The Impact of Macroeconomic Instability on Remittance Inflows to Egypt during the Period (1980-2021)

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Abstract

This paper examines how macroeconomic instability impacts remittance inflows to Egypt over the period (1980-2021). The study constructed a comprehensive macroeconomic instability index using principal component analysis (PCA). An autoregressive distributed lag (ARDL) bounds testing approach is employed to estimate the impact of macroeconomic instability on remittance inflows. The results revealed that macroeconomic instability has a positive and statistically significant impact on remittance inflows to Egypt. Furthermore, remittances respond negatively to real GDP per capita in the home country, and positively to international oil prices and exchange rate. These results are consistent with dominance of the altruistic motive of remittances and provide evidence on their countercyclicality. The results reveal the compensatory reaction of remittances to the negative consequences of macroeconomic instability during the periods of economic hardship and their role in absorbing macroeconomic shocks. Although macroeconomic instability induces altruistically motivated remittances, government policies are required to mobilize remittance savings, attract investment-induced remittances, and direct them towards domestic productive investments.

Keywords: macroeconomic instability- remittances inflows- principal component analysis- ARDL bounds testing – Egypt.

1. Introduction

Over the past few decades, disturbances in foreign capital inflows became one of the urgent challenges facing developing countries with low levels of domestic savings. Remittances represent a significant part of foreign capital inflows, exceeding Foreign Direct Investment (FDI) and Official Development Assistance (ODA) in many developing countries. As defined by (Carling, 2005, p. 79), remittances are generally understood as "transfers of value by emigrants or their descendants to their country of origin". According to this broad definition, remittances include not only monetary transfers but also in-kind, and informal transfers. In this paper, remittances are precisely defined as personal monetary transfers from migrants to their home countries.

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In the fiscal year 2021/2022, remittances dwarfed other sources of foreign capital, reaching around five times the size of Suez Canal revenues and more than double tourism revenues. In addition, remittances contribution to GDP have surpassed that of foreign direct investment and official development assistance since 2010.

Macroeconomic instability, by imposing uncertainty on the overall economic environment, negatively impacts productivity, employment, investments, economic growth, government budgets, and debt sustainability. Additionally, the inflationary impact of macroeconomic instability erodes the purchasing power, leading to a decline in living standards, reducing the equality of income distribution, increasing poverty and economic hardship.

One of the distinctive features of remittances is that they are less volatile compared to other sources of foreign capital. Migrants' remittances have demonstrably remained stable even during times of crisis. Unlike FDI, remittance inflows to Egypt showed a relatively stable pattern during the periods of the international financial crisis, 2011 revolution, and post Covid-19. Chami, *et al*. (2003) argue that remittances are compensatory in nature, whereas they may act as a hedge against income shocks and adverse economic conditions in the home countries.

The main purpose of this study is to examine how remittance inflows respond to macroeconomic instability in Egypt during the period (1980-2021) while accounting for other determinants such as income level in the home country, international oil prices, and exchange rate. The study tests the hypothesis that there is a positive relationship between macroeconomic instability and remittance inflows in Egypt.

This study contributes to the extant literature in two ways. First, it uncovers the impact of macroeconomic instability on remittance inflows. Apart from Akçay and Karasoy (2019), there is a lack of research in the relationship between macroeconomic instability and remittances especially in the context of Egypt. In this respect, the study fills a gap in the literature. Second, this study constructs a multidimensional index for macroeconomic instability in Egypt and estimates its impact on remittance inflows. Previous studies mostly used inflation rate (Buch and Kuckulenz, 2010; Guetat and Sridi, 2017), total reserves (Khodeir, 2015), external debt, and fiscal deficit (Abbas *et al*., 2017; Bettin *et al*., 2017) separately as indicators for macroeconomic instability and only few studies used bidimensional composite indices (Akçay, 2018; Akçay and Karasoy, 2019). In contrast, this study used principal component analysis (PCA) to construct a comprehensive index combining the most important indicators of macroeconomic instability: inflation rate, fiscal deficit, and external debt. Unlike using

a single indicator for macroeconomic instability, the constructed multidimensional index combines multiple variables to provide a more comprehensive indicator of internal as well as external risks and vulnerabilities.

Following this introductory section, section 2 gives a brief overview of the theoretical and empirical literature. An analytical overview of remittance inflows to Egypt is presented in section 3. The adopted methodology is illustrated in Section 4. The results are reported, interpreted, and evaluated in Section 5. Finally, Section 6 concludes and provides some policy recommendations.

2. Theoretical background and empirical literature review

The theoretical debate on the determinants of remittances was provoked in the mid-1980s by Lucas and Stark (1985). Since then, empirical studies have distinguished between two major motives behind remittances: altruism and self-interest. In their seminal paper, Lucas and Stark (1985) classified the microeconomic determinants of remittances into three categories; pure altruistic motives, pure self-interest motives and tempered altruistic or enlightened self-interest motives. They argued that under the pure altruistic motive, remittances are primarily driven by migrants' concern about improving the welfare of their families at home countries, whereas migrant's utility is derived from the utility of the dependent households. Remittances may also serve as insurance to households, whereby the migrants are expected to support their family members at home countries against income shocks. In this case, remittances are predictable and behave countercyclically to economic conditions in the home country. On the other hand, the pure self-interest motive, also known as the investment motive, describes remitters' aspiration to accumulate assets at their home countries and their decisions to allocate their savings and investments between home country assets and host country assets. Under this motive, remittances would be highly susceptible to interest rate differentials, political stability, and economic uncertainty and display a procyclical pattern. Finally, tempered altruism or enlightened self-interest describes the mutually beneficial agreements between the migrants and their families at home. In this case, remittances are regarded as a means of payment for the services provided to migrants by their families during migration, or repayments of loans used to finance their migration (Poirine, 1997; Antoniades et al., 2018).

From another perspective, the drivers of international remittance inflows can be classified into internal or domestic factors (known as pull factors), and external factors (known as push factors) (Fernandez-Arias, 1996; Schoorl *et al*., 2000; Al-Mashat, and Billmeier 2012;). Internal factors pulling remittance inflows to an economy include the level of economic activity in the home country, macroeconomic stability, inflation,

domestic interest rates, exchange rate systems, financial development, and liberalization of financial markets. The dominance of these factors indicates that remittance inflows are a function of economic policies in the home country. On the other hand, external factors pushing remittances include the income levels in the host countries. In contrast to pull factors, the significance of push factors limits the ability of economic policies to attract remittance inflows.

In the empirical literature, numerous factors are identified as macroeconomic determinants of remittances such as inflation, interest rates differentials, exchange rates, incomes of home and host countries, financial development, and economic and political stability (Elbadawi and Rocha, 1992; Hagen-Zanker and Siegel, 2007; Adams Jr, 2009). These factors can be categorized into five main groups, as identified by Spatafora and Aggarwal (2005): first, the economic activity in the migrants' host country; second, the economic activity in the migrants' home country; third, economic policies and institutions in the home country; fourth, general risks in the migrants' home country; fifth, investment opportunities.

Macroeconomic instability refers to the situation when “the domestic macroeconomic environment is less predictable” (World Bank, 2005, p. 93). It does not only undermine the quality of macroeconomic policies, but also it hampers capital accumulation, distorts resources allocation and investment decisions and hence, impedes economic growth. Literature on the impact of macroeconomic instability on remittances is scarce, creating a gap in our understanding of this important relationship. This may be due to the absence of a comprehensive indicator for macroeconomic instability. Using inflation rate as an indicator of macroeconomic instability, two main contradicting channels of effect were identified: First, inflation may stimulate migrants to increase their remittances through reducing the purchasing power of their families in their home countries. In addition, inflation and hard economic conditions in the home countries might prompt migration to foreign countries and increase migrants stock causing remittance inflows to increase (Ali et al., 2015). Second, from a migrant’s perspective, higher level of inflation involves higher degree of uncertainty, which lowers the rate of return on investments in the home economy and reduces investment-induced remittances (Buch and Kuckulenz, 2010). In their study, Spatafora and Aggarwal (2005) showed that macroeconomic instability, exchange rate restrictions and black-market premia may deter migrants from sending remittances or divert remittances away from formal channels toward informal ones.

The few previous empirical studies that investigated the effect of macroeconomic instability on remittance inflows provided mixed results. In Turkey, Akçay (2018) using

misery index as a proxy for macroeconomic instability, found a positive relationship between macroeconomic instability and remittance inflows. Using inflation as a proxy for macroeconomic instability, Buch and Kuckulenz (2010) showed that remittances and domestic inflation are not significantly related for a sample of 87 developing countries. However, Abbas, *et al*., (2017) revealed a negative association between inflation rates and remittances in Pakistan. A similar conclusion is presented by Guetat and Sirdi, (2017) for the Middle East North Africa (MENA) region.

In Egypt, El-Sakka and McNabb (1999) investigated the macroeconomic determinants of migrant`s remittances. The results of their study suggest that interest rate differentials, exchange rate, black market premium are significant determinants of official remittance inflows. Al-Mashat and Billmeier (2012) explored the effect of pull and push factors on migrant's remittances using the Vector Error Correction Model (VECM). They found that both oil price (used as a proxy for the host countries' economic activity) and GDP growth in the home country promote remittance inflows, while inflation rate, interest rate, exchange rate, and credit to private sector have no significant effect on remittance inflows. In addition, Artal-Tur, *et al*. (2014) applied their model on MENA region countries, including Egypt. They concluded that GDP per capita and unemployment rates in the home country, and GDP growth rates in the host countries positively impact remittances. However, domestic credits to private sector, unemployment rates in the host countries, and interest rate differentials have a negative effect on remittance inflows. Using Vector Error Correction Model (VECM), Khodeir (2015) concluded that real GDP per capita and money supply have positive impact on remittances inflows, meanwhile oil prices and exchange rate negatively affect them. The results of Akçay and Karasoy (2019) revealed that economic growth in the home country has no significant impact on remittances. Remittances are positively associated with macroeconomic instability, oil prices, domestic currency depreciation and economic growth in the host countries, while they are negatively associated with financial development.

According to the World Bank (2005), macroeconomic instability can be projected through the behavior of key macroeconomic variables and their volatilities. In Egypt, high inflation rates, fiscal deficit and external debt are recognized as major causes of macroeconomic instability. This study advances the field by constructing a comprehensive index for macroeconomic instability in Egypt, incorporating key indicators like inflation rate, fiscal deficit, and external debt. This allows us to estimate the impact of overall macroeconomic instability, rather than individual factors, on remittance inflows.

3. Remittance Inflows to Egypt

Egypt is one of the top emigration countries in the world. Emigration from Egypt was mainly driven by internal economic factors, including poverty, low standard of living, unemployment, in addition to oil booms in Gulf Cooperation Council (GCC) which stimulated their demand on Egyptian labor. In 2022, remittances to Egypt registered US $29 billion. As shown in figure (1) Egypt is largest recipient of remittances in the Middle East and North Africa (MENA) region and the sixth largest recipient in the world following India (US $111 billion), Mexico (US $61 billion), China (US $51 billion), Philippines (US $38 billion), and Pakistan (US $30 billion) (Ratha *et al*., 2023).

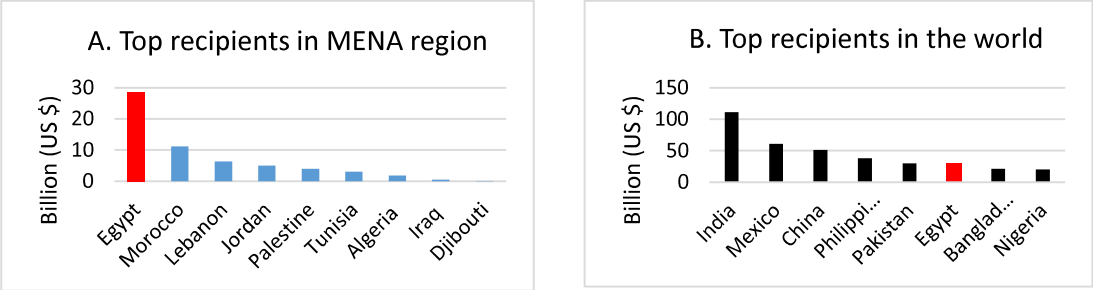

Figure 1: Top recipients of remittances in 2022
Source: Adapted from Ratha et al., (2023).

Egyptian migrants are mainly concentrated in few oil exporting Gulf countries. As shown in figure (2), the GCC countries are the major source of remittance inflows to Egypt, contributing by more than 73% of Egypt's total remittances. In 2021, Saudi Arabia contributed 25.8%, followed by the United Arab Emirates (25.7%), Kuwait (12%), and Qatar (5.6%), while remittances from Bahrain and Oman together were around (4.5%). Concludingly, the geographical concentration of remittance inflows makes Egypt highly vulnerable to external economic and political shocks that might take place in these countries.

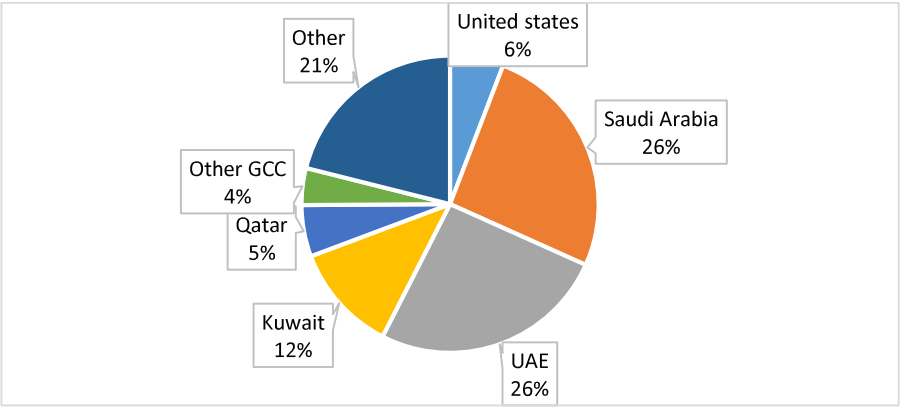

Figure 2: Distribution of remittance inflows to Egypt by destination
Source: KNOMAD/World Bank Bilateral Remittance Matrix 2021, December 2022.

Figure (3) demonstrates the evolution of remittance inflows to Egypt during the period (1980-2021). During this period, migrants' remittances increased substantially from US $2.7 billion in 1980 to US $31.5 billion in 2021 at an average annual growth rate of 8.5%. Over this period, official remittances have been remarkably influenced by domestic as well as international economic and political conditions. In the early 1980s, remittances witnessed an upward trend due to the increase in demand for labor in GCC countries which resulted from a rise in international oil prices. In the second half of 1980s, remittance inflows experienced fluctuations till 1992. The relative instability of remittances during that period was mainly attributed to the fall in oil prices, adopting policies of substituting foreign labor with national labor and replacing Egyptian labor with Asian workers in GCC countries (Ghoneim, 2010). By the end of the first Gulf war, remittances started to gradually recover. It reached around 14.6% of GDP in 1992. Following this peak, remittances decreased for almost a decade due to the drop in oil prices followed by the collapse of the East Asian financial market in 1997. In the first half of the 2000s, remittances were almost stable and averaged US $3 billion during the period (2000-2003). After the sharp devaluation of the Egyptian pound in 2004, remittances started to increase steadily reaching US $8.7 billion in 2008, however, it slightly declined to US $7 billion in 2009 as a result of the world financial crisis.

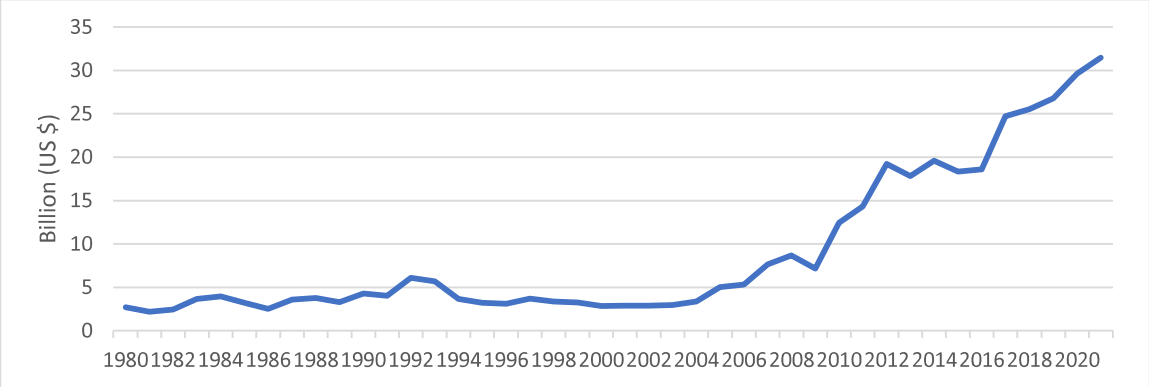

Figure 3: Remittance inflows (current US $) to Egypt during (1980-2021)
Source: World bank development indicators database.

Despite the political, social, and economic instability that followed the 2011 revolution, remittance inflows to Egypt increased significantly to reach US $18.3 billion in 2015. Furthermore, remittances unexpectedly jumped to US $24.7 billion after the second devaluation of the domestic currency in 2016. Afterwards, official remittances continued to increase at an average annual growth rate of 12%. In 2021, remittance inflows to Egypt have increased by around 10.5% to register US $31.5 billion.

The relative importance of migrants' remittances is evaluated based on its share to GDP. Figure (4) displays migrants' remittances, foreign direct investments (FDI), and official development assistance (ODA) as shares to Egypt's GDP during the period (1980-2021).

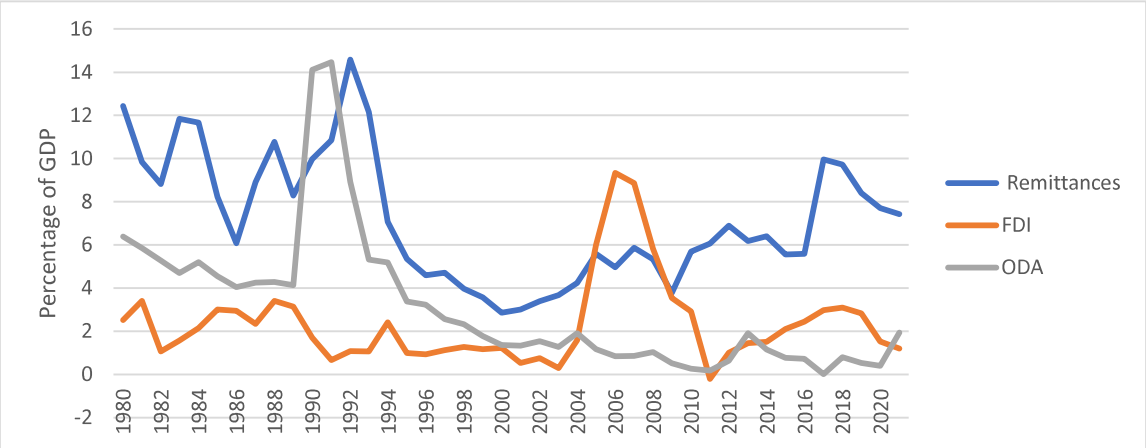

Figure 4: Sources of foreign capital inflows to Egypt during (1980-2021)
Source: World bank development indicators database.

Compared to other sources of foreign capital, remittances contributed by the largest share during most of the period under investigation except for the subperiods (1990-1992) and (2005-2008). The average shares of remittance inflows, foreign direct investments and official development assistance were around 7.2%, 2.4% and 3% respectively.

4. Methodology

Before assessing the impact of macroeconomic instability on remittance inflows to Egypt, the degree of macroeconomic instability should be measured first. To assess the impact of macroeconomic instability on remittance inflows to Egypt, we must first measure its degree. This section is structured accordingly, with three subsections. The first subsection details the process of constructing a macroeconomic instability index. The second subsection explains the specification of the econometric model used in the study. Finally, the third subsection demonstrates the empirical methods employed.

4.1. Measuring macroeconomic instability in Egypt

This study constructs a multidimensional index for measuring the degree of macroeconomic instability in Egypt. This multidimensional index captures monetary, fiscal, and external vulnerability dimensions of macroeconomic instability. The index construction is based on a linear combination of three indicators: inflation rate, fiscal deficit (expressed as a percentage of GDP), and external debt stocks (expressed as a percentage of GDP). High inflation rates erode purchasing power, reduce equality of

income distribution and discourage investment. Large and persistent fiscal deficits can lead to high government debt that crowds out private investment slowing down economic growth. High external debt can make a country vulnerable to external shocks and limit its policy options. The multidimensional approach offers distinct advantages. First, there's no universally accepted single indicator for macroeconomic instability. Second, unlike a single measure like inflation, this index incorporates multiple variables, providing a more holistic view of Egypt's internal and external vulnerabilities and risks.

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The data set of each indicator is normalized by the "minimum-maximum" approach to smooth out their different scales without distorting differences in the ranges of their values and to transform the highly skewed indicators. The normalized value of each indicator lies between 0 (representing the lower end) and 1 (representing the top end) (Yorulmaz, 2018).

After normalization, principal component analysis is applied to derive the dimension`s weights for the overall macroeconomic instability index. By assigning the extracted weights (W_i) to the three dimensions, the macroeconomic instability index (MII) is constructed by the following a linear function:

$$MII = W_1D_1 + W_2D_2 + W_3D_3 \quad (1)$$

Where, MII: Macroeconomic instability Index, D_1, D_2, and D_3 capture the inflation, fiscal deficit, and external debt dimensions of macroeconomic instability, respectively. It is worth mentioning that the higher value of the index indicates a higher degree of macroeconomic instability and vice versa.

4.2. Model specification and Data

Following El-Sakka & McNabb (1999) and Abbas *et al*. (2017), this study employs the extended model in equation (2) to estimate the impact of macroeconomic instability on remittance inflows within a multivariate approach that captures other macroeconomic determinants of remittances. The specified model can be expressed by the following equation:

$$REM_t = \gamma_0 + \gamma_1 MII_t + \gamma_2 GDPPC_t + \gamma_3 Oilp_t + \gamma_4 EX_t + \epsilon_t \quad (2)$$

Where, REM is remittance inflows (expressed as a ratio of home country GDP), MII is a composite macroeconomic instability index, GDPPC is the real GDP per capita used as a proxy for the level of economic activity in the home country, Oilp is the international price of Dubai crude oil (US$ per barrel) used as a proxy for the level of economic activity in host countries, EX is the nominal exchange rate (LE/ US$), and ϵ_t is the standard random error term.

Theoretically, the relationship between remittance inflows and macroeconomic instability is influenced by the motive behind remittances. For instance, if the altruistic motive dominates, macroeconomic instability in the home country might have positive impacts on remittance inflows. When the altruistic motive dominates, macroeconomic instability in the home country can lead to increased vulnerability and economic hardship for migrants' families, potentially prompting migrants to boost remittance inflows. On contrast, if the investment motive prevails, macroeconomic instability may raise economic uncertainty, and discourage migrants from investing at their home countries and hence reduce their remittances (Elbadawi and Rocha, 1992; El-Sakka and McNabb, 1999; Akçay and Karasoy, 2019).

The level of economic activity in the home country is expected to affect remittances negatively if the altruistic motive dominates and positively if remittances are mainly for investment purposes (Lucas and Stark, 1985; Osili, 2007). Moreover, a higher level of economic activity in the host countries is expected to increase migrants' employment opportunities, wages, and hence, remittances to their home countries (Bettin *et al*. 2012; Artal-tur *et al*., 2014).

The impact of exchange rate (EX) on remittances is determined by two opposing effects: wealth and substitution effects (Faini, 1994). According to the wealth effect, depreciation of domestic currency increases migrants' purchasing power and wealth (in terms of domestic currency), so, their remittances would increase for investment purposes. On the other hand, exchange rate depreciation makes goods and services relatively cheaper (in terms of foreign currencies), thus migrants would remit less for supporting their families (Bouhga-Hagbe, 2006). From the substitution effect perspective, depreciation often leads to inflation, making goods and services more expensive in the home country. This would encourage migrants to increase their altruistically motivated remittances (Bleaney and Tian, 2019).

The annual data of remittance inflows, real GDP per capita, official nominal exchange rate, inflation rate, and external debt stocks is outsourced from the World Development Indicators (WDI) by the World Bank. The annual data of fiscal deficit is obtained from

the ministry of finance (MOF) and the Egyptian Central Agency for Public Mobilization and Statistics (CAMPAS), while the annual data for international price of Dubai crude oil is extracted from the world bank commodity price data (the pink sheet).

4.3. Econometric methodology

The empirical analysis starts by assessing the stationarity status of the variables by applying the augmented Dickey-Fuller (ADF) unit root test to ascertain that none of the included series is integrated of order (2). After determining the order of integration of each of the included variables, co-integration between the variables is examined using the bounds testing approach of the autoregressive distributed lag (ARDL) model proposed by Pesaran and Shin (1996) and Pesaran *et al*. (2001).

The ARDL model offers some advantages over the traditional cointegration techniques. First, it establishes co-integration among the underlying variables of interest irrespective of their order of integration. Second, it allows different variables to take different optimal lag lengths, while this is not possible in traditional models. Third, it is used to estimate long run as well as short run coefficients. Fourth, it provides robust results in the case of small samples. Finally, it addresses the endogeneity problem.

The ARDL model involves applying several steps. First, the Akaike information criterion is used to identify the optimum order of lags of the model. The second step is establishing co-integration via the bounds test, which involves estimating the conditional unrestricted error correction (UECM) form. Following Pesaran *et al*. (2001) the error correction representation of the ARDL model is as follows:

$$\Delta LnREM_t = \alpha_0 + \sum_{i=1}^{\rho} \alpha_{1i}\Delta LnREM_{t-i} + \sum_{i=1}^{q} \alpha_{2i}\Delta MII_{t-i} + \sum_{i=1}^{m} \alpha_{3i}\Delta LnGDPPC_{t-i} + \sum_{i=1}^{n} \alpha_{4i}\Delta LnOILP_{t-i} + \sum_{i=1}^{s} \alpha_{5i}\Delta LnEX_{t-i} + \beta_1 LnREM_{t-1} + \beta_2 MII_{t-1} + \beta_3 LnGDPPC_{t-1} + \beta_4 LnOILP_{t-1} + \beta_5 LnEX_{t-1} + \in_t \quad (3)$$

Where, α_0 is a drift term, Δ is the first difference operator, $\alpha_{1i}, \alpha_{2i}, \alpha_{3i}, \alpha_{4i}, and\ \alpha_{5i}$ are the short run dynamic coefficients of the underlying ARDL model, with lag length p, q, m, n, and s respectively, $\beta_1, \beta_2, \beta_3, \beta_4, and\ \beta_5$ are the long-run multipliers, and $\in_t$ is a white-noise error term.

The Wald test (F-test) is then used to establish if there is a long-run relationship among the series. The null of no cointegration, $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$, is tested against the alternative that at least one of β_i, i = {1,2,3,4,5} is not equal to zero. The computed F statistic is compared to the critical values provided by Pesaran *et al*. (2001) and Narayan (2005) for the hypothesis tests. If the computed F-statistic exceeds the upper bound value, we will reject the null hypothesis and conclude that there is a long-

run relationship among the variables. On the other hand, if the computed F-statistic is less than the lower bound value, the null of no co-integration cannot be rejected. Finally, if the computed F-statistics lies between the lower bound and upper bound, the test is inconclusive.

Once cointegration is established between variables, the long-run relationship can be estimated using the ARDL (p, q, m, n, s) represented in equation (4) as follows:

$$LnREM_t = \beta_0 + \sum_{i=1}^{\rho} \beta_{1i} LnREM_{t-i} + \sum_{i=1}^{q} \beta_{2i} MII_{t-i} + \sum_{i=1}^{m} \beta_{3i} LnGDPPC_{t-i} + \sum_{i=1}^{n} \beta_{4i} LnOILP_{t-i} + \sum_{i=1}^{s} \beta_{5i} LnEX_{t-i} + \mu_t \quad (4)$$

Where, β_0 is the drift term, $\beta_{1i}, \beta_{2i}, \beta_{3i}, \beta_{4i}, and\ \beta_{5i}$ are long run elasticities, p, q, m, n, s are the optimal lags of regressors $LnREM_t, MII_t, LnGDPPC_t, LnOILP_t, and\ LnEX_t$ respectively, μ_t is an error term.
Finally, the short-run dynamic parameters are obtained by estimating the restricted error correction model (ECM) as in equation (5).

$$\Delta LnREM_t = \alpha_0 + \sum_{i=1}^{\rho} \alpha_{1i} \Delta LnREM_{t-i} + \sum_{i=1}^{q} \alpha_{2i} \Delta MII_{t-i} + \sum_{i=1}^{m} \alpha_{3i} \Delta LnGDPPC_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta LnOILP_{t-i} + \sum_{i=1}^{s} \alpha_{5i} \Delta LnEX_{t-i} + \varphi EC_{t-1} + \mu_t \quad (5)$$

Where, α reflects the short-run dynamic coefficients and φ captures the speed of adjustment needed to restore equilibrium over the long run following a shock to the system.

Finally, the model must undergo several diagnostic checks to examine the reliability of the estimated ARDL model. These checks are the Lagrange multiplier (LM) test of residual serial correlation, Jarque-Bera's normality test and the Breusch-Pagan-Godfrey's heteroskedasticity test. Additionally, stability diagnostics checks as the cumulative sum of recursive residuals (CUSUM) test and the cumulative sum of squares of recursive residuals (CUSUM of squares) test are conducted to ascertain the stability of the estimated model.

5. Results and Discussion

This section presents the results of the study; it is divided into two subsections. The first subsection explains the results of the principal component analysis used for developing the macroeconomic instability index. The empirical results of the estimated econometric model are presented in the second sub-section.

5.1. Principal Component Analysis for Macroeconomic Instability Index

Table (1) reports the results of the principal component analysis (PCA). Through the PCA, eigenvalues for each principal component are estimated. As shown in the table

there are three eigenvalues: 1.84, 0.81 and 0.35 respectively. For each eigenvalue, there is an eigenvector. The principal components obtained from first, second and third eigenvectors are PC1, PC2 and PC3 respectively.

Table 1: Principal component analysis for the macroeconomic stability Index

Eigenvalues: (Sum = 3, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	1.8400	1.0302	0.6133	1.8400	0.6133
2	0.8099	0.4598	0.2700	2.6499	0.8833
3	0.3501	---	0.1167	3.0000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3
Inf	0.4470	0.8751	0.1849
Deficit	0.6530	-0.1779	-0.7361
Debt	0.6113	-0.4498	0.6510

Notes: PC: principal component, Inf: inflation rate, Deficit: fiscal deficit, and Debt: external debt stocks.
Source: Computed using E-views packages

The proportions of variance representing the ratio of each eigenvalue to their sum show that PC1, PC2 and PC3 explain 61.33 %, 27% and 11.67% of standardized variance respectively. The highest eigenvalue of the principal components corresponds to the higher standardized variance. Since PC1 is the only principal component that has an eigenvalue greater than 1, it is considered for the analysis and the macroeconomic instability index is estimated using the weights assigned to the first principal component of each dimension. The first principal component (PC1) consists of a linear combination of inflation rate, fiscal deficit, and external debt stocks with weights obtained from the first eigenvector: 0.447, 0.653, and 0.611 respectively.

5.2. Empirical results

This section presents the empirical results of the econometric model applied in the study.

5.2.1. Stationarity tests.

The results of the augmented Dickey-Fuller (ADF) unit root test are presented in Table (2). The results show that none of the included series is integrated of order (2). All the included variables are non-stationary at levels but stationary at their first differences except for the real gross domestic product per capita (LnGDPPC) which is stationary at level at 5% significance level. This makes the bounds testing approach suitable for examining co-integration between the included variables.

Table 2: Augmented Dickey-Fuller (ADF) unit root test

Variable	ADF-statistic		
	Level		First difference
	Constant	Constant and trend	Constant
LnREM	-2.0900	-1.8476	-5.7917***
MII	-1.5678	-1.9317	-7.5307***
LnGDPPC	-0.9766	-3.7791**	-4.0388**
LnEX	-1.2023	-3.1417	-3.5907**
LnOILP	-1.0560	-2.3164	-6.2894***

Notes: * and ** indicate that the estimated coefficient is statistically significant at 1% and 5% respectively.**
Source: Computed using E-views packages.

5.2.2. The bounds test for cointegration. Three lags are chosen as a maximum for the specified model and the optimal number of lags (1, 3, 0, 0, 2) are selected based on AIC criterion. The results of the bounds test for cointegration are demonstrated in table (3). The results reveal a long-run cointegration relationship between remittance inflows, macroeconomic instability index, real per capita GDP, international oil price, and exchange rate since the F-statistic is greater than the upper bound of the critical value at the 1% significance level.

Table 3: Results of the Co-integration bounds test

F-Bounds Test			Null Hypothesis: No levels relationship			
			n = 35		n = 40	
Test Statistic	Value	Significance	I(0)	I(1)	I(0)	I(1)
F-statistic	5.8584***	10%	2.46	3.46	2.427	3.395
		5%	2.947	4.088	2.893	4
		1%	4.093	5.532	3.967	5.455

Note(s): The lower and upper bound critical values are obtained from Pesaran *et al.* (2001).
Source: Computed using E-views packages.

5.2.3. Estimation of Long run relationship and short run dynamics.

Table (4) reports the estimated coefficients of the specified ARDL model. The estimated long run coefficients presented in Panel (A) of the table reveal that the long-run elasticities of the macroeconomic instability and exchange rate are significant at the 1% significance level while the long-run elasticities of GDP per capita and the international oil price are significant at the 5% significance level. Macroeconomic instability has a positive statistically significant influence on remittances in the long run. A percentage point increase in macroeconomic instability index increases remittances by 145%, ceteris paribus. This result suggests the dominance of the altruistic motive and supports the compensatory nature of remittances since the economic hardship at the home country stimulates migrants to increase their remittances to financially support their families. This result is consistent with the findings of Akçay and Karasoy (2019).

The level of economic activity in the home country has a negative statistically significant effect on remittance inflows to Egypt. Holding other factors constant, an increase in the real GDP per capita by 1% decreases remittance inflows by 1.66% at 5% significance level. This result supports that altruism is the motivating factor for remittances in the long run. Accordingly, remittances are countercyclical and act as an absorber to macroeconomic shocks. On the other hand, the level of economic activity in the host country is found to have a positive statistically significant effect on remittance inflows. Where, a 1% increase in oil prices raises remittance inflows by 0.32% in the long run at 5% significance level.

Concerning the exchange rate, the results reveal that there is a positive and statistically significant association between the exchange rate and remittance inflows, whereas an increase in exchange rate by 1% results in an increase of remittance inflows by 0.55% at 1% significance level. This means that depreciation of the domestic currency triggers remittance inflows, which could grant insurance against balance of payment crisis. This result could be attributed to the exchange rate pass-through to consumer prices in the Egyptian economy (Elsharkawy and Elroukh, 2023).

The error correction term is negative and statistically significant at 1% significance level. It shows a relatively high speed of convergence in the long run dynamics of the variables. It indicates that around 66% of last period's disequilibrium is corrected in the current period. The adjusted R2= 0.86 which reflects the goodness of fit of our model.

Table 4: Estimated long run and short run parameters of the ARDL model

Panel (A): Long run estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MII	1.4481***	0.199557	7.257032	0.0000
LnGDPPC	-1.6590**	0.675567	-2.455735	0.0205
LnOILp	0.3181**	0.136455	2.331321	0.0272
LnEX	0.5505***	0.136585	4.030713	0.0004
C	15.857**	6.317831	2.509976	0.0181
ECT_{t-1}	-0.6631***	0.103023	-6.436423	0.0000

Adjusted R-squared 0.8609

Panel (B): Diagnostic tests

Serial Correlation	3.6928[0.1578]
Heteroskedasticity	0.7591[0.6651]
Normality (Jarque-Bera)	2.2317 [0.3276]

Notes: * and ** indicate that the estimated coefficient is statistically significant at the 1% and 5% respectively.**
Source: Computed using E-views packages.

5.2.4. Diagnostic Checks

The results of the diagnostic checks are shown in Panel (B) of table (4). The Lagrange multiplier (LM) test of residual serial correlation statistic and the F-statistic of the Breusch-Pagan-Godfrey test applied to test homoscedasticity provide no evidence of serial correlation or heteroskedasticity in the error term. In addition, Jarque-Bera's normality test shows no evidence to reject the normality assumption.

The cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) tests are applied to examine parameter stability. Figure (6) plots the CUSUM and CUSUM of squares statistics for examining the stability of the estimated long-run relationship. The results indicate all the estimated long-run parameters are stable since the plots of the two statistics fell consistently within the 5% significance critical bounds.

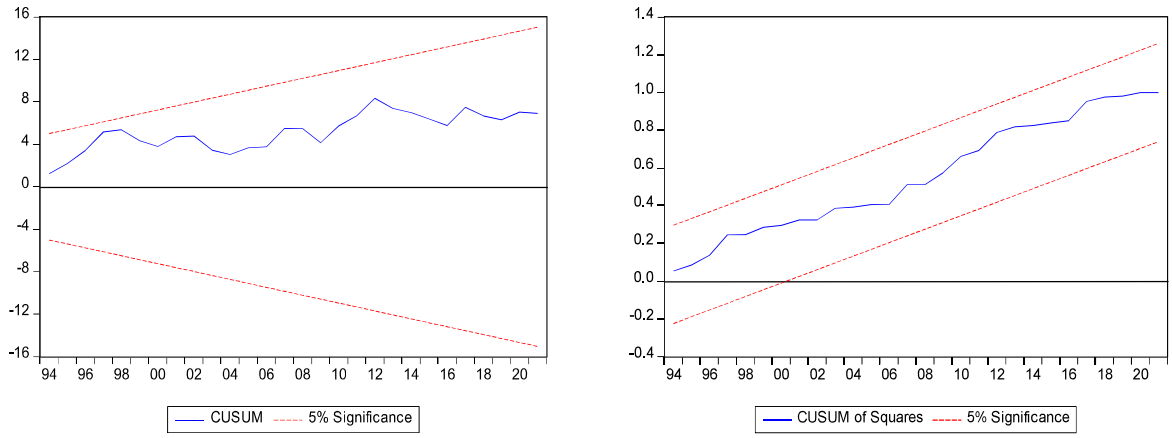

Figure 6: Plots of CUSUM and CUSUMSQ statistics for coefficient stability

6. Conclusion and policy recommendations

Understanding the main determinants of remittances is crucial for helping policymakers to design appropriate policies. This study investigates the impact of macroeconomic instability on remittance inflows to Egypt using ARDL bounds testing procedure for the time series data spanning 1980- 2021.

The findings of the study revealed the existence of cointegration between remittance inflows, macroeconomic instability, real GDP per capita in the home country, international oil prices, and exchange rate. Despite its severe negative consequences, remittance inflows react positively to macroeconomic instability in Egypt. Furthermore, remittances respond negatively to real GDP per capita in the home country, and positively to international oil prices and exchange rate. These results support the altruistic motive of remittances and provide evidence on their countercyclicality. They are also consistent with the compensatory nature of remittances during the periods of economic hardship whereas they work as an absorber to macroeconomic shocks.

These results have important implications for policy makers. First, policy makers should adopt suitable economic policies to mobilize remittance savings and direct them towards domestic productive investments. Second, although remittance inflows react positively to macroeconomic instability, policy makers should keep on adopting macroeconomic stabilization policies to avoid its negative consequences. In contrast to self-interest remittances devoted to investment, altruistically motivated remittances are mainly directed towards consumption. Therefore, maintaining macroeconomic stability and improving the macroeconomic environment in Egypt is a necessary condition for attracting self-interest remittances required for enhancing domestic investments and hence, achieving economic growth.

7. Suggestion for Future research

The analysis of the relationship between remittance inflows and macroeconomic instability can be expanded to analyze the impact of disaggregated remittance inflows on economic growth and macroeconomic stability. In addition, the asymmetric impact of macroeconomic instability on remittance inflows is recommended to be assessed in future research.

References:

- Abbas, F., Masood, A., and Sakhawat, A. (2017). "What determines remittances to Pakistan? The role of macroeconomic, political, and financial factors", *Journal of policy modeling*, vol. 39 No.3, pp. 519-531.
- Adams Jr, R. H. (2009). "The determinants of international remittances in developing countries", *World development*, Vol. 37 No.1, pp. 93-103.
- Akçay, S. (2018). "Remittances and misery index in Turkey: is there a link?", *Applied Economics Letters*, Vol. *25* No. 13, pp. 895-899.
- Akçay, S., & Karasoy, A. (2019). "Determinants of remittances in Egypt: Do macroeconomic instability and oil price matter?" *International Migration*, Vol. 57 No.5, pp. 142-160.
- Ali, A., Mujahid, N., Rashid, Y., and Shahbaz, M. (2015). "Human capital outflow and economic misery: Fresh evidence for Pakistan". *Social Indicators Research*, Vol. 124, pp. 747-764.
- Al-Mashat, R., & Billmeier, A. (2012). "Push or pull? The determinants of remittances to Egypt", *Review of Middle East Economics and Finance*, Vol. 8 No. 2, pp. 1-27.
- Antoniades, A., Seshan, G., Weber, R., and Zubrickas, R. (2018). "Does altruism matter for remittances?", *Oxford Economic Papers*, Vol. 70 No. 1, pp. 225-242.
- Artal-Tur, A., Peri, G., and Requena-Silvente, F. (2014). *The socio-economic impact of migration flows*, Cham, CH: Springer International Publishing, Switzerland. DOI 10.1007/978-3-319-04078-3
- Bettin, G., Presbitero, A. F., and Spatafora, N. L. (2017). "Remittances and vulnerability in developing countries", *The World Bank Economic Review*, Vol. 31 No. 1, pp. 1-23.
- Bleaney, M. F., and Tian, M. (2019). "How do international remittances respond to real exchange rate movements?", Working paper (No. 19/06), Centre for Research in Economic Development and International Trade (CREDIT), The University of Nottingham, Nottingham.
- Bouhga-Hagbe, J. (2006). "Altruism and Workers' Remittances: Evidence from Selected Countries in the Middle East and Central Asia", IMF Working Papers (No. 06/130), International Monetary Fund, May 2006.
- Buch, C. M., and Kuckulenz, A. (2010). "Worker remittances and capital flows to developing countries", *International Migration*, Vol. 48 No. 5, pp. 89-117.
- Carling, J. (2005). "Migrant remittances and development cooperation", *PRIO report* (*1*/2005), Oslo.
- Chami, R., Fullenkamp, C., and Jahjah, S. (2003). "Are immigrant remittance flows a source of capital for development?", IMF Working Papers (No. 03/189), International monetary fund, September 2003.

- Elbadawi, I., and Rocha, R. R. (1992). "Determinants of expatriate workers' remittances in North Africa and Europe", Working paper (No. 1038). Country Economics Department, World Bank, November 1992.
- El-Sakka, M. I., and McNabb, R. (1999). "The macroeconomic determinants of emigrant remittances" *World development*, Vol. 27 No. 8, pp. 1493-1502.
- Elsharkawy, R. A., and Elroukh, A.W. (2023). "Asymmetric exchange rate pass-through to consumer prices in Egypt", Journal of Politics and Economics, Vol. 20 No. 21, pp. 451-470.
- Faini, R. (1994). "Workers remittances and the real exchange rate: A quantitative framework", *Journal of Population Economics*, Vol. 7 No. 2, pp. 235-245.
- Fernandez-Arias, E. (1996). "The new wave of private capital inflows: push or pull?", *Journal of development economics*, Vol. 48 No. 2, pp. 389-418.
- Ghoneim, A. F. (2010). "Labour migration for decent work, economic growth, and development in Egypt", International Migration Papers (No. 106), International Labor Organization.
- Guetat, I., and Sridi, D. (2017). "Institutional quality effect on remittances in MENA region", *Middle East Development Journal*, Vol. 9 No. 1, pp. 84-100.
- Hagen-Zanker, J. and Siegel, M. (2007). "The Determinants of Remittances: A Review of the Literature", Working Paper (No. 2007/03), Maastricht Graduate School of Governance, Maastricht University, June 2007.
- Khodeir, A. N. (2015). "Migration remittances inflows and macroeconomic shocks: The case of Egypt", *International Journal of Economics and Financial Issues*, Vol. 5 No. 4, pp. 1001-1010.
- Lucas, R. and Stark, O., (1985). "Motivations to Remit: Evidence from Botswana", *Journal of Political Economy*, Vol. 93 No. 5, pp. 901–918.
- Narayan, P. K. (2005). "The saving and investment nexus for China: Evidence from cointegration tests", *Applied Economics*, Vol. 37 No. 17, pp. 1979–1990.
- Osili, U. O. (2007). "Remittances and savings from international migration: Theory and evidence using a matched sample", *Journal of development Economics*, Vol. 83 No. 2, pp. 446-465.
- Pesaran, M. H., and Shin, Y. (1996). "Cointegration and speed of convergence to equilibrium", *Journal of econometrics*, Vol. 71 Nos. 1-2, pp. 117-143.
- Pesaran, M. H., Shin, Y., and Smith, R. J. (2001). "Bounds testing approaches to the analysis of level relationships", *Journal of applied econometrics*, Vol. 16 No. 3, pp. 289-326.
- Poirine, B. (1997). "A theory of remittances as an implicit family loan arrangement", *World development*, Vol. 25 No. 4, pp. 589-611.
- Ratha, D., Plaza, S., Kim, E. J., Chandra, V., Kurasha, N. and Pradhan. B., (2023). "Migration and Development Brief 38: Remittances Remain Resilient but Are Slowing", KNOMAD–World Bank, Washington, DC.
- Schoorl, J., Heering, L., Esveldt, I., Groenewold, G., Bosch, A., De Valk, H. A., and De Bruijn, B. (2000). "Push and pull factors of international migration: A comparative report", Office for official publications of the European Communities.
- Spatafora, N., and Aggarwal, R. (2005). "Two current issues facing developing countries", World Economic Outlook, pp. 69-107.
- World Bank (2005). "Economic Growth in the 1990s: Learning from a Decade of Reform", The World Bank, Washington, DC.
- Yorulmaz, R. (2018). "An analysis of constructing global financial inclusion indices", *Borsa Istanbul Review*, Vol. 18 No. 3, pp. 248-258.