8. THE EFFECTS OF REMITTANCES ON INFLATION (CPI AND WPI) AND EXCHANGE RATE: A CASE OF PAKISTAN

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Abstract

The objective of this research is to determine the effects of workers' remittances (WR) on long-term inflation in the case of Pakistan. We use the consumer price index (CPI) and the wholesale price index (WPI) as indicators of inflation and the market determined exchange rate (EXR) regime. The data of workers' remittances (WR), CPI, WPI and EXR from July 2001 to December 2016 have been used for this analysis. The outcomes of Johansen cointegration confirmed the long run association between WR and CPI and EXR, and WR and WPI and EXR. Moreover, the WR and CPI food and EXR, and WR and WPI food and EXR also demonstrated a long run association. The results of Toda-Yamamoto Wald test and Granger causality VEC/Exogeneity Wald test concluded that there is a presence of one-way causality from workers remittances to CPI and WPI. Similar results have been revealed for food groups of both inflation indicators (CPI and WPI). Therefore, it is concluded that the influx of workers' remittances causes inflation in the case of Pakistan when the exchange rate (EXR) is also included in the VAR model.

Keywords: workers remittances; consumer price index; wholesale price index; inflation; exchange rate; Johansen cointegration; Granger causality

JEL Classification: C32, D13, E31

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1. Introduction

Workers' remittances are the main source of foreign reserves for developing economies, but the implication and flow of remittances are exclusive to the developing deferent countries (World Bank Group, 2017). According to a World Bank report, India ($62.7 billion), China ($61 billion), the Philippines ($29.9 billion), Mexico ($28.5 billion) and Pakistan ($19.8 billion) were the top five recipient countries of foreign remittances in 2016. From the South Asian countries, India ($62.7 billion), Pakistan ($19.8 billion), and Bangladesh ($13.7 billion) were the highest remittances recipient countries (World Bank Group, 2017). In case of Pakistan, the decade of the 1970s was the most significant period in which the Gulf corporation council has provided the massive job opportunities in the Middle East. It is imperative to understand that, in the 1980s Pakistan was able to manage significant inflows of remittances and became 10% of Pakistan's total GDP (Mughal, 2012). However, due to the oil crises and the Gulf War, the Arab economies deteriorated, which reduced the significant job opportunities, and the Pakistani workers were those who suffered more in those crises. In addition, after the atomic explosions in 1998, employment opportunities were more reduced and remittances abroad decreased by 36%. But, again from 2001, the inflow of remittances shows a continuous and sustainable increase. It was estimated at around $1 billion in 1999 and reached more than $13 billion in 2012 (State Bank of Pakistan, 1999-2012), and reached $19.5 billion in 2016 (World Bank Group, 2017).

Workers' remittances have played an important role in Pakistan's economy over the last five decades. The magnitude of remittances has increased greatly in recent years and is expected to increase in the coming years (Khan and Islam, 2013). The growth of the economy is achieved by some direct and indirect means; for example, foreign remittances facilitate the country's total capital and foreign reserves. However, the negative influence of remittances on the economy in general may not be ignored. The adverse influence of remittances on the receiving economy can occur in the form of the Dutch disease, reduced incentives for recipient economies, reduced employment and ethical disadvantages. Workers' remittances increase the flow of foreign currency that can cause the appreciation of the national currency. Subsequently, this can reduce the competitive advantage of the export market, which can lead to the stagnation of the economy in general (Abosedra and Fakih, 2017, Lartey, 2015, Ball *et al*., 2012, Balderas and Hiryana, 2005). It is essential to distribute this capital to productive economic activities that further improve economic growth and provide numerous opportunities for new jobs. Workers' remittances also provide influence to international trade, which also contributes indirectly to economic growth (Meyer and Shera, 2017; Iqbal *et al*., 2013). If these funds are spent on consumption, even then this creates the multiplier effect in the economy the higher level of consumer demand will lead to a higher level of expansion in the economy, which ultimately creates new employment opportunities in the economy. Therefore, the vast majority of the population gets employment and their family income increases significantly, which also reduces poverty and brings general welfare to the country (Snudden, 2017; Narayan *et al*., 2011). It is also imperative to understand that remittances can trigger inflation in an economy through the aggregate demand channel. The inflow of remittances can intensify the money supply that feeds the demand for services and goods, and improves the pattern of spending on services and goods. The escalation of demand establishes an increasing pressure on prices that increases demand-pull inflation (Abosedra and Fakih, 2017, Nishat and Nighat, 1991). On the other hand, inflation has always been one of the main macroeconomic challenges due to its negative effects on the economy that raise the cost of doing business and, therefore,

discourages investment and savings. It also negatively influences the pattern of consumption and affects the fixed and low-income strata of the population by reducing their purchasing power (Abdul-Mumuni and Quaidoo, 2016; Iqbal and Sattar, 2005).

Therefore, taking into account the negative influence of workers 'remittances on inflation, it is now imperative to investigate the type of association between workers' remittances and inflation (Abdul-Mumuni and Quaidoo, 2016). In the case of Pakistan, this issue is very relevant when the effect of inflation has worsened on the one hand, while, on the other hand, the importance of workers' remittances has been overlooked (Nisar and Tufail, 2013). Workers' remittances may have a different effect on different markets, and in some way this pattern of spending brings some changes in the relative prices (Wadood and Hossain, 2017, Cáceres and Saca, 2006). Although the current literature on the impact of foreign remittances has touched several disciplines, however, there is limited literature available on the influence of workers' remittances to increase relative CPI and general inflation (Mpofu, 2017; Iqbal and Sattar, 2005; Nishat and Nighat, 1991). Current literature does not specifically explain the effect of foreign remittances on the consumer price index, the wholesale price index and the exchange rate of the Pakistani economy. Therefore, based on the previous literature and discussion, the objective of this research is to verify the hypothesis that workers' remittances have a significant long-term association with general inflation (CPI and WPI), under a flexible exchange rate regime. In addition, this paper also examines the influence of workers' remittances on food and non-food items of CPI and WPI inflation under a flexible exchange rate regime in the case of Pakistan.

Food and non-food items are essential for survival, such as health, well-being, housing, education, and possession of property for the dignity of people in any country. Therefore, this research investigates the impact of workers' remittances on the transmission of the general consumer price and the variation of the wholesale price, and also examines the simultaneous impact of remittances on the exchange rate, the rate of consumer prices (CPI) and the wholesale price index (WPI) for food and non-food items in the context of the Pakistani economy. This research study is different from previous studies which were conducted in Pakistan in this area for three reasons: (1) We use monthly data for these variables, (2) The relative price variability is used in the current study and (3) The VAR specification with seasonal dummies and international oil prices as an exogenous variable are considered in this investigation. Since Pakistan is an oil importuning country and 70% of trade bill comprises of oil payments, therefore, the oil price is a major cause of trade deficit.

The rest of this paper is organized as follows: section two describes the literature review and the third section elaborates the methodology of the study. Section four is composed of empirical data and analyses, section five contains the results and discussion, and section six is the coherent conclusions of the research study.

2. Literature Review

There are two constituents of the current literature, which is relevant to our research work, the first constituent emphasizing the impacts of workers' remittances on the general pattern of expenditures of the economy. Durand *et al*. (1996) have focused on this component; in their study, they examined thirty groups in Mexico and concluded that only 10% of remittances have been spent on productive investments. In addition, they concluded that 14% was spent on housing, and the rest of 76% was spent on consumption. Zarate-Hoyos (2004) also carried out another important research on the Mexican economy; he compared the expenditure arrays of workers' remittance recipients' households (RRH) with non-

recipient households. The results of the study showed that remittance-receiving households even exhibited below-standard expenditures in most of the expenditure groups that households receiving non-recipient remittances. The RRH spent their highest proportion of spending on housing, luxury appliances and improving housing standards, therefore, this expense has provided the benefits in the general economy through the labor and commodity markets throughout Mexico. However, the subsequent constituent of this literature comprises the association between remittances and dissemination on overall inflation and comparative prices (Konte, 2016; Maduekwe and Adesina, 2015). In their significant works Lartey (2015), Vining and Elwertowski (1976), and Parks (1978) have produced significant and influential research studies in this category. They showed an affirmative association between relative price variability (RPV) and inflation in the economies considered; however, the direction of causality has always been a problem, which created interest and curiosity, and motivated researchers and economists to explore more avenues. The previous theories suggested that a certain extraneous factor is always there, which in turn causes inflation and relative price variability (RPV) regardless of the direction of causality.

Mughal (2012) has investigated the role of workers' remittances in overall inflation; he concluded that demand pushes inflation because of workers' remittances in case of the Pakistani economy. The results of the research work also showed that remittances could be considered as short-term inputs that can improve macroeconomic variables. Narayan *et al.* (2011) have examined the association between workers' remittance and inflation for 54 developing and developed economies' panel data and considered the time period 1995–2005. They concluded that the rises in remittances increase the domestic prices because of the money supply that could lead expansion in an effective exchange rate of these countries. However, the long-term impact of escalation in real exchange rate illustrated an affirmative effect on economic growth. Hassan and Shakur (2016) conducted a similar study in Bangladesh and concluded the long-term and short-term impacts of inflation due to workers' remittances, specifically in the developing economies.

According to Snudden (2017) and Viqueira (1991), in any organization there must be an affirmative association between inflation and relative price variability (RPV) because of the price setting behavior of different commodities' characteristics and marketplaces in which these commodities are transacted. This impact also depends on those industries, which stream these commodities. However, Risso and Carrera (2009) argued that the increase in government spending and policy of exchange rate expand the space between relative prices of transacted vis-à-vis non-traded commodities during earlier Mexican economic crises of 1994. Meyer and Shera (2017), and Rogers and Wang (1995) revealed that it was strong evidence regarding the fiscal policy; real money growth, asset market turbulence, and exchange rate, which were the main causes of inflation. They further concluded that the money growth and fiscal shocks have played the most influential factors in inflation. Iqbal *et al.* (2013) have considered the period of 1980–2012; the long run inflation was tested through Johansen integration, whereas, for short-run dynamics, they used the VECM techniques. The outcomes of the research study confirmed a positive effect of workers' remittance on the inflation in case of Pakistan; hence, it was proved that escalation in workers' remittance increased the buying power of households. Thus, the rise in purchase power enhances the demand that leads to escalating the inflation rate. Ball *et al*. (2012) concluded that the effective exchange rate had a negative effect on inflation because the depreciation in real exchange rate meant more expensive imports and cheaper exports that raised the aggregate demand, which further increased inflation rate.

Nisar and Tufail (2013) have also conducted a research in order to examine the association between workers' remittances and the inflation rate. They have taken annual data of CPI, food price index, textile index, money supply, footwear, and per capita income for the period from 1970–2010 in the Pakistani economy. They concluded that the macro indicators such as effective per capita income, workers' remittances, and money supply exerted a positive impact on overall inflation including for various categories. Mpofu (2017) has investigated the influence of remittances on inflation of different categories for the emerging economies. They defined the food inflation as the most affected category among all other categories; however, the housing and construction were the least effective. They indicated that the remittance caused demand-pull inflation if the government failed to channel the funds towards the productive investments.

Similar to other developing countries, Bangladesh has considerably larger remittance as compared to other developing countries. Khan and Islam (2013) have conducted a research to examine the effect of workers' remittance on inflation for the period 1972–2010. The outcomes of the research study revealed that the workers' remittance expressively reduces the poverty level in the country; they established one-way or unidirectional causality from workers' remittances to inflation. Wadood and Hossain (2017) have investigated the association between remittances and inflation. They concluded a long run association between workers' remittance and the inflation rate; however, they did not get any evidence of a short-run association between remittances and inflation in the case of Bangladeshi economy.

Another research was conducted by Roy and Rahman (2014) to explore the relationship of remittance and inflation for the period from 2003 to 2013. They used two different models to establish the relationship, and the results of both models concluded that the remittances cause inflation. The study further revealed that the food inflation was around two and a half (2.5) times higher as compared to the overall inflation in case of Bangladesh; this implies that the remittance received is spent more for food consumptions. The above-noted implication shows that the absences of these internal earnings from workers reduce the food intake of households. Islam *et al.* (2017) have conducted important research and employed different econometric models to establish the association between remittances and inflation; they also concluded similar results in the case of Bangladesh.

Nath and Vargas-Silva (2012) have examined the effect of remittance on the cross circulation of prices and development of distinct relative prices, they used monthly data of CPI for 272 consumer items for this purpose, covering the period 1996–2001 for the Mexican economy. They examined the response of comparative prices for non-durable and durable food items; they included industrial production, remittance inflows, CPI, M2 and exchange rates as macroeconomic variables for their study. Abosedra and Fakih (2017) have examined the impact of remittances and inflation in the case of Lebanon. The results indicated a long run significant rise in the prices of consumption items, however; on short run, positive shocks to remittances lower the prices of maximum consuming items. Thapa and Acharya (2017) have carried out the research study in Nepal, and concluded that it was variation in different categories of consumption items; this showed that the rise in remittances had very important implication on relative prices.

Hence, it is concluded from the previous research studies that the previous literature neither examined the relationship between remittances and inflation along with exchange rate nor modelled these variables to investigate the impact of remittances on CPI for food items and non-food items, and remittances on WPI for food and non-food items, and simultaneous influence of remittances on inflation and exchange rate or the other way around. Thus, it is

also inferred from the previous literature that significant portion of workers' remittances has been used for spending on consumption; this may suggest that a substantial share of remittances must have a cogent effect on services and commodities' prices (Akçay, 2017; Dendir, 2017; Abdul–Mumuni and Quaidoo, 2016). Therefore, it was a strong need to reinvestigate the long-run association between remittances and indicators of inflation (CPI and WPI), and exchange rate in the Pakistani context. This paper will be a significant addition to the current literature in terms of this relationship, by taking CPI and WPI as inflation proxies under a flexible exchange rate regime.

3. Analysis

3.1. Methodology

Several researchers, such as Nisar and Tufail (2013), Iqbal *et al.* (2013), Kemal (2006), Khan and Abid (2010), Mukhtar (2010), Qayyum (2006) have carried out studies to comprehend the causes of inflation in the Pakistani economy. Outcomes of these research studies were mixed regarding the undertaken issue; for instance, Kemal (2006), Iqbal and Sattar (2005), and Qayyum (2006) have argued that inflation is linked with the monetary sensation. However, Nisar and Tufail (2013), Iqbal *et al*. (2013), Khan and Abid (2010), and Mukhtar (2010) have established that the inflation to be underlying in nature. These studies have incorporated different macroeconomic indicators, such as GDP, budget deficit, money supply, exchange rate, trade openness, support prices, and remittances as a minor determinant. None of these studies have taken remittances as a major cause of inflation; thus, we have incorporated the remittance as a major determinant of inflation. We examined the impact of remittances on CPI and WPI as inflation indicators with exchange rates; moreover, we have also examined the simultaneous influence of remittances on food and non-food inflation with exchange rates.

3.2. Theoretical Justification of Variables

The remittance is considered to be an important variable of the demand side, which is anticipated to influence the inflation in an assertive manner at the micro level. Remittances support the direct increase in revenues and increase the internal demand for services and goods, if they exceed domestic production, generate a constructive production and inflation gap (Akçay, 2017; Dendir, 2017; Iqbal *et al*., 2013; Khan and Islam, 2013; Nisar and Tufail, 2013). Thus, the remittance is important to be incorporated in the inflation regression because of its influence both at macro and micro level. Additionally, the influence of remittances may not be constant across different commodity groups, as the empirical investigations have exhibited that the expenditure patterns differ by categories' consumption, and this influences the relative prices of diverse services and goods (Abosedra and Fakih, 2017; Thapa and Acharya, 2017; Mukhtar, 2010; Balderas and Hiryana, 2005). Therefore, the undertaken study has considered remittances as the main cause of overall inflation and food and non-food inflation categories. We have included the exchange rate (EXR) in the undertaken study, and estimated the workers remittances (WR) with consumer price index (CPI) and wholesale price index (WPI). Therefore, the fluctuations of exchange rate (EXR) may affect the workers remittances (WR) in case of Pakistan or the other developing countries that receives these remittances. It may vary country-to-country, and depends on countries economic situation and ground realities.

The money supply is a variable of monetary policy and considered to be a vital cause of inflation. The inflow of remittances may intensify the money supply that fuels the

demand for services and goods, and enhances the pattern of spending on services and goods. The escalation of demand sets rising pressure on prices that increases the demand-pull inflation (Abosedra and Fakih, 2017; Nishat and Nighat, 1991). The adverse influence of remittances on the recipient economy may happen in the shape of Dutch disease, curtailed incentives to employment for the receiving economies and ethical drawbacks. Workers' remittances increase the stream of foreign exchange that may cause the appreciation of domestic currency. Consequently, this may reduce the competitive advantage of the export market, which may lead the stagnation of the overall economy. However, the influence of money supply may vary within different consumption categories, and thus, have varied impact on inflation for different categories such as food and non-food (Abosedra and Fakih, 2017; Lartey, 2015; Ball *et al*., 2012; Qayyum, 2006; Kemal, 2006).

3.3. Estimation Techniques

We used different econometric techniques to carry out this research study; first, we employed two tests to examine the stationarity of data series, such as the Philips–Perron (1988), and the widely used Augmented Dickey–Fuller (1979, 1981) methods. We run the unrestricted vector autoregression (VAR) models to identify the appropriate lags. We applied cointegration econometric techniques, which were proposed by the Johansen (1988, 1991, 1995), and Johansen-Juselius (1990) with appropriate lags to examine the long-run association. We have estimated VEC (being the subsistence of cointegration) within the fitting lags. Finally, we applied the Toda-Yamamoto Wald test and VEC Granger causality/Block Exogeneity Wald technique to investigate the directions of causality for different variables. We used both VAR and VEC models with the inclusion of seasonal dummies as well, incorporating two structural dummies, namely 1) financial crunch of 2008 that affected the prices significantly, and 2) fluctuations of prices due to oil prices shock of 2014. It was evident that the first shock created the adverse effects on prices, whereas, the second shock do not provide evidence of inflation due to the decrease in oil prices, thus termed as a positive shock.

3.4. Philips–Perron and Augmented Dickey–Fuller Tests

The most popular and extensively used technique is the Augmented Dickey–Fuller (1979, 1981). The common form of ADF test is given as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \alpha \, \Delta y_t + e_t \qquad (1)$$

where: y_t – time series, t – the time period, n – the optimal lags, α_0 – constant, e – random error.

Philips – Perron (1988) test is derived from AR(1) procedure and can be shown as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + e_t \qquad (2)$$

where: y_t – time series, t – the time period, αo – constant, e – white noise error

3.5. Johansen Cointegration Testing Approach

The Johansen testing approach establishes the cointegration between the two similar orders of integrated stationary time series (Hall and Henry, 1989). According to Dickey *et al.* (1991), if y_t is known as vectors for 'n' stochastic factors, then there will be the presence of 'p' lags VAR besides Gaussian errors. The generalized equation is expressed as:

$$\Delta y_t = \mu + \Delta_1 y_{t-1} + \cdots + \Delta_p y_{t-p} + \mathcal{E}_t \qquad (3)$$

where: in Eq. (3), 'y_t' is the 'nx1' vectors of factors, and these factors are incorporated as follows:

$$\Delta y_t = \mu + \eta y_{t-1} + \sum_{i=1}^{n-1} \tau_t \, \Delta y_{t-1} + \mathcal{E}_t \tag{4}$$

where: $\eta = \sum_{i=1}^{p} A_{i-1}$ and $\tau_t = \sum_{j=i+1}^{p} A_j$.

For signaling out the value of cointegrating vectors, we used the Johansen-Juselius (1990) and Johansen (1988, 1991, 1995) tests approaches. These tests measure the two-statistics analyses; the first is called the Trace test or simply λ-trace and the second is known as the Eigenvalue test (λ-max). The following is the condition for the Trace test:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} ln\left(1 - \hat{\lambda}_{r+1}\right) \tag{5}$$

where: T is the numbers of functioning observations and λ_{r+1} – the measured Eigenvalues from the considered matrix.

The second is called the Max–Eigen statistics or simply λ–Max test; hence, these values are measured by the following equation:

$$\lambda_{max}(r, r+1) = -Tln\left(1 - \hat{\lambda}_{r+1}\right) \tag{6}$$

The Eq. (6) integrates and examines the void assumptions whether there is 'r' number of cointegrating vectors in connection with decision theory that is 'r+1' cointegrating vectors.

3.6. VEC Granger Causality and Vector Autoregression (VAR) Models

The Granger (1969) causality is comparatively the simplest technique in order to measure the directional causal association. The pairwise VEC Granger causality technique for these two stationary series y_t and x_t include as a first phase to estimate from the two VAR techniques as expressed below:

$$y_t = \alpha_1 + \sum_{i=1}^{n} \beta_i \, x_{t-i} + \sum_{j=1}^{m} \gamma_j \, y_{t-j} + \mathcal{E}_{1t} \tag{7}$$

$$x_t = \alpha_2 + \sum_{i=1}^{n} \theta_i \, x_{t-i} + \sum_{j=1}^{m} \delta_j \, y_{t-j} + \mathcal{E}_{2t} \tag{8}$$

where: y_t & x_t – two time series and ε_{1t} & ε_{2t} – uncorrelated white noise errors

In above two models, the VEC Granger casualty technique estimates the VAR models as shown by Eq. (7) and Eq. (8). We employed Eviews software to test the lag length criteria because Granger causality test is very sensitive about lag length.

3.7. Vector Error Correction Model (VECM)

Like VAR properties, the econometric method of VECM has the similar properties as stated in the ECM technique. In the ECM format, all the variables are differenced in order to confirm that these data series are stationary, and also includes the error correction term as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 \Delta y_{t-1} + \alpha_2 \Delta S_{t-1} - \tau_1 (y - S)_{t-1} + e_{1t} \tag{9}$$

$$\Delta S_t = \beta_0 + \beta_1 \Delta y_{t-1} + \beta_2 \Delta S_{t-1} - \tau_2 (S - y)_{t-1} + e_{2t} \tag{10}$$

Eq. (9) and Eq. (10) are the simple variables models, which have a single lag, however, Eq. (9) and Eq. (10) are constructed for more variables with greater order of lags. Though VECM advances the fundamentals of VAR because VECM explains the variables stationarity, but before running VECM it requires to run first cointegration test and then the VECM model.

3.8. Toda & Yamamoto Wald Technique

Tada and Yamamoto (1995) have developed another imperative technique that is an advanced form of Wald's method. This technique is unique in the sense that it could be used independently of the order of integration; the Eq. (11) and Eq. (12) are the mathematical forms of the technique of Toda and Yamamoto Wald that is given as:

$$Y_t = \alpha_1 + \sum_{t=1}^{k+d} g_{1i} Y_{t-i} + \sum_{t=i}^{k+d} g_{2i} X_{t-i} + e_{yt} \tag{11}$$

$$X_t = \alpha_2 + \sum_{t=1}^{k+d} h_{1i} Y_{t-i} + \sum_{t=i}^{k+d} h_{2i} X_{t-i} + e_{xt} \tag{12}$$

where: in Eq. (11) and Eq. (12) "d" means the number of integration orders, while 'k' denotes for lag orders, and 'e_{yt}' and 'e_{xt}' represent white noise errors for two time series of 'X' and 'Y'.
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4. Empirical Data and Analysis

4.1. Data Collection

The monthly data was collected for the period from July 2001 to December 2016 as shown in Table 1.

Table 1

Sources of data collection

Description / S. No.	Macroeconomic Variable	Frequency	Source
1.	Consumer Price index (CPI)	Monthly	Pakistan Bureau of Statistics
2.	Wholesale Price index (WPI)	Monthly	Pakistan Bureau of Statistics
3.	Workers' Remittances	Monthly	State Bank of Pakistan
4.	CPI for Food Group	Monthly	Pakistan Bureau of Statistics
5.	CPI for Non–food Group	Monthly	Pakistan Bureau of Statistics
6.	WPI for Food Group	Monthly	Pakistan Bureau of Statistics
7.	WPI for Non–food Group	Monthly	Pakistan Bureau of Statistics
8.	Exchange rate (EXR)	Monthly	State Bank of Pakistan

Source: Authors' compilation.

We covered two base period such as base 2000–01 and base 2007–08, for consistent series we have used usual merging method to get all prices indices series from July 2001 to December 2016 for the base of 2007–08. For the analysis purposes, we employed a log transformation for all the time series in order to avoid possible heteroskedasticity. The empirical data analysis of the data time series comprises of four steps, namely: 1) application of Philips – Perron (P–P) and ADF to examine the stationarity of data series, 2) application of the econometric model of VAR to identify the appropriate lags for cointegration analysis, 3) employing the well known Johansen cointegration technique to investigate the long run

association, and finally 4) using of VEC/Exogeneity Wald method to examine the directionality of data series.

4.2. Philips–Perron and Augmented Dickey–Fuller Tests

For the cyclic time series, we have to check the unit root in given series of data, for this purpose, we have employed the Philips–Perron and Augmented Dickey–Fuller methods. The outcomes presented in Table 2 demonstrated the overall CPI, overall WPI, workers' remittances (WR), and exchange rate (EXR) data series converted into stationary at first difference or simply integrated of order one or I(1). However, the results of lag 1 showed that the data series is not stationary, thus, we have to take the first difference, and lag 2 showed that series has become stationary for all the variables. Similarly, the results of CPI for food, and non-food also became stationary at first difference in both PP and ADF tests. Finally, we checked the WPI data series for food and non-food groups with PP and ADF techniques, and it is also evident that these two data series also become stationary at first difference.

Table 2

Unit root tests (data series are converted into natural log arrangement)

A. At Level:						
Description / Variables	Augmented Dickey–Fuller Test			Philips–Perron Test		
	Lags	ADF t–statistics	Prob.	Bandwidth	Adj. t–statistics	Prob.
CPI	0	-0.5756	0.8718	7	-0.5199	0.8833
CPI Food	0	-0.9640	0.7657	3	-0.9203	0.7802
CPI Non–food	3	-0.3662	0.9110	8	-0.0666	0.9502
WPI	1	-1.0013	0.7527	7	-0.9329	0.7761
WPI Food	1	-0.4929	0.8886	4	-0.4945	0.8883
WPI Non–food	1	-1.1820	0.6821	7	-1.0955	0.7175
WR	2	-2.2959	0.1744	7	-2.9091	0.0461
EXR	2	-0.1613	0.9397	7	-0.0402	0.9528
B. At First difference:						
	Lags	ADF t–statistics	Prob.	Bandwidth	Adj. t–statistics	Prob.
CPI	0	-5.5054	0.0000	5	-11.5891	0.0000
CPI Food	0	-12.1474	0.0000	2	-12.1348	0.0000
CPI Non–food	2	-5.3342	0.0000	7	-12.1645	0.0000
WPI	0	-7.7476	0.0000	3	-7.7687	0.0000
WPI Food	0	-10.3127	0.0000	2	-10.3426	0.0000
WPI Non–food	0	-8.5075	0.0000	5	-8.6519	0.0000
WR	1	-14.4186	0.0000	7	-22.7390	0.0000
EXR	1	-6.7412	0.0000	5	-11.1427	0.0000

Note: Conclusion: All variables are I(1) considering ADF test statistics.
Source: Authors' calculation.

4.3. Johansen Cointegration Technique

Before the application of Johansen cointegration, we have to select the suitable lags; therefore, we have employed the VAR model. The results of Table 3 suggested 1, 2, 4, 8, and 12 lags for overall WR, CPI, and EXR at first difference. However, we selected lags 1, 2, 4, and 8 for WR, CPI food group, and EXR. For WR, CPI non-food and EXR, we have selected lags 1, 2, 3, and 4 at first difference. However, for WR, overall WPI and EXR, we

have selected lags 1, 2, 4, and 8 at first difference. Though for WR, food group of WPI and EXR, we have selected lags 1, 2, 4, and 8 at first difference and finally, for WR, non-food group of WPI and EXR; we have selected lags 1, 2, and 4 at first difference.

After the selection of appropriate lags, we have employed Johansen cointegration test, the results of Table 3 exhibited a long run association between: 1) WR, overall CPI, and EXR, 2) WR, overall WPI and EXR, 3) WR, CPI food and EXR, and 4) WR, WPI food, and EXR. It is also established that all sets of variables are integrated with each other except for WR, non-food groups of CPI, WPI and EXR. The results further showed that the Trace value is higher than the critical value, and corresponding probabilities are lower than 0.05 ($p<0.05$).

Table 3

Johansen unrestricted cointegration rank test (Trace)

Series (log form):	WR, Overall CPI and EXR	WR, Overall WPI and EXR	WR, CPI-food and EXR	WR, WPI-food and EXR
Sample (adj.):	2002M04 to 2017M06	2002M04 to 2017M06	2002M04 to 2017M06	2002M08 to 2017M06
Included Obs.	179	183	183	183
Lags (in first diff.):	1, 2, 4, 8, 12	1, 2, 4, 8	1, 2, 4, 8	1, 2, 4, 8
Hypothesis: No Cointegration equation:				
Eigenvalues	0.127	0.117	0.130	0.155
Trace Statistics	35.56	34.07	44.30	46.71
Probability*	0.010	0.015	0.001	0.000
Hypothesis: No Cointegration equation:				
Eigenvalues	0.127	0.117	0.130	0.155
Trace Statistics	24.40	22.69	25.44	30.884
Probability*	0.017	0.030	0.012	0.002

Note: (i) Seasonal dummies are included as exogenous in considered equations, and (ii) Linear deterministic drift is presumed for all cointegrating equations; * Mackinnon – Haug–Michlis (1999) p–value.

Source: Authors' calculation.

4.4. VEC Granger Causality/Block Exogeneity Wald Technique

Table 4 shows the outcomes of VEC Granger casualty/BEW test. According to the results, the workers' remittances (WR) do not cause overall WPI, overall CPI, and EXR. However, pairwise Granger causality test shows one causal relationship between WR and overall CPI, and overall WPI, and there is no causal relationship between WR and EXR. The food groups of CPI and WPI have also a unidirectional causal relationship with WR. As for non-food groups of CPI and WPI exhibit no causal relationship to WR. However, if EXR is taken as a dependent variable, both inflation indicators along with WR depicted VEC causal relationship as probability value is less than 0.10 or (90% confidence). Similar results have been exhibited for food groups of both inflation indicators (CPI and WPI). Hence, it is concluded that the workers' remittances inflow causes inflation in case of Pakistan when exchange rate (EXR) is also included in the VAR model.

Table 4

VEC Granger causality/Block Exogeneity Wald technique

WR, CPI and EXR				WR, CPI-food and EXR			
Dependent variable: D(LWR)				*Dependent variable: D(LWR)*			
Excluded	Chi-sq	Df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LCPI)	2.180	5	0.82	D(LCPI_f)	2.840	4	0.59
D(EXR)	1.088	5	0.96	D(EXR)	1.259	4	0.87
All	4.491	10	0.92	All	5.616	8	0.69
Dependent variable: D(LCPI)				*Dependent variable:*			
Excluded	Chi-sq	Df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LWR)	6.726	5	0.24	D(LWR)	8.384	4	0.08
D(EXR)	1.025	5	0.96	D(EXR)	1.082	4	0.90
All	8.132	10	0.62	All	9.824	8	0.28
Dependent variable:				*Dependent variable: D(LEXR)*			
Excluded	Chi-sq	Df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LWR)	7.359	5	0.20	D(LWR)	9.288	4	0.05
D(LCPI)	20.551	5	0.00	D(LCPI_f)	10.702	4	0.03
All	34.200	10	0.00	All	25.224	8	0.00
WR, WPI and EXR				WR, WPI-food and EXR			
Dependent variable: D(LWR)				*Dependent variable: D(LWR)*			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LCPI)	6.259	4	0.18	D(LWPI_f)	2.119	3	0.55
D(EXR)	1.774	4	0.78	D(EXR)	1.607	3	0.66
All	8.231	8	0.41	All	4.639	6	0.59
Dependent variable: D(LWPI)				*Dependent variable:*			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LWR)	3.018	4	0.55	D(LWR)	3.020	3	0.39
D(EXR)	1.783	4	0.78	D(EXR)	2.039	3	0.56
All	5.576	8	0.69	All	5.308	6	0.51
Dependent variable:				*Dependent variable: D(LEXR)*			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	Df	Prob.
D(LWR)	8.818	4	0.07	D(LWR)	8.330	3	0.04
D(LWPI)	8.519	4	0.07	D(LWPI_f)	12.058	3	0.01
All	19.920	8	0.01	All	22.798	6	0.00

Source: Authors' calculation.

4.5. Toda and Yamamoto causality Technique

The results of Table 5 exhibited the similar outcomes of Granger causality test. The results in Table 5 show that there is a unidirectional causal effect between WR and both general inflation indicators; however, EXR has no causal effect on WR. Therefore, from the results of Table 5 we can conclude that the causality of Toda Yamamoto finds no evidence of the hypothesis that the monthly changes in worker remittances D(LWR) do not cause the monthly change in both inflation indicators D(LCPI) and D(LWPI); however, vice versa is true in the case of the Pakistani economy.

Table 4

Toda and Yamamoto Wald technique

Null Hypothesis:	Chi-square	P-value	Granger Causality
D(LWR) does not Granger Cause D(LCPI)	2.9910	0.2501	No
D(LCPI) does not Granger Cause D(LWR)	6.2234	0.0421	Yes
D(LWR) does not Granger Cause D(LWPI)	3.3100	0.1851	No
D(LWPI) does not Granger Cause D(LWR)	6.3224	0.0391	Yes
D(LWR) does not Granger Cause D(lexr)	3.1203	0.2101	No
D(LEXR) does not Granger Cause D(LWR)	3.3200	0.1901	No
D(LWR) does not Granger Cause D(LCPI_f)	2.2923	0.2621	No
D(LCPI_f) does not Granger Cause D(LWR)	7.0259	0.0299	Yes
D(LWR does not Granger Cause D(LCPI_nf)	3.1003	0.2201	No
D(LCPI_nf) does not Granger Cause D(LWR)	3.2200	0.2001	No
D(LWR) does not Granger Cause D(LWPI_f)	2.2723	0.2821	No
D(LWPI_f) does not Granger Cause D(LWR)	5.9591	0.0501	Yes
D(LWR) does not Granger Cause D(LWPI_nf)	0.8333	0.6592	No
D(LWPI_nf) does not Granger Cause D(LWR)	1.1232	0.5521	No

Source: Authors' calculation.

5. Results and Discussions

We intend to examine the association between workers' remittances and inflation. We used CPI and WPI as indicators of inflation, and exchange rate (EXR) in the undertaken study. We further explored the impact of remittances on CPI food and exchange rate (EXR), and CPI non-food items and exchange rate (EXR), and further explored the influence of workers' remittances on WPI food and exchange rate (EXR), and WPI non-food groups and exchange rate (EXR).

The results concluded that worker remittance (WR) and overall consumer price index (CPI) and exchange rate (EXR), worker remittance (WR) and CPI food and exchange rate (EXR) have a long-run relationship to each other. In addition, workers 'remittances (WR) and the general wholesale price index (WPI) and the exchange rate (EXR), and workers' remittances and the food group and the WPI exchange rate also have a long-term relationship with each other. Previous research studies also showed the long-term association between workers' remittances and inflation, which were carried out in different time horizons around the world (Thapa and Acharya, 2017, Akçay, 2017, Konte, 2016, Nisar and Tufail, 2013; Iqbal *et al*., 2013; Khan and Islam, 2013; Narayan *et al*., 2011). According to Wadood and Hossain (2017), Meyer and Shera (2017), Roy and Rahman (2014), Cáceres and Saca (2006), Iqbal and Sattar (2005), and Nishat and Nighat (1991), the short run relationship always happens amongst the variables, and every mentioned study concluded there exist short run relationship between the variables. Thus, the results of the undertaken study are consistent with these studies, and concluded a short run relationship between workers remittances (WR) and CPI non-food items, and exchange rate (EXR). The similar short run relationship occurred between workers remittances (WR) and WPI non-food items, and exchange rate (EXR).

Since we have incorporated two structural dummies, namely 1) financial crunch of 2008 that affected the prices significantly, and 2) fluctuations of prices due to oil prices shock of 2014, it was evident that the first shock created the adverse effects on prices, whereas, the second shock did not exert any significant effect on inflation due to the decrease in oil prices, thus, it was termed as an affirmative shock. The previous literature is also consistent with the results of the current study, and concluded the same pattern (Snudden, 2017; Abdul–Mumuni and Quaidoo, 2016; Arby and Ghauri, 2016; Iqbal *et al*., 2013; Rogers and Wang, 1995; Bashir *et al*., 2011).

According to the results of Toda-Yamamoto Wald test and VEC Granger casualty/BEW test the workers' remittance (WR) does not cause overall WPI, overall CPI, and EXR. However, pairwise Granger causality test shows one causal relationship between WR and overall CPI and WPI and there is no causal relationship between WR and EXR. The food groups of CPI and WPI have also a unidirectional causal relationship with WR. As for non-food groups of CPI and WPI, they exhibit no causal relationship to WR. However, if EXR is taken as a dependent variable, both inflation indicators along with WR depicted VEC causal relationship. Similar results have been exhibited for food groups of both inflation indicators (CPI & WPI). Hence, it is concluded that the workers' remittances inflow causes inflation in case of Pakistan when exchange rate (EXR) is also included in the VAR model. The results are also validated by the findings of previous research studies, which also concluded that the workers' remittances create the overall inflation because of excessive spending, and people buy imported luxury goods, and households items that triggers the overall inflation in non–food items but ultimately increases the prices of food items as well (Mpofu, 2017; Islam *et al*., 2017; Hassan and Shakur, 2016; Roy and Rahman, 2014; Nisar and Tufail, 2013; Nath and Vargas-Silva, 2012; Narayan *et al*., 2011; Durand *et al*., 1996; Zarate-Hoyos, 2004).

6. Conclusions

The influx of workers' remittances has emerged as one of the most important issues for Pakistan's monetary and fiscal policies. Workers' remittances not only benefited the families of their country of origin, but were also a great source for reducing poverty for their countries of origin. These remittances are also a vital cause of investment financing for recipient countries; in addition, it is also a large foreign exchange base for their countries. On the other hand, workers' remittances also have the potential to generate an inflationary severity for recipient countries as other foreign investments. But in the case of Pakistan, workers' remittances are the largest source of foreign currency inflows to the country, which contributes enormously to the settlement of external debts each year, which is why it is also the most important source to boost the economy of the country. Consumption patterns are the fundamental element to decide if these remittances cause an inflationary pressure or a constructive factor on the economic consequences of the country. The results of this research concluded a long-term association between remittances and general inflation (CPI and WPI) under a flexible exchange rate regime that shows that the long-term influence of remittances causes an inflationary effect in the economy when the type of change is included in the findings. The remittance increases the entries of foreign currency in the economy, in addition to the positive effects, the exchange rate also creates an inflationary effect, since these remittances are spent on luxury goods and household appliances, so there will be more possibilities of inflation in the economy due to enormous trade deficit. The results of this study also concluded that workers' remittances cause the wholesale price index and the consumer price index, since both the CPI and the WPI are the indicators of inflation,

therefore, in the case of the Pakistani economy, remittances are responsible for increasing inflation in the country and the reason behind this inflation is the adverse use of these remittances. Therefore, it is necessary to take corrective measures to invest the remittances of workers in the right direction, which will boost the economy and create more jobs by boosting the economic growth of the country. The results of the study also emphasize that there is a unidirectional causal relationship between the remittance and the CPI, WPI and there is no evidence of the causality of the exchange rate; however, if the EXR is taken as a dependent variable, both inflation indicators together with WR reveal VEC causal relationship. Therefore, it is concluded that the inflow of workers' remittances causes inflation in the case of Pakistan when the exchange rate (EXR) is also included in the VAR model. Consequently, it is imperative to take into account the positive and negative effects of the inflow of remittances when designing economic policies. It is concluded that food inflation is more evident in comparison with general inflation; therefore, it reflects that remittances are more inclined towards the pattern of food consumption. Since the recipients of these remittances belong to the lowest strata of the population, they prefer to spend more money on their food and, secondly, they are consuming money on imported household appliances and luxury goods, which further increases inflation in the Pakistani economy due to the enormous trade deficit.

6.1. Recommendations and Policy Implications

The results of this research emphasize the reduction in surplus consumption, since the amplified demand that follows the driven consumption generates a constructive production gap that raises inflation. Therefore, policies must be designed to direct the use of workers' remittances so that this money supply remains useful for the economy, and empirical research shows that to obtain the maximum benefit from remittances, it is imperative to invest these money flows. Therefore, based on the results of this study, it is recommended that the government formulate productive investment policies to channel the use of workers' remittances. These remittances must be diverted to build infrastructure and towards education, the government must encourage the private sector to obtain lucrative business opportunities, which will not only improve job creation but also expand the overall economic growth of the country. There is a great need to channel this pattern of spending, and households must be educated to invest these remittances in other profitable projects, which will also benefit the economy. Imports of household appliances and luxury goods are evidence of the misuse of these remittances; the import bill is increasing continuously every year. If the inflows of remittances do not go into the right direction, then this inflation will spread to other sectors of the economy. Therefore, the government must provide lucrative investment opportunities to the recipients of these remittances. The financial sector must also offer lucrative products such as mutual funds, secondary bond market, stock market and lucrative profits in savings certificates, etc. Consequently, both the government and the private sector can channel these remittances, which will not only reduce the inflationary effect but also improve economic opportunities in the country.

6.2. Significance and Limitations of the Research

The results of the study are significant in the global perspective, especially for the developing economies. Therefore, policymakers and financial professionals can boost their financial and investment policies in perspective of the results of this study. In addition, this research also provides basis to researchers from the developing economies, and they can carry out their researches by incorporating the indicators of this study into their studies. The results of the study are not only important for the Pakistani economy, but could be generalized to other developing economies from Asia, Eastern Europe, Latin America and Africa. Migration is an

international phenomenon, and the inhabitants of developing nations are widely involved in the migration of workers, both for skilled and unskilled workers. Consequently, this labor force is the main source of foreign remittances for their countries of origin. Therefore, the effect of workers' remittances has a significant influence on inflation in the recipient countries. This research study has a certain limitation; first, it only described the economic situation in Pakistan in view of workers' remittances and their impact on the CPI and the WPI with the exchange rate. Second, we have incorporated only two indicators of inflation and the exchange rate to examine the impact of workers' remittances. Therefore, it is recommended that the comparative analysis of developing economies be studied in perspective of workers' remittances and their influence on inflation in future research studies. In addition, to the CPI, WPI and exchange rate, other important macroeconomic indicators should be taken into account and then examined the impact of workers' remittances for the developing economies in future studies.

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