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Article

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Cogent Economics & Finance

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Suggested Citation: Prempeh, Kwadwo Boateng; Kyeremeh, Christian; Danso, Felix Kwabena (2023) : The link between remittance inflows and financial development in Ghana: Substitutes or complements?, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 11, Iss. 2, pp. 1-17,
<https://doi.org/10.1080/23322039.2023.2237715>

This Version is available at:

<https://hdl.handle.net/10419/304148>

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To cite this article: Kwadwo Boateng Prempeh, Christian Kyeremeh & Felix Kwabena Danso (2023) The link between remittance inflows and financial development in Ghana: Substitutes or complements?, Cogent Economics & Finance, 11:2, 2237715, DOI: [10.1080/23322039.2023.2237715](https://doi.org/10.1080/23322039.2023.2237715)

To link to this article: <https://doi.org/10.1080/23322039.2023.2237715>



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Published online: 21 Jul 2023.



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Received: 10 April 2023
Accepted: 13 July 2023

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Reviewing editor:
David McMillan, University of Stirling, UK

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FINANCIAL ECONOMICS | RESEARCH ARTICLE

The link between remittance inflows and financial development in Ghana: Substitutes or complements?

Kwadwo Boateng Prempeh^{1*}, Christian Kyeremeh¹ and Felix Kwabena Danso¹

Abstract: This empirical paper explores the link between remittance inflows and financial development in Ghana from 1980–2019. Empirical analyses are carried out using the ARDL VECM, DOLS, CCR and FMOLS techniques. Furthermore, the IRF and forecast FEVD analyses were employed to comprehend better financial development's response to shocks to remittance inflows and other macroeconomic factors. The results demonstrate that the variables are cointegrated, and remittance was found to be beneficial to financial development in both the short and long run. Furthermore, from the IRF analysis, positive shocks to remittance have a favourable influence on financial development. The FEVD investigation suggests that shocks to migrant remittance accounted for almost 32% of the overall variations in financial development. The implication is that, from a policy perspective, well-structured strategies should be devised and executed to promote higher remittance flows via

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PUBLIC INTEREST STATEMENT

Remittances and Financial sector development are critical determinants of economic growth. Migrant remittances are money sent by migrants working overseas to their home countries, representing the most important external funding source for emerging economies. They play a significant role in financing productive investments and allow consumers to stabilise consumption. Though the effect of remittances and financial development on economic growth has been investigated in Ghana, little is known about how remittances affect financial development. The paper utilises time series data to examine whether financial development and remittances complement or substitute each other. We establish that remittances positively influence financial sector development in Ghana both in the short and long run. To say it differently, remittances complement financial development to boost economic growth. To this end, we suggest policy ramifications to promote the inflows of remittances through formal channels in Ghana and other emerging economies.

official conduits. This will stimulate economic growth, financial development, and other monetary benefits of remittance inflows to the nation.

Subjects: Sustainable Development; Economics; Finance

Keywords: remittance inflows; financial development; Ghana; innovation accounting; ARDL

JEL Classification: C32; F22; F37

1. Introduction

In many emerging economies, migrant remittances are among the major external funding sources. They play a significant role in financing productive investments and allow consumers to stabilise consumption after economic shocks (Nanyiti & Sseruyange, 2022). Remittances are the second largest source of external financing, following foreign direct investment (FDI), and are seen as more stable than other overseas flows. This has motivated academics and decision-makers to examine how remittances impact several economic dimensions (Aggarwal et al., 2011; Coulibaly, 2015). For instance, some studies observed how remittances affected economic expansion (E. K. Chowdhury et al., 2022; Fayissa & Nsiah, 2010; Feeny et al., 2014; Goschin, 2014; Kumar, 2013; Kumar et al., 2018; Meyer & Shera, 2017; Sayantan, 2017; Sutradhar, 2020; Tahir et al., 2015), inflation (Narayan et al., 2011; Nisar & Tufail, 2013; Rivera & Tullao, 2020), poverty alleviation (Bang et al., 2022; Khan et al., 2022; Moniruzzaman, 2022; Saptono et al., 2022), energy usage (Rani et al., 2022; Sahoo & Sethi, 2022; Zafar et al., 2022; Zhang et al., 2022), income (Akçay, 2022; Basnet et al., 2022; Mishra et al., 2022), entrepreneurial activities (Alhassan, 2022; Nanyiti & Sseruyange, 2022; Yavuz & Bahadir, 2022), exchange rate (Chemseddin & Abdelkader, 2022; McFarlane, Brown, & Das, 2022), among others. These empirical papers reported that remittances promote economic expansion, aid in poverty reduction, promote energy usage, positively affect incomes of households and entrepreneurial activities, and mainly increase exchange rates confirming the Dutch disease and increasing inflation. Remittances' effects on both emerging and industrialised nations' financial sector development (FSD) have drawn much interest recently (Aggarwal et al., 2011; Akçay, 2020; Atem, 2022; Azizi, 2020; Bhattacharya et al., 2018; Bindu et al., 2022; Deheri, 2022; Fromentin & Leon, 2019; Hamma, 2017; Karikari et al., 2016; Keho, 2020; Mehta, Qamruzzaman, et al., 2021; Miao & Qamruzzaman, 2021; Prakash & Gounder, 2011; Shahzad et al., 2014; Tsaurai & Hlupo, 2019). It has become a topical subject in developing economies because FSD is critical in enhancing economic growth. By facilitating capital mobilisation and directing it to investments in the key sectors of the economy, remittances stimulate economic development. Bettin and Zazzaro (2012) and Peprah et al. (2019) recorded that remittance inflows support FSD in boosting economic growth in emerging nations.

A developed financial sector tends to magnify the growth-enhancing effect of remittance inflows. However, as postulated by Aggarwal et al. (2011), when and how remittances impact FSD remains *a priori* ambiguous. Remittances are linked to the expansion of financial institutions since it serves as an avenue through which remittances are transferred (Fromentin, 2017). Even if not received via a formal institution, the beneficiaries of these remittances may need banking services that offer secure storage of these funds. When a person gets remittances via a formal entity, such as a bank, the likelihood of learning about and requesting further bank services increases. In addition, by offering remittance transfer services, banks can locate receivers with low financial intermediation. As demonstrated by Azizi (2020), for instance, an increase in remittances (% of GDP) is connected to an increase in bank deposits, which leads to a rise in domestic credit to the private sector and bank lending. However, remittances can ease a household's financial constraint, which might cause credit to drop and harm credit market expansion (Nanyiti & Sseruyange, 2022).

From a theoretical standpoint, the remittances-FSD nexus is grounded on two contradictory hypotheses, namely, substitutability and complementarity hypotheses. According to the substitutability hypothesis, remittances are an alternative to credit, easing individuals'/households'

financial constraints. This may lower credit demand and impede credit market growth, particularly in recipient nations with weak financial systems (Bettin et al., 2017). On the other hand, the complementarity hypothesis suggests that remittances via the formal sector may stimulate financial development in underdeveloped nations since they serve as a major funding source. Empirical studies such as Akçay (2020), Deheri (2022), Azizi (2020), Aggarwal et al. (2011), M. B. Chowdhury (2011), Fromentin (2017), Bhattacharya et al. (2018) and Kakhkharov and Rohde (2020) lend support to the complementarity hypothesis. On the contrary, the works of Uddin and Sjö (2013), Bettin and Zazzaro (2012), Opperman and Adjasi (2019), Atem (2022), and Keho (2020) validated the substitutability hypothesis.

Furthermore, the remittances-FSD nexus has been empirically examined for various nations and regions in the panel/pooled or time series framework. Most of these earlier studies demonstrated a beneficial effect of remittance inflows on FSD. For instance, Bindu et al. (2022), using yearly data from BRICS nations, discovered that remittances considerably influenced financial development. Similarly, Fromentin and Leon (2019), using a panel of 30 developing nations, reported a significant effect of remittances on FSD. Utilising a panel of 50 African countries and three measures of FSD, Karikari et al. (2016) established that remittances greatly boost some aspects of FSD; likewise, the receipts of remittances are facilitated by an advanced financial system. Tsaurai and Hlupo (2019) revealed that for 19 transitional markets, remittances have a neutral impact on FSD regardless of the measure of FSD. Aggarwal et al. (2011), employing a sample of 109 emerging economies from 1975 to 2007, found a substantial positive correlation between remittances and FSD. With the aid of a panel of the 57 nations that receive the most remittances and a dynamic system-generalised approach of moments, Bhattacharya et al. (2018) found a considerable positive connection between remittances and FSD. However, the magnitude of the impact was lower for developing economies than developed ones. According to Cooray (2012), remittances support FSD in nations where state ownership of banks is low and promote efficiency in nations where state ownership of banks is high. Fromentin (2017, 2018) recorded a positive nexus between remittances and financial development in developing countries, Latin America and Caribbean countries. Williams (2016), using the Generalised Method of Moments (GMM) estimator, reported that remittances spur financial development in some selected Sub-Saharan African (SSA) countries. However, a study conducted by Coulibaly (2015) failed to provide robust evidence that remittances promote FSD in SSA countries, as the results varied according to the country or measure of FSD employed, unlike Donou-Adonsou and Sylwester (2016). Shahzad et al. (2014) found that remittance inflows significantly impact FSD in South Asia. In analysing 24 developing countries using data from 1990–2015, Azizi (2020) documented a favourable impact of remittances on FSD.

Focusing on time series studies, Deheri (2022) found that in the long run, remittances positively affect FSD in India. On the contrary, in the case of Kenya, Atem (2022) reported that remittances hurt FSD, which contradicts the findings of Misati et al. (2019), who found that remittances promote FSD in Kenya. This may result from the various measurements of FSD used in their investigations and the time under consideration. Furthermore, Akçay (2020) established a nonlinear relationship between remittances and FSD, confirming the complementarity hypothesis in the case of Bangladesh. This agrees with the observations of M. B. Chowdhury (2011), which documented that remittance promotes FSD in Bangladesh. Deonanan et al. (2020) found that in Jamaica, remittances foster FSD in the long run while substituting it in the short run. Additionally, these studies utilised various time series techniques to investigate the remittance–FSD nexus. These include the Autoregressive Distributed Lag (ARDL) approach (Akçay, 2020; Atem, 2022; Deheri, 2022; Deonanan et al., 2020; Misati et al., 2019; Prakash & Gounder, 2011), the Vector Error Correction model (VECM) (M. B. Chowdhury, 2011; Deheri, 2022; Sibindi, 2014) and Nonlinear ARDL (Mehta, Serfraz, et al., 2021).

Along with remittances, other critical determinants, such as economic growth, finance and trade liberalisation, may stimulate the FSD of a nation. Therefore, the exact nexus between economic growth and FSD remains unclear. Nevertheless, a well-functioning financial system supports

economic expansion by mobilising financial resources and channelling them into productive investments (Levine, 1997; Schumpeter, 1911). The path of causation between finance and growth is theoretically classified into four major phenomena: the finance-led growth hypothesis, the growth-led finance hypothesis, the feedback hypothesis, and the neutrality view (Nyasha & Odhiambo, 2018). Recent studies such as Deheri (2022) and Misati et al. (2019) have demonstrated that economic expansion fosters FSD. Regarding the influence of financial and trade openness on FSD, research shows that financial and trade openness enhances the availability of outside funding and encourages the use of financial services and institutions, hence promoting financial deepening (Mishkin, 2009; Rajan & Zingales, 2003). However, trade and financial openness make the domestic system susceptible to external shocks, thereby increasing capital market imperfections and volatility that may harm FSD. Studies such as Deheri (2022), Akçay (2020), and Baltagi et al. (2009) have documented the critical role trade and financial openness play in the FSD.

Against this backdrop, we aim to investigate the short and long-term influence of remittances on Ghana's FSD. Ghana was chosen for our investigation because the nation has experienced significant remittance inflows in recent years. Ghana was recognised as the second largest recipient of remittances in Sub-Saharan Africa after Nigeria in 2021, with a total value of around \$4.5 billion (Benson, 2022). Remittance inflows contribute significantly to GDP (about 5.9% in 2021 (Sasu, 2022)), which is vital for funding current account deficits. Concerning sources, about 68% of the remittance inflows to Ghana are from the USA, Nigeria, the UK, Italy and Germany (RemitScope, 2020). The Ghanaian government intends to reach its Sustainable Development Goals (SDGs) and Ghana Beyond Aid (GBA) targets by 2030. In this situation, greater financial development is necessary to achieve these targets. As stated, remittances transferred via formal channels may foster financial development. Moreover, if appropriately mobilised and steered towards productive investment, remittances may promote economic growth and augment the development impacts that are sorely needed in a developing nation like Ghana. Nevertheless, if remittances serve as alternatives for financial development, the effect may be detrimental. Thus, it is crucial to determine if remittances stimulate or inhibit financial development in Ghana.

This study offers three contributions. First, as far as the authors are aware, this study is the first to examine how overseas remittances influence FSD in Ghana at the distinct national level. Secondly, prior research on the subject mainly employed numerous proxies of FSD, such as bank deposits (%GDP), domestic credit (%GDP), broad money (%GDP), market capitalisation (%GDP) and liquid liabilities (%GDP) (see, e.g., (Bhattacharya et al., 2018; R. P. C. Brown et al., 2013; Donou-Adonsou et al., 2020; Karikari et al., 2016; Keho, 2020; Misati et al., 2019; Williams, 2016)). However, FSD is multifaceted, and measuring it with any of the variables mentioned may exclude other crucial dimensions. We used an index of FSD created by Svirydenka (2016) to address this issue. The index reflects the overall FSD, including access, efficiency, and depth of the financial institutions and market. Lastly, several cointegration tests were used to examine the long-run association among the variables. The Granger causality test and innovative accounting are also used to determine the dynamic connection between the variables. Our findings suggest that remittance inflows positively influence FSD in Ghana in the long and short run.

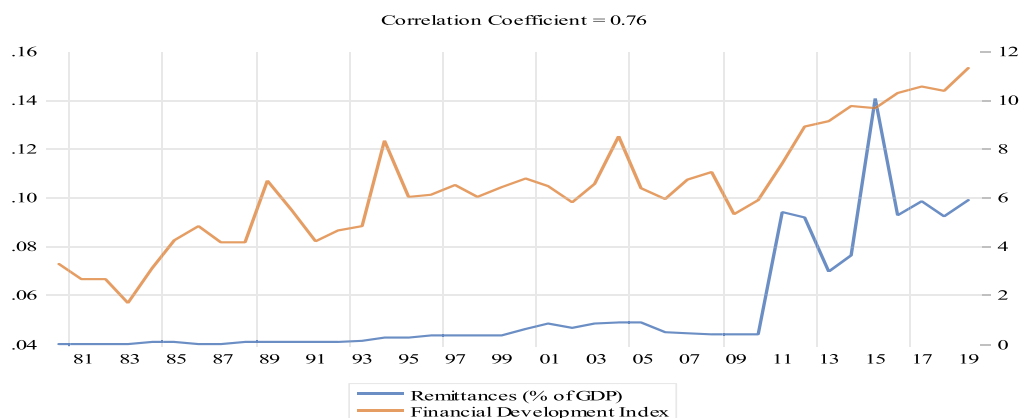
The remainder of the paper is structured as follows. Remittances and FSD movements in Ghana are covered in the section that follows. Section 3 provides an overview of the data and methods. Section 4 analyses and discusses the findings. The conclusion and ramifications for policy are found in Section 5.

2. Trends in financial sector development and remittance inflow in Ghana

Figure 1 depicts the trends in financial sector development and remittances inflows (% GDP) spanning 1980 to 2019. Remittance inflows to Ghana have risen from 0.02% of GDP in 1980 to approximately 6% in 2019. Migrant remittances continued to rise steadily from the commencement of the study period to 2010, from 0.42% of GDP to 5.43% in 2011. Remittance inflows (% GDP) peaked at 10.04% in 2015, which declined to 5.31% in 2016. However, from 2016 it

Figure 1. Trends of remittance inflows and financial development.

Source: IMF, WDI databases and author's estimation



experienced considerable increases up to 2019. On the other hand, financial sector development exhibited a decreasing trend up to 1984. Developing countries, especially Ghana, experienced a major banking crisis in the eighties. Many reasons were assigned to this phenomenon; almost 30% were related to non-performing loans (NPLs) within the economy's private sector. To make the financial sector effective and efficient, the sector has undergone many financial restructuring and transformations. Establishing a market-oriented financial sector was the goal of the Comprehensive Economic Adjustment Program (CEAP) of 1983, the Financial Sector Adjustment Program (FINSAP) of 1988, financial deregulation in 1990, and the adoption of the universal banking system during the first quarter of 2003. Universal banking allowed banks to engage in merchant, commercial, investment and development banking without obtaining separate licenses. The deregulated environment and the relatively stable macroeconomic environment saw the influx of both foreign and local banks. This development also led to a massive expansion of the banking sector and intense competition. In addition, the FINSAP encouraged banking sector reforms and paved the way for creating a capital market. Establishing a capital market became inevitable towards the end of the FINSAP-1, which covered 1988–1999 since many state-owned enterprises were being divested. Consequently, financial sector development regained impetus and has been steadily increasing since 1985, albeit with occasional fluctuations until the end of the sampled period. The correlation coefficient between financial sector development and remittance inflows is 0.76, indicating a favourable interaction between the two variables. The scatter plots further support this, as shown in Figure 2.

3. Data and methodology

3.1. Data

The primary purpose of this paper is to determine whether personal remittances received in Ghana spurred FSD from 1980 to 2019. Data availability dictated the choice of the study period. In sync with previous studies, we employ the FSD index constructed by Sviryzdenka (2016), which captures the aggregate development of the financial sector (Deheri, 2022; McFarlane, Brown, Campbell, et al., 2022) as a measure of the financial sector development. We measured remittance by personal remittances received (% GDP) (Atem, 2022; Bindu et al., 2022; Deheri, 2022; Karikari et al., 2016; Miao & Qamruzzaman, 2021; Rehman et al., 2021). The paper uses control variables such as economic growth, which is proxied by Per capita GDP (constant 2015 US\$) (Aggarwal et al., 2006; Bindu et al., 2022; R. P. C. Brown et al., 2013; Deheri, 2022; Karikari et al., 2016; Miao & Qamruzzaman, 2021; Rehman et al., 2021), financial openness measured by net direct investment inflows (% GDP) (Deheri, 2022; Karikari et al., 2016; Keho, 2020; Olayungbo & Quadri, 2019; Tsaouri & Hlupo, 2019) and trade (% of GDP) as a measure of trade openness (Bindu et al., 2022; R. P. C. Brown et al., 2013; Deheri, 2022; Olayungbo & Quadri, 2019). The FSD index was the only variable for which data were not obtained from the WDI database. The index of FSD was obtained from the IMF database. Figure 3 depicts the graphic representations of the series exhibiting their

Figure 2. Scatter diagram of the lower triangular matrix, histogram of regression line variables.

Source: IMF, WDI databases and author's estimation

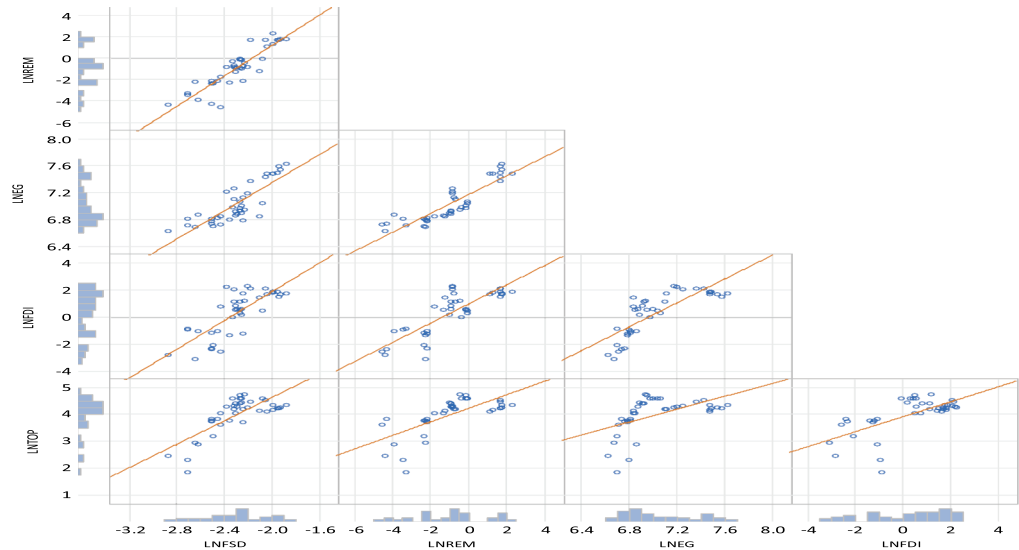
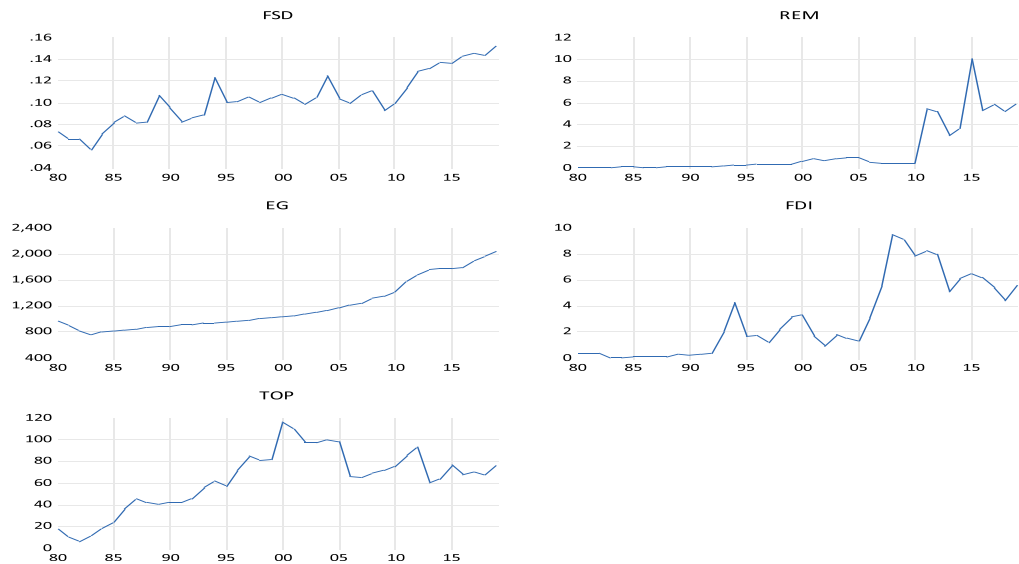


Figure 3. Plots of variables employed in the analysis.

Source: IMF, WDI databases and author's estimation



actual behaviour. Table 1 also shows the rate at which the variables deviate from their respective means. All the variables are positively skewed except TOP. We observed that all variables have a platykurtic distribution except REM, which has leptokurtic distribution. The Jarque-Bera tests reveal that the variables are relatively normally distributed (p -value > 0.05), apart from REM and EG (p -value < 0.05).

3.2. Methodology

To empirically investigate the long-run association and short-run dynamism between $\ln\text{REM}$ and $\ln\text{FSD}$, we utilise the autoregressive distributed lag (ARDL) model suggested by Pesaran et al. (2001). The ARDL model performs better than conventional cointegration test models concerning small or finite samples. Additionally, regardless of the order of integration (i.e., $I(0)$ and $I(1)$), the ARDL bounds testing technique enables evaluating cointegration between the outcome variable and its determinants. However, the technique cannot accommodate variable $I(2)$. Lastly, the problems of endogeneity and serial correlation can be resolved by choosing the appropriate lags. The sample period in our study is relatively small, and there could be probable endogeneity in the

Table 1. Descriptive statistics of series

	FSD	REM	EG	FDI	TOP
Mean	0.10	1.50	1187.17	3.02	62.80
Median	0.10	0.41	1034.51	1.76	66.90
Maximum	0.15	10.08	2053.59	9.47	116.05
Minimum	0.06	0.01	757.92	0.05	6.32
Std. Dev.	0.02	2.38	377.37	2.94	28.06
Skewness	0.24	1.87	0.95	0.74	-.29
Kurtosis	2.46	5.79	2.54	2.25	2.43
Jarque-Bera	0.87	36.40	6.32	4.58	1.11
Probability	0.65	0.00	0.04	0.10	.57
Observations	40	40	40	40	40

Source: The authors

model, hence our choice of the ARDL model. In sync with earlier studies on the association between REM and FSD (Aggarwal et al., 2006; Akçay, 2020; Bhattacharya et al., 2018; Bindu et al., 2022; Deheri, 2022; Karikari et al., 2016; Mehta, Serfraz, et al., 2021; Prakash, 2008; Sobiech, 2019) and determinants of FSD (see, among others (Baltagi et al., 2009; Law & Habibullah, 2009; Mishkin, 2009; Rajan & Zingales, 1998)), to reflect the dynamic impact of $\ln\text{REM}$, $\ln\text{EG}$, $\ln\text{FDI}$, and $\ln\text{TOP}$ on $\ln\text{FSD}$, we propose the empirical model.

$$\ln\text{FSD}_t = \alpha_0 + \alpha_1 \ln\text{REM}_t + \alpha_2 \ln\text{EG}_t + \alpha_3 \ln\text{FDI}_t + \alpha_4 \ln\text{TOP}_t + \varepsilon_t \quad (1)$$

Where FSD denotes financial sector development, REM represents personal remittances, the main variable of interest. EG, FDI and TOP represent economic growth, foreign direct investment and trade openness, which are critical determinants of FSD. All the variables are expressed in their natural log (\ln) form. ε_t is the stochastic error term. *A priori* $\ln\text{REM}$ (α_1) can positively (+) or negatively (-) influence $\ln\text{FSD}$. $\ln\text{REM}$ is anticipated to boost finance industry efficiency. However, it is noted that REM data employed in most studies (with this paper being no exception) is limited as it does not give the exact volume of the remittance movements, given that substantial volumes of REM are transmitted through informal channels. According to Taylor and Castelhana (2016), approximately 50% of REM are under recorded as they are conveyed through informal channels. $\ln\text{EG}$ (α_2) is expected to promote (+) $\ln\text{FSD}$. $\ln\text{FDI}$ and $\ln\text{TOP}$ (α_3 and α_4) can positively (+) or negatively (-) influence $\ln\text{FSD}$. Based on Model 1, we specify the ARDL model as follows:

$$\begin{aligned} \Delta \ln\text{FSD}_t = & \alpha_0 + \psi_0 \ln\text{FSD}_{t-1} + \psi_1 \ln\text{REM}_{t-1} + \psi_2 \ln\text{EG}_{t-1} + \psi_3 \ln\text{FDI}_{t-1} + \psi_4 \ln\text{TOP}_{t-1} \\ & + \sum_{i=1}^n \Phi_{0i} \Delta \ln\text{FSD}_{t-i} + \sum_{i=1}^n \Phi_{1i} \Delta \ln\text{REM}_{t-i} + \sum_{i=1}^n \Phi_{2i} \Delta \ln\text{EG}_{t-i} + \sum_{i=1}^n \Phi_{3i} \Delta \ln\text{FDI}_{t-i} \\ & + \sum_{i=1}^n \Phi_{4i} \Delta \ln\text{TOP}_{t-i} + \varepsilon_t \end{aligned} \quad (2)$$

Model 2 captures the short- and long-run dynamics of the REM-FSD link. The coefficient α_0 is the deterministic component, Δ is the symbol for first difference, and n is the lag length of the corresponding variables. The parameters ψ_0, \dots, ψ_4 capture the long-run associations while $\Phi_0 \dots \Phi_4$ represent the short-run parameters. The bound testing method for evaluating cointegration entails evaluating the $H_0: \psi_0 = \psi_1 = \psi_2 = \psi_3 = \psi_4 = 0$ against the $H_1: \psi_0 \neq \psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq 0$ using the F -test. H_0 is rejected if the estimated F -statistic exceeds the $I(1)$ of the selected significance level. We fail to reject the null hypothesis whenever the estimated F -value is smaller than $I(0)$. However, the conclusion is equivocal if the F -statistic lies between $I(0)$ and $I(1)$ (Pesaran et al.,

2001). Following the confirmation of cointegration, the unrestricted error correction model for *lnFSD* may be evaluated using Model 3.

$$\Delta \ln FSD_t = \mu_0 + \sum_{i=1}^n \chi_i \Delta \ln FSD_{t-i} + \sum_{i=1}^n \beta_i \Delta \ln REM_{t-i} + \sum_{i=1}^n \sigma_i \Delta \ln EG_{t-i} + \sum_{i=1}^n \mu_i \Delta \ln FDI_{t-i} + \sum_{i=1}^n \theta_i \Delta \ln TOP_{t-i} + \xi ECM_{t-1} + \varepsilon_t \quad (3)$$

Where χ , β , σ , μ and θ represent the short-run influence of *lnREM* on *lnFSD*, and ξ represents the rate of adjustment, which depicts the speed of convergence from the short to the long run. *ECM_{t-1}* is the lagged error correction term which captures the rate at which a disequilibrium is adjusted in the next year to reach equilibrium. In theory, the coefficient should be negative and significant. Further, diagnostic and stability checks are executed to ensure that the ARDL model is well-fitted. The diagnostic tests evaluate the model's normality, serial correlation, model specification and heteroscedasticity. We test the structural stability of the model using the cumulative sum (CUSUM) of recursive residuals and the cumulative sum of squares recursive residuals developed by R. L. Brown et al. (1975). To test the robustness of the ARDL bounds testing approach, we utilise the maximum likelihood technique, Bayer-Hanck, and Gregory-Hansen cointegration tests which have been used extensively in the existing literature.

4. Empirical analysis and discussion

We first established the stationarity characteristics of the variables used in our empirical scrutiny utilising the augmented Dickey and Fuller (ADF) (Dickey & Fuller, 1979) and Philip and Perron (PP) (Phillips & Perron, 1988) unit root tests. This is crucial because the ARDL bound tests demand that the variables are *I*(0) or *I*(1). However, in the presence of structural breaks, these conventional tests might produce biased results. Therefore, we utilised the Zivot and Andrews (ZA) (Zivot & Andrews, 1992) unit root test, considering whether the series contains structural breaks. The *F*-test will give bias estimates if any variable is *I*(2). From the findings of the ADF, PP and ZA unit root tests presented in Table 2, all the variables are *I*(1) even after accounting for structural breaks.

Following Deonanan et al. (2020), we use a general-to-specific technique to choose the lag lengths to produce a more parsimonious ARDL model. To ensure that the estimated model's residuals are free

Table 2. Outcomes of stationarity test

Variables	ADF		PP		ZA	
	Level	First difference	Level	First difference	Level	First difference
<i>lnFSD</i>	-1.42	-6.50***	-0.90	-14.05***	-4.498 (2005)	-7.794** (2011)
<i>lnREM</i>	-1.44	-7.02***	-1.10	-19.02***	-3.491 (2006)	-8.570*** (2011)
<i>lnEG</i>	0.68	-3.50**	1.84	-3.34**	-4.521 (2010)	-5.670*** (2010)
<i>lnFDI</i>	-1.14	-5.76***	-1.09	-5.79***	-4.005 (1993)	-6.127*** (1987)
<i>lnTOP</i>	-1.68	-5.23***	-1.66	-5.23***	-3.811 (2006)	-9.870*** (1988).

Source: The authors

Notes: *** and ** denote significance at 1% and 5%, respectively. Values in parentheses (#) are break years. We use the Schwarz information Criterion for the ADF test and a maximum lag of 9 years. We use the Bartlett kernel spectral method for the PP with the Newey-West bandwidth selection. For the ADF and PP tests, we used the intercept specification. For the ZA test, we allow for a break in the intercept and a maximum lag of 4.

Table 3. Cointegration tests outcomes

ARDL bound test outcomes				
Model	F-statistic	I(0)	I(0)	Decision
$lnFSD = f(lnREM, lnEG, lnFDI, lnTOP)$ Selected Model: ARDL (1, 1, 0, 2, 0)	8.456	3.74	5.06	Cointegration
Bayer and Hanck cointegration test				
	Fisher-type test statistics		5% critical value	
EG-J	55.355**		10.576	
EG-J-Ba-Bo	123.046**		20.143	
Gregory-Hansen cointegration test				
ADF	Z_t		Z_a	
-6.289 ^a [2012]	-6.371*** [2012]		-40.732*** [2012]	

Source: The authors

Notes: The critical $I(0)$ and $I(1)$ values are at a 1% level of significance from Pesaran et al. (2001). The values in the brackets (#) are the optimal lag lengths for each variable, determined using the AIC and a maximum lag of 4 years. *** and ** denote significance at 1% and 5%, respectively.

from serial correlation, heteroscedasticity, or non-normality, the maximum lag (n) was established using the Akaike information criterion (AIC). The outcomes of the ARDL bounds test are shown in Table 3. The Table shows a convincing cointegrating association among the variables when regression is normalised in $\ln FSD$. The estimated F -statistic exceeds the $I(1)$ critical value at a significance level of 1%.

The robustness of the cointegration association among the variables was further tested by applying the Bayer and Hanck (2013) and Gregory and Hansen (1996) cointegration tests (see Table 3). Even in the presence of structural breaks, the Gregory and Hansen cointegration and the Bayer-Hanck combined cointegration tests both supported the presence of a cointegrating association. This was further validated by Johansen and Juselius (1990) cointegration test, reported in Table 4. The trace and maximum eigenvalue test statistics are greater than their corresponding critical values at the 1% level of significance. As a result, the null hypothesis that there is no cointegration between the series is not supported. Instead, the test proves that the system has

Table 4. Outcome of Johansen Cointegration test (optimal lag length 3)

Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	Critical value (5%)	P-value
None *	0.975	199.905	69.819	.000
At most 1 *	0.643	710119	47.856	.000
At most 2 *	0.495	35.029	29.797	.011
At most 3	0.267	11.136	15.495	.203
At most 4	0.007	0.248	3.841	.618
Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical value (5%)	P-value
None	0.975	128.786	33.877	.000
At most 1 *	0.643	36.090	27.584	.003
At most 2	0.495	23.893	21.132	.020
At most 3	0.267	10.887	14.265	.160
At most 4	0.007	0.248	3.841	.618

Source: The authors

three cointegrating vectors. Hence, all four cointegration tests conducted support the existence of cointegration among the series.

After determining that the variables are cointegrated, we compute the impact of *lnREM*, *lnEG*, *lnFDI*, and *lnTOP* on *lnFSD* in the short- and long-term. To evaluate the resilience of the model, we further evaluate the long-run associations using Vector Error Correction Model (VECM), Fully Modified OLS (FMOLS) (Phillips & Hansen, 1990), canonical cointegrating regression (CCR) and Dynamic OLS (DOLS) (Stock & Watson, 1993) methods. The results of the ARDL estimates are disclosed in Table 5. The parsimonious ARDL estimation shows that *lnREM* significantly promotes *lnFSD* in the short and long run. Increased REM increases savings which in turn expands access to private sector credit. The result lends support to the complementarity hypothesis. This finding implies that *lnREM* drives *lnFSD* and corroborates similar results reported in the literature (e.g., (Akçay, 2020; Azizi, 2020; M. B. Chowdhury, 2011; Deheri, 2022; Misati et al., 2019; Williams, 2016)). *lnEG* marginally promotes *lnFSD* in the long run, lending credence to the growth-led hypothesis. Also, this resonates with the endogenous growth model, which posits that *lnEG* impacts *lnFSD* by fostering a market for financial products, culminating in the deepening of the financial sector and fostering further growth (King & Levine, 1993). This finding is at odds with the finding of Deonanan et al. (2020) but supports the findings of Deheri (2022), Azizi (2020) and Karikari et al. (2016) and Fromentin (2018). *lnFDI*, which measures financial openness, significantly spurs *lnFSD* in the short run. Nevertheless, in the long run, increases in *lnFDI* negatively impact *lnFSD*, holding other variables constant. This finding supports the notion that rapid financial liberalisation without supervision may harm the banking system. The finding is also supported by Keho (2020) and Tsaurai and Hlupo (2019) but contradicts the findings of Akçay (2020). In addition, the results show that *lnTOP* significantly promotes *lnFSD* in the long run. The outcome supported the theory that TOP generates a market for innovative financial services by considering trade financing and risk mitigation. Misati et al. (2019), Donou-Adonsou et al. (2020), Abeka et al. (2022), and Thi Thuy et al. (2021) found similar results. The coefficient of the ECT_{t-1} is significant with the appropriate sign, indicating that the variables have a steady long-run connection. The coefficient implies that around 85.3% of long-run disequilibrium is adjusted in the next era toward establishing equilibrium.

Regarding the diagnostics, the value of the R^2 suggests that variations in *lnREM*, *lnEG*, *lnFDI* and *lnTOP* explain about 89% of the variations in *lnFSD*. The model diagnostics results further revealed that the

Table 5. ARDL test outcome

Short-run estimates outcomes

Lag Order:	0	1	2	3	4
$\Delta \ln \text{REM}$	0.054*** (0.016)				
$\Delta \ln \text{FDI}$	0.019 (0.020)	0.080*** (0.022)			
ECT_{t-1}	-0.853*** (0.123)				

Long-run estimates outcomes

Constant	<i>lnREM</i>	<i>lnEG</i>	<i>lnFDI</i>	<i>lnTOP</i>	
-3.752*** (1.156)	0.097*** (0.028)	0.266* (0.139)	-0.053** (0.021)	0.085*** (0.037)	

Diagnostic tests

SC	HET	NORM	RESET	CUSUM	CUSUMQ
0.609	0.595	0.642	0.412	Stable	Stable

Source: The authors

Notes: ***, ** and * represent significance at 1%, 5% and 10%, respectively. NORM is the normality test. RESET is Ramsey's test for model misspecification. SC is a test for serial correlation, and HET represents Heteroskedasticity Test. Their respective *p*-values are below the SC, RESET, NORM, and HET tests. Values in parentheses (#) are standard errors.

p -values for the HET, SC, NORM and RESET tests exceed 0.05. This demonstrates that none of the diagnostic tests suggests a breach of the standard ARDL model assumptions. Finally, predicated on the CUSUM and CUSUMQ (see Figure 4 for their visual plots), we conclude that the estimated model is stable.

As noted earlier, we re-evaluated Model 1 using the FMOLS, DOLS, CCC, and VECM techniques to ascertain the consistency of the long-run estimates. The long-run outcomes of these four approaches are all significant and identical in sign and magnitude, as shown in Table 6, therefore validating the ARDL estimation.

The paper employed innovative accounting grounded on VECM estimates to investigate the response of the outcome variable to positive shocks to the model's regressors. The graphs of the impulse responses for the VECM are presented in Figure 5. The impulse response function of the VECM has no error band because it is based on theoretical restrictions. The impact response of $\ln FSD$ to one standard deviation innovation to $\ln REM$, $\ln EG$ and $\ln TOP$ are relatively robust and positive, which persevered throughout the forecast horizon. In most forecast periods, the response of $\ln FSD$ to positive shocks to $\ln FDI$ is also positive. The impulse response analysis indicates positive shocks to $\ln REM$, $\ln EG$, $\ln FDI$, and $\ln TOP$ promote $\ln FSD$. This result is in tandem with the long-run estimates.

Table 7 reports the VEC model's variance decomposition estimates with normalisation on financial development. The forecast period is 10 years, and the system's contribution to a one standard

Figure 4. CUSUM and CUSUM of square tests.

Source: The authors

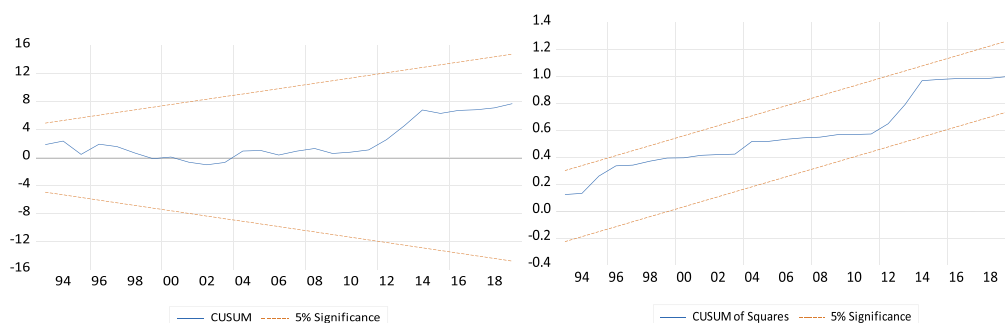


Table 6. FMOLS, DOLS, CCC and VECm estimates of model 1

Method	Constant	$\ln REM$	$\ln EG$	$\ln FDI$	$\ln TOP$
FMOLS	-5.379*** (1.047)	0.051** (0.025)	0.378*** (0.138)	-0.042** (0.021)	.122*** (.036)
DOLS	-2.907** (1.334)	0.142*** (0.054)	0.263** (0.121)	-0.062*** (0.024)	.056*** (.021)
CCC	-5.618*** (1.242)	0.050** (0.023)	0.408** (0.160)	-0.317** (0.129)	.130*** (.0423)
VECM	9.460	0.471*** (0.064)	1.364*** (0.333)	-0.094*** (0.032)	.423*** (.101)

Source: The authors

Notes: *** and ** denote significance at 1% and 5%, respectively. Values in parentheses (#) are standard errors.

Figure 5. Plots of the impulse response of the VECM.

Source: The authors

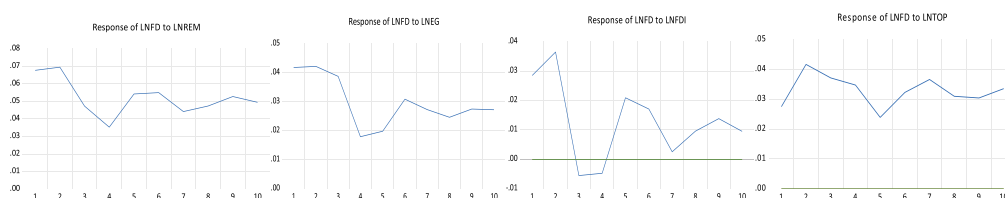


Table 7. Variance decomposition outcome

Period	lnFSD	lnREM	lnEG	lnFDI	lnTOP
2	72.875	15.656	0.396	10.917	.156
4	60.406	24.460	2.007	9.921	3.205
6	44.097	28.203	5.645	13.202	8.853
8	36.921	33.374	6.077	12.991	1.637
10	31.341	31.538	9.886	14.476	12.758

Source: The authors

deviation shock to the regressors and the outcome variable's own shock is discussed. According to the VECM findings, a contemporaneous shock to *lnREM*, *lnEG*, *lnFDI*, and *lnTOP* would significantly impact *lnFSD*. In other words, the variation in *lnFSD* due to a shock would decline over a long time following a concurrent shock in the regressors unless the fiscal or monetary authorities intervene to mitigate the effect of the shocks. Shocks to *lnREM* account for approximately 16% of the variation in *lnFSD* in the 2nd horizon, which increases to around 32% at the end of the 10th period. The variations in *lnFSD* attributable to shocks in *lnEG* are within the range of 1% to 10% throughout the forecast period. Shocks to *lnFDI* explained approximately 11% of the variation in *lnFSD*, which marginally increased to approximately 15% at the end of the forecast horizon. Shocks to *lnTOP* accounted for less than 1% of the variation in *lnFSD* in the 2nd horizon. However, this increased significantly to around 13% in the 10th horizon. The FEVD analysis shows that *lnREM*, *lnEG*, *lnFDI* and *lnTOP* are critical determinants of *lnFSD*. Shocks to the regressors jointly account for more than 60% of the total variation in *lnFSD* in Ghana.

Table 8. VECM- Granger causality test outcome

Null Hypothesis	F-Statistic	P-value	Causality
LNREM LNFS	5.435	.009	Yes
LNEM LNFS	6.147	.005	Yes
LNFDI LNFS	8.020	.051	Yes
LNTOP LNFS	11.346	.000	Yes
LNFS LNREM	0.980	.386	No
LNEM LNREM	3.777	.033	Yes
LNFDI LNREM	4.671	.016	Yes
LNTOP LNREM	1.490	.240	No
LNFS LNEG	0.309	.736	No
LNREM LNEG	1.216	.310	No
LNFDI LNEG	3.080	.059	Yes
LNTOP LNEG	8.332	.001	Yes
LNFS LNFDI	1.445	.250	No
LNREM LNFDI	1.016	.373	No
LNEM LNFDI	4.664	.016	Yes
LNTOP LNFDI	4.010	.028	Yes
LNFS LNTOP	0.061	.941	No
LNREM LNTOP	0.680	.514	No
LNEM LNTOP	0.031	.970	No
LNFDI LNTOP	0.371	.693	No

Source: The author.

Notes: The sign indicates no causality between the specified variables. All the variables are in their first difference.

Finally, the VECM Granger Causality/Block Exogeneity Wald Tests examines the causal direction among the variables. Table 8 summarises the outcomes. The results show a unidirectional causality from *lnREM*, *lnEG*, *lnFDI* and *lnTOP* to *lnFSD* with no feedback. This shows that *lnFSD* does not drive *lnFDI* and *lnREM* flow to Ghana. Also, *lnFSD* does not cause *lnEG* and *lnTOP* in Ghana.

5. Conclusion and policy ramifications

Particularly in emerging economies, the regular flow of remittances brought on by the integration of the financial markets has piqued the curiosity of policymakers and scholars. Notwithstanding the increasing prominence of remittances, studies on the remittances-finance nexus in developing economies, including Ghana, remain unexplored. As a result, this study seeks to fill this void and provide a solution to the research questions. Do remittances influence FSD in Ghana? Are FSD and its determinants cointegrated in Ghana? In our attempt to solve these critical queries, the paper examines the link between remittances and FSD, employing economic growth, FDI and trade openness as the control variables from 1980 to 2019. The ARDL bound, Bayer and Hanck, Gregory and Hansen and the Johansen cointegration tests were used to explore the cointegrating connection between the variables. All tests' results point to a cointegrating link between the variables. After determining the existence of cointegration among the variables, the ARDL model was used to scrutinise the short and long-run influence of REM on FSD. According to the long-run estimates, REM supports FSD in the short and long term. The findings also demonstrated that TOP and EG positively interact with FSD in the long run. However, FDI has a deleterious effect on long-term FSD. The FMOLS, CCC, DOLS, and VECM estimates agree with the long-run ARDL findings.

We used the IRF and FEVD analyses to understand better how FSD responds to shocks to the determinants in the model. The analyses suggest that FSD primarily responded favourably to a positive shock to REM, EG, TOP and FDI inflows. According to the FEVD analysis, shocks to REM account for a sizable proportion ($\approx 32\%$) of the overall variance in FSD. Shocks to other determinants also contribute significantly to the variation in FSD. Regarding the direction of causation, we prove that FSD has no feedback effect on REM, economic growth, FDI, and trade openness. Generally, the findings show a complementarity link between foreign remittance inflow and FSD in the long and short run. The results coincide with remittance-finance theory and lend support to most empirical works.

From the findings, we propose that policymakers in Ghana should put in efforts to promote remittance inflows through formal channels. However, the transaction costs of remittance transfers via official channels are high in developing nations such as Ghana. The average fee for remittance of \$200 to Ghana is approximately 7.4%.¹ In addition, it is reported that considerable sums of remittances are routed through informal channels due to high transaction costs. Thus, authorities should develop policies to minimise transaction costs related to remittance transfers and banking services to incentivise remittances through formal channels. Also, introducing tax exemptions on remittance-led investments or inter-banks with competitive deposit rates for the diaspora may draw additional remittances (Bindu et al., 2022; Donou-Adonsou et al., 2020). Intuitively, the population of migrant workers overseas impacts the volume of remittances received into the economy. Therefore, the government of Ghana should explore possibilities for overseas employment for surplus labour by establishing bilateral connections with nations with inadequate labour supply. Remittances contribute to long-term economic growth by fostering financial development. The consequence is that the financial sector facilitates international money transfers. Future studies may investigate remittance's possible nonlinear or asymmetric impact on financial development in emerging economies.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Citation information

Cite this article as: The link between remittance inflows and financial development in Ghana: Substitutes or complements?, Kwadwo Boateng Prempeh, Christian

Kyeremeh & Felix Kwabena Danso, *Cogent Economics & Finance* (2023), 11: 2237715.

Note

1. Data on average transaction cost of sending remittance to a specific country is available at <https://data.worldbank.org/indicator/SI.RMT.COST.IB.ZS>

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