

### *What Do We Know of Exchange Rate Pass Through?*

ABDUL JALIL,<sup>1</sup> *Professor of Economics, PIDE*

Domestic prices in an open economy are influenced by fluctuations of exchange rates. The effect of exchange rate changes on the domestic prices is termed *exchange rate pass through* (ERPT) (see Box 1).

When the variations in exchange rate are fully transmitted in the domestic prices, then it is known as complete ERPT and vice versa. Theoretically, the degree and speed of ERPT varies for the different types of price indices. It is the lowest in consumer price index and the highest in import prices. The literature also bifurcates the first stage and second stage pass through.<sup>2</sup>

#### **Estimated ERPTs in Selected Countries**

ERPT is determined by several factors such as trade openness, globalization, stance of monetary policy, transparency of monetary policy, direction of exchange rate, exchange rate volatility, inflationary environment of the country, size of current account balance,

composition of import basket, central bank's independency and level of dollarization of the country. ERPT is also asymmetric in that an appreciation or a depreciation may not have the same effects.

In the Table 1 here, we present a broad summary of estimated ERPT as a percentage of the price level. Hence the estimate shows the expected rate of percentage point change in the price level for a percent change in the exchange rate.<sup>3</sup>

#### **Box 1: Definition, Formula and Measurement of ERPT**

ERPT is a measure of degree of response of inflation to a change in exchange rate. Formally, ERPT is an elasticity of domestic prices with respect to the exchange rate. More formally,

$$ERPT = \frac{\text{percentage change in domestic prices}}{\text{percentage change in exchange rate}}$$

#### **Measurement**

Measurement of ERPT is typically performed using the impact of nominal exchange rate on aggregate price indices like consumer price index, wholesale price index and import price index along with some other macroeconomic variables which can affect domestic prices.

The standard approach to measure ERPT is based on the following regression

$$\Delta \ln p_t = \alpha_0 + \sum_{i=0}^q \beta_i \Delta \ln er_t + \delta \Delta \ln X_t + \varepsilon_t$$

Here  $p$  is the price index,  $er$  is nominal exchange rate,  $X$  is the vector of other macroeconomic variables,  $\Delta$  is notation for change,  $\ln$  is for log,  $\varepsilon$  is for error term and subscript  $t$  is a representation of time. The above regression can be estimated through different estimation techniques keeping the properties of data series in view. The sum of

$\beta_i$ , that is  $\sum_{i=0}^q \beta_i$ , is ERPT after  $q$  periods.

<sup>1</sup>My thanks to Nadeem Ul Haque for suggesting the topic and his guidance through the project. Errors of course remain the responsibility of the author.

<sup>2</sup>The ERPT related to import price is known as first stage pass through and ERPT to consumer price is known as second stage pass through.

<sup>3</sup>Details of sample, measurement of variables, methodological issues and interpretations of size speed of ERPT are in the list of references.

Table 1: *The Degree of Exchange Rate Pass Through in Emerging Markets Economies*

Country	Study	ERPT	Study	ERPT	Study	ERPT	Study	ERPT	Exchange Rate Regime
<b>Brazil</b>	Correa and Minella (2010)	0.0% to 9%	Kolhscheen (2010)	32%	Nogueira and Leon-Ledesma (2009)	11%	Ghosh (2013)	47%	Independently floating
<b>Bangladesh</b>	Aziz et al (2013)	59%	Khondker et al (2012)	60% to 100% <sup>†</sup>	--	--	--	--	Fixed Pegged Arrangements
<b>Chile</b>	Justel and Sansone (2015)	14 %	--	--	--	--	--	--	Independently floating
<b>Colombia</b>	Rincón and Rodríguez (2016)	11% to 29% <sup>†</sup>	Rowland (2003)	8%	--	--	--	--	Managed Floating
<b>Czech Republic</b>	Kolhscheen (2010)	52%	Kucharcukova et. al. (2013)	11%	Hajeka and Horvath (2016)	50%	María-Dolores (2010)	17%	Independently floating
<b>Ghana</b>	Asafo (2019)	9% - 14% <sup>†</sup>	--	--	--	--	--	--	Managed Floating
<b>Hungary</b>	Hajnal et. al. (2015)	10% to 60% <sup>†</sup>	María-Dolores (2010)	49%	--	--	--	--	Independently floating
<b>Indonesia</b>	Kolhscheen (2010)	60%	Edwards and Sahminan (2008)	16%	Ito and Sato (2008)	40%	Prasertnukul et. al. (2010)	10%	Managed Floating
<b>India</b>	Khundrakpam (2007)	5% to 20% <sup>†</sup>	Kapur and Behera (2012)	10%	Bhattacharyaya et al. (2008)	3% to 17% <sup>†</sup>	--	--	Managed Floating
<b>Malaysia</b>	Ahmad (2009)	18%	Ito and Sato (2008)	0.5 % to 3% <sup>†</sup>	Bank Negara (2012)	1.5%	--	--	Managed Floating
<b>Maldives</b>	Masha and Park (2012)	79%	--	--	--	--	--	--	Fixed Pegged Arrangement
<b>Mexico</b>	Kolhscheen (2010)	13 %	Edwards (2006)	2 %	Ghosh (2013)	1 %	Peóna and Brindisb (2014)	2%	Independently floating
<b>Nigeria</b>	Adekunle and Tiemyu (2018)	61%	Musti and siddiki (2018)	84%	Zubair et al. (2013)	26%	--	--	Managed Floating
<b>Pakistan</b>	Ahmed et al. (2018)	7%	Hyder and Shah (2004)	10.27%	Minhaj and Nishat (2018)	0.06% to 1.26% <sup>†</sup>	--	--	Managed Floating
<b>Peru</b>	Forero and Vega (2015)	10% to 20% <sup>†</sup>	Winkelried (2014)	10%	--	--	--	--	Managed Floating
<b>Philippines</b>	Kolhscheen (2010)	9%	Ito and Sato (2008)	6%	Prasertnukul et. al. (2010)	0.0%	Central Bank of Philippines	0%	Independently floating
<b>Poland</b>	Przystupaa and Wrobel (2011)	7% to 27% <sup>†</sup>	Arratibel and Michaelis (2014)	10%	María-Dolores (2010)	24%	--	--	Independently floating
<b>Romania</b>	Stoian and Murararu (2015)	7% to 29% <sup>†</sup>	Gueorguiev (2003)	16% to 43% <sup>†</sup>	--	--	--	--	Managed Floating
<b>South Korea</b>	Kolhscheen (2010)	20%	Ito and Sato (2008)	7%	Prasertnukul et. al. (2010)	6%	Edwards (2006)	3%	Independently floating
<b>South Africa</b>	Aron et. al. (2014)	50%	Kolhscheen (2010)	25%	Aron et. al. (2014)	40%	Aron et. al. (2014)	30%	Independently floating
<b>Thailand</b>	Wattanakoon (2013)	15%	Kolhscheen (2010)	16%	Ito and Sato (2008)	14%	Prasertnukul et. al. (2010)	12%	Managed Floating
<b>Turkey</b>	Arslaner et al. (2015)	15%	Kara and Ogunc(2008)	30%	Kara and Ogunc(2012)	15%	Kilinc and Tunc (2017)	18%	Independently floating
<b>Egypt</b>	Helmy et al. (2018)	72%	Awad (2019)	15% to 20% <sup>†</sup>	--	--	--	--	Managed floating
<b>Ukraine</b>	Faryna (2016)	6.8%	--	--	--	--	--	--	Managed Floating
<b>Vietnam</b>	Van (2009)	8% to 16 % <sup>†</sup>	--	--	--	--	--	--	Fixed Pegged Arrangements
<b>27 emerging markets</b>	Caselli et al (2019).	22%	--	--	--	--	--	--	--

*Note 1:* † indicates that the *study* reports various ERPT depending on various samples and methods. The reported range depicts minimum and maximum magnitudes of ERPT in that particular study.

*Note 2:* Tunc (2017) recently estimate horizon of ERPT for the emerging market economies. It varies from 5 months (Russia) to 24 months (Chile).

The Table 1 shows the large variation in the ERPTs calculated in various emerging economies. Average ERPT of 27 emerging market economies is about 22%. Furthermore, this range is much lower in the short run. It implies that the concerns of inflationary consequences of depreciation of exchange rate in emerging market economies are somewhat inappropriate. Therefore, we may argue that so-called stability (or overvaluation) of exchange rate is not important and desirable for reducing the inflationary cost on the economy.

Several points should be noted in interpreting these ERPT calculations especially for policy purposes.

1. The Table 1 shows that there is a huge variation in the degree of ERPT among the emerging market economies. Different studies calculate/report the different degree of ERPT even in the case of same country. ERPT also varies by sample, methodology and country.
2. The degree of ERPT is non-linear and asymmetric, that is, the variation in the exchange rate impact differently on the inflation rate in the case of appreciation or depreciation. Caselli and Roitman (2019) estimates posit that ERPT becomes nonlinear when the exchange rate depreciates by more than 24 percent in the case of emerging market economies<sup>4</sup>.
3. The degree of ERPT is sensitive to level of inflation of the country. That is, it may be different in the high inflation episode than a low inflation episode of the country<sup>5</sup>. The empirical literature suggests that the degree of ERPT has declined in low inflationary environment.
4. Research suggests that estimates vary by choice of data and other misspecification issues. Using the ERPT, therefore, requires care and context-specific interpretation. For policy, authorities should measure ERPT carefully through several methods contextualized to local considerations.
5. The literature does not guide us regarding the impact of exchange regimes on the degree of ERPT on inflation. There is a huge variation in the degree of ERPT in our selected sample, even in a similar type of exchange rate regimes (see the last column of the table). Hence, we cannot claim that exchange rate regime may explain the degree of ERPT.

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<sup>4</sup> However, Caselli and Roitman (2019) also postulate that 24 percent is not unique threshold level but there may be a reasonable range of threshold exists. More clearly, it would appear that this threshold level may vary from country to country.

<sup>5</sup> The high and low episodes are in relative terms. The literature does post the size or range regarding low or high inflation in this regard.

## ERPT FOR PAKISTAN

There are few studies on ERPT in the case of Pakistan (see Table 2).

Table 2  
*Estimates of ERPT in Pakistan*

Study	Sample	Variables	Methodology	ERPT		Lags††s	Speed of ERPT†
				Long Run	Short Run		
<b>Hyder and Shah (2004)</b>	1988–2003	CPI, OP, LSMI, WPI, M2 and ER	Recursive VAR	10.27%	3.44%	4	12 months
<b>Ahmed Et al (2018)</b>	2005–2015	ER, IP, MS, IR, OP and CPI	Recursive VAR	7.19%	0.31%	12	10 months
<b>Minhaj and Nihsat (2018)</b>	1982–2016	CPI, ER, MS, IR, IP, GDP	Markov Switching Approach	--	1.26%	--	--
<b>Chaudri and Khan (2002)</b>	1982–2001	CPI, ER, FCPI	Ordinary Least Square	--	2.00%	4	24 months
<b>Author's Calculation</b>	<b>1999–2019</b>	<b>CPI, ER, PSB, LSMI, MS, OP</b>	<b>ARDL</b>	<b>15.10%</b>	<b>2.59 %</b>	<b>4</b>	<b>13 months</b>

Note 1: †=ERPT speed implies that ERPT will be completed in 12 months (see last column).

Note 2: †† indicates the optimal lags in estimation procedure.

The table 2 shows that there is no evidence of a significant pass-through of rupee depreciations to consumer prices in the short run. It is around 3 percent in short run. However, the long run pass through of rupee depreciations ranges from 7.19 % to 15.10 %. Furthermore, the duration of complete pass through may range from 10 months to 24 months (see last column of table 2).<sup>6</sup>

### Box 2: ERPT Estimation Methodology of the Present Study

This study uses Auto regressive distributed lag (ARDL) model for estimating short run and long run ERPT. The ARDL model has various advantages over the other estimating methodologies (see Pesaran and Pesaran 1999 and Pesaran et al 2001). We specify an econometric regression as follows

$$CPI = \beta_0 + \beta_1 ER + \beta_2 PSB + \beta_3 OP + \beta_4 MS + \beta_5 LSMI + U_t$$

Where CPI is consumer price index, ER is exchange rate, PSB is public sector borrowing, OP is oil price, MS is money supply (M2), LSMI is large scale manufacturing index and U is Gaussian error. All data series are taken from State Bank of Pakistan. We use monthly data from January 1991 to November 2019.

The estimates of the present study show that long run ERPT is around 15.10 percent and 2.59 percent in short run. The estimated duration of complete ERPT is 13 months.

<sup>6</sup> Aron et. al (2014) note that even in the long run, the pass-through may not be ‘complete’ in that the change in the exchange rate may not be fully passed through to prices.



## CONCLUSION

In Pakistan, the long ERPT ranges between 7.19 % to 15 % and short run ERPT 1 % to 3.4 % irrespective of the methodology and data sample. This estimate should inform the discussion of inflation and exchange rate in Pakistan. It also informs the fear of nominal exchange rate fluctuations and especially of future depreciations. In general, a debate on this issue will lead to a better monetary and exchange rate policy.

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