International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

http://TuEngr.com

PAPER ID: 11A04N

MEASURING J-CURVE EFFECT USING EXCHANGE RATE INSTABILITY AND TRADE IMBALANCES: A QUANTITATIVE 3SLS APPROACH

Fahim Afzal [a*], Pan Haiying [a], Farman Afzal [b], Imran Ahmed Shah [b]

[a] *Business School, Hohai University, Nanjing, 210029, PR. CHINA*
[b] *School of Management and Economics, University of Electronic Science and Technology of China, Chengdu, CHINA.*

ARTICLEINFO

Article history:
Received 12 August 2019
Received in revised form 25 November 2019
Accepted 06 December 2019
Available online 12 December 2019

Keywords:
J-curve theory; 3SLS technique; GARCH; Import and Export; Exchange rate instability; Trade-balance; Least-squares.

ABSTRACT

The exchange rate (ER) instability is an important factor in determining the trade-balance (Tb) of a country. Fluctuations in ER do affect the confidence level of shareholders, traders, and investors (stockbrokers and individual buyers) in the economy; if their confidence is shattered, then it will ultimately slow the trade process. The effect of ER instability on the Tb has been analyzed in this study that implies the impact of J-curve in Pakistan during the time of the 9/11 issue. This study is entirely quantitative considering the basic time-series of data consisting of the following variables; ER volatility, growth instability, export instability, agriculture and manufacturing instability, and trade instability. The instability values of imports, exports, ER, Tb, agriculture, and manufacturing variables have been calculated by using the variance obtained from generalized autoregressive conditional heteroscedasticity (GARCH). It has been found that for a short period, the impact of ER instability on exports is significantly positive with the coefficient of 0.2, but the negative impact of ER instability on imports is -0.2, respectively. Moreover, the relationship between the ER and terms of trade is significant, with a slightly negative coefficient of -0.13. Importantly, this study concludes that the J-curve effect does not work effectively due to different geostrategic problems in a region.

Disciplinary: Management and Economics.

ACRONYMS

The acronyms used in this article are given in Table A.

*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com

Table A: Acronyms of the terms used in this article.

Term	Abbreviation	Term	Abbreviation
C	Constant	D(LNER)	The first derivative of LNER
LNER	Natural log of exchange rate	D(LNR)	The first derivative of LNR
ERI	Exchange rate instability	D(TOT1)	The first derivative of TOT1
TOT1	Term of trade at lag 1	D(LNMG)	The first derivative of LNMG
TOTI	Term of trade instability	ER	Real devaluation of exchange rate
LNR	Natural log of reserves	Ag	The growth rate of agriculture
LNX	Natural log of exports	Mg	Growth rate manufacturing
LNXI	Natural log of exports instability	TOT	Term of trade
LNM	Natural log of imports	Tb	Trade-balance
GDP	Gross domestic product	R	The growth rate of FOREX reserves
LNGDP	Natural log of GDP	M	The growth rate of imports
GDPI	GDP Instability	X	The growth rate of exports
LNAG	Natural log of agriculture	Cg	Consumer goods
LNMG	Natural log of manufacturing goods	Kg	Capital goods
LNCG	Natural log of consumer goods	ICM	Intermediate consumer goods imports
LNKG	Natural log of capital goods	IKM	Intermediate capital goods imports
AGI	Agricultural instability	AM	Agriculture and manufacturing
MGI	Manufacturing instability	AMI	Instability in agriculture-manufacturing
D(LNX)	First derivatives of LNX	G	The growth rate of GDP
D(LNCG)	First derivatives of LNCG	GI	The growth rate instability
D(LNKG)	First derivatives of LNKG	TOT	Term of trade
D(LNAG)	First derivatives of LNAG	XI	Exports instability
D(LNM)	First derivatives of LNM		
D(LNGDP)	First derivatives of LNGDP		

1. INTRODUCTION

The foreign exchange market is the area that is highly concerned with the study of global finance and international trade. According to most sources, the modern forex world truly began in 1973 when the system first went on-line. From that moment forward, the exchange was finally digital. Nowadays, the stock market is the most liquid financial market in the world. According to The Wall Street Journal, the volume of currency trading around the globe has hit $6.6 trillion a day. In April 2010, the US trade accounted for 17.9%, Japan's trade accounted for 6.2%, and the UK's trade accounted for 36.7%, making it the most significant place for financial trading in the world. Therefore, a great number of studies have been carried out before the exchange rate (ER) fluctuations and their impact on trade and other economic variables, and vice versa. (Alper, 2014). The studies neither empirically nor theoretically determine whether the stability of the financial market improves international trade or not (Adrian, 2019; Akthar & Hilton, 1984).

The phenomenon of the volume impact over the price impact, in the long-run, is the Marshall-Lerner condition (MLC). Whenever it is time-plotted, the graph of trade response yields a J-like line. Thus these lines represent the J-curve terminology (Aftab & Aurangzeb, 2002; Afzal & Ahmad, 2004). MLC explains the devaluation in the currency of one country as not being beneficial in the short-run. However, to improve the balance of payment and trade-balance (Tb) MLC is proved to be a powerful tool. The elasticity of the ER is small, making the J-curve application less likely to be satisfied in the short-run. However, as time passes, the elasticity grows larger making the J-curve effect applicable by crossing the threshold point and thus creating progress in Tb. Henceforth, the J-curve theory expresses that local currency depreciation will increase the price of foreign goods for the locals and implication of cheaper local goods over foreign goods will decrease the imports and increase in exports, causing improvements in the Tb (Rehman et al., 2012).

The study of the relationship between Tb and ER is particularly significant for some developing countries where trading streams keep on driving the balance of payment accounts because of the low advancement of capital markets. Regardless of whether dictated by exogenous or endogenous shocks or by any strategy or policies, the behavior of ER has been a typical, yet questionable along with the policy issue in the vast majority countries. Many studies have been conducted to examine the relationship between Tb and changes in the ER around the world. (Alessandria & Choi, 2019; Onakoya et al., 2019). Predictions of the effects of ER changes on the Tb possibly affected by several different factors in the economy. The behavior of economic factors does have an impact, but apart from that, the macroeconomic conditions in a country do affect the sensitivity of trade to the changes in ER (Backman, 2006).

The J-curve theory is dependent on the elasticity of imports and exports to the ER movements. If it is elastic enough to the movements of the ER, then the J-curve theory will work (Rehman et al., 2012). J-curve in Pakistan is found, but this does not provide enough information to devaluation policy in Pakistan. The country can devalue its currency against one country and appreciate others. In this situation, the directions are not clearing, so bilateral trade data is suggested for future study (Rehman & Afzal, 2003).

This study examines the ER instability and its impact on Tb that signifies the j-curve effect if it is satisfied in Pakistan during the post 9/11 period (September 11, 2001, terrorists' attack on America caused a major change in global economic position, where Pakistan was also affected due to its geo-strategic location.). The model consists of the following variable: ER, export, and import as dependent variable and agriculture, manufacturing, gross domestic product, intermediate capital goods, and intermediate consumer goods, reserves as an independent variable. The variance calculated by generalized autoregressive conditional heteroscedasticity (GARCH) has been used to obtain the instability values of the ER, imports, exports, Tb, and agriculture-manufacturing instability variables. Actual data values are used with log values and first derivatives, whereas the first lag is used to check the long term impacts of instruments.

2. REVIEW OF LITERATURE

The renowned J-curve theory expresses that the devaluation of the local currency makes the foreign goods more costly for locals and domestic goods less expensive for foreigners, which infers the increasing of exports and the decreasing of imports, causing Tb improvements (Rehman et al., 2012). Many economists (Englama et al., 2019; Khan, et al., 2018) believe that the devaluations in currency show positive competitive advantages in foreign trade. Khan et al. (2019) have used the Co-integration and vector error models to study the impact of the J-curve on the Pakistani economy. This study states that the country can devalue against one country and appreciate it against others. The economic theory explains that the improvements in the Tb in the long-run are caused by the devaluation of the real ER explained by J-curve. It also explains that domestic and foreign income shows negative and positive relationships with trade ratio (Rehman & Afzal, 2003).

In Pakistan ordinary least squares (OLS), two-stage least squares (2SLS), three-stage least squares (3SLS) models have been used to find out J-curve and MLC from different perspectives (Afzal & Ahmad, 2004). Aftab & Aurangzeb (2002) study the long-term and short-term effects of

*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com
Journal of Engineering, Management, & Applied Sciences & Technologies. Volume 11 No.04 ISSN 2228-9860 eISSN 1906-9642
CODEN: ITJEA8 Paper ID:11A04N http://TUENGR.COM/V11/11A04N.pdf DOI: 10.14456/ITJEMAST.2020.74

ER devaluation on Pakistan's Tb and impact of MLC equation with respects to the significant trade partners of Pakistan, i.e., United States, Germany, Japan, United Kingdom, Italy, France, Korea, Singapore, Netherland, and Canada, using OLS and 2SLS models. Studies show that real devaluation of currency (Pakistan rupee) can be used as a policy tool to improve Tb. However, the Tb may worsen in the future, and After that, the Tb is expected to continue to make progress (Aftab & Aurangzeb, 2002).

Kemal (2005) has considered the instability of the ER and its consequences for the trade of Pakistan. His analysis depends on using the 3SLS technique of the simultaneous equations model. Four risk factors have considered, i.e., agriculture-manufacturing instability, ER, export, and growth instability. GARCH variance is used to figure out stability in the three factors. The principle target of his study is to examine that if the ER instability influences the trade or not and assuming this is the case, at that point in what direction? In a large portion of the previous studies (Kemal, 2005; Rehman & Afzal, 2003), gross domestic product (GDP) is utilized as a representative of the market. However, they have utilized agriculture and manufacturing instability (segments of GDP and are exportable divisions) in the export functions since exports are primarily reliant on these factors and not on different segments of GDP. The impact of the ER is insignificant on exports but significant with imports, yet it cannot be stated explicitly whether it positively influences the Tb because direct Tb did not use by many researchers in the model. However, it is presumed that the improvements in the Tb by increasing the exports and decreasing the imports is caused by genuine trade devaluation (Aftab & Aurangzeb, 2002; Kemal, 2005; Rehman et al., 2012).

Khan & Sajjid (2006) have used the 3SLS technique and resulted that the MLC is significantly fulfilled in Pakistan under certain conditions. The 3SLS sums up the 2SLS to assess the relationships. 3SLS requires three stages: (1) in the first-stage regressions, the endogenous regresses values to be predicted; (2) in a 2SLS step to get the cross-equation correlation matrix by evaluation of residuals; and (3) the last 3SLS estimation step.

The J-curve theory has been recently studied for Pakistan utilizing quarterly data more from the year of 1972 to 2002 and found the proof of the J-curve, and given the long-term effects of the actual depreciation of the Pakistani currency (PKR), it would leave a bad impression (Afzal & Ahmad, 2004).

3. MATERIALS AND METHODS

The analysis is performed to test the impact of the depreciation of the Pakistani currency (PKR) ER on the bilateral Tb between Pakistan and its ten major trading partners, i.e., (USA, Germany, Japan, UK, Italy, France, Korea, Singapore, Netherland, and Canada). These countries, together, represent practically 50% of Pakistan's exports. This research begins with the empirical study by considering the basic time-series of economic data using an autoregressive distributed lag (ARDL) method. The research is entirely quantitative consisting of the following variables which are used to determine the ER volatility: ER instability, growth instability, and export instability (Afzal & Ahmad, 2004), agriculture and manufacturing. Moreover, the fifth variable introduced in this research is the term of trade, as suggested by Rehman and Afzal (2003).

Data has been collected on an annual basis from the years 1979 to 2013, mainly having the focus on the post 9/11 period. The economic data strictly covers the pre-post 9/11 period, where the

ER instability and J-curve trend were not static. Since 2013, it has been observed that the country's economic situation went out of danger. Therefore, this study only considered twelve years of the post 9/11 data. The numerical figures regarding the variables are from the issues of Economy Survey of Pakistan, World Trade Organization, International Monetary Fund, and World Bank, etc.

First derivatives and first lags are used to calculate the long-run impact of annual data of all the variables, as mentioned earlier. As the exports of Pakistan primarily consist of agriculture and manufacturing; thus, other constituents of GDP are not considered as suggested by Kemal (2005). GARCH variance is used to compute the instabilities. To overcome the problem of non-stationary econometric data, a unit root test is applied at the preliminary stage of the test to incorporate stationary data results.

Briefly, the model consists of the following variable: ER, export, and import as the dependent variable, agriculture growth, manufacturing growth, GDP, intermediate capital goods, intermediate consumer goods, and reserves as an independent variable. GARCH variance is used to compute instability values of the ER, import, agriculture-manufacturing, export, and trade instability, etc. while considering these variables in estimating the exports, imports and ER, mathematically the model and the relationship between the variables can be presented as shown in the following equations:

Estimation Exports Equation

$$\Delta(\Lambda N\Xi) = \begin{aligned} & X(1)+X(2)*\Lambda N\Xi(-1)+X(3)*\Lambda NX\Gamma(-1)+X(4)* \\ & \Lambda NK\Gamma(-1)+X(5)*\Lambda NA\Gamma(-1)+X(6)*A\Gamma I(-1)+X(7)* \\ & \Lambda NM\Gamma(-1)+X(8)*M\Gamma I(-1)+X(9)*\Lambda NEP(-1)+X(10)* \\ & EPI(-1)+X(11)*\Delta(\Lambda N\Xi(-1))+X(12)*\Delta(\Lambda NX\Gamma(-1))+ \\ & X(13)*\Delta(\Lambda NK\Gamma(-1))+X(14)*\Delta(\Lambda NA\Gamma(-1))+X(16)* \\ & \cong TPEN\Delta\ X(15)*\Delta(\Lambda NM\Gamma(-1)) \end{aligned} \quad (1)$$

Estimation Imports Equation

$$\Delta(\Lambda NM) = \begin{aligned} & X(1)+X(2)*\Lambda NM(-1)+X(3)*\Lambda N\Gamma\Delta\Pi(-1)+X(4)* \\ & \Gamma\Delta\Pi\Pi(-1)+X(5)*\Lambda NEP(-1)+X(6)*EP\mathrm{I}(-1)+X(7)* \\ & \Lambda NP(-1)+X(8)*\Delta(\Lambda NM(1))+X(9)*\Delta(\Lambda N\Gamma\Delta\Pi(-1))+ \\ & X(10)*\Delta(\Lambda NEP(-1))+X(11)*\Delta(\Lambda NP(-1))+X(12)*\cong TPEN\Delta \end{aligned} \quad (2)$$

Estimation Exchange Rate Equation

$$\Delta(\Lambda NEP) = \begin{aligned} & X(1)+X(2)*\Lambda NEP(-1)+X(3)*EP\mathrm{I}(-1)+X(4)*TOT\mathrm{I}(-1)+X(5)* \\ & TOT\mathrm{I}(-1)+X(6)*\Lambda NP(-1)+X(7)*\Lambda N\Xi(-1)+X(8)*\Lambda N\Xi\mathrm{I}(-1)+ \\ & X(9)*\Lambda NM(-1)+X(10)*\Delta(\Lambda NEP(-1))+X(11)*\Delta(TOT\mathrm{I}(-1))+ \\ & X(12)*\Delta(\Lambda NP(-1))+X(13)*\Delta(\Lambda N\Xi(-1))+X(14)*\Delta(\Lambda NM(-1))+ \\ & X(15)*\cong TPEN\Delta \end{aligned} \quad (3)$$

In Equation (3) the X shows the growth rate of exports, where ICM shows the growth rate of

*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com
Journal of Engineering, Management, & Applied Sciences & Technologies. Volume 11 No.04 ISSN 2228-9860 eISSN 1906-9642
CODEN: ITJEA8 Paper ID:11A04N http://TUENGR.COM/V11/11A04N.pdf DOI: 10.14456/ITJEMAST.2020.74

intermediate consumer goods imports, AM shows the joint variable of agriculture and manufacturing growth rate, IKM represents the growth rate intermediate capital goods imports, ERI shows the exchange rate instability, ER shows the real devaluation, AMI shows the instability in agriculture-manufacturing. M represents the growth rate of imports, R represents the growth rate of foreign exchange reserves or forex reserves, GI shows growth rate instability, G shows the growth rate of GDP, Tb shows the growth rate of the trade-balance, XI shows export instability and TOT shows term of the trade (Kemal, 2005).

4. DESCRIPTIVE ANALYSIS

OLS and 2SLS techniques are used in the first stage of the analysis. The test consists of 16 variables, out of which 6 are risk variables: instability of ER, agriculture, and manufacturing, the term of trade, export and GDP. The GARCH variance calculates the instabilities. The Wald test is also applied to determine the confidence level in the long-run to check the correlation of variables. The 3SLS model is used to incorporate the covariance between the ER and deterministic factors of import and export.

Compound annual growth rates of all variables for the period 1979-2013 are shown Table 1. Imports' compound growth rate (CGR) for the entire period (1979-2013) is 9.24%, which is higher than the export growth rate of 6.69%. The growth rate for capital goods is positive but consumer goods have a negative compound growth rate. The highest demand for consumer goods was in 1990, while capital goods import was highest in 2008. Manufacturing shows a slightly negative growth rate of -0.74% that is reflected by the political instability and unmet capital requirements in the past decades, whereas the agriculture sector grew at a higher rate i.e., 6.75% — moreover both agriculture and manufacturing show an increasing trend in the long-run after 1990.

Table 1: Compound Annual Growth Rates 1979-2013

Instruments	1979-2001	2001-2013
ER	8.11	4.52
Ag	4.71	8.93
Mg	4.44	-9.57
TOT	9.16b	15.77
Tb	-5.02	29.42
R	35.28	18.14
M	-1.04	20.3
X	7.76	9.74
GDP	8.7	9.9
Cg	-3.18	-5.42
Kg	5.77	17.11

An overall increasing trend is seen in agriculture growth in Pakistan from the years1979 to 2003. Though Pakistan's economy is heavily depending upon agriculture, it is expected that the value would accelerate in the coming years. An overall increasing trend in imports predicts a worsening situation of the Tb of Pakistan.

$$\text{CGR} = \left\{\left(\frac{Y_n}{Y_0}\right)^{\frac{1}{n}}\right\} * 100 \qquad (4)$$

An improvement is seen in the Tb between the years 2003-2004, and then a sudden negative trend in Tb has been found between the years 2007-2013.

Figure 1 shows the relationship between ER instability and exports. It has been pointed out that

in the short and long-run, ER instability has had a significant positive impact on exports. Figure 2 shows that the negative short-run relationship of imports is positive, but the long-run relationship is positive.

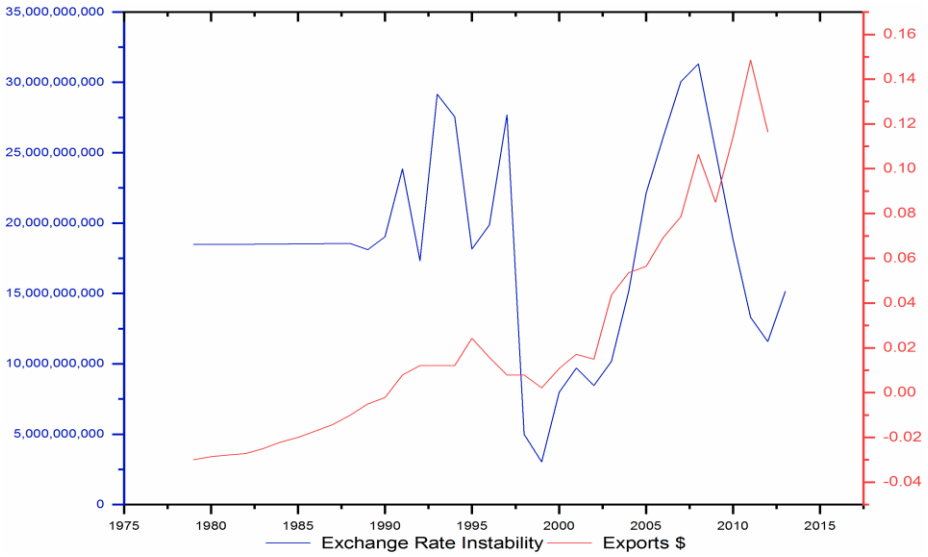

Figure 1: Exports and Exchange Rate Instability

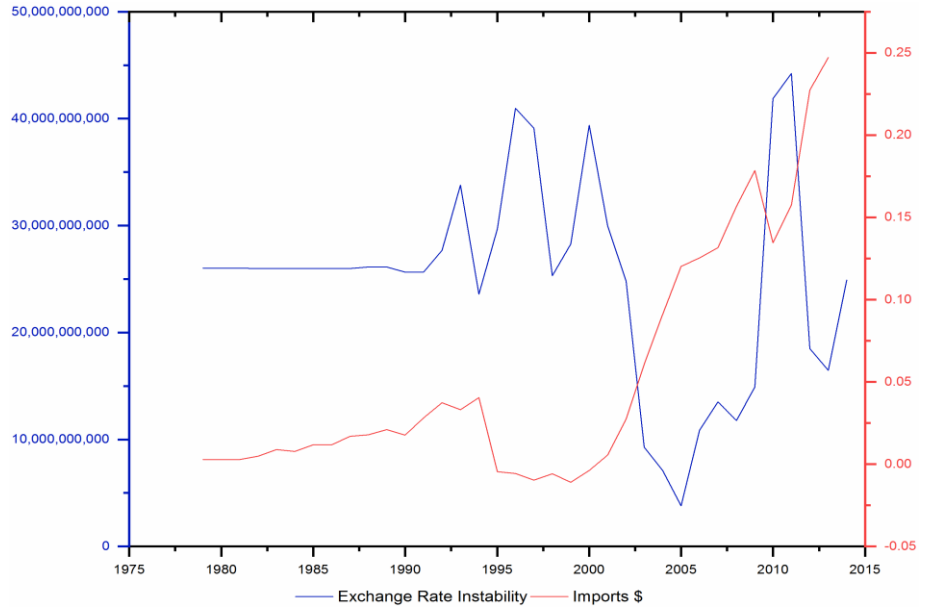

Figure 2: Imports and Exchange Rate Instability

Figure 3 shows the relationship between the Tb and ER. The graph shows the significant positive relationship between ER instability and imports, anyhow the significance level of covariance between both can only be concluded by considering all other instruments.

*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com Volume 11 No.04 ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8 Paper ID:11A04N http://TUENGR.COM/V11/11A04N.pdf DOI: 10.14456/ITJEMAST.2020.74

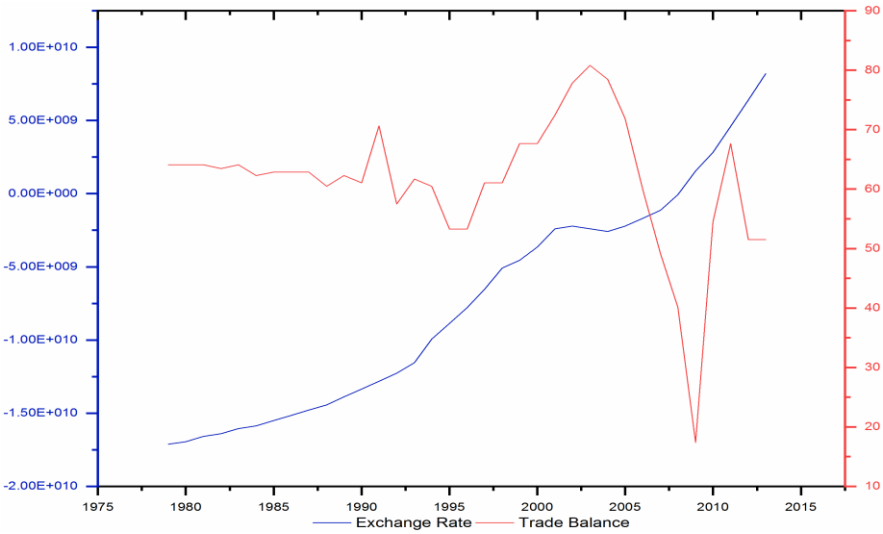

Figure 3: Trade-Balance and Exchange Rate

5. KEY FINDINGS

3SLS method has been used for the estimation of the simultaneous equations: import equation, export equation, and ER equation. The results show that exports affect the ER positively with a coefficient of 0.2, and imports affect the coefficient of -0.15 negatively. Conversely, ER volatility in the long-run affects export positively and negatively to imports with coefficients of 0.5 and -3.7 respectively. This positive export and negative import covariance of ER imply that in long-run ER instability helps in improving the Tb, keeping other market changes as constant.

For econometric models like OLS, 2SLS, and 3SLS, stationary data is required for the operation. While some economic and time-series data used in our equations show trending and non-stationary behavior, we have applied the "unit root test" to overcome this issue. Such variables include the ER, asset prices, and real GDP, etc. According to Kemal (2005), the data is stationary at level with 1 to 2 lags as per the requirement. As the secondary data gathered for the test is stationary at level with one lag, we have used the first derivatives of variables. The natural logarithm is taken to verify the long-run impact of covariance between instruments.

5.1 2SLS EXPORT EQUATION

The values of coefficients of the export equation show that agriculture and manufacturing and ER affects exports equation significantly. LNCG (-1) with a coefficient value of 0.022 and a probability of 0.856 shows a positive but insignificant relationship with exports. The coefficient of LNKG (-1) shows a negative but insignificant relationship with exports. Test statistics of LNAG (-1) are 2.23, and it shows a significant positive relationship with the coefficient value of 0.237261 because the probability is less than 0.05 which is 0.0159. Similarly, the test statistic of LNMG (-1) is 4.13, and it shows a significant positive relationship with the coefficient value 0.397662 because the probability is less than 0.05 which is 0.024. Moreover, the test statistic of AGI (-1) is 0.64, which shows a positive but insignificant relationship with the coefficient value of 0.19. MGI (-1) t-stat is 0.6, and it shows a negative but insignificant relationship with the coefficient value -0.1873. This predicts that if the agriculture and manufacturing of domestic countries have grown over time, it will render us a growth trend in exports in the long-run.

The test statistic of LNER (-1) is 2.4, and it shows a significant positive relationship with the coefficient value 0.558 because the probability is less than 0.05 which is 0.046. This means that one

unit change in the ER will increase by 2.4 units of exports. This is basically according to MLC that with the increased ER, the domestic currency is depreciated, and foreigners now have to pay less to buy our products. Hence an increasing trend in exports can be observed in the long-run.

D(LNAG(-1)) and ERI (-1) has a t-test of -0.3 which shows the insignificant negative relationship with the coefficient value -1.19 and -0.077. D(LNKG(-1)), D(LNCG(-1)), D(LNX(-1)) and D(LNMG (-1)) show the insignificant positive relationship with the coefficient values 0.072, 0.008, 0.13 and 0.5 respectively

$$\Delta(\Lambda N\Xi) = 32.46271 + 0.547137 * \Lambda N\Xi(-1) + 0.2372 * \Lambda NA\Gamma(-1) + 0.397 * \Lambda NM\Gamma(-1) + 0.5588 * EPI(-1) \quad (5).$$

5.2 2SLS IMPORT EQUATION

Coefficient estimates of import equation show that GDP, ER and reserves ratio impact the imports significantly. LNM(-1) ERI(-1), D(LNR(-1))and LNGDP(-1) shows the significant positive relationship with the coefficient value of 0.44, 0.8, 0.2 and 0.5 respectively. GDPI (-1) and D(LNER (-1)) show positive insignificant relationship with the coefficient value of 0.036344 and 2.1 respectively.

LNER (-1) and D(LNGDP (-1)) show a negative and significant relationship with the coefficient value of -3.79193 and -2.589, respectively. LNR (-1)) and D(LNM (-1)) show an insignificant negative relationship with the coefficient value -0.0143 and -0.13, respectively.

$$\Delta(\Lambda NM) = \begin{matrix} 0.447259 * \Lambda NM(-1) + 0.053644 * \Lambda N\Gamma\Delta\Pi(1) - 3.79193 * \Lambda NEP(-1) + \\ 0.806156 * EPI(-1) 2.58951 * \Delta(\Lambda N\Gamma\Delta\Pi)(-1)) + 0.209608 * \Delta(\Lambda NP(-1)) \end{matrix} \quad (6)$$

5.3 3SLS EXCHANGE RATE EQUATION

The coefficient values of the test suggest that terms of trade, reserves, export, and imports have a substantial impact on the ER equation. TOT (-1) shows a significant negative relationship with the coefficient value of -0.013. The test statistic of TOTI (-1) and LNR(-1) shows the insignificant but negative relationship with the coefficient value of -5.00 and -0.035 respectively. This depicts that if we increase our domestic reserves, it will appreciate the domestic currency as the ER will decrease due to negative association. The test statistic is 4.23 of LNX (-1)) shows a significant positive relationship with the coefficient value 0.206 because the probability is less than 0.05 which is 0.0249.

The coefficient of LNXI (-1) shows the significant negative relationship with the coefficient value -0.005 because the probability is 0.030 which is less than 0.05. The test statistic of LNM (-1) is 4.10 that shows the significant negative relationship with the coefficient value -0.15 because the probability is less than 0.05 which is 0.0007. The test statistic of LNER (-1) is 1.55 that shows the insignificant positive relationship with the coefficient value of 0.316 because the probability is less than 0.05 which is 0.0479. ERI (-1) with a t-stat of 2.88 shows the significant negative relationship with the coefficient value of -0.09 because the probability is less than 0.05 which is 0.01.

Test statistic is 0.75 of D(LNX(-1)) shows the insignificant negative relationship with the coefficient value -0.06 because the probability is greater than 0.05 which is 0.49. D(LNER (-1)), D(LNR(-1)), D(LNM(-1)), D(TOT1(-1)) and trend have the insignificant positive relationship with the coefficient value 0.06, 0.0049, 0.188, 0.005 and 0.089 respectively.

*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com

$$\Delta(\Lambda NEP) = \begin{aligned} &7.782 + 0.31656 * \Lambda NEP(-1) - 0.09 * EPI(-1) - 0.013 * \\ &TOTI(-1) - 0.035 * \Lambda NP(-1) + 0.206 * \Lambda N\Xi(-1) - \\ &0.005171 * \Lambda N\Xi I(-1) - 0.1588 * \Lambda NM(-1) + 0.0054 * \\ &\Delta TOTI(-1)) + 0.0049 * \Delta(\Lambda NP(-1)) + 0.188 * \\ &\Delta(\Lambda NM(-1)) + 0.08969 * \cong TPEN\Delta \end{aligned} \tag{7}$$

Table 2: 3SLS Exchange Rate Table

Instruments	OLS			2SLS(Export)			2SLS(Imports)			3SLS		
	Coef.	t-value	Sig.	Coef.	t-value	Sig.	Coef.	t-value	Sig.	Coef.	t-value	Sig.
C	1.72	0.4	0.7	32.5	3.94	0.04	-71	-2	0.2	7.8	3	0
LNER(-1)	0.48	2.8	0.1	0.56	2.45	0.05	-3.8	-3	0	0.3	2	0.1
ERI(-1)	-0.1	-1.8	0.1	-0.1	-0.4	0.73	0.81	2.3	0	-0.1	-3	0
TOT1(-1)	0	-2.5	0							0	-4	0
TOTI(-1)	0.01	1.8	0.1							0	0	1
LNR(-1)	0.27	3.3	0				0	0	0.9	0	-2	0
LNX(-1)	0.16	1.9	0.1	0.55	3.27	0				0.2	4	0
LNXI(-1)	0	-0.6	0.6							0	-2	0
LNM(-1)	-0.1	-2.2	0.1				0.45	2.1	0	-0.2	-4	0
LNGDP(-1)	-0.2	-1.4	0.2				0.54	3.6	0			
GDPI(-1)	0.01	0.4	0.7				0.04	2	0.1			
LNAG(-1)	0.32	2.2	0	0.24	2.24	0.02						
LNMG(-1)	0	-0.2	0.9	0.4	4.13	0.02						
LNCG(-1)	0.01	0.5	0.6	0.02	0.18	0.86						
LNKG(-1)	0	-0.6	0.6	0	-0.1	0.96						
@TREND	0.06	1.5	0.2	0.29	1.25	0.23	-0.3	-1	0.2	0.1	5	0
AGI(-1)				0.2	0.65	0.53						
MGI(-1)				-0.2	-0.7	0.51						
D(LNX(-1))				0.01	0.04	0.97				-0.1	-1	0.5
D(LNCG(-1))				0.01	0.12	0.91						
D(LNKG(-1))				0.07	0.27	0.79						
D(LNAG(-1))				-1.2	-1.1	0.31						
D(LNM(1))							-0.1	-1	0.5	0.2	3	0
D(LNGDP(-1))							-2.6	-3	0			
D(LNER(-1))							2.12	1	0.3	0.1	0	0.8
D(LNR(-1))							0.21	2.6	0	0	0	0.8
D(TOT1(-1))										0	2	0
D(LNMG(-1))				0.51	0.41	0.69						

6. CONCLUSION

The primary objective of this study is to examine the ER instability and its impact on Tb that signifies the J-curve effect if it is satisfied in Pakistan during the post 9/11 period. To analyze J-curve comparatively, sample data is taken from the years 1979 to 2013. The analysis is based upon three equations: estimation of exports, estimation of imports, and estimation of the ER. The outcomes do not give any help to the standard J-curve phenomenon. An effort has been made to verify the J-curve phenomenon between Pakistan and its ten well-known trade partners. The result from the studies bolsters the customary view that depreciation leads to improvements in the Tb; however, because of the rapid effect of devaluation on Tb analysts failed to recognize the J-curve.

In this study, the impact of ER instability on exports has been found to be a significant positive impact with a coefficient of 0.2, but the negative impact of ER instability on imports is -0.2. This means that ER instability helps to improve the long-run Tb. However, the term of trade has a

negative but important relationship with ER, with a coefficient of -0.013. ER and Reserves have a negative relationship that means increasing reserves appreciate the currency. Agriculture and manufacturing have a positive association with the export math model (equation).

As this study has used annual data, we can only conclude the long-run significance of the J-curve in Pakistan. Some aspects of the research are suggested for future study, including the use of short term (quarterly, monthly, or daily) data to find out if the J-curve is satisfied in the short-run. Future comparative studies can show ER volatility and its impact on trade with major trading partners. Furthermore, new variables can be added in the estimation models to check the covariance coefficients whether other variables will have a significant impact on Pakistan's Tb and ER fluctuations. Various other tests, like the error correction model with a combination of the 3SLS approach, can be applied to test the J-curve phenomena in the future.

7. DATA AND MATERIALS AVAILABILITY

Information relevant to this study is available by contacting the corresponding author.

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*Corresponding author (Fahim Afzal). Tel: +86-15261858637. E-mail: fahimafzal@mail.com

Volume 11 No.04 ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8 Paper ID:11A04N http://TUENGR.COM/V11/11A04N.pdf DOI: 10.14456/ITJEMAST.2020.74

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Fahim Afzal is a Ph.D. Scholar at the Business School of Hohai University Nanjing. He received his Master's Degree in Management Science and Engineering from the Business School of Hohai University. His research area is Financial Development and Economic Growth, Project Risk Management and Stock Market Trading.

Professor Dr. Pan Haiying is a Professor at the Business School of Hohai University. She received her Ph.D. in Management and Master's degree in Engineering from Hohai University Nanjing. Her research area is Financial Development and Economic Growth, Market Trading Mechanism, Macro-Finance, and Firm Investment and Financing Policy.

Farman Afzal is a Ph.D. Scholar in the School of Management and Economics, University Electronic Science and Technology of China. Mr. Farman is a Lecturer at the Institute of Business & Management, University of Engineering and Technology Lahore, Pakistan. He received his Master's Degree in Management Sciences from SZABIST, Pakistan. His research interests are Operations Management and Project Complexity & Risk

Imran Ahmed Shad is a Ph.D. Scholar at the School of Management and Economics, University Electronic Science and Technology of China. He is a Lecturer at Shah Abdul Latif University, Khairpur Pakistan. His research interest is Occupational Psychology.