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Abstract

Despite concerns that the COVID-19 economic collapse would torpedo international remittances, formal remittances to several developing countries ballooned early in the pandemic. This increase might, however, have reflected a shift from informal channels to formal ones rather than a change in actual flows. This paper employs Mexican data to explore this and finds that remittance channels did change. The rise in formal inflows was larger among municipalities that were previously more reliant on informal channels (for example, near a border crossing). Households there also experienced a disproportionate increase in bank accounts opened after lockdown measures. The paper also rules out hypotheses related to the US Coronavirus Aid, Relief, and Economic Security (CARES) Act and altruism.

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Neither by Land nor by Sea: The Rise of Electronic Remittances during COVID-19*

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1 Introduction

Following the implementation of lockdown policies in March 2020 in response to the COVID-19 pandemic, governments and international organizations predicted a massive decline in remittances. As of April 2020, remittances to developing countries were expected to fall by 20 percent during the year due to the unprecedented slowdown in economic activity in remitting countries and a disproportionate increase in unemployment among migrants (World Bank, 2020; Capps et al., 2020; Garrote Sanchez et al., 2020; Caruso et al., 2021). Instead, formal remittances to several developing countries grew at unprecedented rates.[1] Given the high unemployment rates in remitting economies since the start of the pandemic, these patterns are difficult to reconcile with the literature about the determinants of remittance flows (Ratha et al., 2007; Frankel, 2011; Gupta, 2006). In contrast, household survey data show that most recipient households in Latin America reported a drop in remittances during 2020.[2] Unlike official estimates, these survey data more likely capture the change in both formal (also known as "registered," "recorded," and "electronic") and informal remittances, since they rely on actual individual responses rather than only on data from electronic transfers.

In this paper, we suggest that a shift from informal to formal channels during the economic crisis caused by COVID-19 partly explains the increase in formal remittances coupled with the decline reported in household surveys. Since official remittance data sources often struggle to accurately measure informal remittances—that is, cash carried by hand or sent through other informal channels—a shift in the composition of remittances from informal to formal may be misleading as to the actual change in total remittances. It is challenging to estimate the number of informal remittances as they involve many transactions of minor value that are not recorded anywhere and thus easily go undetected.[3] However, scholars have argued that trends in formal remittances could be informative regarding changes in informal ones. In particular, the long-term growth in formal remittances suggests informal ones are still sizable but slowly yielding over time to formal ones. This is due to a reduction in the cost of sending remittances through formal channels and to a crackdown on informal remittance providers in several destination countries (Clemens and McKenzie, 2018). We propose that COVID-19 lockdown policies accelerated this formalization process by increasing the costs of sending and receiving informal remittances to prohibitive levels.

To test our hypothesis that a shift from informal to formal channels partially explains the increase in formal remittances observed at the municipality level, as opposed to a real gain in remittance flows, we exploit the variation induced by the dramatic slowdown in geographic mobility caused by the pandemic.

[1] As shown in Figure A1, monthly formal remittances for a group of selected countries grew between April and September 2020 after declining at the start of the crisis.

[2] See Table A1 in the Appendix.

[3] Several articles have used indirect methods to assess the magnitude of these flows. For example, Freund and Spatafora (2005) estimate that informal remittances amount to 35–75 percent of the value of formal ones. In Latin America, Page and Plaza (2006) estimate that informal remittances represent 73 percent of the total.

The travel ban made it impossible to physically transport cash or assets from the United States to Mexico. Consequently, the financial system became the only way to send and receive international transfers. Since informal remittances are mostly unobservable, we hypothesize that if the gain in formal remittances in 2020 arose from a sudden shift from informal to formal channels, this increase should be disproportionately larger among municipalities closer to the US-Mexican border. Informal remittances were likely more prevalent in these areas before COVID-19 because the costs of sending and receiving them, relative to the same costs for formal remittances, were lower due to border proximity.

By examining the link between distance to a border crossing and an increase in formal remittances, we find evidence that a shift from informal to formal remittances during the first period of COVID-19 partially explains increases in formal remittances observed at the municipality level. First, we show suggestive evidence that growth in remittances was more substantial for municipalities closer to the nearest border crossing. We also provide descriptive evidence that Mexican migrants born in northern Mexico are more likely to live in US areas closer to the Mexican border than migrants born in southern Mexico. Thus, households from Mexican municipalities near a US border crossing are also close to their diaspora in the United States. The relevance of distance to the border during COVID-19 is also confirmed by the evolution of remittances by US state of origin: the increase in formal remittances observed in 2020 was significantly larger among border states including Texas, Arizona, and New Mexico.

It is nonetheless possible that the relationship between distance and the increase in remittances is not due to this shift but instead to other economic variables related to both distance and remittances. In particular, other relevant determinants of the heterogeneous changes in remittances across Mexican municipalities could be a lower prevalence of unemployment in US border states or higher exposure to local economic shocks in northern Mexican municipalities.[4] After controlling for these plausible alternatives in a difference-in-difference research design, we show that distance to the border still strongly correlates with remittances during the first year of COVID-19. Specifically, our empirical strategy compares changes in remittances during the pandemic across municipalities according to their distance to the nearest border crossing, while controlling for potentially confounding factors. We find that a 10 percent increase in travel time to the nearest border crossing reduced remittances by around 0.36 percent during our period of analysis. The same pattern holds for other geographic distance measures, and the results are robust to several robustness checks and placebo tests.

In addition, our research design enables us to rule out alternative hypotheses for the rise in formal remittances. For example, we do not find evidence that the large US fiscal stimulus package known as the CARES Act contributed to the observed growth in formal remittances at the municipal level. We show descriptive evidence—regarding the regional incidence of CARES, lower eligibility of remitting households,

[4]This can also be a proxy for the altruism motive. A growing literature has explored this motive during COVID-19 at the aggregated level. See Shimizutani and Yamada (2021); Chen et al. (2020).

and similar remittance patterns in other countries with diasporas not mainly in the United States—that does not support this hypothesis. To study this more rigorously, we evaluate the role of more generous unemployment insurance (UI) in 2020 by introducing measures of local exposure to US unemployment and UI replacement rates in our main specification. The inclusion of these controls does not affect the estimated link between remittances and distance during COVID-19. We also rule out altruism and several other hypotheses that could potentially link remittances and distance during this period.

We acknowledge that our empirical approach only identifies the link between distance and remittances at the municipal (or local) level. While we show patterns consistent with the hypothesis of a shift from informal to formal channels and robust to alternative explanations, we do not draw conclusions about net remittance inflows into Mexico after the onset of COVID-19. That is, we can't identify national trends in shifts from informal to formal remittances or determine the extent to which the national increase in observed remittances is driven by such a shift. Nonetheless, our results are academically interesting as we rigorously measure the change in methods as one mechanism behind the increase in remittances during the first year of the pandemic. These results are also policy relevant as they highlight the role of financial development among remitting households.

We focus on Mexico for three reasons. First, Mexico has rich data on subnational remittances and locations of Mexican migrants in the United States. We thus combine geographic variation and mobility restrictions to hypothesize about the relative use of formal and informal remittances, with controls for numerous confounding factors. Second, the United States and Mexico form the largest remittance corridor in the world (Ratha et al., 2016). Third, it has long been argued that their physical proximity facilitates informal remittances (Canales, 2008; Amuedo-Dorantes and Pozo, 2005). In fact, existing literature documents the convenience and lower cost for family members and friends who cross the US-Mexico border with money in their pockets (Beylier and Fortuné, 2022; Orraca-Romano, 2019).

This article contributes to the literature in several ways. First, it provides new evidence for the hypothesis that a change from informal to formal remittance channels helps to explain the rise in recorded remittances during the first year of COVID-19 (Kpodar et al., 2021). This is important for the design of crisis-era policies to support households that depend on remittances and may be more vulnerable than official remittance data suggest. Although our findings imply that Mexicans who lived near a border crossing witnessed a disproportionate increase in official inflows, the change in total remittances might have been smaller due to the dramatic increase in unemployment among migrants and to their lack of the financial literacy needed to use formal processes (Karakurum-Ozdemir et al., 2019; Ruiz-Durán, 2016; Stanley and Bhattacharya, 2008). Second, this paper adds to a large body of literature on informal remittances. This work has mostly relied on indirect methods to estimate the magnitude of the informal channel (see, e.g., Freund and Spatafora (2008)). Although our paper does not estimate the volume of informal remittances, it is the first to estimate the consequences of a shutdown of the informal channel on recorded remittances by

exploiting the location of migrants.

We also extend the literature concerning the connection between remittances and financial development (Aggarwal et al., 2011; Demirgüç-Kunt et al., 2011; Ambrosius and Cuecuecha, 2016; Fromentin, 2018; Uddin et al., 2022).[5] Using an event study approach, we find the elasticity between distance and transaction bank accounts became negative during the early COVID-19 period. This supports the hypothesis that a larger increase in formal remittances in areas near a border crossing consequently produced more bank accounts in those regions.

2 Remittances during COVID-19 and the role of distance

As a result of the implementation of COVID-19 lockdown measures in the United States, international and financial organizations predicted a significant decline in remittances to Mexico.[6] In fact, household surveys conducted by phone in Latin America show that on average, 64 percent of households that typically received remittances reported a decline in inflows from May through June 2020.[7] In the case of Mexico, this figure was 36.5 percent; 46 percent reported no changes, and only 17 percent reported an increase. Nevertheless, formal remittances to Mexico experienced record growth in every month of our period of analysis since the start of the pandemic even though unemployment among Mexican workers in the United States rocketed during the same period, as shown in panel A of Figure 1.[8]

Several hypotheses have attempted to explain this phenomenon, including the role of the large US fiscal stimulus package and the heightened incentives of migrants to help relatives in Mexico who were affected by the crisis. Others have proposed a sudden acceleration in the formalization of remittances during COVID-19 as a potential explanation. Mexico's proximity to its diaspora provides a good setting to examine the last hypothesis.

Without mobility restrictions, the cost of sending remittances informally would typically increase with the cost of travel and physical distance between senders and recipients. Therefore, one would expect Mexican municipalities closer to the US border to have greater networks of migrants living in southern US states and to receive a higher share of informal remittances. We test this assumption as follows. First, we show that before the pandemic there was a negative association between total (formal and informal) remittances and distance that was 50 percent higher than the negative association between formal remittances

[5] Moreover, this paper contributes to recent policy analyses that support the relevance of digital technologies and financial inclusion in the post-pandemic era (Pandey et al., 2020; Ozili, 2020; Mughal et al., 2021).

[6] World Bank (2020) predicted a 19.3 percent decline in remittances to Latin America and the Caribbean, where Mexico is the largest recipient. Private financial institutions also estimated significant declines. See, e.g., El Financiero (2020); El Economista (2020); Reuters (2020).

[7] See Table A1 in the Appendix.

[8] A steady increase in remittances to Mexico over the last 20 years has been documented, with some arguing that the gain between 1996 and 2003 emerged from a shift from informal to formal channels (Hernández-Coss, 2005).

and distance.[9] In this sense, municipalities closer to the border were more likely to receive a higher share of not only formal but also informal remittances than those farther away.

Second, we employ migration patterns of Mexicans from northern states (Fig. 2) to show they were more likely to migrate to southern US states between 2016 and 2019, whereas those from states in southern Mexico do not show a clear pattern.[10] However, geographic mobility declined dramatically in March 2020. As seen in panel B of Figure 1, the number of border crossings between Mexico and the United States dropped by 70 percent in April 2020 compared to April 2019. As a comparison, border crossings between 2007 and 2008 fell by only about five percent. The decline in mobility since March 2020—not only at the border but also within the United States and Mexico—implies that informal remittance channels suddenly shut down. As a result, municipalities closer to the US border that received remittances through informal networks would be disproportionately more likely to experience a shift from informal to formal channels, and recorded remittances would be more likely to increase. Descriptive patterns of remittance flows across municipalities since March 2020 align with the shift towards formal channels, as northern Mexican municipalities and southern US states experienced disproportionate increases in this type of remittance flow.[11]

Several articles have assessed geographic mobility and distance as important variables that affect the level of remittances (Frankel, 2011; Docquier et al., 2012; Lueth and Ruiz-Arranz, 2008). However, to disentangle the role of distance, it is necessary to use subnational or individual-level data, which enable us to control for unobservable factors that might affect cross-country regressions. Evidence that uses such data is scarce. Exceptions include Ferriani and Oddo (2019), who use data on official remittances from institutions or other authorized intermediaries (MTOs, banks, and post offices) at the provincial level in Italy. They find a strong positive correlation between remittance outflows to other countries and the cost of travel to such countries, which is heavily driven by distance. The authors interpret this finding as evidence of the importance of informal remittances when the distance between recipients and senders is shorter. Similarly, Simpson and Sparber (2020) use the US Current Population Survey (CPS) to estimate the determinants of household remittances abroad using household surveys, which include both channels. They find that a 10 percent increase in distance reduces the probability of remitting by 4.7 percentage points. In other words, these findings accord with the notion that distance increases the total costs of sending remittances but reduces the relative cost of sending them through formal channels relative to informal ones.

[9] See Table A2 in the Appendix. Before the pandemic, the elasticity of formal (official) remittances and distance was -0.50 and the elasticity between total (formal and informal) remittances and distance was -0.75. Although the difference between the two coefficients is not statistically significant at the conventional levels (p-value = 0.14), the magnitude of the difference is economically relevant.

[10] See Figure A2 for migration patterns during the 2002–2020 period.

[11] See Figures A3, A4, A5, and A6 in the Appendix.

3 Data

3.1 Data sources

Table A3 in the Appendix presents summary statistics of all variables used in the analysis.

A. Formal remittances: Data from formal remittances come from quarterly reports produced by Mexican authorities starting in 2013 that contain information about remittances received by each municipality during that time. They also provide information on the origin of remittances by US state. The reports are produced through declarations from credit institutions and legal entities that provide international transfer services and primarily reflect remittances received electronically. Since quarterly remittances at the municipal level tend to be noisy, we aggregate the data at the biannual level in our main analysis.

B. Registry of Mexican immigrants: To provide a comprehensive measure of the bilateral connection between Mexico and the United States, we use a confidential version of the Mexican government's *Matricula Consular de Alta Seguridad* (MCAS) database. The *matricula consular* is a document (card) that Mexican consulates issue to Mexican citizens who live in the United States. These data provide robust measurement of trends in Mexican immigration (both authorized and unauthorized) in the United States. (Allen et al., 2018). We restrict our analysis to employed Mexicans living in the United States whose ages range from 18 to 69 years. Thus, we observe around 3.1 million individuals from 2009 to 2013. For each, we observe their birth municipality in Mexico, the US county of residence, and demographic characteristics such as age, gender, education, and occupation. This subnational information lets us exploit variation in labor market patterns over time and control for state-level shocks and policies that may impact remittance flows.

C. Unemployment of Mexicans in the United States: To test the relationship between remittances and unemployment in the United States, we use unemployment data from the CPS, which comprise a monthly sample survey of 60,000 eligible households conducted by the US Census Bureau for the Bureau of Labor Statistics. We use quarterly (seasonally adjusted) unemployment rates of Hispanics of Mexican origin living in the United States at the county level for the 2013–2020 period. As we explain in the next section, we can estimate the exposure measure by merging this dataset with MCAS.

D. Municipality's proximity to the nearest border or airport: To measure closeness between each Mexican municipality and the United States, we implement the following approach. First, we obtained addresses for the 50 US–Mexico border crossings and Mexico's 60 international airports from the Ministry of Foreign Affairs. Second, we used the `HERE` geolocation API to calculate driving distances (in kilometers) and driving times (in minutes) from the center of every Mexican municipality to each access point.[12] Given that informal remittances are also conveyed through air travel, we used an alternative measure of distance from

[12] See https://developer.here.com/ and Weber and Péclat (2017) for details on the methods used.

each municipality to the nearest international airport. However, this measure does not accurately estimate the cost of informal remittances for each municipality because it is difficult to know the exact itinerary of returning migrants or *encomenderos*.

E. Economic activity: To control for the potential effect of an increase in remittances in places hit hardest by the pandemic early on (due to an increased altruism motive), we build a Bartik-style measure of local labor market shocks at the municipal level during our period of analysis. For each municipality we estimate shocks as the expected change in employment by multiplying employment shares in January 2020 by sector at the municipal level with changes in employment in these sectors at the national level between January and June 2020. This index can be interpreted as the predicted changes in employment at the municipal level due to industry composition in the local labor market and industry-specific national employment changes during the first year of the pandemic.[13]

F. Bank account data: Data from wage and transaction accounts at the municipal level come from Mexico's financial regulator—the Mexican National Banking and Securities Commission (CNBV). This public database provides monthly municipal-level data on the number of wage and transaction bank accounts. Transaction accounts are the most common bank accounts and can be opened (with minimum requirements) by any individual in Mexico. In contrast, wage accounts are usually opened by an employer and require the holder to be formally employed by a company associated with the bank. This distinction is relevant for our analysis since an increase in demand for bank accounts that arises from a formalization of remittances (i.e., electronic transfers) should relate specifically to transaction accounts. However, controlling for the number of wage accounts at the municipal level helps to mitigate the bias introduced by other confounding variables that potentially affect the number of transaction accounts and remittances (e.g., local shocks).

G. Household remittances: Data from the National Survey of Household Income and Expenditure (ENIGH) provide information about household income and expenditure sources, uses, and distributions, including income from remittances. ENIGH also details the occupational and sociodemographic characteristics of household members. We obtained access to the 2016, 2018, and 2020 surveys. Thus we can provide estimations at the household level of total remittances—that is, those received through both channels.

H. Wage replacement rates: To test the hypothesis that the CARES Act contributed to the observed growth in remittances across Mexican municipalities, we used microdata on the unemployment insurance (UI) system to estimate wage replacement rate distributions by US state from Ganong et al. (2020).

I. Additional controls: To control for potential confounding elements, we collected data from two additional sources. First, we obtained measures of COVID-19 incidence at the municipal level from the COVID-

[13]This Bartik-style instrument for labor demand shock at the local labor market level has been widely used in the literature. For a recent article, see Notowidigdo (2020).

19 control panel.[14] We aggregated the number of cases at the quarterly and municipal levels. Then, we used population size at the municipal level to estimate municipal COVID-19 incidence rates and included this rate as a control variable. Second, to account for trade across the border as a potential confounder, we also controlled for per capita exports at the municipal level using data from INEGI (Instituto Nacional de Estadística y Geografía).

3.2 A measure of exposure to US unemployment

Given that we did not know the labor market status of Mexican migrants by municipality of birth and US state of residence, we created a Bartik-style measure of exposure of each municipality m to US state s unemployment of Hispanics of Mexican origin:

$$UExp_{mt} = \sum_{s=1}^{S} M_{ms} \times U_{st} \tag{1}$$

where M_{ms} corresponds to the share of migrants from municipality m in each state s (fixed over time), and U_{st} indicates the state-level unemployment rate at time t. To estimate U_{st}, we use the unemployment of Hispanics of Mexican origin living in the United States.

4 Empirical Strategy

We estimate the following equation:

$$R_{mt} = \alpha + \beta_0 UExp_{mt} + C\text{-}19 \times (\beta_1 UExp_{mt} + \beta_2 Dist_m + \beta_3 Eco_{mt}) + \lambda_t + \delta_m + \gamma_{mt} + \epsilon_{mt} \tag{2}$$

where R_{mt} is the log of remittances received by municipality m in semester t, and C-19 is a dummy that takes the value of one for every period during 2020. $Dist_m$ is a measure of distance from municipality m to the nearest border crossing, and Eco_{mt} is our measure of local labor demand shocks in municipality m during our period of analysis, which controls for the potential increase in remittances in municipalities hit hardest by the pandemic (altruism mechanism) that might also be closer to the northern border.

Additionally, λ_t and δ_m are time and municipality fixed effects that control for shocks common to all municipalities and time-invariant characteristics of the municipalities, respectively.[15] All models also include municipality trends γ_{mt}. This is important given the increase in formal remittances, which is likely

[14] See https://www.coronavirus.gob.mx/datos/.

[15] In this model, remittances do not depend on distance and economic shocks before COVID-19, as these effects are absorbed by the fixed effects.

different across municipalities that have different degrees of dependence on informal inflows. Finally, to adjust our estimations by the importance of remittances to each municipality, all regressions are weighted using the average quarterly remittances at the municipal level.

Our main coefficient of interest is β_2, which captures the differential growth in remittances in 2020 by distance to the nearest border crossing. We expect this coefficient to be negative. The coefficient β_0 corresponds to the semi-elasticity of remittances to US employment rate exposure at the municipal level. Then, β_1 measures the change in this semi-elasticity with respect to the baseline β_0 in 2020. Finally, β_3 measures the association between remittance inflows and local economic conditions in Mexico during our period of analysis, thus capturing the altruism mechanism.

5 Results

Main Results. Table 1 presents the main results of our specification (2). As a measure of distance, we use the log of the number of hours needed to travel to the nearest border crossing. We find that the elasticity between distance and biannual remittances in 2020 is around -0.036 (column (1)). In other words, a 10 percent increase in distance to the nearest border crossing is associated with a 0.36 percent decline in remittances in 2020.

This result is stable after including control variables to account for alternative hypotheses. First, we find a negative relationship between US unemployment and biannual remittances before the pandemic. Although the estimated coefficient of this relationship is statistically insignificant, the magnitude of the coefficient is relevant: according to column (2), a 10 percentage point increase in unemployment exposure was associated with a 2.5 percent decrease in remittance inflows before the pandemic. This negative association became weaker in 2020, as shown by the interaction with the 2020 variable (C-19), which is positive but statistically insignificant. Thus, we do not reject the hypothesis that the total effect of US unemployment exposure during 2020 was zero. Second, to test the altruism channel, we control for local economic activity and show that this variable is not significantly related to remittances during 2020 (columns (3) and (4)). Moreover, its inclusion does not affect the coefficient associated with distance during the period of analysis.

We also evaluate the hypothesis that the shift from informal to formal remittances was greater in rural municipalities, since these locations were more likely to depend on informal remittances before the pandemic due to their lower levels of financial inclusion (Amuedo-Dorantes and Pozo, 2005). Table A4 in the Appendix reports the estimates of the main regression, splitting the sample between urban and rural municipalities. As expected, the role of distance was stronger among rural municipalities during this period.

Robustness Checks and Placebo Tests. Our main estimates are robust to using alternative units of physical distance (e.g., kilometers or travel time to a border crossing or an airport) and to a dummy defining northern municipalities (Table 2, panel A, columns (1) to (3)). Second, we also show that they are not driven by outliers (panel A, column (4)). Third, given the many people in northern Mexico who cross the border daily to work in the United States (Romano, 2015), one could argue that the disproportionate rise in remittances here stemmed from the fact that these workers stayed in the United States. Column (5) of panel A in Table 2 excludes from the sample municipalities where cross-border workers represent at least five percent of total workers. While this is also a proxy variable for distance, the coefficient associated with distance during this period remains negative and statistically significant.

We conduct two placebo tests to confirm the link between distance to the US border and remittances in 2020. These results are in panel B of Table 2 (columns (1) and (2)). First, among municipalities far enough from the border, the cost of sending remittances through informal channels should not vary substantially by distance, as would be the case among municipalities closer to the border. To test this hypothesis, we restrict our sample to municipalities more than 500 minutes away from the US-Mexico border. We separate them into two groups and define the half closer to the border as the northern municipalities. As we show in column (1) in panel B, the link between distance and remittances in 2020 became statistically insignificant. Second, we define the COVID period as if it had happened in 2019. If the role of distance was significant in 2019, it would indicate that the effect in 2020 was driven by preexisting trends. This is plausible given the slow shift from informal to formal remittance channels. As shown in column (2) in panel B, the coefficient associated with distance is statistically insignificant. This supports the hypothesis that the role of distance with regard to informal remittances changed in 2020.

Including Additional Control Variables. We first show that the coefficient associated with distance in 2020 did not change when controlling for the spread of COVID infections in Mexico (column (3), panel B). Second, since northern municipalities may have been more exposed to trade with the United States and hence hit harder by the economic downturn, we include an interaction term between the value of exports per capita from each Mexican municipality to the United States during 2014 and the first months of the pandemic, and we show that the main result remains robust (panel B, column (4)).

Ruling out the CARES Act as a Potential Mechanism. A popular hypothesis suggests that the massive US stimulus package implemented via the CARES Act contributed to the increase in remittances to Mexico. This is an unlikely channel for three reasons. First, if this hypothesis were true, one would expect the main remitting states—namely, those along the Mexican border—to have disproportionately benefited from the fiscal package. However, the two main direct transfers implemented by the United States since March 2020 do not seem to have benefited these areas more.[16] As Ganong et al. (2020) show, the uniform $600 Federal

[16] As the direct payments to taxpayers did not target specific regions, benefits should be roughly proportional to the population of each state. At the same time, Hispanic families, particularly those without US citizens, were less likely to receive stimulus payments (Holtzblatt and Karpman, 2020).

Pandemic Unemployment Compensation (FPUC) supplement increased replacement rates significantly on average, but these rates were not consistently higher among border states.[17]

Second, our main specification includes exposure to unemployment in the United States as an explanatory variable. If an increase in unemployment led to higher liquidity due to the generosity of FPUC, it may have led to higher remittances. However, as shown in Table 1, we estimate that the relationship between US unemployment and remittances was weaker in 2020 (statistically not different from zero). Third, formal remittances have also increased in developing countries with diasporas concentrated in developed countries other than the United States.[18] To further examine the role of the CARES Act, we construct a variable of exposure to the increase in wage replacement rates due to FPUC[19] and add it to the main equation (2) interacted with the 2020 period indicator. Column (6) of panel B in Table 2 shows that the coefficient associated with exposure to FPUC does not affect the coefficient associated with distance during this period.[20]

6 Exploring the Financial Inclusion Mechanism

The increase observed in formal remittances could have been driven by a decline in informal remittances in favor of electronic transfers through the banking system. If this was the case, recipient families in Mexico had incentives to open transaction bank accounts so that relatives in the United States could send these transfers.[21] To explore this channel, we study the relationship between transaction bank accounts and remittances at the municipal level to learn how this relationship changed during COVID-19 and if it differed for municipalities closer to the northern border.

Specifically, we estimate the following event study:

$$TransBankAcc_{mt} = \sum_{\tau=-3}^{-1} \delta\tau Dist_{m\tau} + \sum_{\tau=1}^{12} \delta\tau Dist_{m\tau} + \beta_1 Dist_{m,t} \times \mathbf{1}_{[\tau>-3]} + \beta_2 WageBankAcc_{mt} + \beta_3 Eco_{mt} + \lambda_t + \alpha_m + \gamma_{mt} \quad (3)$$

where $TransBankAcc_{mt}$ is the log of the stock of transaction bank accounts in municipality m in month

[17] See Figure A7 in the Appendix.

[18] For example, as seen in Figure A1 in the Appendix, Bangladesh, Pakistan, and Kosovo also experienced large increases in official remittances, and most of their emigrants live in the Middle East or Europe.

[19] We constructed the variable $CARES_{mt} = \sum_{s=1}^{S} M_{ms} \times RR_{st}$, where RR_{st} is the wage replacement rate of the unemployment insurance scheme in state s in period t and M_{ms} is the share of migrants from municipality m in each state s. Fig. A7 in the Appendix shows the variation in this variable across US states.

[20] Results also indicate that the estimated coefficient from the interaction between exposure to FPUC and the indicator for the 2020 period is not statistically significant.

[21] A survey conducted by the Global Findex at the World Bank in Mexico shows that 45 percent of respondents reported receiving electronic remittances through a bank (or formal financial institution) account or in a mobile money account for the first time during the pandemic. This was in addition to 26 percent who reported receiving remittances the same way but not for the first time. Less than 12 percent reported receiving remittances in person (See Fig. A8 in Appendix).

t; $WageBankAacc_{mt}$ is the log of wage bank accounts in municipality m in month t; and the rest of the variables are defined as in Equation (1). All models also include municipality fixed effects, time fixed effects, and linear municipality trends. The event study window is defined relative to December 2019 ($\tau = 0$). The main coefficient of interest is δ_τ, which captures the relationship between transaction bank accounts and distance relative to December 2019.

Results from Specification (3) are presented in Fig. 3. First, we find no relationship between transaction bank accounts and distance to the border before February 2020, precisely when the first restrictive travel policies were implemented.[22] After that period, we find that the elasticity between distance to the closer border crossing and bank accounts was negative. This indicates that municipalities closer to the border increased their bank accounts during COVID-19 with respect to municipalities farther away from the border. This is consistent with the idea that recipient households at the border opened bank accounts at the outset of COVID-19 to receive remittances through formal channels that previously might have been sent via informal ones (such as through a border crossing).

7 Discussion

Remittances are a vital source of income for developing countries. Remittance flows to low- and middle-income countries are larger than foreign direct investment flows and overseas development assistance combined. The economic recession caused by COVID-19 was expected to reduce remittance inflows. Indeed, households reported a decline in remittance inflows from May through June 2020. Yet, formal remittances to several developing countries—including Mexico—increased substantially during the first months of the pandemic.

This article produces evidence to explain this paradox. It contends that a sudden acceleration in the formalization of remittances partly explains the increase in recorded remittances observed in several developing countries during the first period of the COVID-19 pandemic. This stemmed from a prohibitive increase in the costs of sending informal remittances due to mobility restrictions imposed to control contagion. We use subnational data from a developing country, Mexico, to show that the increase in formal remittances was driven by municipalities closer to a US border crossing that had been more likely to receive informal remittances before March 2020. Consistent with this hypothesis, these areas also experienced a disproportionate increase in transaction bank accounts during this period. These accounts were probably opened in order to receive formal remittances via electronic transfer that would have come through informal channels prior to the pandemic.

[22] On January 31, 2020, the White House 2019 Novel Coronavirus Task Force announced the implementation of new travel policies effective on February 2, 2020. For a detailed timeline of the different events since December 2019, see the CDC museum timeline in the following website.

Our findings are robust to the municipality exposure to the CARES Act in the U.S. as well as possible increases in altruism in response to economic declines at the municipality level. The results suggest that formal remittances to municipalities onset the of COVID-19 were not affected by either factor on average. We encourage additional research to examine the importance of various sources of change in remittances at the national level.

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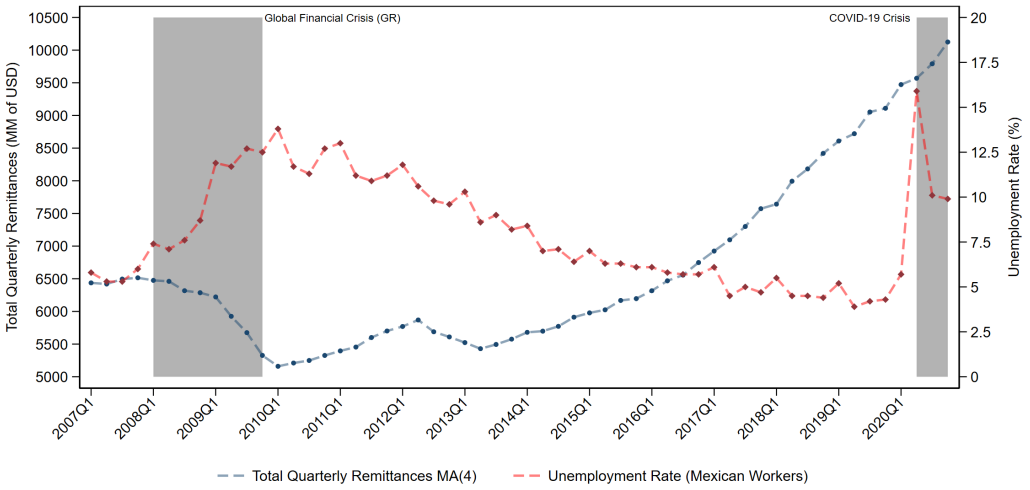
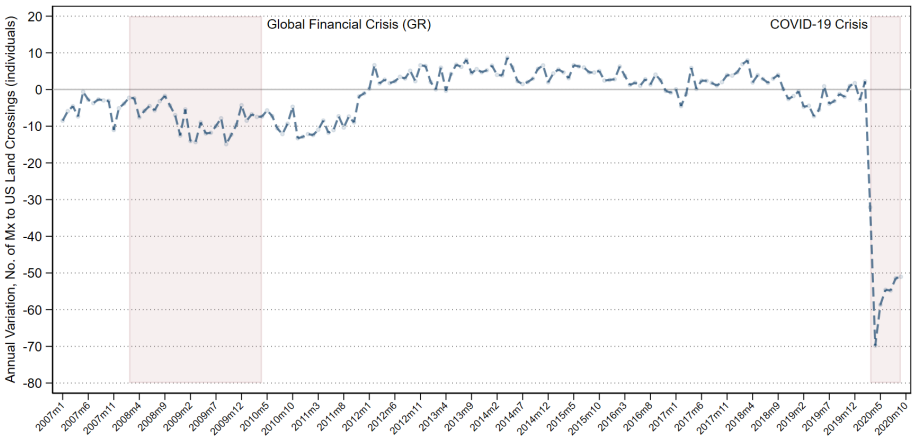
Exhibits

Figure 1: **Remittance inflows and land crossings before and during the pandemic**

Panel A. Remittances to Mexico and unemployment of Mexican workers in the US.



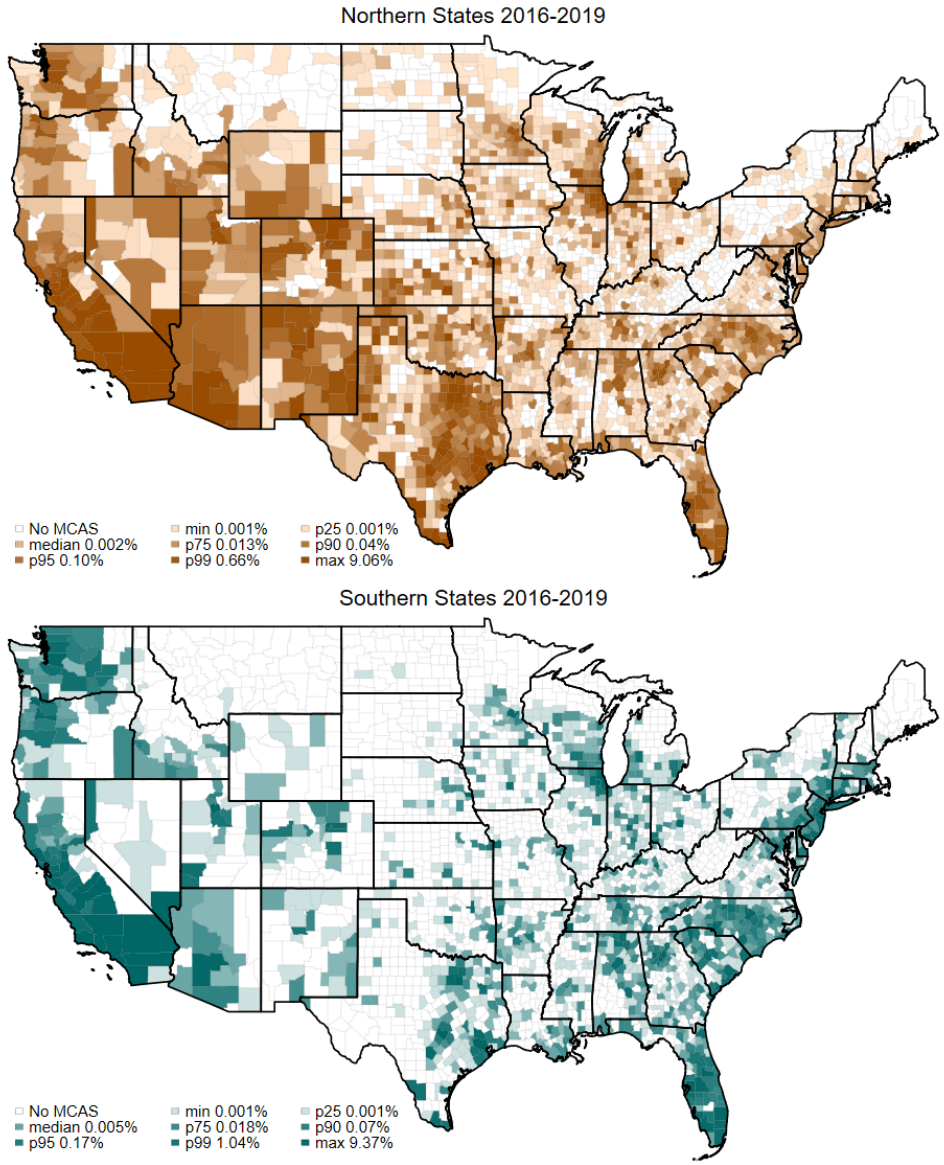
Panel B. Annual variation in land crossings from Mexico to the US.



Source: Data on unemployment come from the Labor Force Statistics from the US Current Population Survey and remittance data are from reports by Mexican authorities. Border Crossing data are from the Bureau of Transportation Statistics.

Notes: Panel A shows the four-period moving average (one year) of quarterly remittances from the United States to Mexico in current dollars (axis 1) and the unemployment rate of Mexican workers 16 years and older living in the United States (axis 2). Panel B shows the variation in land crossings from Mexico to the United States compared to the same month of the previous year.

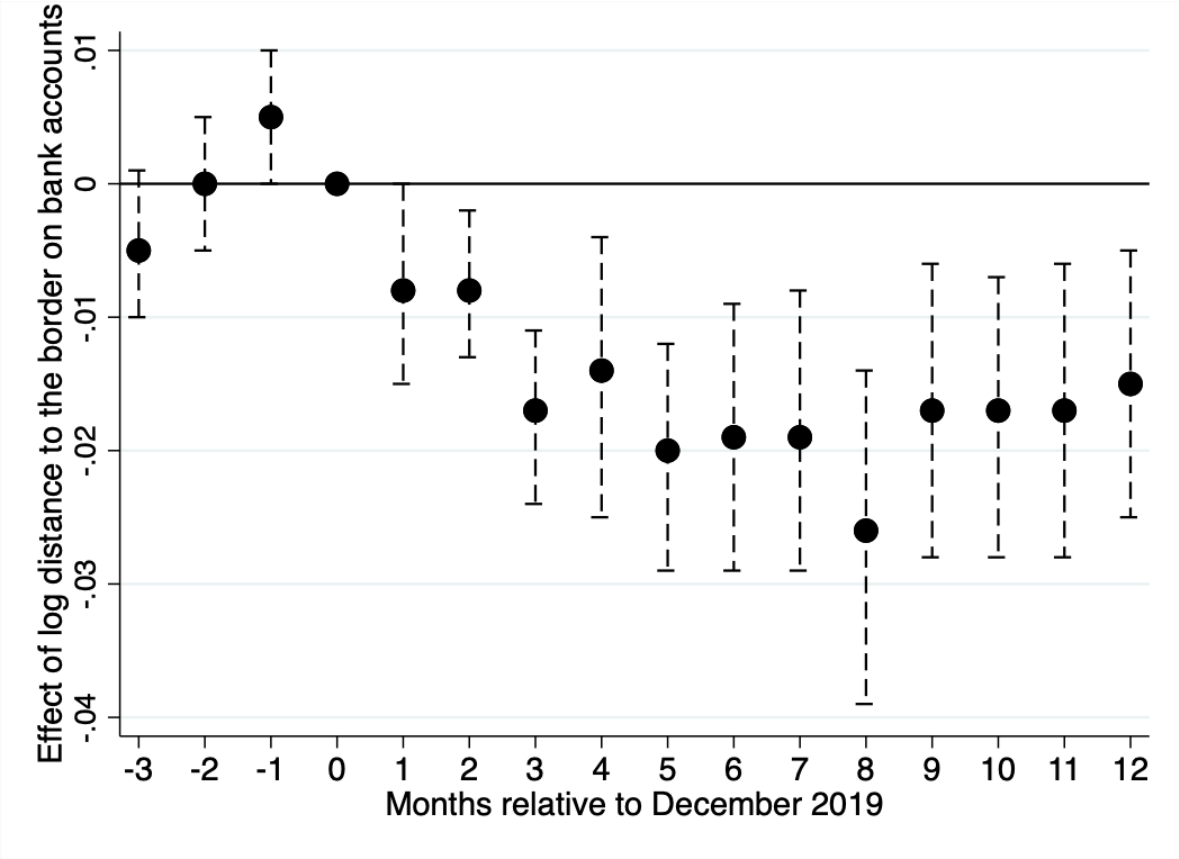
Figure 2: **Migration patterns of Mexican citizens to the United States by region of origin (North or South) during the 2016–2019 period**



Source: Data are from the Mexican government's registry of Mexican immigrants and correspond to the stock of migrants with a valid *matricula consular* registry from 2016 to 2019.

Notes: This figure shows the change of migration inflows from Mexico to the United States by state of origin in Mexico. The northern border states in Mexico are Baja California, Chihuahua, Coahuila, Sonora, Nuevo Leon, and Tamaulipas. The southern states in Mexico are Quintana Roo, Yucatan, Chiapas, Oaxaca, Tabasco, and Campeche.

Figure 3: **Effects of distance to the border on transaction bank accounts**



Notes: This figure shows the correlation between the log of the number of transaction bank accounts (TBA) and time dummies multiplied by the log of distance from each municipality to the border. The point estimate is interpreted as the additional monthly increase in TBA for each increase of 100 percent in distance to the border, relative to December 2019, by month. Regression controls for wage accounts and local economic activity, and includes municipality-by-month fixed effects and municipality linear trends as well. The lines extending from the point estimates show the 95 percent confidence intervals with standard errors clustered at the municipal level. Municipalities where transaction accounts equal zero at any point between 2013 and 2020 are omitted from the estimation sample.

Table 1: **Remittances in times of COVID**
Dependent variable: Biannual remittances (log)

	(1)	(2)	(3)	(4)
C-19 × Distance (in log (hours))	-0.036***	-0.035***	-0.036***	-0.035***
	(0.008)	(0.009)	(0.008)	(0.009)
Unemployment exposure index (UEI)		-0.250		-0.249
		(0.238)		(0.238)
C-19 × UEI		0.022		0.019
		(0.310)		(0.310)
C-19 × Local economic activity			0.012	0.014
			(0.156)	(0.155)
Constant	3.240***	3.270***	3.239***	3.269***
	(0.002)	(0.025)	(0.003)	(0.025)
Observations	25,600	25,600	25,600	25,600
p-value H0: UEI + C-19 × UEI = 0		0.428		0.424
Mean dependent variable	3.229	3.229	3.229	3.229

Notes: Table 1 shows the associations between biannual remittances and three factors that can explain changes in remittances during the pandemic. Column (1) presents the *base model*, which consists of the association between remittances and distance of each municipality to the US-Mexico border in hours (in log). Column (2) presents results from column (1) after controlling for a measure of unemployment exposure of Mexicans in the United States before and during COVID. The unemployment exposure index (UEI) was estimated using unemployment of Mexicans adjusted by the share of Mexicans living in each state in the United States. Column (3) shows results of the base model including a control for changes in local economic activity during COVID. Finally, column (4) summarizes estimated coefficients of the full model, which includes the three factors simultaneously. C-19 is a dummy indicator for 2020. The estimation sample includes all municipalities and all semesters during the 2013–2020 period. All models include municipality and time-quarter fixed effects, and municipality trends. Standard errors are clustered at the municipal level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2: **Robustness Checks**
Dependent variable: Biannual remittances (log)

Panel A. USING ALTERNATIVE MEASURES OF DISTANCE AND SAMPLES					
	All Observations			Restricted sample	
	Distance		Min. distance to border/airport	Excluding	
	in log(km)	<350km	in log(hr)	1% tails of rem. change	>5% HH relat. working in US
	(1)	(2)	(3)	(4)	(5)
C-19 × Distance	-0.029***	0.079**	-0.032***	-0.033***	-0.025***
	(0.007)	(0.039)	(0.011)	(0.009)	(0.010)
Observations	25600	25600	25600	21000	25409

Panel B. PLACEBO TESTS AND INCLUSION OF ADDITIONAL CONTROLS					
	Changing North-South Definition	Defining COVID = 2019	COVID incidence control	Exports control	CARES channel
	(1)	(2)	(3)	(4)	(5)
C-19 × Distance	-0.014	-0.001	-0.037***	-0.033***	-0.034***
	(0.016)	(0.005)	(0.008)	(0.008)	(0.009)
C-19 × pc exports (log)				0.004	
				(0.003)	
C-19 × CARES exposure					0.045
					(0.137)
Observations	22354	25600	25600	25600	25600

Notes: Table 2 shows robustness checks of the main results. *Panel A* presents results using alternative measures of distance between the municipality and the US-Mexico border. Column (1) uses a measure of distance in log(km) and column (2) presents results using a north municipality indicator that takes the value of one if the distance between the municipality and the US-Mexico border is less than 350 km. Column (3) uses the minimum distance to the border or airport measured in log(hr). Columns (4) and (5) present results for restricted samples using log(hr) as in the main model. Column (4) drops observations below or above percentiles one and 99 of the change in biannual remittances distribution and column (5) restricts the sample to municipalities in which less than five percent of households have relatives living in the United States. *Panel B* summarizes results of placebo tests and after the inclusion of additional controls in the main model that might confound the main effects. In column (1), we restrict the sample to non-north municipalities (distance $\geq$ 350 km) and define a north municipality dummy that takes a value of one if its distance is below the median within the restricted sample. Column (2) in panel B defines the COVID dummy = 1 for the year 2019 instead of 2020. Column (3) controls for COVID-19 incidence rates at the municipal level measured as the number of cases per 100,000 inhabitants. Columns (4) and (5) include the value of per capita (pc) exports (in log) and the exposure to the CARES index at the municipal level as controls, respectively. C-19 is a dummy indicator for 2020. All models include municipality and time-quarter fixed effects, and municipality trends, and are weighted by average quarterly remittances at the municipal level. Standard errors are clustered at the municipal level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix

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Table A1: **Remittance inflows in 2020: household surveys vs. official estimates**

	Recipient households				Official remittances (US$)	
	% did not receive or experienced a decline		% received the usual amount		y-o-y change	
	May-June (1)	July-August (2)	May-June (3)	July-August (4)	Q2 (5)	Q3 (6)
Bolivia	79.6	48.4	15.9	8.7	-48.0	-5.7
Colombia	74.0	59.2	11.0	27.4	-22.4	6.1
Costa Rica	58.6	52.4	22.6	23.5	-8.5	
Dominican Republic	45.5	56.7	42.2	9.2	3.4	29.4
Ecuador	69.3	51.5	22.2	25.9	-16.3	
El Salvador	67.4	61.1	26.1	22.2	-16.4	17.7
Guatemala	74.1	30.6	22.6	23.4	-8.5	12.7
Honduras	61.2	52.8	29.8	39.5	-9.8	
Mexico	36.5	24.4	46.2	19.2	4.1	9.1
Paraguay	80.0	48.5	17.8	19.2	-35.2	-0.6
Peru	62.5	65.9	29.6	24.6	-33.5	
Average	**64.4**	**50.2**	**26.0**	**22.1**	**-17.4**	**9.8**

Source: World Bank High Frequency Surveys (WBHFS), available at: https://www.worldbank.org/en/topic/poverty/brief/high-frequency-monitoring-surveys, and formal remittance inflows from the Central Bank of Mexico.
Notes: Columns (1) and (3) report the share of recipient households that reported a decline or the same amount of remittances since the beginning of lockdown measures in Mexico (between May and June 2020), with respect to the last 12 months using WBHFS data. Columns (2) and (4) report the share of recipient households that reported a decline or the same amount of remittances in July–August 2020 with respect to May–June 2020 using WBHFS data. Recipient households are those that received remittances between May–June 2019 and May–June 2020. Columns (5) and (6) present annual changes on formal remittances inflows in Q2 and Q3, respectively, using official data from Central Bank of Mexico.

Table A2: **Relevance of informal remittances before COVID**

	Official remittances (log)		Total remittances (log)	
	(1)	(2)	(3)	(4)
Distance (log(hr))	-0.530**	-0.500*	-0.738*	-0.754*
	(0.268)	(0.270)	(0.397)	(0.406)
C-19 x Distance (log (hr))	-0.036***	-0.027**	-0.011	0.281
	(0.008)	(0.012)	(0.184)	(0.205)
Constant	4.482***	4.524***	39.052***	55.679***
	(0.630)	(0.640)	(5.855)	(7.627)
Observations	25600	25600	225963	216048

Notes: Table shows the associations between the magnitude of remittances, distance to the border, and other relevant variables. Columns (1)–(2) are regressions at the municipal level with data on official biannual (formal) remittances for the period 2013–2020 as dependent variable. Results in column (1) are from a model that includes distance (log(hr)) and interaction between distance and C-19 as an indicator for the pandemic period (year 2020). Results in column (2) are from a model similar to the one in column (1) and additional controls such as unemployment exposure index, measure of local economic activity, and the interaction between these two variables and the C-19 indicator. These two models include municipality and year fixed effects and linear municipality trends. Standard errors are clustered at the municipal level. Columns (3)–(4) show the results of regressions at the household level using annual data from ENIGH 2016, 2018, and 2020. Results in column (3) are from a model that includes distance (log(hr)), interaction between distance and C-19 as an indicator for the pandemic period (year 2020), and controls at the household level (average years of education, per capita income, and share of household members employed). Results in column (4) are from a model similar to the one in column (3) and additional controls such as unemployment exposure index, measure of local economic activity, and the interaction between these two variables and the C-19 indicator. These two models include year and state fixed effects and standard errors are clustered at the state-urban/rural level.The sample size differs because columns (1)–(2) use biannual values of municipal-level variables for 2013-20, and columns (3)–(4) use yearly values at the household level for three years. Sample size differs between columns (3)–(4) because data for the local economic activity variable is not available for some municipalities.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3: **Summary Statistics (estimation sample)**

	Mean	SD	Min	Max	Observations
Panel A. Outcomes					
Formal remittances (Million $US)	6.10	16.65	0.00	321.10	38,928
Panel B. Control variables					
Unemployment exposure index	0.13	0.05	0.02	0.46	38,928
Matricula Consular Registries (N)	1,215.12	2,634.97	1.00	62,790.00	38,928
Distance to border					
In hr	17.33	6.99	0.07	36.04	38,896
In km	1,100.58	450.91	0.85	2,358.19	38,896
Local economic activity	0.01	0.05	-0.45	1.22	30,457
COVID incidence (cases per 100,000)	17.39	90.59	0.00	2,873.45	39,140
Exports per capita ($US)	10,869.82	459,440.60	0.00	2.27e+07	39,140
CARES exposure	1.88	0.09	1.39	2.50	38,928
Panel C. Household variables					
HH receives remittances	0.06	0.24	0.00	1.00	226,615
Remittance inflow ($US, monthly)	8.90	65.12	0.00	5,648.42	226,615
Avg. years of education (N)	8.68	4.39	0.00	23.00	226,615
Share of employed members (%)	0.77	0.35	0.00	1.00	226,615
Per capita income ($US, monthly)	448.23	1,031.27	0.00	166,074.30	226,615

Source: Remittance data at the municipal level come from reports produced by Mexican authorities. Unemployment exposure index was estimated using unemployment of Mexicans in the United States adjusted by the share of Mexicans living in each state with data from the CPS and the registry of Mexican immigrants, *matricula consular*. Estimates of driving distances are calculated with data on the location of border crossings provided by the Mexican Ministry of Foreign Affairs and the HERE geolocation API. Local economic activity is a Bartik-style measure of local labor market shocks at the municipal level based on the expected change in employment during COVID-19. COVID incidence is obtained from the COVID-19 control panel published by Mexican authorities. Exports per capita are obtained from INEGI. CARES exposure is the UI wage replacement rate by US state from Ganong et al. (2020). All *panel* C variables are calculated with the Encuesta Nacional de Ingreso y Gasto de los Hogares (ENIGH).

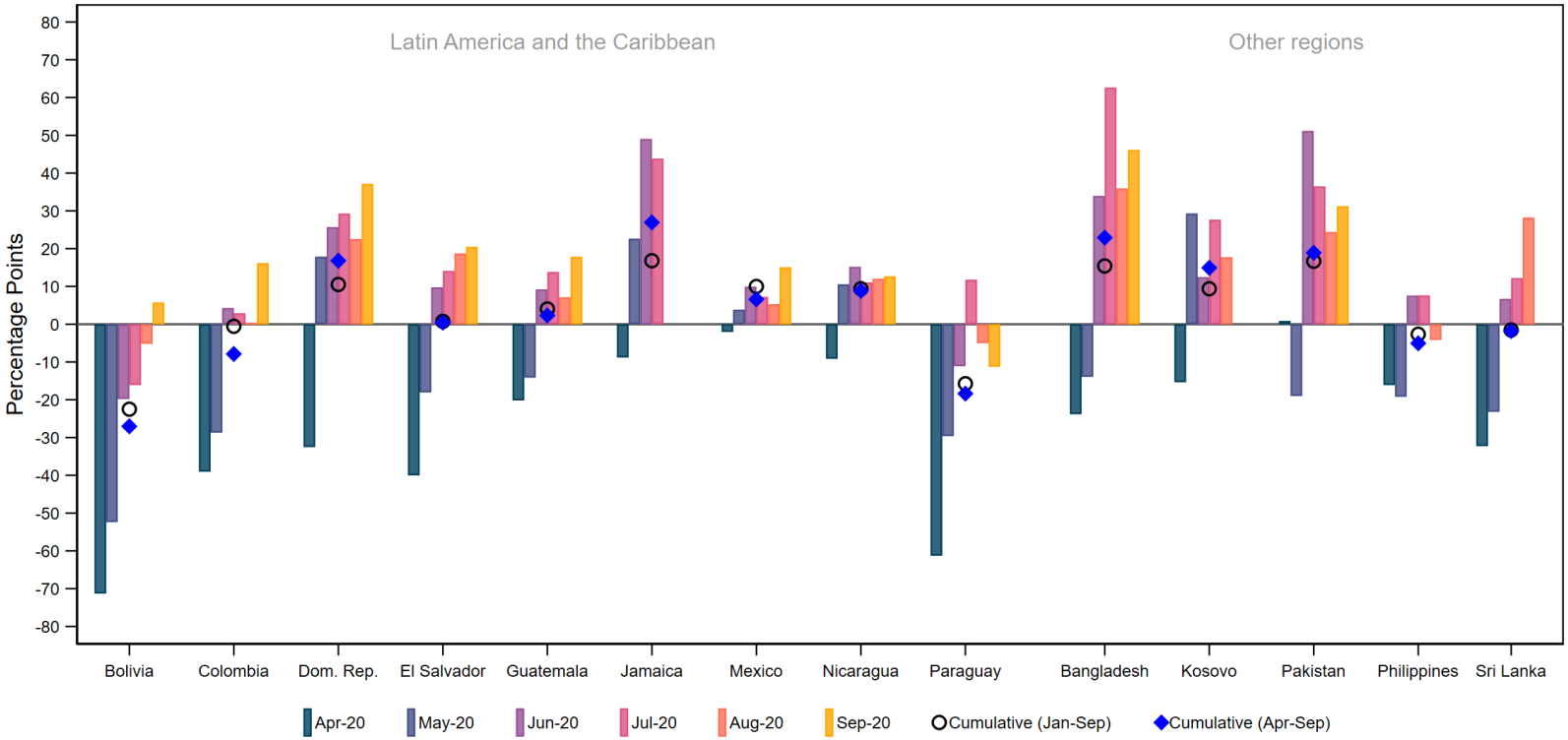
***Notes*:** Table shows descriptive statistics of the main variables under analysis. *Panels* A and B show biannual values of municipal-level variables for the period 2013–2020, and *panel* C shows yearly values at the household level for 2016, 2018, and 2020; this explains the difference in sample size between *panel* C and the previous two. All monetary variables are expressed in US dollars.

Table A4: **Remittances in times of COVID**
Separating by Urban-Rural using Population Density
Dependent variable: Biannual remittances (log)

	(1) **Rural**	(2) **Urban**
C-19 × Distance (in log (hours))	-0.0560***	-0.0286***
	(0.0217)	(0.0104)
Unemployment exposure index	-0.7051**	-0.0493
	(0.3314)	(0.3161)
C-19 × Unemployment exposure index	0.4984	-0.1872
	(0.4886)	(0.3811)
C-19 × Local economic activity	-0.2297	0.3949
	(0.1651)	(0.2485)
Constant	2.5380***	3.5532***
	(0.0352)	(0.0337)
Observations	12812	12788

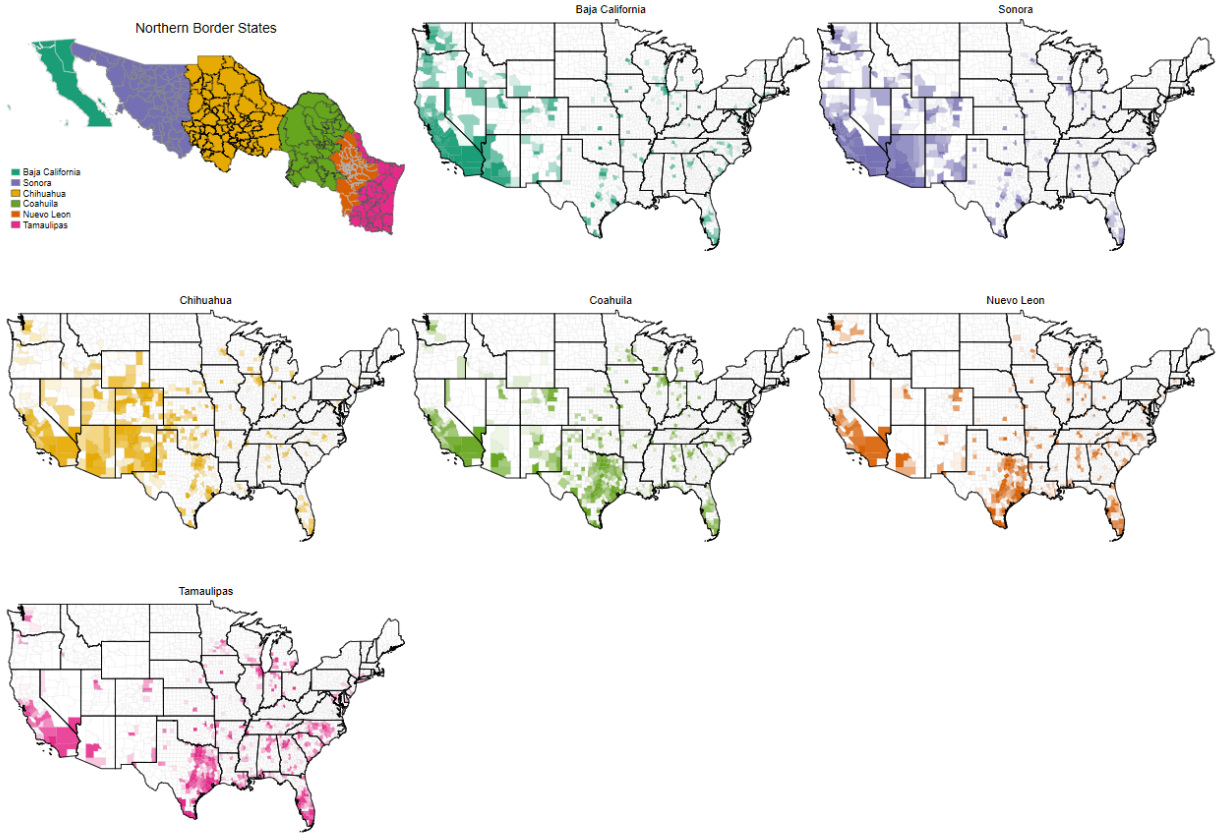
Notes: Table shows the associations between (formal) remittances and three factors that can explain changes during the pandemic. Columns (1) and (2) show the estimates for rural and urban municipalities, respectively, where rural municipalities are defined as those with levels of population density below the median. Unemployment exposure index was estimated using unemployment of Mexicans adjusted by the share of Mexicans living in each state in the United States. C-19 is a dummy indicator for 2020. Estimation sample includes all municipalities and all semesters with available data. Models include municipality and time-quarter fixed effects and municipality trends. Standard errors are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1, + p=0.101

Figure A1: **Formal remittance inflows, 2019–2020 growth**



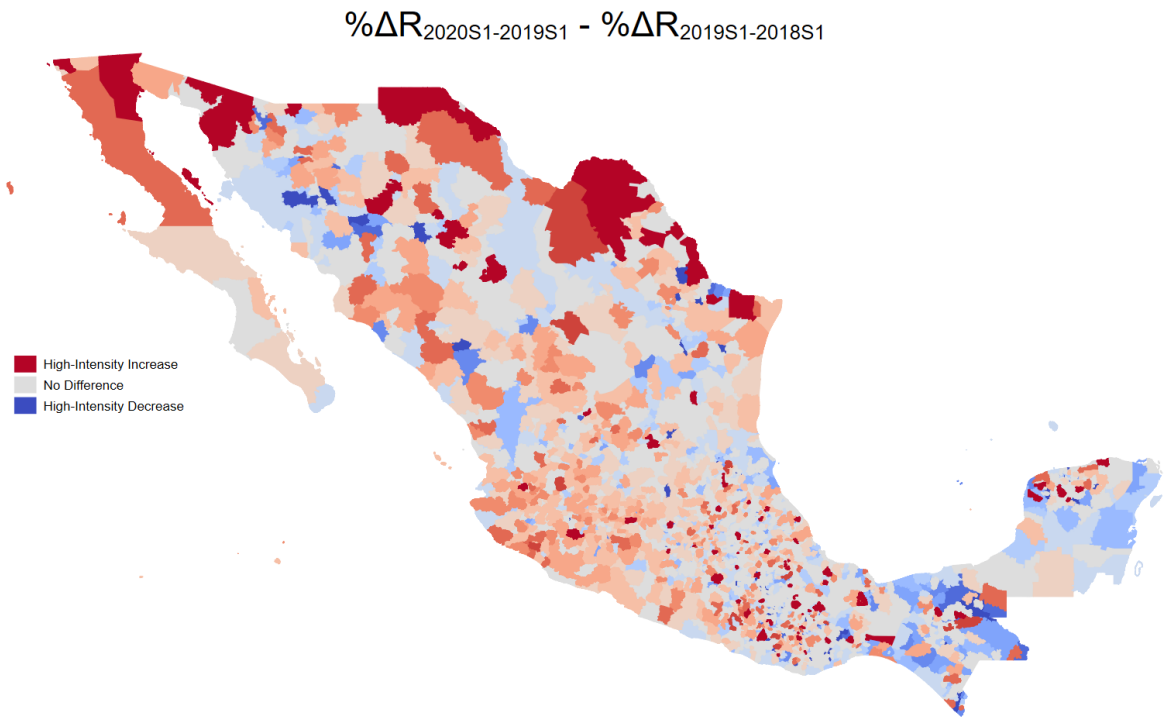
Notes: Each bar in the figure shows monthly growth in total formal remittance inflows during the year 2020, with respect to the same month in the year 2019. The dots show total formal remittance inflow growth in January through September 2020 (April through September 2020), with respect to the same period in 2019. Data were obtained from reports of the central bank of each country.

Figure A2: **Migration Patterns of Mexican Citizens from Northern States to the United States 2002–2020**



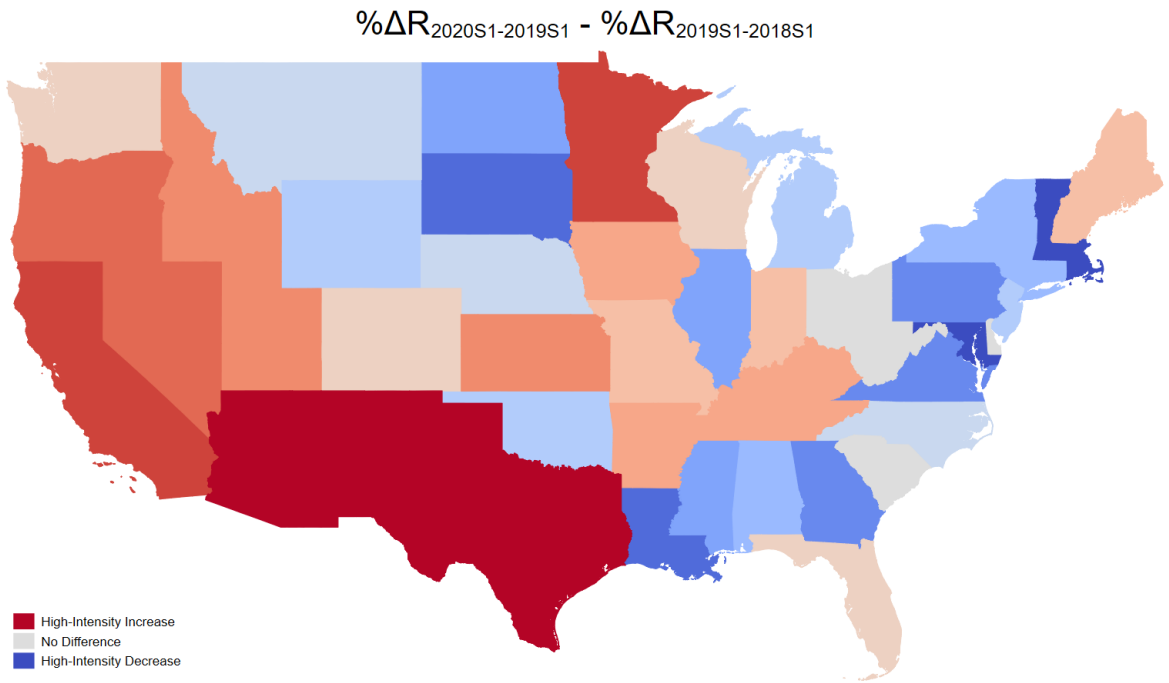
Notes: This figure shows the change of migration inflows from Mexico to the United States by state of origin (northern border) in Mexico. The northern border states in Mexico are Baja California, Chihuahua, Coahuila, Sonora, Nuevo Leon, and Tamaulipas. The data correspond to all matricula consular records from 2002 to 2020.

Figure A3: **Changes in formal remittance trends at the municipal level**



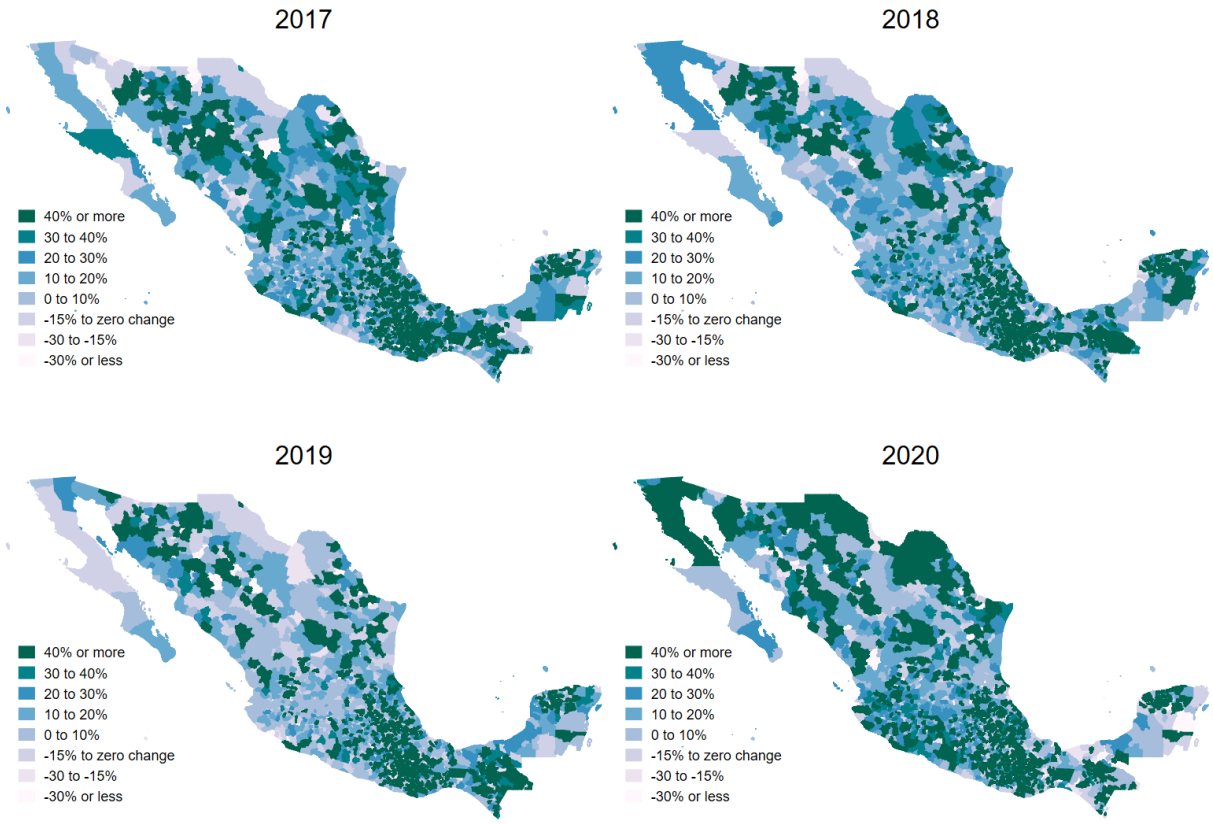
Notes: This figure shows the differences in formal remittance growth received by each municipality in Mexico during the first semester of 2020 relative to the growth in formal remittances during the previous period. Each difference at the municipal level has been estimated by subtracting the percentage change in total formal remittances received during the first semester of 2018 and 2019 from the percentage change in total formal remittances received during the first semester of 2020 and 2019.

Figure A4: **Changes in State-Level Formal Remittances Compared to the Previous Trend**



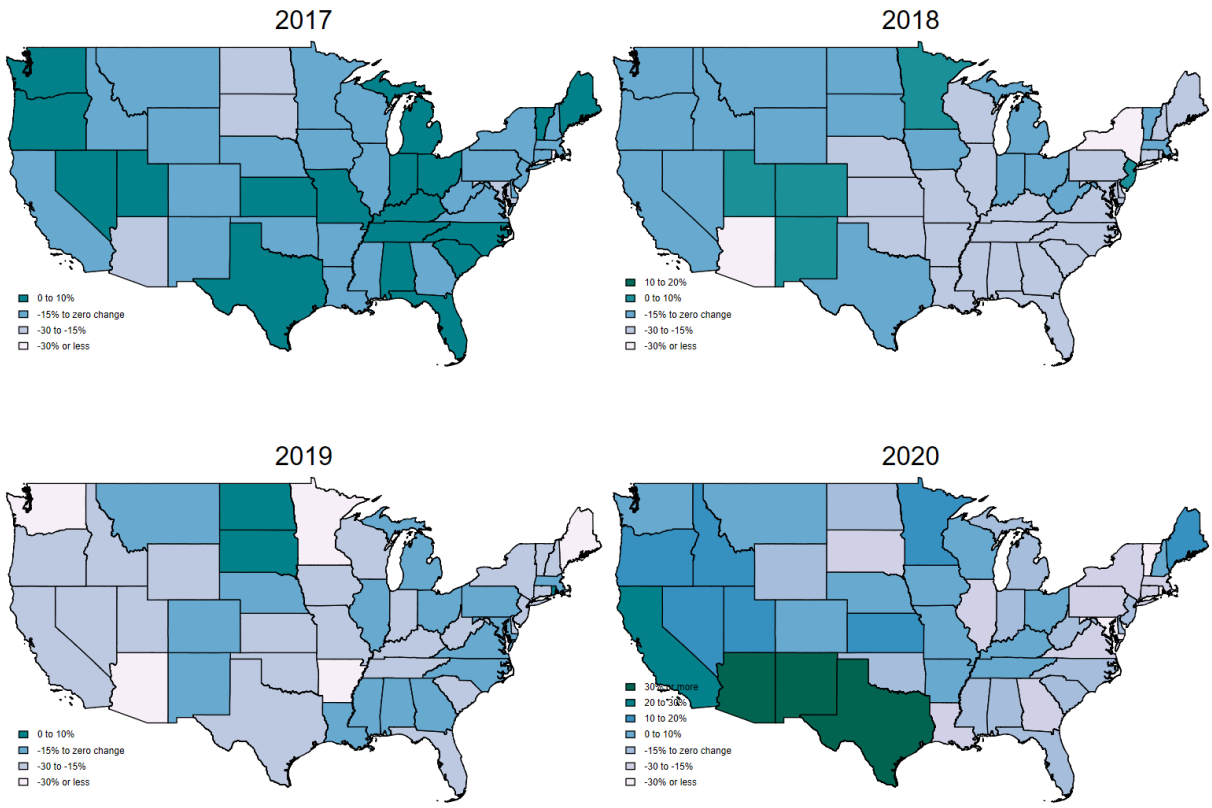
Notes: This figure shows the changes in formal remittances sent from each state in the United States to Mexico during the first semester of 2020 relative to the previous trend. To do so, it subtracts the state-level percentage change in total formal remittances sent during the first semester of 2018 and 2019 from the percentage change in total formal remittances sent during the first semester of 2020 and 2019. Estimations indicate that US states with the largest differences in trends are the closest to the US-Mexico border.

Figure A5: **Annual Changes in Formal Remittances Received by Year at the Municipal Level**



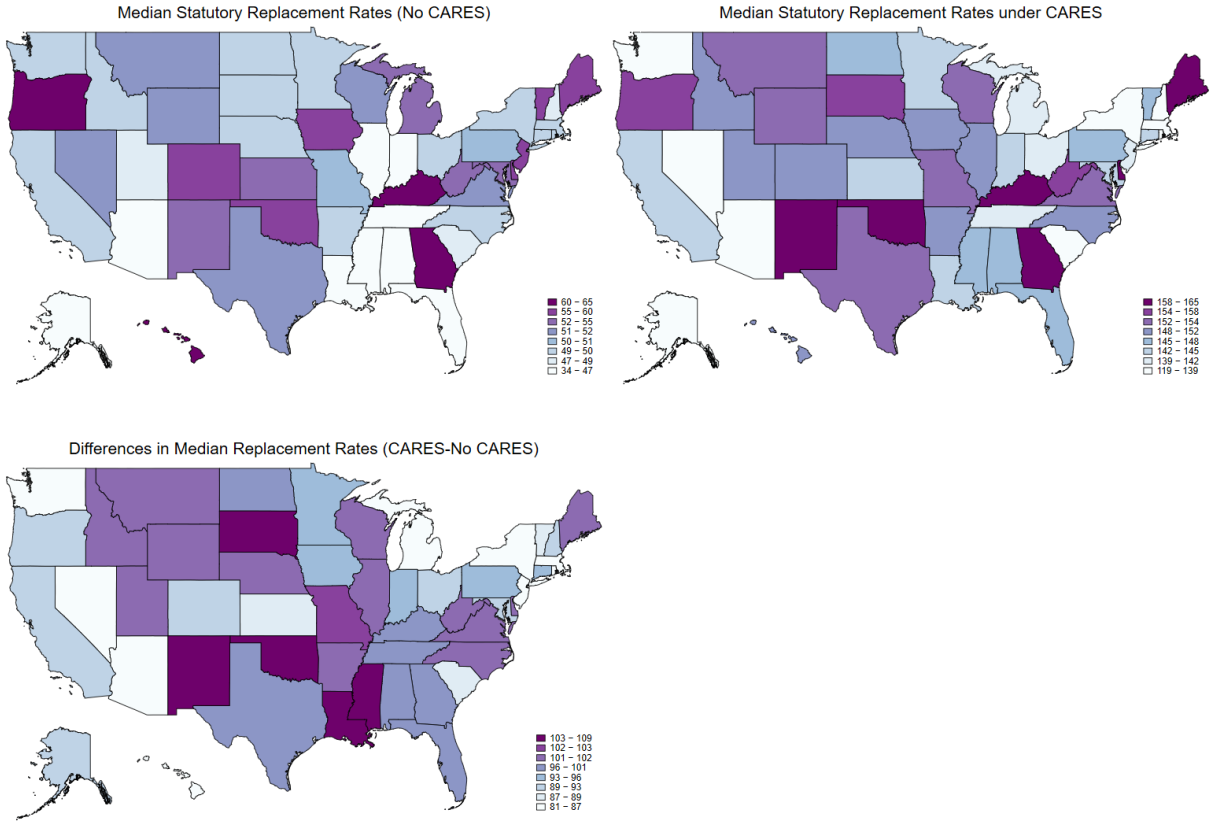
Notes: This figure shows the annual percentage change in formal remittances received for each municipality in Mexico, by year. For example, for 2020 we compare total formal remittances received in each municipality during the first semester of 2019 and during the first semester of 2020.

Figure A6: **Annual Changes in State-Level Formal Remittances Sent by Year**



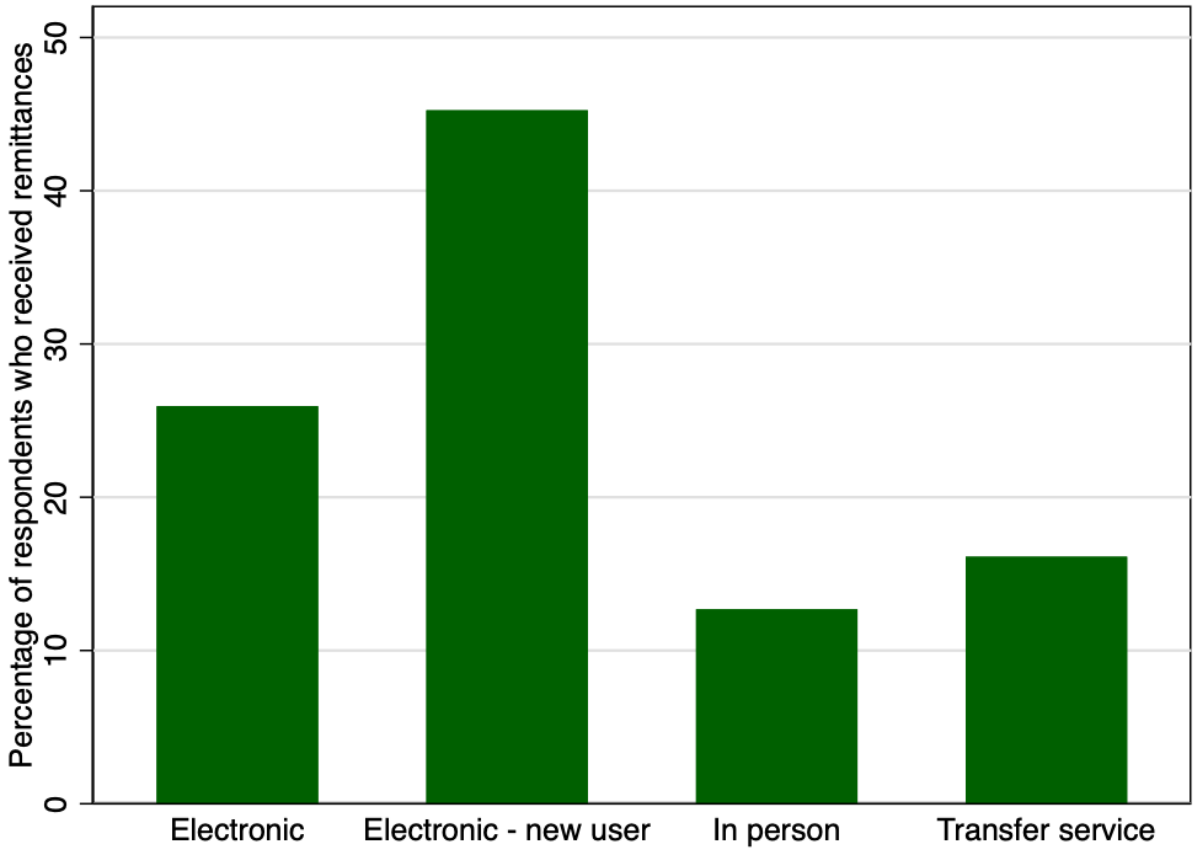
Notes: This figure shows the annual percentage change in formal remittances sent by each state in the United States, by year. For example, for 2020 we compare total formal remittances sent by each state during the first semester of 2019 and during the first semester of 2020.

Figure A7: **Median Statutory Unemployment Replacement Rates by State with and without CARES Act**



Notes: This figure maps the median statutory replacement rate for April through July 2020 with and without the Federal Pandemic Unemployment Compensation (FPUC) supplement implemented by the CARES Act. The data were obtained from Ganong et al. (2020).

Figure A8: Distribution of remittance channels in 2020



Source: Global Findex database, 2020.
Notes: This figure shows the distribution of remittance channels in Mexico for 2020, as reported by households. Electronic channels include receiving money in an account at a bank, another type of formal financial institution, or in a mobile money account.