when the deficit problem in balance of payments was faced [Aftab and Khan (2008)]. In the literature of economics,

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there are two patterns that make the foundation of depreciation of domestic exchange rate, to get improved trade balance; the absorption and the monetarist approach. The former approach believes that devaluation leads to increase expenditures from imported to local goods; hence, it betters the trade balance of a country; while the Monetarists argue that devaluation decreases the real value of cash balance and shift the relative price of tradable and non-tradable goods – resultantly, the trade balance improves [Baharumshah (2001)].

Much of the work about trade balance improvement gravitates around the parallel concepts of Marshall–Lerner (ML) condition and the J-curve process Bahmani-Oskooee and Ratha (2007). ML condition says that larger trade volume as a result of depreciation can only be obtained when sum elasticity of import – and export demands exceeds the unity. Exponents of this concept believe that ML condition provides both the necessary and sufficient conditions for trade balance improvement. However, there are situations in which this condition comes true, yet the trade balance continues to degenerate [Bahmani-Oskooee (1985)].

Thus, the economists have evaluated the short-run processes of phenomenon to check the true implications of currency devaluation. The J-curve movement in trade balance is the concept that was found during the effort. As the exchange rate adjusts instantly, the consumers adjust to the changed relative prices after the lapse period, which vary in the result of currency devaluation [Junz and Rhomberg (1973), Magee (1973) and Meade (1988)]. Hence, a short-run deficit in trade balance goes with a long-run betterment which seems like an essential characteristic of depreciation. There has been a lot of work on existence or non-existence of J-curve in various economies of the world.

Another short-run implication was introduced by Backus et al. (1994), between the terms of trade and trade balance that was labeled as the 'S-curve'. Instead of a regression analysis, they basically looked at the cross-correlation between the terms of trade and the trade balance. The cross-correlation is positive when these variables are explained as, a positive relation represents favorable effects of a real depreciation on the trade balance. They found that cross-correlation values between the current terms of trade and the future values of trade balance are positive, but between the current terms of trade and past values of trade balance, these are negative. By plotting the cross-correlation coefficients, they presented a design matching horizontally to the alphabet S, and thus, it was called the S-curve. Meanwhile, the contemporaneous correlation can be positive or negative. There exist the Harbeger– Larsen–Metzler (HLM) phenomenon, if the contemporaneous correlation is negative. An important interpretation of this approach is to determine industries which could gain international competitiveness and enjoy improvement in their trade balance, due to depreciation of the currency.

No study has been conducted for S-curve on Pakistan and this is the first curve, ever attempted to see it in Pakistan trade, both at aggregate and disaggregate levels. The characteristics whether the industry have any impact on S-curve is also analyzed.

In the next Section II, the review of literature presented on S-curve is analyzed. The data source and the description of variables are presented in Section III. Results are obtained in Section IV, while Section V consist of discussion and recommendations of the study.

II. Review of Literature

The latest literature in dynamic general equilibrium setup has found that trade balance is negatively correlated with the current and future movements in terms of trade but positively correlated with the past movements. For the first time, Backus, et al. (1994)[1], documented this pattern for a set of OECD countries. They denoted this findings of the S-Curve, because of the asymmetric shape of cross-correlation function for trade balance and the terms of trade. Senhadji (1998) extended the BKK's analysis to 30 LDCs and found the same empirical regularity. He also showed that a small-open-economy model would capture some important features of LDC economies and can reproduce the S-Curve. Many LDCs economies have limited access to international financial markets for capital making and for smoothing effects of international terms of trade and the other exogenous shocks. Scarce foreign exchange is mandatory for their economic growth. In such cases, the trade balance shows the net foreign exchange receipts while the terms of trade determine their purchasing power.

Bahmani-Oskooee and Brooks (1999) discovered that a country's trade balance could be improved with one trading partner and at the same time deteriorate with another. The same can be stated for the real exchange rate. Aggregate data on each of these variables could suppress the true movements, taking place at the bilateral or unite levels; and this is why more recent studies on the topic, employ bilateral trade data. Bahmani-Oskooee and Ratha (2007b) disaggregated the US data by trading partners and showed that the disaggregated data at bilateral level yields better support for the S-curve. Similar strong support for the S-curve at bilateral level between the Japan and her trading partners are also confirmed byBahmani-Oskooee and Ratha (2007a).

Finally, there is no support of S-curve between the US and UK at the bilateral level. Bahmani-Oskooee and Ratha (2008) disaggregated the trade data between the two countries at commodity level and investigated the pattern for 88 industries that traded with these two countries. They obtained overwhelming support for the S-curve for most industries. Furthermore, the results were not sensitive to commodity attributes, such as, durable versus non-durable goods or small versus large industries. Again, Bahmani-Oskooee and Ratha (2009) used the bilateral trade data between the countries of USA and Canada and provided evidence of the S-Curve. Next, in order to identify industries of which the trade flow respond to exchange rate changes, the authors of this study disaggregate the trade data between Canada and the USA; by

[1]Backrus, Kehee and Kydland (1994), hereafter BKK.

commodity and trace the S-Curve for trade balance of 60 industries engaged in imports and exports between the two countries over the period 1962-2004. These industries handled more than 80 per cent of the bilateral trade between the two countries, every year. The S-Curve receives support in 41 industries.

Bahmani-Oskooee,et al. (2008) analyzed the experience of 20 countries of Africa. As S-curve is a new concept, the studies on African region are very few. The authors were able to find the support for S-curve in only eight countries of Burundi, Cˆote d'Ivoire, Egypt, Gabon, Niger, Senegal, South Africa, and Tanzania. Bahmani-Oskooee and Ratha (2010) expanded their study to find the S-curves for Sweden with its major trading partners. In Sweden, trade with the world found the S-curve with a clear HLM effect. They then analyzed the S-curve for Sweden with a group of its major trading partners while taking the inverse of real effective exchange rate. They obtained the S-curve, different than the other countries of the world. Bahmani-Oskooee and Xu (2013) considered the experience of Mexico and the U.S.A., but the aggregate data have supported the S-Curve pattern for both the two countries. They used bilateral data for the two countries with no success in producing the S-curve. Suspecting that the bilateral S-Curve could still suffer from aggregation bias, they disaggregated the trade flow between the USA and Mexico, by commodity, and considered the experiences of 223 industries that traded between the two countries. They were able to discover the S-Curve pattern for only 90 industries.

Bahmani-Oskooee and Xu (2014) analyzed the trade between Korea and its major trading partner the USA, and tried to identify the industries that contribute to an emergence of the S-curve. To do this, the data was disaggregated between the two countries by industry, and considered the experience of 74 industries that possess 78.5 per cent of the market share. They found support for S-curve in 39 industries. There does not exist any study on S-curve for Pakistan. Therefore, this paper is the first attempt in this area.

III. Data and Methodology

The annual data of all export and import industries of Pakistan with the other world is taken for 1983 to 2014 from the statistical record of the World Trade Organization. The record of real exchange rate is taken from the statistics of the State Bank of Pakistan and is used as a proxy for the terms of trade like Bahmani-Oskooee and Xu (2012). As the price of all traded commodities is not available, the term E in Equation (1) is nominal exchange rate which is defined as 'the nominal exchange rate and E is defined as the number of units of the domestic currency that can purchase a unit of a given foreign currency' while, 'CPI_f / CPI_d' is the ratio of consumer price index of foreign and the domestic economy.

$$\text{Real Exchange Rate} = \left[\frac{CPI_f}{CPI_d} \; E \right] \tag{1}$$

Trade balance is carried out as a difference of exports of Pakistan with the imports divided by GDP. In the same way, trade balance is calculated for the entire industry of Pakistan [Bahmani-Oskooeeand Xu{(2013).(2014)}].

$$\text{Trade Balance} = \left[\frac{X - M}{GDP_{pk}}\right] \tag{2}$$

While analyzing the trade of Pakistan with the world trade, it is taken as the real effective exchange rate which is used in order to define the extent to which the purchasing power of Pakistani currency changed during that specific period. The REER of a country can be in an equilibrium if it is found overvalued in relation to one or more trading partners; whilst also being undervalued to the others, as it is an average.

All series are de-trended employing Hodrick-Prescott filter. On the other hand, the lag and lead length are specified through Schwartz Information Criteria, whereas, the cross-correlation coefficient (COR) between trade balance (TB) and the real exchange rate (RE) are calculated by Bahmani-Oskooee and Ratha (2009) and defined as follows.

$$COR = \left[\frac{\sum (RE_t - \grave{RE})\,(TB_{t+k} - Tb)}{\sqrt{\sum (RE_t - \grave{RE})2\,(TB_{t+k} - Tb)2}}\right] \tag{3}$$

IV. Results

Figure 1 depicts that there are evidence of S-curve in Pakistan's aggregate trade. The devaluation of Pakistan exchange rate does not covariate positively, with an improvement of trade balance. The Cross Correlation values also have negative sign in future lags and positive signs in the past lags.

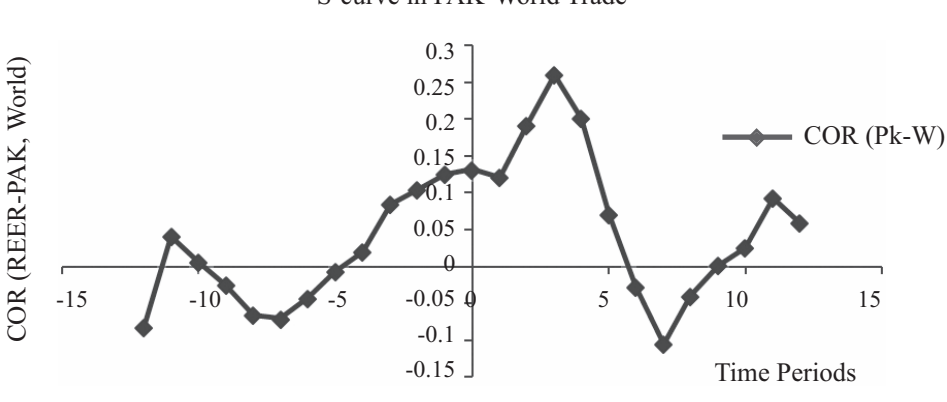

FIGURE 1

S-curve between Pakistan and the World

1. S-curve in Industries Trading with the World

Now, the S-curve for each industry of Pakistan is analyzed on the same basis. The results will show whether disaggregation play any role for existence of the S-curve. The bias effect of aggregation will be wiped out in this analysis which is undertaken in the manner of [Bahmani-Oskooeeand Xu (2013), (2014), Bahmani-Oskooee and Ratha (2008), Bahmani-Oskooee and Ratha (2009)]. There are total sixteen industries included in the sample and to keep brevity, first the results are presented in the table form. In this way it is easy to see which industries support the S-curve.

Therefore, it shows that in Pakistan, out of sixteen industries only six represent the positive correlation between the devaluation and trade balance improvement. The remaining industries do not have any boost in their trade balance with devaluation of the currency. Now, the graphical representation of S-curve in all the industries is provided.

TABLE 1

S-curves in Industries of Pakistan

Sr. No.	Industry	Values at different Lags			(HLM)	Support
		-10	Zero(0)	+10		
1.	Telecommunication Industry	-0.3702	0.0983	0.4157	Yes	Yes
2.	Mining Products	-0.1650	0.3330	0.3940	Yes	Yes
3.	Textile Industry	-0.2280	-0.7340	-0.3840	-	No
4.	Electronic Data Processing and Office Equipment	-0.2160	0.3080	0.4240	Yes	Yes
5.	Iron and Steel	-0.1210	0.7430	0.0790	-	No
6.	Pharmaceuticals	-0.0900	0.1570	0.1100	Yes	Yes
7.	Office and Telecom Equipment Industry	-0.1912	0.1443	0.4230	Yes	Yes
8.	Agriculture	-0.3650	-0.0200	0.1680	Yes	Yes
9.	Machinery and Transport Equipment	-0.0293	0.9938	-0.0422	-	No
10.	Fuel	-0.1085	0.7272	0.2260	-	No
11.	Integrated Circuits and Electronic Components	0.1135	-0.3953	-0.2132	-	No
12.	Manufacturing Industry	0.1711	0.2220	-0.3950	-	No
13.	Food Industry	0.1804	-0.2200	-0.4260	-	No
14.	Cloth	-0.0330	-0.7314	0.0820	-	No
15.	Chemicals	-0.0370	0.9880	-0.0120	-	No
16.	Automotive Products	-0.0050	0.9850	-0.0908	-	No

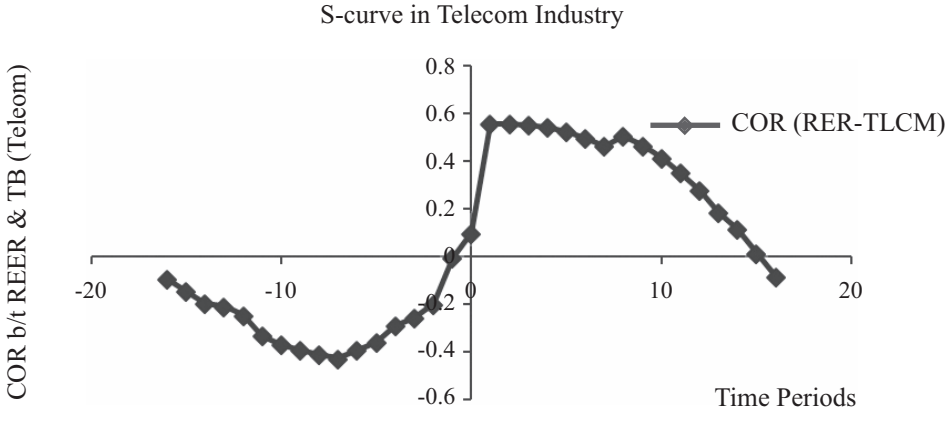

FIGURE 2

Telecommunication Industry

Figure 2 shows that cross-correlation values are positive at lead times and negative at lags, thus; the S-curve exists. At origin, the value of cross-correlation is 0.0983 which represents the effect of (HLM).

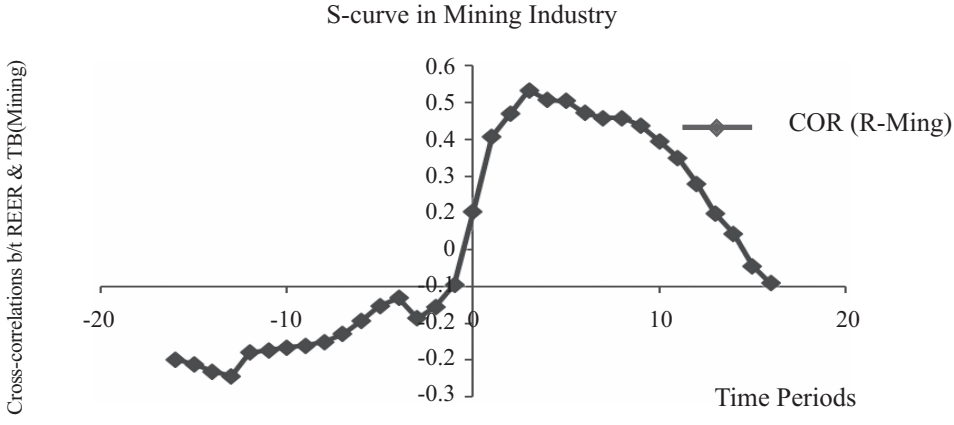

FIGURE 3

Minning Industry

The graph (Figure 3) of mining industry depicts the presence of S-curve. All values of cross correlation are positive at lead times and negative at lags. The (HLM) effect also exists here.

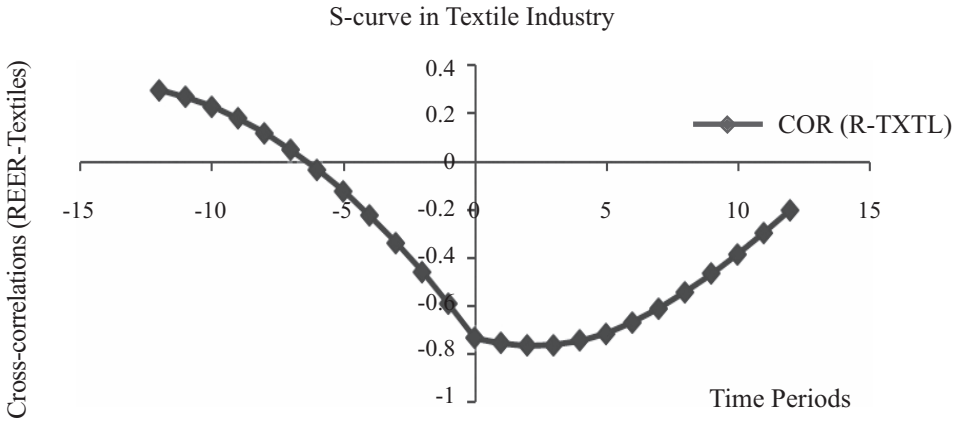

FIGURE 4

Textile Industry

The graph of the textile industry shows that S-curve does not exist in its trade pattern (see, Figure 4); as all the lead times have negative cross correlations.

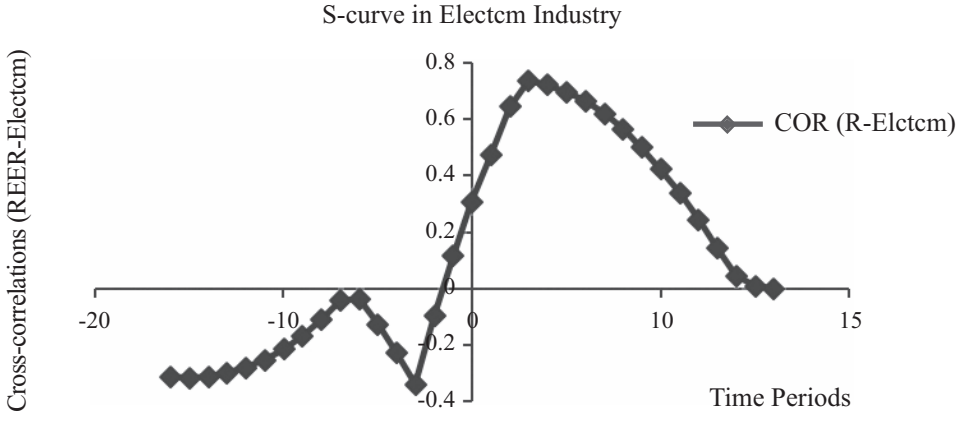

FIGURE 5

Electronic Data Processing and Office Equipment Industry

The electronic data processing and office equipment industry graph shows the existence of S-curve in its trade pattern (Figure 5). Its trade balance improves with deterioration in the exchange rate. The (HLM) effect also exists.

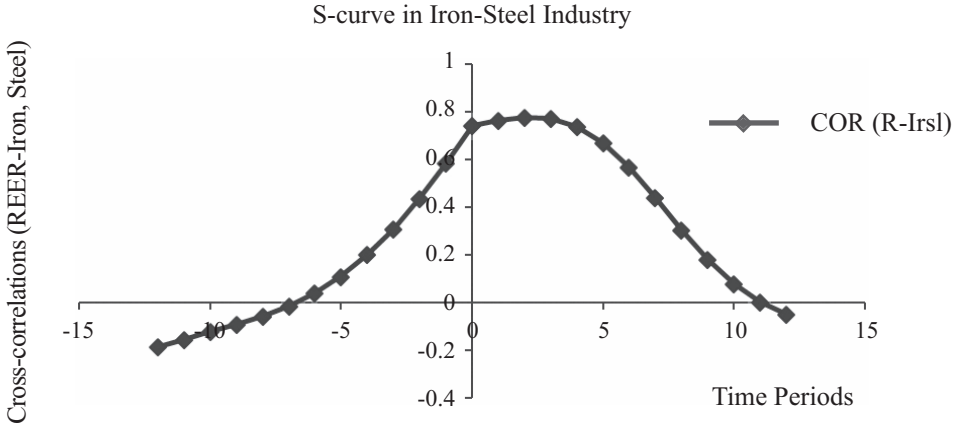

FIGURE 6

Iron and Steel Industry

The graph shows that the iron steel industry does not have S-curve pattern in its trade (Figure 6). The devaluation does not have any link with its trade balance improvement. Its trade balance improves even at the lags.

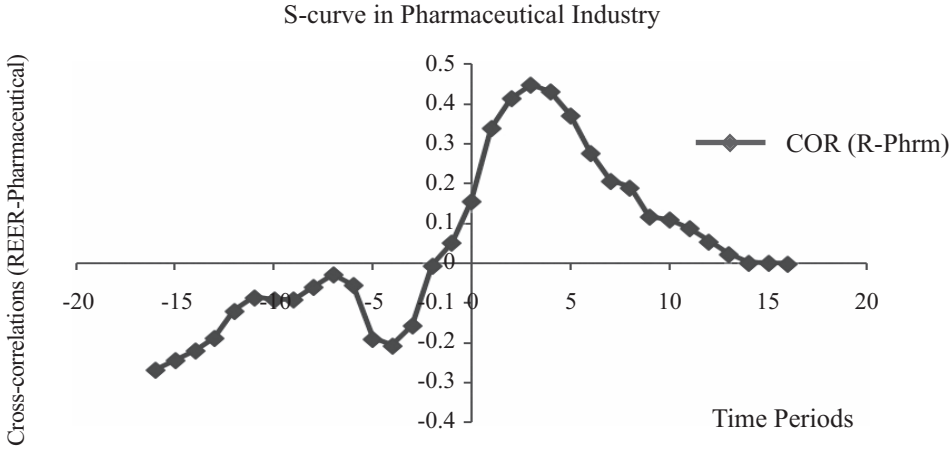

FIGURE 7

Pharmaceutical Industry

The pharmaceutical industry represents that S-curve exists in its trade ways (Figure 7). With devaluation, the trade balance move towards improvement. There also exists the (HLM) effect.

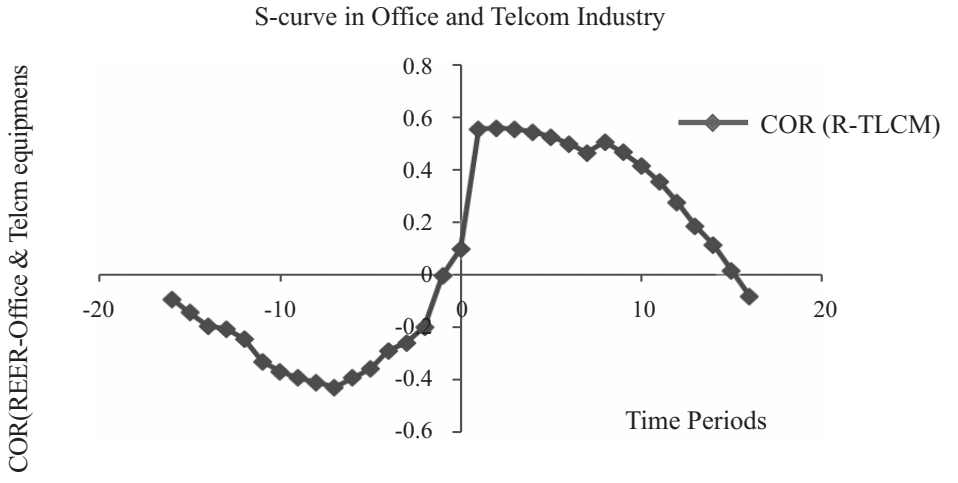

FIGURE 8

Office and Telecom Equipment Industry

Office and telecom equipment industry of Pakistan also represents the presence of S-curve (Figure 8). All values of cross-correlations are positive at leads and negative at lags; while the (HLM) effect is also present.

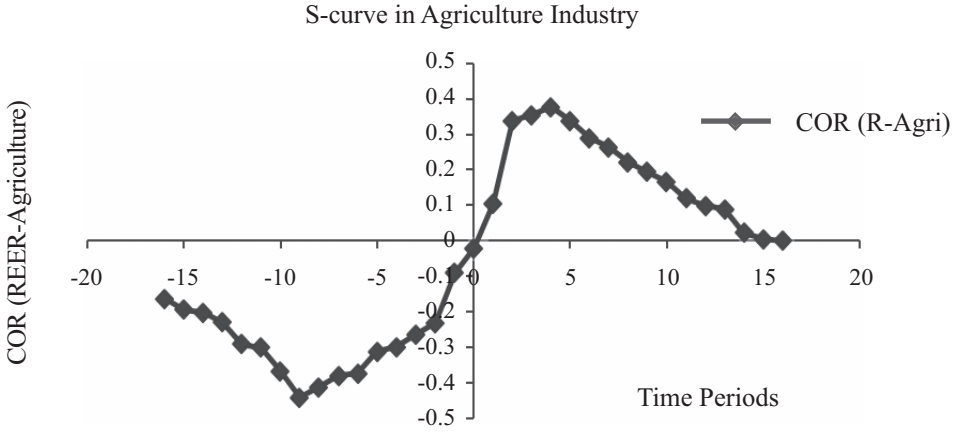

FIGURE 9

Agriculture Industry

Agriculture sector of Pakistan also exhibits the S-curve movement in its trade pattern. Its trade balance improvement moves along devaluation of the currency (Figure 9). However, (HLM) effect is negative here.

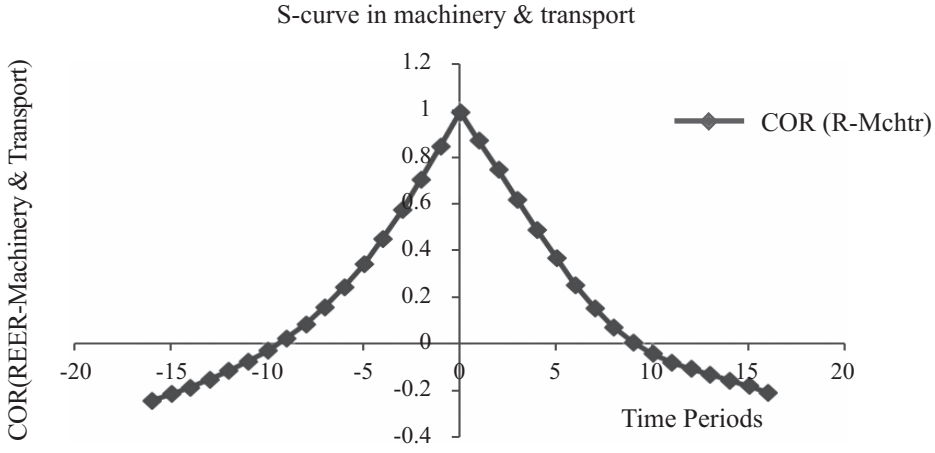

FIGURE 10

Machinery and Transport Equipment Industry

Machinery and transport equipment industry does not have S-curve in its trade pattern (Figure 10).

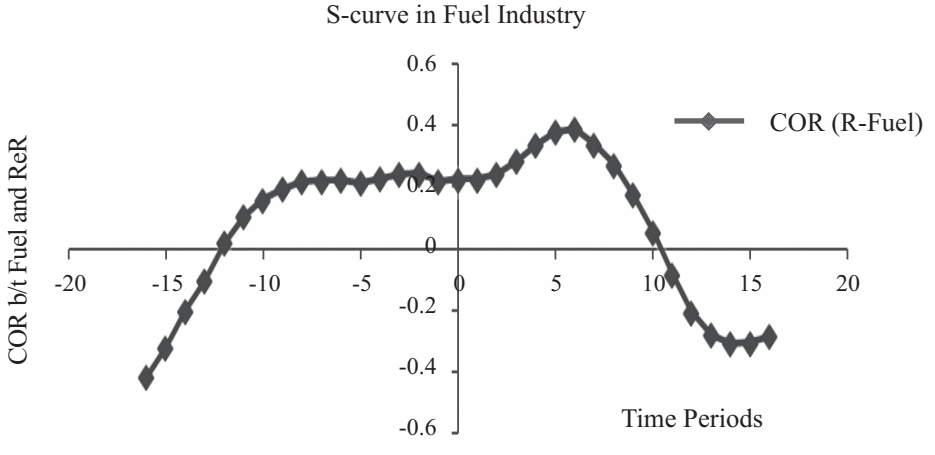

FIGURE 11

Fuel Industry

Fuel industry's curve does not have the S-shape and devaluation does not have positive co-movement with trade balance improvement of the fuel industry.

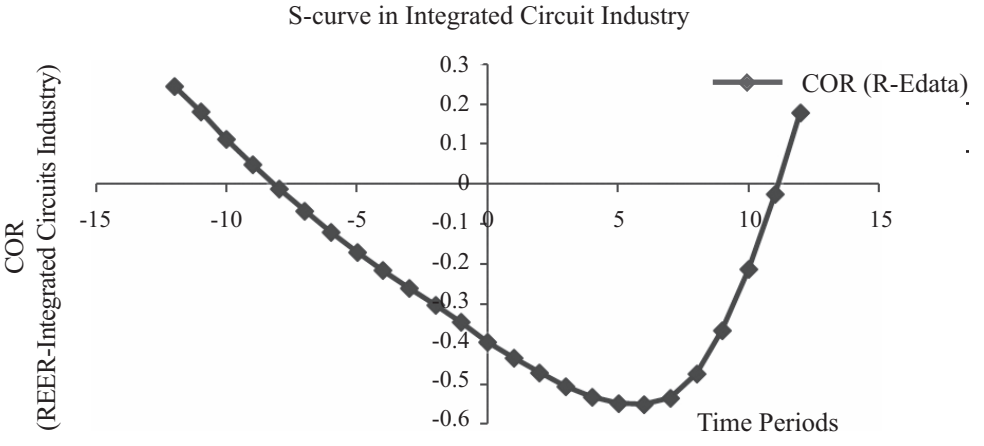

FIGURE 12

Integrated Circuits and Electronic Components Industry

Thus, it deviates from the S-curve pattern in its trade. Integrated circuits and electronic component industry have positive cross-correlation at lag times and negative at lead times (Figure 12). Hence, S-curve does not exist in its trade pattern.

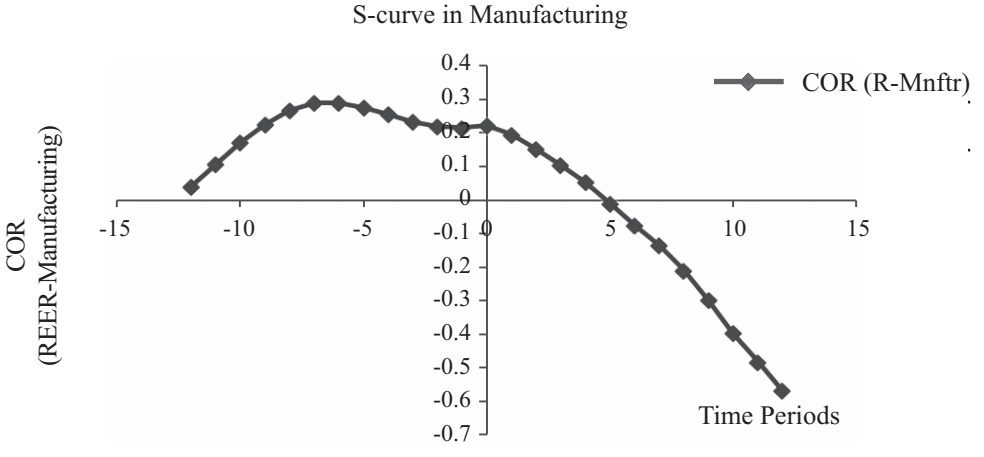

FIGURE 13

Manufacturing Industry

Manufacturing industry does not have S-curve (Figure 13). Its trade balance does not improve with devaluation in the exchange rate.

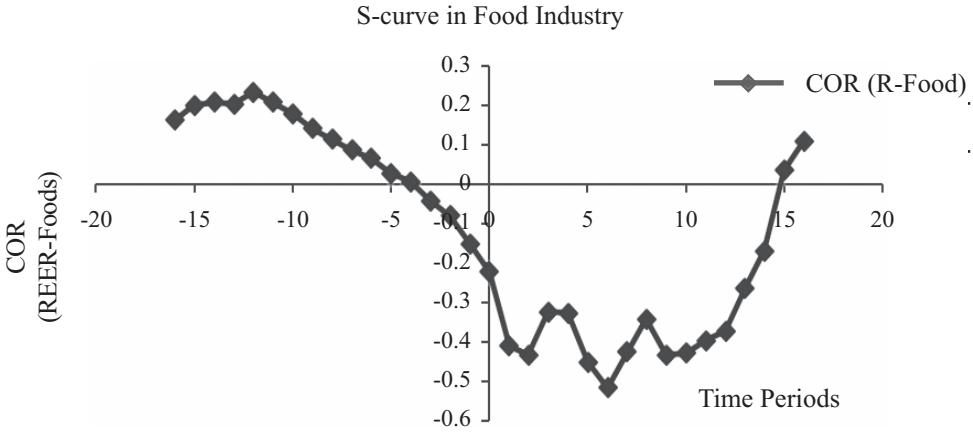

FIGURE 14

Food Industry

Food industry has positive cross-correlations at lag times and positive at lead times (Figure 14). Hence, S-curve is absent in its trade.

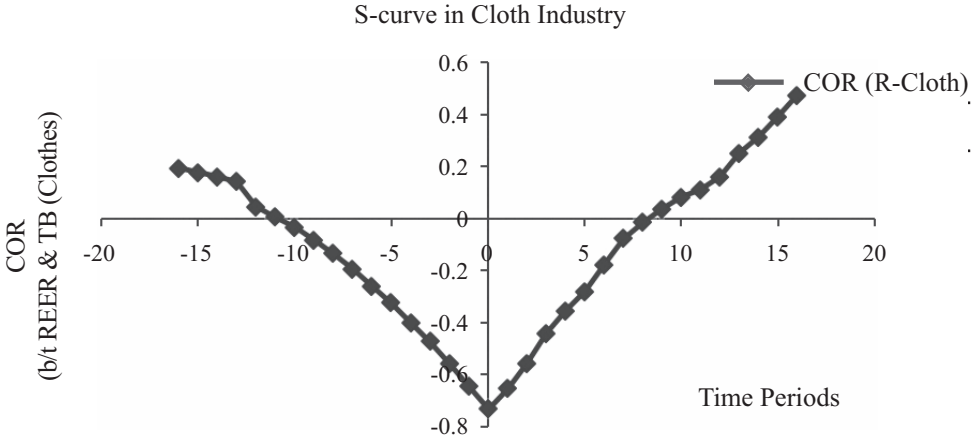

FIGURE 15

Cloth Industry

Cloth industry of Pakistan also represents the absence of S-curve in its trade pattern (Figure 15). The lead times have negative values of cross-correlations.

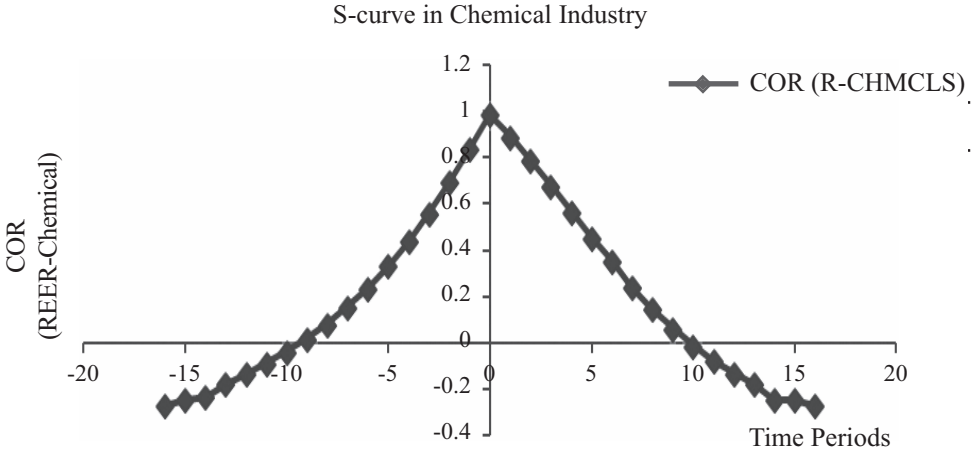

FIGURE 16

Chemical Industry

Chemical industry does not have S-curve in its trade pattern as represented (Figure 16). Its trade balance does not move up words with depreciation of the exchange rate.

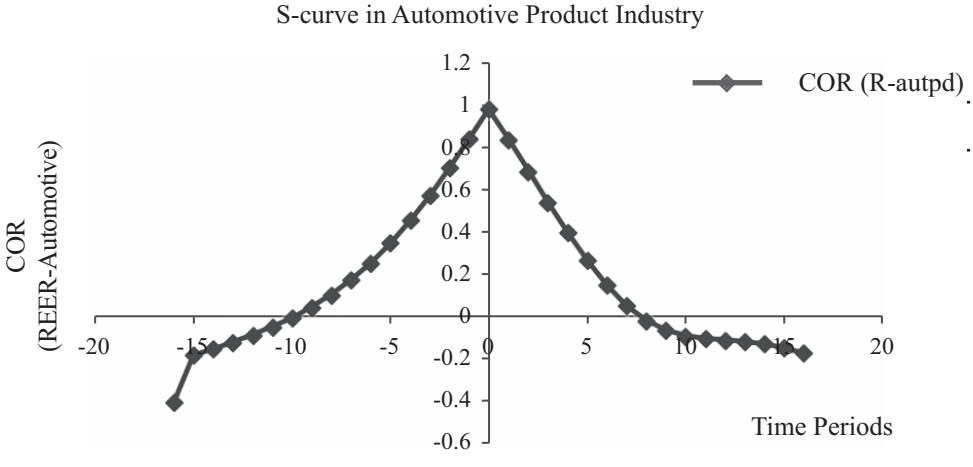

FIGURE 17

Automotive Products Industry

The figure of automatic products industry of Pakistan does not have S-curve (Figure 17). Cross-correlation values between the trade balance and exchange rate are positive at lags. Hence, trade balance of automatic industry does not move along with the devaluation of the exchange rate.

V. Discussion and Recommendations

As the empirical results show, there does not exist the S-curve when aggregate data of Pakistan trade is compared with the World. Suspecting that aggregation might have played its role, the data is disaggregated at an industrial level - the total sixteen industries are included in the sample. Six out of sixteen industries have the lucid evidence of S-curve existence. Therefore, it confirms that devaluation move positively with trade balance of six industries of Pakistan. However, the overwhelming majority of industries do not see such relation among the two. In all previous studies, the researchers found that majority of the industries comply the S-curve pattern; while, in this study the results are little different. Here, the industries which represent the S-curve, are in minority.

Moreover, the characteristics of products do not have any link with existence of the S-curve pattern in trade. Durability and non-durability along with the size (largeness and smallness) of industries have nothing to do with their S-curve trade pattern, i.e., telecommunication and mining products have sharp difference in traits but both have S-Curve. Chemicals and pharmaceuticals are bit similar but pharmaceutical industry has S-Curve, while chemicals do not. Textile and agriculture are both considered large sectors in Pakistan, in terms of production, as well as exports. However, textiles do not have S-Curve while agriculture represents S-Curve in its trade pattern. These results are in line with the results of [Bahmani-Oskooee and Ratha (2007), Bahmani-Oskooee and Ratha (2010) and and Bahmani-Oskooeeand Xu (2014)].

As the telecommunication industry depicts S-curve; therefore it can be suggested that employing devaluation, a handsome profit can be gained from this industry, whereas, textile industry, which is the largest sector in Pakistan do not show any positive relation between devaluation and trade balance, hence, it can be concluded that other variables than devaluation also have significant impacts in textiles trade balance. Agriculture also, do not have S-curve pattern as it may be due to the very low trade share of agricultural products in Pakistan's overall trade. However, the case of fuel industry is important to see here as devaluation goes negative with trade balance of fuels. It is due to the reason that Pakistan has large import of these products.

The motivation of this study is to investigate the short-run dynamics or S-curve for Pakistan on aggregate and industry level data. Hence, the exchange rate depreciation did not come out with an efficient policy to improve the trade balance of most of the industries in a short-run. Aftab and Khan (2008) as well as Hameed and Kanwal (2009) did not find J-curve in their analysis with USA. As J-curve is also a short-run evaluation of exchange rate and trade balance relationship, therefore, to boost the trade balance policy of exchange rate, devaluation should be taken with a caution; as it does not improve trade balance of the majority of industries of Pakistan.

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