The Journal of Developing Areas
Volume 55 No. 4 Fall 2021

REMITTANCES AND REVERSE FLOWS IN JAMAICA

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ABSTRACT

Reverse flows characterize a situation in which external inflows, such as remittances, are used to service external debt, finance capital flight, and/or accumulate foreign reserves. The existing literature on the impact of remittances in developing countries suggests that remittances are used for consumption and/or investment. However, the ultimate development effect of remittances will depend on how much of this external flow is absorbed domestically. If all remittances are not used for domestic consumption and/or investment, the residual amount will flow out of the country in the form of reverse flows. The objective of this paper is to identify the long run amount of reverse flows out of remittances in Jamaica, one of the largest recipient of remittances in the Caribbean. To examine the relationship between remittances and reverse flows in Jamaica, we estimate a net exports equation using the autoregressive distributed lag technique. We then calculate the marginal effect of remittance on reverse flows from the estimated remittance coefficient in the net exports equation. The dataset used in the paper covers the period 1976 to 2017. This determination is a first for Jamaica. The central finding is that, in the long run, approximately $0.24 of every dollar of remittances is used to finance reverse flows. Therefore, only 76 percent of any additional amount of remittances is domestically absorbed in the form of consumption and/or investment in Jamaica. These results suggest that the ultimate development impact of remittances will be overstated if reverse flows out of remittances are not taken into account. Our results echo earlier findings in the existing literature on reverse flows. The overarching policy implication of our finding is that policymakers should design growth policies of remittances after considering its reverse flow impact. Future research should focus on the reverse flow impacts of other external flows such as foreign aid. Further, future research should also identify reverse flows for other Caribbean countries. These findings are not only important for Jamaica but also have significance for other remittance-recipient developing countries.

JEL Classifications: O15, O19, C22
Keywords: Remittances, reverse flows, Jamaica, ARDL
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INTRODUCTION

Remittance inflows as a percentage of Gross Domestic Product (GDP) in Jamaica are relatively large when compared to other small island developing states. This is reflective of the country's large diaspora, which maintains strong ties with the country. In nominal terms, Jamaica's remittances rose from a modest US$88.5 million in 1976 (3percent of GDP) to a high of approximately US$2.3 billion (16.5 percent of GDP) in 2017 (World

Bank, 2020). This makes remittances an important source of foreign exchange receipts for Jamaica. However, there are varying possibilities on the use and impact of remittances in an economy. It is argued, on the one hand, that remittances could be used predominantly to finance domestic consumption and investment, and by extension these flows should foster the growth and development of the economy (Azam et al., 2016; Issahaku, Abor, and Amidu, 2018; Salahuddin and Gow 2015). However, given Jamaica has in general had a very dismal economic growth outcome over the last 40 years, one may seriously ask whether the diversion of remittances away from investment and consumption is a possible contributing factor. On the other hand, remittances could also be financing reverse flows. This is a situation in which remittances would be used to finance capital flight, accumulate reserves and/or service external debt. This paper will investigate whether remittances are being used to finance reverse flows in Jamaica.

An overview of the existing literature on the effects of remittances in developing countries mostly suggests that remittances are used for consumption and/or investment (Adams Jr., 1998; Adams Jr., Cuecuecha, and Page, 2008; Adams Jr. and Cuecuecha, 2010; Conrad, Ramkissoon and Mohammed 2018; Giuliano and Ruiz-Arranz 2009; Stephenson and Wilsker 2016; Yousafzai 2015; Zarate-Hoyos 2004). Yet, the ultimate macroeconomic impact of remittances will depend on the extent to which these flows are absorbed in the domestic economy. From a theoretical perspective, if all remittances are used to increase consumption and/or domestic investment, then the marginal impacts of remittances on consumption and investment will be equal to one (Das and Chowdhury, 2019; Das and Serieux 2010). However, a dollar of remittances received does not necessarily translate into a dollar of remittances available to be absorbed in the domestic economy in terms of its impact on GDP. For example, Das, McFarlane, and Jung (2019) estimated that a 1 percent rise in remittances to Jamaica led to a mere 0.06 percent increase in GDP in the long run. Therefore, beyond the consumption and investment choice in a macroeconomy, academics have suggested the possibility of an additional destination for remittances. Das and Serieux (2010) argued that a part of remittances is often used to service external debt, finance capital flight, and/or accumulate foreign reserves. All three of these combined are referred to as "*reverse flows*", a term coined by them. Any empirical assessment of the remittance-growth nexus is likely to overestimate the impact of remittances on the real economy if reverse flows are not considered.

To our knowledge, there is a void in the extant literature since no other scholar has estimated the reverse flows for Jamaica. Our paper seeks to answer the question: what is the amount of reverse flows for Jamaica? This is a rather interesting question given that Jamaica has accumulated a large amount of external reserves in recent years. At the same time, its remittance receipts have skyrocketed (World Bank, 2020). Further, there is a suggestion that remittances are often used to generate foreign exchange reserves in Jamaica (Simmons, Plaza, and Piché 2005; Wenner 2016). Additionally, it has been suggested that remittances are traditionally used to finance capital flight (Anderson, 2018). Given all these suggestions, which make Jamaica an interesting case study, it is surprising that no other studies exist that have examined this relationship between remittances and reverse flows.

In this paper, we first use the autoregressive distributed lag (ARDL) bounds testing approach to cointegration to estimate a net exports equation. From this, the marginal effect of remittances on reverse flows is estimated. Our central finding reveals a reverse flow estimate that indicates that for every dollar of remittance-receipts, approximately

$0.24 is used to finance reverse flows in Jamaica. Our finding derives from a unique long run cointegrating equilibrium relationship running from remittances to net exports. In this relationship, there is an oscillatory and fast adjustment back to equilibrium from short run perturbations. The findings of this paper will assist policymakers with a better understanding of reverse flows and help them create a more informed assessment on the growth impact of remittances.

The rest of the paper is organized as follows. We review the existing literature in section two, and discuss the remittances and reverse flow profile of Jamaica in section three. Section four describes the methodology and data, and section five discusses the results. We conclude in section six with an explication of the policy implications.

LITERATURE REVIEW

Reverse Flows In The Aid Literature

Although the purpose of this paper is to examine the relationship between reverse flows and remittances, it is important to understand how reverse flows were introduced in the empirical literature. The idea of reverse flows out of external finance was first identified in the foreign aid literature. In recent years, Das (2010), Serieux (2011), and Das and Serieux (2015) discussed the macroeconomic significance of foreign aid and its relationship with reverse flows in developing countries. Therefore, in this section, we provide a short summary of how reverse flows evolved in the foreign aid literature. We then discuss the association between remittances and reverse flows.

The importance of foreign aid for development can be traced back to the two-gap theory of Chenery and Strout (1966). According to their theory, aid generates development by means of filling two gaps: (a) the gap between domestic saving and investment and (b) the foreign exchange gap. The first gap is important because, in some growth theories, foreign investment requires a pre-existing degree of financial development. In the absence of such development as an attracting condition for foreign investment, domestic savings becomes especially important. However, given strong limits to domestic saving, aid flows are necessary precursors to investment. In terms of the second gap, a situation in which the current account deficit is greater than the sum of capital inflows can also be overcome, at least to some extent, through aid inflows. Therefore, foreign aid should fill both gaps. An important assumption of the two-gap model is that all aid is used to increase savings and thereby, finance investment in the recipient countries. In other words, the marginal effect of aid on investment should be one.

Perhaps the first major challenge to this model was from Rahman (1967). He argued that aid would be used for both consumption and investment if the marginal output-capital ratio was greater than the marginal cost of borrowing foreign loans. This implies that the marginal effect of aid on investment is less than one, and the marginal effect of aid on investment and consumption together is one. Since the 1970s, a growing body of literature used different ideological and methodological approaches to understand the effectiveness of foreign aid. Doucouliagos and Paldam (2006) conducted a meta-analysis of 43 papers that examined the impact of aid on savings or investment. They found from these papers that approximately 25 percent of aid is invested and 75 percent is domestically absorbed through consumption. In addition to the obvious choice of consumption and

investment, there may be a third destination of foreign aid. In this regard, Rahman (1967) noted that if some amount of foreign aid were used to finance reverse flows in the form of debt service payments, that amount would not be available for domestic absorption through consumption and investment. Therefore, any study that does not consider the reverse flows of aid, potentially overestimates the effectiveness of aid. Serieux (2011) showed that approximately 50 percent of any additional aid flow was used to finance reverse flows in Sub-Saharan Africa from 1980 to 2006. Das and Serieux (2015) extended the work of Serieux (2011) and used a panel dataset of 71 developing countries from 1971 to 2012. Their findings suggested that about 75 percent of any increase in aid was domestically absorbed (either consumed or invested) and the other 25 percent was used to finance reverse flows in the form of debt servicing, capital flight, and increase in reserves.

Remittances And Reverse Flows

Over the last few decades, there has been a significant focus on the macroeconomic impact of remittances in developing countries. However, there is no consensus among academics about the ultimate use and impact of remittance in the recipient countries. One strand of the literature argues that remittances ease the credit constraint in capital markets by augmenting working capital for investment (Alderman, 1996; Agarwal, Demirgüç-Kunt and Pería 2011; Faini, 2002). That being said, remittances can potentially behave like foreign aid and bridge both the savings-investment gap and foreign exchange gap in developing countries. In other words, the Chenery-Strout two-gap model can be used to explain the effectiveness of remittances in developing countries.

Another strand of the literature argues that most remittances are used to finance consumption (Combes and Ebeke 2011; Stahl and Habib, 1989; Tansel and Yaşar 2010). However, there is some evidence, albeit mostly anecdotal, that the full amount of remittances that flow into developing countries is not used for just consumption and investment (Avendano, Gaillard, and Nieto-Parra 2011; Mohapatra, Ratha, and Silwal, 2010; Ratha, 2003, 2009). Only two studies have estimated the reverse flow impact of remittances. The first is by Das and Serieux (2010), who found that approximately 20 to 27 percent of any increase in remittances were used to finance reverse flow in developing countries. The other is Das and Chowdhury (2019). They estimated the marginal effect of remittances on reverse flows in Bangladesh over the period 1976 to 2015. They applied the ARDL approach to cointegration and found that approximately 86 percent of remittances were domestically absorbed and financed consumption and investment in Bangladesh. The other 16 percent were used to finance reverse flows in the form of debt servicing, capital flight and/or increased reserves.

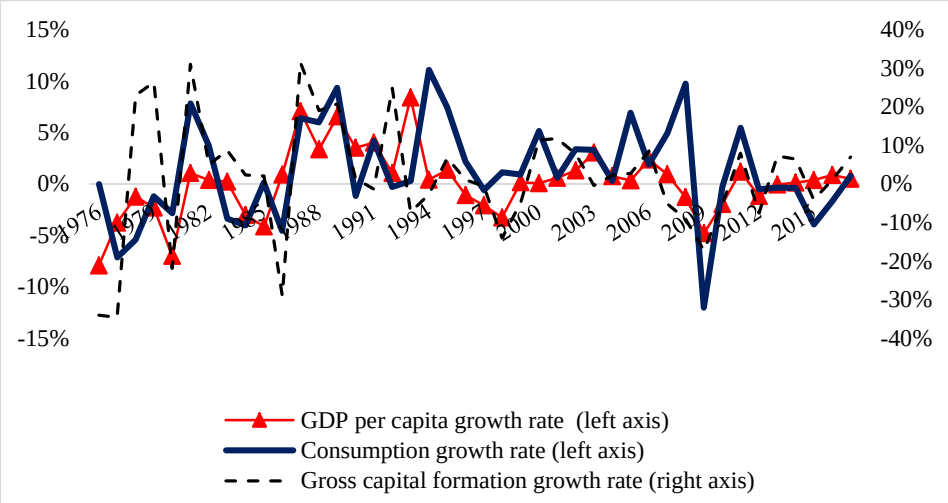
The existence and magnitude of reverse flows constitute a potential argument against the effectiveness of remittances in developing countries. If substantial portions of remittances are diverted into reverse flows, then remittances are less likely to have the intended effect of growing the recipient economy by means of consumption and investment.

REMITTANCES AND REVERSE FLOWS IN JAMAICA

Remittances Profile of Jamaica

Jamaica's economic performance over the last four decades has been weak. From Figure 1, average GDP per capita growth rates has hovered around zero from 1976 to 2017. The average annual rate of growth being 0.13 percent over this period.

FIGURE 1. THE ANNUAL GROWTH RATES OF JAMAICA'S GDP PER CAPITA, CONSUMPTION AND GROSS CAPITAL FORMATION, 1976-2017.

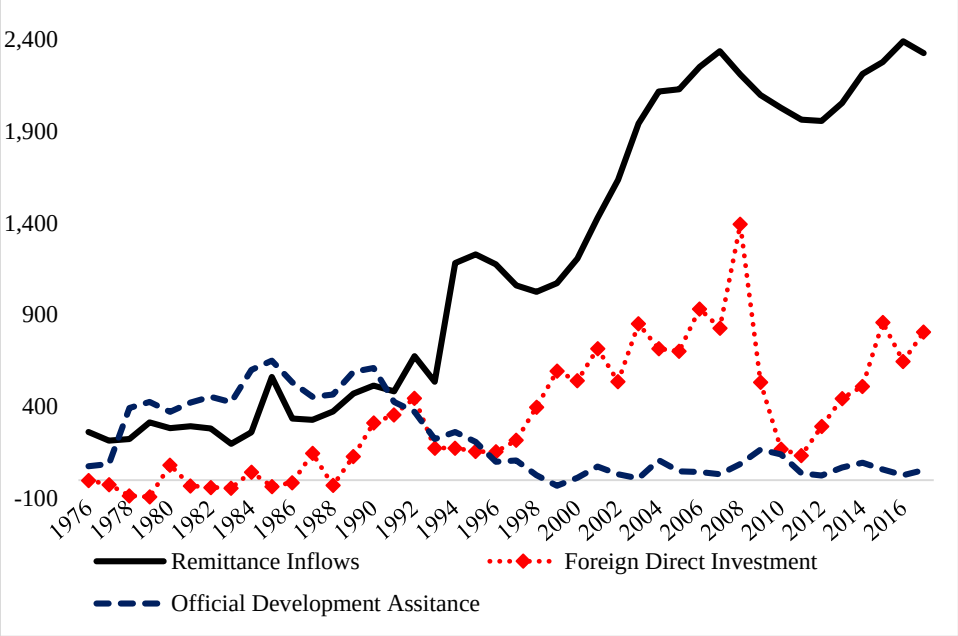


Notes: (1) Authors' calculation based on World Development Indicators of the World Bank (2020) database.

From Figure 1, the growth rates of real final consumption expenditure and gross capital formation have been consistently higher than the rate of growth of GDP. Real final consumption expenditure and gross capital formation average annual growth rates over the 1976 to 2016 period were 1.3 percent and 1.8 percent respectively. Jamaica, a vulnerable small island developing state, must therefore rely heavily on external funding if it is to sustain its current consumption and investment pattern. For Jamaica, like so many other small countries, remittances represent an extremely important source of external finance of any sort from which it can accumulate well-needed capital, purchase goods and services and more generally, used to alleviate the plight associated with poverty.

From Figure 2, remittance flows to Jamaica, measured in 2010 constant US dollar terms, reached US$2.3 billion in 2017. There has been an upward trend in remittance flows to Jamaica since the early 1990s.

FIGURE 2. JAMAICA'S REMTTANCES, FOREIGN DIRECT INVESTMENT, AND OFFICIAL DEVELOPMENT ASSISTANCE (CONSTANT US $MILLION), 1976-2017



Notes: (1) Authors' calculation based on World Development Indicators of the World Bank (2020) database.

This pattern is in line with the continuously increasing amounts of remittances the Latin America and Caribbean region received over the past one and a half decades. Remittances to the region increased by over 60 percent between 2010 and 2017 and stood at US$2.3 billion in 2017 (World Bank, 2019). In addition, remittances to the region, in general and Jamaica in particular, continue to show steady and robust growth over these decades outpacing both official development assistance (ODA) and foreign direct investment (FDI) flows. Figure 2 shows ODA inflows (measured in 2010 constant US dollars) to Jamaica exhibiting a continuous decline. Noticeable also in Figure 2 is the downward trend in FDI flows (measured in 2010 constant US dollars) in recent times making remittances one of the largest sources of foreign exchange earnings for Jamaica. Moreover, relative to FDI flows, remittances appear less volatile and are counter-cyclical; however, the most recent financial crisis caused remittances to exhibit some pro-cyclicality. This is evidenced by the sharp decline in remittances to the Jamaican economy during the Great Recession (see Figure 1). However, as the global economy recovers, and especially the United States, so too did remittance flows to Jamaica which jumped by approximately 20 percent between 2010 and 2017. The amount of remittances from the United States has been particularly strong and stable and accounts, on average, for almost 70 percent of total remittances received.

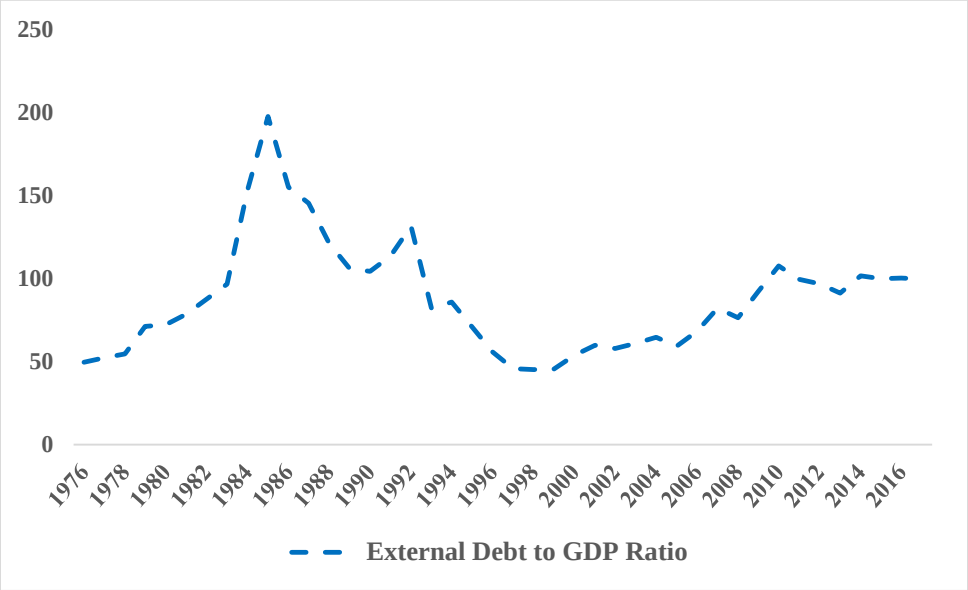
Remittances also represent a significant source of income for households as well as a major foreign exchange earner for the country as evidenced by its 16.5 percentage share of the country's GDP in 2017. While the period of our analysis in this paper is up to 2017 due to data limitation, we can note that in 2018 Jamaica was among the top 10 remittance-receiving countries in the Latin America and Caribbean (LAC) region. Jamaica ranked fourth only behind Haiti (33.6%), El Salvador (21.1%) and Honduras (19.9%). Additionally, in 2018, remittances were US $858.1 per capita, 75.7 percent of tourism expenditures, 123.8 percent of exports, 43.1 percent of imports, and 30.2 percent of foreign direct investment inflows, thus making remittances the second highest source of external financial flow, behind tourism revenues. According to the World Bank (2016), 45 percent of the Jamaican born population lived outside the country, with estimates of the total size of its diaspora ranging between 75 percent and 100 percent of those living in Jamaica (Glennie and Chappell 2010; Thomas-Hope 2018). Most of the remittances in 2018 are from the United States (67%), followed by the United Kingdom (11.8%), Canada (8.5%), and the Cayman Islands (6.8%).

Reverse Flows of Jamaican Remittances

While several papers studied the impact of remittances on economic growth in Latin America and the Caribbean including Jamaica (See for example, Ramirez 2013, Das, McFarlane, and Jung 2019), the literature on the relationship between remittances and reverse flows in Jamaica is non-existent. Since the beginning of the 21st century, Jamaica's external debt has been large and growing. External debt to Gross National Income (GNI) increased from 63 percent in 2000 to 72 percent in 2006. *The Great Recession* has only made the situation worse. In the past decade, the ratio of external debt to GNI rose and was 108 percent for the most recent numbers in 2018 (World Bank, 2020). Figure 3 presents the graphical illustration of the evolution of external debt in Jamaica. Comparing Figures 2 and 3, it is evident that remittances and external debt did not follow a similar trend in Jamaica. It is possible that some remittances were used to finance external debt, although the existing literature does not explicitly discuss this issue.

To address the issue of unsustainable debt burden, Jamaica worked with international organizations including the International Monetary Fund, World Bank, and Inter-American Development Bank. Johnston (2013) discussed how Jamaica restructured its debt for lower interest rates and extended maturity period but failed to lower the principal amount. However, the interest payment, which amounted to 11 percent of its GDP was still the highest in the world (Johnston and Montecino 2011; Johnston and Montecino 2012; Johnston, 2013). Although not much has been discussed on the use of remittances to service debt and finance capital flight, credit agencies often view remittances as a safeguard against credit risk and capital flight (Avendano, Gaillard, and Nieto-Parra 2011).

FIGURE 3. EVOLUTION OF JAMAICA'S EXTERNAL DEBT TO GDP RATIO, 1976-2017



Notes: (1) Authors' calculation based on World Development Indicators of the World Bank (2020) database.

Since the early 1990s, Jamaica has been accumulating significant amounts of foreign reserves. Total reserves excluding gold increased from US$ 106 million in 1991 to US$ 3.5 billion in 2018 (World Bank, 2020). It is generally believed that remittances are used for building foreign exchange reserves in Caribbean countries, including Jamaica (Wenner, 2016; Simmons, Plaza, and Piché 2005). Bugamelli and Paternò (2009) argued that large flows of remittances lessen the probability of current account reversals due to a decrease in foreign reserves. Therefore, there is anecdotal evidence that remittances finance reverse flows at least in countries where remittance inflows are significant. Clearly, it is worth testing the theory for Jamaica. The amount of remittances that are used for financing reverse flows in Jamaica are not available for domestic absorption in terms of consumption and investment, restricting the potential economic growth impact of remittances.

THEORETICAL FRAMEWORK, METHODS, AND DATA

Theoretical Framework of Remittances and Reverse Flows

The theoretical underpinning of the relationship between remittances and reverse flows was derived by Das and Serieux (2010) and extended by Das and Chowdhury (2019). We provide a summary of the derivation below. The starting point of the derivation is the basic

rule of balance of payments (BOP) that the sum of all transactions in the BOP must be zero. Therefore,

$$BOP \equiv 0$$

$$CU + CA \equiv 0$$

$$CU \equiv -CA \tag{1}$$

Here *CU* is the current account and *CA* is the capital account. *CU* consists of net exports (*NX*), net transfers (*NT*) and net foreign income (*NFI*), *CA* includes net official flows (*NOF*) and net private flows (*NPF*). Thus, equation (1) becomes:

$$NX + NT + NFI \equiv -(NOF + NPF) \tag{2}$$

Dividing both sides of equation (2) by GDP (*Y*) gives the average propensity of each of the components of *CU* and *CA*. Equation (2), therefore, takes the following form:

$$\frac{NX + NT + NFI}{Y} \equiv -\left(\frac{NOF + NPF}{Y}\right)$$

$$nx + nt + nfi \equiv -nof - npf \tag{3}$$

where, $nx = \frac{NX}{Y}$, $nt = \frac{NT}{Y}$, $nfi = \frac{NFI}{Y}$, $nof = \frac{NOF}{Y}$, and $npf = \frac{NPF}{Y}$. In the next step, we differentiate Equation (3) with respect to the remittance-GDP ratio (*rm*) to get the marginal effects of remittances on each of the components of Equation (3).

$$\frac{\partial nx}{\partial rm} + \frac{\partial nt}{\partial rm} + \frac{\partial nfi}{\partial rm} \equiv -\frac{\partial nof}{\partial rm} - \frac{\partial npf}{\partial rm} \tag{4}$$

The marginal effect of remittances on net transfers is 1 (remittances are net transfers). Assuming some remittances are used to finance reverse flows, remittances affect interest payments on foreign debt (component of *nfi*), principle amounts of debt and foreign reserves (component of *nof*) and capital flight (*npf*), $\left(-\frac{\partial nof}{\partial rm} - \frac{\partial npf}{\partial rm} - \frac{\partial nfi}{\partial rm}\right) \neq 0$. $\left(-\frac{\partial nof}{\partial rm} - \frac{\partial npf}{\partial rm} - \frac{\partial nfi}{\partial rm}\right)$ is the marginal effects of remittances on reverse flow. Taking all these into account, Equation (4) can be written in the following manner:

$$1 = -\frac{\partial nx}{\partial rm} + \left(-\frac{\partial nof}{\partial rm} - \frac{\partial npf}{\partial rm} - \frac{\partial nfi}{\partial rm}\right)$$

$$1 = -\frac{\partial nx}{\partial rm} + \frac{\partial r}{\partial rm}$$

$$\frac{\partial r}{\partial rm} = 1 - \left(-\frac{\partial nx}{\partial rm}\right) \tag{5}$$

where *r* is the ratio of total amount of reverse flows to GDP. Therefore, the marginal effect of remittances on reverse flows can be estimated by subtracting the marginal effects of remittances on trade deficits from 1. Additionally, both Das and Serieux (2010) and Das and Chowdhury (2019) showed that

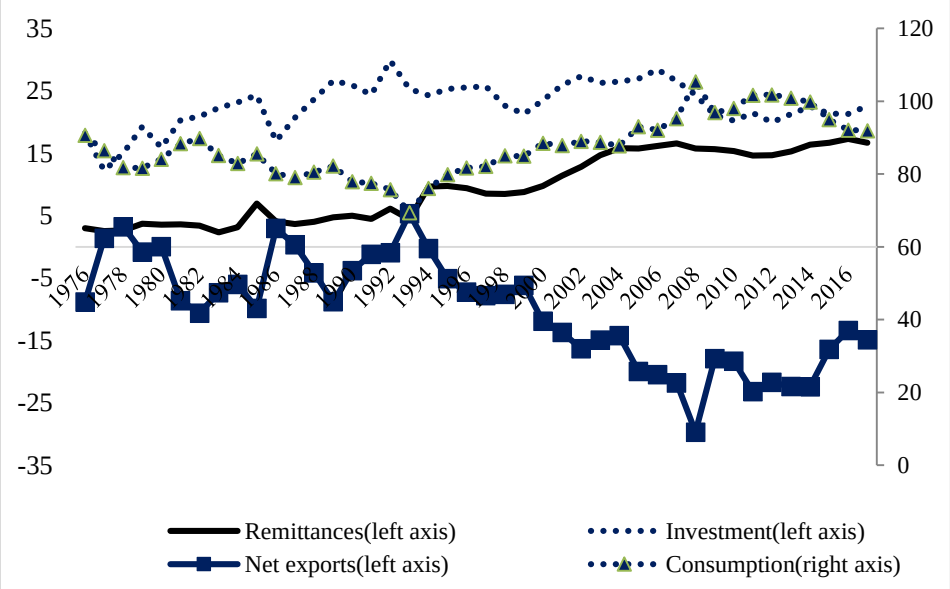
$$\frac{\partial con}{\partial rm} + \frac{\partial inv}{\partial rm} = -\frac{\partial nx}{\partial rm} \tag{6}$$

where, *con* is the average propensity to consume (i.e., total consumption to GDP ratio) and *inv* is the average propensity to invest (i.e., investment to GDP ratio). From Equations (5) and (6), it follows that:

$$\frac{\partial con}{\partial rm} + \frac{\partial inv}{\partial rm} + \frac{\partial nx}{\partial rm} = 1 \tag{7}$$

Equation (7) shows that the marginal effects of remittances on economic aggregates are realized only when we consider consumption, investment and net exports. We use Equation (5) to estimate the marginal effects of remittances on reverse flows in Jamaica. The theoretical relationship, presented in Equation (7), is somewhat visible in Figure 4. This figure shows that remittances, consumption and investment (all measured as a share of GDP) have moved in a positive direction. However, and net exports (measured as a share of GDP) has had a negative trend from the mid-1990s.

FIGURE 4. EVOLUTION OF CONSUMPTION, INVESTMENT, NET EXPORTS AND REMITTANCES (AS A SHARE OF GDP), 1976-2017



Notes: (1) Authors' calculation based on World Development Indicators of the World Bank (2020) database.

Methods

As shown in the previous section, one can deduce the marginal effects of remittances on reverse flows from the remittance-GDP coefficient in the net exports equation. Therefore, we first estimate an equation for net exports using an ARDL model. In this model, net exports are a function of foreign and domestic income ratio, remittances, other flows and the real exchange rate. Similar behavioral equations have been used in the empirical literature of reverse flows (Das and Serieux 2010, 2015; Serieux, 2011; Das and Chowdhury 2015). This model, which must be statistically adequate, will permit us to establish the long run level relationship among the variables. From this long run level relationship, we can then deduce an estimate of the long run marginal effects of remittances on reverse flows.

To start, we perform the unit root test for the variables to determine their orders of integration. The building and testing of an ARDL model to establish a long run relationship requires that the variables are integrated of an order not greater than one. Therefore, the variables must be stationary in levels or first differences. We assess stationarity by testing each variable using the Augmented Dickey Fuller (ADF) test. The test is reported with the data generating process for each variable specified as with intercept and trend and no intercept or trend. The lag lengths are based on the Akiake Information Criterion (AIC). If the variables are integrated of order not more than one, then we can proceed to the long run bounds testing approach of Pesaran, Shin, and Smith (2001).

Without the loss of generality, consider if we want to test for the existence of the long run level relationships among the variables y, x, and z. To do so, we first specify and estimate an ARDL model as shown in Equation (8).

$$\Delta y_t = a_0 + \sum_1^l a_{1i}\Delta y_{t-i} + \sum_0^m a_{2i}\Delta x_{t-j} + \sum_0^n a_{3i}\Delta z_{t-k} + \gamma_1 y_{t-1} + \gamma_2 x_{t-1} + \gamma_3 z_{t-1} + e_t \quad (8)$$

The lagged differences on y, x, and z account for the short run dynamics among the variables. The respective lag lengths *l*, *m*, and *n* are chosen by the AIC to ensure that the model is internally valid. This means that the residuals (estimate of the error term e_t) are well-behaved (normally distributed, homoscedastic, and serially uncorrelated). In addition, it must be the case that the model is dynamically stable (roots within the unit circle) and without significant evidence of parameter instability (Cumulative Sum (CUSUM) of the recursive residuals) or variance instability (Cumulative Sum (CUSUM) of the recursive residuals squared). The bounds test is based on calculating an *F*-test statistic and *t*-test statistic. These are respectively compared against upper bound, *I*(1), and lower bound, *I*(0), *F*-test and *t*-test critical values. The null hypothesis of the *F*-test is that there is no level relationship among the variables where y is the dependent variable and x and z are the independent variables. That is, the null hypothesis is that in Equation (8) we have $\gamma_1 = \gamma_2 = \gamma_3 = 0$ against the alternative hypothesis that $\gamma_1, \gamma_2,$ and γ_3 are not all together zero. We fail to reject the null hypothesis if the *F*-test statistic is less than the lower bound *F*-test critical value at the chosen level of statistical significance. If the *F*-test statistic is between the lower and upper bound *F*-test critical values, then the result is inconclusive. On the other hand, if the *F*-test statistic is greater than the upper bound *F*-test critical value we reject that there is no level relationship among the variables.

The *t*-test is a cross-check of the *F*-test. The null hypothesis of the *t*-test is no level relationship with $\gamma_1 = 0$ against - the alternative hypothesis that $\gamma_1 < 0$. The decision rule for *t*-test is that we fail to reject the null hypothesis if the *t*-test statistic is closer to zero (less extreme) than the lower bound *t*-critical value. If the *t*-test statistic is between the lower and upper bond critical value, then the *t*-test result is inconclusive. However, if the *t*-test statistic is less than the upper bound critical value (more extreme) then we reject the null hypothesis of no level relationship. For us to make an overall conclusion that there is evidence at given level of statistical significance of a level relationship among the variables, the conclusions from the *t*-test and *F*-test must both lead us to reject their respective null hypotheses.

Now with an ARDL model that is internally valid with bounds testing indicating a unique long run relationship, we can proceed to estimate the model in error correction form where we can have both the long run parameters and the speed of adjustment parameter for the error correction term. The requirement for cointegration for which there is stability in the long run relationship requires that the speed of adjustment parameter be negative and less than two in absolute terms (Johansen, 1995). The ARDL technique used in the paper has a number of advantages over other standard cointegration techniques. First, this technique is useful when variables are either *I*(1) or *I*(0), or a combination of *I*(1) and *I*(0). Therefore, this method is more flexible than Johansen cointegration approach, which strictly requires that all variables must be *I*(1) at levels and *I*(0) at first differences. Second, the ARDL method is suitable if the time series is small. In our case, given there are only 42 observations (time period is from 1976 to 2017), ARDL is the most suitable technique in this regard. Finally, an important advantage is that the ARDL produces the dynamic relationships between the dependent and independent variables. Therefore, the results presented and interpreted in the paper emerge from long run coefficients.

Data

The Jamaican data are annual and span the period 1976 to 2017. They were obtained from the World Bank (2020). Net exports as a share of GDP, denoted as NX, is measured in current US dollar terms. Remittances are inflows of personal transfers. They are measured as a share of nominal GDP and are denoted as REMIT. The natural logarithm of the ratio of foreign to domestic income is US gross national income divided by Jamaica's gross national income and is denoted as LNINC. Other flows as a share of GDP (OFLOWS) is the sum of all external flows (including foreign aid and remittances) from which we subtract remittance inflows and then divide this figure by nominal GDP. The real exchange rate (EX) is the nominal exchange rate, which is local currency units to the US dollar, divided by Jamaica's consumer price index multiplied by the US consumer price index. Descriptive statistics and additional details on variable construction are provided in Appendix Table A1.

RESULTS

Unit Root And ARDL Bounds Testing

To start, we test for the orders of integration of the variables by ADF unit root testing considering three variants of the data generating process for each variable, namely with intercept, with intercept and trend, and no intercept or trend. Table 1 reports these ADF unit root test results. From this table, without exception, all variables have a unit root at levels but are stationary at first differences. This is true across all variants of the data generating process for each variable. The first difference of OFLOWS is stationary at the less than the 5 percent level of statistical significance. At the same time, NX, LNINC, EX, and REMIT are stationary less than 1 percent level of statistical significance.

TABLE 1. AUGMENTED DICKEY FULLER (ADF) UNIT ROOT TEST

Variable	With Intercept	With Intercept and Trend	No Intercept or Trend
NX	-1.75	-2.71	-0.98
ΔNX	-6.07***	-6.03***	-6.05***
LNINC	-2.41	2.33	0.37
ΔLNINC	-5.55***	-5.60***	-5.59***
EX	-2.20	-2.83	-0.01
ΔEX	-4.89***	-4.95***	-4.92***
OFLOWS	0.59	2.50	1.40
ΔOFLOWS	-3.97***	3.93**	-3.69***
REMIT	-0.59	-2.80	1.05
ΔREMIT	-7.53***	-7.42***	-7.03***

*Note: 1) *** and ** indicate significance at the 1%, 5% and 10% level respectively. 2) The null hypothesis of the ADF test is that the series has a unit root.*

Having established that all the variables are integrated of order one, we can proceed to the ARDL bounds testing of the level relationships among the variables. These test results are reported in Table 2. First, we consider the ARDL equation with NX as the dependent variable. In this case, we find that the *F*-test statistic is higher than its upper bound *F*-test critical value at the less than 1 percent level of statistical significance (5.93 versus 5.06). As to the *t*-test statistic for this equation, its value is higher in absolute terms than the upper bound *t*-test critical value (-4.28 versus -4.26). Hence, we can conclude, based on the *t*-test and *F*-test, to reject the null hypothesis of no level relationship running from LNINC, EX, OFLOWS, and REMIT to NX, the latter being the dependent variable.

Next, we consider the ARDL equations with LINC and EX as the dependent variables. For the LINC equation, the *F*-test statistic is higher than the upper bound critical value at the 1 percent level of statistical significance. For the EX equation, the *F*-statistic is higher than the upper bound *F*-test critical value at the 2.5 percent level of statistical significance. However, for both these equations we find that their respective *t*-test statistics values fall in the inconclusive zones. Consequently, we cannot make the conclusion to

reject the null hypothesis of no levels relationships when LNINC and EX are taken as the dependent variables. For the OFLOWS and REMIT equations, we reach a similar conclusion of failing to reject the null hypothesis of no levels relationship. In OFLOWS and REMIT equations, we make the conclusion from the fact that the *F*-test and *t*-test statistics are in absolute terms less than their respective *F*-test and *t*-test upper bound critical values.

TABLE 2. ARDL BOUNDS TEST

Equation	ARDL	*F*-Statistic	*t*-Statistic
NX=F(LNINC, EX, OFLOWS, REMIT)	(4, 4, 1, 0, 4)	5.93***	-4.28**
LNINC=F(EX, OFLOWS, REMIT, NX)	(4, 1, 5, 4, 5)	6.40***	-3.14
EX=F(LNINC, NX, OFLOWS, REMIT)	(5, 4, 5, 5, 2)	4.92**	-2.72
OFLOWS=F(EX ,LNINC, REMIT, NX)	(5, 3, 5, 5, 5)	3.65	-2.21
REMIT=F(NX, LNINC, EX, OFLOWS)	(4, 2, 2, 2, 4)	3.42	0.83

Statistical Significance	I(0)	I(1)	I(0)	I(1)
5%	2.86	4.01	-2.86	-3.99
2.5%	3.25	4.49	-3.13	-4.26
1%	3.74	5.06	3.43	-4.60

*Note: (1) *** and ** indicate statistical significance at the 1% and 2.5% level respectively for the rejection of the null hypothesis. (2) The null hypothesis is a level relationship as specified in the given equation.*

ARDL Net Export Equation Robustness Checks

The results from the ARDL bounds test indicate a unique level relationship among the variables where NX is the dependent variable. Based on the ARDL equation for NX, we will estimate the cointegrating and long run forms with the objective being to tease out the reverse flow estimate.

TABLE 3. DIAGNOSTIC TESTS ARDL

Equation: NX=F(LNINC, EX, OFLOWS, REMIT)		
Test	Statistic	Probability Value
Jarque-Bera (JB), Normality Test	0.38	0.82
Breusch-Godfrey, Serial Correlation LM Test	0.62	0.48
Breusch-Pagan-Godfrey, Heteroskedasticity Test	0.22	0.23
Ramsey RESET, Statbility Test	0.01	0.94

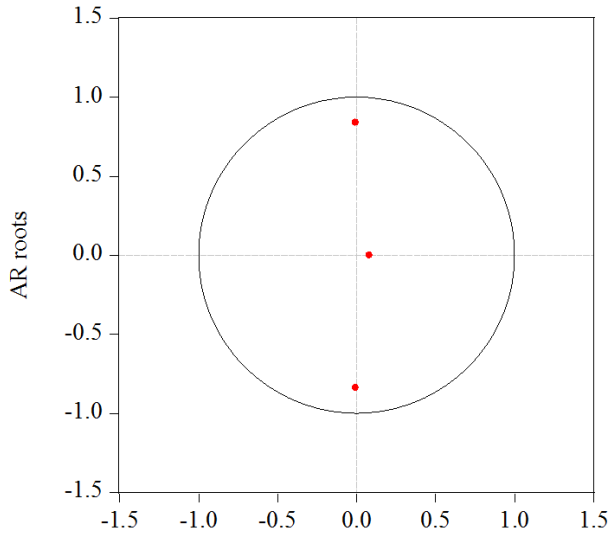
Notes: (1) JB Test H_0: Normality (2) LM Test H_0: No serial correlation (3) Heteroskedasticity Test H_0: Homoskedasticity (5) RESET Test H_0: Functional form is correct.

However, the extent to which our inference on this estimate is reliable depends on the extent to which our ARDL model is internally valid. To that end, Table 3 reports tests for normality, serial correlation, heteroskedasticity for the residuals and the Ramsey RESET test for misspecification and coefficient stability. From Table 3, the Jarque-Berra test of normality indicates that the null hypothesis of normality of the residuals cannot be rejected at conventional levels of statistical significance. In addition, we do not reject at conventional levels of significance the null hypotheses of no serial correlation (Lagrange Multiplier test) and homoskedasticity (Breusch-Pagan-Godfrey test). Finally, the Ramsey RESET indicates that model's parameters are stable insofar as stability from the null hypothesis of correct functional form is not rejected.

Further adequacy of the ARDL mode, can be assessed by checking whether there is also stability in a dynamic sense. This is assessed by considering whether the condition that all the roots of the autoregressive polynomial are within the unit circle is met. As shown in Figure 5, this condition is satisfied. In addition to dynamic stability, Figures 6 and 7 report the CUSUM of the recursive residuals the CUSUM of the recursive residual squares respectively.

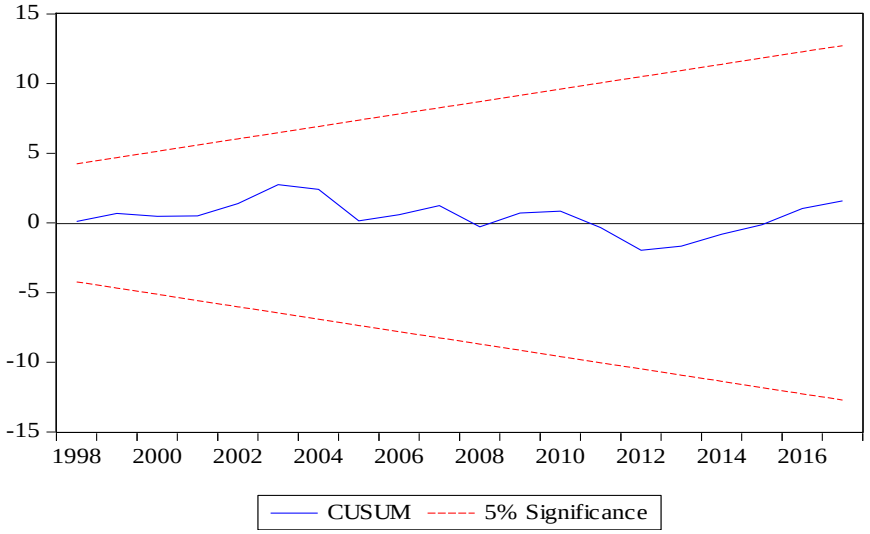
Deviations of the CUSUM of the recursive residuals outside the 5 percent significance confidence bands are indicative of parameter instability in the long run relationship. At the same time, deviations of the CUSUM of the recursive residual squares outside the 5 percent significance confidence bands are suggestive of parameter and/or variance instability. From both figures, we conclude that there is no evidence of parameter or variance instability. From Table 3 and Figures 5, 6, and 7 we conclude that the ARDL model of NX is adequate and, therefore, internally valid and suitable for statistical inference.

FIGURE 5: DYNAMIC STABILITY OF THE ARDL MODEL



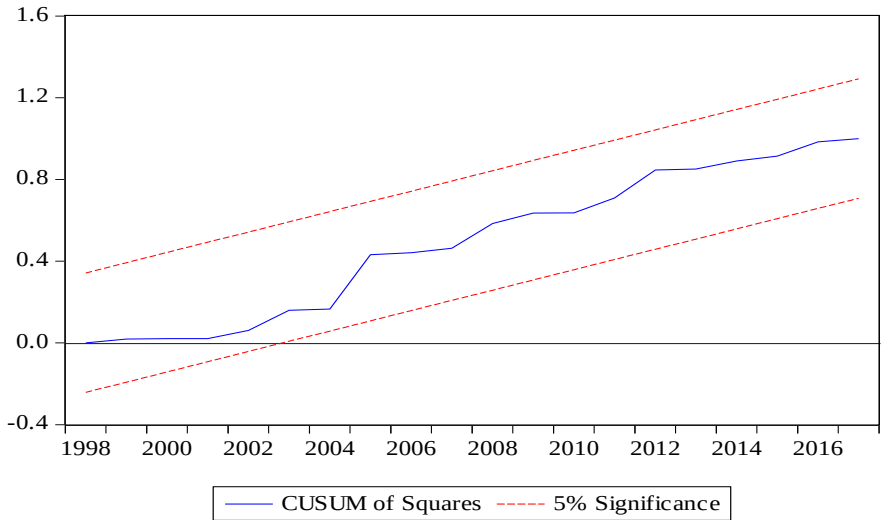
Notes: All roots lie within the unit circle. The ARDL model satisfies the stability condition.

FIGURE 6. CUMULATIVE SUM (CUSUM) OF THE RECURSIVE RESIDUALS EQUATION: NETX=F(LNINC, EX, OFLOWS, REMIT)



Notes: The CUSUM lies within the 5% significance bands. The is evidence supports an absence of coefficient instability in the long run level relationship.

FIGURE 7. CUMULATIVE SUM (CUSUM) OF THE RECURSIVE RESIDUALS SQUARES EQUATION: NETX=F(LNINC, EX, OFLOWS, REMIT)



Notes: The CUSUM of squares lies within the 5% significance bands. The is evidence supports an absence of coefficient or variance instability in the long run level relationship.

ARDL Net Export Cointegrating And Long Run Form

Having established the robustness of the ARDL model for net exports as a share of GDP, the next step is to estimate the long run coefficients of the independent variables used in the net exports equation. Table 4 reports the cointegrating and long run forms based on NX as a function of LNINC, EX, OFLOWS, REMIT from the ARDL model used for the bounds testing. We note that an increase (depreciation) of the real exchange rate has a positive impact on the ratio of net exports to GDP. The coefficient on EX has a value of 0.07 and it is statistically significant at the 10 percent level. This positive relationship is in line with what is expected to hold over the long run, *ceteris paribus*. The coefficient of REMIT is -0.76. Central to this paper is the estimate of the reverse flows based on the long run REMIT coefficient. As discussed in Section 4, the estimated reverse flows would be 1 + *coefficient of* REMIT and this is 1-0.76 = 0.24. In other words, in the long run, approximately 24 percent of any additional flow of remittances was not absorbed domestically in Jamaica; instead, it was used to finance reverse flows.

Ideally, we would like to compare our findings with that of other Caribbean countries. Because of the novelty of the reverse flows concept, there is no other study that estimated the impact of remittances on reverse flows in the Caribbean. Therefore, future research should focus on estimating the impact of remittances on reverse flows in other island countries. Nonetheless, our findings do echo Das and Chowdhury (2019), who argued that not all remittances are used to increase domestic consumption and investment in Bangladesh. It is worth noting that comparing Jamaica and Bangladesh, the marginal effects of remittances on reverse flows is much larger in Jamaica than that of Bangladesh.

TABLE 4. ARDL COINTEGRATING AND LONG RUN FORMS

Equation: NX=F(LNINC, EX, OFLOWS, REMIT)		
Variable	Coefficient	Standard Error
LNINC	-1.60	3.28
EX	0.07*	0.04
OFLOWS	-0.66**	0.28
REMIT	-0.76**	0.28
Error Correction Term (Short Run)	-1.26***	0.21
ARDL Model	(4,4,1,0,4)	
Time Period	1976-2017	
Number of Observations	38	

*Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level respectively.*

The coefficient of OFLOWS is -0.66. This coefficient is statistically significant at the 5 percent level. Thus, in the long run, approximately 34 percent of other flows (including foreign aid) are used to finance reverse flows in Jamaica. Although, the primary focus of the paper is not on foreign aid, it may be worthwhile to hypothesize the potential impact of foreign aid on reverse flows. OFLOWS includes foreign aid in its measure. Therefore, it could be argued that some foreign aid is used to finance reverse flows in the long run in Jamaica, like other developing countries. Estimating the exact amount of reverse flows is beyond the scope of this paper. Nonetheless, we identify this as an important issue and leave this for future research.

We report the speed of adjustment parameter for the short run error correction term and the long run coefficients from this ARDL model. With respect to the speed of adjustment parameter, it is negative and less than two in absolute terms; this means the level relationship among the variables is cointegrating and it is dynamically stable. This reinforces the robustness checks that were discussed above. The speed of adjustment parameter of the error correction terms has a value of -1.26 and it is statistically significant at the less than 1 percent level. The value of this speed of adjustment parameter means that in response to any short run perturbation to the long run equilibrium cointegrating relationship among the variables, there is a dampened and rapid oscillatory adjustment process back to long run equilibrium.

DISCUSSIONS AND CONCLUSIONS

In some quarters, it is posited that remittances could have a positive impact on economic growth to the extent it is absorbed domestically. Consequently, this would increase consumption and investment expenditure and by extension real GDP. The part of remittances that are not absorbed domestically are known as reverse flows; they are used to service external debt, finance capital flight, and/or accumulate foreign reserves. In this paper, we estimate how much remittances as a share of GDP were in fact absorbed domestically in Jamaica over the period 1976 to 2017. To our knowledge, this is the first such study on Jamaica. Applying the ARDL approach to a net exports function we arrived at the following main finding. Our results robustly indicate that remittances do not go one-

for-one into consumption and investment expenditure. Estimated long-run results suggest that almost one quarter of any additional inflow of remittances is leaked out of the country via reverse flows. We derived the reverse flow coefficient after establishing a long run stable and robust cointegrating relationship running from remittances to net exports.

While remittance flows to Jamaica have outpaced other official flows, and the country is the fourth largest recipient of remittances in the Latin America and Caribbean region, its annual average long-run growth rate has been relatively flat over the last 40 years. Jamaica has also had historically a large debt and chronically low production levels coupled with a high demand for imports. Within this context alongside the debate around the impact of remittances on economic performance, it is of merit to study the impact of remittances on the Jamaican economy in relation to reverse flows. Furthermore, as is the case of Jamaica, when there is high debt with potential capital flight and the resulting need to accumulate reserves to defend the currency, remittances can leak out of the local economy via reverse flows. While the finding of our paper rests on several statistical assumptions, they have one overarching policy implication. This implication is that policymakers wanting to understand and have an unbiased and most informative estimate of the growth impact of remittances on any economy must recognize that the traditional channels of consumption and investment are not the only paths for remittances. Simply put, reverse flows are potentially a growth-inhibiting factor. Therefore, any statistical estimation of remittances impact that does not consider this factor will ultimately overestimate and mischaracterize the impact of remittances in countries like Jamaica.

APPENDIX

TABLE A1. DESCRIPTIVE STATISTICS AND ADDITIONAL DETAILS ON VARIABLES, 1976-2017 (N=42)

	REMIT	EX	INC	OFLOWS	NX
Mean	9.45	99.40	113.60	12.73	-10.13
Median	9.06	98.22	110.85	11.78	-8.82
Maximum	17.29	148.37	193.73	21.43	5.33
Minimum	2.33	60.11	66.16	3.19	-29.69
Standard Deviation	5.42	21.41	29.03	5.46	8.66
Skewness	0.11	0.30	0.65	0.01	-0.17
Kurtosis	1.38	2.56	3.27	1.65	2.15

Source: Authors' calculation based on World Bank (2020) World Development Indicators database.

Notes: (1) REMIT = Remittance inflows ÷ GDP (2) EX= Real exchange rate (3) INC = Jamaica GNI ÷ US GNI (4) OFLOWS = (Primary, Secondary Income and Personal Transfer Receipts - Remittance Inflows) ÷ GDP (4) NX = Net Exports ÷ GDP.

Detailed Definitions from the World Bank (2020):

Remittance pertain to inflows only. The two main components of personal remittances, "personal transfers" and "compensation of employees" are items in the balance of payments (BPM6) framework. Both these items are recorded in the current account. "Personal transfers", a new item in the Balance of Payments (BPM6) represents a broader definition of worker remittances. Personal transfers include all current transfers in cash or in kind between resident and nonresident individuals, independent of the source of income of the sender (irrespective of whether the sender receives income from labor, entrepreneurial or property income, social benefits, and any other types of transfers; or disposes assets) and the relationship between the households (irrespective of whether they are related or unrelated individuals)."

For OFLOWS, Primary income receipts refer to employee compensation paid to resident workers working abroad and investment income (receipts on direct investment, portfolio investment, other investments, and receipts on reserve assets). Data are in current U.S. dollars. Secondary income refers to transfers recorded in the balance of payments whenever an economy provides or receives goods, services, income, or financial items without a quid pro quo. All transfers not considered to be capital are current. Data are in current U.S. dollars. Secondary income refers to transfers recorded in the balance of payments whenever an economy provides or receives goods, services, income, or financial items without a quid pro quo. All transfers not considered to be capital are current. Data are in current U.S. dollars.

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