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What Do We Know of Trade Elasticities?

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Devaluation[2] is necessitated only when policy weakness leads to a loss of reserves. It takes on a harsher form when central banks refuse to recognize the will of the market and spends reserves to preserve an artificial value of the exchange rate.

Ill-informed popular debate appears to hold to the notion that the purpose of a devaluation is to devalue to improve the trade balance and as they say "improve competitiveness."

There is an old debate on whether exchange rate depreciation impacts the trade balance positively or not. We will summarize that here.

The impact of an exchange rate depreciation on trade balance has not been widely endorsed. The studies in the area of depreciation can be divided into two groups. The first group of studies supports the view that depreciation is successful in improving the trade balance and demand for exports and imports are responsive to exchange rate. Whereas, the second group that do not lend support to the effectiveness of depreciation in resolving the trade deficit problem (see Table 1).

Table 1

The Impact of Exchange Rate Depreciation on Different Economies

1. Studies that Support Depreciation			
Author (s), Years	Country	Data Period	Findings
Goldstein and Khan (1978) Goldstein and Khan (1976)	Eight industrial countries	1955–1970	Marshall-Lerner condition is satisfied

	Export demand price elasticities (PX/PXW)	Import demand price elasticities (PM/PD)
Belgium	–1.57	–0.62
France	–1.33	–1.09
Germany	–0.83	–0.70
Italy	–3.29	–0.16
Japan	2.47	0.01
Netherlands	–2.73	0.33
UK	–1.32	0.18
United States	–2.32	–0.45

Balassa, et al. (1989)	Greece and Korea	1960–1978	

	Export demand elasticity (NEER)
Greece	–1.01
Korea	–1.07

Gupta-Kapoor and Ramakrishnan (1999)	Japan	1975:l–1996:4	4.6 % appreciation in NEER initially deteriorates the import to export ratio by 1.1 % but after six quarter this ratio improves.
Narayan (2004)	New Zealand	1970–2000	A depreciation of REER deteriorate the import to export ratio for the first three years but after that it improves.

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[2] In this study devaluation and depreciation will be used interchangeably and market based flexible exchange rate system followed by SBP from July 2000.

Gomes and Paz (2005)		Brazil	1990–1998	Depreciation of real exchange rate improves the trade balance by 0.86 %.
Soleymani and Saboori (2012)		Malaysia→China	1993:1– 2009:4	Out of 53 industries, 1 % depreciation of RER improve the trade balance of 11 durable goods industries ranging 3.33% to 37.41%.
Bahmani-Oskooee and Zhang (2013)		UK→China	1978–2010	Out of the 47 industries depreciation has favourable short-run effects in most of industries trade surplus ranging from 0.36% to 3.50%. However, the short-run effects last into the long run only in seven cases and get the trade surplus from 0.19% to 7.88%.
Musawa (2014))		Zambia	2000–2010	1% depreciation of REER causes the trade balance to change by 0.045%.
		2. Studies that do not Support Depreciation		
Miles (1979)	1956–1972	14 countries	No evidence is found to support the hypothesis that depreciation improves the trade balance	

	Trade Balance elasticity w.r.t Exchange rate		
UK	–32.3***	New Zealand	36.47***
Denmark	0.34	Costa Rica	1.60
France	2.56***	Ecuador	0.22
Finland	2.55***	Guyana	–26.2**
Iceland	–0.10	Israel	–0.86
Ireland	45.47	Sri Lanka	–1.77
Spain	–0.07	Philippines	0.28

Rose (1991)	1974–1986	5 major OECD countries	Exchange rate is not a significant determinant of the trade balance:

	Trade Balance elasticity w.r.t Exchange rate
UK	2.27
Canada	0.48
Germany	0.49
Japan	0.79
US	1.26

Yazici (2006)	1986: 1– 1998:3	Turkey	Depreciation of real exchange rate deteriorates the trade balance by 4.46 %.
Bahmani-Oskooee and Kutan (2009)	1990:1–2005:6	11 east European emerging economies	J-curve hypothesis does not hold

	Trade Balance elasticity w.r.t Real Effective Exchange rate		
Bulgaria	1.64	Romania	–2.69**
Croatia	–8.46***	Russia	–43.03
Cyprus	–12.35***	Slovakia	–2.51
CzechR.	3.91	Turkey	5.02
Hungary	23.27**	Ukraine	7.84***
Poland	–1.85		

Galebotswe and Andrias (2011)	1993:3 –2010:4	Botswana	depreciation of the exchange rate is associated with output contraction by 0.53%
Bahmani-Oskooee and Gelan (2012)	1971Q1–2008Q4	9 African countries	J-curve hypothesis does not hold

	Trade Balance elasticity w.r.t Real Effective Exchange rate		
Burundi	16.72***	Nigeria	–4.17
Egypt	–4.08	Sierra Leone	26.18
Kenya	–4.94***	South Africa	–5.03***
Mauritius	10.73	Tanzania	4.58
Morocco	1.83		

Ayen (2014)	1998:1–2010:4	Ethiopia	REER has country effect in long run and lead to decrease the output by 0.29%.

Note: PX= price of exports; PXW= weighted average of the export prices of the country's trading partners; PM is import prices, PD is domestic price. ***, ** indicates significance at 1% and 5%.

Here we will review the evidence from Pakistan to inform policymaking and local research about

1. The elasticities of imports and exports with respect to income, relative prices and exchange rate;
2. Examine the short-term effect and long term effect of the real depreciation of PKR on the real imports and real exports of Pakistan; and
3. Investigate the existence of J-curve Phenomena.

Box 1: J-curve/ Marshall-Lerner Condition

The J-curve suggests the impact of depreciation on trade volume over time. In short run, prices are sticky and don't respond initially, which make imports expensive for domestic country and consequently deteriorates her trade balance. Whereas, in the long run the prices would adjust to new level and exports of home country would become cheaper for the rest of the world and imports would be expensive. This brings the improvement in the balance of trade (Magee, 1973).

Marshall-Lerner (ML) enables us to explore whether the depreciation is going to correct the balance of trade deficit or further deteriorate it. The ML condition suggests that the sum of total export (η_X) and import elasticities (η_M) must be greater than one if depreciation is to have a favourable impact on the trade balance. Mathematically it may be written as:

$$|-\eta_M|+\eta_X>1$$

Survey of Empirical Studies on the Demand for Imports and Exports in Pakistan

In the field of international economics, income and price elasticities are useful in determining the trade flows. Income elasticities measures how the trade flows respond to change in GDP and price elasticities access the impact of changes in relative prices, tariffs and/or exchange rates on trade flows (see Box 2).

These elasticities are especially critical to the Pakistan economy because of rising trade deficit. In case of Pakistan, there is a vast amount of the literature focuses on the role of exchange rates in affecting the trade balance or, more specifically the demand for exports and imports both at aggregated and disaggregated (commodity wise, industry wise and country wise) level. Here we are reviewing the studies that measures the elasticities at aggregated level.

Box 2: Measurement of Trade Elasticities

Demand for Imports

The estimation of the demand for imports usually relates changes in the quantity of imports to changes in domestic income (Y_d) and real exchange rate ($RER = (NER* P_f / P_d)$), it can be expressed in equation as $import = f(RER, Y_d)$.

It is common to estimate import demand equation by decomposing RER into price ratio (P_f/P_d) and nominal exchange rate (NER) i.e., $import = f(NER, P_f / P_d, Y_d)$.

The equation can also be specified with split prices i.e., $import = f(NER, P_f / P_d, Y_f$.

Demand for Export

The estimation of the demand for exports usually relates changes in the quantity of exports to changes in foreign income (Y_f) and real exchange rate ($PER = (NER*P_f / P_d)$, it can be expressed in equation as $Export = f(RER, Y_f)$. It is common to estimate export demand equation by decomposing RER into price ratio (P_f/P_d) and nominal exchange rate (NER) i.e., $Export = f(NER, P_f / P_d, Y_f)$. The equation can also be specified with split prices i.e., $Export = f(NER, P_f / P_d, Y_f)$.

Trade Balance

The impact of real exchange rate on balance of trade is usually estimate by regressing the trade balance on real exchange rate, foreign country's real income and real income of domestic country i.e.,

$Trade\ Balance = f(RER, Y_f, Y_d)$

These equations are estimated by double log model in which the coefficients are direct estimates of elasticities.

The Tables 2, 3 and 4 provide the elasticities of import, export and balance of trade with respect to exchange rate, prices and income. Instead, they vary depending on their sample period, data frequency, empirical methods and modelled macroeconomic variables.

Table 2

Pakistan Import Demand Elasticities

Author (s), Years	Data Period	Y_d	*RER or REER*	*NER*	P_M/P_d	P_M
Khan (1994)	1983Q1 – 1993Q3	2.13	0.78			
Aftab and Aurangzeb (2002)	1980Q1 – 2000Q4	0.91			–0.87	
Afzal and Ahmad (2004)	1960–2003	3.19		–2.27	–5.26	
Kemal and Qadir (2005)	1981–2003		–0.52			
Felipe et al. (2009)	1980–2007	0.91	–0.24			
Baluch and Bukhari (2012)	1971–2009	1.22			–0.53	
Bano et al. (2014)	1980–2010	0.69		–0.53	0.710	
Khan et al. (2016)	1981–2010	1.40	–0.34			
Ishtiaq et al. (2016)	1970Q1–2012Q4	1.22	–0.78			
Khan and Majeed (2018)	1978–2016	2.16			–1.57	
Yasmeen et al. (2018)	1980–2016	1.13	0.23			–0.37

Note: Bold figure represent the insignificant coefficient.

Y_f is foreign country income, *RER is real exchange rate, REER* is real effective exchange rate, *NER* is nominal exchange rate, P_M is import price, P_d is price in home country.

Table 3

Pakistan Export Demand Elasticities

Author (s), Years	Data Period	Y_f	*RER or REER*	*NER*	P_X/P_f	P_X
Khan (1994)	1983Q1 – 1993Q3	1.63	–0.32			
Aftab and Aurangzeb (2002)	1980Q1 – 2000Q4	2.11			–0.62	
Atique and Ahmad (2003)	1972–2000	2.93	–0.39			
Afzal and Ahmad (2004)	1960–2003	–3.78		0.04	2.92	
Kemal and Qadir (2005)	1981–2003		–0.66			
Felipe et al. (2009)	1980–2007	1.41	–0.34			
Khan et al. (2013)	1981–2010	1.28	–0.86			
Bano et al. (2014)	1980–2010	0.96	–0.30		0.10	
Khan et al. (2016)	1982–2015	1.11	–0.42		–0.06	
Ishtiaq et al. (2016)	1970Q1–2012Q4	1.73	0.31			
Yasmeen et al. (2018)	1980–2016	2.23	–0.80			–0.44

Note: Bold figure represent the insignificant coefficient. Y_f is foreign country income, P_X is export price, P_f is price in foreign country.

Table 4

Pakistan Balance of Trade Elasticities

Author (s), Years	Data Period	Y_f	Y_d	*RER or REER*
Rehman and Afzal (2003)	1972Q1–2002Q4	2.86	–1.82	–0.89
Aslam and Amin (2012)	1980–2008	3.03		–0.31
Shahbaz et al. (2012)	1980Q1–2006Q4			–1.02
Saeed and Hussain (2013)	1985–2010	3.45	–2.42	–0.02
Shah and Majeed (2014)	1980–2011		–2.34	–1.51
Faridi and Kausar (2016)	1972–2014			–0.09
Khan (2016)	2005Q1–2014Q4	–0.01	–0.97	0.024
Ishtiaq et al. (2016)	1970Q1–2012Q4	1.68		0.92

Conclusions of these studies exhibit no common pattern regarding the role of exchange rates in determining trade flows.

- In case of export demand, the range of real exchange rate elasticity lies between –0.80 to –0.30 (except Ishtiaq *et al.*, 2016). It means that Pakistan's export demands do not increase in a significant way with the depreciation of exchange rate.
- Increase in world income has positive impact on export demand.
- For import demand, the range of real exchange rate elasticity lies between –0.24 to –0.78 (except Khan (1994) and Yasmeen et al. (2018)). It means that depreciation of real exchange rate decreases the import's demand at low rate.
- Increase in domestic income boosts the demands of foreign product.
- Real exchange rate depreciation will not lead to improve the balance of trade its ranges between –1.51 to –0.02.

Beside the exchange rate there are other factors behind the persistent trade balance and limits the role of exchange rate policies to correct the trade balance. Such as:

(1) Most of Pakistan's imports consist of capital and intermediate goods. This dependence makes import demand relatively inelastic and unresponsive to exchange rate policies.
(2) Agricultural goods have inelastic supply and most of Pakistan's exports are consisting of agricultural goods. Therefore, export demand may be less sensitive, in term to its prices and the world income and depreciation policy did not have much effect on the export volume.
(3) Low Value addition in Pakistan's exports due to low development of industrial sector, Pakistan has not yet expanded her product range in favour of technology-intensive products.

Does currency depreciation necessarily result in positive exports and negative imports? Evidence from the updated data

The exchange rate policies of Pakistan and their relationship to trade flow is presented in Box 3.

The visualization of nominal and real exchange rate of PKR against US $ is depicted in Figure 1. Rise in NER and RER shows the depreciation of nominal and real exchange rate respectively. From 1980 to 2001 both lines follow the same direction but after that NER and RER have been moving in opposite directions as the SBP started pursuing a policy of intermittently fixing the exchange rate even as crises happened. It indicates that domestic prices are increasing relative to foreign prices and offsetting the impacts of NER depreciation. In the past few years, despite of significant amount of nominal depreciation, real depreciation has not occurred, in fact RER has moved in opposite direction. Clearly SBP exchange rate policy was standing against the market. SBP should not try to use reserves to fix the value of the exchange rate except to deal with very short-term disorderly conditions. Otherwise, currency crises or attacks happen if the SBP attempts to use reserves to hold the exchange rate against the market.[3]

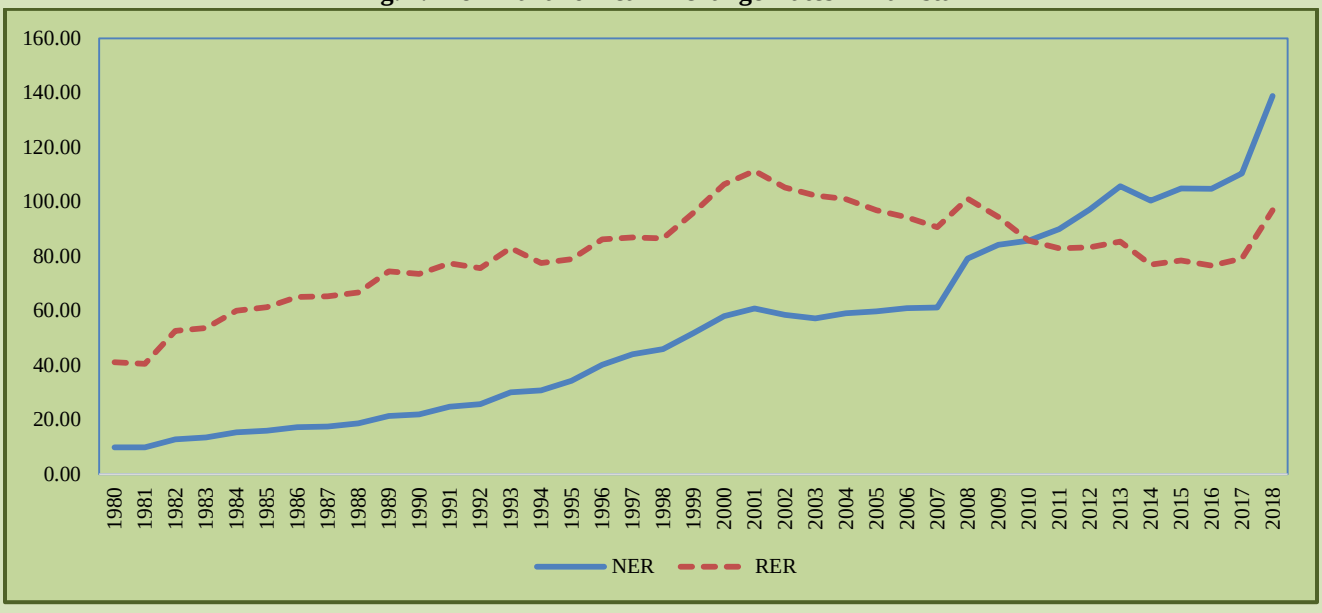
Box 3: Exchange Rate Policies and Trade Flow of Pakistan

Pakistan followed a policy of export-led growth in order to bring the sustainability in her balance of payments. To achieve this objective, Pakistan had adopt various exchange rate regimes from fixed exchange rates to a policy of managed float.

- In January 1982 Pakistan rupee was delinked from the US $. Previously the rupee/dollar exchange rate was fixed and appreciation of the US $ in 1980-81 had reduced the competitiveness of Pakistan's export in the international market. The floating exchange rate policy helped the import liberalization process by allowing the government to eliminate restrictions without running into balance of payment problems because the exchange rate was set by the market force. Under the new system, State Bank of Pakistan used to set an exchange rate of PKR based on trade weighted currency basket.
- PKR has been devalued by 39 percent, for the period of 1982–87. During this period, export earnings boosted by 65 percent and balance of trade improved by 27.3 percent. It should be keep in mind that beside devaluation, incentives were given to industrialist to increase manufactured exports and the Economic Co-operation Organization (ECO) and the South Asian were found in 1980s to increase trade with in South Asian region. These improvements could not be sustained over a long period because of political instability in the country and rapid increases in oil prices.
- Managed float was abolished by the State Bank of Pakistan in July 2000 and flexible exchange rate system was finally achieved. Trade policies are highly liberalized after 2000, average tariff rate was reduced from 47% in 1990s to 18% in 2000s (FBR, year book 2018-2019). During this period both export and import sector showed improvement. Regardless of, the average annual growth rate of imports is 14% greater than the annual growth rate of exports i.e., 10%.

As Figure 2 shows this flawed exchange rate policy has also showed up in the trade balance. While Pakistan as a developing country had a trade balance but in as exchange rate policy took on an increasing anti market stance, imports started to grow and exports more or less stagnated to lead to a widening trade balance. The imports grew faster than the exports and have almost been always higher than the exports.

Fig. 1. Nominal and Real Exchange Rates in Pakistan



[3] PIDE's Knowledge Brief No. 7:2020, Pakistan's five currency crisis by Nadeem Ul Haque and Hafsa Hina.

Fig. 2. Imports, Exports and Trade Balance

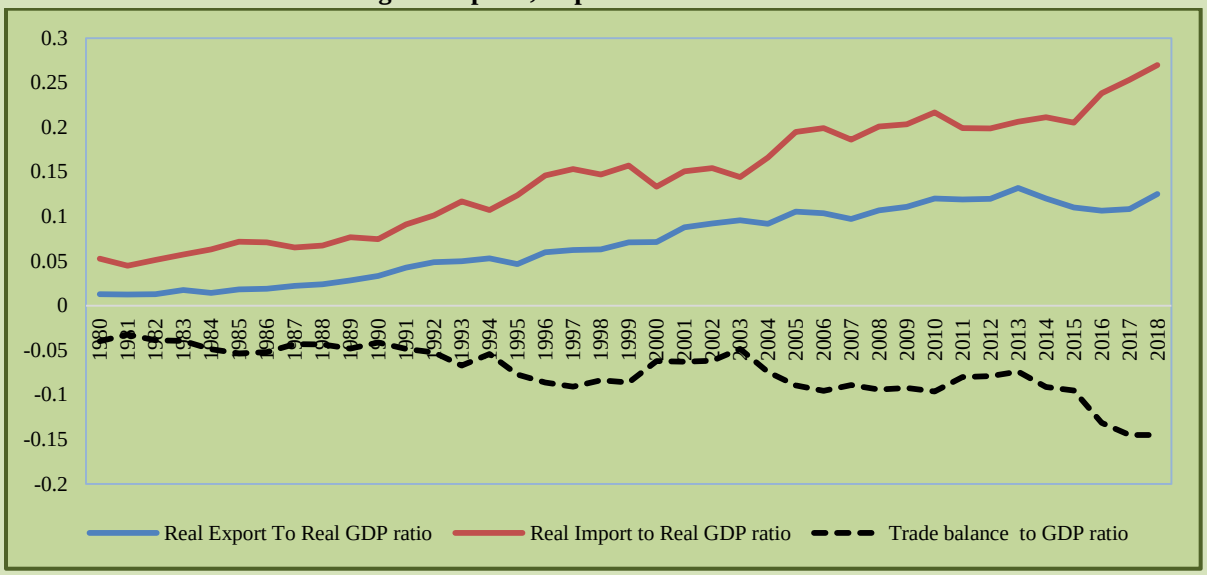


Table 4

Import , Export and Trade balance Elasticities[4]

	Y_d	Y_f	RER
Import	2.03***		0.65***
Export		3.69***	0.45*
Trade balance	–0.73***	1.37***	–0.48***

Note: ***, * indicates significance at 1% and 10%.

Table 4, shows that:

(1) 1% depreciation of real exchange rate of PKR will increase the demand for exports by only 0.45% and increase the demand for imports by 0.65%. Therefore, trade balance deteriorate by 0.48%.

(2) Marshall Lerner condition does hold for Pakistan because as export elasticity is according to theory and depreciation would increase the demand for export. But, import elasticity is opposite to theory and deprecation would not reduce the demand for imports. Therefore, at aggregate level, Pakistan will remain a net importer and depreciation policy will not improve its trade balance.

Box 3: Estimation Mythology of the Present Study

This study uses Johansen and Juselius (1992) cointegration technique for estimating short run and long run elasticities. The econometric regression for import demand, export demand and trade balance are specified as

$$IM = \alpha_o + \alpha_1 Y_d + \eta_M RER + \varepsilon_1$$
$$EX = \beta_o + \beta_1 Y_f + \eta_X RER + \varepsilon_2$$
$$TB = \gamma_o + \gamma_1 Y_d + \gamma_2 Y_f + \eta_{TB} RER + \varepsilon_3$$

Where *IM* is real imports, *EX* is real exports, TB is trade balance (It is the difference between real export and real imports, and divided by real GDP in order to control for scale effects), *Yd* is real GDP of Pakistan, *Yf* is real GDP of USA (use as proxy for foreign income) RER is real exchange and ε is Guassian error.

All variables are log transformed, TB transformed by adding 1 minus the minimum value in order to avoid logs with null values.

All data series are taken from International financial Statistics from 1980 to 2019.

CONCLUSION

Depreciation is an outcome as a country loses reserves rather than a policy option to improve trade. Elasticities reflect the structure of the economy. Export elasticity reveals that export demand is less responsive to change in real exchange rate. It shows that we are still exporting commodities with no Pakistan brand. For example, most of our primary goods such as basmati rice are exported to the name of other country brands. Brand loyalty protects the goods in the international market and it is necessary to educate exporters about the branding of their products. Import demand is also inelastic to change in real exchange rate. Our major imports are based on machinery and petroleum products, which serve as necessity input in production. Inelastic import demand reveals that we have made no progress on developing energy saving and remain dependent on imported energy. Therefore, exchange rate policy can do nothing on the structure. In fact, the need for a devaluation is the inefficiencies in the structure of the economy. Thus the choice is clear reform to fix the structure or let the exchange rate to depreciate.

[4] The cointegration results are highly sensitive to the choice of the lag length, structural break and the coefficients may vary with trade regimes. The issue of structural break and trade elasticities for different trade regimes are addressed in the working paper 24:2020 of PIDE.

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