



Effect of Remittance Inflows on External Debt in Developing Countries

Abdoul' Ganiou Mijiyawa¹ · Djoulassi K. Oloufadi²

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Abstract

This paper analyzes the effect of remittance inflows on external debt in developing countries, by identifying international reserves as a potential transmission channel. Using panel data over the period 1970–2017 and covering 50 low-and middle-income countries worldwide, we find a positive and significant effect of remittance inflows on the external debt-to-GDP ratio. We also find a negative and significant effect of international reserves on external debt. After controlling for international reserves, the effect of remittance inflows on external debt increases; it remains positive and significant. The results suggest that the role of international reserves as a self-insurance mechanism, and the Dutch disease effect related to remittance inflows are at play. In addition, we find negative and significant effects of economic growth and savings-investment gap on external debt. We also find positive and significant effects of the nominal exchange rate and the United States lending interest rate on external debt. We discuss the policy implications of these findings, while highlighting factors that policymakers should focus on for containing external debt in developing countries in the post-COVID-19.

Keywords External Debt · Remittance Inflows · International Reserves · Low-and Middle-Income Countries

JEL Classification E6 · F24 · F34 · H63

✉ Abdoul' Ganiou Mijiyawa
amijiyawa@worldbank.org

¹ World Bank, Washington D.C., USA

² Central Bank of West African States (BCEAO), Dakar, Senegal

1 Introduction

In 2008, the total external debt of low- and middle-income countries (henceforth, LMICs) was estimated to US\$3.5 trillion; ten years later, this debt more than doubled, reaching US\$7.8 trillion in 2018 (World Bank 2019a). Such an increase in external debt occurred while emerging and developing economies have become more vulnerable on a variety of fronts than they were ahead of the fourth wave of debt¹ that started in 2010: 75 percent of them now have budget deficits, their foreign currency-denominated corporate debt is significantly higher, and their current account deficits are four times as large as they were in 2007 (Kose et al. 2020).

The outbreak of COVID-19 has further increased macroeconomic and financial vulnerabilities of LMICs. COVID-19 has led to economic recession in many countries. Global GDP was expected to contract by 5.2 percent in 2020 due to COVID-19, the deepest global recession in decades. In emerging and developing countries, GDP was forecast to contract by 2.5 percent in 2020, the lowest economic growth rate since 1960 (World Bank 2020). In addition, COVID-19 had devastating effects on public finance. Countries increased public spending to finance health response and to support households and firms. At the same time, revenues collapsed, particularly for commodity exporters and tourism-dependent countries. Thus, fiscal balances turned sharply negative, to -9.1 and -5.7 percent of GDP in middle-income and low-income countries, respectively, in 2020 (International Monetary Fund –IMF 2020).

Under these circumstances, the World Bank and the IMF called the G20 to grant debt-service suspension on bilateral debt to the poorest countries to help them manage the severe impact of the COVID-19 pandemic.² The objective is to allow low-income countries to concentrate their resources on fighting the pandemic. As of May 1, 2020, G20's Debt Service Suspension Initiative (DSSI)³ has become operational. The suspension period, originally set to end on December 31, 2020, has been extended through the end of 2021 if requested by International Development Association (IDA) countries and least developed countries (LDCs)⁴ that are current

¹ Kose et al. (2020) have identified four major debt waves since 1970 in emerging and developing countries. The first wave spanned the 1970s and 1980s; the second wave ran from 1990 until the early 2000s; the third was a run-up in private sector borrowing in Europe and Central Asia region from European Union headquartered “mega-banks” after regulatory easing. This wave ended when the global financial crisis disrupted bank financing in 2007–09. The latest wave of debt accumulation began in 2010 and has already seen the largest, fastest, and most broad-based increase in debt in emerging and developing economies over the past 50 years.

² The G20 brings together the leaders of both developed and developing countries from every continent. Collectively, G20 members represent around 80 percent of the world's economic output, two-thirds of the global population and three-quarters of international trade.

³ More information on DSSI and its benefits can be found at: <https://www.worldbank.org/en/topic/debt/brief/covid-19-debt-service-suspension-initiative>

⁴ Eligibility for IDA support from the World Bank depends first and foremost on a country's relative poverty, defined as Gross National Income per capita below an established threshold and updated annually (\$1,175 in the fiscal year 2020). Least developed countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human assets.

on their IMF and World Bank obligations. The DSSI allows 72 IDA countries and LDCs and Angola to suspend principal and interest payments on their debts to G20 members.⁵

More than ever, the pre-existing macroeconomic and financial vulnerabilities, and the aggravation that resulted from the COVID-19 crisis, highlight the need for analyzing the driving factors of external debt in developing countries. External borrowing could help to boost economic growth and poverty reduction by financing much needed infrastructure, education, and health in developing countries. However, external debt becomes a source of concern when it grows at a fast pace, as has happened in several developing countries over the past years. Indeed, a rapid growth of external debt could weigh on the economy and ultimately lead to crisis, such as the 1980s' debt crisis in developing countries. Therefore, the objective of this paper is to identify factors that could contribute to containing external debt in developing countries.

More specifically, in this paper, we analyze the effect of remittance inflows on external debt in LMICs, by identifying international reserves as a potential transmission channel. Over the past years, remittance inflows have become a significant source of external financing for developing countries, surpassing international aid and foreign direct inflows (World Bank 2019b). Thus, in addition to other macroeconomic effects of remittance inflows discussed in the literature,⁶ it is crucial to investigate whether remittance inflows could also contribute to reducing external debt in developing countries. As far as we know, this is the first paper that examines the effect of remittance inflows on external debt while seeking to identify the related transmission channel.

The effect of remittance inflows on external debt through international reserves is ambiguous. For instance, when serving as a self-insurance mechanism, international reserves could contribute to reducing external debt if countries draw on reserves in "bad times". In that case, depending on the effect of remittance inflows on international reserves, it could contribute to reducing or increasing external debt. On the other hand, as a source of foreign exchange earnings, remittance inflows contribute to higher international reserves; thereby, they may increase external debt if international reserves serve as collateral for external borrowing. However, because of Dutch disease effects and weaker international competitiveness, remittance inflows could reduce international reserves, and thereby leading to lower external borrowing. Such possible ambiguous effects of remittance inflows reinforce the need to examine its link with external debt in developing countries.

The rest of the paper is organized as follows. Section 2 analyzes the trends of external debt and remittance inflows in LMICs. Section 3 proposes an overview of the literature on the determinants of external debt in developing countries. Section 4 develops theoretical arguments showing that the effect of remittance inflows on

⁵ The G20 also called on private creditors to participate in the initiative on comparable terms.

⁶ See, for instance, Chami et al. (2008) for theoretical and empirical evidence on the macroeconomic effects of remittance inflows. These authors also discuss the potential effects of remittances on debt sustainability.

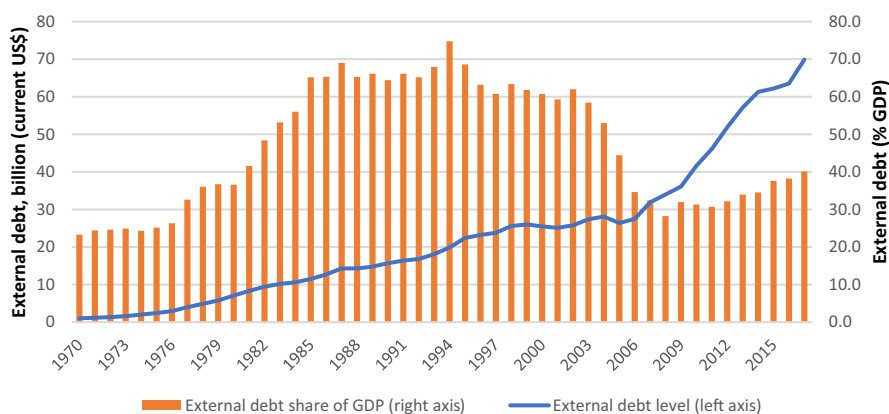


Fig. 1 Trends of External Debt in Low- and Middle-Income Countries. *Source:* Authors' estimates based on data from the World Bank's World Development Indicators

external debt through international reserves is ambiguous. Section 5 uses four-year average panel data over the period 1970–2017 to analyze the effect of remittance inflows on external debt in LMICs. Section 6 presents the results, while Sect. 7 discusses the main findings of the paper. Finally, Sect. 8 concludes the paper with some policy implications.

2 Patterns of External Debt and Remittance Inflows in Low-and Middle-Income Countries

2.1 Trends of External Debt

Three main periods can be distinguished for analyzing the trend of external debt in LMICs.⁷ The first period spans between 1970 and 1999 and was characterized by a steady increase in external debt. It was followed by a period of fluctuation between 2000 and 2005, and then another period of a steady rise in external debt started in 2006 (Fig. 1).

During the first period, the average amount of external debt in LMICs was multiplied by 26, rising from US\$1 billion to US\$26 billion between 1970 and 1999. Following such a large increase, external debt fluctuated around US\$26 billion during 2000–05. Since 2006, a new phase of a steady increase in external debt has begun, but at a slower pace compared to 1970–99. Indeed, the amount of external debt was multiplied by 2.5 during 2006–17 (rising from US\$27.5 to US\$69.9 billion). A

⁷ LMICs are countries with 2018 gross national income (GNI) per capita ranging between \$1,025 or less (low-income countries) and \$12,375 (upper-middle-income countries), calculated using the World Bank's Atlas method. From this section onward, by LMICs, we mean the 50 countries for empirical analysis in this paper. Data availability on remittance inflows over a long period guided us in the choice of the 50 countries (see more details in [Appendix](#)).

slower pace of increased external debt during 2006–17 compared to 1970–99 could be due to the development of alternative sources of financing such as remittance and foreign direct investment inflows in LMICs. It could also be the outcome of the development of domestic financial markets and more efforts for domestic revenue mobilization in LMICs.

Three main periods can also be distinguished to analyze the trend of the external debt-to-GDP ratio in LMICs. The first period spans between 1970 and 1994. During that period, the external debt-to-GDP ratio steadily increased (with a short period of fluctuation over 1988–92). In 1978, the external debt-to-GDP ratio hit 36 percent for the first time and had accelerated since then. The acceleration of the external debt-to-GDP ratio coincided with declining commodity prices in the 1980s; consequently, LMICs increased external borrowing to cope with the crisis. The external debt-to-GDP ratio hit a peak (74.8 percent) in 1994, two years before the launch of the heavily indebted poor countries (HIPC) initiative⁸ that led to significant external debt reliefs for several low-income countries, notably in Africa.

The second main period for the analysis of the trend of the external debt-to-GDP ratio in LMICs is 1995–2008. During that period, the external debt-to-GDP ratio declined from 68.6 to 28.2 percent, driven by a significant increase in nominal GDP (about 167.6 percent increase, on average) between 1995 and 2008. The third period for the analysis of the trend of the external debt-to-GDP ratio in LMICs started in 2009. During that period, the external debt-to-GDP ratio fluctuated around 32 percent, with an acceleration that started in 2014. This period was marked by the global financial crisis as well as declining commodity prices; both crises increased the need for external borrowing in LMICs.

2.2 Comparative Trends of External Debt and Remittance Inflows

Figure 2 depicts the trends of external debt and remittance inflows in LMICs. Without repeating the main characteristics of external debt trends discussed earlier, three main patterns emerge from Fig. 2. The first pattern is that remittance inflows to LMICs have steadily increased for almost the entire period under investigation. In fact, they registered only two main declines during 1970–2017. The first major decline of about US\$92,000 occurred during 2008–09, in the context of the global financial crisis. The second significant decline (about US\$108,000) of remittance inflows happened during 2015–16. This was in the context of the commodity prices shock that started in 2014. The 2008 global financial crisis and the 2014 commodity prices shock reduced the ability of migrants to send money back to their home countries; this is illustrated in Fig. 2.

⁸ The HIPC initiative was jointly launched in 1996 by the International Monetary Fund and the World Bank, with the objective of ensuring that no poor country faces unsustainable debt, i.e., a debt burden it cannot manage. There are 39 eligible countries under the HIPC initiative. More information about the HIPC initiative can be found at: <https://www.imf.org/en/About/Factsheets/Sheets/2016/08/01/16/11/Debt-Relief-Under-the-Heavily-Indebted-Poor-Countries-Initiative>

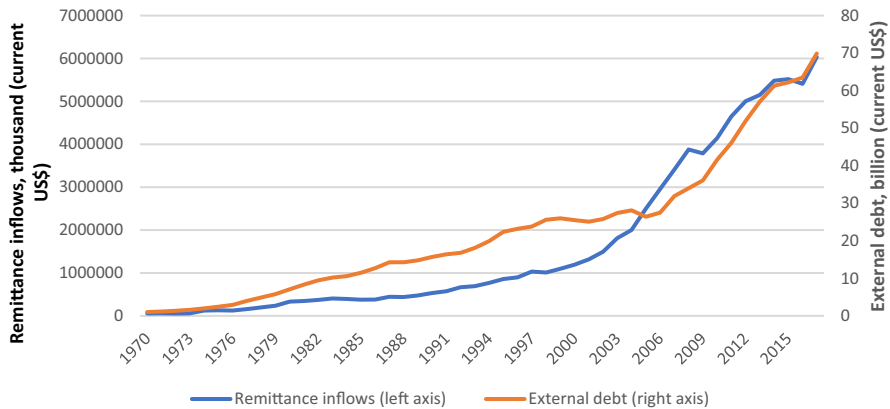


Fig. 2 Comparative Trends of External Debt and Remittance Inflows in Low- and Middle-Income Countries. Source: Authors' estimates based on data from the World Bank's World Development Indicators

The second pattern emerging from Fig. 2 is that remittance inflows registered three main waves of acceleration. The first acceleration occurred in 1997 when for the first time, remittance inflows to LMICs hit US\$1 billion. The second acceleration happened in 2006 when they almost hit US\$3 billion. In 2012, the third acceleration occurred with remittance inflows to LMICs exceeding US\$5 billion for the first time. Though it is difficult to pinpoint the underlying factors of the acceleration of remittance inflows, better economic conditions in migrants' host countries may have contributed. For instance, the first acceleration of remittance inflows to LMICs occurred during the dot-com boom in the United States of America. In addition, improved data collection on remittance transactions may have also contributed to identify periods of acceleration of remittance inflows. In fact, though there is still room for improvement, data collection on remittance transactions has improved over the past years.

The third pattern from Fig. 2 is that both external debt and remittance inflows to LMICs have been on upward trends during the period under consideration. This may reveal the existence of a possible link between remittance inflows and external debt that the results of the econometric analysis in this paper may confirm.

3 Literature Review

Over the past years, there have been several research papers on the determinants of external debt in developing and emerging countries. These research papers can be grouped into three main categories: (i) papers focusing on economic determinants of external debt across countries, (ii) papers highlighting the importance of political factors affecting external debt in developing countries, and (iii) country-level analysis on the determinants of external debt.

Tiruneh (2004) examines the demand for external borrowing, using random and fixed effects models on panel data over 1982–1998 for 60 heavily indebted poor

countries and non-heavily indebted less-developed countries. The results suggest that variables such as debt service payments and the imports-to-GDP ratio constitute the important factors determining the demand for external borrowing. They also reveal that capital flight and income per capita are critical determinants of external debt.

Lane (2004) investigates the determinants of external debt for a set of low- and middle-income countries. The results show that external debt strongly increases with the level of initial output. They also indicate that more open economies have higher debt levels.

Waheed (2017) investigates the macroeconomic factors determining external debt in oil and gas exporting and importing countries, using 12 countries of each group over the period 2004–2013. The results indicate that economic growth, foreign exchange reserves, government revenue, international oil price, and domestic investment appear to be the important drivers that reduce external debt in oil and gas exporting countries. However, the results highlight that a rise in trade deficit, international oil price, interest payment on external debt, foreign direct investment, and domestic investment increase external debt when it comes to oil and gas importing countries.

Colombo and Longoni (2009) use a panel of 61 developing countries covering the period 1970–2000 to study the determinants of long-term external debt. While including socio-political factors in their model to explain the level of external debt in developing countries, they find that external debt is positively impacted by the level of economic development, the degree of openness, the level of education, and the flexibility in the exchange rate. Their results also indicate that financial depth and the inflation rate positively impact external debt. Similarly, they show that the openness and competitiveness of the electoral system have the potential to induce a positive effect on external debt, highlighting the favorable reaction of international financial markets to the transparency of the electoral system and the political stability.

Bittencourt (2015) also investigates the main determinants of government and external debt in the young democracies of South America between 1970 and 2007, focusing on political and economic factors. Based on dynamic panel time-series analysis, the results suggest that economic growth has significantly reduced debt in the region. However, other candidates suggested by the literature—for example, inflation, inequality, and constraints on the executive—do not present the expected or clear-cut estimates on government and external debt.

Using panel data of 36 Sub-Saharan African (SSA) countries over the period 1975–2012, Chiminya et al. (2018) also investigate the economic and political factors that influence external debt accumulation. Their findings highlight that while democratically administered governments accumulate more external debt than autocratic ones, parliamentary systems have more debt than presidential democracies. They also suggest that economic activity and trade openness are essential economic variables that may reduce external debt in SSA countries.

Oatley (2010) specifically analyzes the effect of political institutions by hypothesizing that variation in foreign indebtedness in developing countries is a product of the impact of the regime type on government borrowing and investment decisions.

Autocratic regimes will borrow more from foreign lenders and invest fewer of these funds in public goods than democratic regimes. Consequently, autocracies are more likely to develop sizeable foreign debt burdens than democracies. Oatley (2010) tests this hypothesis by estimating error correction models using a sample comprising 78 developing countries between 1976 and 1998. The analysis suggests that autocratic governments accumulate substantially larger foreign debt relative to their national income than democratic governments.

At a country level, some scholars have also attempted to identify the determinants of external debt in developing and emerging countries. For example, Selami (2004) examines the relationship between defense expenditure and external debt in Turkey over the period 1979–2000. Using the Engle–Granger methodology, the author finds no clear evidence of defense expenditure–external debt relationship in Turkey. As for Özata (2017), he finds that variables such as the exchange rate, interest rate, savings, and fiscal deficit have significant effects on the accumulation of external debt in Turkey both in the short and long term.

Awan et al. (2011) analyze the link between external debt and some macroeconomic factors in Pakistan during the period 1974–2008 and find a significant long-run relationship between external debt, the exchange rate, and the deterioration of the terms of trade. Awan et al. (2015) also study the macroeconomic determinants of external debt in Pakistan using the cointegration technique and error correction models on annual time series data over the period 1976–2010. They find that the fiscal deficit, the nominal exchange rate, and trade openness significantly increase external debt of Pakistan. Moreover, their results highlight that the terms of trade have a negative and significant impact on external debt in the country.

Imimole and Imougehele (2014) scrutinize Nigeria's external debt and find that it is determined by gross domestic product, debt service, and the exchange rate. Abdullahi et al. (2015) also examine the main factors that determine the accumulation of foreign debt in Nigeria using time series data. Their results point out that Nigeria's external debt is statistically impacted by the interest rate, national savings, the exchange rate, and fiscal deficit in the short and long run.

The literature review suggests that our paper is the first to analyze the effect of remittance inflows on external debt in developing countries while identifying international reserves as a potential transmission channel. Moreover, our paper complements the existing literature by using panel data covering longer period and more recent years (our analysis covers the period 1970–2017) while addressing endogeneity issues by applying the system-GMM technique in examining the effects of economic, political, domestic, and external factors on external debt in developing countries.

4 Theoretical Arguments on the Link between External Debt and Remittance Inflows

Remittance inflows could affect external debt through its effect on international reserves. As will be discussed later, international reserves could, in turn, affect external debt through the precautionary or collateral channel (Jones 2018).

However, the effect of remittance inflows on international reserves is ambiguous. On the one hand, as a source of foreign exchange earnings, remittance inflows could increase international reserves. Along the same vein, according to World Bank (2019b), excluding China, remittances to LMICs were estimated to \$462 billion, significantly larger than FDI flows (\$344 billion) in 2018. This makes remittances the largest source of foreign exchange earnings in the LMICs, excluding China. In fact, many countries have started looking at their diaspora for potential sources of foreign exchange earnings that could be tapped through the issuance of diaspora bonds. Countries such as El Salvador, Ethiopia, Nepal, the Philippines, Rwanda, and Sri Lanka have issued or are considering the issuance of diaspora bonds (Ratha 2007; Mohapatra et al. 2010).

On the other hand, remittance inflows could reduce the level of international reserves by having a negative effect on recipient countries' international competitiveness. This could happen because remittance inflows, like any other foreign exchange inflow, may carry a potential for Dutch disease effects (International Monetary Funds 2005; World Bank 2006a). Dutch disease is a phenomenon where remittance inflows might lead to a real exchange rate appreciation and a contraction of tradable sectors. This could happen because additional income in the form of remittances is mostly consumed (Oberai and Singh 1980; Durand et al. 1996; Gilani et al. 1981; Glytsos 1993; Inter-American Development Bank's Multilateral Investment Fund 2004; World Bank 2006b), notably on non-tradable goods and services. The increased demand for non-tradable goods leads to higher prices of these goods. Higher prices of non-tradable goods and services could move workers and other resources from the tradable to the non-tradable sector. In the end, the economy will be in a situation with high relative prices of non-tradable goods, corresponding to a real exchange rate appreciation. Moreover, as demonstrated by Acosta et al. (2009a), remittances may increase the reservation wage of recipients, reducing labor supply, which within the context of fixed world prices, could lead to higher production costs and a contraction of the tradable sector. Empirically, several authors have found that remittance inflows lead to a real exchange rate appreciation (Amuedo-Dorantes and Pozo 2004; Bourdet and Falck 2006; López et al. 2007; Acosta et al. 2009b; Lartey et al. 2012; Vargas-Silva 2009).

The effect of international reserves on external debt is also ambiguous. In fact, one of the explanations advanced in the literature for countries holding international reserves is that they serve as an insurance against the risk of an external crisis, a self-protection mechanism through increased liquidity (see Aizenman and Lee 2007; Calvo et al. 2012; Dominguez et al. 2012; Frankel and Saravelos 2012; Gourinchas and Obstfeld 2012; Bussière et al. 2013).⁹ From the precautionary perspective, countries should accumulate reserves in "good times" and deplete them in "bad times".

⁹ Holding reserves for insurance purpose comes with a social cost. The cost has been estimated at close to 1 percent of GDP for all developing countries (Rodrik 2006). However, according to Yeyati (2008), the cost of holding reserves for self-insurance purpose may have been overestimated because the estimated cost does not consider the impact of the resulting lower spreads on the service costs of the stock of sovereign debt due to higher international reserves.

Thus, international reserves and external debt would be negatively correlated, as higher international reserves would reduce the need for external borrowing. However, international reserves could also play a collateral role, serving to relax external borrowing constraints (Jones 2018; Flood and Marion 2002; Shousha 2017).¹⁰ When serving as collateral, the link between international reserves and external debt is likely to be positive, because higher reserves mean greater ability to pay back debt.

The discussion above leads to four possibilities for the effect of remittance inflows on external debt through international reserves. The four possibilities are illustrated in Table 1. The first possibility is a situation where remittance inflows have a positive effect on international reserves (foreign exchange earnings effect), which in turn could increase external debt (collateral effect). Because of the dominance of the two aforementioned effects of international reserves and remittance inflows, the latter ends up increasing external debt. The second possibility is a situation where the collateral role of international reserves for external borrowing still predominates; however, this time round, remittance inflows have a negative effect on international reserves because of weaker export competitiveness due to Dutch disease effects. The negative effect of remittance inflows on international reserves, while the latter has a positive effect on external debt, leads to a negative relationship between remittance inflows and external debt.

The third possibility highlighted in Table 1 is when international reserves serve as a self-insurance mechanism with a positive effect of remittance inflows on international reserves. Thus, the third possibility is a situation where remittance inflows would have a negative effect on external debt because of a positive effect of remittance inflows on international reserves, which in turn are negatively linked with external debt. Finally, the fourth and last possibility is a situation where international reserves still serve as a self-insurance mechanism, but this time round, remittance inflows have a negative effect on international reserves because of Dutch disease effects. Thus, the fourth possibility is a situation where remittance inflows will increase external debt because they reduce the level of international reserves, which in turn have a negative effect on external debt.

Which of the four possibilities for the effect of remittance inflows on external debt through international reserves will prevail? This is a fundamental policy research question that our empirical analysis aims at helping to respond.

5 Empirical Analysis

5.1 Model Specifications

This paper aims to estimate the effect of remittance inflows on external debt, while identifying international reserves as a potential transmission channel. To achieve the

¹⁰ By serving as a collateral, this does not mean that investors can seize a country's international reserves in case of default of sovereign debt payment, but rather higher international reserves boost investors' confidence in the country's ability to pay back its external debt.

Table 1 Possible links between remittance inflows, international reserves, and external debt

	Remittances' effect on international reserves through increased foreign exchange earnings	Remittances' effect on international reserves through weaker export competitiveness
Collateral effect of international reserves on external debt predominates	Possibility 1 <ul style="list-style-type: none"> • Positive effect of remittances on international reserves • Positive effect of international reserves on external debt • Positive effect of remittances on external debt 	Possibility 2 <ul style="list-style-type: none"> • Negative effect of remittances on international reserves • Positive effect of international reserves on external debt • Negative effect of remittances on external debt
Insurance effect of international reserves on external debt prevails	Possibility 3 <ul style="list-style-type: none"> • Positive effect of remittances on international reserves • Negative effect of international reserves on external debt • Negative effect of remittances on external debt 	Possibility 4 <ul style="list-style-type: none"> • Negative effect of remittances on international reserves • Negative effect of international reserves on external debt • Positive effect of remittances on external debt

Source: Authors' deduction based on the theoretical arguments developed in this paper
 "Positive" and "negative" effects stand for the expected effects from econometrics perspective

paper's objective, we first estimate the effect of remittance inflows on external debt while controlling for other determinants of external debt (Eq. 1). We then estimate the effect of remittance inflows on external debt while controlling for other determinants of external debt and international reserves; the latter being a potential transmission channel for the effect of remittance inflows (Eq. 2).

Thus, we estimate the following models:

$$Debt/GDP_{it} = c + \alpha Debt/GDP_{it-1} + \beta remit_{it} + \sigma X_{it} + u_i + v_t + \varepsilon_{it} \quad (1)$$

$$Debt/GDP_{it} = c + \alpha Debt/GDP_{it-1} + \beta remit_{it} + \sigma X_{it} + \mu reserve_{it} + u_i + v_t + \varepsilon_{it} \quad (2)$$

With X_{it} a set of control variables in country i at time period t , but excluding international reserves. In both Eqs. (1) and (2), the dependent variable is the total external debt-to-GDP ratio ($Debt/GDP_{it}$). Total external debt is debt owed to non-residents. It is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, short-term debt, and use of IMF credit. Moreover, in both equations, remittance inflows ($remit_{it}$) and international reserves ($reserve_{it}$) are expressed as a percentage of GDP. Remittance inflows comprise personal transfers and compensation of employees, transferred back to home country. International reserves refer to holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities.

As per our earlier theoretical discussion, the effect of remittance inflows on international reserves is ambiguous. Thus, when adding international reserves in Eq. (2), the coefficient associated with remittance inflows could increase (decline) if the effect of remittance inflows on international reserves is negative (positive). Moreover, as discussed earlier, the effect of international reserves on external debt could be positive (negative) if the role of international reserves as a collateral for external borrowing predominates (if international reserves serve as a self-insurance mechanism). Similarly, as discussed earlier, the effect of remittance inflows on external debt is ambiguous. In fact, without enumerating all the four possibilities discussed in the theoretical section, the effect of remittance inflows on the dependent variable could be positive when remittance inflows have a negative effect on international reserves, which in turn have a negative effect on external debt. Alternatively, the coefficient associated with remittance inflows could be negative when remittance inflows and international reserves are positively linked, with the latter having a negative effect on external debt.

In addition to our two variables of interest, based on the existing literature, we also control for other determinants of external debt. The other determinants of external debt could be grouped into three categories. The first category is about domestic economic factors that could affect external debt. This includes: (i) lagged external debt-to-GDP ratio; (ii) the nominal exchange rate; (iii) economic growth rate; and (iv) savings-investment gap as a percentage of GDP. The second category of other determinants of external debt consists of external factors, such as (i) the terms of trade; and (ii) the United States (U.S.) lending interest rate. The third category

focuses on political factors that could affect external debt. More specifically, this is about the level of democracy in a country.

Lagged External Debt-to-GDP Ratio This variable is used to capture the persistence of external debt. It is a proxy for initial conditions that determine the country's external borrowing needs. For instance, given the shortage of critical infrastructure (roads, energy, hospitals, schools, etc.), the need for external borrowing to fund infrastructure will not disappear overnight in most developing countries. Thus, developing countries that recourse to external borrowing for financing their development needs are more likely to use it again in the future. We therefore expect a positive effect of the lagged external debt-to-GDP ratio on the dependent variable.

The Nominal Exchange Rate This is a key variable for developing countries borrowing abroad. According to Eichengreen et al. (2003), because they are not able to borrow abroad in their own currencies, developing countries suffer from the “original sin” problem, with an aggregate currency mismatch on their balance sheet. More specifically, for developing countries borrowing abroad, a depreciation of the local currency leads to an increase in the external debt burden. In this paper, the nominal exchange rate is measured by the amount of the local currency that is needed to purchase one-unit of dollar. Thus, a higher value of the exchange rate variable corresponds to a depreciation of the local currency vis-à-vis the dollar, which is expected to positively affect the external debt-to-GDP ratio.

Economic Growth A negative coefficient associated with the economic growth rate is expected because a higher economic growth rate generates more tax revenue, less public spending, and a lower fiscal deficit; consequently, less debt accumulation.¹¹ Economic growth is measured by the annual growth rate of real gross domestic product.

Savings-Investment Gap as a Percentage of GDP This variable indicates the extent to which domestic savings meet the need for investment in a country. The higher the level of domestic savings relatively to the investment need, the lower the need for external borrowing. Thus, we expect the savings-investment gap as a percentage of GDP to have a negative effect on external debt.

The Terms of Trade An increase in the terms of trade generates more revenue, less deficit and eventually, lower external borrowing. However, an increase in the terms of trade could also lead to excess spending and debt accumulation when countries expect such an increase to last. This is what happened in the late 1970s when

¹¹ External debt could also negatively affect economic growth beyond a certain threshold. This is the so-called “debt overhang theory”, which has been empirically analyzed by several authors (see Patillo et al. 2002, for instance). However, testing the “debt overhang theory” is beyond the scope of this paper.

developing countries borrowed excessively, expecting a steady rise in commodity prices.¹² Thus, the effect of the terms of trade on external debt is ambiguous.

The U.S. Lending Interest Rate The U.S. interest rate could have spillover effects in developing countries. For instance, higher U.S. interest rates reduce incomes and expenditures in the U.S., thus leading to lower U.S. demand for both domestically produced and imported goods and reducing activity and GDP growth rate abroad (Iacoviello and Gaston 2019). By reducing economic growth in developing countries, a higher U.S. lending interest rate could increase external debt. In the same vein, several authors argue that the tightening of monetary policy in the U.S. drove up interest rates and has contributed to the debt crisis in the 1980s by generating contraction in the global economy and lower demand for exports from developing countries (Mugasha 2007; Barth et al. 1987). Thus, we expect a positive effect of the U.S. lending interest rate on the external debt-to-GDP ratio.

Political Right This variable examines the effect of political factors or the political regime type on external debt. Several authors (Oatley 2010; Bittencourt 2015; and Colombo and Longoni 2009) have emphasized the importance of political factors or the political regime type in understanding the level of indebtedness in developing countries. More specifically, it has been argued that autocratic regimes will tend to borrow more from abroad and invest less in the domestic economy due to a lack of accountability, generating more rent-seeking behavior in autocratic regimes. However, because of higher accountability, democratic regimes may also tend to borrow more to meet the needs of voters or citizens for public goods and services. This paper uses the political right index to proxy the political regime type. The political right index measures the degree of freedom in the electoral process, political pluralism and participation, and functioning of government. It ranges between 1 and 7, with higher values representing less democratic regimes. As sketched above, the effect of the political right index on external debt is ambiguous.

5.2 Econometric Techniques

As outlined in the model specifications, we use panel data for econometric analysis. More specifically, the analysis uses non-overlapping four-year average panel data over the period 1970–2017. The use of four-year average data helps to smooth annual fluctuations in external debt, remittance inflows data, as well as other variables used for the econometric analysis. Panel data also allow controlling for country fixed effects (represented by u_i). Country fixed effects account for time-invariant specific factors that could affect a country's ability to borrow from abroad, including colonial history, or a physical closeness to major economies or markets. Likewise, the use of time fixed effects (represented by v_t) allows to control for external shocks,

¹² See Sachs (1987) for historical analysis of how the commodity prices boom contributed to the debt crisis in the 1980s in developing countries.

such as the 1980s' commodity prices crisis or the 2008 global financial crisis that simultaneously affected the level of debt in various countries.

However, despite their advantages, estimating panel data can be challenging, especially when the lagged value of the dependent variable is included in the list of independent variables, as it is the case in this paper. Such a model suffers from endogeneity bias, especially when the time dimension of the panel data is short (Nickell 1981). To address this situation, we use the system-GMM technique, developed by Blundell and Bond (1998). This technique has been proved more efficient in estimating dynamic panel models. It has been widely used for analyzing macroeconomic phenomenon and has the advantage of dealing with the endogeneity of all the explanatory variables, including our variables of interest (remittance inflows, and international reserves) by using their lagged values (in level and in first difference) as instrumental variables. The validity of the instrumental variables used in the system GMM estimations is checked through several tests, notably the Sargan-Hansen test. Moreover, the model also controls for the variables such as economic growth rate and exchange rate that could simultaneously affect external debt, remittance inflows, and international reserves; thus, reducing the risk of endogeneity.

We use panel data from 50 LMICs (see Table 13 in the Appendix for the list of the countries) over the period 1970–2017. The choice of the countries sample has been guided by data availability over a long period, especially the availability of remittance inflows data. For econometric analysis, we should normally have 12 observations per country, leading to a total of 600 observations. However, since some of the variables are not available either for some countries or for some periods, we use unbalanced panel data (see Table 3 in the Appendix for the summary of statistical descriptive of the main variables). Thus, when reporting econometric results, the number of countries and observations might be lower than 50 and 600, respectively.

All the data used in this paper are from the World Bank's 2020 World Development Indicators, except the political right index and the terms of trade data. The political right index is from Freedom House, while the terms of trade variable is from the IMF.

6 Econometric Results

6.1 Baseline Results

According to the results in Table 2, remittance inflows have a positive and significant effect on the external debt-to-GDP ratio. More specifically, an increase of one percentage point of remittance inflows as a share of GDP would lead to about 0.76 percentage points increase in the external debt-to-GDP ratio (column 4 of Table 2). Likewise, the results show that international reserves have a negative and significant effect on external debt. A one percentage point increase in international reserves as a share of GDP would lead to about 0.30 percentage points decrease in the external debt-to-GDP ratio. After controlling for international reserves, the effect of remittance inflows on external debt increases; it remains positive and significant. This

Table 2 Baseline results

	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
VARIABLES	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.665*** (14.64)	0.635*** (13.05)	0.801*** (15.20)	0.730*** (9.52)
Nominal exchange rate	0.003 (1.46)	0.002 (0.95)	0.002* (1.66)	0.003* (1.77)
GDP growth rate	-1.000*** (3.01)	-1.153*** (3.38)	-0.820** (2.47)	-0.838** (2.09)
Savings-investment gap/GDP	-0.441*** (2.77)	-0.437** (2.42)	-0.404*** (2.91)	-0.318** (2.68)
U.S. lending interest rate	30.33*** (2.74)	27.71** (2.35)	0.763* (1.76)	0.628* (1.81)
Terms of trade	1.612** (2.24)	1.575** (2.10)	1.401 (1.43)	0.573 (1.02)
Political right	-0.265 (0.40)	-0.796 (1.06)	1.333 (1.05)	2.206 (0.94)
Remittance inflows/GDP	0.206 (0.85)	0.430* (1.77)	0.345* (1.67)	0.76*** (3.03)
International reserves/GDP		-0.405*** (3.24)		-0.301** (2.17)
Constant	-248.1** (2.56)	-224.0** (2.16)	-136.5 (1.51)	-55.06 (1.11)
Observations	515	437	515	438
R-squared (adjusted)	0.75	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.319	0.247
AR (1)			0.001	0.003
AR (2) ²			0.456	0.897

1/Stands for the p-values associated with the Sargan-Hansen test. The p-values are higher than 10 percent, which suggests that the lagged values of the variables that we use as instruments in the system-GMM model are valid.

2/Stands for the p-values associated with the test of absence of autocorrelation of second order. The result shows that there is no such autocorrelation in the data; thereby, validating the use of lagged variables of a minimum of two periods as instruments in the system-GMM model. We limit the number of instruments used, by making sure that their number is lower than the number of countries, which is an additional condition for checking for the validity of the system-GMM estimations.

***, **, * denote significant coefficients at the 1%, 5% and 10% level. The figures in brackets are robust t-statistics. All the estimations include time fixed effects whose coefficients are not reported.

suggests the existence of a negative relationship between international reserves and remittance inflows.¹³

Overall, the results in Table 2 are consistent with the “possibility 4”, discussed in the theoretical section for the effect of remittance inflows on external debt through international reserves. In fact, we find a negative effect of remittance inflows on international reserves, which in turn have a negative effect on external debt. And because of the negative effect of remittance inflows on international reserves, the former variable ends up having a positive effect on external debt. Thus, the results suggest that the role of international reserves as a self-insurance mechanism predominates, explaining the negative effect of international reserves on external debt. Similarly, the Dutch disease story for the effect of remittance inflows holds, explaining the positive effect of remittance inflows on external debt, as higher remittance inflows reduce international reserves because of the negative effect on international competitiveness.

In addition to our two variables of interest, other control variables have also significant and expected effects on external debt. The effect of the lagged value of external debt is positive and significant, regardless of the model specification. According to the results, an increase of one percentage point of the lagged value would lead to about 0.80 percentage points increase in the external debt-to-GDP ratio. This suggests a persistence of external debt. We also find a positive and significant effect of the nominal exchange rate on external debt. The results suggest that an increase of 10 units of the amount of the local currency that is needed for purchasing one-unit of dollar would increase the ratio of external debt-to-GDP by 3 percentage points. This confirms the existence of the “original sin”, which is the risk of increased burden of external debt denominated in foreign currency, in the event of depreciation of local currencies in developing countries, as suggested by Eichengreen et al. (2003).

The effect of economic growth rate is negative and significant, regardless of the model specification. An increase of one percentage point of economic growth rate would reduce the external debt-to-GDP ratio by 0.8 percentage points. Thus, stimulating economic growth rate is key for reducing external debt in LMICs. Likewise, we also find a negative and significant effect of the savings-investment gap on external debt. According to the results, an increase of one percentage point of the savings rate relatively to the investment rate would reduce the ratio of external debt to GDP by about 0.3 percentage points. This suggests that increasing domestic savings would reduce the need for external borrowing in LMICs.

¹³ Using panel data and controlling for fixed effects, we found a negative and significant effect of remittance inflows on international reserves. This is revealing of the risk of the Dutch disease effect associated with high volume of remittance inflows. Also, after excluding the top-10 recipient countries of remittances (in ascending order of average remittance inflows as a share of GDP over 1970–2017: Lesotho, Samoa, Jordan, Cabo Verde, El Salvador, Jamaica, Egypt, Philippines, Honduras, and Dominica. These countries are likely to experience the Dutch disease phenomenon due to higher remittance inflows) from our sample, we found a negative but non-significant effect of remittance inflows on external debt. In other words, by excluding larger recipient countries of remittance, the associated risk of the Dutch disease effect becomes low in our sample. These results are not shown but are available upon request.

We also find a positive and significant effect of the U.S. lending interest rate. According to the results, a one percentage point increase in the U.S. lending interest rate would increase the external debt-to-GDP ratio by about 0.7 percentage points. This suggests a spillover effect of the U.S. lending interest rate, which could be translated into an increase of external debt in LMICs.

6.2 Robustness Checks

We run several robustness checks of our baseline results. The results of all the robustness checks are reported in the appendix. The first robustness check that we carry out consists of changing the period of analysis, by focusing on the period 1978–2017. In fact, according to the trend analysis, since 1978, the external debt-to-GDP ratio has accelerated in LMICs. Thus, it is important to check whether our results would still be valid by focusing on that period.

We also check the robustness of the results to the level of external debt. To do so, we proceed in two steps. We first exclude from our sample, the top 10 countries with the highest average external debt-to-GDP ratio over the period 1970–2017.¹⁴ This leads to the second robustness check. Then, we run regressions without HIPC countries in the sample, leading to the third robustness check. HIPC countries are countries that benefited from debt relief over the past years, and one may suspect that their presence in the sample could have driven our main results.

In addition, we check the robustness of the results to the measurement of external debt. So far, we've used total external debt as the dependent variable. We consider two alternative measurements of external debt: long-term (LT) external debt, and public and publicly guaranteed (PPG) external debt. This leads to the fourth and fifth robustness checks, respectively. Both LT and PPG external debt are components of total external debt, with LT external debt representing debt with a minimum of one-year maturity. PPG external debt comprises long-term external obligations of public debtors, including the national government, political subdivisions (or an agency of either), and autonomous public bodies, and external obligations of private debtors that are guaranteed for repayment by a public entity.

We also test the robustness of our results with regards to the measurement of international reserves. So far, we've used total international reserves as a share of GDP. Alternatively, in place of total reserves, we consider reserves excluding gold as a percentage of GDP. This is the sixth robustness check. Another alternative variable that we use is total international reserves in terms of months of imports covered. This is the seventh robustness check.

The eighth robustness check that we carry out consists of changing the functional form of the econometric model. Up to now, we've used a linear model. Alternatively, we also use a log linear model, where the dependent variable is the natural

¹⁴ These are the following countries, from the highest to the lowest average external debt-to-GDP: Republic of Congo, Cote d'Ivoire, Jamaica, Jordan, Sudan, Togo, Madagascar, Mali, Bolivia, and Ethiopia. For each of these countries, the external debt-to-GDP ratio is at least 60 percent on average over the period 1970–2017.

logarithm of the external debt-to-GDP ratio, and its lagged value as one of the independent variables.

The results of the aforementioned robustness checks confirm our initial findings. In fact, despite changing the period of analysis, changing the indicator of external debt, modifying the sample composition based on countries' level of external debt, considering different indicators for international reserves, and changing the functional form of the model, we still find a positive and significant effect of remittance inflows on external debt. The effect of remittances inflows increases; it remains positive and significant after controlling for international reserves, which in turn, are negatively and significantly linked with external debt.

So far, we have used linear regressions for econometric analysis. However, the link between remittance inflows and external debt could be non-linear. To explore such a possibility, we run a last robustness check by adding in the models, remittance inflows as a share of GDP and its squared value as explanatory variables. The results indicate a negative but non-significant effect of remittance inflows as a percentage of GDP, a positive and significant effect of its squared value on the external debt-to-GDP ratio. These results do not support the hypothesis of a non-linear relationship between remittance inflows and external debt. In fact, a non-linear relationship requires that the coefficients associated with both an explanatory variable and its squared value to be statistically significant (Greene et al. 2005), which is not the case in this paper for remittance inflows. On the other hand, the fact that the squared value of remittance inflows has a positive and significant effect on external debt confirms the risk of the Dutch disease effect that could result from a high volume of remittance inflows. The latter effect predominates; that is why in the linear regressions, the effect of remittance inflows on external debt is positive and significant.

7 Discussions of the Results

In this paper, we find a positive and significant effect of remittance inflows on the external debt-to-GDP ratio in LMICs. We also find a negative and significant effect of international reserves on external debt. After controlling for international reserves, the effect of remittance inflows on external debt increases; it remains positive and significant. These results suggest that the role of international reserves as a self-insurance mechanism, and the Dutch disease effects of remittances inflows are at play.

Thus, efforts should be pursued for more contribution of remittance inflows to productive activities in LMICs. In fact, one of the development paradigms that need to be changed in the post COVID-19, is shifting remittance inflows from consumption to investment and productive activities in developing countries. This could be possible by strengthening property rights and rule of law, which will increase the confidence of diaspora and recipients of remittances to invest more in developing countries. Improving communication towards diaspora for existing investment opportunities in home countries, reducing transfer costs of remittances for investment purposes, and targeting specific infrastructure that could be financed through diaspora bond for instance, should also be part of the strategies for increasing

remittance inflows' contributions to investment and economic growth in developing countries. Increased remittance inflows' contributions to productive activities and domestic investment has the potential to accelerate economic growth and reduce the associated-Dutch disease effects; thereby, contributing to lower the burden of external debt in developing countries.

The results of the paper also suggest that increasing international reserves and use them appropriately when the economy needs it, should also be part of the strategies for reducing external debt in LMICs. To do so, improving competitiveness and diversification of exports should be a priority, as this could generate foreign exchange earnings and higher international reserves that could be used when needed, including for financing high impactful infrastructure, thus reducing financing pressure in LMICs.

In addition to our two variables of interest, we also find negative and significant effects of economic growth and savings-investment gap on the external debt-to-GDP ratio. This suggests that stimulating economic growth, as well as increasing domestic savings should be part of the priorities for reducing external debt in LMICs.

We also find positive and significant effects of the nominal exchange rate and U.S. lending interest rate on the external debt-to-GDP ratio. This suggests that managing well the exchange rate is important for developing countries with debt denominated in foreign currencies. However, it is important to avoid overvaluation of the real exchange rate, as this could negatively affect LMICs' competitiveness. Similarly, the results highlight the spillover effect of the U.S. lending interest rate, which could lead to increased external debt in LMICs. Thus, managing well the spillover effect of the U.S. lending interest rate could be part of the solutions for containing external debt in developing countries.

8 Conclusion

In this paper, we analyze the effect of remittance inflows on external debt in low- and middle-income countries (LMICs). We assume that international reserves are a potential channel through which remittance inflows could affect external debt. We develop theoretical arguments showing that the effect of remittance inflows on external debt through international reserves is ambiguous. This leads to four theoretical possibilities discussed in this paper, concerning the relationships between remittance inflows, international reserves, and external debt.

Using panel data over the period 1970–2017, covering 50 LMICs worldwide, we find a positive and significant effect of remittance inflows on the external debt-to-GDP ratio. We also find a negative and significant effect of international reserves on external debt. After controlling for international reserves, the effect of remittance inflows on external debt increases; it remains positive and significant. This suggests a negative relationship between remittance inflows and international reserves due to weaker international competitiveness that could result from high remittance inflows. The results are consistent with one of the four theoretical possibilities discussed in this paper for the relationships between remittance inflows, international reserves, and external debt. More specifically, the results suggest that the role of international

reserves as a self-insurance mechanism and the Dutch disease effects of remittance inflows are at play.

In addition, we find negative and significant effects of economic growth and savings-investment gap on external debt. We also find positive and significant effects of the nominal exchange rate and the U.S. lending interest rate on external debt in LMICs. Moreover, we find that external debt is persistent, with lagged value having a positive and significant effect on the current external debt-to-GDP ratio.

A policy implication of our findings is that much more effort is needed to increase the contributions of remittance inflows to productive activities and investment in developing countries. This has the potential to reduce the risk of Dutch disease effects associated with remittance inflows and make it one of the possible solutions for reducing external debt in developing countries. Thus, shifting remittance inflows from consumption to investment and productive activities should be one of the priorities for reducing external debt in developing countries in the post-COVID-19. Similarly, increasing international reserves that could be used in “bad times”, as well as increasing domestic savings are also critical strategies for containing external debt in developing countries.

The results also highlight the importance of economic growth for managing properly the level of external debt. Thus, stimulating economic growth in the post-COVID-19 should be a priority, as higher economic growth rates could contribute to containing external debt in developing countries. Additionally, managing well the nominal exchange rate should also be part of the solutions, as a larger depreciation of the exchange rate would increase the burden of external debt for developing countries borrowing abroad in foreign currencies. Finally, the results of our paper also highlight the importance of considering the spillover effect of higher U.S. lending interest rates that could be translated into increased external debt in developing countries.

Appendix

Table 3 Statistical description of the main variables

Variable	Observation	Mean	Std. Dev	Minimum	Maximum
External debt/GDP	592	46.97	32.82	0	253.04
Lagged external debt/GDP	542	47.84	33.62	0	253.04
Nominal exchange rate	598	196.22	548.68	2.40e-12	6073.28
GDP growth rate	589	4.09	3.08	-5.23	22.65
Saving-investment gap/GDP	589	-5.15	11.51	-93.54	45.65
U.S. lending interest rate	600	7.63	3.01	3.25	13.96
Terms of trade	579	95.86	3.64	81.32	100.59
Political right	596	4.04	1.79	1	7
Remittance inflows/GDP	545	5.65	16.36	0.003	226.76
International reserves/GDP	502	13.17	14.65	0.12	112.88

Table 4 Robustness to changing the period of analysis

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.665*** (13.43)	0.636*** (12.12)	0.779*** (12.05)	0.736*** (9.34)
Nominal exchange rate	0.003 (1.30)	0.002 (0.738)	0.002 (1.295)	0.002 (1.184)
GDP growth rate	-1.108*** (2.98)	-1.304*** (3.47)	-0.775** (1.97)	-1.049** (-2.46)
Saving-investment gap/GDP	-0.451*** (2.61)	-0.442** (2.29)	-0.446*** (3.14)	-0.358*** (2.84)
U.S. lending interest rate	29.98*** (2.71)	27.14** (2.31)	0.882* (1.82)	0.890** (2.02)
Terms of trade	1.597** (2.18)	1.556** (2.04)	1.990* (1.84)	0.428 (0.62)
Political right	-0.259 (0.36)	-0.922 (1.14)	1.521 (1.20)	2.187 (1.30)
Remittance inflows/GDP	0.258 (1.02)	0.496** (2.00)	0.303* (1.87)	0.707** (2.28)
International reserves/GDP		-0.412*** (3.20)		-0.474** (2.27)
Constant	-245.4** (2.49)	-219.3** (2.09)	-196.4* (1.94)	-41.62 (0.678)
Observations	479	408	479	409
R-squared (adjusted)	0.74	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.226	0.140
AR (1)			0.002	0.003
AR (2) ²			0.401	0.930

1/Stands for the p-values associated with the Sargan-Hansen test. The p-values are higher than 10 percent, which suggests that the lagged values of the variables that we use as instruments in the system-GMM model are valid.

2/Stands for the p-values associated with the test of absence of autocorrelation of second order. The result shows that there is no such autocorrelation in the data; thereby, validating the use of lagged variables of a minimum of two periods as instruments in the system-GMM model. We limit the number of instruments used, by making sure that their number is lower than the number of countries, which is an additional condition for checking for the validity of the system-GMM estimations.

***, **, * denote significant coefficients at the 1%, 5% and 10% level. The figures in brackets are robust t-statistics. All the estimations include time fixed effects whose coefficients are not reported.

Table 5 Robustness to excluding the 10 countries with the highest external debt-to-GDP ratio from the sample

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.634*** (13.37)	0.603*** (11.90)	0.623*** (11.37)	0.590*** (7.633)
Nominal exchange rate	0.004** (2.19)	0.004* (1.92)	0.003*** (3.76)	0.003** (1.99)
GDP growth rate	-0.652** (2.07)	-0.699** (2.04)	-0.751** (2.22)	-0.950** (2.34)
Saving-investment gap/GDP	-0.233 (1.62)	-0.238 (1.51)	-0.121 (1.27)	-0.227* (1.94)
U.S. lending interest rate	29.89*** (3.37)	29.69*** (2.97)	0.971** (2.56)	0.889* (1.81)
Terms of trade	2.148*** (4.13)	2.090*** (3.79)	-0.041 (0.07)	-0.365 (0.36)
Political right	0.172 (0.30)	-0.0641 (0.09)	-0.753 (0.73)	-0.378 (0.25)
Remittance inflows/GDP	0.387* (1.84)	0.542** (2.49)	0.293* (1.79)	0.305* (1.71)
International reserves/GDP		-0.254*** (3.19)		-0.135** (2.07)
Constant	-300.9*** (4.13)	-288.1*** (3.64)	14.26 (0.26)	47.41 (0.50)
Observations	408	363	408	363
R-squared (adjusted)	0.68	0.70	-	-
Number of countries	40	36	40	36
Sargan-Hansen test ¹			0.380	0.210
AR (1)			0.008	0.021
AR (2) ²			0.119	0.183

The same as in Table 4

Table 6 Robustness to excluding heavily indebted and poor countries from the sample

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.683*** (10.91)	0.652*** (10.69)	0.760*** (8.07)	0.688*** (6.35)
Nominal exchange rate	0.004* (1.90)	0.003* (1.69)	0.003*** (3.17)	0.003** (2.56)
GDP growth rate	-1.287*** (3.08)	-1.304*** (3.16)	-1.005** (2.09)	-0.983** (2.26)
Saving-investment gap/GDP	-0.546*** (2.75)	-0.513** (2.567)	-0.383** (2.26)	-0.325** (2.00)
U.S. lending interest rate	24.92* (1.88)	22.87* (1.71)	0.604 (1.39)	0.807* (1.69)
Terms of trade	1.217 (1.54)	1.123 (1.47)	0.576 (0.92)	0.171 (0.22)
Political right	-1.047 (1.27)	-0.845 (1.07)	-0.026 (0.02)	0.347 (0.27)
Remittance inflows/GDP	0.472* (1.80)	0.555** (2.17)	0.330* (1.86)	0.593*** (3.22)
International reserves/GDP		-0.365*** (2.93)		-0.340* (1.74)
Constant	-188.1* (-1.698)	-164.5 (-1.502)	-48.59 (-0.774)	-9.335 (-0.122)
Observations	367	366	367	366
R-squared (adjusted)	0.75	0.76	-	-
Number of countries	36	36	36	36
Sargan-Hansen test ¹			0.117	0.245
AR (1)			0.009	0.012
AR (2) ²			0.868	0.784

The same as in Table 4

Table 7 Robustness to considering long-term external debt

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.657*** (14.32)	0.623*** (12.51)	0.746*** (10.27)	0.645*** (7.45)
Nominal exchange rate	0.002 (1.175)	0.001 (0.471)	0.001 (1.437)	0.001 (1.110)
GDP growth rate	-0.845*** (2.84)	-0.974*** (3.15)	-0.626** (2.03)	-0.788** (2.31)
Saving-investment gap/GDP	-0.368*** (2.67)	-0.370** (2.37)	-0.332*** (2.81)	-0.308** (2.60)
U.S. lending interest rate	29.42*** (3.00)	26.29** (2.54)	0.643* (1.81)	0.714** (2.47)
Terms of trade	1.300** (2.07)	1.229* (1.88)	1.241 (1.25)	0.493 (0.80)
Political right	-0.397 (0.68)	-0.890 (1.33)	1.284 (1.14)	0.748 (0.43)
Remittance inflows/GDP	0.235 (1.13)	0.431** (2.06)	0.283* (1.69)	0.689** (1.99)
International reserves/GDP		-0.376*** (3.44)		-0.458** (2.35)
Constant	-215.6** (2.53)	-187.5** (2.06)	-122.8 (1.32)	-42.99 (0.77)
Observations	515	437	515	437
R-squared	0.74	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.308	0.501
AR (1)			0.002	0.008
AR (2) ²			0.435	0.940

The same as in Table 4

Table 8 Robustness to considering public and publicly guaranteed external debt

VARIABLES	Fixed Effect		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.644*** (13.62)	0.613*** (12.19)	0.723*** (8.61)	0.644*** (7.68)
Nominal exchange rate	0.001 (0.59)	-0.0003 (0.281)	0.001 (1.26)	0.0002 (0.21)
GDP growth rate	-0.862*** (3.14)	-1.035*** (3.70)	-0.594** (2.05)	-0.780** (2.45)
Saving-investment gap/GDP	-0.301** (2.46)	-0.301** (2.20)	-0.271** (2.65)	-0.256** (2.27)
U.S. lending interest rate	28.15*** (3.46)	24.42*** (2.91)	0.595* (1.71)	0.762*** (2.91)
Terms of trade	1.217** (1.98)	1.160* (1.82)	0.921 (0.94)	0.488 (0.79)
Political right	-0.679 (1.25)	-1.097* (1.80)	-0.163 (0.13)	-0.208 (0.13)
Remittance inflows/GDP	0.116 (0.58)	0.315 (1.58)	0.319* (1.74)	0.707** (2.20)
International reserves/GDP		-0.369*** (3.37)		-0.463** (2.38)
Constant	-203.7** (2.54)	-175.9** (2.08)	-84.15 (0.92)	-39.21 (0.69)
Observations	515	437	515	437
R-squared (adjusted)	0.78	0.79	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.312	0.182
AR (1)			0.006	0.012
AR (2) ²			0.491	0.947

The same as in Table 4

Table 9 Robustness to considering international reserves excluding gold

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.665*** (14.64)	0.655*** (13.25)	0.801*** (15.20)	0.724*** (9.49)
Nominal exchange rate	0.003 (1.46)	0.002 (1.01)	0.002* (1.66)	0.003* (1.90)
GDP growth rate	-1.00*** (3.01)	-1.16*** (3.38)	-0.820** (2.47)	-0.817** (2.13)
Saving-investment gap/GDP	-0.441*** (2.77)	-0.422** (2.40)	-0.404*** (2.91)	-0.297** (2.47)
U.S. lending interest rate	30.33*** (2.74)	27.94** (2.43)	0.763* (1.76)	0.632* (1.92)
Terms of trade	1.612** (2.24)	1.613** (2.10)	1.401 (1.43)	0.614 (1.12)
Political right	-0.265 (0.40)	-0.814 (1.05)	1.333 (1.05)	1.808 (0.77)
Remittance inflows/GDP	0.206 (0.85)	0.411* (1.64)	0.345* (1.67)	0.767*** (3.05)
International reserves/GDP		-0.218** (2.15)		-0.289* (1.77)
Constant	-248.1** (-2.556)	-233.0** (-2.235)	-136.5 (-1.508)	-57.75 (-1.190)
Observations	515	438	515	438
R-squared	0.75	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.319	0.297
AR (1)			0.001	0.003
AR (2) ²			0.456	0.865

The same as in Table 4

Table 10 Robustness to considering international reserves in terms of months of imports covered

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.665*** (14.64)	0.651*** (12.61)	0.801*** (15.20)	0.756*** (9.05)
Nominal exchange rate	0.003 (1.46)	0.003 (1.23)	0.002* (1.66)	0.002 (0.67)
GDP growth rate	-1.000*** (3.01)	-1.147*** (3.22)	-0.820** (2.47)	-0.859** (2.20)
Saving-investment gap/GDP	-0.441*** (2.77)	-0.355* (1.92)	-0.404*** (2.91)	-0.262** (-2.029)
U.S. lending interest rate	30.33*** (2.738)	28.52** (2.429)	0.763* (1.762)	0.675* (1.85)
Terms of trade	1.612** (2.24)	1.573** (1.98)	1.401 (1.43)	0.863* (1.79)
Political right	-0.265 (0.40)	-1.037 (1.32)	1.333 (1.05)	0.005 (0.008)
Remittance inflows/GDP	0.206 (0.85)	0.339 (1.40)	0.345* (1.67)	0.468* (1.93)
International reserves/GDP		-0.602* (1.91)		-1.136* (1.89)
Constant	-248.1** (-2.556)	-229.8** (-2.131)	-136.5 (-1.508)	-74.62 (-1.535)
Observations	515	427	515	427
R-squared (adjusted)	0.75	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.319	0.168
AR (1)			0.001	0.002
AR (2) ²			0.456	0.667

The same as in Table 4

Table 11 Robustness to considering the natural logarithm of the external debt-to-GDP ratio

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.608*** (14.93)	0.583*** (13.96)	0.681*** (9.44)	0.498*** (4.57)
Nominal exchange rate	0.0001*** (2.71)	7.32e-05* (1.96)	7.91e-05** (2.53)	5.44e-05* (1.71)
GDP growth rate	-0.015*** (2.74)	-0.017*** (3.03)	-0.035* (1.71)	-0.015** (2.59)
Saving-investment gap/GDP	-0.006** (2.29)	-0.005* (1.79)	-0.008*** (3.47)	-0.007** (2.61)
U.S. lending interest rate	0.947*** (3.83)	0.895*** (3.60)	0.022* (1.72)	0.023** (2.26)
Terms of trade	0.059*** (4.90)	0.060*** (4.93)	0.044** (2.10)	0.037* (1.92)
Political right	0.017 (1.32)	0.018 (1.10)	0.010 (0.42)	0.005 (0.30)
Remittance inflows/GDP	0.008* (1.93)	0.015*** (3.29)	0.013** (2.10)	0.026*** (3.74)
International reserves/GDP		-0.011*** (5.25)		-0.015*** (4.88)
Constant	-7.745*** (4.49)	-7.435*** (4.24)	-3.210 (1.48)	-1.951 (0.97)
Observations	508	431	508	431
R-squared (adjusted)	0.79	0.80	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.307	0.153
AR (1)			0.001	0.011
AR (2) ²			0.160	0.238

The same as in Table 4

Table 12 Robustness testing for non-linear effect of remittance inflows on external debt

VARIABLES	Fixed Effects		System-GMM	
	(1)	(2)	(3)	(4)
	External debt/GDP	External debt/GDP	External debt/GDP	External debt/GDP
Lagged external debt/GDP	0.666*** (14.72)	0.657*** (13.33)	0.770*** (11.03)	0.696*** (6.63)
Nominal exchange rate	0.00302 (1.433)	0.00211 (1.01)	0.00184 (0.890)	0.00197 (1.325)
GDP growth rate	-0.956*** (2.87)	-1.100*** (3.22)	-0.763** (2.265)	-0.728* (1.80)
Savings-investment gap/GDP	-0.526*** (3.19)	-0.508*** (2.79)	-0.372*** (3.33)	-0.363** (2.47)
U.S. lending interest rate	31.72*** (2.87)	28.88** (2.53)	1.358* (1.98)	0.223 (0.26)
Terms of trade	1.688** (2.33)	1.638** (2.12)	-0.050 (0.07)	-0.444 (0.70)
Political right	-0.260 (0.39)	-0.817 (1.05)	1.846* (1.96)	2.378 (1.19)
Remittance inflows/GDP	-0.589 (1.54)	-0.368 (0.91)	-0.529 (1.30)	-0.526 (1.01)
Remittance inflows/GDP_squared	0.0229*** (3.35)	0.0213*** (3.04)	0.0126* (1.83)	0.0156* (1.85)
International reserves/GDP		-0.218** (2.17)		-0.318* (1.75)
Constant	-258.1*** (2.64)	-236.2** (2.26)	-2.647 (0.04)	51.84 (0.87)
Observations	515	438	515	438
R-squared (adjusted)	0.75	0.74	-	-
Number of countries	50	43	50	43
Sargan-Hansen test ¹			0.515	0.342
AR (1)			0.002	0.006
AR (2) ²			0.444	0.994

The same as in Table 4

Table 13 List of the countries

Country Classification by Income Level

Algeria ³	Colombia ³	Fiji ³	Madagascar ¹	Rwanda ¹
Argentina ³	Congo, Rep. ²	Gabon ³	Mali ¹	Samoa ³
Bangladesh ²	Costa Rica ³	Ghana ²	Mexico ³	Senegal ²
Benin ¹	Cote d'Ivoire ²	Guatemala ³	Morocco ²	South Africa ³
Bolivia ²	Dominica ³	Honduras ²	Niger ¹	Sri Lanka ¹
Botswana ³	Dominican ³ Republic	India ²	Nigeria ²	Sudan ¹
Brazil ³	Egypt, Arab Rep. ²	Jamaica ³	Pakistan ²	Thailand ³
Burkina Faso ¹	El Salvador ²	Jordan ³	Papua New Guinea ²	Togo ¹
Cabo Verde ²	Eswatini ²	Kenya ²	Paraguay ³	Tunisia ²
Cameroon ²	Ethiopia ¹	Lesotho ²	Philippines ²	Turkey ³

Country Classification by Region

SSA	EAP	LAC	MENA	SA
Benin*	Fiji	Argentina	Algeria	Bangladesh
Botswana	Papua New Guinea	Bolivia*	Egypt, Arab Rep	India
Burkina Faso*	Philippines	Brazil	Jordan	Pakistan
Cabo Verde	Samoa	Colombia	Morocco	Sri Lanka
Cameroon*	Thailand	Costa Rica	Tunisia	
Congo, Rep		Dominica	Turkey	
Cote d'Ivoire*		Dominican Republic		
Eswatini		El Salvador		
Ethiopia*		Guatemala		
Gabon		Honduras*		
Ghana*		Jamaica		
Kenya		Mexico		
Lesotho		Paraguay		
Madagascar*				
Mali*				
Niger*				
Nigeria				
Rwanda*				
Senegal*				
South Africa				
Sudan				
Togo*				

1/ Stands for low-income countries, i.e., countries with 2018 gross national income (GNI) per capita of \$1,025 or less, calculated using the World Bank's Atlas method.

2/ Stands for lower middle-income countries, i.e., countries with 2018 gross national income (GNI) per capita between \$1,026 and \$3,995, calculated using the World Bank Atlas method.

3/ Stands for upper middle-income countries, i.e., countries with 2018 gross national income (GNI) per capita between \$3,996 and \$12,375, calculated using the World Bank Atlas method.

SSA stands for Sub-Saharan Africa, EAP for East Asia and Pacific, LAC for Latin America and Caribbean, MENA for Middle East and North Africa, SA for South Asia

These are country classifications for operational and analytical purposes by the World Bank

*stand for heavily indebted and poor countries (HIPCs)

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