Remittances, costs, and shocks

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Abstract

The paper attempts to better understand the mechanisms underlying the costs of remittances. It does so using a multi-country analysis over the 2010s. More specifically, it tries to highlight whether and how the operators on the market adjust to a shock in the demand for remittances. To address endogeneity as well as severe measurement errors, I propose to use the climatic disasters that occurred in the country receiving remittances as an instrument. It appears that, overall, a demand shock on the market of remittances does push up costs up to a delay of a quarter up to a year. Reassuringly, the catastrophe contemporaneously impacts the remittances and so to a large extend, which suggests that further use of of this instrument can be achieved in future research.

Keywords: Remitttances, Costs, Corridors, Catastrophe

> Le privilège des grands, c'est de
> voir les catastrophes d'une terrasse.
> *La guerre de Troie n'aura pas lieu* -
> 1935 - Jean Giraudoux

1. Introduction

Magnitudes of Remittances. Remittances are well-known to be a major flow of capital and represent a colossal share of the Gross Domestic Product (GDP) in several countries such as Kyrgyzstan, Tajikistan, Salvador, Nepal, *etc*, where it accounts to more than 20% of the GDP. For many developing countries, inflows from remittances exceed Official Development Assistance (ODA) as well as the more volatile portfolio debt and equity flows. Over the

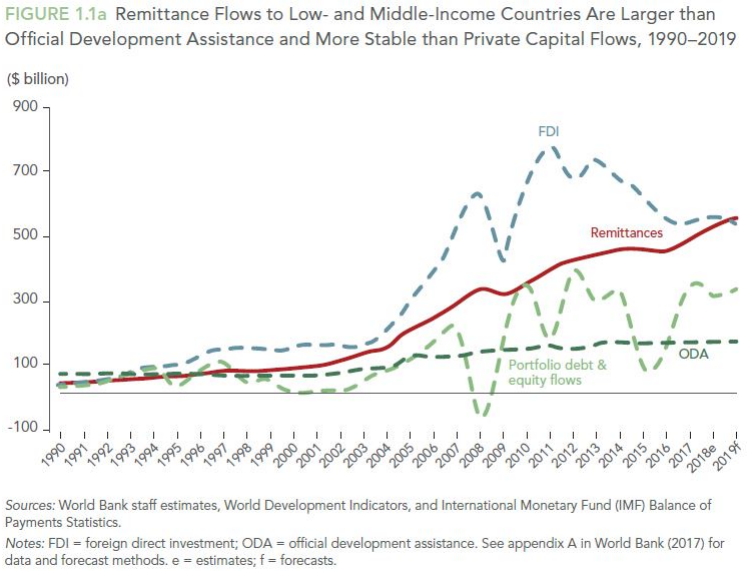

Figure 1:

2010s the Foreign Direct Investments (FDI) have been reduced while remittances pursued its steady rise so that both account now to about the same worldwide inflows. One can refer to the Knomad figure (1) displayed below.

Multilateral concern about the price of remittances. Transferring money to the family left behind or anyone else is costly. In the present paper, I will name this cost the price of transfer (or of remittances). This is indeed a price that the customers - the migrants - are paying to the service providers. It has become of higher interest to policy makers to reduce the price of remittances. The prices sometimes appear to be extremely high and might prevent migrants from remitting as frequently or even as much as desired. One of the already outdated G8 commitments settles that the global average of the price of remittances should fall below 5% in five years (the G8 happened in 2009...) Additionally, the World Bank considers a reduction in the price of remittances as a tool to "reduce inequality within and across countries" (Sustainable Development Goal #10)[1]. A better understanding of the costs drivers might be helpful to further push them down. In the present paper,

[1]https://unstats.un.org/sdgs/metadata/files/Metadata-10-0C-01.pdf

remittances price is what the sender (and sometimes the receiver) will have to pay to send the money.

Remittances and development. Whether remittances are beneficial towards the macroeconomic development and the microeconomic situation of households is a question that has occupied a rich on-going literature (Docquier and Rapoport in 2006 [1] or Clemens and McKenzie in 2018 [2]). Both approaches do not always seem to be in line with each other: remittances can bring a risk of *Dutch disease* (see for example Acosta *et al.* [3] in 2009 or Chatterjee *et al.* [4] in 2018) but also have a positive impact on financial development (see Azizi 2020 [5]), on growth provided that the financial system is sufficiently integrated (see Giuliano and Ruiz-Arranz in 2009 [6]) or provided that the institutions are sufficiently strong and stable (see Catrinescu *et al.* in 2009 [7]). When the political system is not too authoritarian, Bastiaens *et al.* in 2019 show that remittances can promote democracy [8].

On the other hand, remittances at the micro level have demonstrated that it can be helpful to thwart poverty (Adams [9] in 2005), to potentially spend more in productive investments (Adams and Cuecuecha [10] in 2010), to develop entrepreneurship (Murard [11] in 2016 or Vadean *et al.* [12] in 2019), to reduce inequalities (Margolis *et al.* in 2015 [13]), women inclusion (Amuedo and Pozo [14] in 2006 or Lokshin and Glinshaya [15] in 2009), more socially committed implications (Nikolova [16] in 2017) or a higher self-reported well-being (Ivlevs *et al.* [17] in 2019).

Whether remittances help the development of a country and family to leave the poverty trap is important but pushing down the price of remittances can be justified even without the fulfillment of those criteria. Remittances have different well known determinants, which do not necessarily contradict themselves: altruism, repayment (of the costs migration implied as well as the costs of taking care of the children left in the home country), insurance, bequest motives. A lower price of remittances always allows the migrant to better match the value of the amount sent and the desired amount - it increases the *capabilities*. For some of the above motives, the family and the migrants often seal agreements related to the migration and thus remittances are expected to happen (see for example Azam and Gubert in 2005 [18]). A reduction of remittances prices eases the matching between the family and the migrant.

Price variation. There is heterogeneity across the country receiving remittances and more generally across corridors. The prices of remittances widely

vary across corridors, the most established being usually the cheapest. The corridors involving Russia and former Soviet countries manifest very low prices of remitting (about 2.3% of the amount sent). Conversely, the prices of remittances from South Africa are about 15% of the amount of money sent. The magnitudes are even higher for the remittances sent from Nigeria and Tanzania (23.5% and 19.2%, respectively).

Within corridors, heterogeneity remains. Remittances imply a large spectrum of products which are dispersed around several dimensions: (i) the speed of the transfer, (ii) the point of access of the money, (iii) the type of operator providing the service. Remittances can be processed in less than an hour to about a week by banks, Money Transfer Operators (MTOs) or others entities szch as post offices. The price to pay for the service crucially varies across those dimensions. In essence, those sources of heterogeneity will have an influence of the costs of the service delivered as well as the preferences of the customer.

Several factors can impact the prices of transfers. The degree of competition has an impact of the prices. A large amount of corridors can be considered as being monopolistic. There are only a few actors providing remittances services. In some corridors, one or two MTOs almost fully cover the market. The size and the unity of the diaspora, the type of migration (permanent *versus* temporary, family-based migration, working migration, etc), the exchange rate stability, the financial deepening (in the country receiving the transfers), among others, also impact the amount the operators can price. A question that is not often investigated is whether a demand shock will impact the price of remittances. A rich literature has already highlighted that a higher price of transfer subsequently leads to higher remittances. A tension in the demand for remittances might increase the price which will then push down the amount remitted in the future and this will not be only due to a re-balancing process.

The objective of the paper. A better understanding of the price reaction to shocks matters to point more accurately the policy changes that would be most efficient. The present article has the ambition to better underline the cost structure of the remittances by analyzing the effects of demand shocks: several increases in demand for remittances from the source country. An obvious concern is the reverse causality of most of the shocks hence the use here of environmental catastrophes that can arguably be considered as exogenous. The results suggest that remittances are temporarily pushed

up when country of emigration suffers from catastrophe. This increase in remittances seems to temporarily (about one or two quarters) lead to higher prices.

2. Literature

2.1. Remittances prices in the literature

The market structure. The usual actors of money transfers are: Money Transfer Operators (MTO), banks, and postal banks. The recent years witnessed an increase of online platforms (TransferWise as an example among others[2]) that might push down prices by increasing the competition and the substitutability of services, provided that both sides of the remittances flow have an online access.

Competition intensity tends to decrease prices (see Orozco in 2002 [19] in the case of Latin Countries towards the US). However, it seems that a large number of corridors are driven by a monopolistic structure which can push the price of transfer upward. This can be the case even in corridors with a large diaspora and remittances: Koksal *et al.* explore remittances from Germany to Turkey [20] and attest that Turkish banks hold a monopolistic *status quo*. In the case of the post crisis setting, remittances price sent from the UK seem to have been reduced more in smaller companies (see Sirkeci and Přívara in 2017 [21]). For financially excluded households, a development of the transfer services through post offices as well as¡ mobile banking can increase financial inclusion (see Arcand *et al.* in 2013 [22]). Not only the market structure but also the types and the sizes of actors matter. As Ratha and Reidberg mentionned in 2005 [23], new small sized actors are sought to enter the market but the problem in different host countries is the sunk cost for the operators to enter the market.

By offering new channels of remitting, will the FinTech developments modify the nature of the market by introducing more competition? La Cava and Naatus (2020 [24]) assess the potential impact it will have on remittances. It is interesting to notice that some countries already put strong regulations on crypto-remittances (China) but it should be stressed that the overall expected impact is hard to estimate and that clearly is a key aspect the already well-furnished World Bank data on the price of remittances can enrich in the future.

[2]https://transferwise.com/gb/blog/overview-of-world-remittance-industry

The role of institutions. Yang in 2011 [25] advocates that policy regulation can have a strong leverage on limiting the costs of remittances through bolstering tougher competition and better informing the remitters about the different channels they have in hands.

When the diaspora is well structured the transfer prices tend to be lower.

Prices-Remittances elasticity. In the case of remittances sent from New Zealand to Tonga, Gibson *et al.* in 2006 [26] analyze the elasticity between prices and the amount remitted. They find that it has a magnitude of -0.22 between all the remittances senders, but the effects is about three times larger for those who decide to change the amount remitted. This important conclusion stresses the problematic of the competition structure as one could expect a price competition *à la* Bertrand when the amount remitted does respond to prices. Aycinena *et al.* in 2010 [27] estimate the change in remittances sent when the price is reduced: a $ 1 reduction leads to a $ 25 increase in remittances sent. More recently and on a macro scale, Ahmed *et al.* in 2020 [28] show that a 1% reduction in the costs of remittances induces a 1.6% increase in remittances.

Previous works. Given its relevance to better understand but also shape the structure of the prices of remittances, studies about remittances prices are surprisingly scarce. Freund and Spatafora [29] in 2008 provide a frame to analyze remittances along with their prices. They find that remittances prices paid by the remitters are a function of financial depth, the stock of migrants, the stability of the currency compared to the dollar. Beck and Peria in 2011 [30] pursue the analysis and show that bank participation along with MTOs has an impact in reducing the prices of remittances. The larger the number of actors the lower the price - confirming that competition matters to reduce prices. They also highlight that the results vary across the types of firms (mostly banks and MTOs) so that the pricing of both structure might be driven by different reasons.

Ahmed *et al.* in 2020 [28] investigate the impact of remittances prices on the magnitude of remittances with the use of a gravity equation. They try to deal with endogeneity and use several instruments to proxy the prices of remittances. It appears to be a difficult challenge and it seems that their instruments are rather weakly related to the prices of remittances (given the low value of the Wid-stat).

2.2. Remittances and Disasters in the literature

How do remittances flows adapt to the situation in the country of migration and the remittances receiver country? Frankel in 2011 [31] demonstrates that remittances are counter-cyclical with respect to the country receiving remittances and pro-cyclical towards the country of the migrant. This goes in line with an altruistic behavior. Disasters, however, are short term changes, the response of the migrant can be to send more remittances in emergency[3].

The link between remittances and disasters has already been vastly studied. Overall, studies demonstrate that remittances are increasing in response of a disaster, which is in favor of altruistic and/or risk diversification motives (see for example Bettin & Zazzaro in 2018 [32]). Usually, the push up in the amount remitted is offset with the future periods as the migrant cannot provide more than before as his or her situation did not change (see Bragg *et al.* in 2018 [33]).

Several studies have been more mitigated. Some are in line with the result that remittances increase after a disaster and can therefore be a tool for development (see for example Shivakoti in 2019 [34] in the case of the 2015 earthquakes in Nepal). Some others find that the remittances decrease after a disaster (see for example Lueth & Ruiz-Arranz in 2006 [35]) or that the impact of post disaster remittances might increase output volatility when the country's gross product is highly dependent on remittances (Ebeke & Combes in 2013 [36]). Post-disaster remittances can also increase the inequalities as the poorest households usually do not benefit from any remittances as Le De *et al.* showed in 2015 [37]. The post-disaster remittances can have different impact, depending on the amount of assets that can sustain the disaster and be sold after it as mentioned Mohaprata *et al.* in 2009 [38]. In some countries, population would therefore be more dependent on the subsequent flow of remittances. Post-disaster remittances have heterogeneous impact across countries as well as within countries. However, the lion's share of the studies indicate, and our results here will corroborate this, that remittances usually increase with a disaster happening in the country where the family left behind lives.

[3]Return migration can also be, but rarely, be a response to a disaster. The recent period of pandemic let us observe large waves of return migration, mostly of internal migrants.

3. Theoretical intuitions

Endogenous Markups. Gali in 1994 [39] discusses the impact of endogenous markups in a neoclassic growth model. Keeping all other assumptions on the standard growth model but the endogeneity of markups is enough to depart from a unique equilibrium: several equilibria can now emerge when, for instance, the markups are a function of the number of firms providing a good in a monopolistically competitive setting.

It seems that the cost of remittances fit somewhere between the cost of other financial flows that are more prone to a price equalization as investors might not be constrained by the destination point. On the other hand, traded goods might suffer from this constraint as settling new trading partners appear to be costly. Remittances suffer from this very similar constraint but magnified till the extreme: either the migrant remit to the source country, or s/he doesn't[4].

Given the number of actors, monopolistic competition seems to be a match here. Substitutability of the service is a function of the number of actors, of the number of different types of transfers each offer in terms of length, accesspoints, etc.

- Economic environment:
  - *Actors.* Migrants and their families seeking to transfer money (large number of customers). Banks and MTOs providing the service (a small number of providers *per corridor*). As an example, transfers through Western Union accounts for about 80% of the overall amount of remittances sent to Nigeria; MoneyGram and Western Union almost cover 100% of the market (see Ajide in 2019 [40]).
  - *Contracts* Some corridors, mostly the most concentrated ones are also characterized with *exclusivity agreements*. They consists of a clause that forces the local agent to use only one service provider, usually an MTO. Orozco in 2009 [19] highlights that the remittances market in Rwanda in affected by exclusivity agreements which hamper the competition.

[4]There is the exception of the associations promoting a globalised Polyanian understanding of remittances, but this clearly is an outlier so far.

  - *Information.* The customer does not know the cost function of each providers but can reasonably compare the prices (through the internet, at least for MTOs).

- Primitives
  - Structure of the supply? A limited number of quite distinct actors. They often offer different types of products (speed of transfer, access point).
  - Structure of the demand? Might vary according to prices (not clear). Melitz and Ottaviano: non CES preferences leading to endogenous mark-ups. HAVE A CLOSER LOOK!
  - *Technology.* The production is assumed to have increasing returns to scale with a fixed cost and a variable cost.

- Exogenous variables
  - Corridor's elasticity of substitution: If remitting from the US to Mexico becomes more expensive, I won't rather remit to, say, Bolivia.
  - Demand shocks: arguably unexpected so no change in the number of providers but rather the need for (urgent) remittances. A disaster cannot be expected and implies urgent need thus quite inelastic.

- Decision variables
  - *Profit maximization* with free entry and free exit condition (but a fixed cost at entry).
  - Customers try to remit at their desired level, which is a function of "emergency".

- Equilibrium solution
  - Nash equilibrium in a monopolistic competition setting.

4. Data

4.1. Price of Transfers - RPW data

The countries. The remittances prices are mustered by the World Bank database: Remittance Price Worldwide (RPW) for the first quarter of 2011 onward. The data was enriched over time form a sample of 29 and 88 host and home countries in the first quarter of 2011 to 48 and 105 countries, respectively, in the second quarter of 2019. In the present paper, the host country will characterize the country where the migrant lives and the home country will characterize the country where the family left-behind is[5]. The number of corridors rose from 199 to 367. This data offers a rich set of information about the price of remitting $200 and $500 with different firms and potentially different timing. One can visualize the groups of senders and receivers in the figure (2). A map displaying the corridor and their relative strengths is provided in Appendix A.1. Overall, the hosts are in the Western world, Russia, Chile and few middle East countries, Northern American countries have links with Latin America, South East Asia and a few sub-Saharan Africa. Oceania's countries are mostly linked with the surrounding islands, South East Asia and some countries in Southern Eastern Africa. Russian corridors cover former USSR block countries, middle East receiving countries are Southern Asia and close African countries. European sourced remittances are in majority headed to former colonies.

The map attests the variety of both senders and receivers in terms of geographic location, political, historical and cultural contexts. The median amount of remittances providers per corridors is 15 when the entire period is considered, it is 10 within periods (see Appendix A.2 for some more details).

Price of transfers over time. The price of remittances have decreased over the 2010s. The global average price of sending $500 has decreased from 5.42 to 4.52 % [6]. The pattern for the $ 200 transfers is similar (a reduction from around 9% to 6.84%)[7]. It appears that this downward trend is globally shared by the different host countries with few exceptions such as Brazil.

[5]Migration and remittances literature sometime uses source and destination countries but this raises a confusion: the source of the migrant him/herself or the source of the capital transferred? I therefore prefer to only use host and home which appears to be less misleading.

[6]September 2019 report RPW over the $ 500 transfers

[7]September 2019 report RPW over the $200 transfers

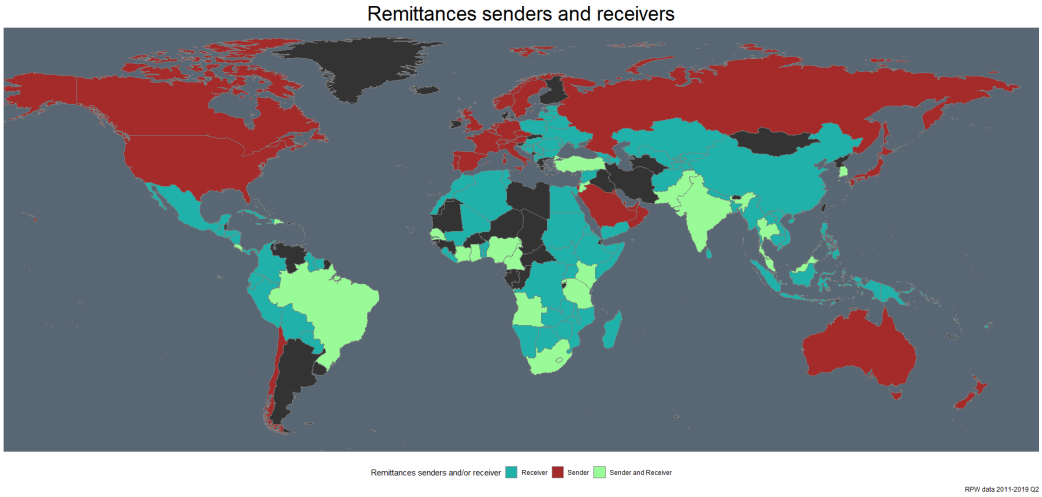

Figure 2: Distribution of the countries sending, receiving remittances

Within the G20 countries, there is a large variation in the average costs with South Africa having the most expensive and the Russian Federation the lowest costs (beyond 15% and below 2% respectively for a transfer of $200). The market there is considered to be highly competitive, suggesting that mark-ups cannot be high (see Ilinitchi in 2020 [41]) However, a first concern of measurement is raised: depending on the institution delivering the service, a long lasting subscription might be needed (mostly the case of banks), which subscription can also be costly (see for example Yang 2011 for some more discussion [25]). A second concern deals with the types of remittances. A share of the remittances are in-goods and thus are not part of the present analysis. The two channels can be complementary but they can also substitute one to the other in some cases. It can be the case when the migrant is seeking to invest in specific goods and wants to be sure the remittances will be spent accordingly. It can also be the case that a price transfer rise of money-based remittances pushes the migrant to rather send goods.

Amount transferred. For each corridor, firm, product available, the RPW provide the transfer costs for two amount of money remitted, $200 and $500. Logically, the transaction costs, as a share of the amount remitted, is decreasing (not proportionally) with the amount of money sent, indicating that the

cost structure is a mix of fixed and variable costs. In general, the type of product has a similar impact on both amount sent but the $200 transfer has a higher variance (for detail, see figure(Appendix A.3) and table (A.9)).

Direction and Prices. The data focuses on some home countries and some host countries that very rarely overlap. However, one might wonder whether the price on one way is similar to the price on the reverted way. It appears that the data offer results to this question for two corridors only: Rwanda-Kenya and Tanzania-Kenya. It appears that, in those two very specific cases the mean comparison test fail to reject an equal mean.

4.2. Remittances

Quarterly personal transfers received. The use the Balance of Payment (BoP) for each country and use the personal transfers (credit) in the current account is rather common in the literature (see, for example, Alfieri *et al.* in 2005 [42] or Reinke in 2007 [43]). This method has severe drawbacks: (i) it only looks at the country-specific flows and not the corridor-specific so one cannot disentangle the corridors with the highest impacts. (ii) There is a large number of missing countries[8].

A severe measurement error is that the data cannot account for the substitutability between official stream of remittances and non formal ones (*e.g.* in-kinds goods sent or brought over a temporary return.) Those information are regularly available on LSMS datasets, which therefore calls for some more micro-based analyses to complement the type of study performed here, and to potentially understand the missing bridge (see Clemens and McKenzie in 2018 [2] or Gibson *et al.* [44]).

In addition the the aforementioned points raised, the strategy is based on an external instrument that is quarter-home country specific. Therefore, the estimated remittances will lose the variation across host countries. Since the causality can be reversed, it is chiefly important to secure this aspect. Even though some yearly bilateral remittances data are available, I use the quarterly inflows to keep the available dimensions granted by the instrument.

[8]As an example, data from a country as large and integrated to the international flows of capital as the USA does not display the data through the database.

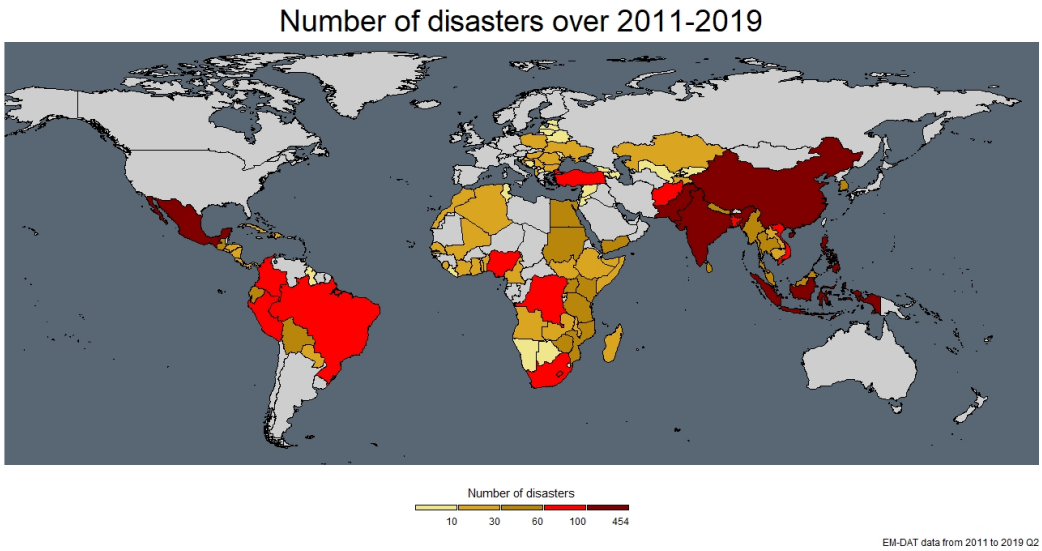

Figure 3: Count of disasters per receiving countries

4.3. EmDat

Disasters data are collected in the EmDat base by the university of Louvain [45]. It has details about the day(s) of the event, the type of disaster (environment-based such as flood, drought, volcano eruptions, or human-based such as transport or industrial accidents). I compute the total length of each disaster and aggregate the total people impacted (injured and casualties). Over the period of interest here, there are 1004 disasters that were reported on the EmDat concerning the home country for which I can match the cost of remittances.

In order to give sense of the disasters over the remittances-receiving countries, figure (3) displays the number of reported disasters and the yearly mean share of affected population. Most populated countries such as China, India, Indonesia, Pakistan or Mexico have the highest number of reported disasters.

Overall, it appears that the home countries are heterogeneous in terms of disasters prevalence. It should be noted, however, that the two figures do not catch the variability within the countries and the periods that would be key to the present paper.

4.4. Other

The World Development Indicators database provides yearly country-level variables used here such as the population, the GDP per capita. Quarterly data can be found from the IMF about the consumption price index, the value of both exports and imports, the amount of FDIs as well as the bilateral quarterly exchange rates. Those variables will systematically be included as controls into the regressions (with a lag to prevent reverse causality).

5. Remittances and Transfer Prices

Fixed Effects. RPW data allow to have differential effects within a country pair. As discussed above, the delay to receive the remittances, the point of access of the transfer or the operator chosen, all bring heterogeneity into the corridor. I will call a product a combination of a transfer speed, an access point, and an operator. Each "product" can follow a different pattern and some might be preferred over others in case of emergency such as disasters (the impatience raises). Obviously, across corridor, it seems that the variation is indeed very high, even when the home country is the same. The volatility of the exchange rate, the diaspora, the capacity to remit widely vary. This explain the choice over the econometric analysis to implement fixed effect that are (i) quarter fixed effects, (ii) corridor-product fixed effects. This should take into account most static preferences and thus identify the shift in costs for a particular product. It is possible that the demand shifts more for a specific product type and that is the reason why I will provide (Appendix B) the results with a sub-sample: I will keep only the faster transfer which is the most likely to be highly demanded after a disaster. The product-corridor fixed effects coupled with quarter fixed effects stands in the related literature and is aiming to better isolate the effect of an exogenous demand shock.

Remittances and Prices. A first important relationship to analyze concerns the remittances and the prices. Do the prices increase along with remittances or, conversely, do they decrease with more remittances? One could argue that, with increasing marginal costs, prices should rather increase. On the other hand, with increasing returns to scale as in a usual monopolistic competition setting the prices paid by the migrants and their families should rather be lower (as long as the elasticity of demand and of substitution does not vary).

To scrutinize the nature of the relationship, I simply apply the following:

$$prices_{ijt} = \alpha_{ij} + \nu_t + \kappa Remittances_{ijt-m} + \delta X_{ijt} + u_{ijt} \quad (1)$$

with i and j respectively denoting the host and the home countries, t denoting the timing, here quarters of years. X_{ijt} is a vector of controls: GDP per capita, population, exchange rate towards the $US of both host and home countries; a consumption price index, the value of foreign direct investment, the values of both imports and exports of the home country, the amount of products in a corridor (in a quarter). Lastly, m characterizes the delay in quarter.

Table (1) displays the naive results using the remittances directly to estimate the prices of remittances. One can notice that the remittances do not seem to impact the price of transaction.

Though not statistically significant, one can notice that the contemporaneous and the first lag (so a quarter before) remittances inflows systematically have positive signs. Lagged remittances have negative signs, again not significant.

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices % b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices b/se
Remittances Inflows	0.000045					
	(0.000)					
Lag 1 Remittances Inflows		-0.000093				
		(0.000)				
Lag 2 Remittances Inflows			-0.000021			
			(0.000)			
Lag 3 Remittances Inflows				-0.000215***		
				(0.000)		
Lag 4 Remittances Inflows					-0.000113	
					(0.000)	
Lag 5 Remittances Inflows						-0.000015
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3.05e+04	2.84e+04	2.57e+04	2.27e+04	1.91e+04	1.64e+04
r2	0.908695	0.909993	0.914702	0.915636	0.912848	0.916217

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table 1: Transaction Prices and Remittances

6. Disaster and Remittances

Are disasters and remittances related in practice? It seems natural to believe that, for altruistic motives but also for risk diversification motives, disasters in the home country will push the remittances stream up. Ratha *et al.* in 2016 [46], Bettin & Zazzaro in 2018 [32] stress that remittances are indeed largely raised right after a natural disaster.

Link between disaster and remittances. Simple linear correlations between the disaster's impacts and the remittances have positive signs for disasters having occurred. It appears the the quarterly country-specific linear correlation is about 1/3. The specification includes the controls presented before, the same fixed effects and the impact of disasters.

$$Remittances_{ijt} = \alpha_{ij} + \gamma_t + \sum_{i=0}^{n} \nu_{ti} Disaster_{jt-i} + \delta X_{ij} + u_{ijt} \tag{2}$$

with i and j denoting the host and the home countries, t denoting the timing, here quarters. I also include lags of disasters in order to control for the persistence of the disasters' impacts. An important choice for the first stage is the inclusion of the lags of disasters. The quarterly structure allows some refinements in the timing of reaction as well as whether the exist some cyclicality in the disasters (mostly those that find their origins in the seasons such as some floods or droughts). At least four quarters shall therefore be included into the regression to have an idea of whether disasters seem to occur on an annual basis. To keep a reasonable amount of corridor and variability within them, the kept amount of lags will be located between 1 and 2 years[9].

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Results can be found in table (2). This is the first stage regression and it is reassuring about the relevance of the set of instruments: even with the large spectrum of fixed effects, the disasters indeed impact the remittances. More interestingly (with the exception of the lag 3 remittances), a disaster contemporaneously impacts remittances in the sense that it contributes to push remittances up. On the other hand, one can notice that one or two quarters later the remittances are lower. This is intuitive since the migrant hurries to send more remittances when most needed and then reduces the amount remitted to smooth it over time. This is is line with the idea that the yearly remittances can only poorly catch the effect of a demand shock and therefore comfort the decision taken here not to use the bilateral yearly remittances data.

Disasters as instrument. Equipped with those results, it seems natural to argue that disasters can have an impact on prices through remittances. The

[9]The AIC and BIC criteria on the specification (2) are minimal for 7 quarters.

first stage controls for potential other channels, mostly the exchange rate. The exogeneity of the instrument seems quite obvious - especially for the lagged values - and will be comforted when looking at the Jansen J stat statistic. The relevance also appears to be satisfactory: the first stage highlights that even when controlling with several variables and partialling out a large share of the variance through the fixed effects, there is still a large impact of past and contemporaneous disasters on the amount of remittances received.

	(1) Remittances Inflows b/se	(2) Lag 1 Remittances Inflows b/se	(3) Lag 2 Remittances Inflows b/se	(4) Lag 3 Remittances Inflows b/se	(5) Lag 4 Remittances Inflows b/se	(6) Lag 5 Remittances Inflows b/se
Deads or Affected	5.293563*					
	(3.095)					
Lag 1 Deads or Affected	4.891682	6.180573***				
	(6.862)	(2.285)				
Lag 2 Deads or Affected	-0.190158	3.481856	7.643647***			
	(6.533)	(5.185)	(2.674)			
Lag 3 Deads or Affected	-2.396774	-2.238291	2.140251	3.125871		
	(5.157)	(4.967)	(4.517)	(3.043)		
Lag 4 Deads or Affected	2.672201***	-3.626716	-4.094960	-5.217562	6.417802**	
	(0.872)	(4.078)	(4.909)	(6.061)	(3.051)	
Lag 5 Deads or Affected	-2.876562	1.192325	-3.801209	-1.16e+01*	-4.752161	12.613454***
	(1.854)	(0.985)	(3.815)	(6.213)	(5.330)	(4.673)
Lag 6 Deads or Affected	-4.619109	-4.865328***	-0.251764	-7.300503	-1.08e+01**	2.999835
	(2.995)	(1.075)	(1.743)	(5.607)	(5.367)	(6.410)
Lag 7 Deads or Affected		-4.268600*	-5.127524***	-3.748124*	-9.475346*	-8.277913
		(2.535)	(1.177)	(2.227)	(4.993)	(6.020)
Lag 8 Deads or Affected			-4.003658*	-8.543072***	-2.523085	-1.524598
			(2.055)	(1.479)	(2.237)	(5.893)
Lag 9 Deads or Affected				-6.409248***	-6.045733***	11.359426**
				(2.341)	(1.617)	(5.428)
Lag 10 Deads or Affected					-4.676413**	-1.153893
					(2.036)	(2.270)
Lag 11 Deads or Affected						-2.494087
						(1.498)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3.05e+04	2.84e+04	2.57e+04	2.27e+04	1.91e+04	1.64e+04
r2	0.994569	0.994796	0.994724	0.995090	0.995101	0.995425

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table 2: First Stage

7. Disasters, Remittances and Remittance Prices

7.1. Baseline

Now the idea is to look at whether catastrophes in the home country potentially modifies the prices the firms will charge through their impacts in the remittances. The usual model to apply is the two stage least squares but the estimation can suffer from heteroskedasticity and clustering. Therefore, I run a Hausman test between GMM and 2SLS and it appears that GMM is the efficient choice; the regressions are systematically clustered at the home country level as this is where both the disasters and the remittances are extracted.

$$prices_{ijt} = \alpha_{ij} + \nu_t + \sum_i \kappa_{t-i} \hat{Remittances}_{jt-i} + \delta X_{ijt} + u_{ijt} \quad (3)$$

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices % b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices % b/se
Remittances Inflows	-0.000062					
	(0.000)					
Lag 1 Remittances Inflows		0.000277**				
		(0.000)				
Lag 2 Remittances Inflows			0.000306**			
			(0.000)			
Lag 3 Remittances Inflows				0.000288		
				(0.000)		
Lag 4 Remittances Inflows					0.000347**	
					(0.000)	
Lag 5 Remittances Inflows						-0.000147
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3.05e+04	2.84e+04	2.57e+04	2.27e+04	1.91e+04	1.64e+04
Hansen J statistic	3.322447	3.437265	3.364341	6.574588	3.066779	7.367740
p-value of Hansen J statistic	0.767423	0.752297	0.761922	0.361985	0.800420	0.288173
F statistic for weak identification (KP rk)	1.74e+02	1.67e+02	1.60e+02	74.379340	64.258180	20.688151

Clustered standard errors at the home country level.

* p¡0.10, ** p¡0.05, *** p¡0.01

Table 3: Transaction Prices, Disasters and Remittances

The results are displayed in table (3). The contemporaneous impact of the estimated remittances is negative. This can be puzzling. It is not easy, though, within the quarter to know when the highest amount of remittances was sent compared to when the disasters occurred. The disasters could have occurred in the end of the quarter, and thus the measure loses its interpretation. More importantly, the remittances a quarter up to a year before have a strong positive linear impact on the costs of remittances. The banks and the MTOs adapt their costs according to the observed demand the previous period.

7.2. Differential effects

Banks versus MTOs. When the sample is split between the two main categories of transfers actors, one can notice a different pattern: banks tend to be more reactive towards demand shocks while it takes longer for the MTOs to adapt. In both cases the impact does not seem to last more than a year, hence the need for data available at higher frequency.

Splitting the sample between two types of remittances providers - banks and money transfer operators[10]-, one can see the heterogeneity of the effects

[10]The banks and MTOs represent the lion's share of the type of institutions. I gathered

only when the lagged costs is taken into account. The results depicted in tables (4) and (5) highlight that the MTOs are less prone to rapidly adapt their prices to a demand shock than a bank which certainly has other activities than remittances. Banks can be related to the country suffering the disaster for different reasons and that might make it more responsive in its general pricing policy. On the other hand, MTOs have a delay in the reaction. The contemporaneous remittances even display a negative sign.

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices % b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices % b/se
Remittances Inflows	0.000400**					
	(0.000)					
Lag 1 Remittances Inflows		0.000736***				
		(0.000)				
Lag 2 Remittances Inflows			-0.000179			
			(0.000)			
Lag 3 Remittances Inflows				-0.000211		
				(0.000)		
Lag 4 Remittances Inflows					0.000481**	
					(0.000)	
Lag 5 Remittances Inflows						0.000153
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	6.05e+03	5.57e+03	4.98e+03	4.36e+03	3.67e+03	3.17e+03
r2	0.007894	0.004840	0.001533	0.001003	-0.001640	0.003056
r2_a	0.001621	-0.001819	-0.005540	-0.006621	-0.009905	-0.006142
Hansen J statistic	4.776727	3.122951	3.398027	4.125848	3.878185	4.331308
p-value of Hansen J statistic	0.572752	0.793265	0.757484	0.659650	0.693157	0.631937
F statistic for weak identification (KP rk)	77.693919	1.70e+02	2.15e+02	73.853142	26.881776	32.479993

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table 4: Second stage for banks only

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices % b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices % b/se
Remittances Inflows	-0.000384***					
	(0.000)					
Lag 1 Remittances Inflows		0.000154				
		(0.000)				
Lag 2 Remittances Inflows			0.000532***			
			(0.000)			
Lag 3 Remittances Inflows				0.000610***		
				(0.000)		
Lag 4 Remittances Inflows					0.000071	
					(0.000)	
Lag 5 Remittances Inflows						-0.000220*
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2.32e+04	2.18e+04	1.97e+04	1.74e+04	1.47e+04	1.25e+04
Hansen J statistic	5.165920	2.963298	3.709703	6.033116	2.987746	8.442275
p-value of Hansen J statistic	0.522716	0.813439	0.715892	0.419491	0.810383	0.207458
F statistic for weak identification (KP rk)	1.18e+02	1.22e+02	96.681423	67.558621	73.795313	22.876117

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table 5: Second stage for MTOs only

few different appellations into those two categories defined by RPW. The defined as bank any structure first called "bank" or "credit union". Money transfer operators muster the other structures such as post offices, non-bank financial institutions.

7.3. Within products cost structure

The shift in the price of transfers depends on the value of the transfer itself (see AppendixE.18). This implies that the marginal cost of producing the transfer service is not constant. Companies seem to face decreasing returns to scale. I therefore reproduce the same procedure with $\Delta Price$ = \$200 $Tranfers$ - \$500 $Tranfers$. Results are displayed on table (6). It is striking that the transfer price gap increase with an exogenous demand shock. This expansion goes on for about a year after the shock. This tends to push the policy makers to advocate for a more homogeneous change in the prices as this heterogeneity can affect the most fragile people and/or those who are to send remittances in emergency but cannot have a large amount at disposal.

	(1) $\Delta Prices$ b/se	(2) $\Delta Prices$ b/se	(3) $\Delta Prices$ b/se	(4) $\Delta Prices$ b/se	(5) $\Delta Prices$ b/se	(6) $\Delta Prices$ b/se
Remittances Inflows	0.000185***					
	(0.000)					
Lag 1 Remittances Inflows		0.000157***				
		(0.000)				
Lag 2 Remittances Inflows			0.000292***			
			(0.000)			
Lag 3 Remittances Inflows				0.000302***		
				(0.000)		
Lag 4 Remittances Inflows					0.000192***	
					(0.000)	
Lag 5 Remittances Inflows						0.000022
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3.04e+04	2.84e+04	2.56e+04	2.26e+04	1.91e+04	1.63e+04
Hansen J statistic	5.046142	3.228711	3.959487	5.355978	5.360805	9.097033
p-value of Hansen J statistic	0.537909	0.779642	0.682159	0.499032	0.498437	0.168194
F statistic for weak identification (KP rk)	1.74e+02	1.66e+02	1.56e+02	73.459052	64.440447	20.575138

Clustered standard errors at the home country level.
* pj0.10, ** pj0.05, *** pj0.01

8. Robustness

FUTURE WORK...

8.1. What about a supply shock?

Use the debit and net flows of IMF-BOP data.

The personal transfer exiting the country that was impacted by the disaster should not follow the same pattern that the personal transfers entering the country. Using the same IMF BOP data, I simply reproduce the first stage using rather the exiting personal transfers. Table (7) shows mitigated results as the contemporaneous outflows as usually unaffected by the disasters. Interestingly, there seem to be a push in outflows 1 year after the disaster which can find several causes: flows stopped to exit for a while, it can also be that the urgent inflows are to be reimbursed.

	(1) Remittances Outflows b/se	(2) Lag 1 Remittances Outflows b/se	(3) Lag 2 Remittances Outflows b/se	(4) Lag 3 Remittances Outflows b/se	(5) Lag 4 Remittances Outflows b/se	(6) Lag 5 Remittances Outflows b/se
Deads or Affected	-4.555332					
	(5.079)					
Lag 1 Deads or Affected	-1.690033	-2.411530				
	(2.517)	(4.424)				
Lag 2 Deads or Affected	7.302168***	0.541945	-2.521776			
	(1.778)	(1.707)	(4.555)			
Lag 3 Deads or Affected	-2.246890	10.002533***	2.706558**	2.380467**		
	(2.046)	(1.183)	(1.192)	(1.007)		
Lag 4 Deads or Affected	16.069312***	-0.486172	12.812006***	6.925024**	7.787532***	
	(1.647)	(1.507)	(1.677)	(3.353)	(2.570)	
Lag 5 Deads or Affected	-9.915499***	17.206921***	-0.182322	17.677693***	11.248477***	5.786952
	(2.463)	(1.923)	(1.293)	(4.326)	(3.426)	(4.647)
Lag 6 Deads or Affected	-1.09e+01***	-7.632917***	19.126336***	7.552570**	22.829052***	5.106054
	(2.987)	(2.271)	(3.297)	(3.085)	(4.680)	(4.853)
Lag 7 Deads or Affected		-1.04e+01***	-7.332839***	17.106649***	7.638954***	17.848124***
		(2.791)	(1.838)	(3.429)	(2.372)	(5.288)
Lag 8 Deads or Affected			-1.02e+01***	-9.377863***	17.784522***	4.166288
			(2.318)	(1.311)	(3.067)	(3.144)
Lag 9 Deads or Affected				-9.841540***	-7.663431***	13.302788***
				(1.194)	(2.196)	(2.491)
Lag 10 Deads or Affected					-9.428067***	-1.12e+01***
					(1.351)	(1.637)
Lag 11 Deads or Affected						-1.02e+01***
						(0.939)
N	2.98e+04	2.90e+04	2.52e+04	2.30e+04	1.88e+04	1.66e+04
r2	0.987974	0.987663	0.987485	0.992005	0.993122	0.996410

Clustered standard errors at the home country level.
* p0.10, ** p0.05, *** p0.01

Table 7: Personal Transfers Exiting the Country

8.2. What if political disasters?

Use ACLED [47]? See Appendix D

8.3. Diaspora

Use the diaspora? See Appendix C

8.4. Interaction with the number of actors within the corridor

For each corridor and quarter, it is possible to compute the number of actors and or of products that are proposed to send remittances. Rough linear correlations logically indicate that the more actors/products the lower the costs. What to do next?

9. Conclusion

The prices of remittances seem to be positively impacted by a push of demand characterized in the present study by an environmental disaster. The effect usually appears after a quarter up to a year. Among the providers, Banks seem to adapt faster to a shock in remittances' demand. To my knowledge, this is a first attempt to analyze how the transaction costs of remittances change following a demand shift.

The transfer pricing is impacted differently, depending on the products, but also within the product according to whether \$200 or \$500 are sent. The demand shock adapts differently to the amount remitted: the more is remitted the less volatile the pricing. Policy makers whose objective is to

reduce the price paid by the migrants might try to impact more the pricing for small amount of money sent as this is the most likely to shift upwards after a demand shock.

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Appendix A. Data

Appendix A.1. The corridors worldwide

The figure here simply add the different corridors in the database on the map **??**. The corridors are split by the amount of remittances sent, the with edges are the corridors with less remittances sent (in absolute terms), the dark edges corresponds to the highest amount of remittances. One can point out that the sending countries are gathering a large amount of corridors - the US, Canada, Australia and New-Zealand, a few European countries, the Russian Federation, and the Arabic peninsula.

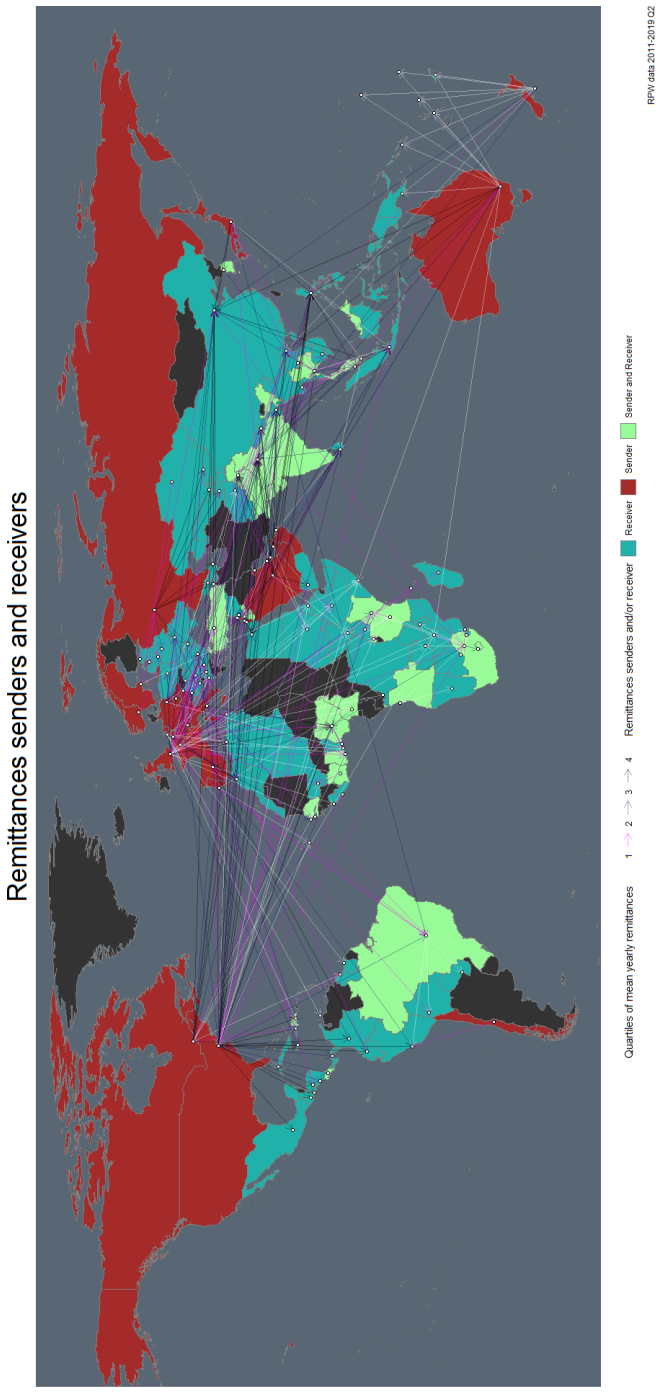

Figure A.4: Corridors in the RPW data

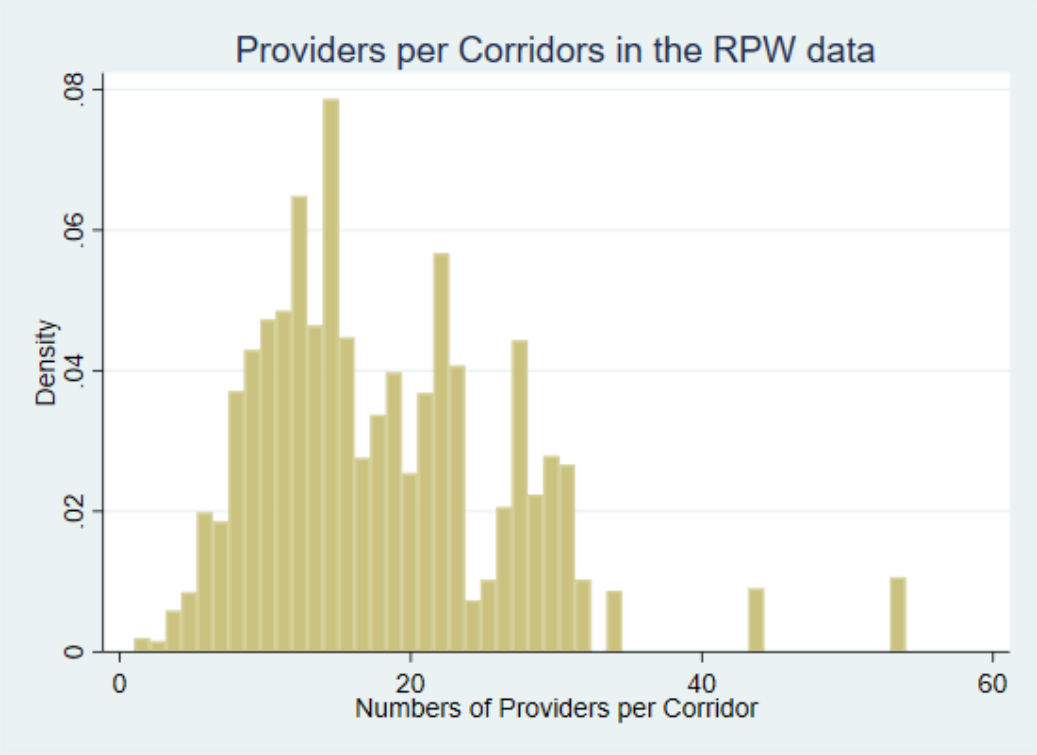

Figure A.5: Amount of Providers

Appendix A.2. The amount of providers

One can easily notice that a minority of countries have very few different providers. There are 8 corridors with one or two providers only that were reported in the RPW data: Germany-Afghanistan, Nigeria-Benin, Nigeria-Mali, Saudi Arabia-Myanmar, Saudi Arabia–South Sudan, Saudi Arabia-Sudan, Saudi Arabia-Syrian Arab Republic, United Arab Emirates-South Sudan. On the other side of the distribution, there are two corridors with more than 40 providers reported in the database: Australia-India and Australia-Philippines.

Appendix A.3. Transfer prices - $200 versus $500

MTOs versus Banks. Banks are on average more expensive than MTOs. One can notice that the prices descreased for both actors over the 2010s. One can easily observe that the gap between bank's prices and MTO's prices dramatically decreases with the amount of the transfer. This seems to suggest

Costs of	Firm type	2011 (Q1)	2019 (Q2)
$ 200 transfer (%)	Banks	12.2	10.4
$ 200 transfer (%)	MTOs	7.2	6
$ 500 transfer (%)	Banks	5.9	5.4
$ 500 transfer (%)	MTOs	4.8	4.2

Table A.8: Average transaction costs, recent evolution

that the higher amount of transfer are more usual operations for banks and thus the competition is tougher for higher transfers.

Distribution. The histograms displayed here simply depict the distribution of transfer prices for the two amount of money transferred that are available in the RPW data. On average, the prices are relatively higher for a $200 transfer than for a $500 with a gap of about 3 percentage points (4.8% *versus* 7.2%). The second moment is also different across the two amounts remitted: the variance is indeed almost three time larger in the case of $200 transfers.

Costs and transfers characteristics. The different layers of heterogeneity of the price of remittances is mostly characterized here through different channels: (i) the corridors, (ii) the type of sender, (iii) the speed of the transfer, (iv)the point of access. The different corridors and the types of actors have been described above so I will simply provide additional information for the remaining two.

Table (A.9) indicates how the fixed effects would be related to the costs of transfers, for both amount remitted, *i.e.* $200 and $500. Fundamentally, the three categories separate the types of remittances by the sort of enterprise providing the service (f), by the point of access to pick up the remittances (a), and by the delay of the remittances (s). The two regressions add quarter and corridors fixed effects. The banks appear to be more expensive than MTOs. The point of access also has an impact on the price of transfer: the cheapest means of remitting are call center and on-line transfers. Post office access point are usually more expensive. Lastly, the speed of the transfer seems to be slightly different for $200 than for $500: for a lower amount of remittances, surprisingly, a long delay is related to a higher price while it is not significant for $500 remittances. One would rather expect the price to reduce with the time of the transfer (which is what happens for the shorter intervals).

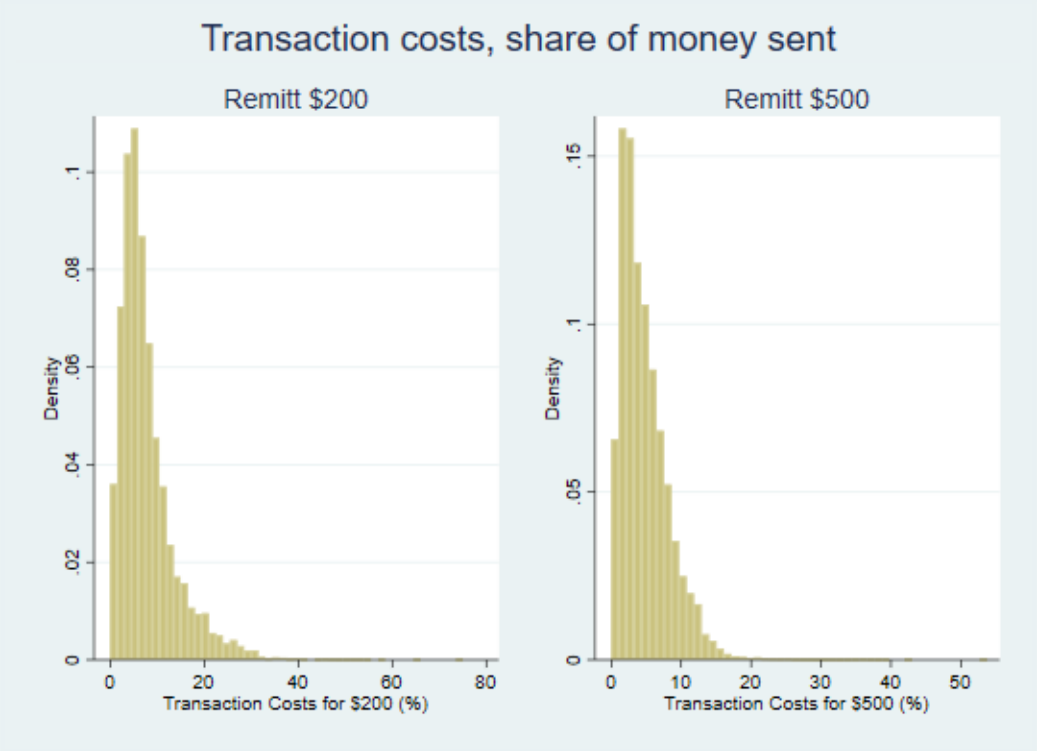

Figure A.6: Amount of Providers

Figure A.7: Speed of the transfer and transfer prices

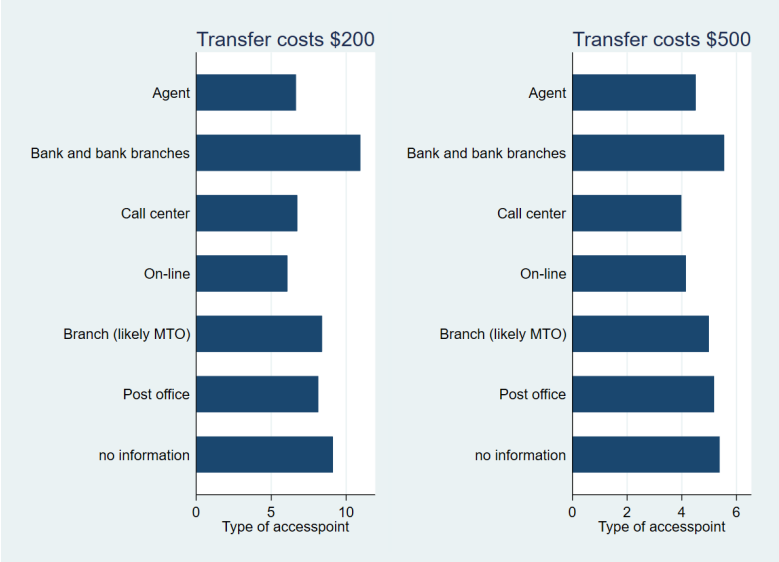

Figure A.8: Access points and transfer prices

In any case, the objective of this discussion is simply to raise the issue of the heterogeneity and its impact on the price of remittances. To sum up, the results demonstrating the large impact of each criteria discussed justify the use of more refined fixed effects, namely the fixed effects accounting for all the heterogeneity: corridor-actor-speed-access.

$$costs_{safijt} = \alpha_{ij} + \nu_t + \gamma speed_{sijt} + \kappa accesspoint_{aijt} + \delta MTO_{fijt} + u_{safijt} \quad \text{(A.1)}$$

	(1) Prices for $200 transfer b/se	(2) Prices for $500 transfer b/se
Speed of access to remittances (ref. Less than 1 hour)		
Same day	-1.570811***	-1.060398***
	(0.166)	(0.106)
Next day	-1.462881***	-1.260524***
	(0.213)	(0.117)
Two days	-0.732821**	-1.000145***
	(0.316)	(0.176)
3-5 days	0.044132	-0.939442***
	(0.290)	(0.182)
6 days or more	2.803708***	0.198935
	(0.653)	(0.319)
Type of access point (ref. Agent)		
Bank and bank branches	0.195785	-0.058649
	(0.253)	(0.135)
Call center	-2.635241***	-1.580599***
	(0.557)	(0.354)
On-line	-2.129548***	-1.000626***
	(0.144)	(0.100)
Other branches (MTOs)	-0.466258***	-0.313018***
	(0.140)	(0.092)
Post office	1.206918***	0.705064***
	(0.453)	(0.208)
No information	-0.471736	-0.002575
	(0.669)	(0.390)
Type of operator (ref. Banks)		
MTOs	-3.734002***	-1.236764***
	(0.334)	(0.178)
Constant	15.305829***	7.817671***
	(0.620)	(0.342)
Quarter FE	Yes	Yes
Corridors FE	Yes	Yes
N	9.43e+04	9.40e+04
r2	0.493431	0.413890

Clustered standard errors at the corridor level.
* pj0.10, ** pj0.05, *** pj0.01.

Table A.9: Transaction Costs and Remittances Characteristics

Appendix B. When only the fastest transfers are included

A disaster is supposed to push the migrant to remit as soon as possible and to have the transfer implemented as fast as possible. Hence it can be that the fastest transfer (less than an hour to receive the money for the family in the home country) catches the shift in the pricing pattern. I simply sub-sample the data and only include the products that are transferred in less than an hour in the following tables. The results provided in tables (B.10), (B.11), and (B.12) display results in line with the baseline but the magnitude of the coefficients in the second stage are about twice larger. This would imply that the fastest transfers are more price elastic to a demand shock.

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices % b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices % b/se
Remittances Inflows	0.000090					
	(0.000)					
Lag 1 Remittances Inflows		-0.000114				
		(0.000)				
Lag 2 Remittances Inflows			-0.000144			
			(0.000)			
Lag 3 Remittances Inflows				-0.000366***		
				(0.000)		
Lag 4 Remittances Inflows					-0.000031	
					(0.000)	
Lag 5 Remittances Inflows						0.000119
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1.49e+04	1.40e+04	1.27e+04	1.12e+04	9.52e+03	8.23e+03
r2	0.866231	0.872556	0.879039	0.884747	0.885996	0.894268

Clustered standard errors at the home country level.
* pj0.10, ** pj0.05, *** pj0.01

Table B.10: Transaction Costs and Remittances

	(1) Remittances Inflows b/se	(2) Lag 1 Remittances Inflows b/se	(3) Lag 2 Remittances Inflows b/se	(4) Lag 3 Remittances Inflows b/se	(5) Lag 4 Remittances Inflows b/se	(6) Lag 5 Remittances Inflows b/se
Deads or Affected	5.129195*					
	(2.984)					
Lag 1 Deads or Affected	5.557950	6.123690***				
	(6.475)	(2.149)				
Lag 2 Deads or Affected	0.873040	4.586295	7.461670***			
	(6.047)	(4.891)	(2.371)			
Lag 3 Deads or Affected	-1.393863	-0.758980	3.638852	3.006189		
	(4.779)	(4.572)	(4.141)	(2.620)		
Lag 4 Deads or Affected	3.048505***	-2.198169	-2.344806	-3.668941	6.091057*	
	(0.743)	(3.824)	(4.578)	(5.614)	(3.296)	
Lag 5 Deads or Affected	-2.596470	1.813498	-2.279934	-9.785551*	-3.398422	11.186363**
	(1.737)	(1.176)	(3.595)	(5.845)	(5.092)	(4.908)
Lag 6 Deads or Affected	-4.230882	-4.442472***	0.442603	-5.850549	-9.369470*	2.861090
	(2.881)	(0.995)	(1.904)	(5.360)	(5.313)	(6.834)
Lag 7 Deads or Affected		-3.732474	-4.704184***	-3.079856	-8.509747*	-8.406358
		(2.427)	(1.185)	(2.506)	(5.015)	(6.564)
Lag 8 Deads or Affected			-3.493108*	-8.364545***	-1.758240	-2.730639
			(1.919)	(1.594)	(2.543)	(6.850)
Lag 9 Deads or Affected				-5.966017***	-5.742203***	13.097784***
				(2.219)	(2.051)	(4.826)
Lag 10 Deads or Affected					-4.153497**	-0.100223
					(2.064)	(2.069)
Lag 11 Deads or Affected						-1.587871
						(1.647)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1.49e+04	1.40e+04	1.27e+04	1.12e+04	9.52e+03	8.23e+03
r2	0.994488	0.994685	0.994586	0.994935	0.994953	0.995467

Clustered standard errors at the home country level.

* p¡0.10, ** p¡0.05, *** p¡0.01

Table B.11: First Stage

	(1) Transaction Prices % b/se	(2) Transaction Prices % b/se	(3) Transaction Prices %e b/se	(4) Transaction Prices % b/se	(5) Transaction Prices % b/se	(6) Transaction Prices % b/se
Remittances Inflows	-0.000164					
	(0.000)					
Lag 1 Remittances Inflows		0.000716***				
		(0.000)				
Lag 2 Remittances Inflows			0.000787***			
			(0.000)			
Lag 3 Remittances Inflows				0.000512***		
				(0.000)		
Lag 4 Remittances Inflows					0.000085	
					(0.000)	
Lag 5 Remittances Inflows						0.000317*
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1.49e+04	1.40e+04	1.27e+04	1.12e+04	9.52e+03	8.23e+03
Hansen J statistic	2.650756	3.644672	3.232366	4.818568	3.383210	8.508763
p-value of Hansen J statistic	0.851229	0.724633	0.779168	0.567285	0.759438	0.203147
F statistic for weak identification (KP rk)	2.18e+02	2.12e+02	1.46e+02	56.278184	59.959269	17.828942

Clustered standard errors at the home country level.

* p¡0.10, ** p¡0.05, *** p¡0.01

Table B.12: Transaction Costs, Disasters and Remittances

Appendix C. With the corridor dimension all the way

One key issue highlighted in the data relates to the fact that both disasters and remittances are home country and quarter specific while prices of transfers are corridor and quarter specific. I will apply one way of introducing this higher dimension in the analysis by changing the concerned variables. (i) Disasters will now be relative to the size of the diaspora in each corridor; (ii) remittances will be weighted by both the diaspora and the gross national index gap between the host and home countries.

Disaster per diaspora. This measure fundamentally weights the magnitude of the shock by the amount of people who are directly concerned with potentially remitting. The measure is simply: $Disasters_{jt}/Diaspora_{ij}$. The data from the diaspora in taken from

Constructed Bilateral Remittances. Following the methods applied for example in Ratha and Shay in 2007 [48] or in Rather *et al.* in 2016 [46] one can build approximation of bilateral remittances from the IMF BOP data.

$$R_{ij} = R_j \frac{r_{ij} M_{ij}}{\sum_i r_{ij} M_{ij}} \tag{C.1}$$

where

$$r_{ij} = \begin{cases} \mathrm{Y}_j & \text{if } Y_i > Y_j \\ \mathrm{Y}_j + (Y_i - Y_j)^\beta & \text{if } Y_i < Y_j \end{cases} \tag{C.2}$$

with $0 < \beta < 1$ that basically tunes the sensitivity of the gap between the two countries. Y_i is the GNI per capita of the host country and Y_j for the home country. Therefore, r_{ij} weights the personal remittances to be received by a proxy of the capacity to pay. M_{ij} is the diaspora of migrants living in country i and originating from country j.

Using GNI from the WDI data and the bilateral migration stock from the United Nation Population Division (UNPD) and the remittances from the BOP of the home countries, I construct the approximated bilateral remittances.

As mentioned above, the refinement of have corridor-specific remittances flows cannot be inserted in the two stage procedure as the external instruments are solely derived at the home country level. It is interesting to notice that the results in table (C.13) display a large contemporaneous impact of remittances on the costs and the effect is partly offset by an increase due to

lagged remittances. The obvious issue here is the reverse causality for the contemporaneous variable that make it unreliable.

A second important point to mention is the first stage displayed on table (C.14). The disasters impact positively the amount of transfer but this impact generally is not significant. This worry is confirmed in table (**??**) where the weak identification statistic is much lower than for the original remittances data. The weak identification statistics is worryingly small for the first stage with the contemporaneous remittances but then becomes acceptable (compared to Stock and Yogo (2002) critical values [49]). The second stage display results that are very similar to the ones in the main body of the paper. The contemporaneous remittances shocks don't affect the price of the transfers but this price increases during the two following quarters. Again, this suggests that the operators adapt their strategy by increasing the prices when the demand is higher and very inelastic.

	(1) Transfer Prices (%) b/se	(2) Transfer Prices (%) b/se	(3) Transfer Prices (%) b/se	(4) Transfer Prices (%) b/se	(5) Transfer Prices (%) b/se	(6) Transfer Prices (%) b/se
Bilateral Remittances Inflows	0.000076					
	(0.000)					
Lag 1 Bilateral Remittances Inflows		0.000010				
		(0.000)				
Lag 2 Bilateral Remittances Inflows			0.000077			
			(0.000)			
Lag 3 Bilateral Remittances Inflows				-0.000052		
				(0.000)		
Lag 4 Bilateral Remittances Inflows					-0.000064	
					(0.000)	
Lag 5 Bilateral Remittances Inflows						-0.000008
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2.90e+04	2.70e+04	2.50e+04	2.21e+04	1.87e+04	1.60e+04
r2	0.904420	0.905095	0.909344	0.910801	0.908366	0.912355

Clustered standard errors at the home country level.

* pj0.10, ** pj0.05, *** pj0.01

Table C.13: FE - Built Bilateral Remittances and Price of Transfer

	(1) Bilateral Remittances b/se	(2) Lag 1 Bilateral Remittances b/se	(3) Lag 2 Bilateral Remittances b/se	(4) Lag 3 Bilateral Remittances b/se	(5) Lag 4 Bilateral Remittances b/se	(6) Lag 5 Bilateral Remittances b/se
Disaster over Diaspora	-3.67e+03					
	(7312.182)					
Lag 1 Disaster over Diaspora	-8.64e+03	1.89e+03				
	(6091.014)	(7598.635)				
Lag 2 Disaster over Diaspora	-1.97e+04**	-7.25e+02	3.67e+03			
	(9010.058)	(7889.691)	(8084.243)			
Lag 3 Disaster over Diaspora	-4.45e+03	-1.26e+04	2.45e+03	2.05e+03		
	(8993.438)	(9022.052)	(6064.718)	(11535.440)		
Lag 4 Disaster over Diaspora	1.08e+04	-5.03e+03	-1.15e+04	-8.29e+03	8.32e+03	
	(9033.806)	(10705.271)	(12127.741)	(9754.597)	(15225.216)	
Lag 5 Disaster over Diaspora	-5.46e+03	2.08e+04**	-1.59e+02	-1.59e+04	-7.86e+03	2.20e+04
	(7213.068)	(9712.171)	(11050.559)	(15446.683)	(10037.497)	(19528.735)
Lag 6 Disaster over Diaspora	2.78e+03	-1.16e+02	2.33e+04*	-1.27e+03	-9.56e+03	6.39e+03
	(4254.889)	(9479.823)	(12159.736)	(11790.357)	(21714.916)	(16792.235)
Lag 7 Disaster over Diaspora		-2.74e+03	-5.66e+03	1.51e+04	-4.11e+03	-1.05e+04
		(5285.580)	(10354.137)	(13914.936)	(20089.217)	(30771.719)
Lag 8 Disaster over Diaspora			-2.36e+03	-4.80e+03	1.86e+04	5.05e+02
			(5453.767)	(14054.597)	(19215.433)	(28087.252)
Lag 9 Disaster over Diaspora				-1.53e+03	1.08e+03	2.14e+04
				(6940.100)	(18360.950)	(26667.328)
Lag 10 Disaster over Diaspora					-1.22e+03	-9.15e+03
					(6948.352)	(20963.191)
Lag 11 Disaster over Diaspora						-3.88e+03
						(6504.801)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2.77e+04	2.59e+04	2.39e+04	2.11e+04	1.77e+04	1.51e+04
r2	0.988718	0.989433	0.989959	0.990655	0.991054	0.992259

Clustered standard errors at the home country level.

* p¡0.10, ** p¡0.05, *** p¡0.01

Table C.14: First Stage, Built Bilateral Remittances - Disasters

	(1) Transfer Prices (%) b/se	(2) Transfer Prices (%) b/se	(3) Transfer Prices (%) b/se	(4) Transfer Prices (%) b/se	(5) Transfer Prices (%) b/se	(6) Transfer Prices (%) b/se
Bilateral Remittances Inflows	0.000555*					
	(0.000)					
Lag 1 Bilateral Remittances Inflows		0.002514***				
		(0.000)				
Lag 2 Bilateral Remittances Inflows			0.000892***			
			(0.000)			
Lag 3 Bilateral Remittances Inflows				0.000000		
				(0.000)		
Lag 4 Bilateral Remittances Inflows					-0.000875***	
					(0.000)	
Lag 5 Bilateral Remittances Inflows						0.000932***
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2.77e+04	2.59e+04	2.39e+04	2.11e+04	1.77e+04	1.51e+04
r2	-0.003415	-0.137944	-0.013679	0.001413	-0.012391	-0.011836
r2_a	-0.004756	-0.139574	-0.015122	-0.000056	-0.013934	-0.013511
Hansen J statistic	3.277362	3.552279	4.369993	5.553624	3.305365	6.374818
p-value of Hansen J statistic	0.773316	0.737002	0.626740	0.474999	0.769659	0.382538
F statistic for weak identification (KP rk)	6.842626	26.694905	25.546092	10.273972	19.150143	32.468292

Clustered standard errors at the home country level.

* p¡0.10, ** p¡0.05, *** p¡0.01

Table C.15: Second Stage, Built Bilateral Remittances - Disasters

Appendix D. Conflict data - ACLED Data [47]

The present section replicates the analysis done in the plain text but changes the instrument: disasters are replaced with conflicts. It allows to pursue the analysis performed through the use of a different tool: political (sudden) conflicts. One problem of the database used is that the number of observations dramatically reduces.

ACLED records all the conflict and locates them. This level of refinement is not needed in the present analysis as I can neither disentangle the specific locations of the remittance flows nor the specific locations of the prices of remittances. Both the first and second stages displayed in tables (D.16) and (D.17) follow the results that are derived by environmental disasters: high frequencies of fatalities contemporaneously leads to larger streams of remittances and this, in turn, impacts the prices of remittances, leading to higher prices in the short run and then a decrease after about 9 to 12 months.

However, some specifications are at the risk of weak identification as the F-statistic is lower than ten in the lag 1 of remittances. Another problematic issue relates to the number of observations: there are now about 5000 observations only for contemporaneous remittances.

	(1) Remittances Inflows b/se	(2) Lag 1 Remittances Inflows b/se	(3) Lag 2 Remittances Inflows b/se	(4) Lag 3 Remittances Inflows b/se	(5) Lag 4 Remittances Inflows b/se	(6) Lag 5 Remittances Inflows b/se
Number of fatalities	0.126351**					
	(0.058)					
Lag 1 Number of fatalities	0.061824	0.116595*				
	(0.042)	(0.059)				
Lag 2 Number of fatalities	-0.059432	0.025928	0.278143***			
	(0.050)	(0.054)	(0.077)			
Lag 3 Number of fatalities	-0.016256	-0.093480	0.221746**	0.183583		
	(0.054)	(0.060)	(0.083)	(0.166)		
Lag 4 Number of fatalities	-0.033620	-0.081204	0.155355	0.225043	0.553133***	
	(0.082)	(0.056)	(0.104)	(0.270)	(0.106)	
Lag 5 Number of fatalities	0.044850	0.003679	-0.034359	0.445994**	-0.848926***	3.329097***
	(0.098)	(0.086)	(0.100)	(0.202)	(0.154)	(0.023)
Lag 6 Number of fatalities	0.067664	0.019065	0.182771	-0.186096	0.008900	-0.425040***
	(0.112)	(0.096)	(0.118)	(0.175)	(0.107)	(0.007)
Lag 7 Number of fatalities		0.075073	0.100275	-0.135465	-0.453720***	-0.880043***
		(0.103)	(0.117)	(0.221)	(0.090)	(0.006)
Lag 8 Number of fatalities			0.176702*	-0.283538	0.062490	-1.299348***
			(0.091)	(0.179)	(0.151)	(0.028)
Lag 9 Number of fatalities				-0.059183	-0.026918	-1.528937***
				(0.071)	(0.126)	(0.025)
Lag 10 Number of fatalities					-0.887235***	-0.275858***
					(0.103)	(0.013)
Lag 11 Number of fatalities						-0.286667***
						(0.004)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4.66e+03	4.22e+03	3.44e+03	2.71e+03	1.80e+03	1.29e+03
r2	0.997148	0.997118	0.997656	0.998316	0.999758	0.999954

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table D.16: First Stage, Remittances - ACLED conflicts

	(1) Transfer Prices (%) b/se	(2) Transfer Prices (%) b/se	(3) Transfer Prices (%) b/se	(4) Transfer Prices (%) b/se	(5) Transfer Prices (%) b/se	(6) Transfer Prices (%) b/se
Remittances Inflows	0.001384***					
	(0.000)					
Lag 1 Remittances Inflows		0.001426***				
		(0.000)				
Lag 2 Remittances Inflows			0.000257*			
			(0.000)			
Lag 3 Remittances Inflows				0.000024		
				(0.000)		
Lag 4 Remittances Inflows					0.000300	
					(0.000)	
Lag 5 Remittances Inflows						-0.000323
						(0.000)
Quarters FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Corridor FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4.66e+03	4.22e+03	3.44e+03	2.71e+03	1.80e+03	1.29e+03
r2	-0.008307	-0.006373	0.000247	-0.000230	0.000006	0.001416
r2_a	-0.014620	-0.013335	-0.007969	-0.010314	-0.014642	-0.017455
Hansen J statistic	5.590301	6.106285	3.550189	4.435325	4.124785	9.716106
p-value of Hansen J statistic	0.470611	0.411390	0.737281	0.617982	0.659794	0.137128
F statistic for weak identification (KP rk)	31.358382	6.375903	16.459312	43.658352	1.55e+02	4.66e+05

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table D.17: Second Stage, Remittances - ACLED conflicts

Appendix E. Transfer Prices for $500

The RPW database provides information about the price to be paid if the person sends $200 and $500. Prices are relatively lower the higher the amount sent, suggesting there are increasing returns to scale, which seems likely in a financial service. The first stage does not vary, only the second stage is modified. The pattern looks similar to the one encountered with $200 transfers but the magnitudes are much lower and the coefficients are not statistically significant. This highlights the fact that the costs for higher transfer values will be less subject to exogenous demand shifts.

	(1) Transfer Prices (%) b/se	(2) Transfer Prices (%) b/se	(3) Transfer Prices (%) b/se	(4) Transfer Prices (%) b/se	(5) Transfer Prices (%) b/se	(6) Transfer Prices (%) b/se
Remittances Inflows	-0.000272***					
	(0.000)					
Lag 1 Remittances Inflows		0.000125				
		(0.000)				
Lag 2 Remittances Inflows			0.000062			
			(0.000)			
Lag 3 Remittances Inflows				0.000035		
				(0.000)		
Lag 4 Remittances Inflows					0.000151	
					(0.000)	
Lag 5 Remittances Inflows						-0.000068
						(0.000)
N	3.04e+04	2.84e+04	2.56e+04	2.26e+04	1.91e+04	1.63e+04
Hansen J statistic	3.478800	3.140708	3.540006	6.080257	4.630223	9.852130
p-value of Hansen J statistic	0.746788	0.790991	0.738640	0.414260	0.592035	0.131019
F statistic for weak identification (KP rk)	1.74e+02	1.66e+02	1.56e+02	73.459052	64.440447	20.575138

Clustered standard errors at the home country level.
* p¡0.10, ** p¡0.05, *** p¡0.01

Table E.18: Second Stage, Remittances $500 Transfers