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6

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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE Does inflation reduce remittance outflows in Saudi Arabia?

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economics & finance

Bashier Al-Abdulrazag¹ and Musa Foudeh²*

Abstract: This study examines the potential relationship between inflation and remittance outflows in Saudi Arabia over the period 1971-2019 by applying the autoregressive distributed lag (ARDL) model. As a pioneering study in Saudi Arabia, the paper addresses an important literature gap. The statistical tests reveal the model's reliability and the existence of a long-run equilibrium among the variables. Moreover, the empirical results show a significant negative impact of inflation has on remittance outflows, and the short-run and long elasticities of remittance with respect to inflation are 0.26% and 0.32% respectively. These results suggest that despite the weak elasticity of remittance outflows to the inflation rate, an increase in general prices would reduce remittance outflows in Saudi Arabia. Moreover, we find that the capital investment indicator has a more significant effect on the volume of remittance outflows. Therefore, policymakers in Saudi Arabia should apply appropriate actions to reduce the outflows of foreign workers by urging private companies to hire more Saudi workers, increasing capital investment and encouraging foreign workers, especially those with high incomes, to invest in Saudi Arabia by facilitating their ownership of financial market shares and real estate units.

Subjects: Middle East Studies; Economics and Development; Economics

Keywords: Saudi Arabia; remittance outflows; inflation; autoregressive distributed lags model; cointegration

JEL Classifications: 053; 040; C21

1. Introduction

It is well documented in the economic literature that international migration plays a considerable role in both labor-sending and labor-receiving countries (Javid & Hasanov, 2022). Regarding

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sending countries, labor migration is due to wage differentials, unemployment, and poverty, among other factors. Hence, labor migration helps to mitigate unemployment and improve the balance of payments. The Saudi Arabian economy depends heavily on oil. In addition, it is amongst the largest oil producers and exporters in the world, with a daily average of 9.3 million barrels of total world exports (World Energy Outlook, 2019). For decades, Saudi Arabia has been one of the most attractive host countries for labor migration, due both to its high oil revenues and its chronic shortage of skilled and unskilled domestic labor. The surge in oil revenues stimulated the Saudi government's ambitions to boost various targeted development plans by increasing government spending. As a result, various economic activities have experienced growth, such as the industrial, education, and transportation sectors.

The booming Saudi economy has attracted a large flow of international workers since the 1970s. Migrant workers represent, on average, about 30% of KSA's total population (see, Table 2 in Section 4). This proportion increased from 4% in the early 1970s to 38% in 2018, and migrants' labor market share increased to reach about 76% in 2019 (GAS, 2019). The increase of migrant workers is associated with a considerable volume of remittance outflows from sending economies, since they remit a large portion of their income to their home country. Saudi Arabia is among the highest remittance-sending countries, ranking third in the world after the United States of America and the United Arab Emirates (World Migration report, 2020, page 37). In 2018, KSA remittance outflows reached 33.9 billion USD, representing 4.31% of (GDP), compared with a maximum of 38.787 billion USD in 2015 (see, Table 2 in Section 4).

In oil-exporting countries, oil prices play a major role at the macroeconomic level. Hence, higher oil prices may cause a short and long run surge in inflation rates. Moreover, increases in global oil prices are expected to generate fiscal surpluses, which would encourage the Saudi government to significantly increase its public spending, stimulating domestic aggregate demand and raising the level of general prices. According to our analysis, this may lead to a decline in remittance outflows, since, foreign expatriates increase their spending on goods and services to maintain the same level of living in host countries.

While remitting countries have received little attention due to their small relative contribution to GDP, a considerable number of applied studies on remittance flows have heavily focused on the flows' impact on labor-sending countries (Balderas & Nath, 2008; Cazachevici et al., 2020; Kadozi, 2019; Khan & Islam, 2013; Lastovetska, 2017; Meyer & Shera, 2017; Narayan et al., 2011; Opperman & Adjasi, 2019; Rao & Hassan, 2011). Naufal and Genc (2018) noted that recent research on remittance outflows has focused on examining their macroeconomic impact on remittance-sending countries (Al-Kaabi, 2016; Alkhathlan, 2013; Edrees, 2016; Haddad & Choukir, 2017; Rahmouni & Debbiche, 2017; Salameh & Aldaarmi, 2019; Termos et al., 2013).

Regarding the Gulf Cooperation Council (GCC) countries, very little applied research has examined the association between remittance outflows- oil price fluctuations nexus in the GCC region. For example, for the GCC countries, Termos et al. (2013), found a negative association between remittance outflows and inflation rate; Naufal and Termos (2009) found a weak elasticity (0.4) of remittance outflows to oil prices; Ratha et al. (2015) found a statistically small positive effect (0.1) on remittance outflows; and, more recently, De et al. (2019) found that a sharp decline in oil prices was associated with a modest decline in remittance outflows in GCC countries in 2016 and 2017. Moreover, Taghavi (2012) reported a unidirectional causality running from remittances to inflation. In contrast, Al-Kaabi (2016) found that inflation was irresponsive to the growth of remittance outflows and was negative only for Bahrain. Although migrant remittances do not have adverse effects in the GCC countries, as they do not account for a significant share of GDP, Termos et al. (2013) stated, "The staggering amount of remittances fleeing the GCC region during economic upturns seems to play a stabilizing role as a tacit monetary policy tool reducing inflationary pressure in these economies." For Saudi Arabia, Haddad and Choukir (2017) confirmed the main finding of Termos et al. (2013). However, as oil prices start to fall and reach their lowest levels, the high share of remittances could negatively influence the balance of payments and, thus, aggregate demand, posing a serious problem for policymakers. Therefore, reducing remittance outflows in GCC countries is of great importance. This can be achieved by studying the determinants of remittance outflows (e.g., inflation rate) in remitting countries. A high general price level in remitting countries could increase expenditures and thus reduce remittance outflows.

This paper is motivated by the concern of policymakers in KSA, a remitting country, regarding the volume of remittance outflows, which constitute a considerable share of GDP. In addition, remittance outflows are considered a drain on foreign reserves. For KSA, the trend of the percentage of remittance outflows is increasing despite fluctuations in certain years, and their volume reached about 33.5 billion USD in 2019. Moreover, applied research on remittance outflows in Saudi Arabia provides evidence on their negative impacts on financial development (Al-Abdulrazag & Abdel-Rahman, 2016) and economic growth (Alkhathlan, 2013) among others. These negative impacts are expected to slow investment activities in Saudi Arabia. This behavior of remittance outflows has raised concerns among policymakers in KSA about the potential negative impacts on Saudi economy.

The main finding of this paper is that the inflation rate has significant long-run and short-run negative impacts on remittance outflows. Regarding control variables, we find that economic growth has a significant positive effect, whereas capital investment and trade openness exert negative effects on remittance outflows. The estimation results show that, after a sudden shock, about a year and a quarter is required for the model to restore its long-run equilibrium (as indicated by the ECM term).

The present study contributes to the existing applied literature in several ways. First, the existing literature focuses heavily on the determinants and effects of remittance flows in the context of receiving countries rather than sending countries. Consequently, the factors affecting the volume of sending countries' remittance outflows have received less attention from both policymakers and researchers. For example, Al-Abdulrazag and Abdel-Rahman (2016) and Alkhathlan (2013) examined their adverse impacts on selected macroeconomic factors in Saudi Arabia, such as economic growth, monetary policy, and inflation. It is clear that very few researchers have studied the inflation—remittance outflows nexus in Saudi Arabia. Thus, this study represents a pioneering effort to fill this gap in the existing literature. It examines the long-run and short-run impacts of inflation on remittance outflows by applying the ARDL estimation method and the H. Y. Toda and Yamamoto (1995) approach to annual data. In addition, it suggests some policy implications that would be useful to KSA policymakers to reduce the volume of remittance outflows and their adverse impacts on the Saudi economy.

We used the ARDL model to test the hypothesised long-run negative relationship between inflation rate (INF) and remittance outflows in KSA over the period 1971–2019. The research's importance relies on the fact that it takes place in the midst of the Saudi government's new policy —Vision 2030—to cut down the number of foreign workers and increase the dependence on local labor, which suffers from unemployment, and hence, reduce remittance outflows.

The structure of the study is as follows. Section 2 surveys the most relevant empirical literature. Section 3 describes the data and methodology. Section 4 contains estimation results, followed by the discussion section. Finally, conclusions and policy recommendations are presented in Section 6.

2. Key findings of previous empirical literature

The increasingly important economic role of remittances has attracted the attention of applied researchers, who have studied their impacts on various economic activities. A review of applied empirical studies of remittance flows clearly shows that most applied work has focused on the flows' adverse impact on key macroeconomic and microeconomic variables in receiving countries

rather than sending countries. Moreover, extensive empirical work has applied modern estimation techniques using time-series and panel data. For example, such studies have examined economic growth (Al-Kaabi, 2016; Alkhathlan, 2013; Edrees, 2016; Kadozi, 2019, 2019; Makhlouf & Kasmaoui, 2017; Meyer & Shera, 2017; Rahmouni & Debbiche, 2017; Salameh & Aldaarmi, 2019). Others have investigated inflation, (Haddad & Choukir, 2017; Iqbal et al., 2013; Khan & Islam, 2013; Narayan et al., 2011; Termos et al., 2013); trade openness (Ebeke, 2011; R. R. Kumar, 2012); financial development (Aslam & Selliah, 2020;; ; Al-Abdulrazag & Abdel-Rahman, 2016); and imports (Al-Abdulrazag, 2018); among others.

Generally, the applied work is in two strands. The first strand focuses heavily on the laborsending (remittance-receiving) countries. The second strand, which receives less attention, focuses on the labor-receiving (remittance-sending) countries. Termos et al. (2013) suggested that the reason for the gap between the two strands is the relatively insignificant contribution of emittance outflows to the GDP of most remitting countries. Nevertheless, Saudi Arabia emerges as a remarkable exception, with remittances making up a large share of GDP.

The applied work mostly covers several dimensions including economic growth, inflation, financial development, trade openness, and imports. Regarding the relationship between remittance flows and economic growth, the results were mixed. However, they tended toward positive association, as Cazachevici et al. (2020) pointed out in a meta-analysis: approximately 40% of these studies reported a positive effect, approximately 20% reported a negative effect, and approximately 40% reported no significant impact.

The relationship between remittance outflows, inflows, and economic growth has been the subject of a vast body of empirical work. By ignoring endogeneity issues, time-series studies reported systematically larger effects of remittances on growth, and the results were mixed. Whereas, some researchers, including Rapoport and Docquier (2005), De et al. (2019), Ratha et al. (2015), and B. Kumar (2021), report a positive and significant impact. However, Salameh and Aldaarmi (2019), Al-Kaabi (2016), Alkhathlan (2013), and Abdel-Rahman (2006) found a negative relationship in Saudi Arabia. In contrast, Rahmouni and Debbiche (2017) revealed an insignificant impact in Saudi Arabia.

As for other countries, Kadozi (2019) found an insignificant impact of remittances on GDP in the region of Sub Saharan Africa, except in Rwanda concerning the period 1980–2014. Bouoiyour et al. (2019) showed that the effect of remittances on GDP in Tunisia varies with time. Meyer and Shera (2017) showed a positive relationship in Albania, Bulgaria, Macedonia, Moldova, Romania and Bosnia Herzegovina during the period 1999–2013. While Lueth and Ruiz-Arranz (2006), Bettin et al. (2017), and Lianos (1997) found that remittance inflows to the recipient countries respond positively to the GDP of the host country, Sayan (2004) and Panda and Trivedi (2015) indicated that remittance inflows in Turkey respond negatively to German GDP. However, Ahmed and Inmaculada (2014) found that the GDP of the host country has an insignificant effect on remittances. In a more general result, Panda and Trivedi (2015) revealed that global GDP exerts a positive impact on remittance inflows.

Another stream of research focused on the remittances-trade openness nexus. Ebeke (2011) found a significant negative impact of trade openness on the cyclicality of remittances; remittances are countercyclical, and this effect increases as trade openness increases. Vanuatu and R. R. Kumar (2012) found that greater openness could boost remittances.

Focusing on the literature related to the remittance outflows-inflation nexus for labor-receiving countries, the results are mixed. Makhlouf and Kasmaoui (2017), Narayan et al. (2011), Panda and Trivedi (2015), Lueth and Ruiz-Arranz (2006), Lianos (1997), Iqbal et al. (2013), Khan and Islam (2013), and Taghavi (2012) found that, in Saudi Arabia, inflation is positively influenced by remittance outflows. In addition, a negative relationship was reported by Barua et al. (2007), Termos et al. (2013), and Haddad and Choukir (2017).

Regarding financial development, Gupta et al. (2009) and Aggarwal et al. (2011) found that remittance inflows promote the financial development of recipient countries by raising the level of deposits and credit intermediated by the local banking sector. On the one hand, Ezeoha (2013) identified a positive impact of financial development on remittances, especially in developing economies. While, Al-Abdulrazag and Abdel-Rahman (2016) found a negative effect of financial development on remittance outflows from Saudi Arabia.

To this end, the abovementioned literature on the remittance outflows-major macroeconomic variables nexus has produced mixed results spanning from positive to insignificant impacts. These different results are due to differences in country-specific or cross-country factors, research estimation techniques, data types, or the time span of the data. For Saudi Arabia, the remittance outflows-inflation nexus has received little attention. Instead, the literature has focused on the impact of variables other than remittance outflows, such as oil prices and inflation, in remittance-receiving countries. Hence, this paper contributes to examining the remittance outflows-inflation nexus in the context of Saudi Arabia, thus bridging this empirical gap.

3. Conceptual framework, econometric model and methodology

The relationship between the inflation rate and remittance flows has been conceptualized theoretically in the economic literature in various approaches. For example, Javid and Hasanov (2022) tackle this relationship through labor demand and labor supply functions. They show through a demand function that marginal productivity equals the wage rate in profit maximization. In addition, through the utility function of labor supply, remittance outflows depend on price level along with other factors, such as GDP in the host country. They argue that price increases lead to extra expenditure on consumption, hence forcing foreign workers to reduce their remittances.

The Saudi Arabian economy is an open economy. The total production at the equilibrium point:

 $\mathsf{C}+\mathsf{I}+\mathsf{G}+\mathsf{X}-\mathsf{M}=\mathsf{G}\mathsf{D}\mathsf{P}$

Where:

C: Consumption,

I: Investment,

G: Government public expenditure

X-M: Net exportation

Consumption and government expenditures are the two main components of the demand side through which remittances are affected. As it has been mentioned before, millions of foreigners work and live in Saudi Arabia. They represent, on average, about 30% of KSA's total population (See, Table 2 in Section 4). Hence, foreigners represent a significant share of households in KSA. The total annual amount of their remittances is determined directly by the net income after subtracting all their internal consumption bills, fees, and taxes.

REMT = GI - CB - DT - RGSF

Where:

REMT: the total annual volume of remittances sent by foreign workers to their countries.

GI: gross annual Income earned by foreign workers in the host country (Saudi Arabia).

CB: annual Consumption Bills of foreign workers in the host country (Saudi Arabia).

CB are the sum of all goods and services consumed by foreigners in the host country (Saudi Arabia). It constitutes the largest proportion of their total expenditures. The general commodity prices in the host country are considered the most important determining factor of the s of foreigners' annual consumption bills. In short, the increase in general prices will increase the expenses of foreign workers in the host country, which will reduce the volume of their remittances abroad.

DT: direct Taxes on incomes generated by foreign workers.

It is to be mentioned that the Saudi government doesn't impose any direct taxes on the revenues earned by foreigners. Therefore, this variable has no effect on the remittance outflows.

RGSF: residence and government service fees paid by foreigners.

Here we mention that the VAT application of 15% and the gradual increase in the price of fuel by the Saudi government led to a rise in the prices of goods, services, and real estate, which constituted a burden on the budget of foreigners, leading to an increase in their consumption bills. In addition, imposing fees for accompanying family members led to a continuous decline in the volume of their remittances since 2016 (See, Table 2 in Section 4).

In oil-exporting countries, oil prices play a major role at the macroeconomic level. Hence, higher oil prices in these countries may lead to an increase in inflation rates in both the short and long run. The increase in global oil prices is expected to generate fiscal surpluses in the Saudi budget, which would encourage the Saudi government to significantly increase its public spending G, thereby stimulating domestic aggregate demand and raising general prices consequently. According to our analysis, the rise in global oil prices is associated with a rise in inflation and a decline in remittance outflows. As a result, foreign expatriates increase their spending on goods and services to maintain the same standard of living in their host countries. Therefore, relying on theory and previous applied research, the econometric model is expressed as follows:

$$LREM_{t} = \alpha + \beta INF_{t} + \varphi LZ_{t} + \varepsilon_{t}$$
⁽¹⁾

where $LREM_t$ is the remittance outflows; INF_t is the inflation rate; Z_t is a set of control variables thought to affect $LREM_t$; and ε_t is the normally distributed error term. All the variables except inflation rate are expressed in logarithmic form, which transforms the estimated parameters into elasticities. The expected negative sign of inflation parameter β indicates that remittance outflows decrease as inflation rate increases. Please refer to Table 1 for the parameters and expected signs.

In investigating the outflows of the remittances-inflation nexus in the KSA, the present paper uses the autoregressive lag (ARDL) model approach to cointegration introduced by Pesaran et al. (2001). This approach is documented in the applied literature (Janesh, 2013; Javid & Hasanov, 2022; Nkoro & Uko, 2016), and it has several advantages over other estimation approaches (Engle & Granger, 1987; Johansen & Juselius, 1990). The conventional cointegration approaches of Granger (1981) and Engle and Granger (1987) require that all variables be integrated of the same orders—that is, either the I(1) or I(0) orders (Nkoro & Uko, 2016). Moreover, EG suffers from the problem of variable order, which becomes far more serious in the case of more than two variables. In addition, it does not provide the number of cointegrating vectors (Asteriou & Hall, 2007). In our case, using the EG approach is ruled out for the abovementioned reasons, whereas the Johansen and ARDL cointegration procedures are applicable. However, the application of ARDL

requires that only one cointegrating vector exists. In contrast, when there are multiple cointegrating vectors, the Johansen and Juselius (1990) approach is the alternative. The application of Johansen cointegration approach requires that all variables are integrated of the same order (Asteriou & Hall, 2007).

The autoregressive lag (ARDL) model can be applied to small samples regardless of whether the variables are I(0) or I(1), but it cannot be applied to I(2) variables (Pesaran et al., 2001). That is, the ARDL cointegration technique does not require pretests for unit roots, unlike other techniques (Nkoro & Uko, 2016). Furthermore, it captures both short-run and long-run effects, and it addresses the potential problem of endogeneity. In addition, ARDL explicitly tests for the existence of a unique cointegration vector (Javid & Hasanov, 2022; Nkoro & Uko, 2016). This approach's main advantage is that it can identify cointegrating vectors when there are multiple cointegrating vectors (Nkoro & Uko, 2016). It also provides different optimal lag orders for each model's variables.

Table 1. Dependent and Independent Variables						
Variable	Definition	Coefficient	Expected Sign			
LREM _t	The Log of remittance outflows at time (t)	Dependent				
LREM _{t-i}	The lag of the dependent variable (explicative variable):	γ	+			
INF _t	Inflation rate at time (t) (The main independent variable)	β	-			
Z _t	Vector of control variables (other explicative variables):	$oldsymbol{arphi}^{\prime}$				
LGDPC	Log of gross domestic product at constant prices (2010 = 100) at time (t). The level of economic activity.	$arphi^{LGDPC}$	+			
LGF	Log of gross fixed capital formation at time (t). A proxy for investment.	$arphi^{LGF}$	-			
LOPEN	Log of Exportation + Importation /GDP at time (t)	$\pmb{\varphi}^{LOPEN}$	±			

3.1. Measuring variables

Table 1 summarizes the variables expected to affect migrant remittance outflows, including inflation rates, real economic activity, investment levels, and trade openness. According to El-Sakka and Mcnabb (1999), "A high rate of domestic inflation may thus act as a proxy for uncertainty and risk and, therefore, discourage the flow of remittance earnings." Moreover, Termos et al. (2013) reported that remittance outflows in sending countries negatively affect inflation. Accordingly, the authors suppose similarly that inflation in sending countries may also reduce remittance outflows by increasing the consumption expenditures of migrant workers; therefore, the inflation coefficient is expected to be negative.

According to Swamy (1981), the economic activity of remitting countries determines the volume of remittance outflows. Desai et al. (2009) showed that migrants' remittance outflows are affected by pro-cyclical activities, which increase their income and strengthen their ability to transfer money.

We assume that a higher level of investment (the Log of gross fixed capital formation in the remitting countries) improves efficiency by replacing expatriate workers, decreasing their demand, and reducing their wages and employment, hence lessening their ability to transfer money abroad. Therefore, LGF is expected to have a negative impact on remittance outflows via the marginal rate of technical substitution.

Finally, LOPEN is the trade openness (measured as the ratio of total trade to GDP). On the one hand, Allen and n.d.ikumana (2000) reported a positive correlation between LOPEN and economic growth, which increases workers' income and, consequently, their remittances. We believe that imports, especially capital goods, can have a negative impact on remittance outflows. Imports may have a detrimental impact on growth by increasing the prices of intermediate goods and hence the production cost of final goods. Indeed, the increase in prices reduces the competitive power of final local goods, decreasing profits and potentially eliminating local industries. As a result, local production decreases, which may lead to the layoff of a considerable reduction in the number of foreign workers or a reduction in their wages; this implies that trade openness can negatively affect remittance outflows.

3.2. The ARDL model

The unrestricted ARDL specification of the long-run relationship between REM_t and INF_t in the KSA is as follows:

$$\Delta LREM_{t} = \alpha + \sum_{j=1}^{p} \gamma_{t-j} \Delta LREM_{t-j} + \sum_{j=0}^{q} \beta_{t-j} \Delta INF_{t-j} + \sum_{j=0}^{s} \varphi_{t-j} \Delta LZ_{t-j} + \lambda_1 LREM_{t-1} + \lambda_2 INF_{t-1} + \lambda_3 LZ_{t-1} + \varepsilon_t$$
(2)

The specification outlined in Eq. (2) allows for the short- and long-run effects of exogenous variables. By estimating the parameter of the first-difference of the variable, we show the short-run effect of an exogenous variable, whereas, the long-run effects are captured by the estimates of λ_2 - λ_3 normalized by λ_1 .While Narayan (2005) offers critical values for small samples, Pesaran et al. (2001) recommend F-test to establish a joint significance of the linear combination of lagged variables as an evidence supporting the cointegration, and offered a new set of tabulated critical values applicable to large sample sizes.

Eq. (2) can also be considered as an ARDL of order (p, q, s) for outflows. The Akaike Minimum Information Criteria (AIC) are used to define the appropriate lag length structure. The long-term equilibrium can be determined by the computed F-statistic using Wald test, which is sensitive to the lag length (Shahbaz et al., 2012). The null hypothesis of no long-run equilibrium relationship is $H_0: \lambda_1 = \lambda_2 = \lambda_3 = 0$ versus the alternative hypothesis $H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$. Accepting or rejecting H_0 is based on the calculated F-statistic compared with the critical values. Accordingly, if the F-statistic is greater than the upper limit I(1), the null hypothesis is rejected; whereas, if the F-statistic is less than the lower bound I(0), H_0 is accepted. However, if the F-statistic is between the two limits, the outcome is inconclusive (Mahmoudinia et al., 2013).

3.3. Johansen cointegration approach

The study applies the cointegration method developed by Johansen (1988, 1991) and Johansen and Juselius (1990) to determine the rank of cointegration. The Johansen method is preferred over the two-step Engle-Granger method because it can test for multiple cointegrating vectors and directly obtains the maximum likelihood estimates of the cointegrating vectors and fitting parameters. The system of cointegrating vectors can be described as a set of vector autoregressions (VAR) of nonstationary time series as follows (Boon, 2000):

$$\Delta X_t = \prod X_{t-1} \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-1} + \mu + \Theta t + \varepsilon_t$$

$$\Pi = -\left(I - \sum_{i=1}^{k} \Pi_i\right), \Gamma_i = -\left(I - \sum_{j=1}^{k} \Pi_j\right), i = 1, \dots, K - 1$$

- X_t is avector of Pvariables
- μ are the intercepts
- t is the deterministic trend
- ε is avector of Gaussian random variables

The matrix coefficient Π is the long run impact matrix that contains information about the stationarity of the variables and the long-run relationship between them. The rank of the matrix determines the number of cointegration vectors. If the coefficient matrix is full rank, (r = P), then all variables are stationary with no trend or long-term relationship between them. However, if the rank of the matrix is zero, (r = 0), then there is no cointegration and the variables are not stationary. The last possible case is where the rank lies between zero and p (0 < r < P). In this case, there are r linear combinations of variables in Xt that are stationary, and the variables are cointegrated with r vectors in the long-run. Johansen and Juselius (1990) and Johansen (1988) derived two likelihood ratio tests for the hypothesis of (r) cointegrating vectors; the trace test and the Maximum Eigenvalues test. The trace test tests whether the number of distinct cointegrated vectors is less than or equal to r against the alternative of more than r cointegrating vectors. The trace test is computed as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+t}^{p} ln(1-\lambda)$$

Where T is the sample size, $\hat{\lambda}_{r+1}, \ldots, \hat{\lambda}_p$ are p - r smallest estimated Eigenvalues and *ln* is the natural log. The null of the second (max) test is the number of cointegrating vectors r against the alternative of r + 1 cointegrating vectors. The Maximal Eigen value test is given by the statistic:

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1})$$

Where, $\hat{\lambda}_i$ equals the estimated Eigenvalue of the characteristic roots, r = 0,1, 2,., T = number of observations. The critical values of these tests are produced by the Monte Carlo simulation and tabulated by Johansen (1988) and Osterwald-Lenum (1992). In the case of conflicting cointegration rank results provided by λ_{trace} and λ_{max} , the λ_{trace} statistic is preferable to the λ_{max} statistic (Enders, 2003).

3.4. Toda and yamamoto causality test

The Granger causality test assumes the stability of the time series. However, it performs poorly if the time series are not integrated from the same order. In other word, the integration process must be clear. Instead, the approach of H. Y. Toda and Yamamoto (1995) applies a VAR model to determine the existence of a long-run equilibrium relationship among variables. Toda and Yamamoto's method has the advantage of not requiring integration and cointegration of variables; for further information see, Moftah and Dilek (2021), Fawad (2013), H. Toda and Phillips (1993), and Zapata and Rambaldi (1997).

To determine the causality direction between inflation rates and remittance outflows in Saudi Arabia, the causality test of H. Y. Toda and Yamamoto (1995) estimates the VAR (k+ dmax) model as following:

$$\mathsf{LREM}_{t} = \alpha_{0} + \sum_{i=1}^{k} \alpha_{1i} \mathsf{LREM}_{t-i} + \sum_{j=1}^{k+d_{max}} \alpha_{1j} \mathsf{LREM}_{t-j} + \sum_{i=1}^{k} \alpha_{2i} \mathsf{INF}_{t-i} + \sum_{j=1}^{k+d_{max}} \alpha_{2j} \mathsf{INF}_{t-j} + \sum_{i=1}^{k} \alpha_{3i} \mathsf{LGDPC}_{t-i} + \sum_{j=1}^{k+d_{max}} \alpha_{3j} \mathsf{LGDPC}_{t-j} + \sum_{i=1}^{k} \alpha_{4i} \mathsf{LOPEN}_{t-i} + \sum_{j=1}^{k+d_{max}} \alpha_{4j} \mathsf{LOPEN}_{t-j} + \sum_{i=1}^{k} \alpha_{5i} \mathsf{LGF}_{t-i} + \sum_{j=1}^{k+d_{max}} \alpha_{5j} \mathsf{LGF}_{j-i} + \varepsilon_{1t}$$

$$(4)$$

$$INF_{t} = \beta_{0} + \sum_{i=1}^{k} \beta_{1i}INF_{t-i} + \sum_{j=1}^{k+d_{max}} \beta_{1j}INF_{t-j} + \sum_{i=1}^{k} \beta_{2i}LREM_{t-i} + \sum_{j=1}^{k+d_{max}} \beta_{2j}LREM_{t-j} + \sum_{i=1}^{k} \beta_{3i}LGDPC_{t-i} + \sum_{i=1}^{k} \beta_{3i}LGDPC_{t-i} + \sum_{j=1}^{k+d_{max}} \beta_{4j}LOPEN_{t-j} + \sum_{i=1}^{k} \beta_{5i}LGF_{t-i} + \sum_{j=1}^{k+d_{max}} \beta_{5j}LGF_{j-i} + \varepsilon_{2t}$$
(5)

Where: k is the optimal lag-length of the level VAR, d_{max} is the maximum order of integration.

The following four steps are required for carrying out Toda-Yamamoto causality test:

1) To improve the estimated model's explanatory power, we determine the appropriate optimal lag order in the estimated VAR model (k), based on either the lowest Akaike Information Criterion or the lowest Schwartz Information Criterion. See, Umoru and Tizhe (2014).

2) The second step is applying unit root tests to determine the maximum order of integration (dmax) for all series.

3) The estimation of the VAR in level form with the modified order of VAR ($k+d_{max}$).

4) At final step, the Wald test for Granger causality well be conducted.

4. Estimation results

This section presents the estimation results of Eq. (2), including the ADF unit root test, bounds test to cointegration, ARDL estimation results, diagnostic residuals tests, stability test, and Grange causality test based on the Toda–Yamamoto method.

4.1. Descriptive analysis

Table 2 presents the development of remittance outflows over the period 1980–2019. It shows that the number of migrants in KSA has steadily increased over time, representing about 30% of the total population on average. Consequently, remittance outflows rose continually. Table 2 shows that the total amount of remittances doubled between 2005 and 2010 and then increased by \$11 billion between 2010 and 2015. This growth was due to the significant increase in oil prices between 2005 and 2015. Thereafter, remittances began to decline, coinciding with the decline in oil prices. Although the value of foreign remittances increased to record levels between 2005 and 2015. This is because GDP (the denominator) rose very sharply during this period due to the surge in oil prices, which superpass the increase in remittances.

Table 3 shows that remittance outflows represent 5.77% of the GDP on average over the period 1971–2109, which is similar to the percentage calculated by Alkhathlan (2013) for the period 1970–2010 (5.61%). This percentage puts KSA in the top 10 remitting countries in the world. Moreover, the mean inflation rate is 3.7%, which is within the acceptable standard inflation rates. The inflation rate

ranges from a minimum of -3.20% to a maximum of 34.57%, indicating the absence of hyperinflation episodes in Saudi Arabia. The Jarque-Bera test statistics is insignificant for all variables except for the inflation rate at the 1% level. This implies that these variables are normally distributed.

Figure 1 depicts the development of migrant remittance outflows (REMIT) and inflation rates (INF) over time, highlighting their similar trends. Both variables witnessed fluctuations due to the state of the Saudi economy. Furthermore, they are moving in opposite directions, indicating the inverse relationship.

This figure is elaborated by the authors based on World Bank dataset.

To make the comparison possible, the inflation rates were multiplied by 1000.

Table 2. Migrants and remittance outflows in the KSA						
Year	# of Migrant Workers ¹	% of total population	Remittance Outflows (US \$ million) ²	Remit in % of GDP at current prices*		
1980	1,920,478.00	30.55	4,090	2.49		
1985	3,401,020.00	30.55	5,200	5.00		
1990	4,998,445.00	30.55	11,200	9.59		
1995	5,122,702.00	27.17	16,600	11.65		
2000	5,263,387.00	24.60	15,400	8.17		
2005	6,501,819.00	26.28	14,303	4.35		
2010	8,429,956.00	30.01	27,069	5.14		
2015	10,185,945.00	32.29	38,787	5.93		
2016	10,884,335.00	33.54	37,842	5.87		
2017	10,694,320.00	32.31	36,119	5.25		
2018	9,578,055.00	28.42	33,882	4.31		
2019	9,827,096.00	28.68	33,466	4.73		

Source: (1) Annual outflows remittance data, World Bank (April 2020); (2) International migrant stock, total/World Bank online data; (3) Data from 2016 to 2019 are from Saudi General Authority for Statistics (https://www.stats.gov. sa/en).

*Calculated by the authors based on GDP/World Bank dataset 2019 (Available online at the website).

Table 3. Descriptive statistics during the period from 1971 to 2019						
	REMITGDP (%)	INF (%)	GF	GDP (%)	OPEN XMGDP (%)	GDPC
Mean	5.774701	3.6934	71	20.96660	76.80579	3.95E+11
Median	5.003559	1.2060	73	20.97991	75.08284	3.59E+11
Max	13.37369	34.576	11	29.99081	120.6203	7.04E+11
Min	1.141326	-3.203331		8.834239	56.08838	1.56E+11
SD	2.999484	7.624659		4.255244	12.90819	1.52E+11
J-B	3.638603	172.6770		3.088748	6.337822	4.734024
Prob.	0.162139	0.0000	00	0.213445	0.042049	0.093760
Obs.	49	49		49	49	49

This table is elaborated by the authors based on results obtained by Eviews 9. All values are expressed as percentages, except GDP, which represents constant prices.

Figure 1. Evolution of outflows remittance and inflation rates in the KSA from 1980 to 2019.



4.2. Unit root test

Nkoro and Uko (2016) indicated that the ARDL approach can not be applied to I(2) variables. Table 4 indicate that all series are composed of either I(0) or I(1) variables. Three other stationarity tests (not reported) were performed, and they suggested similar results.

Table 4. Break Point Unit Root Tests (Model with Constant and Linear Trend)								
		Level				1st Dif	ferenced	
Variable	Breakpoint	ADF t-statistic	Prob.	Lags #	ADF t-statistic	Prob.	Lags #	Integrated Level
LREMIT	2015	-3.161	0.94	1	-4.75**	0.027	0	I(1)
INF	1984	-4.240	0.37	1	-5.38**	0.029	0	I(1)
LCPI	2009	-7.29***	< 0.01	1				I(0)
LGDPC	1986	-4.17	0.42	0	-7.6***	< 0.01	0	I(1)
LOPEN	2004	-5.52**	0.02	0				I(0)
LGF	2002	-5.67***	0.01	1				I(0)

Null hypothesis: The series has a unit root. **Break selection**: Minimize Dickey-Fuller t-statistic. Lag length: Based on Schwarz information criterion Asterisks indicate significant differences (*** significant at 1%, ** significant at 5%, * significant at 10%).

4.3. Analysis of cointegration results

To begin, the application of Johansen cointegration analysis requires estimating a VAR model to determine the lag number. The endogenous variables (LREMIT, LGDPC, LOPEN, LGF and INF) are included in the VAR model. We also include a dummy variable for the year 2015 (Dum = 1), when remittance outflows increased dramatically. This increase was triggered by the increase in oil revenues and fiscal reforms. Table 5. reports the lag selection results. Following the SC criterion, we estimate the VAR with one lag.

Table 5. Reports the optimal lag length selection; however, there are different lags, and most of the criteria indicated four lags. To be more specific, a VAR(1) with one lag is estimated and tested for autocorrelation, and the LM test rejects the null hypothesis of no autocorrelation. However, the VAR(4) accepts the null hypothesis. Hence, we use VAR(4) with four optimal lags.

Table 5. Optimal Lag selection creterion						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-49.24541	NA	9.58e-06	2.633129	3.034610	2.782797
1	207.5855	433.7589	3.25e-10	-7.670467	-6.265285*	-7.146629
2	250.8430	63.44436	1.52e-10	-8.481912	-6.073029	-7.583905*
3	268.4900	21.96067	2.41e-10	-8.155111	-4.742526	-6.882934
4	315.7608	48.32123*	1.16e-10*	-9.144923*	-4.728637	-7.498576

LogL: indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

The VAR estimation passes all the statistical diagnostic tests for the residuals, including the serial correlation LM test, normality tests, stability test and the heteroscedasticity test, as reported in Table 6.

Table 6. VAR residual diagnostics test results						
VAR Residual Serial Co	VAR Residual Serial Correlation LM Tests					
Lags	LM-Stat	Р	rob			
1	34.68942	0.	094			
2	28.14718	0.3	3011			
3	15.75869	0.9	9218			
4	25.62861	0.4276				
5	27.96227	0.3096				
Probs from chi-square with 25 df.						
VAR Residual Heteroscedas	ticity Tests					
Chi-sq	df	Р	rob.			
618.7603	615	0.4499				
VAR Residual Normality Te	sts					
Skewness	Chi-sq	df	Prob.			
	3.206606	5	0.6682			
Kurtosis	Chi-sq	df	Prob.			
	2.936385	5	0.7098			
Jarque-Bera	df	Prob				
6.142991	10	0.8031				

As a results, the Johansen cointegration test can be applied. The results of the trace and the maximum eigenvalue are reported in Table 7. It recommended dropping models 1 and 5 to avoid any linear trend in the long-run part of the VECM (Javid & Hasanov, 2022). The trace and maximum eigenvalue statistics both reject the null hypotheses of no cointegration for the five models (r = 0). Table 8. clearly shows that both tests indicate only one cointegration equation.

The critical values for the cointegration test are taken from MacKinnon

Table 7. Johansen cointegration test summary							
Test Type	Model1 No: C and t	Model2 Only C	Model3 Linear (Only c)	Model4 Linear (C &t)	Model5 Quadratic (c &t)		
Trace	1	1	1	2	2		
Max-Eig	1	1	1	1	1		

C and t indicate the intercept and the trend, respectively. r is the rank of the matrix Π , that is, the number of cointegrated equations.

 Λ trace and λ_{max} are the trace and max-eigenvalue statistics, respectively

Table 8. Johansen cointegration test results for type (model2)						
Null Hypothesis	<i>r</i> = 0	<i>r</i> ≤ 1	<i>r</i> ≤ 2			
λ_{Trace}	75.38393*	33.49338	12.32267			
λ _{max}	20.96851*	41.89054	9.074578			

*** denotes rejection of the null hypothesis at the 5% significance levels.

Based on these results, we can consider employing single-equation-based or residual-based cointegration methods and long-run estimators. Therefore, we can employ the bounds-testing approach proposed by Pesaran et al. (2001), which is superior to other long-run estimators for small sample sizes.

4.4. ARDL estimation results

The ARDL technique is applied to estimate the long-run and short-run relationships between remittance outflows and inflation.

4.4.1. Optimal model lags

The automatic AIC optimal lag selection criterion was used over 768 evaluated models' adjusted R^2 and F-statistic values. We opted for automatic selection by choosing the maximum lag length at three lags. Table 9 shows the relative goodness adjusted R^2 as 0.99, indicating that the model explains approximately 99% of the variation in the remittance outflows. Moreover, the F-statistic is significant at the 1% level, indicating that the model is not spurious.

Table 9. ARDL Optimal Model Lags (1971–2019)					
Dependent Variab	le: LREMIT- Selecte	ed Model: ARDL(1, 0), 1, 2, 3)		
Variable	Coefficient	Std. Error	t-Statistic	Prob.*	
LREMIT(-1)	0.795975	0.066644	11.94371	0.0000	
INF	-0.001993	0.001806	-1.103666	0.2777	
LGDPC	-0.032996	0.281235	-0.117327	0.9073	
LGDPC(-1)	-0.322118	0.236902	-1.359709	0.1831	
LOPEN	-0.393794	0.229286	-1.717476	0.0953	
LOPEN(-1)	0.264478	0.166486	1.588584	0.1217	
LOPEN(-2)	-0.283078	0.191388	-1.479076	0.1486	
LGF	-49.04811	9.884969	-4.961888	0.0000	
LGF(-1)	142.1488	28.58327	4.973148	0.0000	
LGF(-2)	-137.8665	27.62439	-4.990755	0.0000	

(Continued)

Dependent Variable: LREMIT- Selected Model: ARDL(1, 0, 1, 2, 3)						
Variable	Coefficient	Std. Error	t-Statistic	Prob.*		
LGF(-3)	45.00677	8.987789	5.007546	0.0000		
DUM	-0.030494	0.026595	-1.146603	0.2598		
С	4.458340	2.139137	2.084177	0.0450		
R-squared	0.993761	Mean depe	Mean dependent var			
Adjusted R-squared	0.991492	S.D. dependent var		0.465553		
S.E. of regression	0.042943	Akaike inf	Akaike info criterion			
Sum squared resid	0.060855	Schwarz	Schwarz criterion			
Log likelihood	87.17058	Hannan-Quinn criter.		-3.031215		
F-statistic	437.9939	Durbin-Watson stat		1.754060		
Prob(F-statistic)	0.000000					

This table is elaborated by the authors based on the results obtained by E-Views 9, where the regressors are: LREMIT INF LGDPC LOPEN GF. Model selection method: Akaike Information Criterion (AIC).

4.4.2. ARDL bound-test result

The bounds-test result is reported in Table 10. As the F-statistic (6.486) is greater than the upper limit (5.06), a long-run relationship is detected between the model variables.

Table 10. Bounds-Test of Cointegration						
Test Statistic	Value	k				
F-statistic	6.486129	4				
Critical Value Bounds						
Significance	I ₀ Bound	I ₁ Bound				
5%	2.86	4.01				
1%	3.74	5.06				

Null Hypothesis: No long-run relationship.

4.4.3. ARDL model diagnostic tests

To provide evidence supporting our model validity, statistical diagnostic tests are reported in Table 11.

Table 11. Residuals and Stability Tests					
A: Heteroscedasticity	B: Autocorrelation	C: Normality	D: Stability		
F-statistic	F-statistic	Jarque-Bera	F-statistic		
(Probability)	(Probability)	(Probability)	(Probability)		
1.19204	0.469725	0.042531	2.19954		
(0.3287)	(0.6296)	(0.978959)	(0.1478)		

- (A)The Breusch–Pagan–Godfrey test indicates the acceptance of the null hypothesis of homoscedasticity. This implies that the t-statistics, and consequently the *p*-values, are asymptotically normally distributed.
- (B)The Breusch–Godfrey Lagrange multiplier test indicates that the residuals are not serially correlated.
- (C)The Jarque-Bera statistic shows the normal distribution of residuals.

(D)The Ramsey RESET test indicates that the model is correctly specified.

Figure 2 shows that both the cumulative sum (CUSUM) and the cumulative sum squared CUSUMSQ of recursive residuals indicate model stability. This confirms that the OLS regression parameters do not suffer from structural changes.



Figure 2. Plot of cumulative sum and cumulative sum of squared recursive residuals.

Null hypothesis: parameters are stable

4.4.4. Short-run estimation results

The high significance of the error correction coefficient λ , which equals -0.829 (with a t-statistic of -12.784), is another indication that the model variables are cointegrated, as shown in Table 12. As λ represents the speed of adjustment, this indicates that our variables quickly return to equilibrium; 83% of any short-run shock is corrected within one period. Moreover, we observe a significant negative effect of inflation on remittance outflows (-0.268), suggesting that a 1% increase in inflation rate leads to a 0.26% decrease in outflows. Thus, inflation reduces remittances in the short run.

Table 12. Short-Run ARDL (1, 0, 1, 2, 3)					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
D(INF)	-0.268975	0.001806	-148.923831	0.0000	
D(LGDPC)	1.676421	0.281235	5.960924	0.0000	
D(LOPEN)	1.786532	0.229286	7.791705	0.0000	
D(LOPEN(-1))	8.037240	0.191388	41.994411	0.0000	
D(LGF)	5.725817	9.884969	0.579245	0.5664	
D(LGF(-1))	10.090104	27.624388	0.365261	0.7172	
D(LGF(-2))	-11.618519	8.987789	-1.292700	0.2051	
D(DUM)	0.186681	0.026595	7.019388	0.0000	
CointEq(-1)	-0.829526	0.066644	-12.447133	0.0000	

4.4.5. Long-run estimation results

The long-run estimation results reported in Table 13 show the significantly negative coefficient of inflation implies that increasing inflation by 1% decreases remittance outflows by 0.32%. As expected, the real level of economic activity (represented by LGDPC) positively affects remittance outflows, since a higher level of economic activity in the sending country increases workers' income, which strengthens the ability of migrant workers to transfer money abroad. The empirical

results reveal a negative impact of trade openness on remittance outflows. Finally, the negative coefficient of LGF indicates the efficiency of capital formation in reducing remittance outflows by replacing foreign workers with capital machines.

Table 13. Long-Run Estimation Results of ARDL model					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
INF	-0.324251	0.025099	-12.918997	0.0000	
LGDPC	1.381101	0.257345	5.366737	0.0000	
LOPEN	-15.640718	1.340918	-11.664183	0.0000	
LGF	-11.629037	0.952450	-12.209606	0.0000	
DUM	0.225045	0.035692	6.305222	0.0000	
С	0.644224	2.600067	0.247772	0.8058	
Cointeq = LREMIT—(-0.3243*INF + 1.3811*LGDPC -15.6407*LOPEN -11.6290*LGF + 0.2250*DUM + 0.6442)					

4.4.6. Toda-Yamamoto test: Non-Granger causality test

The long-run causal relationship between inflation and remittance outflows confirmed by the ARDL estimation results was examined by Granger causality based on the H. Y. Toda and Yamamoto (1995) method. Table 14 reports the Toda-Yamamoto (TY) results. The table shows that there is a significant unidirectional causal relationship running from inflation rate to remittance outflows but not vice versa. This result confirms the ARDL result, implying that inflation is a significant determinant of remittance outflows. However, one must bear in mind that the TY result provides the causal direction but not the sign or magnitude of the effect, which can be deduced by estimating the ARDL model.

Table 14. Toda-Yamamoto VAR Granger Causality/Block Exogeneity Wald Tests					
Null Hypothesis	Chi-sq	P-value	DF		
INF does not granger cause LREM	13.24130	0.0102	4		
LREM does not granger cause GDP	3.217958	0.5220	4		

Note: The rest of causality directions results between control variables and dependent and main independent

variables are available upon the request from the authors.

5. Discussion of the empirical estimation results

The current study is a pioneer in investigating the remittance outflows- inflation nexus in Saudi Arabia. Table 4 shows the ADF test results, which indicate that all variables are either I(1) or I(01). This means that their means, variances and covariances are not constant over time. Therefore, any sudden shock to these variables—including policy shocks—would result in a permanent change. However, these variables turn out to be stationary after differencing. Moreover, the cointegration results shown in Table 10 indicate that the variables have a long-run equilibrium relationship. The estimation results are expected to improve our understanding of the long-run behavior of remittance outflows in Saudi Arabia, thus providing useful information to policymakers when formulating relevant measures.

The empirical results reveal a long-run inverse relationship between the inflation rate and remittance outflows, and the price negatively affects remittance outflows from Saudi Arabia. A 1% increase in the inflation rate reduces remittance outflows by 0.32%. Since the inflation rate reflects the cost of living, higher rates discourage migrants from sending more money to their homelands. While our empirical results suggest that higher general prices reduce remittance

outflows in Saudi Arabia, Termos et al. (2013) found that an increase in remittance outflows in the GCC region reduced inflation rates. For Saudi Arabia, Taghavi (2012) showed a unidirectional causality, suggesting that higher outflows could lead to changes in the inflation rate.

These results indicate that inflation rates and remittance outflows interact. The finding that remittance outflows exhibit weak elasticity to inflation rates could be explained by this interaction, as each of the two variables weakens the influence of the other. The mechanism of this feedback effect runs through oil prices, as Saudi Arabia is highly dependent on oil. Indeed, higher oil prices could lead to higher inflation rates in both the short and long run. Finally, the presence of a statistically weak negative impact of inflation on remittance outflows in Saudi Arabia is consistent with De et al. (2019), Ratha et al. (2015) and Naufal and Termos (2009).

Additionally, one of the main empirical findings of our study is that although the increase in inflation reduces the ability of foreigners in Saudi Arabia to transfer money abroad, its effect is clearly limited compared to the capital investment indicator, which is associated with higher elasticity. This result is in line with the recommendation of Alkhathlan (2013): "Saudi Arabia must find appropriate new channels to convince foreign workers to consume and invest their money in the country."

The estimation results shown in Table 13 also reveal that all the explanatory variables have the theoretical expected long-run impacts. The elasticity of Saudi GDP is positive and statistically significant, and a 1% increase in Saudi Arabia's GDP increases remittance outflows by 1.38% in the long run. There are two possible justifications for this positive relationship. First, the increase in Saudi Arabia's GDP increases the level of economic activity, which, in turn, increases the demand for domestic labor and foreign workers (AlKhathlan, 2013; Javid & Hasanov, 2022). This can be seen from the fivefold increase in the level of GDP during the study period (1971–2019), which is associated with a 22-fold increase in the number of expatriates during the same period, which would lead to an increase in remittance outflows. Second, the increase in the level of economic activity—and hence labor demand—would increase the average wage, thereby increasing remittance outflows.

Finally, we acknowledge that this study has one limitation: it does not include the number of foreign workers due to a lack of data. Previous studies have revealed this variable's positive effect on remittances (Chami et al., 2005; El-Sakka & Mcnabb, 1999; Swamy, 1981).

6. Conclusions and policy recommendations

Numerous empirical studies have focused on the impact of remittance inflows on economic performance in receiving developing countries. However, most of the research on remitting countries has focused on the role of remittance outflows in determining selected macroeconomic variables. In contrast, factors like the impact of inflation on remittance outflows have not attracted much attention due to the relatively small share of remittance outflows of GDP, especially in GCC countries. Recently, Saudi Arabia has begun to focus on the high level of migrant remittances. This study is an attempt to determine whether high inflation in KSA reduces remittance outflows. Thus, this research stems from the hypothesis that there is an inverse relationship between inflation and remittance outflows in Saudi Arabia. To examine this relationship in the long and short term with the presence of different degrees of integration -I(0) or I(1)- among variables, the ARDL model is employed regardless of the degree of integration (Pesaran et al., 2001).

To find out the direction of causality between the two main variables, we used the Granger causality test based on the H. Y. Toda and Yamamoto (1995) method, since it has the advantage of not requiring integration and cointegration of variables. The causality test result shows a unidirectional causality running from inflation rate to remittance outflows, which implies that price indicator causes remittance outflows.

We examined the potential long-run and short-run impacts of inflation, along with selected control variables, on the outflow of remittances from Saudi Arabia over the period 1971–2019 by applying the

ARDL bounds test to cointegration. The empirical estimation results revealed a long-run equilibrium relationship between the selected variables in this study. The empirical results show an inverse relationship between migrant remittance outflows and inflation in Saudi Arabia. The inflation rate coefficient implies that a 10% increase in inflation reduces remittance outflows by 3.2%; a reduction in remittance outflows by a small percentage of 3.2% requires a significant (threefold) increase in the inflation rate. Thus, foreign remittance outflows are weakly responsive to changes in inflation. Since the elasticity of remittance outflows to the inflation rate is low, migrant workers will likely remit a significant amount of their money abroad no matter how high inflation is in Saudi Arabia. This empirical result also suggests that migrant workers in KSA will be able to adjust their consumption patterns to rising prices over time in order to maintain their remittance levels. The weak elasticity in Saudi Arabia can be attributed to the acceptable inflation rates, the absence of hyperinflation, and the pegged Saudi Riyal exchange rates against the US dollar over the past five decades. Hence, policymakers should consider that opting to raise inflation as a consequence of any economic policy would not have a considerable effect on remittance outflows.

Our empirical findings reveal that remittance outflows in Saudi Arabia are strongly influenced by factors such as capital investment rather than general prices.

It is well documented in the literature that the number of expatriates has a significant impact on the volume of remittances (Chami et al., 2005; El-Sakka & Mcnabb, 1999; Swamy, 1981). However, this variable is not considered in the present study, as there is no data available for the study period. In addition to the number of migrant workers, other macroeconomic variables affect remittance outflows. Although our results suggest that inflation reduces remittance outflows in the KSA, this study does not explain the nature of this relationship. Therefore, it would be interesting to investigate whether there is an asymmetric relationship between inflation and remittance outflows in the KSA, i.e., whether a positive shock to the inflation rate has a different effect than a negative shock to inflation. Thus, the present study leaves the door open for future research using more variables and other estimation methodologies.

These findings may be useful to policymakers, as remittance outflows have adverse impacts on the development of the Saudi economy. Indeed, remittances are considered the main channel for the leakage of Saudi Arabia's foreign reserves. A large volume of applied research has found that the outflow of remittances has a negative impact on essential economic activities such as economic growth, consumption and investment. Moreover, these results may prove important and useful for policymakers because KSA has expressed a desire for changes in its labor market policies to facilitate economic participation among Saudis.

The Saudi authorities should continue to encourage and urge private companies to hire more Saudi workers, with a commitment to train and qualify them to meet the demands of the labor market. In order to reduce the volume of remittance outflows from Saudi Arabia, the Saudi policy makers are invited to encourage foreign workers, especially those with high incomes, to invest in Saudi Arabia by facilitating their ownership of financial market shares and real estate units.

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Correction

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