Impact of oil prices on remittances to Pakistan from GCC countries: evidence from panel asymmetric analysis

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ABSTRACT

International migration and remittances from oil-exporting Gulf countries are important sources of employment, income, and foreign exchange for Pakistan. This study investigates the asymmetric impact of oil prices on remittances to Pakistan from GCC countries, over the period 1980 to 2018, by employing the recently advanced non-linear panel Pooled Mean Group (PMG) model. The findings show that oil prices and remittance are asymmetrically associated. The increasing oil prices have a significant positive effect only in the long run; whereas, reducing oil prices reveal a significant negative effect only in the short run. Findings of other explanatory variables show that the economic condition in host countries, exchange rate, and trade relations have positive effects only in the long run; whereas the economic condition in the home country has significant negative effects in the long run and positive effect in the short run. This study urges oil exports to stabilize oil supply and prices, and Pakistan to enhance trade relations, exchange rate adjustments, and financial development.

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Keywords: Energy prices, remittances flow, asymmetric analysis, panel data, Pakistan

1. Introduction

The Middle East is the major oil-exporting region in the world that holds more than 65 percent of total crude oil reserves. The economic performance of oil-exporting countries is dependent on the price and export of crude oil. The oil price can be influenced by many factors besides traditional supply and demand-side factors, such as geopolitics and rivalry among exporters. The oil market has witnessed large volatility after oil prices shock of 2015 due to excessive production and supply of crude oil, Baffes et al (2015). During recent years, the oil market is witnessing a historical decline in oil prices due to the large deterioration in oil demand, due to pandemic 'COVID-19', along with the excess supply. The changing crude oil prices have a considerable economic impact on both oil-exporting and oil-importing countries across the globe.

The objective of this study is to explore the asymmetric impact of changing oil prices on workers' remittances inflow to Pakistan from the oil-exporting Gulf countries, which are major destinations for expatriate workers and source of more than 70 percent of total remittances inflow. Pakistan is a major labor-exporting developing country, which is facing an acute shortage of foreign capital due to highly sluggish growth performance, large fiscal deficit, and exploding current account deficit, (Abbas 2019). The majority of emigrants are working on oil-rich countries in the Persian Gulf. Worker remittance is an important source of employment and foreign exchange for Pakistan. The theoretical and empirical literature on the impact of oil prices on macroeconomic aggregates of Pakistan, such as economic growth, domestic investment, and inflation, is well established with fewer studies on oil prices and remittances nexus. It is therefore important to explore the dynamic relationship between the changing crude-oil prices and remittances from GCC countries.

The changing oil prices can affect remittance inflow through two main channels. First, from the perspective of migrant-exporting and oil-importing countries, oil is an important input of the domestic manufacturing process and increasing oil prices will enhance the domestic cost of living by increasing the cost of production and price level. As a result, the altruistically motivated remittances flow to the home country will increase, (Makhlouf and Kasmaoui 2018; Akcay and Karasoy 2019). Second, from the perspective of oil-exporting and labor-importing countries, oil is a very important source of revenue and foreign exchange earnings. The increasing oil prices will enhance their investment and production activities, which will increase demand for international migrants and hence remittance outflow, (John, 2018). The literature on remittances and crude oil prices nexus is nascent. Few notable studies conducted on oil-importing and labor exporting countries of Asia have revealed a significant positive relationship between remittance inflow and crude oil prices, (Lueth and Ruiz-Arranz 2007; Mallick 2017). Similarly, studies on labor importing and oil-exporting countries of GCC have also revealed significant positive effects of changing oil prices on remittances outflow, (Naufal and Termos 2009).

The above-discussed arguments have examined the linear (symmetric) relationship between crude oil prices and remittances and ignored the presence of non-linearity. Akcay and Karasoy (2019) urged that oil prices and remittances are asymmetrically associated with each other. They highlighted several factors to explain the asymmetric relationship between oil prices and remittances. First, structural reforms, financial shocks, and policy changes in oil-exporting countries mostly exhibit asymmetric behavior, (Shin et al. 2014). Second, changing crude oil prices can asymmetrically affect macroeconomic aggregates in the host countries due to inertia, hence workers' remittances (Akçay 2019). Third, the asymmetric effect of changing oil prices can occur through sectoral allocation, uncertainty, unemployment, and precautionary savings, (Herrera et al., 2015 and Sek 2017).

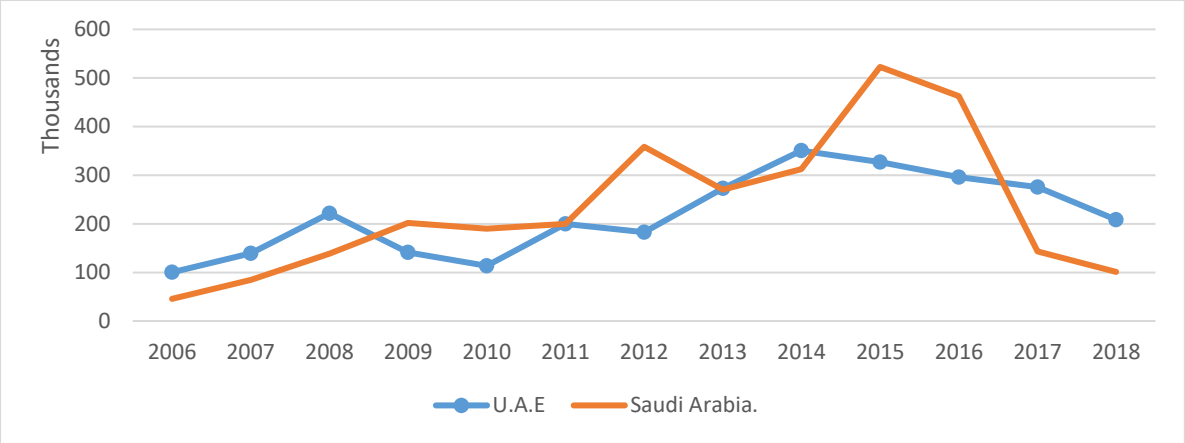
The literature on oil price and remittances flow to Pakistan is nascent with a few studies that have explored only the linear relationship, (Umair and Waheed 2017). This study expands the literature of remittances in Pakistan by exploring the asymmetric impact of changing crude oil prices. Exploration of dynamic asymmetric relationship is important as positive and negative changes in crude oil prices would have a different effect on remittances flow. The rest of this study is organized as follows: Following the introduction in section 1, section 2 provides an overview of international migration and remittances inflow to Pakistan. Section 3 reviews theoretical and empirical literature. Section 4 discusses methodology and data issues, whereas, results are analyzed in section 5. Section 6 concludes the study with policy recommendations.

2. Remittances Inflow to Pakistan

Pakistan is one of the major labor-exporting developing countries due to highly unfavorable economic conditions. Lack of domestic income and employment opportunities have forced millions of Pakistanis to migrate across the globe in search of better income and employment opportunities. These emigrants can be categorized into two groups. The first group comprises highly skilled migrants that have migrated and settled in advance countries, and the second group consists of lower-skilled temporary workers working on oil-rich countries of Gulf Cooperation Council (GCC) i.e. Bahrain, Kuwait, Qatar, Saudi Arabia, Oman, and United Arab Emirates, (Abbas, 2017).

The history of international migration to GCC countries dated back to the formation of the Organization of the Petroleum Exporting Countries (OPEC) in the early 1970s. The increasing crude-oil price has expanded economic activities in oil-exporting GCC countries and increased demand for the international labor force. According to BE&OE (2019), approximately 10.48 million Pakistanis are working abroad, among which 96.5 percent are living in GCC countries. Saudi Arabia and the United Arab Emirates are major destinations for Pakistani emigrants, which are primarily employed in the private sector, such as agriculture, manufacturing, construction, and services. Figure 1 shows the number of people registered for employment in Saudi Arabia and UAE from 2006 up to 2018.

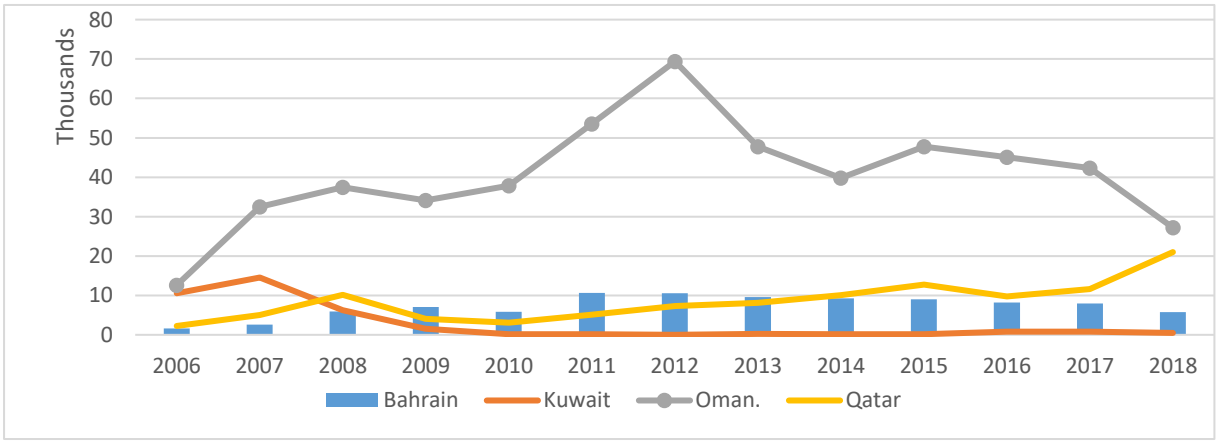
Figure 1 Migration from Pakistan to Saudi Arabia and UAE



Source: data has been collected from the BE&OE (2019).

Figure 1 shows a considerably large increase in international migration from Pakistan toward Saudi Arabia and UAE from 2006 to 2015 along with the considerable distortion after 2015 onward. In 2015, the total registration for employment in Saudi Arabia was 0.523 million; whereas, 0.327 million were registered for employment in UAE, which has reduced to 0.101 million in Saudi Arabia and 0.209 million in UAE during 2018. This sharp reduction in international migration toward Saudi Arabia, UAE, and other GCC countries can be due to a reduction in aggregate economic activities due to a sharp decrease in oil prices. Figure 2 shows international migration from Pakistan toward other GCC countries. Among other GCC countries, Oman is hosting the largest number of Pakistani migrants. Figure 2 reveals that the international migration toward Oman considerably increased from 2006 to 2012 and then drastically reduced to 0.027 million in 2018. Similarly, other GCC countries are also witnessing a sharp reduction in emigration in recent years, except Qatar that is witnessing modest improvement after 2017 onward[1].

Figure 2 Migratints from Pakistan to other GCC countries



[1] The international migration to Qatar has increased after conflict with other GCC countries over the political disputes.

Source: data has been collected from the BE&OE (2019).

The presence of the large Pakistani emigrant in the GCC countries has made it the largest remittance sending region in the world. Remittance inflow to Pakistan from selected GCC countries was 1.293 billion US$ in 1980, which has increased to 12.756 billion US$ in 2016. The recent years have witnessed large distortions in the workers' remittances to 11.376 billion US$ in 2018 from 12.123 billion in 2017. This large reduction in remittances inflow may be, among others, due to the large decrease in international crude oil prices. The imported crude oil price has drastically reduced from the peaked value of 102.58 US dollars a barrel in 2011 to 38.70 dollars a barrel in 2016 and recent years have witnessed a recovery in crude oil prices up to 61.34 dollars a barrel in 2018.

The majority of emigrant workers are from lower-income households of rural Punjab, KPK, Sindh, and Baluchistan, respectively. More than 70 percent of total remittances inflow to Pakistan are directed toward rural areas. The remittances sent by the expatriate workers are a major source of income for these households and source of foreign exchange reserves for the government. Abbas (2019) has argued that the major portion of workers' remittances to Pakistan are utilized to develop human capital (education) and acquire real estate (housing). The literature on the effect of workers' remittances on development has revealed a significant eradication of rural poverty and rural development. Considering a rich data dealing with 40,000 households Imran et al. (2019a) have argued that foreign workers remittances' inflow is lowering the incidence and severity of poverty in all parts of the Punjab province of Pakistan, the largest province of the country having more than 50 percent registered emigrants of Pakistan. Similarly, migrant households have significantly higher development in terms of housing at all populous levels relative to non-migrant households, hence, outward migration can be an important development tool for the country (Imran et al., 2019b). The considerable distortion in the workers' remittances due to changing oil prices and other macroeconomic growth prospects in the host countries has the potential to aggravate the rural poverty level and developments.

3. Review of literature

The behavior of workers' remittances inflow is influenced by a wide range of microeconomic and macroeconomic variables. These determinants can be specific to the economic conditions at home and host countries. The review of literature has identified that the domestic output level, exchange rate, financial development, and cost of capital inflow are important to home country-specific determinants; whereas, important host country-specific variables are categorized as domestic income, employment opportunities, cost of migration, and cost of capital outflow.

Two major theories explain why emigrants send remittances to households at home countries, such as altruistic theory and self-interest theory. According to Akkoyunlu and Kholodilin (2006), these theories can explain the effects of home-country economic conditions on remittance inflow. The altruistic theory urges that the improvements in economic conditions in the home country would reduce

remittance inflow; whereas, the self-interest theory proposes a significant positive effect. Consistent with the argument of altruistic theory, Antoniades, *et al*., (2018) suggested the strategic theory of remittance inflow, which urges for the significant positive effect of the decreasing domestic household income on remittance inflow.

The empirical literature on the relationship between workers' remittances and home-country economic conditions has provided mixed results. Nishat and Bilgrami (1993) investigated the motive behind sending remittances to Pakistan by using survey data of 7061 emigrants that are working in Gulf countries. The findings revealed both altruism and self-interest motives behind sending remittances. Similarly, Waheed and Aleem (2008) found a significant positive effect of remittances on the economic growth of Pakistan in the short-run; whereas, in the long run, a significant negative effect is observed over the period 1981-2006. The findings thus validated the altruist theory of remittances in the long run. In recent studies, Ahmed and Martinez-Zarzoso (2014) investigated domestic and external determinants of remittances to Pakistan from 23 countries by using the Gravity model for the period of 2001-2011. The result revealed that the improvement in economic conditions in the home and host countries have a significant positive effect. Similarly, findings of Abbas (2016) concluded the positive effect of home-country economic conditions and workers remittances to Pakistan from major 12 remittance sending countries, and validated self-interest theory; whereas, Umair and Waheed (2017) found a significant negative effect of economic conditions in the home country for remittances from Saudi Arabia.

The fluctuations in the domestic exchange rate can also affect emigrants' motives to send remittances. Faini (1994) urged that the depreciation of local currency would affect workers' remittances through wealth and substitution effects, which are shaped by the self-interest ad altruistic motives. The depreciation of home currency increases the value of earned foreign currencies and stimulate remittances for self-interest objectives to buy house, land, and other consumer durable assets (Al-Mashat and Billmeier 2012; Abbas et al., 2017; and Akçay and Karasoy 2019). Whereas, if remittances are motivated by the altruistic objectives or repaying loans, a depreciation of home country's currency would reduce the dollar equivalence of loan denominated in domestic currency and reduce remittances that reflect the substitution effect (Yang, 2008; and Ojede et al., 2018). The above-mentioned literature suggests an ambiguous effect of the depreciation of the home country's exchange rate. Esteves and Khoudour-Casteras (2011) have urged that there are two hypotheses, i.e. complementarity and substitutability, regarding nexus between worker remittances and financial development. The complementarity hypothesis urge that the development financial sector would reduce transaction costs and positively affect remittances inflow; whereas, the substitutability hypothesis ascertains that the workers' remittances and financial development of the home country are negatively associated. The empirical studies on Pakistan have revealed a significant positive effect of financial development validating complementarity proposition, (Ahmed and Martinez-Zarzoso 2014; and Umair and Waheed 2017).

The economic conditions in the host countries play an important role in international migration and remittance outflow. The literature on remittances has concluded a significant positive effect of host countries' economic condition and remittances inflow to Pakistan, (Abbas, 2016; Ahmed and Martinez-Zarzoso 2014; and Umair and Waheed 2017). The economic performance of GCC countries despite continuous efforts of diversification, dependent on the demand for crude oil and oil prices. The findings of Umair and Waheed (2017) have revealed an insignificant effect of oil prices on workers' remittances to Pakistan from Saudi Arabia. Moshiri (2015) has urged that oil prices may have an asymmetric effect on economic conditions in oil-exporting countries and argued that with the increase in oil prices government in GCC countries starts large projects, manly social programs that are not only unproductive but also lead to higher inflation. Whereas, with the significant decrease in oil prices, governments in oil-exporting GCC countries find it difficult to reduce public spending on such programs. Instead, governments run a budget deficit that is usually financed by borrowing nationally and internationally. Another major source of nonlinearity, according to Ibrahim (2015), is public regulations and public policy schemes of the price floor and price ceiling of GCC countries that ensures stable and low prices for basic services and food items[2]. Moreover, the price of many items, i.e. oil prices, are fixed by the central governments, which are causing an asymmetric effect on domestic economic conditions.

The asymmetric response on change in crude oil prices on economic conditions of GCC countries also asymmetrically affect international migration and remittances outflow. Akçay (2019) has investigated the asymmetric effect of crude oil prices and remittances outflow from Oman from 1975 to 2015 by using asymmetric autoregressive distributed lag (ARDL) model and validated the asymmetric effect of changes in crude oil prices and remittances outflow from Oman in both short-run and long run. Akçay and Karasoy (2019) have examined the asymmetric effect of oil prices on international remittances inflow to India by using a non-linear autoregressive distributed lag (NARDL) model from 1975 to 2017. The findings have revealed that changes in oil prices and remittances are asymmetrically associated. As compare to positive effects, negative oil price shocks have a more profound effect on remittances to India in the long run.

The review of above-discussed empirical literature has identified various microeconomic and macroeconomic factors that affect remittances and showed no reliable empirical study on the asymmetric effect of oil prices on workers' remittances to Pakistan. This study extends the literature exploring both symmetric and asymmetric effect of crude oil price shocks on workers' remittances inflow to Pakistan from GCC countries.

[2] The GCC countries are giving subsidies aiming to distribute oil wealth with its population and support private sector to ensure stable and cheap supply of basic services and food items, (Iriani and Trabelsi, 2015).

4. Methodological framework

This section discusses model specification, estimation strategy, and data used to explore the behavior of workers' remittances inflow to Pakistan from GCC countries, i.e. Bahrain, Kuwait, Qatar, Saudi Arabia, Oman, and the United Arab Emirates over the period 1980 - 2018.

4.1. Model specification

This study explores the asymmetric impact of changing crude oil prices on workers' remittances to Pakistan from GCC countries. The review of the abovementioned theoretical and empirical literatures have identified economic conditions in remittance sending and receiving countries along with the oil prices, exchange rate, foreign relations, and financial development as important determinants of remittances flow. Following Lueth and Ruiz-Arranz (2007); Umar and Waheed (2017); Akcay and Karasoy (2019a); Akcay and Karasoy (2019b), this study constructed an eclectic model for remittances inflow that incorporated oil prices along with the other explanatory variables, which is as presented as:

$$LREM_{ijt} = a_0 + a_1 Oil_{it} + a_2 LGDP_{it} + a_3 LGDP_{jt} + a_4 BT_{ijt} + a_5 ER_{ijt} + a_6 FD_{it} + \mu_{it} \quad (1)$$

Where LREMij is the logarithm of workers' remittances to Pakistan from GCC countries; OILi is the price of imported crude oil; LGDPi is the logarithm of the gross domestic product of Pakistan; LGDPj is the logarithmic value of gross domestic products of GCC countries; BTij is total bilateral trade which proxy's between Pakistan and GCC countries as a percentage of Pakistani GDP; ERi is the official exchange rate of Pakistan, and FDi is the proxy of financial development in Pakistan.

The price of crude oil (OIL) plays an important role in the economic growth and development of oil-dependent GCC countries, therefore an increase in oil price is assumed to have a significant positive effect on remittances inflow. The gross domestic product of the home country (GDP_i) indicates aggregate economic activities and employment opportunities at Pakistan, which according to altruistic proposition would reduce workers' remittances and increase remittances inflow according to self-interest theory. The GDP of GCC countries (GDP_j) is used as a proxy of their economic growth and development, which is expected to have a positive effect on remittances inflow. Bilateral trade with GCC as a percentage of GDP (BT_{ij}) has been taken as a proxy for foreign trade relations, which according to Umair and Waheed (2017) would facilitate international migration and remittances inflow. The deprecation of the bilateral exchange rate (ER_{ij}) of Pakistani Rupee in terms of one unit foreign currencies increases the purchasing power of foreign income, which according to the wealth effect increases remittances inflow and reduces remittances due to the substitution effect. There are several measures of financial development that have been used in the literature, such as the size of the stock market to GDP, the share of private sector credit to GDP, and the expansion of monetary base in the

home country, and this study following Umair and Waheed (2017) used monetary growth as a proxy for financial development. The development of financial deepening according to complementarity hypothesis would enhance remittances; whereas, the substitutability hypothesis ascertains that the workers' remittances and financial development of the home country are negatively associated.

4.2. Estimation strategy

The panel data merges cross-sectional observations over an extended period and gives more informative data with greater degrees of freedom. The panel data usually exhibit properties and problems of both time series and cross-sectional data. Like time series data, panel data also exhibit unit root problem and regression analysis of non-statonary series can result in bais estimates. Moreover, this study aims to explore long run symmetric and asymmetric relationship of crude-oil prices along with other explainatory variables on remittances inflow to Pakistan from GCC countries. The existence and nature of unit root provide an important informations regarding selection of panel estimation techniques.

Selected variables are first subjected to panel unit root analysis to explore the existence of unit root and order of integration. There are various types of panel unit root analysis, which can be categorized into two groups. The first group of panel unit root analysis is highly restrictive with the assumption of common unit root across all cross-sections; whereas, the second group is less restrictive and more powerful as it allows heterogeneities in the unit root process. The panel unit root test proposed by Levin et al (2002) can be categorized into the highly restrictive first group; whereas, the panel unit root test of Im, Pesaran, & Shin (2003) can be categorized into the less restrictive group. This study employed both types of unit root tests to explore the existence of unit root and order of integration.

4.2.1. Panel Pooled Mean Group Analysis

Various panel estimation techniques can be used when underlined variables will exhibit different order of integrations, i.e. I(0) and I(1), such as ordinary least square technique, panel fixed-effect model, panel random effect model, and panel ARDL model. These traditional panel regression techniques differs in the treatment of cross sectional specific heterogeneities and do not provide any information regarding the long run and short-run effects. The panel autoregressive distributed lag model (ARDL) approach to cointegration analysis, proposed by the Pesaran et al (2001), provides both short-run and long-run estimates, but is ineffective to address the short-run heterogeneities.

To address above-discussed problem associated with the panel ARDL model, Pesaran *et al*. (1999) introduced panel pooled mean group estimates (PMG) technique that provide homogenous long-run estimates along with the dynamic short term heterogeneities. The PMG estimates of ARDL model has superior explanatory power over the alternatives and widely accepted to explore dynamic short run and long-run relationships among variables with a different order of integrations. This study employed both linear and non-linear panel PMG estimation technique to explore the effects of oil prices along

with other explanatory variables on workers' remittances to Pakistan from GCC countries. The optimum lag length of the variables is selected based on the minimum values of the Schwarz Bayesian criterion by allowing the maximum lag length of 2.

Following Pesaran *et al*. (1999), the estimated version of equation 1 in the form of panel PMG estimates of panel ARDL model can be presented as:

$$\begin{aligned}\Delta LREM_{ijt} = {} & a_{0i} + \delta_1 LREM_{ijt-1} + \delta_2 OIL_{it-1} + \delta_3 LGDP_{it-1} + \delta_4 LGDP_{jt-1} + \delta_5 LER_{it-1} \\ & + \delta_6 BT_{ijt-1} + \delta_7 FD_{it-1} + \sum_{k=1}^{n} \beta_1 \Delta LREM_{ijt-k} + \sum_{k=0}^{2} \beta_2 OIL_{it-k} \\ & + \sum_{k=0}^{2} \beta_3 \Delta LGDP_{it-k} + \sum_{k=0}^{n} \beta_4 \Delta GDP_{jt-k} + \sum_{k=0}^{n} \beta_5 \Delta BT_{ijt-k} + \sum_{k=0}^{n} \beta_6 \Delta ER_{it-k} \\ & + \sum_{k=0}^{n} \beta_7 \Delta FD_{it-k} + \mu_{\text{it}} \quad (2)\end{aligned}$$

Where k indicates numbers of optimally selected lags with maximum lag length allowed is 2 lags. The negative sign and significance of the cointegration equation will reveal the convergence of short term disturbances and the existence of cointegration. Given, the asymmetric nature of relationship between changing crude oil prices on economic conditions and remittances outflow. This study employed a nonlinear autoregressive distributed lag model (NARDL) version of the PMG estimation technique. The asymmetric series of the oil prices are generated by decomposing into positive and negative components, as presented in Equation 3.

$$OIL_{it}^{+} = \sum_{i=1}^{t} OIL_i^{+} = \sum_{i=1}^{t} \max(OIL_i, 0) \; ; \; OIL_{it}^{-} = \sum_{i=1}^{t} OIL_i^{-} = \sum_{i=1}^{t} \min(\Delta OIL_i, 0) \qquad (3)$$

The decomposed components of crude oil prices are then introduced to Equation 2 and subjected to nonlinear PMG model, which is an extension of the symmetric PMG model. The employed unrestricted/unconstrained asymmetrical PMG model is presented as follows:

$$\begin{aligned}\Delta LREM_{it} = {} & a_{0i} + \delta_1 LREM_{t-1} + \delta_2 OIL_{it-1}^{+} + \delta_3 OIL_{it-1}^{-} + \delta_4 LGDP_{it-1} + \delta_5 LGDP_{jt-1} + \delta_6 LBT_{ijt-1} \\ & + \delta_7 ER_{ijt-1} + \delta_8 FD_{it-1} + \sum_{k=1}^{2} \beta_1 \Delta LREM_{ijt-k} + \sum_{k=0}^{2} \beta_2 \Delta OIL_{it-k}^{+} \\ & + \sum_{k=0}^{2} \beta_3 \Delta OIL_{it-k}^{-} + \sum_{k=0}^{n} \beta_4 \Delta GDP_{it-k} + \sum_{k=0}^{2} \beta_5 \Delta LGDP_{jt-k} + \sum_{k=0}^{2} \beta_6 \Delta BT_{ijt-k} \\ & + \sum_{k=0}^{2} \beta_7 \Delta ER_{ijt-k} + \sum_{k=0}^{2} \beta_8 \Delta FD_{it-k} + \mu_{\text{it}} \quad (4)\end{aligned}$$

The coefficients of positive and negative innovation of crude oil prices would reveal the prevalence of both long term and short term asymmetric relationship between crude oil prices and workers' remittances from GCC countries. If the effect of both innovations is the same, i.e. then the asymmetric PMG model will reduce to symmetric PMG model. Moreover, the spread of positive and negative

innovation also reveals the asymmetric nature of the response. The stability of estimated parameters of the asymmetric model is explored by using the cumulative sum of recursive residuals (CUSUM) test and CUSUM of squares residual test.

5. Analysis of results

5.1. Preliminary investigation

The data for this study are taken from various national and international databases. The data of remittances flows to Pakistan from selected GCC countries in million US dollars have been collected from the Govt. of Pakistan (2019). Annual data of imported crude oil prices are collected from the US Energy Information Administration, https://www.eia.gov/petroleum/data.php. The data of bilateral trade flow (exports + imports) are collected from the Direction of Trade statistics, published by the International Monetary Fund; whereas, data of other explanatory variables are collected from World Development Indicators, published by the World Bank (2019). The average value of remittances to Pakistan from GCC countries and oil prices are presented in Table 1.

Table 1 Average remittances inflow to Pakistan and crude oil prices (1980-2018)

Periods	Remittances Inflow to Pakistan, million US$							Crude Oil Price
	Bahrain	Kuwait	Qatar	Saudi Arabia	Oman	UAE	Average	
1980-85	44.87	175.36	68.33	1172.91	127.28	277.02	310.96	31.62
1985-90	45.32	180.83	40.82	849.63	115.68	222.09	242.39	17.30
1990-95	31.43	59.64	15.24	566.37	62.35	132.59	144.60	17.91
1995-00	32.55	72.61	12.28	429.82	54.18	164.19	127.61	18.88
2000-05	56.01	160.22	53.63	460.64	77.66	492.55	216.78	30.99
2005-10	128.87	335.33	217.20	1188.29	200.24	1185.47	542.57	67.09
2010-15	253.38	595.23	329.96	3789.88	434.76	2929.44	1388.77	85.60
2015-18	397.38	765.03	376.65	5481.83	730.83	4321.03	2012.12	48.84
Average	111.93	272.33	129.49	1593.78	204.12	1077.69	564.89	39.92
Minimum	23.87	15.12	7.57	304.43	38.11	97.76	7.57	12.07
Maximum	448.40	774.20	404.40	5968.30	819.40	4365.30	5968.30	102.58

Table 1 reveals that a continuous decrease in imported crude oil prices from 31.62 dollars a barrel in 1980-85 to 18 dollar a barrel in 1995-2000 and then increased up to 2010-15 before decreasing again from 2015 to 2018. Following the pattern of changing oil prices, the average remittances inflow to Pakistan from GCC countries also reduced from 310.96 million in 1980-85 to 127.61 million in 1995-2000 and then exponentially increased to 1388.77 million US$ in 2010-15. Following a sharp decline in oil prices, remittances inflow also reduced to 2012.12 million during 2015-18. After descriptively analyzing the relationship between changing crude oil prices and workers' remittances from GCC

countries, this study proceeds with the exploration of stationarity level to explore the existence of cointegration.

Table 2. Result of panel unit root test

	Common root: Levin, Lin, Chu				Individual root: Im, Pesaran, Shin			
	I(0)		*I*(1)		*I*(0)		*I*(1)	
	C	*C & T*	*C*	*C & T*	*C*	*C & T*	*C*	*C & T*
$LREM_{ijt}$	1.883	0.544	-5.085*	-4.438*	3.152	2.903	-9.529*	-8.824*
Oil_{it}	0.610	0.777	-3.411*	-4.376*	0.582	0.156	-11.359*	-10.129*
$LGDP_{jt}$	1.943	0.517	-14.516*	-14.18*	5.298	1.382	-12.294*	-11.703*
$LGDP_{it}$	2.532	-1.362***	-9.252*	-8.046*	5.100	-0.267	-10.052*	-9.358*
BT_{ijt}	-0.752	-0.855	-16.332*	-12.740*	-1.543***	-1.576***	-16.072*	-12.199*
ER_{it}	7.082	1.994	-3.288*	-2.546*	9.890	2.904	-6.030*	-6.069*
FD_{it}	-0.537	-6.198*	-12.515*	-11.571*	1.411	-3.905*	-10.574*	-9.243*

Source: Author's estimation. Note: * shows significance at the 1 percent level; **is significance at 5 percent

The estimated result of panel unit root analysis is reported in Table 2 revealed that among selected variables workers remittances, oil prices, and gross domestic product of the home country, and the exchange rate of the home country has a unit root at their level and become stationary at the first difference, whereas, other variables are stationary at their level. The varying order of integration restricts this study to proceed with the analysis of traditional cointegration analysis.

5.2. Pooled Mean Group Estimator

This study reported result of both linear and non-linear PMG model estimates to examine sensititivty of other explainatory variables to change in estimation techniques. The estimatated results are presented in Table 3.

Table 3. Result of panel mean group estimation

Dependent variable: $LREM_{ijt}$

Variable	Symmetric PMG estimaion			Asymmetric PMG estimation		
	Coef.	t-Stat.	Prob.*	Coeff.	t-Stat.	Prob.*
Oil_{it}	0.022	4.414	0.000	-	-	-
OIL_{it}^{+}	-	-	-	0.023	7.380	0.000
OIL_{it}^{-}	-	-	-	-0.001	-0.271	0.787
$LGDP_{jt}$	1.167	2.961	0.004	1.608	4.316	0.000
$LGDP_{it}$	-0.973	-5.590	0.000	-0.759	-7.772	0.000
BT_{ijt}	0.389	1.921	0.056	0.209	1.896	0.060
ER_{it}	0.064	5.049	0.000	0.022	2.343	0.020
FD_{it}	0.138	5.179	0.000	0.095	6.058	0.000

Coint. Eq.	-0.202	-11.754	0.000	-0.309	-7.063	0.000
ΔOil_{it}	0.006	1.615	0.108	-	-	-
ΔOIL_t^+	-	-	-	0.003	0.642	0.522
ΔOIL_t^+	-	-	-	-0.006	-1.946	0.053
$\Delta LGDP_{jt}$	-0.142	-0.342	0.733	-0.140	-0.378	0.706
$\Delta LGDP_{it}$	0.554	1.957	0.052	0.545	1.750	0.082
ΔBT_{ijt}	-0.094	-0.676	0.500	-0.116	-0.683	0.495
ΔER_{it}	-0.026	-10.065	0.000	-0.024	-10.298	0.000
ΔFD_{it}	-0.015	-1.103	0.073	-0.011	-1.200	0.232
Constant	5.509	11.662	0.000	7.339	6.905	0.000

Mean dependent var.	0.057	0.054
S.E. of regression	0.220	0.221
Sum squared resid.	8.732	8.165
Log-likelihood	71.326	76.275
S.D. dependent var.	0.293	0.296
Akaike info criterion	-0.148	-0.134

Source: authors' estimation

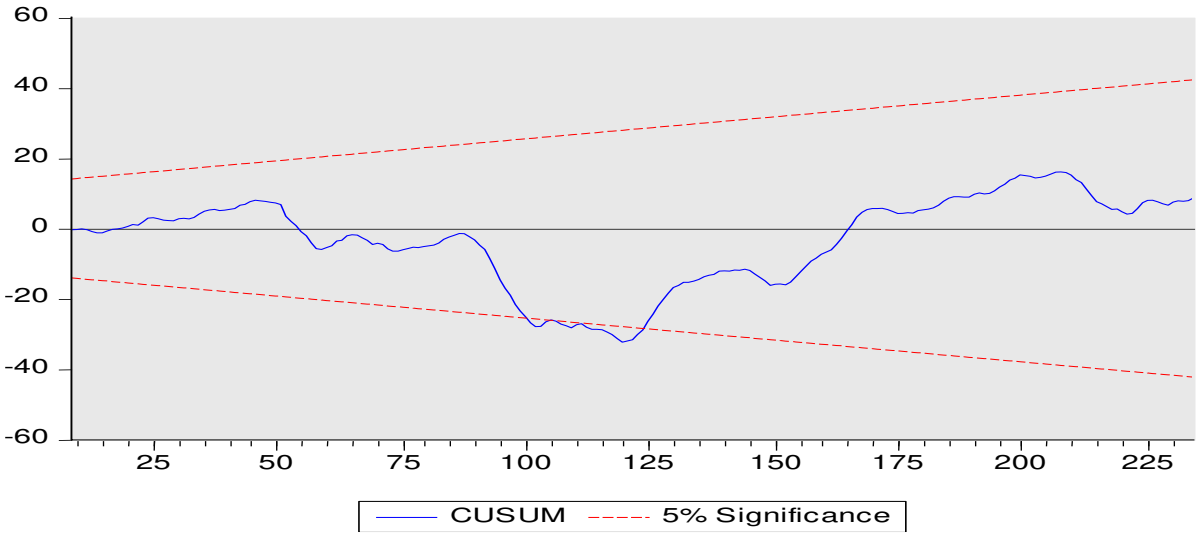
The estimated results of symmetric ARDL estimates of the Pooled Mean Group model have revealed that the increasing crude oil prices have a significant positive effect on remittances flow to Pakistan from selected GCC countries in long run; whereas, in the short-run positive insignificant effect is observed. The findings thus validate the inter-dependence of workers' remittances and oil prices. Estimated results of the nonlinear PMG model reveal that the positive and negative innovations of oil prices have an asymmetric impact on remittances flow. In the long run, the positive innovation of oil prices reveal a significant positive effect on remittance flow, and negative innovation shows an insignificant negative effect. Whereas, in the short run, rising crude oil prices exhibit an insignificant effect, and falling oil prices indicate a significant negative effect. It implies that the increasing oil prices will induce workers' remittances to Pakistan from GCC countries in the long-run; whereas, decreasing oil prices can distort remittances inflow only in the short run.

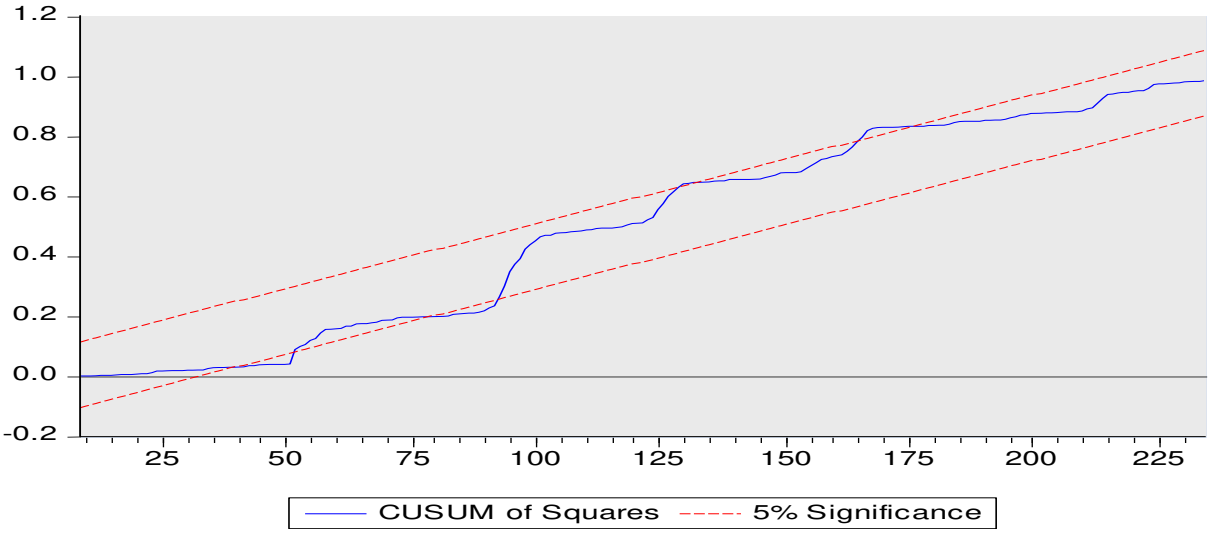
The estimated results of other explanatory variables show that the economic condition of the host countries has a significant positive effect of higher intensity in the long run and insignificant effect in the short run. It implies that a one percent increase in the GDP of host countries can enhance remittances by 1.17 percent. Whereas, the economic condition of the home country has revealed a significant negative effect of high intensity in the long run with a significant positive effect of lower intensity in the short run. This finding is consistent with Umair and Waheed (2017). The estimated result thus validated the altruistic motives of sending remittances in the long run and self-interest motives in the short run. Consistent with the result of Umair and Waheed (2017), the finding of bilateral trade relations reveals a significant positive effect in the long run and insignificant effect in the short

run. The estimated result of the bilateral exchange rate reveals a significant positive effect in the long run and a negative effect in the short run. It implies that the depreciation of the bilateral exchange rate is following the income effect proposition in the long run and substitution effect proposition in the short run. Whereas, the estimated results of financial deepening reveal a significant positive effect in the long run and insignificant effect in the short run. The findings are consistent with the Umair and Waheed (2017) and validate the complementarity hypothesis in the long run. The findings of symmetric and asymmetric PMG model estimates are same, which validate the robustness of established relationships.

The error correction term, as presented by Coint. Eq. equation, reveal a significant negative effect, which validates the existence of cointegration in both the model. The coefficient of Coint. Eq. shows that approximately 20.2 percent of short term disturbances of the linear PMG model and 30.9 percent of short term shocks of the nonlinear PMG model are converging to equilibrium in a year. The findings thus validated the efficiency of nonlinear PMG model estimates over the linear PMG model estimates. The stability of the estimated non-linear PMG model is explored by using CUSUM and CUSUM of the square test. Figure 3 validated the stability of the established non-linear relationship.

Figure 3. Result of CUSUM AND CUSUM OF SQUARE test





Source: Author's construction

6. Concluding remarks

Pakistan is the remittance dependent country due to unfavourable economic and trade performance. Workers' remittances have a significant impact on the Pakistani economy. This study explores the symmetric and asymmetric effect of crude oil prices along with other explanatory variables on remittances inflow to Pakistan from GCC countries, over the period 1980 - 2018, by employing advance panel nonlinear Pooled Mean Group (PMG) model, proposed by the Pesaran et al (1999). The variable for short-term and long-term asymmetries is created by decomposing changing crude-oil price into positive and negative partial sum.

The estimated result of the linear PMG model has revealed a significant positive effect of crude-oil prices on remittance inflow in the long run; whereas, in the short run insignificant effect is observed. The estimated results of the panel asymmetric PMG model have revealed that the rising crude-oil prices have a significant positive effect only in the long run; whereas, falling crude-oil price reduces workers' remittances only in the short-run. It implies that the positive innovation in crude-oil price will enhance the inflow of remittances in the long run; whereas, negative innovation will reduce remittance inflow in the short run. The findings thus validated the asymmetric effect of crude oil prices on workers' remittances inflow to Pakistan from selected GCC countries. The findings of other explanatory variables have revealed that economic conditions of the host countries, depreciation of domestic exchange rate, bilateral trade relations, and financial development of the home country have significant positive effects on remittance inflow in the long run; whereas, the economic condition of the home country has portrayed significant negative impact.

The following policy implications have emerged from this study. The oil-exporting GCC countries should stabilize oil prices by formulating long term stabilizing policies as decreasing oil prices can adversely affect economic growth activities in oil-exporting countries, which in turn reduce migration and remittances to labour-exporting developing countries. The recent crude-oil shock have considerably reduced emigrants of Pakistan in GCC countries along with dramatic reduction in remittances flow. Pakistan should utilize expertise of expatriate workers by enhancing domestic economic development activities. The reduction in crude-oil prices would have a short term effect on international migration and remittance flow and will along with the recovery of crude-oil prices. Pakistan should increase skills and productivity of human capital through training programs, develop financial sector, reduce cost of remittances flow through official channel, and stabilize exchange rate fluctuation to enhance remittance inflow.

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