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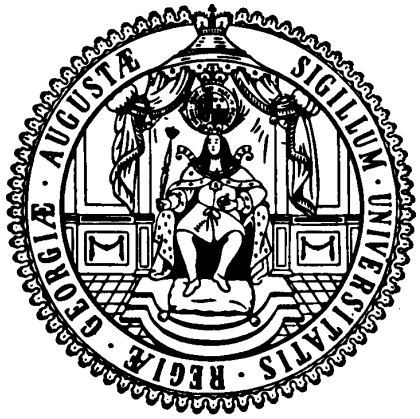

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The Impact of COVID-19 Government Responses on Remittances in Latin American Countries

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Abstract

Workers' remittances sent to Latin America declined sharply as the COVID-19 pandemic spread in the first half of 2020, rebounding in the second half. This paper uses a gravity model to estimate the impact of containment and economic support measures, as well as travel restrictions, on remittances sent to Latin America. The results indicate that containment measures and restrictions in internal and international movement in receiving countries are the factors mainly explaining the fall in remittance flows. Moreover, the business cycle in sending countries and the real exchange rate in receiving ones help explain the subsequent recovery of remittances.

Keywords: Remittances, Latin America, COVID-19, Lockdown
JEL Codes: F10, O10

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1 Introduction

Remittances to Latin America and the Caribbean have significantly increased in the last two decades of the 21st century, hand in hand with sustained growth in migratory flows. Meanwhile, in the 2010s, remittances became the main source of foreign exchange for some countries, reaching a historical peak in 2019 and playing an important role in fostering economic growth and reducing poverty. However, after this glorious decade, remittances fell drastically in 2020 due to the outbreak of the Covid-19 and the consequent lock-downs, job losses, and economic contraction that sending and receiving countries experienced.

The magnitude of this fall depends not only on the impact of the pandemic on the migrants sending remittances and their relatives receiving them, but also on the specific Covid-19 policy responses in sending and receiving countries. Considering that remittances occur within households, those whose income depends heavily on these transfers have been doubly affected by the pandemic. On the one hand, emigrants whose jobs were interrupted during lock-downs are less able to send remittances, and on the other hand, employment opportunities have also decreased in the receiving economies due to lock-downs and economic contraction. Given the important role that remittances have played historically in fostering economic growth and reducing poverty, it is crucial to quantify the magnitude of those effects and ascertain whether they might have lasting consequences on well-being.

Therefore, this paper focuses on quantifying the direct and indirect impacts of the Covid-19 pandemic on remittances using quarterly data for 2019 and 2020 for ten receiving countries and all available sending countries. We focus on Latin America given the importance of remittances for many countries in the region and the fact that they imposed strict lock-down measures that lasted several months in 2020. Moreover, the virus incidence still persisted in 2021, with the second-highest number of Covid-caused deaths reported in February 2021, despite the severe lock-downs and restrictive measures imposed during the past waves of the pandemic in 2020. These developments could have long-lasting effects on economic activity in the region, considering that in 2020 economic growth in Latin America contracted by -7.4 percent (IMF, 2021) and around 17 million people are estimated to have fallen into poverty (IMF, 2021).

The existent literature investigating the determinants of remittances points to a counter-cyclical effect in times of crisis and a certain resilience to external shocks (Adams, 2006; Bettin et al., 2017). In particular, recent studies for the region found that the economic activity of the migrants' destination countries has a positive and statistically significant effect on remittances (Vacaflores, 2018). Other factors, such as exchange rates and interest rate differentials, are also found to be relevant (Amuedo-Dorantes and Pozo, 2004).

The research related to the fall in remittances during the Covid-19 pandemic in Latin America and its consequences is still in its infancy. To our knowledge, there is only one published paper slightly related to

our topic, Caruso et al. (2021) which investigates the distributional and poverty impacts of the change in remittance inflows in Central America. This paper focuses instead on quantifying the effect of Covid-19 policy responses on remittances for a selected group of Latin American countries. We analyze the results in relation to the severity of the crisis and the measures taken in the countries where migrants live and in their origin countries. Our empirical model controls for variables that are commonly used as determinants of remittances in the related literature and that have quarterly variation.

The main contribution of this paper is to incorporate in a gravity model of remittances a number of policy responses that were put forward during the Covid-19 pandemic in both developed and developing countries, which to our knowledge has not been done before. The selected set of indices on government responses and policies are provided from the Oxford COVID-19 response tracker (OxCGRT), including 19 indicators for a wide cross-section of countries (Hale et al., 2021).

Our main results point to the relevance of containment measures in the remittance-receiving countries. Moreover, the business cycle in host countries and the real exchange rate in the origin countries are also of utmost importance. This implies that a recovery in the host country's economy and a depreciation in the remittances receiving countries lead to an increase in remittances. Hence, economic growth in the host countries and weak currencies in Latin American countries will give remittances a boost.

The rest of the paper is structured as follows. Section 2 summarizes the existent literature closely related to our research. Section 3 presents the data and the empirical strategy, and Section 4 outlines the main results. Finally, the conclusions and some suggestions for further research are presented in Section 5.

2 Literature Review

2.1 On the motives of remittances: altruism versus self-interest.

In this section, we briefly revise the theoretical and empirical literature that examines the determinants of remittances. Theoretical models distinguish between altruistic and self-interest factors when explaining why migrants send money back to their countries of origin (Lucas and Stark, 1985). While altruism reflects the fact that migrants care about those left behind and remitting is primarily intended at helping family members, the self-interest motives reflect the use of remittances as an investment for future benefits or as insurance against unexpected income shocks (Frédéric Docquier et al., 2012). These motives include investment in assets, paying back the cost of migration, saving for retirement, or buying administration services, usually maintaining or expanding assets in the home country. Self-interest motives can also be related to the migrant's intention to return home in the future (Rapoport and Docquier, 2006). The existent models provide rigorous justifications for the decision to send remittances and indicate that it depends on the degree of altruism of the migrant and the returns to assets in the host or home countries, indicating

as well that remittances depend positively on the migrant's income and negatively on the family's income as stated by McCracken et al. (2017). The author develops a microeconomic model for the motives of remittances and applies the model to data using macroeconomic aggregates. He finds that apart from the economic conditions in sending and receiving countries, other important determinants are interest rates and the returns to assets in both countries, together with the cost of remittances. All these factors also seem to affect whether altruism or self-interest motives prevail.

The empirical studies could be classified into two strands. The first uses microeconomic data, namely, household surveys, census or migrant surveys, and the second focuses on macroeconomic aggregates (Rapoport and Docquier, 2006) to explain remittances. The studies in the first strand allow estimating the household earnings elasticity of remittances, which varies widely depending on the estimation strategy and data selected as shown by Simpson and Sparber (2020) while controlling for specific characteristics of the households. In this framework, most studies are constrained by having either data on the migrant-sending remittances or the household receiving them, but hardly on both. Authors typically analyze the effect of the skill composition of migrants, the time elapsed since emigration, age of migrants, and specific socio-economic characteristics of households receiving remittances (Adams Jr., 2009; Frédéric Docquier et al., 2012). Controversies particularly arise around the effect of the skill level of migrants. Whereas some authors argue that this effect is ambiguous and depends on the immigration policy conducted at the country of destination (Frédéric Docquier et al., 2012), the human capital theory argues that more educated people are more likely to migrate, and thus their home countries potentially receive higher volumes of remittances. Moreover, countries with high poverty rates and low levels of human capital have an even larger number of people who intend to migrate and send remittances.

The second strand includes studies that use data at the country level and considers macroeconomic factors to explain remittances. Those factors include interest rate differentials, real exchange rates, variables that proxy for the political or economic risk in the home country, and GDP differentials between host and home country to capture economic conditions. Concerning the expected effects of these factors, whereas Adams Jr. (2009) finds that the real interest rate in the receiving country has a positive and significant impact on per capita remittances, indicating that they are positively related to investment returns at home, McCracken et al. (2017) point to the ambiguous effect of the interest rate of the home country, which could reflect a higher risk for assets. However, other authors find no significant relationship between domestic interest rates and remittances. For example, Buch and Kuckulenz (2010), using data for 87 countries for the years 1970 to 2000, find that the spread of the domestic lending rate over the London Inter-bank Offered Rate (Libor) is not statistically significant when considered as a factor explaining remittances.

The findings concerning the effect of the real exchange rate on remittances are also mixed. On the one side, a depreciation of the domestic currency in the receiving countries vis-a-vis currencies of the sending

countries increases the purchasing power of remittances and could induce an increase in the flows. On the other side, high volumes of remittances, particularly those sent to small economies, can cause a dutch disease effect, with adverse effects on export competitiveness of the receiving country via appreciation of the domestic currency. In this line, Amuedo-Dorantes and Pozo (2004) used a panel of 13 Latin American and Caribbean countries to find evidence of real exchange rate appreciation caused by increasing remittances, suggesting a shift of resources from the traded to the non-trade sectors of the economy.

With respect to income levels, they are considered one of the most important macroeconomic determinants of remittances (Adams, 2006). A certain consensus arises, indicating that the poorest of the poor are not able to migrate, as they cannot afford migration costs. Adams Jr. (2009) also considers household poverty levels on a cross country study, finding that it has no statistical effect on the amount of per capita remittances received. At the same time, the author also finds that countries with a larger share of low-skilled migrants receive more remittances per capita.

The volume of remittances is also linked to the economic cycle in the migrant's country of origin. In this line, consumption-smoothing models argue that remittances increase during economic downturns or natural disasters, like draughts or unexpected losses in harvests, acting as a buffer in times of crisis (Ahmed and Martínez-Zarzoso, 2016; Bettin et al., 2017; Mohapatra et al., 2012). The empirical literature on the counter-cyclical effect of remittances shows, at best, mixed results, frequently depending on whether the altruism or self-interest motives dominate, as suggested by Simpson and Sparber (2020). In the first case, remittances increase with output contractions in the recipient country (Chami et al., 2005), whereas in the second, remittances increase when the investment environment in the home country is favorable (Yang, 2008; Adams Jr and Cuecuecha, 2010; Cooray and Mallick, 2013).

In conclusion, the interconnection of the global economy and the simultaneity in motives and decisions when sending remittances make it hard to separate empirically home from host country effects and the altruism versus self-interest motivation to send remittances. Mandelman and Zlate (2012) finds that remittance flows are responsive to business cycles in the source and destination countries while Lueth and Ruiz-Arranz (2008) find that remittances are not as much influenced by altruism, being mostly profit-driven and governed by portfolio considerations. They do not find evidence of remittances increases following a natural disaster in the home country. Using data for the five largest recipients of remittances sent by migrants living in the US Vargas and Huang (2006) find that host country factors are crucial, as migrants consider the economic situation of the host country relative to the economy of the home country when deciding how much to remit.

Another focus in the literature of remittances takes care of the impact of remittances on economic development. The macroeconomic effects of remittances have been widely analyzed in the development

economics literature, as shown by two recent synopses of the literature (Rapoport and Docquier, 2006; Cazachevici et al., 2020). Rapoport and Docquier (2006) summarize the most important aspects of remittances and their effects. Their main conclusions are that migration and the associated remittances tend to have a positive effect on long-term economic performance in the countries of origin, while, in the short term, it is much more complex to estimate the macroeconomic effects since they depend on the type of exchange rate regime, the degree of mobility in the capital market, and the flexibility of the labor market. In their recent work, Cazachevici et al. (2020) present a meta-analysis of 95 articles published on the effect of remittances on economic growth, concluding that it is positive, although small in magnitude and heterogeneous by region. While the effect is clear in Asia, it is not as clear in Africa and Latin America.

Chami et al. (2005) is one of the first global studies available that estimates the impact of remittances on economic conditions for a global sample of countries. Although the authors find a negative effect on GDP per capita, it becomes positive when the quality of the institutions is considered. More recent works that consider the endogeneity of remittances in the estimated models show positive results even without conditioning the effects on the quality of the institutions (Catrinescu et al., 2009; Cruz Zuniga, 2011).

2.2 Impact of remittances in Latin America

In the specific case of Latin America, Vacaflores (2018) shows that the economic activity of the migrants' destination countries has a positive and statistically significant effect on the number of remittances the region receives. They also confirm that remittances are related to the interest rates of the recipient countries, as suggested by the self-interest hypothesis.

Although remittances are not only pursued by migrants from the receiving country but also, for instance, by NGOs or caritative given agencies, the largest part of them depend on the stock of migrants, which is thus an obvious determinant of remittances. Vacaflores (2018) argues that remittances are endogenous, given that the economic development in the country that receives them does at the same time cause migration and thus subsequent remittances, a problem that needs to be accounted for in empirical models. In a cross-country panel study, Freund and Spatafora (2008) find that recorded remittances depend positively on the stock of migrants and negatively on transfer costs and exchange rate restrictions. They also quantify informal remittances and argue that the true amount of remittances to developing countries is about 35 to 75 percent of official remittances.

Also, for the Latin American case, Ramirez and Sharma (2008) show that remittances have a positive and significant impact on the growth of per capita income in the countries analyzed, the effect being greater in magnitude for countries with a more developed financial system. Previous studies obtain similar results on economic growth and indicate that remittances also contribute to reducing poverty and inequality. Acosta

et al. (2008) quantify the effect of remittances for 10 Latin American countries and conclude that these have not only reduced poverty and inequality but have also contributed to economic growth, although in different magnitude for each country, given the heterogeneity of the economies analyzed. These authors find that an average increase of one percentage point in remittances as a proportion of GDP induces a reduction in poverty of approximately 0.3 percent. Specific studies by country of origin confirm that remittances reduce poverty, but also point out that they can lead to lower labor participation in recipient households, as can be observed in Haiti (Jadotte and Ramos Morilla, 2016) and in the countries of the Northern Triangle: El Salvador, Guatemala, and Honduras (Sousa and García, 2018).

The impact of remittances on other socioeconomic indicators has also been the object of study in the economic literature. Most studies find a positive impact on the schooling rate of children due to an increase in household income, although there is also evidence of higher dropout rates due to the absence of parents caused by migration and the need to compensate for certain tasks at home (Adams, 2011; Rapoport and Docquier, 2006; Amuedo-Dorantes and Pozo, 2010; Bucheli et al., 2018). Regarding the impact of remittances on health indicators, Acosta et al. (2008) econometrically analyze the case of Guatemala and Nicaragua, thanks to the fact that household surveys in these countries include information on health indicators, finding positive and significant effects of remittances on both the weight and height of children.

3 Data and empirical strategy

3.1 Remittances during Covid-19: An V-shaped curve

International financial flows plunged in the second quarter of 2020 after the Covid-Pandemic expanded worldwide, and containment measures restricted work, travel, and economic activity. Preliminary estimates of the World Bank expected a drop of 20% in remittances to Latin America in 2020 (Ratha et al., 2020a), which in the end did not materialize. More recent estimates corrected the fall in remittances for 2020 to -0.2% (Ratha et al., 2020b).

To analyze the effect of the Covid-19 pandemic on remittances in Latin America, we have selected a sample of countries for which total remittances were available either monthly or quarterly from the Central Bank of each country. The final sample includes remittances in US dollar for El Salvador, Guatemala, Dominican Republic, Bolivia, México, Colombia, Paraguay, Nicaragua, Peru, and Ecuador. The sample period starts on the 1st quarter of 2019 and ends on the 4th quarter of 2020, with complete information for all countries except for Ecuador and Guatemala, for which remittances are not available for the last quarter of 2020. Overall, we have a panel data set of bilateral remittances for ten receiving countries and more than 100 sending countries over eight quarters.

Bilateral remittances are calculated by multiplying the total remittances received by each country in

our sample by annual bilateral weights obtained from the bilateral remittance matrix of the World Bank of 2018, which are calculated by the methodology suggested by Ratha and Shaw (2007). Since these are the most updated weights, we extrapolate them to 2019 and 2020.

We use as control variables Real Exchange Rates and Gross Domestic Products (GDP). The real exchange rate corresponds to the quarterly average of the monthly exchange rate and comes from the Bruegel database, calculated by (Darvas, 2012). An increase in the REER indicates, in this case, an appreciation of the currency in the country that receives remittances (the home country) against a basket of currencies of their trading partners.

The quarterly real Gross Domestic Product (GDP) series in US dollar of the countries sending remittances were extracted from the International Financial Statistics of the IMF, while GDP for the Latin American countries in the sample comes from the CEPALSTAT database of the Economic Commission for Latin America and the Caribbean, since this database has up to date GDP data of Latin American countries. GDP is lagged one year following Hayakawa and Mukunoki (2020), in order to avoid GDP variables containing the impacts of policy responses and COVID-19. We capture those impacts uniquely by our policy response variables; therefore, we control for the supply and demand conditions before the pandemic started.

The policy response variables are quarterly averages of the original daily measures calculated and published by the Oxford COVID-19 response tracker (OxCGRT) (Hale et al., 2021). The Oxford COVID-19 response tracker (OxCGRT) provides daily data on government responses to contain the pandemic using 19 indicators and starting on the first of January of 2020 (Hale et al., 2021). Indicators are grouped into four indices: the GRI is a simple average of all categories, the Stringency Index (SI) includes indicators on containment and closure policies (sometimes named lock-down policies). The CHI sub-index adds health policies to the containment and closure policies, and, finally, the Economic Support Index (ESI) exclusively accounts for economic support measures.

For our estimations, we include the SI and the ESI and selected sub-components of them. The aggregated indices vary from 0 to 100, while the sub-indices are expressed in logs since their range of values are not homogeneous (e.g., some of them from 0 to 2, and others from 0 to 3). Since every index takes the value of 0 for the year 2019 (before COVID started), we express the sub-indices as log(1+index). We calculated quarterly averages of the SI and its sub-components using the daily values provided by Hale et al. (2021). It is worth noting that these indices allow for cross-country comparisons of measures taken by governments but do not say much about the degree of implementation.

We select the SI and the ESI as target variables since they are the ones that are more likely to affect remittances. The former includes eight components: school closing, workplace closing, cancel public events, restrictions on gathering size, close public transport, stay-at-home requirements, restrictions on internal

movement, and restrictions on international travel. These policies limit the ability to go to work and also of reaching remittance sending agencies and banks when formal channels are used. If migrants use informal channels to send remittances, those could be affected by restrictions to international travel and internal movement, which were also imposed during the pandemic. The ESI includes four sub-components: income support, debt relief for households, fiscal measures, and international support measures. The first two are ordinal, and the third and fourth are numerical. Income support for households and debt relief directly affect disposable income and can influence remittances depending on the household earnings elasticity of remittances. The summary statistics of the variables are presented in Table 1.

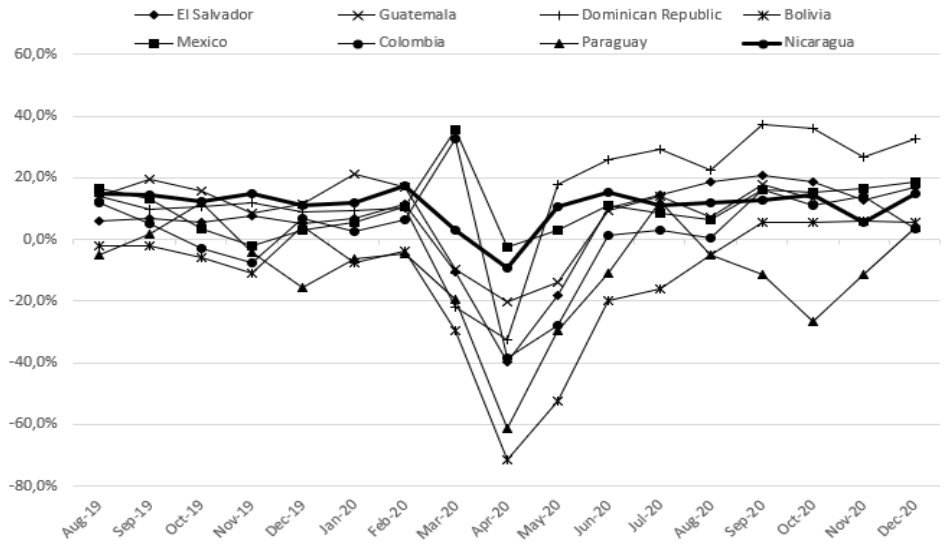
Table 1: Descriptive statistics of variables used in the regression models

Variable	Observations	Mean	Std. Dev.	Min	Max
Bilateral remittances	2539	59272133	5.516e+08	98	1.042e+10
Lag logGDP i	2539	11.532	2.914	8.013	17.119
Lag logGDP j	2539	11.48	1.727	8.184	16.576
LogREER i	2539	4.551	.41	3.296	5.05
LogREER j	2539	4.241	.556	2.793	5.058
Stringency index i	2539	28.03	36.374	0	95.781
Stringency index j	2539	25.188	30.936	0	99.065
Economic support index i	2539	12.808	25.995	0	75
Economic support index j	2539	18.762	32.122	0	100
Log income support i	2539	.201	.309	0	.693
Log income support j	2539	.352	.458	0	1.099
Log debt relief i	2539	.25	.435	0	1.099
Log debt relief j	2539	.31	.437	0	1.099
Log stay at home i	2539	.373	.499	0	1.344
Log stay at home j	2539	.294	.408	0	1.386
Log movement restrictions i	2539	.334	.461	0	1.099
Log movement restrictions j	2539	.285	.413	0	1.099
Log international travel restrictions i	2539	.533	.637	0	1.609
Log international travel restrictions j	2539	.556	.649	0	1.609

Note: The 'i' subsript represents the receiving country and the 'j' subscript the remittance sending country.

Figure 1 shows that the monthly variation of remittances between February and June of 2020 presents a V-shaped pattern for the countries examined. The selected countries are a good representation of the Latin American region and very relevant in terms of remittance flows. Four of them are located in Central America, namely, El Salvador, Guatemala, Nicaragua, and the Dominican Republic, and are highly dollarized economies, small in economic terms, and for which remittances represent a high share of GDP (greater than 10% in all cases). Two other countries, Mexico and Colombia, are large economies with a high volume of remittances but representing a low share of GDP (below 3%). Finally, Bolivia and Paraguay present the special feature of largely receiving remittances from other southern cone countries, reflecting the existence of large south-south migrant flows. .

Figure 1: Year on year variation of monthly remittances from August-2019 to December-2020



A clearer picture of the geographical origin of remittances is shown in the Sankey diagram, which shows the bilateral remittances received by the 10 Latin American countries analyzed in this paper from each sending country in 2020 (Figure 2). Mexico, El Salvador, and Guatemala predominantly receive remittances from the United States, while for the Dominican Republic, the origin of remittances is somewhat more diversified, Spain being the second most important source. In Colombia, diversification is greater since it receives a significant proportion of remittances from countries other than the United States and Spain. On the other hand, remittance flows to Paraguay and Bolivia come mainly from Argentina.

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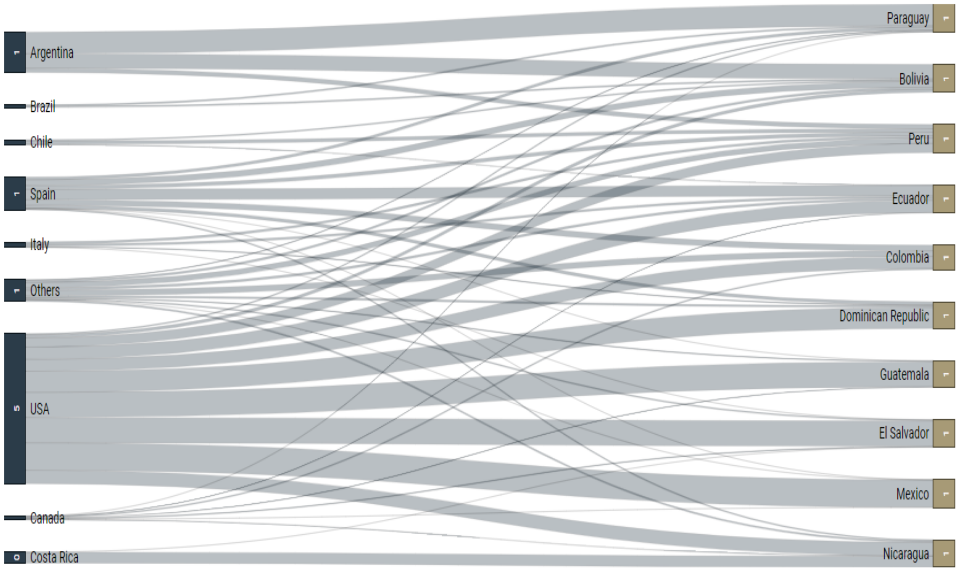
Figure 2: Sankey diagram of bilateral remittances received by Latin American countries from each sending country in 2020



3.2 Model Specification and Empirical Strategy

The main modeling framework for the empirical application is the gravity model, which has been widely used to estimate the determinants of bilateral trade flows. It has also been extensively used to explain other international flows such as FDI (Ribakova et al., 2005), international migration (Mayda, 2010) and equity holding and cross border banking (Portes and Rey, 2005). Although empirical applications to study the determinants of international remittances using the gravity model have been less common, these flows can also be explained by the economic mass of the countries involved in the financial transfer and the frictions that limit the transfer volume. In this study, we employ a gravity model of bilateral remittances, in which variability is explained by the GDPs of both the remittance and sending countries and other factors that might hinder or help deliver the transfer. The baseline empirical model builds on the literature that uses country-level data and cross-country regressions to explore the drivers of bilateral remittances using the gravity model. We build on the approach proposed by Lueth and Ruiz-Arranz (2008), Ahmed and Martínez-Zarzoso (2016), and Ahmed et al. (2020). Given that our focus is on explaining the direct and indirect effects of the Covid-19 government responses on bilateral remittances, we extend the model with proxies for the containment measures applied in sending and receiving countries.

Our main specification is a gravity model of remittances with the dependent variable in levels that will be estimated by Pseudo Poisson Maximum Likelihood (PPML) and includes country-pair fixed effects to account for unobserved heterogeneity and quarter dummies to account for common shocks. The PPML estimator is used to account for zero values in bilateral remittances. That is, if we censor the data to keep only positive observations, we might have a selection bias problem if the chance of having zero bilateral remittances increases when the potential for remitting between two countries is low, as Mnasri and Nechi (2019) explained in the case of trade flows. Furthermore, even if we consider the dependent variable in the form log(1+x), there could be a miss-specification in the estimated model as it interprets zero bilateral remittances flows as an absence of potential for remitting from one country to another. This interpretation may not match the expectations of the altruistic/self-interest remittances theory of McCracken et al. (2017), who predict remittances based on income differentials and remittances costs. Also, and according to Mnasri and Nechi (2019), using the log-linearizing model could lead to biased results related to Jensen's inequality, which implies that the expected value of the logarithm of a random variable would not be the same as the logarithm of the expected value of the same variable.

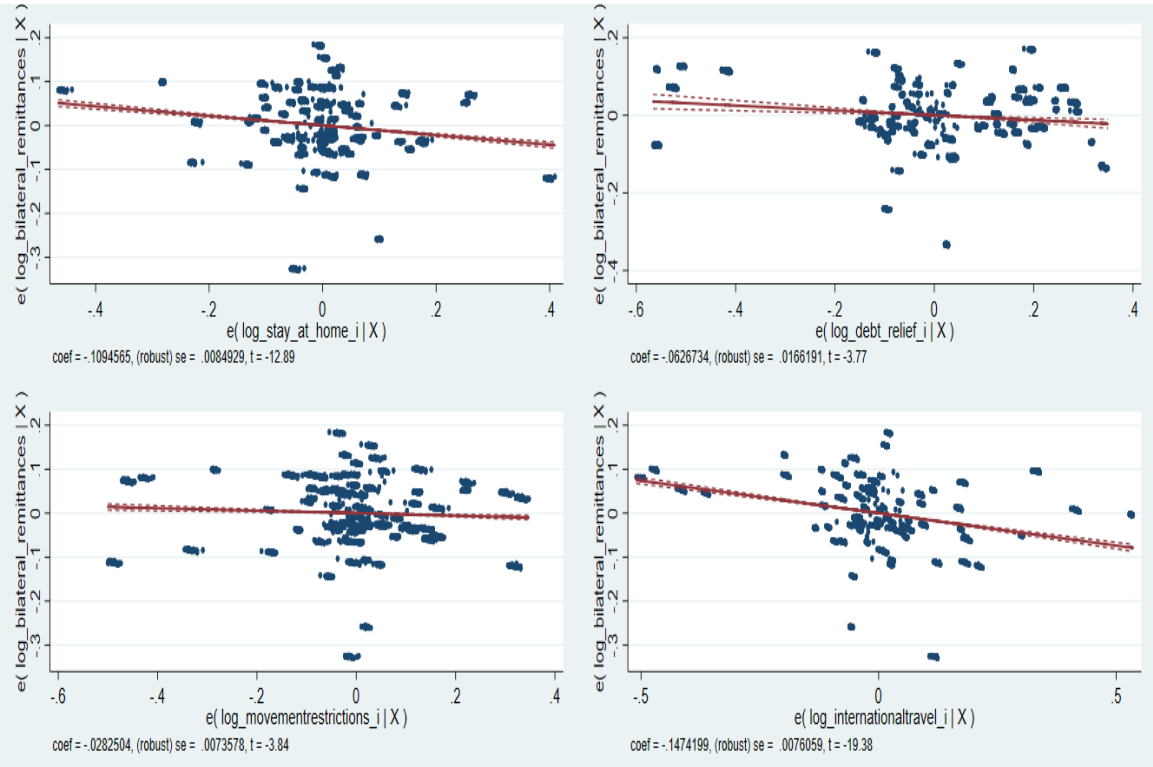
The dependent variable corresponds to remittances sent to receiving county 'i' from sending country 'j' at quarter 't.' The independent variables vary either by destination 'i'or origin 'j' and quarter 't.' Therefore, the baseline model specification takes the following form:

$$BilRem_{ijt} = Exp(\beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3 REER_{it} + \beta_4 REER_{jt} +$$
$$\beta_5 Stringency_{it} + \beta_6 Stringency_{jt} + \beta_6 EconResp_{it} + \beta_6 EconResp_{jt} + \gamma_t + \delta_{ij}) * \varepsilon_{ijt} \quad (1)$$

where GDP denotes Gross Domestic Product, $Stringency_{it}$, $Stringency_{jt}$, $EconResp_{it}$, and $EconResp_{jt}$ measures the stringency and economic support indices of receiving and sending countries, respectively. REER denotes quarterly real exchange rate [1], and two sets of fixed effects (FE) are also included, namely, quarterly (γ_t) and pair FE (δ_{ij}).

As a preliminary exploratory exercise, we first estimate conditional correlations of bilateral remittances and the corresponding sub-indices of receiving and sending countries by regressing the logged bilateral remittances on the sub-indices and the above-mentioned control variables together with country-pair and quarter FE. The results are presented in figures 3 and 4 for the indices of receiving and sending countries, respectively. The correlations show evidence indicating a potential negative effect of four policy response sub-indices of receiving countries on bilateral remittances, these indices being ”stay at home restrictions,” ”movement restrictions,” ”international travel restrictions,” and ”debt relief.” On the other hand, there is no clear evidence of correlations between policy responses of sending countries and bilateral remittances.

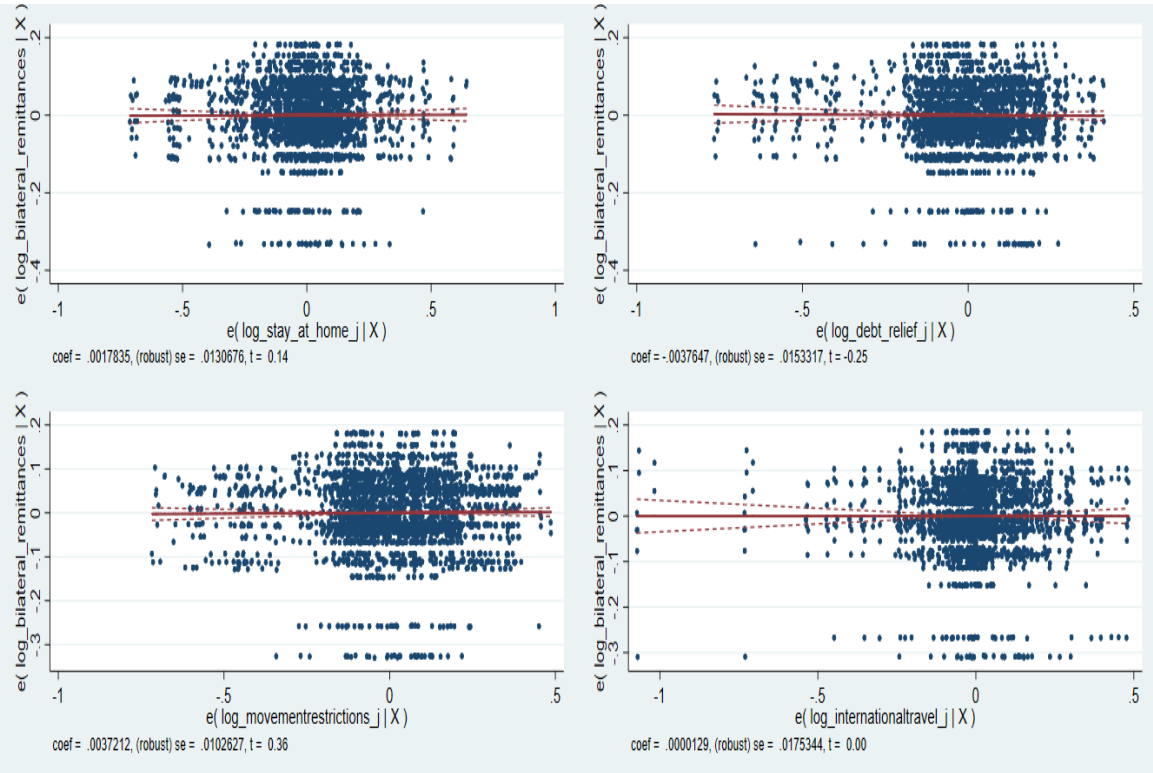
Figure 3: Correlations between policy responses of receiving countries and bilateral remittances



Notes: Scatter plot and predicted fit resulting from a Fixed Effect (FE) regression of the logged bilateral remittances on different policy response indices of receiving countries including the mentioned control variables and quarter dummies.

[1] It’s important to mention that the real exchange rate is expressed in indirect quotation so that an increase stands for an appreciation. In addition, it is computed for a basket of currencies of trade partners.

Figure 4: Correlations between policy responses of sending countries and bilateral remittances



Notes: Scatter plot and predicted fit resulting from a Fixed Effect (FE) regression of the logged bilateral remittances on different policy response indices of sending countries including the mentioned control variables and quarter dummies.

4 Main Results

We estimate four different versions of the baseline model specified in equation 1. The first includes gravity control variables (common language, contiguity, past colonial relationship, and distance) instead of country-pair FE. The second one includes country-pair FE, and the third, fourth, and fifth include selected sub-components of the policy response indices introduced sequentially. In these three last specifications, the ESI is disaggregated into the "income support" and "debt relief" sub-indices, while the SI is disaggregated into the "stay at home restrictions," "movement restrictions," and "international travel restrictions" sub-components, where each of them is included individually to avoid multi-collinearity. The main results obtained by utilizing the PPML estimator are presented in Table 2. [2]

Table 2 presents 5 different models in columns (1) to (5). In col. (1), a traditional gravity model is presented, with typical gravity controls, including bilateral dummy variables for contiguity, common language, previous colonial relationship, and distance between sending and receiving countries. The coefficients of these gravity variables are statistically significant and have the expected sign, but the magnitude of the effect is somewhat larger than expected (7.32 times more remittances between countries that share a border, 2.39 times more for countries speaking the same language, 10.16 times more for pairs with previous colonial relations). The coefficient of distance shows an expected coefficient: A 1% increase in the distance

[2] As was stated in the previous section, this technique offers advantages if the dependent variable (remittances) is zero.

reduces remittances by around 1.3%. Given that the four included bilateral factors cannot account for all time-invariant factors relevant to explain remittance flows (for example, the existence of long-term treaties), we do not interpret the results for the target variables and other time-variant controls in column (1).

The results we rely on and discuss are the ones obtained with the preferred specification shown in col. (2)-(5) containing dyadic (country-pair) FE. They show that the GDP, an indicator of the business cycle, is not significant for origin countries but positive and significant for sending countries. A 1% increase in sending country's GDP increases remittances moderately, namely, by about 0.35%. A 1% increase –appreciation– in the real exchange rate of the recipient country reduces remittances by about 0.6% in Col. (3) and (4), however, this effect is not robust in the other columns. Changes in the real exchange rate of the sending country are not shown to be significant drivers of remittances. In col. (2), we see that increases in levels of containment and closures both in origin countries and in remittance sending countries reduce remittances to a small extent, and so do economic support measures to households in remittances receiving countries as the latter reduce the need for sending remittances. Economic support measures for households in origin countries also reduce remittances slightly, whereas economic support measures for households in host countries leave remittances unaffected. Looking at col. (3)-(5) we find that debt relief measures for households in receiving countries have a robust negative and significant effect on remittances reducing the flows. Containment measures, restrictions on free movement, and restrictions on international travel have only a reducing effect on remittances if they take place in the receiving country. Specifically, a 1% increase in those indices leads c.p to a decrease of remittances by 0.16%, 0.1%, and 0.12%, respectively.

The results stay similar in two additional estimations that we use as robustness checks. The first robustness consists of including the log of Covid-19 cases per capita in both sending and receiving countries in each of the five specifications as an additional control. The main results can be found in Table 3 in the Appendix. The quarterly Covid-19 cases per capita are calculated by aggregating at the quarterly level the new daily Covid cases obtained from the Our World in Data (OWID) database and are expressed as quarterly lags to account for adjustment mechanisms, and then dividing them by the population obtained from the United Nations Population Database.

It turns out that Covid-19 cases per capita is neither a robust determinant for origin countries nor host countries. We think that quarter averages are not relevant for remittance senders and that information on covid-19 cases is already accounted for in the stringency indices that measure containment and closures. To sum up, the coefficients of stay-at-home pleas, movement restrictions, and international travel restrictions in origin countries are robust. These measures seem to reduce the possibility to collect remittances and therefore lead to non-delivery of them.

The second robustness check consists of adding a bilateral trend to the model to account for transaction

costs that could vary over time for each specific country-pair and differences in job opportunities between origin and destination. These results are presented in Table 4 in the Appendix. All the coefficients of the relevant variables are robust, and the business cycle in the sending country decreases in its significance.

Table 2: PPML estimations of the impact of COVID-19 Government Responses on bilateral remittances

	(1) PPML b/se	(2) PPML-FE b/se	(3) PPML-FE b/se	(4) PPML-FE b/se	(5) PPML-FE b/se
Lag_logGDP_i	0.006	0.336	0.247	0.216	0.376
	(0.021)	(0.226)	(0.223)	(0.241)	(0.246)
Lag_logGDP_j	1.316***	0.382***	0.348***	0.368***	0.324***
	(0.040)	(0.088)	(0.085)	(0.082)	(0.098)
Log_REER_i	-0.185	-0.006	-0.064**	-0.059**	-0.016
	(0.205)	(0.037)	(0.032)	(0.026)	(0.027)
Log_REER_j	-0.250**	0.016	0.010	0.011	0.025
	(0.107)	(0.023)	(0.022)	(0.021)	(0.024)
Contiguity	2.086***				
	(0.109)				
Common official primary language	1.237***				
	(0.216)				
Past colonial relationship	2.365***				
	(0.253)				
Log_distance	-1.291***				
	(0.107)				
Stringency index_i	0.014***	-0.002*			
	(0.005)	(0.001)			
Stringency index_j	-0.002	-0.003**			
	(0.010)	(0.001)			
Economicsupport_index_i	-0.001	-0.001*			
	(0.004)	(0.001)			
Economicsupport_index_j	0.017***	-0.000			
	(0.004)	(0.001)			
Log_income_support_i			0.115***	0.072*	0.019
			(0.038)	(0.042)	(0.037)
Log_income_support_j			0.133**	0.110**	0.061
			(0.064)	(0.054)	(0.055)
Log_debt_relief_i			-0.108***	-0.086***	-0.087***
			(0.024)	(0.027)	(0.025)
Log_debt_relief_j			-0.103**	-0.093**	-0.055
			(0.042)	(0.037)	(0.036)
Log_stay_at_home_i			-0.162**		
			(0.075)		
Log_stay_at_home_j			0.038		
			(0.041)		
Log_movementrestrictions_i				-0.102**	
				(0.040)	
Log_movementrestrictions_j				0.012	
				(0.027)	
Log_internationaltravel_i					-0.117***
					(0.023)
Log_internationaltravel_j					-0.017
					(0.050)
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	3175	2577	2539	2539	2539

*** stands for significant at the 0.01 level, ** at the 0.05 level and * at the 0.1 level. Cluster SE at the country pair level in parenthesis

5 Conclusions

Remittances are an important support in developing countries that help low-income families to escape poverty. For this reason, it is crucial to investigate the determinants of remittance flows in sending and receiving countries. This paper investigates how the government measures implemented during the COVID-

19 pandemic have affected bilateral remittances sent to selected countries in the Latin American region. The countries considered are important receivers of remittances and present specific characteristics concerning location, economic size, and development level that allow us to infer whether the different economic support measures, containment measures, and other mobility restrictions have influenced the dynamic of sending and receiving remittances over the period covering from January 2019 to December 2020.

In this paper, we present the monthly evolution of remittances for ten countries and show that a V-shaped pattern is found during the first wave of the pandemic, indicating a recovery of the flows starting in June 2020. We then proceed to estimate a gravity model of bilateral remittances extended with a number of proxies for governmental measures taken during the pandemic in receiving and sending countries. The model is estimated using a PPML estimator to include zero remittance flows and obtain consistent estimates of the target variables.

The main results indicate that containment measures are in particular relevant in the remittance-receiving countries. However, the business cycle in sending countries and the real exchange rate in the receiving countries are also of utmost importance. This implies that a recovery in the host country's economy and a depreciation in the remittances receiving countries lead to increases in remittances. Hence, economic growth in the host countries, together with weak currencies in Latin American countries, will give remittances a boost. Clearly, a slow vaccination roll-out, new mutants of the COVID-19 virus that require new vaccines, and necessary measures of containment and closures are bad for remittances.

It is expected by the Economic Intelligence Unit (EIU) that the population in the US, Europe, and Chile will be vaccinated by late 2021. In the rest of Latin America, the first round of vaccinations should be achieved by mid-2022. Furthermore, EIU expects an economic recovery of the US and European economies in fall 2021. If progress in research in biotechnology continues to be faster than mutant variants, production of vaccines and medical equipment picks up, vaccination roll-out works better than in the past, and if the health sector can be equipped with more nurses and doctors, then an economic recovery of the remittance-sending economies is expected and likely to be paralleled by a recovery of remittances given the econometric evidence. In order to secure that the households left behind can benefit from remittances and that the Covid-19 and its dangerous variants does not spread from poorer countries to richer countries, it will be crucial to deliver vaccines in sufficient quantities in the Global South and support a more efficient vaccination roll-out there.

For future research, we propose extending the model to other regions, particularly Africa and Asia, where there are several countries for which remittances play a crucial role as support for poor households.

References

Acosta, P., C. Calderón, P. Fajnzylber, and H. Lopez (2008). What is the impact of international remittances on poverty and inequality in Latin America? *World Development 36*(1), 89–114.

Adams, Richard H., J. (2006, 10). International remittances and the household: Analysis and review of global evidence. *Journal of African Economies 15*(2), 396–425.

Adams, R. H. (2011). Evaluating the economic impact of international remittances on developing countries using household surveys: A literature review. *Journal of Development Studies 47*(6), 809–828.

Adams Jr., R. H. (2009, January). The determinants of international remittances in developing countries. *World Development 37*(1), 93–103.

Adams Jr, R. H. and A. Cuecuecha (2010). Remittances, household expenditure and investment in Guatemala. *World Development 38*(11), 1626–1641.

Ahmed, J. and I. Martínez-Zarzoso (2016, April). Blessing or curse. *Journal of South Asian Development 11*(1), 38–66.

Ahmed, J., M. Mughal, and I. Mart ínez Zarzoso (2020). Sending money home: transaction cost and remittances to developing countries. Center for European, Governance and Economic Development Research Discussion Papers 387, University of Goettingen, Department of Economics.

Amuedo-Dorantes, C. and S. Pozo (2004). Workers' remittances and the real exchange rate: A paradox of gifts. *World Development 32*(8), 1407–1417.

Amuedo-Dorantes, C. and S. Pozo (2010). Accounting for remittance and migration effects on children's schooling. *World development 38*(12), 1747–1759.

Bettin, G., A. Presbitero, and N. Spatafora (2017). Remittances and vulnerability in developing countries. *World Bank Economic Review 31*(1), 1–23.

Buch, C. M. and A. Kuckulenz (2010). Worker remittances and capital flows to developing countries. *International Migration 48*(5), 89–117.

Bucheli, J. R., A. K. Bohara, and M. Fontenla (2018). Mixed effects of remittances on child education. *IZA Journal of development and migration 8*(10), 1–18.

Caruso, G. D., M. E. Cucagna, and J. Ladronis (2021). The distributional impacts of the reduction in remittances in Central America in COVID-19 times. *Research in Social Stratification and Mobility 71*, 100567.

Catrinescu, N., M. Leon-Ledesma, M. Piracha, and B. Quillin (2009). Remittances, institutions, and economic growth. *World Development 37*(1), 81–92.

Cazachevici, A., T. Havranek, and R. Horvath (2020). Remittances and economic growth: A meta-analysis. *World Development 134*, 105021.

Chami, R., C. Fullenkamp, and S. Jahjah (2005). Are immigrant remittance flows a source of capital for development? *IMF Staff papers 52*(1), 55–81.

Cooray, A. and D. Mallick (2013). International business cycles and remittance flows. *The BE Journal of Macroeconomics 13*(1), 515–547.

Cruz Zuniga, M. (2011). On the path to economic growth, do remittances help? Evidence from panel VARs. *The Developing Economies 49*(2), 171–202.

Darvas, Z. (2012). Real effective exchange rates for 178 countries- a new database. Working Papers 06, Bruegel.

Frédéric Docquier, Hillel Rapoport, and Sara Salomone (2012). Remittances, migrants' education and immigration policy: theory and evidence from bilateral data. *Regional Science and Urban Economics 42*(5), 817–828.

Freund, C. and N. Spatafora (2008, June). Remittances, transaction costs, and informality. *Journal of Development Economics 86*(2), 356–366.

Hale, T., N. Angrist, R. Goldszmidt, B. Kira, A. Petherick, T. Phillips, S. Webster, E. Cameron-Blake, L. Hallas, S. Majumdar, and H. Tatlow (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nature Human Behaviour 5*, 529–538.

Hayakawa, K. and H. Mukunoki (2020, June). Impacts of COVID-19 on international trade : evidence from the first quarter of 2020. IDE Discussion Papers 791, Institute of Developing Economies, Japan External Trade Organization(JETRO).

IMF (2021). World economic outlook update.

Jadotte, E. and X. Ramos Morilla (2016). The effect of remittances on labour supply in the Republic of Haiti. *The journal of development studies : JDS 52*(12), 1810–1825.

Lucas, R. E. B. and O. Stark (1985, October). Motivations to remit: evidence from Botswana. *Journal of Political Economy 93*(5), 901–918.

Lueth, E. and M. Ruiz-Arranz (2008, October). Determinants of bilateral remittance flows. *The B.E. Journal of Macroeconomics 8*(1), 1–23.

Mandelman, F. S. and A. Zlate (2012). Immigration, remittances and business cycles. *Journal of Monetary Economics 59*(2), 196–213.

Mayda, A. M. (2010). International migration: A panel data analysis of the determinants of bilateral flows. *Journal of population economics 23*(4), 1249–1274.

McCracken, S., C. Ramlogan-Dobson, and M. M. Stack (2017). A gravity model of remittance determinants: Evidence from Latin America and the Caribbean. *Regional Studies 51*(5), 737–749.

Mnasri, A. and S. Nechi (2019, April). New approach to estimating gravity models with heteroscedasticity and zero trade values. MPRA Paper 93426, University Library of Munich, Germany.

Mohapatra, S., G. Joseph, and D. Ratha (2012). Remittances and natural disasters: ex-post response and contribution to ex-ante preparedness. *Environment, Development and Sustainability 14*(3), 365–387.

Portes, R. and H. Rey (2005). The determinants of cross-border equity flows. *Journal of international Economics 65*(2), 269–296.

Ramirez, M. D. and H. Sharma (2008). Remittances and growth in Latin America: A panel unit root and panel cointegration analysis. Working Papers 51, Yale University, Department of Economics.

Rapoport, H. and F. Docquier (2006). The economics of migrants' remittances. In S. Kolm and J. M. Ythier (Eds.), *Handbook of the Economics of Giving, Altruism and Reciprocity*, Volume 1 of *Handbook on the Economics of Giving, Reciprocity and Altruism*, Chapter 17, pp. 1135–1198. Elsevier.

Ratha, D., S. De, E. J. Kim, S. Plaza, G. Seshan, and N. D. Yameogo (2020a, Apr). COVID-19 crisis through a migration lens. Migration and Development Brief 32, World Bank.

Ratha, D., S. De, E. J. Kim, S. Plaza, G. Seshan, and N. D. Yameogo (2020b, Apr). Phase II: COVID-19 crisis through a migration Lens. Migration and Development Brief 33, World Bank.

Ratha, D. and W. Shaw (2007). South-south migration and remittances. Technical Report 102, World Bank Publications.

Ribakova, E., B. Horváth, D. G. Demekas, and Y. Wu (2005, June). Foreign direct investment in Southeastern Europe; How (and how much) can policies help? IMF Working Papers 2005/110, International Monetary Fund.

Simpson, N. B. and C. Sparber (2020). Estimating the determinants of remittances originating from US Households using CPS Data. *Eastern Econ Journal 46*, 161–189.

Sousa, L. D. and A. García (September 2018). *Remittances and labor supply in the Northern Triangle*, Volume 8597 of *Policy Research Working Paper*. Washington, D.C.: World Bank Group Poverty and Equity Global Practice.

Vacaflores, D. E. (2018). Beyond altruism and self-interest: the growing importance of external factors in the determination of remittances flowing to Latin America. *International Economic Journal 32*(2), 235–255.

Vargas, C. and P. Huang (2006, 02). Macroeconomic determinants of workers' remittances: Host versus home country's economic conditions. *Journal of International Trade and Economic Development 15*, 81–99.

Yang, D. (2008). Coping with disaster: The impact of hurricanes on international financial flows, 1970-2002. *The B.E Journal of Economic Analysis & Policy 8*(1), 1–45.

Appendix

Table 3: Robustness check 1: PPML estimations of the impact of COVID-19 Government Responses on bilateral remittances controling for COVID-19 cases percapita

	(1) PPML b/se	(2) PPML-FE b/se	(3) PPML-FE b/se	(4) PPML-FE b/se	(5) PPML-FE b/se
Lag_logGDP_i	0.006	0.356*	0.268	0.230	0.373
	(0.021)	(0.209)	(0.201)	(0.222)	(0.230)
Lag_logGDP_j	1.302***	0.329***	0.309***	0.336***	0.325***
	(0.039)	(0.084)	(0.086)	(0.083)	(0.086)
LogREER_i	-0.201	-0.014	-0.092***	-0.083***	-0.032
	(0.202)	(0.037)	(0.022)	(0.019)	(0.022)
LogREER_j	-0.266**	0.023	0.018	0.019	0.025
	(0.109)	(0.024)	(0.022)	(0.022)	(0.023)
Contiguity	2.092***				
	(0.110)				
Common official primary language	1.217***				
	(0.220)				
Past colonial relationship	2.319***				
	(0.254)				
Log_distance	-1.287***				
	(0.109)				
Stringency_index_i	0.015***	-0.002			
	(0.006)	(0.001)			
Stringency index_j	-0.002	-0.003**			
	(0.012)	(0.001)			
Economicsupport_index_i	-0.001	-0.001*			
	(0.004)	(0.001)			
Economicsupport_index_j	0.016***	-0.000			
	(0.005)	(0.001)			
Quarterly_log_COVIDcasespc_i	-0.045	-0.014	-0.022**	-0.020***	-0.009
	(0.072)	(0.009)	(0.009)	(0.008)	(0.009)
Quarterly_log_COVIDcasespc_j	0.124	0.005	0.009	0.007	-0.004
	(0.080)	(0.008)	(0.008)	(0.007)	(0.007)
Log_income_support_i			0.163***	0.114***	0.044
			(0.035)	(0.043)	(0.037)
Log_income_support_j			0.113*	0.093*	0.067
			(0.061)	(0.052)	(0.055)
Log_debt_relief_i			-0.129***	-0.105***	-0.099***
			(0.023)	(0.027)	(0.024)
Log_debt_relief_j			-0.089**	-0.081**	-0.049
			(0.041)	(0.036)	(0.036)
Log_stay_at_home_i			-0.167**		
			(0.078)		
Log_stay_at_home_j			0.028		
			(0.041)		
Log_movementrestrictions_i				-0.099**	
				(0.042)	
Log_movementrestrictions_j				0.006	
				(0.027)	
Log_internationaltravel_i					-0.112***
					(0.026)
Log_internationaltravel_j					-0.018
					(0.052)
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	3165	2567	2529	2529	2529

*** stands for significant at the 0.01 level, ** at the 0.05 level and * at the 0.1 level. Cluster SE at the country pair level in parenthesis

Table 4: Robustness check 2: PPML estimations of the impact of COVID-19 Government Responses on bilateral remittances controlling for bilateral trend

	(1) PPML b/se	(2) PPML-FE b/se	(3) PPML-FE b/se	(4) PPML-FE b/se	(5) PPML-FE b/se
Lag_logGDP_i	-0.188	-0.148	-0.123	-0.058	0.186
	(0.323)	(0.332)	(0.260)	(0.235)	(0.251)
Lag_logGDP_j	0.449*	0.436*	0.322	0.441*	0.637**
	(0.242)	(0.258)	(0.230)	(0.230)	(0.253)
LogREER_i	-0.068	-0.067	-0.083**	-0.110**	-0.057
	(0.047)	(0.047)	(0.039)	(0.052)	(0.040)
LogREER_j	0.014	0.027	0.040*	0.032	0.035
	(0.020)	(0.022)	(0.022)	(0.021)	(0.022)
Contiguity	0.000				
	(.)				
Common official primary language	0.000				
	(.)				
Past colonial relationship	0.000				
	(.)				
Log_distance	0.000				
	(.)				
Stringency_index_i	-0.002	-0.002			
	(0.001)	(0.001)			
Stringency index_j	-0.003**	-0.003*			
	(0.001)	(0.001)			
Economicsupport_index_i	0.000	0.000			
	(0.001)	(0.001)			
Economicsupport_index_j	-0.000	-0.000			
	(0.001)	(0.001)			
Quarterly_log_COVIDcasespc_i	0.014				
	(0.012)				
Quarterly_log_COVIDcasespc_j	-0.010				
	(0.010)				
Log_income_support_i			0.195***	0.247***	0.161***
			(0.057)	(0.078)	(0.062)
Log_income_support_j			0.188*	0.198*	0.056
			(0.114)	(0.110)	(0.091)
Log_debt_relief_i			-0.136***	-0.134***	-0.159***
			(0.038)	(0.032)	(0.043)
Log_debt_relief_j			-0.110	-0.107	-0.037
			(0.072)	(0.072)	(0.053)
Log_stay_at_home_i			-0.186**		
			(0.092)		
Log_stay_at_home_j			0.063		
			(0.048)		
Log_movementrestrictions_i				-0.117**	
				(0.048)	
Log_movementrestrictions_j				-0.016	
				(0.038)	
Log_internationaltravel_i					-0.130***
					(0.035)
Log_internationaltravel_j					-0.101*
					(0.059)
Bilateral trend	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	2567	2577	2539	2539	2539

*** stands for significant at the 0.01 level, ** at the 0.05 level and * at the 0.1 level. Cluster SE at the country pair level in parenthesis