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Empirical Economics
Journal of the Institute for Advanced Studies, Vienna, Austria

ISSN 0377-7332
Volume 56
Number 3

Empir Econ (2019) 56:865–882
DOI 10.1007/s00181-017-1375-6



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Remittances and output growth volatility in developing countries: Does financial development dampen or magnify the effects?

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Received: 8 February 2016 / Accepted: 9 November 2017 / Published online: 27 December 2017
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Abstract The paper empirically investigated the relationship between remittance flows and output growth volatility for an extensive sample predominated by emerging and developing countries. Following this broad treatment, it goes further to estimate the extent to which the degree of financial development (FD) impacts on the remittances–growth volatility nexus. This novelty distinguishes the work from previous studies. Using the system-generalized method of moments estimator, which corrects for endogeneity and omitted variable concerns, on data spanning the period 1996–2012 for a total of 71 countries some interesting findings ensued. One, both remittances and FD had growth volatility dampening effects. Two, the interaction between proxies for FD and remittances produced mixed results. Three, when volatility of FD is accounted for, the interactive term had mixed results. For instance, banking sector credit produces positive and insignificant coefficients, while private sector produced significant and negative coefficients. Summarily putting these results in other words, the counter-cyclicality of remittances was established, while the complementary dampening effect of financial development is dependent upon its measure. On the basis of the foregoing, a few related policy lessons are documented to conclude the paper.

Keywords Financial development · Remittances · Output growth volatility · GMM

JEL Classification C23 · E32 · F22 · O16

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1 Introduction

Migrant remittances have been documented to be second only to foreign direct investment (FDI) as a source of capital for financing development particularly in developing countries with dire capital scarcity (Ratha 2003; Adam and Page 2005; World Bank 2009). These remittance flows have even surpassed FDI flows in terms of both magnitude and spread in some specific years (see World Bank 2006¹ for details). Hence, it becomes clear why the allure of remittances is attributable in part to the stream of benefits which it has been purported to confer on recipient economies. These desirables include, but are not limited to: smoothing consumption (Combes and Ebeke 2011; Bugamelli and Paterno 2009b; Craigwell et al. 2010), absorbing shocks, especially those arising from natural disasters (Chami et al. 2008, 2010; Bugamelli and Paterno 2009a; Combes and Ebeke 2011, playing a stabilization role by, for instance, lowering the probability of current account reversals (Bugamelli and Paterno 2009a), enhancing investment opportunities through increased savings (Jihoud 2015), as well as reducing the level, depth and severity of poverty (Adam and Page 2005). Beyond these, it has similarly been suggested as the most resilient of all foreign capital flows. On the flip side, notwithstanding, the darker aspects of remittances have equally not escaped the attention of scholars. Some of the well-documented downsides include: causing inflationary pressures, dampening labour participation with the attendant labour supply shortages and provoking real exchange rate appreciation.²

In spite of the foregoing gains and losses, newer vintage literature appears to have shifted focus to the role of remittances in understanding business cycles. On this front, remittances have been partitioned into counter-cyclical, pro-cyclical as well as a-cyclical. This categorization is particularly insightful when viewed from the prism of the direction and magnitude of the remittance-induced impacts on output growth volatility. With little or no doubt, output growth volatility remains a legitimate concern among economists and policy-makers alike. This apprehension is typically couched in the light of its deleterious effects on growth, poverty and welfare (Bugamelli and Paterno 2008). Hence, appreciable research effort has been geared towards the identification of mechanisms for dousing the often adverse macroeconomic consequences of output growth volatility. In this paper, we explore one of such mechanisms, namely the extent of development of the financial system. Along this line, we seek to answer two basic questions: What is the impact of remittances on output growth volatility? Does financial development dampen or magnify such impact? In order to generate reliable estimates of the magnitude of this influence, we deploy data on an extensive sample (71 in all) of countries comprised predominantly of both emerging and developing economies. This empirical exercise is pursued within a panel econometric framework with the system-generalized method of moments (SYS-GMM) used

¹ According to this report, the magnitude of remittances in many developing countries has surpassed official development assistance (ODA), private equity flows and foreign direct investment (FDI), and their rate of growth has outpaced that of official and private capital flows.

² Remittances may be harmful to the long-run growth of recipient economies through an appreciation of the real exchange rate, which tends to be detrimental to the tradable sector and reduce the competitiveness of exports—a phenomenon known as the Dutch disease (Bourdet and Falck 2006; Acosta et al. 2009; Amuedo-Dorantes and Pozo 2004; Acosta et al. 2009).

as estimator. Granted that the impact of remittances on key development outcomes has been studied extensively, there are a number of reasons that can be adduced as warranting the investigation of the mediating role of finance in the remittances–output volatility relationship. We turn to at least three of such arguments in what follows.

First, unlike the industrialized economies, which have experienced the age-long episode of Great Moderation,³ for well over two decades, similar narratives could hardly be told of developing countries' volatility experiences. Admittedly, these economies' have been largely characterized by incessant volatilities mostly with respect to critical macroeconomic variables like output, prices, investment, consumption and a host of others. These have had negative impacts on the realization of most development policy programs, especially the erstwhile Millennium Development Goals (MDGs). As a corollary, high output volatility has been found to adversely affect economic growth, welfare and poverty particularly in developing countries (see Ramey and Ramey 1995 for further details). Thus, maintaining consistent stability in the macroeconomic environment still remains a key development policy goal for these countries. Achieving this condition is paramount since it is one of the initial conditions that potential foreign investors assign appreciable weight to when it comes to their investment decisions.

Second, recourse is often made to migrants' remittances in the face of dwindling foreign direct investments, foreign aid as well as foreign loans and debts. This important role of remittances was during the global financial crisis of 2008/2009. As is well known, many developed economies were worst hit by this financial crisis occasioned by widespread defaults on subprime lending in the US mortgage market. The contagious effects later affected and spread to other financially integrated economies in Europe. Needless to say, that many of these countries had been major aid donors pre-crisis. Therefore, following this shortfall in foreign capital flows to developing countries, remittance receipts presented a veritable stabilization mechanism for the management of economic shocks in remittance recipient economies.

Third, the emerging and developing countries' output volatility episodes have been blamed on country-specific and idiosyncratic factors like domestic FD, institutional quality, trade and financial openness, global and regional shocks among a host of factors (for further exposition, see Kose et al. 2003; IMF 2005). Based on the preceding arguments, it becomes clear that an investigation of the tripartite connection among remittances, output growth volatility and domestic financial development is imperative.

Apparently, there is a limited, but growing literature on remittances and output growth volatility particularly if intermediated via FD. One incisive example in this regard is the study by Ahamada and Coulibaly (2011). These authors investigated the role of financial development (FD) in the remittances–GDP growth volatility nexus using data on 87 developing and emerging economies (their sample almost matches our sample of 71 countries). They deployed a panel smooth transition regression (PSTR)

³ This is a phenomenon in which some advanced industrialized economies like the US, UK, and France witnessed some sort of decline in the volatility of output growth and inflation rates. Conceptually speaking, these are believed to have stemmed from three main reasons fully explicated under different hypotheses like good luck, good policy and good practice, respectively (Blanchard and Simon 2001; McConnell and Perez-Quiros 2000; Stock and Watson 2002 are some of the papers with further empirical expositions).

analysis and found a nonlinear effect of remittances on output growth volatility in the first instance. Additionally, they found the growth volatility stabilizing influence of remittances to be an increasing function of the level of financial development and suggested that financial sector reforms should be bolstered in remittance receiving countries. The incisiveness of their analysis notwithstanding, the choice of both a transition function and threshold for FD is based squarely on the assumption of exogeneity. We alternatively hypothesize that the concerns about the threshold value for FD should be a secondary one and argue that the primary issue is to ascertain that FD is indeed not an endogenous regressor. Put in other words, in dealing with this relationship methodically, the potential endogeneity of FD is a far more serious problem than establishing its threshold value. If the endogeneity hypothesis is confirmed, the appropriateness of FD as threshold variable in the remittances–output growth volatility nexus becomes debatable.

In principle, endogeneity can arise through three main channels, namely omitted variable bias, measurement errors and reverse causality. While omitted variable bias unavoidably plagues most empirical specifications, our case for the ascendancy of endogeneity over thresholds is predicated on the latter two. Theoretically, it can be conjectured that unpredictability (volatility) in the growth of GDP across countries is a significant predictor of the observed pattern of FD. Also, reverse causality from remittances to output may significantly bias estimates as remittances often represent a large share of developing countries' GDP, and they have been found to affect both growth and FD (see Gupta et al. 2009; Giuliano and Ruiz-Arranz 2009; Bettin and Zazzaro 2012; Raheem and Ogebe 2014). In other words, countries with effective stabilization policies may more likely be seen as better macroeconomic performers and therefore more suitable destinations for investible funds. As regards measurement error, Reinke (2007) argued that officially recorded remittances are known to be measured with error. This is just as Bettin and Zazzaro (2012) and Raheem (2015) argued that the “unrecorded” or unofficial remittances account for over 30% of the recorded international capital flow. In addition, there is no generally acceptable means of measuring output growth volatility. The norm in the literature is to use standard deviation of the variable of interest.⁴ These possibilities of endogeneity substantially dampen the veracity of not only the estimation, but also the inferences drawn from an empirical exercise like that of Ahamada and Coulibaly (2011) which somewhat uncritically assumed the strict exogeneity of FD.

Two, virtually, all economic relationships suffer from simultaneity and endogeneity problems, resulting from measurement error, reverse causation and omitted variables. These econometric concerns reinforce the case for the deployment of analytical approaches suited to the correction of these anomalies. Recognizing this fact, the study uses system-generalized method of moments (SYS-GMM).

That said, we thus pursue an empirical strategy in this paper, which recognizes the primacy of endogeneity in the relationship of interest and for the derivable policy implications. Our use of the system-generalized method of moments (an instrumental variable IV approach) is of course a fitting remedial response to the potential challenge

⁴ Studies are silent about the computational process of this measure.

at hand. Put together therefore, our study is distinct (though raises largely similar questions) from our “*sister paper*” to the extent that a theory-consistent consideration of the plausible influence of growth volatility on FD on the one hand, and remittances and growth, on the other hand, is taken on board in the first place. Second, an analytical technique that corresponds to the foregoing realization such as the SYS-GMM is used to elicit estimates and inferences. Third and finally, the policy implications arising from our finding are likely to better reflect the dampening (or otherwise) effect of FD on the association between GDP growth volatility and remittances.

Our estimated models, *inter alia*, present some interesting findings. First, both remittances and FD have growth volatility dampening effects. Second, the interaction between proxies for FD and remittances produces mixed results. Third, if volatility of FD is accounted for, the interactive term has a positive coefficient, which is considered to be higher than the individual effects of both remittances and FD.

The remainder of this article is organized as follows. In Sect. 2, we provide a review of the literature on output growth volatility and remittances. Section 3 presents the methodological kits suitable for the empirical analysis. Section 4 contains the empirical findings and discussions. Finally, Sect. 5 provides concluding remarks and sketches the major policy implications of the findings.

2 Brief literature review

A number of studies have established an array of factors that are capable of impacting on output growth volatility in the literature. These include exogenous shocks (Easterly et al. 1993; Calderon et al. 2005; Hakura 2009); persistent country characteristics (Furceri and Karras 2007; Caballero 2000; Cecchetti et al. 2006); institutional environment (Rodrik 1998; Acemoglu et al. 2003) and remittance flows (Chami et al. 2003, 2006, 2008; Abdih et al. 2008; IMF 2005; Bugamelli and Paterno 2008; Craigwell et al. 2010). Due to the extensive nature of literature on remittances and for the study’s focus not to be misplaced, the literature survey is confined to the remittance-related channel of influence.

In no particular order, Bugamelli and Paterno (2008), using a cross section of 60 emerging and developing countries, argued that the inherent features of remittance size and cyclical properties can help smooth consumption and investment, thus easing economic stability. Craigwell et al. (2010) documented the mitigating effect of remittances on adverse output shocks. However, they found no significant influence on consumption and investment volatility. Combes and Ebeke (2011) analysed the impact of remittances on household consumption instability in a large panel of 89 developing countries over the period 1975–2004. Three main outcomes are discernable from their empirical results: First, remittances are found to significantly reduce household consumption instability. Second, the role of remittances as risk hedger is equally amplified as the effect of various sources of consumption instability in developing countries (natural disasters, agricultural shocks and discretionary fiscal policy) became dampened. Third, this risk hedging role of remittances was more pronounced in less financially developed countries.

Using cross-sectional OLS and generalized method of moments (GMM), Chami et al. (2012) examined the association between workers' remittances and output volatility in a sample of 70 remittances recipients. They found that remittances have a negative effect on output growth volatility, thereby supporting the notion that remittance flows are a stabilizing influence on output. This outcome is in tandem with Chami et al. (2008). Similar in spirit to the present study is Ahamada and Coulibaly (2011). They examined how FD influences the impact of remittances on GDP growth volatility on a panel of 87 developing and emerging countries over the period spanning 1980 through 2008 using a panel smooth transition regression approach. They were able to establish non-linearities between remittances and GDP growth volatility. In addition, they further confirmed that a high level of FD makes remittances have a high stabilizing impact on GDP growth volatility.

More recently, Jihoud (2015) also conducted a study probing both theoretical and empirical channels through which remittances affect macroeconomic volatility in African countries using Dynamic Stochastic General Equilibrium (DSGE) model augmented with financial frictions. The empirical findings showed that remittances as a ratio of GDP had a significant smoothing impact on output volatility, but the impact on consumption was rather small. Ajide et al. (2015) empirically examined the role of institutional infrastructure on the remittance–output growth volatility linkage for a large sample of remittance recipients countries using system-generalized method of Moments. The study established three distinct lines of outcomes. First, the growth volatility reducing influence of remittance flows. Second, the growth volatility reducing potential of remittance was further pronounced in the presence of well-functioning institutions, and lastly, the interaction of institutional dimensions with remittances further lent credence to the growth-enhancing effects of remittances with better institutions. Also, Ajide et al. (2017) confirmed the counter-cyclical effect of remittances on investment volatility. In the same vein, this negative effect could be upturned with the help of good institutional framework.

3 Data and methodology

This section is divided into two parts. In the first part, data related issues are adequately discussed, while the second subsection deals with modelling issues.

3.1 Data

The scope of this study is limited to seventy-one remittances recipient countries in the world. The time frame of the study is 1996–2012. The choice of this scope is predicated on data availability. The main source of our data is the World Development Indicators database.

Output growth volatility is defined as the standard deviation of GDP per capita growth. This measurement has equally been adopted by influential previous studies such as Ramey and Ramey (1995) and Chami et al. (2012). The alternative measure of growth volatility we adopted is the standard deviation of Hodrick–Prescott filtered trend. Also, based on the World Bank's definition, remittances are characterized inde-

pendently of the source of income of the sending household, the relationship between the households and the purpose for which the transfer is made. In terms of FD, the two commonly used indicators we adopted are the private sector credit and credit provided by the banking industry. We also obtained and used data on a set of conditioning variables hypothesized to influence output growth volatility. The details and definitions of these variables are offered concurrently with the model specification in what follows.

3.2 Model specification

This study encompasses four separate strands of the literature. The first being output growth volatility, which is attributable to Ramey and Ramey (1995). The second is related the remittances–growth nexus. Studies such as Ratha (2003) and Adam and Page (2005) among other frequently cited studies have given enormous theoretical and empirical attention to the above nexus. In the third strand are studies that have dwelled on the FD growth nexus. The last related strand is the remittances, FD and growth trilogy (Giuliano and Ruiz-Arranz 2009; Bettin and Zazzaro 2012; Raheem and Ogebe 2014).

As earlier stated, the only closely related study to our paper is Ahamada and Coulibaly (2011). Hence, their model is adopted with few modifications⁵. The baseline equation is specified as:

$$VGDP_{it} = \alpha_0 + \alpha_1 VGDP_{it-1} + \alpha_2 REM_{it} + \alpha_3 FD_{it} + \alpha_4 REM * FD_{it} + \alpha_5 X'_{it} + \varepsilon_{it} \quad (1)$$

where VGDP is the volatility of GDP per capita growth. REM is remittances (measured as a ratio of GDP). FD is the two proxies of FD (% of GDP). REM*FD is the interaction between remittances and FD. X' is a vector of selected control variables that have been hypothesized to affect GDP and by extension, GDP volatility. They include investment, which is proxied by gross fixed capital formation (as a ratio of GDP); trade openness (as a ratio of GDP); inflation and government consumption (as a ratio of GDP).

As regards methodology, the study adopted the System GMM of Arellano and Bond (1991) and Arellano and Bover (1995). The superiority of this methodology over the Pooled OLS is its suitability for dealing with endogeneity issues that might occur as a result of measurement error, omitted variable bias as well as reverse causality. In order to account for heterogeneity issues that might arise from the residuals generated, we adopt a two-step GMM, while one step is consistent with homoscedasticity (Ajide and Raheem 2016a, b). We also used a robust estimator.

4 Empirical results

This section presents the results of both pre- and post-estimation exercises conducted. To begin with, the goal of pre-estimation exercise is to uncover the peculiarities of

⁵ Unlike Ahamada and Coulibaly (2011) study which did not account for the effect of key control variables in their model, our study adequately improved on this shortcoming.

each of the countries with respect to the variables of primary interest. This is done by estimating the cross-sectional mean and median values for all the countries concerned. In addition, the summary statistics is also presented. Table 1 shows that growth volatility for the entire sampled country has mean and median values of 2.71 and 2.94, respectively. The least volatile country within the period of review is Bangladesh with standard deviation of growth rate of GDP standing at 0.63 and followed by Australia and Austria with each having 0.93, while the most volatile countries are Sierra Leone and Latvia with 8.17 and 7.04, respectively. Emanating from the table also are some insightful outcomes relating to other key variables of interest like financial development indicators and remittances. Apparently, the measures of both banking and financial system activities are high in virtually all the developed countries sampled. Of the league of developed countries, Netherland and Switzerland have the highest in terms of credit provided to the private sector and banking sector credit, but with the former displaying marginally higher values. Among developing countries', Congo republic and Cameroun seem to be faring badly in both measures of financial development. This serves as a pointer to the extent of shallowness characterizing financial systems in developing countries (particularly in the African continent). In terms of ratios of remittances to GDP, Jordan takes a lead with 18.62, directly followed by Haiti, El-Salvador, Jamaica, Honduras, Gambia, Guyana and Philippines having 18.18, 14.92, 13.50, 12.90, 11.12, 10.99 and 10.37 in that order. While the least are credited to Argentina and Gabon, with each having 0.11 and belonging to this category also are countries like Papua New Guinea, Norway, Sweden, Congo republic, Denmark, Finland, Ireland, Israel, Iran, Ghana, Germany, South Africa South Korea, Spain, Switzerland, Trinidad and Tobago.

What do these portend in terms of economic intuition? Plainly, a number of positions can be deciphered from the results in Table 1. First, our theoretical postulate requires a well-developed financial system to have dampening effects on output growth volatility. This appears plausible from the table as a number of developed countries like Australia, Austria, Germany, Denmark, Spain, Portugal, France Italy, Switzerland, Sweden, Belgium seem to have low output growth volatility episodes. Second, some countries with well-developed financial systems are also found entangled in high output growth volatility episodes. Such countries include Finland, Luxemburg, Panama, Hong Kong, Ireland, Greece, South Korea and Thailand. Third, on a flip side of the financial development, some countries are best performers in terms of the reduced episodes of output growth volatility. The category of such countries are Bangladesh, Bolivia, Brazil, Colombia, Costa Rica, El-Salvador, Sri Lanka, Honduras, India, Jamaica, Mexico, Guatemala, Pakistan, Philippines and some countries in Africa like Ghana, Kenya, Mali, Senegal and Senegal. Fourth, expectedly, some countries with shallow financial systems also recorded high output growth volatility. These countries include Argentina, Turkey, Iran, Indonesia, Hungary, Guyana, Congo Republic, Cote D'ivoire, Togo, Sudan, Trinidad Tobago, Malawi, Niger, Papua New Guinea, Gambia, Gabon and Sierra Leone.

Viewing these results from the perspectives of remittances–output growth volatility nexus, two distinct lines of generalizations can be distilled. First, the 'counter-cyclicality' argument can only be applied to those countries whose high remittances can be associated with low output growth volatility. Countries that are endowed with

Table 1 Output volatility, institutions and FD, 1996–2012. *Source:* Authors' computation

Country	A	B	C	D	Country	A	B	C	D
Algeria	1.65	10.57	10.39	1.11	Jordan	2.31	76.09	75.92	18.62
Argentina	5.80	13.85	13.48	0.11	Kenya	2.03	28.79	27.71	2.90
Australia	0.93	99.27	102.32	0.31	Latvia	7.04	53.31	53.31	1.66
Austria	0.93	110.48	110.39	0.74	Luxembourg	3.48	141.25	141.16	3.18
Bangladesh	0.63	33.49	33.22	7.29	Malawi	4.65	9.93	8.46	0.37
Belgium	1.63	82.59	82.58	1.91	Mali	2.77	17.68	17.61	4.47
Bolivia	1.59	47.56	45.81	3.27	Mexico	2.80	19.31	16.52	1.91
Brazil	2.22	41.15	40.09	0.27	Morocco	3.21	52.23	51.98	6.67
Cameroun	0.98	9.93	9.92	0.52	Netherlands	2.24	160.77	160.75	0.28
Colombia	2.61	33.91	28.86	1.75	New Zealand	1.78	118.43	118.44	0.92
Congo Rep.	3.22	5.52	5.51	0.23	Niger	3.79	7.58	7.58	1.52
Costa Rica	2.82	33.56	33.50	1.47	Norway	1.73	73.422	71.99	0.17
Cote D' Ivoire	3.96	15.88	15.73	1.20	Pakistan	1.97	24.13	24.09	3.89
Denmark	2.15	146.84	146.73	0.40	Panama	3.25	87.23	80.74	0.83
Ecuador	2.92	22.74	22.36	4.65	Papua New Guinea	4.17	20.37	19.10	0.17
Egypt	1.72	44.85	44.85	4.76	Paraguay	4.78	25.57	24.48	2.74
El-Salvador	1.66	41.69	41.13	14.92	Peru	3.01	24.27	23.94	1.59
Finland	3.44	72.01	71.87	0.32	Philippines	2.14	35.38	35.39	10.37
France	1.61	96.74	96.98	0.65	Portugal	2.49	140.95	140.81	2.16
Gabon	4.01	10.05	10.05	0.11	Senegal	1.70	21.11	21.03	7.78
Gambia	3.51	10.62	10.40	11.12	Sierra Leone	8.17	4.08	3.99	1.60
Germany	2.07	111.55	111.55	0.28	South Africa	1.49	138.60	70.12	0.25
Ghana	2.72	12.85	12.63	0.55	South Korea	3.54	108.35	107.68	0.74

Table 1 continued

Country	A	B	C	D	Country	A	B	C	D
Greece	4.33	73.71	73.58	1.05	Spain	2.53	141.27	141.14	0.69
Guatemala	1.27	24.01	23.60	7.90	Sri Lanka	2.26	29.61	29.59	7.70
Guyana	3.27	47.78	39.78	10.99	Sudan	5.63	7.53	7.54	3.64
Haiti	2.70	14.84	14.20	18.18	Sweden	2.51	108.57	94.44	0.17
Honduras	2.49	41.84	41.08	12.90	Switzerland	1.49	160.44	160.43	0.48
Hong Kong	3.75	157.66	157.66	1.98	Thailand	4.50	121.29	112.37	1.06
Hungary	2.95	46.21	46.18	1.15	Togo	3.97	18.82	18.18	7.43
Iceland	3.69	130.60	130.59	0.57	Trinidad and Tobago	4.73	38.02	34.77	0.57
India	2.28	36.61	36.61	3.00	Tunisia	1.75	62.47	56.15	4.20
Indonesia	4.56	31.03	29.66	0.93	Turkey	4.77	27.80	26.93	0.77
Iran	3.18	23.46	23.46	0.47					
Ireland	4.96	147.34	147.34	0.28	Mean	2.94	58.91	56.95	3.28
Israel	2.43	83.30	83.30	0.36	Median	2.71	41.15	39.78	1.23
Italy	2.12	88.66	88.32	0.21					
Jamaica	1.18	23.26	23.26	13.50					

A: Output volatility

B: Private sector credit to GDP

C: Credit provided by the banking sector to GDP

D: Remittances to GDP

Table 2 Descriptive statistics.
Source: Authors' computation

	Mean	Min	Max	SD
VGDP	2.937	0.637	8.213	1.232
REM	3.305	0.019	28.692	4.850
PCRE	58.850	1.615	319.612	51.302
BCRE	56.915	1.538	50.367	318.937
INV	20.976	-2.424	41.816	5.223
INF	6.205	-4.479	132.832	9.051
GOVC	15.033	5.585	1.325	29.788
OPEN	83.402	14.932	458.332	54.511

this status include Bangladesh, El-Salvador, Egypt, Jordan, Pakistan, Philippines, Senegal, Guatemala, Ecuador, Haiti, Honduras, Jamaica, India, Sri Lanka and Tunisia. The 'pro-cyclicality' argument, however, appears to be fully operational in such countries like Gambia, Guyana, Sudan and Togo.

Taking a tripartite view of the analysis, Jordan appears to be the most suitable candidate with the uncommon quality of having a well-developed financial system, coupled with both high ratio of remittances to GDP and low output growth volatility. Taken together, it could therefore be suggested that having high remittances and more financial development do not constitute automatic preconditions for having stable and predictable growth trajectories.

Table 2 presents the descriptive statistics of the variables in the model. The average value of growth volatility is estimated to be 3%. Even though the two proxies for FD have almost similar mean values, banking sector credit is considered as the most volatile series in the model. This could imply that while the volume of the private sector credit is similar across the countries in our dataset, the level of the banking sector development varies considerably in the selected countries. In terms of macroeconomic stability, most countries have single digit inflation rate. By implication, majority of the sampled countries enjoyed a relatively stable macroeconomic environment.

Table 3 presents the SYS-GMM estimates of the baseline regression. The dampening effect of remittances on output growth volatility was unravelled. This effect was equally found to be significant across the estimated models. These results are similar to previous studies and supports theoretical underpinning. For instance, IMF (2005) argued that the stabilizing influence of counter-cyclical remittance flows on aggregate demand might outweigh their supply side and altruistic effects. Chami et al. (2010) conveyed the notion that the fall in remittances flow during the financial crisis could account for the increase in growth variability in the immediate years succeeding the crisis. Ajide et al. (2015) and Combes and Ebeke (2011) also reached similar conclusions.

The other candidate identified to have growth volatility stabilizing effect is FD. The two proxies of FD support the a priori expectations. To lend credence to this result, previous studies by Easterly et al. (2000), Denizer et al. (2002), Darrat et al. (2005), and Raddatz (2006) all found that countries with high level of FD seem to have relative stability in economic growth. Elaborating on the above, Raddatz (2006)

Table 3 Baseline panel regressions results (dynamic SYS-GMM). *Source:* Authors' computation

	1	2	3	4	5	6
VGDP _{t-1}	0.394** (0.103)	0.233*** (0.039)	0.113** (0.046)	0.382*** (0.012)	0.039** (0.011)	0.384* (0.193)
INV	-1.394 (0.849)	3.143 (1.839)	1.353 (0.744)	1.928 (1.41)	1.354 (0.829)	-1.128 (0.965)
INF	0.019*** (0.005)	0.046*** (0.010)	0.014** (0.006)	-0.003 (0.002)	0.044 (0.051)	0.079 (0.053)
GOVC	-0.203*** (0.063)	-0.282* (0.062)	-0.189* (0.033)	-0.313** (0.110)	-0.101** (0.047)	-0.180* (0.089)
OPEN	1.702 (1.304)	1.638 (0.920)	0.994 (0.484)	1.803 (1.304)	2.203 (1.538)	0.724 (0.594)
REM		-0.244** (0.102)	-0.222*** (0.043)	-0.294** (0.098)	-0.254 (0.192)	-0.230* (0.088)
BCRE			-0.363*** (0.047)	-0.419*** (0.058)		
REM*BCRE				0.295 (0.179)		
PCRE					-0.444** (0.131)	-0.433*** (0.139)
REM*PCRE						-0.666*** (0.192)
AR(2)	0.234	0.638	0.473	0.372	0.838	0.733
HANSEN TEST	0.644	0.338	0.527	0.262	0.102	0.102
WALD TEST	13.522**	14.303**	9.203**	17.293***	17.531***	10.923**
Number of Obs	1202	1193	1189	1193	1178	1189

Values in parenthesis are the standard error values, while ***, **, * shows the level of statistical significance at 1, 5 and 10%, respectively

proved that the moderating effect of FD on macroeconomic volatility results from the influence of the level of liquidity in the financial system. He further argued that this reduction in macroeconomic volatility is made possible through sectors that require high financial implications and/or credit. Raheem et al. (2016) could not reach similar conclusion with Beck et al. (2006), who found no causal relationship in the FD output growth volatility literature. However, the latter authors' were magnanimous enough to have flagged the caveat that their results were "exploitative" rather than "definitive". Hence, policy implications are tasking to appreciate on the basis of their "new" finding.

The interaction between FD and remittances produced the mixed results. For instance, in the model with bank credit, there is no evidence of a dampening effect. Rather, it was observed that bank credit magnifies the volatility of output growth, though this effect turned out to be insignificant. The reverse is albeit the case for private sector credit. On technical ground, it could be argued that bank credit is

considered to be a substantially volatile series consistent with the reported standard deviation in Table 2. As such, it could not be expected to have any dampening effect on the volatility of output growth. Intuitively, if some of the credit provided by the banking system is diverted to unproductive economic activities, then this submission is plausible. Another explanation could be related to the fact that, in our sample, no country simultaneously has high level of both remittance flows and FD. In the case of private sector, it is assumed that private sector is more efficient; as such, credit provided to this sector would be judiciously used and thus reduce the volatile nature of economic growth rate. Also, this measure is considered to measure the most important activities of the financial intermediaries, namely channelling funds from the surplus sector to the deficit sector (Levine et al. 2000; Beck et al. 2000; Raheem et al. 2016). It is important to state at this juncture that the relationship among remittances, FD and growth, by extension—growth volatility—is ambiguous (Giuliano and Ruiz-Arranz 2009 also present evidence consistent with this view).

For the control variables, an important variable in the context of this study is government consumption. In almost all the models, the variable has negative and significant coefficients. Next to this is inflation. The importance of domestic investment and trade openness is meagre.

The post-estimation tests conducted are the Arellano and Bond test for autocorrelation and Sargan test, which is helpful for examining overidentification restrictions. The results of the autocorrelation test showed the absence of autocorrelation in the models in most cases. The results of the Sargan test showed that the instruments are not correlated with the error term; hence, they are exogenous as a group. In addition to these tests, we equally conducted the Wald test for the joint significance of the variables in the model. The results suggest that the estimated models, in most cases, are not inadequate.

Two robustness checks were conducted. The first relates to the adoption of alternative measure of volatility, the standard deviation of the Hodrick–Prescott filtered trend.⁶ The second robustness test is the use of non-overlapping intervals (NOI). NOI helps to fizzle out business cycle influences. Hence, we use a three-year NOI. It is assumed that the three-year interval is sufficient enough to withstand the cycle. Increasing the interval window would likely weaken the model through the loss of degrees of freedom. It is interesting to state that the results of the robustness exercise, which are presented in Tables 4 and 5, do not differ from the results presented earlier in terms of size, sign and statistical significance. However, accounting for business cycle in the bank credit equation makes its interaction with remittances to yield a positive coefficient (Table 5). This might be indicative of the fact that the dampening influence of remittances on growth volatility is conditional upon having a higher level of FD.

⁶ We acknowledge that the generalized autoregressive conditional heteroskedasticity (GARCH) is another approach that can be used to measure volatility. We refrained from its use based on the debate that adeptly queries its suitability in cross-sectional time series analysis, such as we pursued in this paper.

Table 4 Robustness test: HP filter trend. *Source:* Authors' computation

	1	2	3	4	5	6
VGDP _{t-1}	0.203*** (0.039)	0.103*** (0.022)	0.033* (0.012)	0.201** (0.092)	0.129*** (0.011)	0.232 (0.153)
INV	0.830 (0.239)	1.203 (0.939)	1.233 (0.833)	1.228 (0.920)	0.877 (0.590)	1.374 (1.239)
INF	0.030** (0.010)	0.018*** (0.002)	0.032*** (0.003)	0.043 (0.050)	0.033*** (0.000)	0.044 (0.015)
GOVC	-0.128*** (0.001)	-0.038** (0.13)	-0.036*** (0.001)	-0.037** (0.011)	-0.023 (0.017)	0.025** (0.012)
OPEN	1.283 (1.283)	2.929 (1.392)	0.271 (0.273)	1.724 (0.832)	1.285 (0.579)	1.293 (0.829)
REM		-0.155** (0.055)	-0.257** (0.104)	-0.165*** (0.020)	-0.283 (0.202)	-0.023 (0.032)
BCRE			-0.403** (0.162)	-0.419*** (0.199)		
REM*BCRE				-0.283 (0.283)		
PCRE					-0.275*** (0.004)	-0.393*** (0.001)
REM*PCRE						-0.419** (0.127)
AR(2)	0.234	0.463	0.743	0.838	0.572	0.282
HANSEN TEST	0.382	0.283	0.120	0.134	0.262	0.738
WALD TEST	10.332**	11.232**	11.263**	13.337**	10.187**	10.9389**
Number of Obs	400	398	396	398	392	396

Values in parenthesis are the standard error values, while ***, **, * shows the level of statistical significance at 1, 5 and 10%, respectively

5 Conclusion

This study examined the role of FD in the remittances–growth volatility nexus. The dataset used had 71 remittances recipients countries around the globe. The time frame covered was 1996 to 2012. Potential endogeneity issues that might arise were taken care of through the adoption of the system GMM of Arellano and Bover (1995). Our estimated models present some interesting findings. First, both remittances and FD have growth volatility dampening tendencies. Second, the interaction between proxies for FD and remittances produced mixed results. Third, using banking sector credit, if volatility of the proxies of FD is accounted for, the interactive term has a positive coefficient, which is considered to be higher than the individual effects of both remittances and proxies of FD. However, the reserve is the case for private sector credit.

Table 5 Robustness test 3-year averages. *Source:* Authors' computation

	1	2	3	4	5	6
VGDP _{t-1}	0.372*** (0.000)	0.093*** (0.000)	0.046* (0.019)	0.073 (0.092)	0.100*** (0.010)	0.085 (0.130)
INV	1.192 (1.030)	2.048 (1.193)	2.849 (1.394)	1.049 (0.934)	0.628 (0.583)	1.479 (0.939)
INF	0.004*** (0.000)	0.009*** (0.000)	0.014 (0.009)	0.001 (0.002)	0.035*** (0.009)	0.074 (0.066)
GOVC	-0.583*** (0.000)	-0.472** (0.163)	-0.193** (0.066)	-0.044*** (0.014)	-0.080*** (0.002)	-0.084** (0.019)
OPEN	1.165 (1.011)	2.283 (1.834)	3.003 (1.293)	1.083 (1.983)	2.384 (1.373)	1.383 (0.397)
REM		-0.157** (0.073)	-0.200** (0.067)	-0.258** (0.079)	-0.173** (0.043)	0.168** (0.045)
BCRE			-0.583*** (0.068)	-0.213* (0.089)		
REM*BCRE				0.273 (0.165)		
PCRE					-0.209** (0.102)	-0.433** (0.196)
REM*PCRE						-0.241** (0.109)
AR(2)	0.364	0.294	0.383	0.293	0.472	0.372
HANSEN TEST	0.478	0.394	0.378	0.427	0.130	0.176
WALD TEST	12.373***	10.493**	9.444**	10.392**	18.768***	17.567***
Number of Obs	1202	1193	1189	1193	1178	1189

Values in parenthesis are the standard error values, while ***, **, * shows the level of statistical significance at 1, 5 and 10%, respectively

The policy implications, based on the results presented, are in twofolds. The first relates to designing policies that would enhance the development of the financial system on the one hand. On the other hand, policies that seek improvements to the financial sector should be complemented with those that would ensure the stability of any realized gains. Second, remittances inflows should be encouraged. Thus, policies such as reduction in the cost of sending remittances should be strongly pursued, as this would facilitate the increased inflow of remittances. Furthermore, the coexistence of deeper financial systems (using private sector credit) and remittance inflows will be output volatility dampening. In essence, the exact effect of financial sector is dependent upon its measure. This submission accentuates the import of policy complementarities related to both financial sector and diaspora affairs, via remittances.

As a suggestion, future studies might find it interesting to use more than these two measures of financial development to find the exact effect of financial development

on output growth volatility. As a follow up to this point, studies have majorly focused on the money market. Future study might consider the capital market.

Appendix 1: List of countries

Argentina, Algeria, Austria, Australia, Bangladesh, Belgium, Bolivia, Brazil, Cameroon, Columbia, Congo, Rep, Costa Rica, Cote D'Ivoire, Denmark, Ecuador, Egypt, El-Salvador, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guatemala, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Jordan, Kenya, Latvia, Luxemburg, Malawi, Mali, Mexico, Morocco, Netherland, New Zealand, Niger, Norway, Pakistan, Panama, Papa New Guinea, Paraguay, Peru, Philippines, Portugal, Senegal, Sierra Leone, South Africa, South Korea, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey.

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