Inflation and Remittances:
A dynamic study in case of Pakistan using ARDL Approach

Prof. Dr. Masood Mashkoor Siddiqi [a], Dr. Nazia Abdul Rehman[b], Dr. Nazia Abdul Rehman[c],
Dr. Musarrat Shamshir [d]

[a] Dean, Federal Urdu University Arts,Science and Technology
drmasoodmashkoor@yahoo.com
[b] Benazir School of BusinessBenazir Bhutto Shaheed University, Lyari Karachi
nzshakir@gmail.com
[c] Benazir School of BusinessBenazir Bhutto Shaheed University, Lyari Karachi
khurram.shakir@bbsul.edu.pk
[d] Dean Faculty of Management Sciences, Greenwich University (GU), Karachi-Campus
musarrat.adnan@gmail.com

Abstract

This paper is an attempt to identify causes of inflation in Pakistan primarily to identify the effect of remittances on inflation because it is observed that in case of high inflation periods, the remittances also increases concerning their behavior and dependency. Recent literature on Pakistan's economy highlighted that Pakistan is facing the problem of high inflation and data related to remittances also shows a major increase in remittances, signaling the connection between these two variables. For this purpose, yearly data is collected through various national and international reports for the period of 1971 to 2021. For empirical purpose, an Autoregressive Distributed Lag Model (ARDL) technique is applied to measure short run and long run effects of concerned variables. The study concluded that the effect of remittances is negligible in short run as well as in the long run. Whereas, the effect of exchange rate and oil prices are significant both in short run and in the long run. Similarly, the study identified money supply affect inflation only in the long run.

Keywords: Pakistan, Inflation, Remittances, ARDL, Money Supply, Exchange rate, Oil prices

1.   Introduction

Among other sources of foreign exchange reserves, the contribution of remittances also plays a significant role. Existing literature exhibits both advantages and disadvantages of remittances on economy. Some studies concluded that remittances have significant impact in reducing poverty, reducing uncertainty in household consumption and on overall average material living standard of recipients. Some studies concluded that among advantages, there are some issues that are caused by remittances such as increasing inflation, reducing labour supply and disturbing pattern of trade through exchange rate. Pakistan's economic data also exhibits growth in pattern of remittances since independence and exerting significant impact on overall economy.
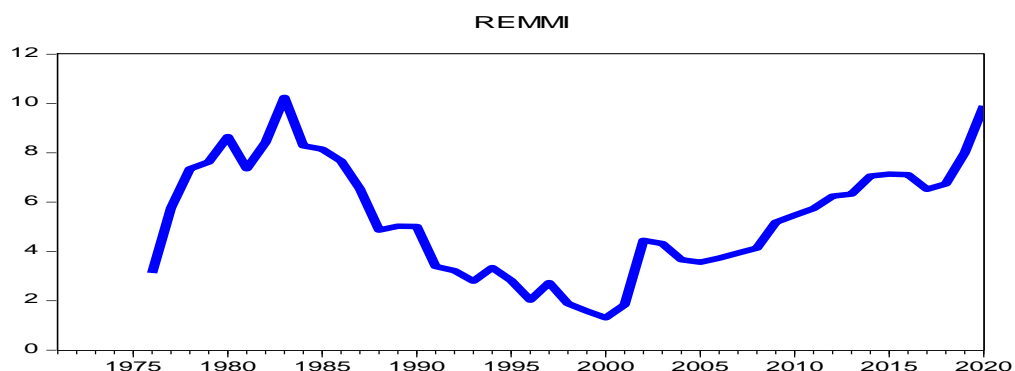
The above figure shows the pattern of remittances to Pakistan from 1971 to 2020. It is highlighted that remittances as a percentage of GDP increases 3.1% in 1976 to 10.2 % in 1983. After 1983 it decreases drastically to 1.3 % in 2002. After that remittances pattern shows increasing trend and then achieved 9.9 % in 2020. The remittances show an upward trend from 1971 to 2021.

Relationship of remittances and inflation: The economic theory tells that demand pull inflation comes from the demand side of the economy whereas supply side of the economy also responsible for inflation in the economy. In case of remittances, demand pull inflation is occurs by changing the recipient of remittances' consumption pattern. Remittances increase household income that leads to increase demand for goods and services. This increase in demand creates the condition of excess demand and ultimately results in increase in overall price level. Similarly, remittances may increase the real exchange rate of the recipient country that leads to increase in inflation.

The economic theory also explained that remittance may also effect from supply side of the economy as it decreases labour supply in the recipient country that result increase the wages in the labour market and causes increases in price level by increasing production cost.

Relationship of other factors with inflation: The economic theory tested empirically and identified that other factors such as money supply, exchange rate, aggregate consumption, oil prices, future expectations about future, output gap are also responsible for inflation in many countries.

2.   Literature review

Balderas & Nath (2008) conducted a study to estimate the impact of remittances on inflation and found that there exists a little significant relationship in case of Mexico for the period 1980 to 2005. The study also examined the impact of distribution of relative price changes and found an insignificant relationship.

Kim & Yang (2008) the paper estimated and concluded that if inflows of capital expanded leads to raise in price of asset in accordance with other factors included in the said study. The said study considered East Asian Countries for estimating purpose.

Rashid & Husain (2010) contributed in the literature by estimated the effect of inflows of capital on price level, money supply increasing policy and volatility of exchange rate in case of Pakistan for the period 2001-2007. The study came with the conclusion that there exists a significant relationship among said variables.

Nazir and others (2013) performed empirical experiment regarding remittances on general price level or inflation for the period of 1980 to 2010 in the context of Pakistan. The study utilized the technique of cointegration test and Error Correction Mechanism (ECM), and came with the conclusion that there exists a significant relationship among variables of concern.

Nisar & Tufail (2013) contributed in the literature by examining the effect of remittances on inflation by implementing the technique of Johansen & Juselius Co-integration. The study examined both short run and long run conditions and found that there exists a short run and long run dynamics among variables.

Khan & Islam (2013) explored the connection between remittances and inflation in case of Bangladesh for the time period of 1972 to 2010. The study aimed to calculate short run and long run conditions by using VAR technique and found that in the long run remittances affect inflation but short run dynamics are insignificant.

Narayan, Narayan & Mishra (2011) added to literature by estimating the effect of remittances and institutional factors on price level by considering short run and long run relationship among variables by utilizing a panel data for the period of 1995 to 2004 of 54 developing countries. The study concluded with a significant short run and long run associationship among variables. The study also concluded long-run associationship of remittances and inflation.

Ball and others (2012) performed an empirical study with the help of yearly/quarterly information and applied econometric technique of panel vector auto autoregression to quantify the results or coefficients of included variables. The said empirical endeavor gave the outcomes that the relationship exists in flexible exchange rate periods. Whereas, the said relation did not exists in fixed exchange rate periods.

3.   Research hypothesis

i)   To measure the effect of remittances on inflation
ii)   To measure the effect of exchange rate on inflation
iii) To quantify the effect of oil prices on inflation
iv)   To quantify the effect of money supply on inflation

## 4.	Econometric Methodology

This section deals with the econometric methodology applied to identify and measure the relationship among variables of concern. For the purpose of measuring short-run and long-run effects, the paper utilized a technique called Autoregressive Distributed Lag Model (ARDL). This technique has many advantages, it is easy to use and does not required pre-testing of variables related to integrated of variables at the level, integrated of I (1), or a combination of both. Similarly, ARDL technique is extremely supportive in a sense that it permits to describe the existence of convergence among factors without mislaying long-run facts. Econometric model is represented as equation to be estimated is as follows

$$\text{inflation}_t\,(INF) = \beta_0 + \beta_1 \text{remittances}_t(REM) + \beta_2 \text{money supply}_t\,(MS) + \beta_3 \text{exchange rate}_t\,(EXR) + \beta_4 \text{ oil price}_t\,(OP) + u_t \tag{1}$$

An ARDL demonstration of equation 1 is as follows

$$\Delta INF = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i}\,\Delta INF_{t-i} + \sum_{i=0}^{n} \alpha_{2i}\,\Delta REM_{t-i} + \sum_{i=0}^{n} \alpha_{3i}\,\Delta MS_{t-i} + \sum_{i=0}^{n} \alpha_{4i}\,\Delta EXR_{t-i} +$$
$$\sum_{i=0}^{n} \alpha_{5i}\,\Delta OP_{t-i} + \beta_1 INF_{t-1} + \beta_2 REM_{t-1} + \beta_3 MS_{t-1} + \beta_4 EXR_{t-1} + \beta_5 OP_{t-1} + e_t \tag{2}$$

Where,

Δ denotes the first difference operator

α_0 is the drift component

e_t is usual white noise residual

The above mathematically written statement explains the process of estimation of short-run and long-run effects performed by ARDL technique. The above equation shows that parameters from (α_0 to α_5) capturing and explaining short run dynamics of the variables whereas parameters from (β_1 to β_5) represent the long run dynamics of the model.

## 5.	Empirical results and discussion:

Table-1

Lag Estimates (selection) for model estimation

ARDL(2,0,1,0,0) designated using (S B C)

Selected Var.	Coef.	St. Er.	T-value (Probab.)
IINF(-1)	1.323	0.109	12.035 (0.000)
INF(-2)	-0.415	0.106	-3.898 (0.000)
REM	0.037	0.194	0.190 (0.850)
MS	0.037	0.080	0.457 (0.650)
MS(-1)	0.281	0.079	3.554 (0.001)
EXR	0.235	0.041	5.657 (0.000)
OP	3.353	1.087	3.084 (0.004)
T	-0.319	0.121	-2.642 (0.000)
C	-0.319	0.121	-2.642 (0.012)
R^2 = 0.9993 $R(Bar)^2$ = 0.9992		**F-stat. value (probab.) = 6566.7 (0.000)**	**DW-stat. = 2.03**
Ser. Corr. = 0.066 (0.797)		**Fun. Form. = 1.863 (0.182)**	**Heter. = 2.037 (0.161)**

Source: author's calculation and compilation

Table-1 presents the process of lag selection that makes the model best and acceptable for estimation. For this purpose Schwarz Bayesian Criterion (SBC) is applied for lag selection. The table identified that inflation with two lags, remittance at level, and money supply at level one, exchange rate and oil prices at level, is an acceptable and favorable for estimating the desired outcomes of the model. So, we will continue the remaining process with this lag selection. Table-1 also explains diagnostic result such as ser. Corr., correct functional form and heteroscedasticity. By considering diagnostic results we are able to reject the presence of ser. corr. as the prob. value is 0.79 that is greater than 1%, 5% and10% level, grounded on the F - stat. Likewise, diagnostic results related to functional form and heteroscedasticity, we are able to reject the hypothesis of 'functional form is not correct' and the hypothesis of 'heteroscedasticity' as the probability showing the value of 0.86 and 0.16 that are also greater than 1%, 5% and 10% level, grounded on the F - stat. Moreover, the deterministic part of the model explained by the value of R-Squared (0.99) exhibit the change in dependent variable is 99% explained by our selected variables. In case of acceptance the overall model, the probability value based on F-statistic is 0.00 indicated that the overall model is highly significant

Table-2

Long-run estimates (ARDL method)

Selected var.	Coef.	St. Er.	t-value (Probab.)
REM	0.0404	2.052	0.196 (0.845)
MS	3.475	1.173	2.960 (0.006)
EXR	2.575	0.648	3.968 (0.000)
OP	36.601	18.287	2.001 (0.054)
T	-3.491	1.911	-1.827 (0.077)
C	-152.799	1.911	-1.827 (0.077)

Source: author's calculation and compilation

Table-2 presents the outcomes of long-run dynamic behavior of variables by (ARDL) Approach. In the long-run remittances does not affect the dependent variable through the channel of expectations of inflation. Classical theory supported the idea that inflation is a monetary phenomenon as it causes price level to increases if the money supply increases. The result of table-2 confirms this believe of classical theorists. The coefficient of MS is positive and significantly from zero as shown by its probability (0.006). The long-run coefficients of EXR & OP also exhibit that exchange rate and oil prices also affects positively to inflation as confirmed by their probability values 0.00 and 0.05 respectively.

Table-3

Short-run estimates (ECM using ARDL method)

Selected var.	Coef.	St. Er.	T-stat	Probab.
D(INF((-1))	0.415	0.106	3.898	0.000
REM	0.037	0.194	0.190	0.850
MS	0.037	0.080	0.457	0.650
RXR	0.235	0.041	5.657	0.000
OP	3.353	1.087	3.084	0.004
DC	-14.000	2.949	-4.746	0.000
DT	-0.319	0.121	-2.642	0.012
ECM(-1)	-0.091	0.027	-3.333	0.002
R-Squared 0.905 R-Bar-Squared 0.888 DW- Statistic 2.035 F-Statistic(45.063) 0.000				

Source: author's calculation and compilation

Table-3 highlighted the short-run dynamic behavior of variables of interest. The ARDL technique captured the short-run estimates by the error correction model (ECM). The short-run model is accepted as the value of

error correction term is negative and significant at 1% level of significance. The short-run disequilibrium is adjusted and moving to equilibrium is caused by selected independent variables except money supply. The short-run dynamics suggested that inflation is significantly depends primarily on money supply, oil prices, exchange rate and people expectations about future inflation. The paper suggested that the role of remittances to cause inflation is negligible in the short-run.

6.   Conclusion of the study:

The paper is an attempt to measure the dynamics of inflation in Pakistan. Inflation is always been an important issue for Pakistan. Inflation directly or indirectly affects many decisions of firms and consumers and for other economic agents. Vulnerable class of the society is more exposed to this issue. This paper came up with conclusion that remittances has negligible effect on inflation and does not support that remittances are the responsible for inflation in Pakistan. Whereas, other factors are more responsible increasing price level that must be controlled. Similarly, the more effect on inflation is caused by oil prices, volatility of exchange rate in flexible exchange regime. Moreover, money supply has also responsible for inflation in Pakistan but the result support this conclusion regarding money supply only in the long run.

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