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Yuan as a Medium of Trade: Volatility in Bilateral Exchange rate of China and Pakistan

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Abstract

The paper presents a quantitative study on the bilateral exchange-rate volatility of Chinese and Pakistani currencies by considering their bilateral trade. For the impact assessment, trade data of major industries were considered, and the "Ng-Perron" unit root test has been employed. The Unit root tested the stationarity of the exports and imports for both partners, and the outcome implied the use of the error correction method. Moreover, the Johansen co-integration technique has also been applied to confirm the existence of co-integration. We found evidence that variability in the exchange rate has a mixed impact on a few exporting and importing commodities both in the long-run and in the short-run, however, only a few commodities were impacted negatively. Thus, policymakers of both countries can consider Yuan as a medium of exchange while trading.

Key Words: Bilateral exchange rate, China, Pakistan, Trade, CPEC

JEL Classification: F14, F31, F36

1. Introduction

In the age of globalization, the effects of bilateral exchange-rate volatility (which we call EV from here onwards) on trade flow have gained vital importance. The international economic theory claimed that EV is a source of trade cost or returns and substantially impact international trade and corresponding trade relations among countries. Comparative advantage theories of trade pointed out the basis of trade, which could be in the form of "exchange rate differential." It is a source of comparative advantage for trade and currencies and influences both terms of trade and trade volume. EV affects the potential trader's decision to trade, and it heavily relies upon their level of risk avoidance.

Generally, uncertainty and risk associated with the exchange rate in trading mainly cause risk-averse traders to reduce trade (Wesley, Shen, Li, and Wilson, 2012). In most cases, the individuals who anticipate that their future income will decrease may desire to expand their existing income by increasing trade. Further,

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the uncertainty in profits due to fluctuations in exchange rates and their association to import price directly impacts the trade size. Another effect is on the volume of inputs trade, and studies exhibit that those imports of inputs are negatively affected, as some local producers substitute domestic inputs with imported inputs (Bahmani-Oskooee and Hegerty, 2007). Substantial studies analyzed the effects of EV, where McKenzie (1999) and Bahmani-Oskooee and Hegerty (2007) are the most significant ones. Their study categorizes all the empirical studies into three classifications; (i) the studies where authors incorporated "total trade" with a specific country and treated the rest of the countries as a combined trade partner and called that combined group the "rest of the world." Other classifications included the research that supports only 'bilateral trade flows', while the third classification of studies analyzing the impact of EV using 'disaggregated bilateral trade data of commodities or industries'. The underlying research is part of the second category as evaluating the bilateral trade of Pakistan and China.

Pakistan's trade with neighboring countries has been proliferating for the last decade. This rapid growth has a significant encouraging influence on the country's growth. One of the neighboring countries is China, and bilateral trade started in January 1963; after that, both countries constructed the Karakorum Highway (KKH) to promote trade from 1970 to the 1980s (Hamid and Hayat, 2012). The commodity-wise analysis of Pakistan's trade revealed the primary commodities that were and still are exported by Pakistan are "raw cotton and wool," "jute," "fabrics," and "synthetic textiles," and around 80 % of Pakistan's exports comprise cotton yarn and fabric. Overall, imports from Pakistan are highly concentrated in a few commodities and countries. In 2006-07, 40% of the imports originated only from seven countries, increasing 10 % in the last ten years, and reaching 50% in 2010-11. The USA, UK, and Malaysia were the major trade partners before Pakistan-China Free Trade Agreement (PCFTA), but their share declined post-PCFTA gradually. Whereas during PCFTA and post-PCFTA period, China became the most significant trade partner, and Pakistan's exports to China showed a growth of 64.59% during 2009-2010.

On the other hand, Pakistan's share in China's imports becomes trivial, with an increasing share only in products of cotton and fish. The trade share with Japan declined significantly in the last decade while Saudi-Arabia remained an exception. During the period of PCFTA, noticeable diversification in Pakistan's exports was observed with an element of emerging regional trade with Afghanistan, Bangladesh, and China. The "Strategic Trade policy" framework 2009-12 and the China Pakistan FTA could drive this diversification in the export market. However, the imports of Pakistan are industrial goods like "hardware and parts", "synthetic

materials", "compound components", "iron and steel" and "therapeutic and pharmaceutical" items. Total trade between Pakistan and China in goods increases, but the exports to China from Pakistan in industrial sectors are still not significant.

The position of the Pakistani Rupee has been continuously decreasing with respect to the US Dollar. The PKR (Pakistani Rupee) and the USD exchange rate was stable between 2001 and 2008 but depreciated from April 2008 to February 2019 due to diverse reasons. However, the exchange rate of the Rupee in terms of the Yuan depreciated relatively to a lesser extent. This depreciation in the PKR-USD exchange rate over the years negatively affects the terms of trade. However, at the same time, the increase in the trade volume over the years with China instead of the USA makes the commodity-specific study between Pakistan and China worth investigating. As Zhang, Lei, Ji, and Kutan (2019) evidenced, the dynamic change in the relative positions of China and the USA in the global economy. In the emerging new dynamics of international markets, could Yuan be a suitable replacement for the USD in trade? The current study highlighted the effects of considering the Yuan as a medium of trade for a small open economy like Pakistan, whose domestic markets are flooded with Chinese goods keeping in view the highly emerging Chinese economy concerning the USA.

Moreover, both countries' officials discuss using Yuan as a medium of exchange in goods and services trade. Therefore, it seemed crucial to evaluate the role of the EV and its associated consequences on commodity trade, which is influencing both trade partners during the construction of roads under the China-Pakistan Economic Corridor (CPEC). Thus, the underlying study empirically finds the answers to the above question by considering the volatility in the bilateral currencies of China and Pakistan. To determine the role of bilateral EV solely, we focus on the bilateral trade after the structural changes of the 1980s and early 90s in Pakistan's economy and thus considered trade data from 1995 to 2019. We employed disaggregated data on exports and imports separately to isolate bilateral EV's impact on major export and import industries.

The underlying study evaluated the above time series using the error correction method to find the impact of EV separately on export and import industries. The final estimates suggest that 22% of the selected export industries were impacted positively, and none were impacted negatively in the short run by EV. While in the long run, 44% of the selected export industries were impacted positively and only 11% negatively. For import industries, short-run estimates suggest that 25% of the selected industries have been impacted negatively and 10% positively. In the long run, these proportions of selected import industries changed

to 20% and 15% respectively, that is, for 20% of import industries the negative effects last in the long run while 15% showed positive effects.

The remainder of this paper is divided into three main sections. Section two highlights the relevant literature related to exchange rate volatility, and the third section presents the "modeling framework, methodology, and data" in detail in sub-sections. Section four is the last section presenting the conclusion and recommendations.

2. Literature Review

So far, the bilateral studies are concerned, the impact on Turkey's export flows of real EV to major trading partners was estimated by Vergil (2002) using monthly data from 1990-2000 by error-correction co-integration models. He concluded the significant adverse impact of the exchange rate on exports. Similarly, Mustafa, Nishat, and Kemal (2004) revealed the significant adverse impact on Pakistan's trade with the UK, USA, Australia, Bangladesh, and Singapore using an error correction model and no effect with New Zeeland and Malaysia. Bahmani-Oskooee and Xu (2013) examined industry-wise trade between the USA and Hong Kong, and the results indicated that USA export industries were positively affected while import industries were affected negatively due to variations in the bilateral exchange rate. In another study, Bahmani-Oskooee, Harvey, and Hegerty (2013) also analyzed these effects for the USA and Brazil. They showed striking results that in the long run, macroeconomic determinants were not affected by EV and had mixed effects on trade, the products with small trade shares are more likely prone to volatility in the exchange rate.

Only specific commodities were tested in cases like Cetin and Karakaya (2013) consider only exports by obtaining data in 2-digits SITC (Standard International Trade Classification). Likewise, Avsar and Turkcan (2013)examined this relationship considering the trade of motors and auto parts classified by Harmonized Tariff Schedule from thirty-seven major trading partners and found a positive impact in the case of commodities that have a larger share in trade. Umoru and Oseme (2013) studied the effect of EV on Nigeria and found the long-run effect of the real EV on trade. Similarly, Soleymani and Chua (2014) also analyzed bilateral EVs for Malaysia and China using disaggregated data for major importing and exporting industries. Mwangi, Mbatia, and Nzuma (2014) explored the impact of EV on a single industry in Kenya with the European Union by employing cointegration and ECM. The findings suggested that it had a significant negative impact in the short and long run.

Bahmani-Oskooee and Bolhassani (2014) checked the third country effect of EV using the trade flow of Canada with the USA and found that due to the third country effect, 66% of the industries were impacted by EV in the short-run and less than 33% in the long run. Serenis and Tsounis (2015) investigated the effect of EV on sectoral exports with significant partners, Germany, Sweden, and the UK, using autoregressive distributed lag modeling for cointegration. Their estimates suggest that EV affected sectoral exports of the UK and Germany but had no co-integrated relationship between exports of Sweden and concluded that it had mixed effects on different sectors of exports.

In Pakistan's case, extensive literature exists that encompassed the role of EV in trade, like Aqeel and Nishat (2006) and Bahmani-Oskooee, Iqbal, and Khan (2017). They highlighted empirical issues in their findings related to stationarity and the error correction model. Mustafa et al. (2004) focused on the multilateral effect of EV on trade and GDP. They suggest trade growth is affected negatively due to EV. Khan, Azim, and Syed (2014) later analyzed the impact of EV on Pakistan's trade with trading partners by using a Generalized Autoregressive Conditional Heteroscedasticity model. Their findings showed that when Pakistan considers USD as the mode of payment while trading, imports and exports were discouraged due to volatility from 1970 to 2009. However, when Pakistan's bilateral exchange rate was employed in domestic currency, the EV did not affect trade with developing countries. Mukhtar and Malik (2010) studied EV from a few South Asian countries using cointegration and the vector error correction technique, but they consider the pre-FTA period, i.e., from 1960 to 2007. They concluded that short and long-run EV had a significant adverse effect on exports. They also discovered that exports were positively affected by the progress in real foreign income and terms of trade. R. E. A. Khan, Sattar, and Rehman (2015) performed the causality analysis using the change in Pakistan's exchange rate on trade and proved that nominal wage contracts in the short run and production costs increase the price in the domestic and international market. They further confirm that the real EV causes trade fluctuations in the long run.

For this reason, we can say the EV primarily performs an influential part in the decision to trade. More recently, Bahmani-Oskooee et al. (2017) studied Pakistan's bilateral trade with the USA using an annual dataset from 1980 to 2014 for 57 exporting and 52 importing industries and provided robust estimates of over-parameterization and aggregation biases by considering maximum lag length equal to four. They showed that thirty-one export industries were affected in the short run due to EV, but only twenty remained vulnerable in the long run. Nevertheless, twenty-five import commodities were affected by volatility, out of which only

eighteen remained sensitive in the long run. Another recent study by Latief and Lefen (2018) measures the effects of EV separately for developing countries that are significant trade partners of China. They highlighted that the EV had negatively impacted countries that are part of China's One Belt and Road Initiative, including Pakistan.

All such studies focused either on the overall trade of a group of countries or even in the case of Pakistan's total trade, but the specific study concerning major industries trade and especially with China, as the trade relation growing day by day, not examined extensively. Therefore, in the situation of evolving China-Pakistan trade, the analysis of the EV help to develop policies for bilateral trade and accordingly maximize the potential return via avoiding the risk associated with trading in the dollar and based on which trade policy can be outlined, considering Yuan as a medium of trade. Moreover, disaggregating data has an advantage as it incorporates commodity-specific or industry-specific attributes and determines the trade competitiveness between the trade partners.

3. Modeling Framework, Methodology, and Data Sources

In framing our estimation equations, we follow the procedure of Kenen and Rodrik (1986) for commodity trade and presume that the commodity-specific trade between Pakistan and China depends on their consumer's income, the EV, and the real effective bilateral exchange rate that yields the following equation (1). This equation shows that exports of Pakistan to China depend on the Chinese consumer's income level, real bilateral exchange rate, and bilateral EV. Similarly, equation (2) shows that China's imports to Pakistan are determined by income level, real bilateral exchange rate, and volatility.

$$lnX_{it} = \alpha_0 + \alpha_1 lnY_{c,t} + \alpha_2 lnEXR_t + \alpha_3 lnVOL_t + \varepsilon_t \quad (1)$$

$$lnM_{it} = \beta_0 + \beta_1 lnY_{pk,t} + \beta_2 lnEXR_t + \beta_3 lnVOL_t + \varepsilon_t \quad (2)$$

Where, M_i represents the value of imports of industry i by Pakistan from China and indexed by time t , X_i represents the value of imports of industry i from Pakistan to China and indexed by time t, Y represents the income of consumers over time for China and Pakistan in equations (1) and (2), respectively. The EXR is the real bilateral exchange rate between the Pakistani Rupee and Chinese Yuan and defined as $(P^C * NE)/P^{PK}$, where P^C and P^{PK} are the price level measured by CPI respectively for Pakistan, China, and NE is the nominal rate of exchange between PKR and Yuan, where a rate increase indicates depreciation in PKR. The VOL is the volatility of the exchange rate, and ε is an error term indexed by time t.

Volatility VOL is calculated by taking the month-wise standard deviation from the annual real bilateral exchange rates (EXR).

In equation (1), the estimate α_1 is likely to be positive; an indication of growth in income of Chinese consumers with an increase in export of industrial goods i to China. The estimation of α_2 is likely to be positive if real deprecation of PKR boosted Pakistani export of industry i (Bahmani-Oskooee et al., 2017). Finally, the estimates of α_3 expected to be negative, if bilateral EV have an unfavorable effect on the exports. In equation (2), estimation of β_1 is likely to be positive because an increment in the per capita income of Pakistani consumers is anticipated to increase the import demand while in the case of the real devaluation of the PKR, the coefficient β_2 likely to decrease the demand for imports i due to high prices. Lastly, estimation of β_3 will depend upon whether the bilateral EV hurts or boosts Pakistan's import in the case of each industry i.

Data for equations (1) and (2) were obtained from 1995 to 2019 for twenty major imports and nine major export industries from "The Pakistan Bureau of Statistics." The data on real exchange-rate has been gathered from "International Financial Statistics" and the GDP and CPI information extracted from the World Development Indicators. Though the flexible exchange-rate system was introduced in Pakistan in 1983, we have taken the data from 1995 to 2019 due to data unavailability for all variables. Further, the Ng Perron Unit Root test was conducted to study the stationarity of the data. The Error Correction Model (ECM) has been used to estimate equations (1) and (2) by adopting the following specifications.

$$\Delta lnX = \gamma + \alpha_0\eta_{t-1} + \sum_{j=1}^{P}\alpha_{1x}\Delta lnX_{t-1} + \sum_{j=1}^{P}\alpha_{2Y_C}\Delta lnY_{Ct-1} + \sum_{j=1}^{P}\alpha_{3EXR}\Delta lnEXR_{t-1} + \sum_{j=1}^{P}\alpha_{4VOL}\Delta lnVOL_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta lnM = \delta + \beta_0\eta_{t-1} + \sum_{j=1}^{P}\beta_{1x}\Delta lnM_{t-1} + \sum_{j=1}^{P}\beta_{2Y_P}\Delta lnY_{Pt-1} + \sum_{j=1}^{P}\beta_{3EXR}\Delta lnEXR_{t-1} + \sum_{j=1}^{P}\beta_{4VOL}\Delta lnVOL_{t-1} + \varepsilon_t \quad (4)$$

In equations (3) and (4), the coefficient of ΔY_C , ΔEXR and ΔVOL represent short-run estimates capturing the effect on ΔX and ΔM. The ECM measures the accuracy of the co-integrated variables across the equilibrium and is used to integrate data series to their long-run equilibrium in situations when series are diverging.

3.1 Ng –Perron Test for Exports and Imports

The GLS de-drifting system of ERS was utilized by Ng and Perron (2001), which is the efficient variant of the modified PP tests of Perron and Ng (1996). The estimates of these tests take into account the type of Phillips and Perron (1988) Z_a

and Z_t insights, and the r_1 measurements of Bhargava (1986). These modified PP tests are more efficient due to lesser distortions of the PP tests for errors with extensive negative MA or AR roots, particularly when φ is near to solidarity. The measurements MZ_α and MZ_t are efficient forms of the PP test with Z_α and Z_t that has considerably smaller size distortions in the existence of the negative moving average error. As we can see from Table 2 and Table 3, the series for exports and imports are stationary at the first difference; therefore, Johansen and Juselius (1990) multivariate cointegration process has been used to detect the existence of cointegration associations, both for trace and maximum eigenvalue measurements.

3.2 Johansen Co-Integration for Exports and Imports

The existing literature highlights that the cointegration test is usually used to determine regular stochastic patterns between data series that are independently non-stationary in levels. The framework's uniform lag structure is placed through an examination procedure, as Vahid and Engle (1993) suggested by utilizing the probability proportion test with a lag length of one to eight. Two probability proportion tests measure the cointegration vector(s); maximum eigenvalue and trace statistics. According to Johansen and Juselius (1990), the multivariate cointegration process is characterized as follows.

$$St = (X, M, YC, YP, EXR, VOL) \quad (5)$$

Johansen's system includes estimating the equation (5) by the maximum likelihood method and testing the hypothesis Ho; $r = 1$ (no cointegration exists), where r is the matrix's rank. The hypothesis of 'no cointegration' fails to reject when the estimated likelihood test statistic is less than its critical value. Estimation reveals a single cointegration vector for all export industries based on the trace statistic as Table 4 presents. For Export-8, we find that a two-integrating vector exists and not a single integrating co-vector exists for Export-56, based on the trace statistic results for the export commodities.

On the other hand, only thirteen out of twenty importing industries have a single co-integrating vector determined based on trace statistics and maximum eigenvalue. These industries are Import-4, Import-19, Import-15, Import-17, Import-21, Import-22, Import-28, Import-31, Import-33, Import-41, Import-45, Import-64 and Import-96 while other commodities are not co-integrated as Table 5 showed.

Table 1: Data Description

Variables Description	Code	Mean	Maximum	Minimum	Std. Dev.
Log of real bilateral exchange-rate	LEXR	1.446	2.974	0.448	0.783
Log of the volatility of the exchange rate	LVOL	2.885	9.326	-1.731	2.764
Income in Pakistan measured by GDP current US dollars	LYP	6.457	7.151	5.887	0.427
Log of Income in China measured by GDP current US dollars	LYC	7.239	9.206	5.751	1.030
Chapter 03	Export-03	-3.098	-1.189	-9.915	2.352
Chapter 04	Import-04	-7.567	-5.452	-10.112	1.212
Chapter 07	Export-07	-7.838	-3.941	-12.917	2.161
Chapter 07	Import-07	-1.916	-0.578	-3.328	0.749
Chapter 08	Export-08	-6.767	-2.339	-12.259	2.323
Chapter 09	Export-09	-8.470	-5.135	-11.570	1.454
Chapter 09	Import-09	-2.708	-1.317	-4.313	0.896
Chapter 15	Import-15	-6.465	-4.922	-10.407	1.176
Chapter 17	Import-17	-3.753	0.016	-8.687	2.344
Chapter 19	Export-19	-6.050	-0.014	-9.390	2.842
Chapter 21	Import-21	-6.608	-3.053	-10.686	2.188
Chapter 22	Import-22	10.386	-6.787	-24.976	4.105
Chapter 28	Import-28	-1.435	-0.576	-2.310	0.563
Chapter 29	Import-29	-0.798	0.781	-2.159	0.969
Chapter 30	Import-30	-2.038	-1.495	-2.692	0.319
Chapter 31	Export-31	-6.233	-3.330	-9.908	1.832
Chapter 31	Import-31	-3.260	0.803	-7.665	2.787
Chapter 32	Import-32	-1.626	-0.664	-2.533	0.599
Chapter 33	Import-33	-4.275	-2.310	-5.895	1.048
Chapter 37	Import-37	-4.272	-3.451	-5.900	0.664
Chapter 40	Import-40	-1.704	-0.145	-2.957	1.001
Chapter 41	Import-41	-6.354	-4.198	-10.416	1.588
Chapter 45	Import-45	-8.034	-5.893	-9.439	0.838
Chapter 48	Import-48	-2.584	-0.552	-4.354	1.269
Chapter 53	Export-53	-5.338	-0.926	-11.050	2.564
Chapter 56	Export-56	-0.449	2.251	-4.827	2.101
Chapter 64	Import-64	-4.084	-1.089	-9.380	2.548
Chapter 96	Export-96	-6.250	-4.019	-7.862	0.847
Chapter 96	Import-96	-2.520	-1.503	-4.033	0.712

Note: Detail description of these chapters is available on Harmonized Commodity Description and Coding Systems (HS) (Classifications, Commodity Codes, Commodity Description, HS, HS code search, WCO) (un.org)

Table 2: Ng –Perron Test for Exports

Log (Variables)	MZ_a	MZ_t	MS_b	MP_t	Δ Variables	MZ_a	MZ_t	MS_b	MP_t
Export-3	-3.39081	-1.20338	0.3549	24.9848	Export-3	-101.788***	-7.12988	0.07005	0.91023
Export-7	-11.8881	-2.41647	0.20327	7.77544	Export-7	-17.1691**	-2.92991	0.17065	5.30769
Export-8	-11.0235	-2.30194	0.20882	8.48471	Export-8	-50.9603***	-5.04777	0.09905	1.78825
Export-9	-11.5819	-2.36516	0.20421	8.07373	Export-9	-24.6870***	-3.50917	0.14215	3.7154
Export-19	-7.94842	-1.86971	0.23523	11.7601	Export-19	-15.0052*	-2.72761	0.18178	6.13831
Export-31	-10.4025	-2.28053	0.21923	8.76036	Export-31	-17.4451**	-2.95338	0.1693	5.22363
Export-53	-7.27618	-1.85042	0.25431	12.6059	Export-53	-17.5874*	-2.96294	0.16847	5.19584
Export-56	-1.77028	-0.85253	0.48158	44.7572	Export-56	-137.528***	-8.28734	0.06026	0.67875
Export-96	-0.97905	-0.60757	0.62057	73.6091	Export-96	-61.4904***	-5.54447	0.09017	1.48359
LYC	-2.25614	-0.73805	0.32713	26.7015	ΔLYC	-26.8909***	-3.50835	0.13047	4.27715
LYP	-3.74768	-1.36323	0.36375	24.2295	ΔLYP	-114.681***	-7.53564	0.06571	0.92132
LEXR	-2.11346	-0.87820	0.41553	35.2284	ΔLEXR	-15.7533*	-2.70355	0.17162	6.36889
LVOL	-6.55744	-1.79666	0.27399	13.8968	ΔLVOL	-16.1579**	-2.84226	0.17591	5.64019

Table 3: NG-Perron Test for Imports

Log (Variables)	MZa	MZt	MSb	MPt	Δ Variables	MZa	MZt	MSb	MPt
Import-4	-11.542	-2.32798	0.2017	8.26206	Import-4	-35.1560***	-4.06036	0.1155	3.29388
Import-7	-11.2312	-2.29931	0.20472	8.4535	Import-7	-30.8003***	-3.88915	0.12627	3.15361
Import-9	-3.64922	-1.33918	0.36698	24.7821	Import-9	-127.451***	-7.95812	0.06244	0.79642
Import-15	-6.84665	-1.76711	0.2581	13.3631	Import-15	-22.0071**	-3.29383	0.14967	4.27744
Import-17	-28.0538***	-3.74485	0.13349	3.25052	Import-17	-35.6039***	-4.21747	0.11846	2.56891
Import-21	-9.96948	-2.23024	0.22371	9.15071	Import-21	-219.826***	-10.483	0.04769	0.41696
Import-22	-11.6819	-2.41637	0.20685	7.80275	Import-22	-19.2486**	-3.10227	0.16117	4.73434
Import-28	-5.22495	-1.61624	0.30933	17.44	Import-28	-27.5400***	-3.71032	0.13472	3.31157
Import-29	-19626.9	-99.0627	0.00505	0.00467	Import-29	-20.2687**	-3.18213	0.157	4.50363
Import-30	-5.67922	-1.68511	0.29671	16.0453	Import-30	-47.9159***	-4.87326	0.1017	2.00653
Import-31	-10.7012	-2.31311	0.21616	8.51552	Import-31	-16.9045**	-2.90714	0.17197	5.39139
Import-32	-4.80992	-1.54695	0.32162	18.9203	Import-32	-872.981***	-20.8889	0.02393	0.10889
Import-33	-6.53913	-1.76129	0.26935	13.9346	Import-33	-22.1232**	-3.32249	0.15018	4.13905
Import-37	-5.77377	-1.6725	0.28967	15.7247	Import-37	-22.4659**	-3.34135	0.14873	4.11598
Import-40	-6.35705	-1.78093	0.28015	14.3336	Import-40	-20.3320**	-3.18598	0.1567	4.49622
Import-41	-6.09033	-1.7336	0.28465	14.9486	Import-41	-19.2337**	-3.1009	0.16122	4.739
Import-45	-8.44582	-2.04942	0.24265	10.8063	Import-45	-17.8294**	-2.98481	0.16741	5.11647
Import-48	-29.1642***	-3.79865	0.13025	3.23738	Import-48	-35.2458***	-4.19796	0.11911	2.58546
Import-64	-16.6020**	-2.83405	0.17071	5.76218	Import-64	-24.3524***	-3.48436	0.14308	3.7715
Import-96	-8.16992	-2.02111	0.24738	11.1538	Import-96	-20.1930**	-3.17308	0.15714	4.53876

Table 4: Cointegration test for Exports

$Exports_t = f(EXR_t, VOL_t, YC_t)$	Trace Statistic				Maximum Eigen Value			
	R = 0	R ≤ 1	R ≤ 2	R ≤ 3	R = 0	R ≤1	R ≤ 2	R ≤ 3
Export-3	82.963***	38.443	22.903	9.563	44.519***	15.540	13.339	9.563
Export-7	64.845**	39.250	15.894	5.223	25.595	23.355	10.670	5.223
Export-8	100.948***	49.931***	21.733	8.302	51.017***	28.197**	13.431	8.302
Export-9	73.406***	34.922	18.674	4.597	38.483***	16.248	14.077	4.597
Export-19	72.239***	35.818	18.413	7.169	36.421**	17.404	11.244	7.169
Export-31	62.008*	36.262	20.945	8.293	25.746	15.316	12.651	8.293
Export-53	67.320**	38.085	19.512	8.368	29.234	18.573	11.143	8.368
Export-56	96.436***	49.265**	24.938*	11.960*	47.171***	24.326*	12.978	11.960
Export-96	70.094**	37.152	18.951	7.6969	32.942**	18.200	11.254	7.6969

Note: *** shows significance at 1%, ** at 5% and , * at 10% levels of significance respectively.

Table 5: Co-integration test for Imports

Imports $=f(EXR_t, VOL_t, YP_t)$	Trace Statistic				Maximum Eigen Value			
	R = 0	R ≤1	R ≤2	R ≤3	R = 0	R ≤1	R ≤2	R ≤3
Import-4	71.389**	32.284	17.478	5.104	39.104***	14.806	12.374	5.104
Import-7	39.104	14.806	12.374	5.104	25.377	14.915	9.166	5.824
Import-9	62.452*	33.816	17.435	7.114	28.635	16.381	10.321	7.114
Import-15	62.976*	35.414	14.353	5.581	27.561	21.060	8.772	5.581
Import-17	66.884**	29.273	14.483	5.583	37.611***	14.789	8.900	5.583
Import-21	83.964***	30.305	13.728	4.297	53.658***	16.577	9.431	4.297
Import-22	69.448**	29.875	15.139	5.897	39.573***	14.735	9.241	5.897
Import-28	69.674**	29.460	15.291	3.852	40.213***	14.168	11.439	3.852
Import-29	51.833	30.399	14.192	3.907	21.434	16.2072	10.284	3.907
Import-30	48.868	27.020	15.325	5.257	21.848	11.695	10.067	5.257
Import-31	85.292***	31.606	14.710	4.604	53.686***	16.895	10.105	4.604
Import-32	56.727	33.187	19.326	7.959	23.540	13.860	11.366	7.959
Import-33	76.664***	31.019	17.221	5.942	45.645***	13.797	11.279	5.942
Import-37	59.511	32.677	15.909	5.180	26.834	16.767	10.728	5.180
Import-40	56.184	32.661	15.895	6.379	23.522	16.766	9.5163	6.379
Import-41	75.959***	29.986	14.914	5.318	45.973***	15.072	9.595	5.318
Import-45	69.375**	41.628*	17.292	6.293	27.747	24.335*	10.999	6.293
Import-48	58.961	34.055	18.319	8.953	24.906	15.736	9.366	8.953
Import-64	63.737*	33.407	18.613	5.686	30.330*	14.794	12.926	5.686
Import-96	61.152*	39.212	18.056	6.156	21.940	21.155	11.900	6.156

Note: *** shows significant at 1%, ** at 5% and , * at 10% levels of significance respectively.

3.3 Error Correction Method for Exports

After establishing cointegration, an Error Correction Method was employed to determine the effects of income level in China, real exchange rate, and bilateral EV on exports and the outcome of the equation (3) presented in Table 6, which shows the short-run and long-run coefficient estimates of nine export industries. In the short run, only two industries, Export-9 and Export-31, were positively affected by bilateral EV, and further estimates showed the convergence of short-run effects in the long run. Five export industries groups were significantly affected by bilateral EV in the long run, out of which two industries Export-9 and Export-31 also showed significant effect earlier in the short run. However, additional industries that showed the same effects are Export-3, Export-56, and Export-96. All the five industries' export flows are positively affected by the bilateral EV.

The possibility of a positive relationship with trade flows is due to the behavior of importers and exporters that are tied to minimizing risk and stimulating positive effects. A similar impact can also be seen in Bahmani-Oskooee and Bolhassani (2014), and Viaene and De Vries (1992). Broll and Eckwert (1999) clarify that instability rises the valuation of a trader's opportunity to export; meanwhile, this risk expands the potential trade. The volume of business will grow as per needs, and bilateral EV may raise exports because of its impact on the expected benefits of risk-neutral firms.

We use the short-run coefficient estimates and form an error-correction term denoted by ECM by utilizing the short-run coefficient estimates. We also formerly displace the linear combination of the lagged level variables by ECM (-1) and evaluate the new error-correction model utilizing the same number of lags on every initially differenced variable. An altogether negative coefficient for ECM (-1) supported cointegration amongst the variables for all industries and indicated convergence in the long run. When exchange-rate volatility is low, then some expenses, especially transport costs may exceed the role of risk in deciding the trader's choice. Bailey, Tavlas, and Ulan (1987) proved that revenue-driven trade differs straightforwardly from exchange-rate risk and counterbalances the risk-on trade. For the producer, the variability of a bilateral exchange rate may outweigh the gains from trade, and governments also intervene in the foreign exchange market through measurable limitations to mitigate the EV. The expense of such barriers to an exporting firm could be more significant than any cost connected with exchange-rate variability, leaving the degree of exchange-rate variability and a company's expenditure uncorrelated.

On the other hand, in the case of the bilateral exchange rate, two industries, Export-3 and Export-7, are negatively affected, but only the effect of commodity Export-3 lasted in the long run. However, additional commodities Export-19 and Export-31 were affected positively, and Export-56 negatively. It highlights that the PKR's real depreciation against the Yuan boosts exports of Pakistan in Export-19 and Export-31. The case of Export-31 is interesting because the export of this industry is also positively affected by bilateral EV. When there is a propensity for exchange rates to vary with a change in inflation, the difficulty to the exporters due to devaluing foreign currency can be balanced by the more significant foreign currency exports if such are evaluated in a foreign currency.

In a relative disposition, to the degree that an exporter imports transitional inputs from a nation whose currency is devaluing, there will be some balance to deteriorating exports income as lower input prices. However, no significant impact on the real exchange rate was found in exports of Export-8, Export-9, and Export-53.

Furthermore, when a firm trades with many countries, the exchange-rates differential offsets some of the risks and works like insurance against currency risk. The trade would be enhanced by bilateral EV when the traders' profits are ensured (Sercu and Vanhulle, 1992). With low EV, the transport cost can outstrip risk in shaping the trader's decision. Further, Bailey et al. (1987) argue that profit incentive correlates with exchange-rate risk and thus offsets trade risk.

In the case of the income variable, no industry is showing a significant impact in the short run, but in the long run, five products are significantly affected by income or economic activity in China. Out of these industries, one sector Export-31 affected negatively while Export-3, Export-7, Export-8, and Export-56 positively, which means that with an increase in income, the demand for imports from Pakistan in these four commodities increases in China. Estimates indicate mixed effects that still after emerging Chinese economy imports increase in four commodities but remain insignificant in the other four. However, Export-31 might be produced domestically or imported from elsewhere. In all these cases, the lagged value of ECM is negative and significant as an indicator of convergence of short-run effects in the long run. Other tests statistics like R square, F test, and Durbin Watson D statistics are given in Table 6 for each exporting industry respectively.

3.4 Error Correction Method for Imports

The outcome of the import equation (4) presented in Table 7 exhibits the short-run dynamics and the long-run impact of the real exchange rate, income, and EV for each imported industry.

The short-run estimates in Table 7 depict the effects of EV in the case of seven industries. These industries are Import-9, Import-15, Import-29, Import-33, Import-37, Import-45, and Import-48; only two showed a positive impact, which is Import-45 and Import-37, and the rest of the commodities showed a decrease in imports due to EV. The negative coefficients infer that an increment in bilateral EV trims down the import of Pakistan from China in these industries. However, when we estimate the long-run dynamics, only Import-5, Import-29, Import-33, Import-37, and Import-48 remain significant with a significant value of ECM, an indication of convergence, and these five industries are affected by bilateral EV both in the long run and short run. Out of which, the only industry which is positive both in the short-run and long-run is the Import-37. The remaining four industries i.e., Import-15, Import-33, Import-29, and Import-48, are affected negatively. However, two additional products are found to be positively and significantly affected including Import-7 and Import-64. Overall, out of twenty industries, four-show negative and three positive effects respectively in the long run.

In the short run, the Import-9 is affected negatively but Import-45 positively. Moreover, the lagged value of ECM is not significant means that the effect of bilateral EV does not last in the long run. Nevertheless, the effect in the case of Import-45 can converge in the long run, but the coefficient remains insignificant. On the other hand, the Import-7 and Import-64 are not affected in the short run, but the ECM value is significant and

Table 6: Export Estimates

Exports	Short Run Model						Long-Run Model						ECM(-1)
	DLEXR	DLVOL	DLYC	R^2	F-Test	DW	Constant	LEXR	LVOL	LYC	R2	F-Test	DW	
Export-3	-3.589***	0.009	1.766	0.522	5.177	2.598	-33.864	-4.834***	0.134*	5.162***	0.835	35.334***	1.176	-0.616***
Export-7	-6.073*	0.298	0.987	0.547	5.74	1.756	-21.399	-2.728	0.1	2.378*	0.151	1.247	1.871	-0.943***
Export-8	0.986	0.217	2.210	0.502	4.784	1.665	-19.686	0.148	0.028	1.744*	0.684	15.142***	1.601	-0.750***
Export-9	0.321	0.349**	-1.27	0.552	5.847	1.996	-1.160	1.415	0.198*	-1.372	0.237	2.177	2.109	-1.181***
Export-19	3.918	0.068	0.998	0.38	2.915	2.216	2.102	4.764**	-0.168	-2.010	0.428	5.239	1.477	-0.772***
Export-31	2.106	0.481***	-1.868	0.652	8.911**	1.845	-0.365	2.803**	0.349***	-1.509*	0.566	9.121**	1.865	-1.000***
Export-53	2.165	0.148	3.467	0.282	1.868	2.309	10.668	1.852	-0.151	-2.521	0.305	3.071	0.865	-0.410**
Export-56	-0.872	0.015	-0.278	0.263	1.697	1.395	-21.429	-1.975***	0.146***	3.234***	0.925	85.862***	1.081	-0.281**
Export-96	-0.427	0.105	-0.822	0.482	4.422	1.848	-9.929	-0.020	0.108**	0.469	0.494	6.828	1.860	-0.986***

Note: *** show significant at 1%, ** show significant at 5% and, * show 10% levels of significance.

Table-7: Import Estimates

Imports	Short Run Model						Long Run Model							ECM(-1)
	DLEXR	DLVOL	DLYP	R^2	F-Test	DW	Constant	LEXR	LVOL	LYP	R^2	F-Test	DW	
Import-4	-1.951	-0.003	3.72	0.614	7.539*	2.056	-15.871	-0.887	-0.887	1.493	0.051	0.377	0.377	-1.294***
Import-7	-1.206	0.012	3.498**	0.565	6.158	1.836	-17.573	-0.729*	0.075*	2.554***	0.661	13.674***	2.109	-1.116***
Import-9	0.681	-0.044**	2.724**	0.342	2.471	2.076	-9.864	0.335**	-0.074	1.066	0.645	12.733***	0.658	-0.433
Import-15	-0.052	-0.205**	-0.684	0.577	6.472	1.589	-5.874	0.468	-0.333***	-0.048	0.619	11.366**	2.509	-1.147***
Import-17	2.241	0.320	3.278	0.530	5.364	1.685	-5.204	0.359	0.111	0.095	0.041	0.299	1.853	-0.839***
Import-21	0.012	0.026	1.828	0.459	4.025	1.456	-33.557	0.416	-0.012	4.085***	0.878	50.192***	1.885	-0.928***
Import-22	-1.972	0.050	9.524	0.529	5.340	2.121	-30.052	0.889	-0.152	2.915	0.219	1.965	1.956	-1.029***
Import-28	-0.055	-0.011	1.069***	0.603	7.221	2.079	-10.332	-0.057	-0.009	1.394***	1.394	206.133***	1.796	-0.918***
Import-29	0.165	-0.033***	0.761*	0.419	3.427	2.101	-12.427	0.292**	-0.022*	1.745***	0.982	371.920***	371.921	-0.548**
Import-30	-0.059	0.029	-1.028	0.42	3.446	1.697	-4.529	-0.160	0.006	0.419	0.056	0.413	0.653	-0.543***
Import-31	-1.281	0.176	4.034	0.658	9.146**	1.816	-44.958	-0.608	0.033	6.578***	0.725	18.418***	2.565	-1.426***
Import-32	-0.187	-0.011	0.541	0.468	4.181	2.120	-10.583	-0.015	-0.013	1.396***	0.954	145.165***	1.614	-0.714
Import-33	0.522	-0.118**	-0.306	0.489	4.545	1.636	-4.491	1.291***	-0.134***	-0.196	0.807	29.283***	1.636	-0.829***
Import-37	-1.053*	0.065*	-0.124	0.340	2.442	2.171	-15.644	-0.680*	0.138***	1.850**	0.500	7.001	0.960	-0.395**
Import-40	-0.152	0.000	2.441***	0.458	4.020	1.855	-15.042	0.150	0.017	2.024***	0.955	148.935***	1.280	-0.778***
Import-41	-1.657	-0.095	6.337*	0.602	7.193	2.019	-13.668	0.755	-0.082	1.000	0.398	0.398	0.398	-1.065***
Import-45	-0.899	0.113*	-1.387	0.382	2.937	2.124	-12.068	-1.115	0.070	1.066	0.415	4.968	1.252	-0.756**
Import-48	0.267	-0.078**	3.225***	0.550	5.810	1.788	-11.027	0.702	-0.182***	1.233	0.786	25.783***	0.568	-0.214*
Import-64	0.045	0.043	4.371*	0.235	1.462	1.451	-42.136	-0.341	0.263***	5.852***	0.869	46.282***	1.029	-0.366*
Import-96	-0.567	0.040	-0.425	0.391	3.044	1.880	-13.705	-0.265	0.050	1.769***	0.664	13.843***	0.919	-0.585***

Note: *** show significant at 1%, ** show significant at 5% and, * show 10% levels of significance.

hence, in the long run, it remained to be positively impacted by bilateral EV. Therefore from the long-run estimates, we find mix effect of bilateral EV on imports of Pakistan in different commodities, and these are in accordance with the outcomes of R. E. A. Khan et al. (2015), who have analyzed aggregate exports and import data of the developing countries.

The real exchange rate also positively affects Import-9, Import-33, and Import-29, which means that the PKR depreciation promotes Pakistan's imports from China. However, Import-7 and Import-37 were areaffected negatively. The negative relation indicates that the real depreciation of the Rupee discourages Pakistan's imports from China in these industries. Overall, it suggests that on account of exchange-rate fluctuations, some household manufacturers may substitute locally delivered goods instead of imported products, but not all the consumers replace most of the imported products with domestic ones and hence are remained unaffected.

Further, the income variable stated a different story; the elasticity of import demand measured the sensitivity of imports to the change in income of Pakistani consumers or economic activity in Pakistan. Income has a positive and significant impact on Import-7, Import-21, Import-28, Import-29, Import-31, Import-32, Import-37, Import-40, Import-64, and Import-96. When the income of Pakistani consumers or economic activity increases, they increase imports rather than producing a substitute for imported commodities.

4. Conclusion and Future Research

This study examines the impact of bilateral EV on goods trade of nine export and twenty import industries of China and Pakistan separately. Johansen cointegration technique and ECM have been used to analyze the annual data from 1995-2019, whereas Ng and Perron (2001) technique is used to confirm the stationarity properties of the data.

Estimates reveal that bilateral EV has a positive and significant impact only for 22% of commodities in the short run while 44%, in the long run, exert the positive effect of volatility on their respective exports. On the other hand, no industry is affected negatively in the short run, but 11% are affected in the long run. Further, in the short run, imports of 25% of industries are affected negatively and 10 % positively. Long-run estimates suggest that the number of products having positive effects increases while decreases for products having a negative effects. In short, 15% of the commodities are affected positively, while 20% of selected commodities are negatively impacted by EV in the long run. Overall results indicate

that most commodities are not vulnerable to bilateral exchange-rate fluctuations. Further, evidence reveals that income levels in Pakistan determine the imports from China for 50% of the selected industries in the short and 40% in the long run, whereas income levels in China do not impact the exports of Pakistan in the short run but 44% positively in the long run, whereas only one Export-31 affected negatively. In that case (Export-31 are the fertilizers), rising income standards in China lead to the substitution of fertilizer from Pakistan to other countries or produced domestically, which indicates a decrease in Pakistan's major exports.

In the short run, we found evidence that the real exchange rate's impact on all importable commodities remained insignificant except for one industry but 22% of exports negatively. However, the significant mixed effects can be seen for a few import and export commodities in the long run. An interesting finding is that the export industry of fertilizer is sensitive to bilateral EV and real exchange rates; however, imports are not affected significantly by any of these factors, while only income level is determined positively with the highest magnitude. This implies that volatility in the bilateral exchange rate does lesser harm to the traders of both the countries as compared to its positive effects. Hence policymakers of both countries can consider Yuan as a medium of exchange while trading.

Overall, most industries are not taking a substantial impact on bilateral EVs. Thus, domestic currencies while trading with each other are less risky and can be a preferred medium of trade. However, the third country affected is not included, so future researchers can consider the multilateral trade for including third-country impudence when examining the bilateral EV. Although this study utilized only a few industries' data, other industries-related data can also be employed to explore this avenue of research more profoundly for a more considerable period in the future.

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