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House Prices and International Remittances: Evidence from Colombia

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Abstract

This paper empirically examines the effects of international remittances on local house prices. International remittances are one of the main drivers of capital inflows in emerging economies. We consider the salient case of Colombia. In the last two decades, remittances have represented, on average, 2% of GDP. One main advantage of studying the Colombian housing market is that we are able to construct a panel of housing returns at the project level. By exploiting the regional and temporal variation of international remittances, we document that they have large heterogeneous effects across regions and housing types. In particular, we find that remittances inflows have positive effects on house prices growth in high unemployment municipalities and low-quality housing. These results hold when considering an IV-strategy using remittances to Latin America countries (excluding Colombia). We develop a stylized model with borrowing constrained households and segmented housing markets to rationalize these results. Our findings suggest that international remittances are an important source of liquidity for credit constrained households.

Keywords: House Prices, International Remittances, Borrowing Constraints, Instrumental Variables

JEL Codes: F32, F41, F44, O15, R31

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Precios de Vivienda y Remesas Internacionales: Evidencia de Colombia

Sergi Basco[*] Jair N. Ojeda-Joya[Ψ]

Resumen

Este artículo examina empíricamente el efecto de las remesas internacionales en los precios de la vivienda en Colombia. Las remesas internacionales son uno de los principales componentes de los ingresos de capital en economías emergentes. Consideramos el caso relevante de Colombia ya que, en las últimas dos décadas, los ingresos de remesas han representado, en promedio, el 2% del Producto Interno Bruto (PIB). Una de las principales ventajas de estudiar el mercado de vivienda colombiano es la posibilidad de construir un panel de precios de vivienda nueva al nivel de proyectos individuales. Mediante el estudio de las variaciones temporales y regionales de las remesas internacionales, documentamos que estas tienen efectos heterogéneos significativos para las diferentes regiones y tipos de vivienda. En particular, encontramos que los ingresos de remesas tienen efectos positivos en los precios de la vivienda en regiones con alto desempleo y en zonas de estrato bajo. Los resultados se mantienen cuando usamos una estrategia de estimación con variables instrumentales mediante el uso de ingresos de remesas a Latinoamérica (excluyendo a Colombia). Desarrollamos un modelo estilizado con restricciones de endeudamiento para las familias y mercados segmentados de vivienda para entender estos resultados. Estos resultados sugieren que las remesas internacionales son una fuente importante de liquidez para las familias con restricciones de endeudamiento.

Palabras clave: Precios de vivienda, remesas internacionales, restricciones de endeudamiento, variables instrumentales.

Códigos JEL: F32, F41, F44, O15, R31

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1 Introduction

Housing is the most important asset throughout history in most countries (Jorda et al., 2019). Fluctuations in house prices have significant quantitative effects on economic activity, including consumption, employment, investment, debt and aggregate productivity.[1] Therefore, it is necessary to understand the drivers of these fluctuations. Recent literature has identified that increases in capital inflows are conducive to housing booms (see, e.g., Laibson and Mollerstrom, 2010 and Basco, 2014). In the context of emerging economies, international remittances are a significantly large component of these inflows. However, the impact of international remittances on the housing prices of recipient economies has been scarcely examined.[2] In this paper, we construct a panel at the housing-unit level to examine the effects of international remittances on local housing prices in Colombia between 2010 and 2019.

Colombia is an ideal country to perform this exercise for three reasons. First, remittances inflows are a large component of its balance of payments (Bonilla-Mejia, 2017). For example, between 2000 and 2020, remittances have represented 2% of GDP. To put this number into perspective, the average current account during these decades in Colombia is -2.74% of GDP (IMF WEO). Second, Colombia is a very unequal country both across regions and within municipalities. One may expect that the effects of remittances are heterogeneous across different income-related characteristics. Third, there exist good quality micro-data for the housing market as well as remittances inflows data decomposed by recipient regions.

One important advantage of focusing on remittances is that they are mostly determined by economic conditions in foreign countries, which makes them, arguably, more exogenous to outcomes in the recipient country. In other words, the remittances sent by Colombian workers living in the United States are plausibly more dependent on US factors (wages, interest rates, economic growth) than on the economic conditions in Colombia. In addition, we have access to the inflows of remittances at the regional level, which further reduces the potential endogeneity concerns. Nevertheless, to address this potential concern, we also consider an instrument variable (IV) approach analogous to Autor et al. (2013). We use remittances to Latin American countries (excluding Colombia) as an instrument for remittances to Colombia. We regionally distribute the aggregate instrument using the initial share of each region's population on the total population.[3]

To perform our empirical exercise, we construct a novel dataset of local house prices using a database of new housing projects which has been compiled by CAMACOL, the main association

[1] See, among others, Jorda et al., 2015, Mian and Sufi, 2011; Mian et al., 2013; Mian and Sufi, 2014, and Basco et al., 2021.

[2] Callejas-Perez, 2021, perform aggregate time-series regression for the Colombian case. Mottaleb et al., 2016 use household surveys information from Bangladesh to study the relation between reported remittances income and property values.

[3] We want to emphasize that since we only exploit the aggregate time variation in remittances, we meet the requirements discussed in Borusyak et al. (2022). We provide more details on our IV-strategy in Section 5.

(guild) of construction companies in Colombia. This database is computed using responses to monthly surveys to all its members across the country. The information from this database allows constructing a cross-section of housing projects and their price variation during their respective selling periods. Note that by constructing the database in this way, we are comparing the same housing unit and, thus, we do not need to make any additional hedonic adjustment. We are able to match these housing returns with regional data on remittances income as well as with regional macroeconomic controls. We also control for some specific characteristics of each project and include time and regional fixed effects.

To guide our empirical analysis, we consider a stylized housing model with segmented housing market and borrowing constraints. We make two main assumptions consistent with the evidence in Colombia. First, agents have heterogeneous access to the financial system. For ease of exposition, we consider that a fraction of households are hand-to-mouth and the rest are able to smooth consumption. Second, we assume that housing supply is heterogeneous in quality. We will make the simplifying assumption that hand-to-mouth consumers can only purchase low quality housing. Given these assumptions, we obtain two salient empirical predictions. First, international remittances inflows have a positive effect on house prices in regions with more credit constrained households. Second, international remittances inflows have a larger effect in low-quality housing.

In our empirical section we document that these the theoretical predictions hold for the case of Colombia. By implementing our IV-strategy, we find that the effects of international remittances inflows on local house prices tend to be positive during periods (or regions) with higher unemployment rates. We also find that the positive effect on house prices is exacerbated in neighborhoods with lower-quality houses. Quantitatively, one standard deviation increase in international remittances inflows results into an increase in house prices of 1.08% in a region with 16% unemployment and low quality-housing. In contrast, the estimated effect is negative in regions with very low unemployment and low-quality housing. These results are robust to different specifications. For example, according to our theoretical motivation our results should strengthen if we focus on poor neighborhoods and social interest housing. We show that this is indeed the case when we restrict the sample to these cases. Our interpretation of the empirical results, through the lens of our stylized model, is that international remittances inflows help borrowing constrained household to purchase houses. The heterogeneous results follow from the fact that these houses are usually located in regions (periods) with higher unemployment and in lower-quality neighborhoods. Our research also contributes to the discussion about the general economic effects of remittances inflows on developing economies. In particular, our results imply that a non-negligible proportion of remittances is allocated to the acquisition of assets (investment motive) instead of increasing consumption[4].

[4]See Hou and Jia, 2023 for additional evidence about the investment motive for remittances, especially in the case of countries with limited access to the financial sector.

Related Literature This paper relates to two main strands of the literature. On the one hand, it is related to some studies that examine the effects of capital inflows on house prices. For example, Ferrero (2015) and Sa and Wieladek (2015) show that the house price boom in the US before 2008, was related to a significant deterioration of the US current account and therefore to important foreign capital inflows. These authors use DSGE models with price rigidities and credit constrains, and DSGE-Based VAR estimations, respectively, to study that channel. Basco (2014) develops a model of rational bubbles with countries that differ on their level of financial development. The main result is that financial globalization may lead to the formation of housing bubbles, which exacerbate the positive effect of capital inflows on house prices. He provides evidence consistent with these predictions using house prices at the metropolitan area level in the US during the 2000s. Basco (2018) provides additional evidence using aggregate house prices and current account data for several countries.

On the other hand, there are studies of the housing market using micro data to better understand the determinants of housing price dynamics. For example, Landvoigt et al. (2015) study the housing market of the city of San Diego (California - USA) using micro-data about housing transactions between 2000 and 2005, and within a theoretical framework with segmented markets. Their estimations show that affordable mortgages and credit for low-income families significantly explain the observed housing-price valuation during the period. More recently, Mian and Sufi (2022) study the credit supply shock that occurred in the US starting in 2003, due to the wide increase of mortgage credit issued by shadow banks. Using micro data on mortgages, their analysis shows that the credit supply shock led to speculative housing-price behavior mainly in those areas where the shock was stronger. Our paper also underlines the importance of changes in credit availability (or liquidity) to understand changes on house prices, specially among credit constrained households and segmented housing markets.

Our contribution with respect to this literature is threefold. First, we consider remittances, which are an important component of external inflows in developing economies, as an additional determinant of housing returns. Second, our econometric exercise finds a causal effect of remittances on housing prices by using instrumental variable (IV) estimation that allows correcting for the feedback from house-price shocks to remittances. Third, we use a project by project database that allows doing all econometric exercises with rich housing market data. Notice that most of the previous related empirical papers have focused on developed economies due to limitations in micro data in emerging economies. The rest of the paper is organized as follows. Section 2 describes the macroeconomic background and the main characteristics of the Colombian housing and credit market. Section 3 presents the theoretical framework to guide the empirical analysis. Section 4 describes the remittances data and explains the construction of house price data. Section 5 discusses the empirical strategy and reports our main empirical results. Section 6 performs some robustness exercises. Section 7 concludes.

2 Macroeconomic Background

Remittances are a very important source of foreign capital inflows in several developing countries, where a significant number of their citizens have migrated to developed economies to live and work. Therefore, these remittances inflows have not only important economic implications on the financial structure of recipient economies, but also significant implications for the design of their macroeconomic policies.[5]

According to World Bank data for 2019, Colombia received net remittances of USD 127 per capita, which is similar to the inflows per capita observed in developing countries such as Yemen, Belarus and Belize. Colombia is an interesting case because it is a small open economy with flexible exchange rates, which is subject to significant remittances inflows, as we show below.

To have a sense of the quantitative aggregate importance of remittances on total capital flows, we computed several ratios using statistics provided by the Central Bank of Colombia. Between 2000 and 2020, total remittances income was, on average, equivalent to 67% of total foreign direct investment (FDI) inflows. In addition, during the same period, remittances inflows were equal to 54% of the accumulated current account deficits on the same period.

Remittances inflows in Colombia are also important on aggregate terms when measured against national income. Figure 1 represents the annual evolution of remittances inflows as a percentage of GDP (and as percentage of good exports) between 2000 and 2020. On average, remittances have represented 2% of GDP and 10% of exports during the same period.[6] Therefore, remittances fluctuations have potentially non-negligible effects on economic activity. Figure 1 also shows that the evolution of these ratios has a volatile component.

Remittances are originated from Colombian immigrants living in developed economies, mainly, in the United States and Spain. Data from the Central Bank of Colombia for 2019 show that 48% and 16% of remittances inflows are originated in the United States and Spain, respectively. A recent study has identified that some macroeconomic variables in the host countries, such as economic activity and unemployment indicators, are important determinants of nationwide remittances inflows (Garavito et al., 2020). This study also detects that remittances have a counter-cyclical role with respect to domestic GDP fluctuations. However, our own calculations show that this countercyclical role weakens when regional data on both economic activity and remittances are used. More specifically, our estimations show that regional remittances inflows in Colombia have a countercyclical relation with regional GDP growth and unemployment, but the estimated coefficients are not statistically significant.[7] This lack of explanatory power of

[5] See Mandelman (2013) and Aggarwal et al. (2011). See also Rapaport and Docquier (2006) for a review of alternative theoretical approaches to study the microeconomic origins and macroeconomic effects of remittances inflows.

[6] In addition, remittances represented 1.7% of the total aggregate disposable income on average between 2005 and 2019.

[7] Formally, we consider a dynamic-panel regression with remittances as the dependent variable. See Annex 1

Figure 1: Remittances Inflows in Colombia

Source: Own calculations with information from the Central Bank of Colombia.

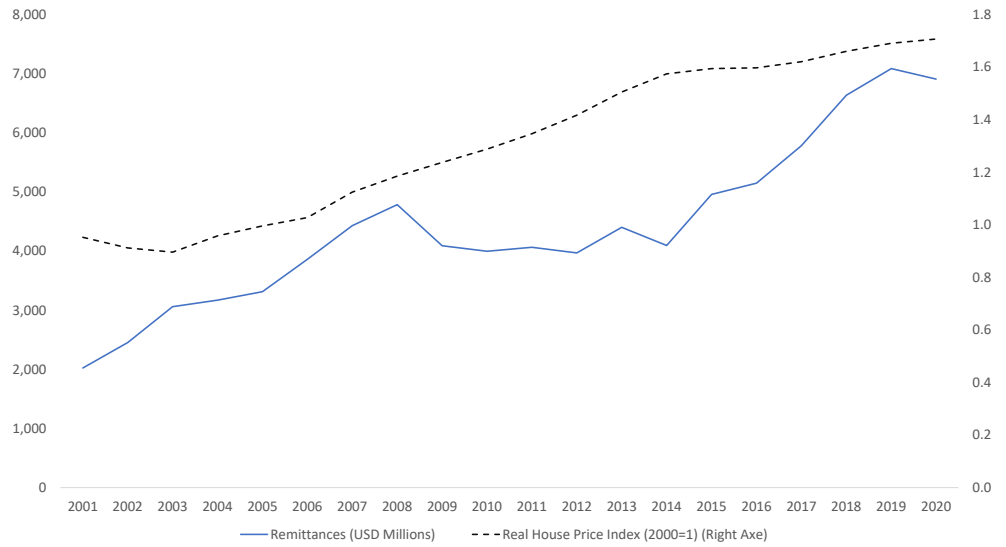
regional economic activity on remittances is consistent with the theoretical framework in which we assume that remittances inflows are exogenous. In any event, there may still be endogeneity concerns which are addressed by implementing an instrumental-variable (IV) approach to take into account the potential reaction of remittances to movements of housing returns in specific regions. We discuss the detail of the IV approach in Section 5.

We want to emphasize that remittances are not a trivial source of income for the recipient household and region. Indeed, Bonilla-Mejia (2017) finds that remittances in Colombia have a significant contribution to several economic well-being indicators, not only for recipient households but also for their regional networks. However, these effects are heterogeneous across regions and households. There are a few regions in which a higher percentage of households are recipients and thus remittances represent, on average, a larger fraction of their total regional income. For instance, remittances received by households in the Colombian regions of *Valle del Cauca* and *Risaralda* represent more than 5.2% of their total income.

Figure 2 shows the evolution of inflows of remittances and aggregate house prices in Colombia between 2001 and 2019. Note that both trends are overall positive, but there does not seem to be a strong and stable correlation between both series. International remittances increased substantially between 2001 and 2008, when they declined and showed no positive trend until around 2015 when they started to rise again. Arguably, this pause in remittances growth could be explained by the Great Recession experienced by the United States and Spain. In any event, given the heterogeneity of the Colombian economy, this aggregate picture may be masking very

for more details on these results.

Figure 2: Remittances and House Prices in Colombia (Levels)



Notes: The dotted line shows the real price index for new houses in Colombia. The blue line depicts the amount of remittances income to Colombia measured in USD millions. Source: Central Bank of Colombia and the National Statistics Office.

different correlations at the regional level. This is precisely the goal of the paper. We use the micro dataset behind these aggregate series to empirically estimate the effects of changes in remittances inflows growth on local housing markets.

It is important to highlight that the potential transmission channels from remittances to housing prices in Colombia could exacerbated by the prevalent use of cash to make housing transactions. According to BBVA-Research (2021), typically less than 50% of new house transactions take place using a bank mortgage. For example, during 2020, this proportion was only slightly greater than 30% due to the effect of the pandemic on the housing market, which underscores that during economic crises only a very selected fraction of the population have access to credit. BBVA-Research (2021) also shows that for mortgages with no government subsidy, the average loan to value ratio (LTV) has been lower than 50% in recent years. In addition, such low mortgage activity is not a specific feature of the pandemic but it is a general pattern of Colombia and other developing economies.

Other indicators confirm that the use of mortgages in Colombia to finance housing transactions is relatively low. According to Badev et al. (2014), with information until 2010, mortgage credit in Colombia as percentage of GDP was below 10%. Meanwhile, this same ratio is near 60% in Spain and above 70% in the United States. On the same line, the indicator of housing-loan penetration, that is, the percentage of population using a credit to buy housing, is above 30% in both the United States and Spain, while it is near 5% in Colombia. This evidence is also related to the scarce use of banking services by Colombian households. According to

computations by Tamayo and Malagon (2017), only 27% of households have positive savings of which only 62% use bank accounts instead of informal saving practices.

The existence of borrowing constraints in Colombia is exacerbated by the unequal financial access across regions. Using information from the Colombian Financial supervisor, computations by Tamayo and Malagon (2017) show that the financial depth indicator (total bank credit to GDP) is very heterogeneous across Colombian regions.[8] The five regions with highest financial depths have a median of 63% of GDP of the same indicator. In contrast, the five regions with the lowest indicators have a median of only 12% of GDP. An analysis of these regions shows that less densely populated locations tend to have tighter borrowing constraints.[9] Even inside the most important cities in Colombia, there is heterogeneous financial inclusion. For example, Gutierrez and Acosta (2019) find, using consumer surveys, that households living in lower-stratum neighborhoods show worse access probability to banking products. We study this aspect of the financial inclusion in Colombia by focusing on regressions including housing projects located on alternative socio-economic strata. We do not focus on the regions with the lowest financial inclusion because they are sparsely populated and there are very few new housing projects during our period of analysis.

Lastly, the housing market is very segmented in Colombia. For example, the stratum is an official neighborhood classification in the main Colombian cities, which consists of an integer between 1 and 6. A higher stratum usually implies that the neighborhood has better access to amenities and features better livability indicators. This classification is used by the government to allocate differential utility fees. We use this stratification in the empirical analysis to explore potential heterogeneous effects of remittances across neighborhoods.[10].

3 Theoretical Framework

In this section, we develop a stylized theoretical model to guide our empirical analysis. The goal is to illustrate a plausible channel through which international remittances can affect house prices. Our theoretical model is based on two assumptions consistent with the housing and credit market in Colombia described above. First, we assume that agents have heterogeneous access to the financial system. Second, the housing market is segmented within municipalities into several strata. Given these assumptions, we deliver empirical predictions on the effects of international remittances on house prices. In the next section we formally test these empirical

[8]These regions correspond to *departamentos*, the main administrative divisions in Colombia in addition to Bogota D.C, the capital district.

[9]The regions with the largest financial depths are Bogota D.C., Antioquia, Atlantico, Risaralda and Valle del Cauca. The regions with the lowest indicators on this matter are Guainia, Vaupes, Arauca, Casanare and Meta.

[10]The strata indicator is more disaggregated than region or *departamento*. In addition this classification is exogenous since it is defined by city regulations established several years ago.

predictions by using micro-data for the housing market of Colombia.

Our economy consists of M municipalities. In each municipality m, there exists a continuum of agents between 0 and 1 indexed by i. The endowment stream of these agents is exogenous. These households may also receive remittances, which are exogenous and unanticipated. We assume that there are two types of agents: (i) hand-to-mouth households and (ii) permanent income consumers. Within each group, all agents are identical. This heterogeneity in financial resources is plausible given our interest in a developing economy. We further assume that in each municipality m there is a fraction λ_m of hand-to-mouth consumers. We allow this fraction to be different across municipalities. In this economy, there exist housing services and other consumption goods. We make the assumption that housing is an essential good. Given these assumptions, we postulate the following housing demand functions for hand-to-mouth (HTM) consumers,

$$H^D_{HTM} = f(p, e, r) = \mu \frac{e_{HTM} + r_{HTM}}{p}, \tag{1}$$

where H_{HTM} is housing demand of hand-to-mouth consumers, $\mu < 1$ is the share devoted to housing, e denotes current endowment, r are the international remittances and p is the price of housing. It would be straightforward to microfound this housing demand with, for example, a standard Cobb-Douglas time-separable utility function combining final-good consumption and housing services, where μ is the weight of housing.

Similarly, the housing demand for permanent-income (PI) consumers is

$$H^D_{PI} = g(p, e, r) = \theta\mu \frac{e_{PI} + r_{PI}}{p}, \tag{2}$$

where H_{PI} is the housing demand of permanent income consumers. Note that the main difference is that $\theta < 1$. This implies that these households have access to financial assets and, thus, their marginal propensity to consume is lower than one. In general, this θ could be a function of, for example, discount factor and interest rates. Note that this is a shortcut to the assumption that households take into account all the stream of future endowments to make consumption choices. Since international remittances cannot be anticipated, we think this is a plausible representation of housing demand for these consumers. For our results, we just need that the marginal propensity to consume is lower in the group of people with access to financial markets. Our housing demand equation is just a shortcut to obtain this general result.

A characteristic of the Colombian housing market is that it is segmented. In particular, we assume that there are high (H) and low (L) quality houses. The housing supply of each type is given by,

$$H^S_q = Q_q \tag{3}$$

for q=H,L. We assume that housing supply is inelastic, which is a plausible assumption in the short-run. For our purposes, we do not need to make any assumption on the relative supply of

each type of housing. Without loss of generality, we assume that $Q_H + Q_L = 1$.

Lastly, we make the reasonable assumption that hand-to-mouth consumers can only access low quality housing while permanent-income consumers can purchase high quality housing. This is a simplifying assumption. For the main result of the model, we only need that the weight of hand-to-mouth consumers is larger in the low-quality housing market. Given these assumptions, we are now ready to derive the equilibrium house prices in each municipality and discuss how they are affected by the international remittances.

House prices in municipality m are given by a weighted average between the price of high- and low-quality housing. That is,

$$P_m = P_m^H * Q_H + P_m^L * Q_L \tag{4}$$

By using our postulated housing demand and supply, it follows that the average price of housing in municipality m is

$$P_m = \lambda_m \mu(e_{HTM} + r_{HTM}) + (1 - \lambda_m)\mu\theta(e_{PI} + r_{PI}) \tag{5}$$

In our empirical application, we are interested in the effect of international remittances. Note that an increase of international remittances raises the demand of housing and, thus, house prices in the average municipality. Formally, note that $\frac{\delta P}{\delta r_i} > 0$ for $i = HTM, PI$.

More importantly, the effect of remittances on average house prices depends on the composition of households in the municipality. The larger the fraction of hand-to-mouth consumers, the larger the increase of house prices. To show this result, let us make the conservative assumption that the evolution of remittances is homogeneous across households in the municipality (i.e., $r_{HTM} = r_{PI} = r$).[11] It follows that $\frac{\delta^2 P}{\delta r \delta \lambda_m} = \mu(1-\theta) > 0$. Intuitively, hand-to-mouth consumers use a larger fraction of the received remittances to purchase houses.

A related result is that the effect of a remittances surge on prices is higher for low quality houses. The reason is that only hand-to-mouth consumers purchase this type of houses, and they use a larger fraction of the remittances for this purchase. Note that we would obtain the same result if we had allowed permanent-income consumers to purchase low quality houses. In other words, we obtain this result as long as the fraction of hand-to-mouth consumers purchasing low quality houses is higher than the fraction of hand-to-mouth consumers purchasing high quality houses. We summarize these results below.

Empirical Prediction *An increase of international remittances in a given municipality (region) raises average house prices in the municipality (region). The effect is exacerbated*

[11] It is a conservative assumption because one could argue that international remittances are more important for hand-to-mouth consumers. If this were the case, the effect of international remittances on average house prices would be exacerbated.

in municipalities (regions) with larger fractions of hand-to-mouth households (financially constrained). The effect is also larger in the case of low quality houses.

In the next sections, we describe the data we use to empirically test these predictions and then, we describe our empirical results.

4 Data

4.1 House Prices

The information that we use about housing prices in Colombia is retrieved from the database compiled by Camacol, which is the main guild of construction companies in Colombia. These companies respond to a comprehensive monthly survey which is used to feed a database of new housing projects. According to the Colombian National Department of Statistics (DANE), this database has a coverage of 97% of the market for new housing in Colombia. In this database a project is defined as a set of housing units built by a construction company, in the same location and with similar characteristics.[12]

Affiliated construction companies monthly report to the survey their current construction projects, their exact location, socioeconomic strata, type of construction (house or apartment), phases of the projects (under construction, selling, sold out), initial construction dates, selling periods, finishing dates, numbers of units, areas, current prices, numbers of rooms and bathrooms and other characteristics. We highlight that these companies also report the monthly number of units sold and the current inventory pending for sale for each project. This information allows us to track the price evolution of each housing unit during its selling period, and computing house-price variations, project by project, during the same period. These price variations can be positive or negative depending on the pricing decisions made by construction companies. These decisions usually depend on the specific demand for each project, which companies gradually learn about during the selling period. There are not specific pricing regulations on new housing in Colombia. The Central Bank of Colombia uses this database and additional related information to compute aggregate and regional house price indexes. These indexes have been found to be highly correlated with alternative aggregate house price indexes, which are computed by DANE.[13]

We also use the database to compute the duration of the selling period, which is defined as the number of months between the initial selling date and when the project is completely sold out. Let T be the duration, P_i and P_f be the initial and final prices respectively. Then we can

[12] More information about these data is found in https://camacol.co/productividad-sectorial/modernizacion-empresarial/coordenada-urbana

[13] Additional details about the construction of housing-price indexes in Colombia can be found in Castano and Morales (2015).

Table 1: Number of New Housing Projects by Strata and Region 2010-2019

Region/Stratum	High	Medium	Low	Total
Bogota D.C.	4583	5651	1127	11361
Antioquia	1352	3025	176	4553
Cundinamarca	215	3343	285	3843
Atlantico	700	719	215	1634
Valle del Cauca	594	773	241	1608
Other Regions	1625	4216	606	6447
Total	9069	17727	2650	29446

Source: Own computations using Camacol's database.

define the return R of the housing project j with the following equation:

$$1 + R_j = \left(\frac{P_f}{P_i}\right)^{\frac{12}{T}} \tag{6}$$

This cross-sectional computation of house-price returns, project by project, is not distorted by hedonic price effects since returns are computed for housing projects with very similar amenities such as area, number of rooms, bathrooms and parking spaces, which do not change during the selling period. Additionally, these returns are not distorted by any spatial effects since every project has the same exact location.[14] Notice that the returns in Equation 6 are calculated as annual equivalent and therefore, they can be compared among different projects despite their diverse selling duration. It is also interesting to highlight that these housing returns include not only offer prices but also transaction prices. The reason is that the final price reported by companies in the survey corresponds to the price agreed by the respective buyers.

We use information in the database for all new projects with selling periods during 2010-2019.[15] We are able to compute descriptive statistics about housing returns by economic stratum and for several Colombian regions during this period. As previously explained, the stratum is an official socioeconomic zone classification used in the main Colombian cities and consists of a discrete number between 1 and 6. A neighborhood with a higher stratum has not only better infrastructure and livability indicators but also higher fees for public utilities and property taxes. For most of the tables in this paper, we use a simplified classification into high (5 and 6), medium (3 and 4) and low (1 and 2) strata.

Table 1 shows the total number of finished housing projects available in the database during the period 2010-2019, by region and strata. The regions shown on the first lines of this table are those with the highest number of new housing projects during the whole period. The remaining

[14]The main reason for not attempting estimations with aggregate house price data in this study is precisely the potential presence of hedonic and spatial effects within municipalities. See for example, Baltagi et al. (2015) for further descriptions and evidence about the importance of these effects for the study of housing prices.

[15]The reason for limiting the analysis to these years is that the database has low coverage before 2010, and during 2020 and 2021 there were extraordinary disruptions to the housing market due to the COVID pandemic.

Table 2: Average Selling Duration of New Housing Projects by Strata and Region (months) 2010-2019

Region	High	Medium	Low	Total
Bogota D.C.	33	31	23	31
Antioquia	40	31	23	33
Cundinamarca	40	29	24	29
Atlantico	45	40	32	41
Valle del Cauca	36	30	30	33
Other Regions	40	33	28	34
Total	37	31	26	32

Source: Own computations using Camacol's database.

Table 3: Average Annual Return of New Housing Projects by Strata and Region (%) 2010-2019

Region/Stratum	High	Medium	Low	Total
Bogota D.C.	2.1	2.0	1.3	1.9
Antioquia	3.1	2.5	2.3	2.6
Cundinamarca	2.9	2.7	2.5	2.7
Atlantico	3.3	3.6	3.4	3.5
Valle del Cauca	3.2	2.3	2.4	2.7
Other Regions	1.7	3.1	2.0	2.6
Total	2.3	2.5	1.9	2.4

Source: Own computations using Camacol's database.

regions are aggregated as "other regions". The participation of the capital city (Bogota D.C.) in the new housing market of Colombia is remarkable since it contains 39% of the total number of projects in the whole country. Additionally, a visible proportion (60%) of all the projects in the database is classified as medium stratum.

Table 2 shows the average selling duration of these housing projects. This selling period starts with the initial opening of the housing project, and ends when all units are completely sold out, which sometimes happens even if the construction of the houses not yet fully finished. While the average selling period for all projects is 32 months, it takes longer (37 months) in average, to sell high stratum housing projects due to their typically higher price. Additionally, low-stratum projects take usually shorter in average (26 months) to be completely sold out.

Finally, Table 3 shows the average annual housing returns. While it is 2.4% for the whole database, these returns have important variations across regions. For example, there are lower average returns (1.9%) in the capital city (Bogota D.C.) and higher returns in the *Atlantico* region (3.5%). Additionally, low stratum projects show lower housing returns on average (1.9%) which is consistent with fewer amenities in those neighborhoods.

Table 4: Annual Remittances Income across Regions (USD Millions)

Region	2011	2012	2013	2014	2015	2016	2017	2018	2019
Antioquia	615	603	660	713	844	833	909	1080	1161
Cundinamarca	570	528	645	646	777	808	946	1155	1176
Atlantico	165	182	266	166	173	177	202	239	276
Valle del Cauca	1130	1112	1157	1204	1264	1406	1571	1667	1684
Risaralda	464	415	391	390	428	421	450	479	493
Other Regions	880	922	1196	798	846	927	1057	1253	1472
Total	3825	3761	4316	3916	4333	4572	5134	5874	6259

Source: Own computations using information from the Central Bank of Colombia.

4.2 Remittances

Our source of remittances data is the Colombian Central Bank's balance of payment statistics. We use quarterly statistics on remittances, which have been separated by region according to the location of the financial institution that receives them. Since there are important seasonal effects on the average amount of remittances inflows each quarter, we include their annual percentage variations in the regressions, instead of their quarterly growth rates.

We match each housing project with the average remittances variation during its specific selling period and for the corresponding region. Therefore, different housing projects in the same region could be associated to the same remittances variation only if their selling periods are the same. This matching is necessary since housing returns are the left-hand side variable, and we use remittances growth and other regional macroeconomic variables as potential determinants. We do not have access to more granular remittances data since the Central Bank's quarterly survey on remittances does not ask financial intermediaries for further temporal or spatial details.

Table 4 shows annual remittances income in the five largest recipient regions. We aggregate the remaining regions as the "other regions" subtotal in the same Table. These inflows have increased during our period of study in most regions and also on the national level. The annual average increase between 2010 and 2019 across all 32 regions is USD 151 millions, with a standard deviation of USD 303 millions. It is clear from Table 4 that *Valle del Cauca* is the region with larger remittances income during the whole period. In addition, while *Antioquia* was the second recipient in 2011, this position was taken over by *Cundinamarca* since 2017.

4.3 Macroeconomic controls

Our goal is to estimate the effects of remittances growth on new housing prices. To appropriately identify these impacts, we include time and regional fixed effects which allow absorbing aggregate cyclical fluctuations and controlling for the fact that housing markets have some idiosyncratic differences across Colombian regions. In addition, we control for some time-varying regional

Table 5: Macroeconomic Controls for Colombia, Annual Averages

Region	2011	2012	2013	2014	2015	2016	2017	2018	2019
Housing Construction Inflation	6.9	2.5	2.7	1.8	5.3	3.2	4.8	2.5	2.8
GDP Growth	6.6	4.0	4.9	4.4	3.1	2.0	1.8	2.6	3.3
Unemployment Rate	11.7	11.3	10.8	10.1	9.9	10.2	10.7	10.8	11.4

Source: Own computations using information from the Colombian Department of Statistics (DANE).

macroeconomic variables which are also house-price determinants. The evolution of the annual average of these controls, for the whole country, is shown in Table 5 .

First, we include a monthly index for housing construction costs, which captures the fluctuations of input prices for housing construction, including those associated to exchange-rate fluctuations. We match each project with the average growth of this index for the corresponding region and selling period. Second, we match each project with the average GDP growth rate in the corresponding region and selling period. This indicator allows controlling for local housing demand growth which may distort the effect of remittances. Finally, we do a similar matching with the unemployment rate indicator for the corresponding city and selling period. This indicator is very important as a proxy of the fluctuations of the population without access to the banking system.[16] All these three macroeconomic controls are calculated and published by the Colombian Department of Statistics (DANE).

5 Empirical Analysis

5.1 Empirical Strategy

We use the following cross-sectional regression to estimate the effects of remittances on housing prices.

$$R_j = \beta_0 \Delta rem_{tr} + \beta_1 \Delta rem_{tr} * str_j + \beta_2 \Delta rem_{tr} * ur_{tr} + \Gamma X_{trj} + \Omega Z_j + \mu_r + \delta_t + \epsilon_j, \qquad (7)$$

where R_j corresponds to the annual return of project j as computed in Equation 6. Average remittances variation in the region r, during the selling period t is denoted as Δrem_{tr}.[17] The vector of macroeconomic controls for the region r and selling period of project j is denoted as X_{trj}. This vector contains average GDP growth, unemployment rate and construction-cost inflation matching the regional information of project j. The vector of specific characteristics of project j is denoted as Z_j. These characteristics are area, number of units, stratum of the neighborhood, and some dummy variables to be described below. Therefore the coefficient

[16] In the case of cities or towns with no unemployment rate available, we use the unemployment rate of the closest city.

[17] We match remittances and other regional macroeconomic data with the corresponding location and selling period of each housing project.

vectors Γ and Ω contain the estimated effects of all regional and specific controls on housing returns, respectively. There is a vector of regional fixed effects denoted as μ_r, which capture specific house-price dynamics in each region during the whole period and control for regional differences. In addition, we include time fixed effects δ_t to represent the effects of specific macroeconomic developments on housing returns across all regions of the country. Both types of fixed effects are useful to prevent omitted-variable biases in the regressions.

In addition to macroeconomic determinants, we control for some housing amenities: area, stratum and the number of units in each project. We also include three dummy variables, first, whether the unit is an apartment or a house, second if the construction company is among the ten biggest construction companies in Colombia, and third whether the housing project is classified as social interest housing.[18] The reason for including a control for big construction companies is that their projects may have different pricing and selling strategies with a significant effect on observed returns. Finally, housing returns are winsorized on the 95% quantile to control for possible reporting errors which can show up as outliers in the data-set.

The most salient empirical predictions of the model is that β_1 is negative and β_2 is positive. That is, remittances should have a more positive effect in regions/periods of high unemployment ($\beta_2 > 0$). In addition, the effect should also be more positive in low-quality housing ($\beta_1 < 0$). Note that the model is silent about the coefficient of remittances, β_0.

For the empirical estimation of Equation 7, we first use Ordinary Least Squares (OLS) with robust standard errors. One potential concern with our OLS estimation is that changes in inflows of remittances may be driven by changing macroeconomic conditions in the region in Colombia. Appendix A examines whether regional outcomes explain remittances inflows. We show that the neither the coefficient of GDP growth nor unemployment rate are statistically significant. However, to address this potential endogeneity concern, we perform an Instrumental Variable (IV) estimation. In particular, we use the annual growth of international remittances inflows in Latin America and the Caribbean (excluding Colombia), $remlat_t$, as the instrument for the international remittances inflows in Colombia. Then, we distribute this aggregate outcome across regions using the share of regional population on the total population (α_r). The right-hand side of equation 8 reproduces the instrument which we use, in the first-stage, to instrument the left-hand side.[19]

$$\Delta remcol_{tr} = \alpha_r * \Delta remlat_t \tag{8}$$

[18] Social interest housing projects usually have limited amenities, smaller areas and lower stratum. Government agencies offer subsidies and special mortgage access to their buyers.

[19] Data about remittances inflows to Latin-American and Caribbean countries are retrieved from the World Bank's DataBank. The list of these countries is the following: Antigua y Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Curacao, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Sint Maarten, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos, Uruguay and Venezuela.

International remittances flows to Latin American economies are highly correlated with each other since the migration patterns and destination countries have been similar during the last 50 years. For example, Figure 3 shows aggregate growth rates of remittances inflows to Latin American economies excluding Colombia. These inflows are highly correlated with those sent to Colombia since external developments such as US unemployment rates and monetary policy affect remittances inflows to all the region. We will report that the F-stat of the first-stage of our IV region satisfies the standard weak instrument tests.

Figure 3: Annual Remittances Growth Latin America vs Colombia

Notes: The dotted line shows the annual growth or remittances inflows in Colombia. The blue line depicts the corresponding indicator for Latin America excluding Colombia. Source: Central Bank of Colombia and World Bank's DataBank.

Our instrument is similar, in spirit, to Autor et al. (2013). In their case, they use Chinese imports at the industry level in developed countries (excluding US) and use regional employment shares in each industry to obtain an exposure measure of the region to the increase in Chinese imports. Their argument is that the increase in Chinese imports reflects productivity growth (at the industry level) in China, which is exogenous to the US. In our case, we argue that the increase in remittances in Colombia are driven by changes abroad. Borusyak et al. (2022) argues that shift-shares may be problematic when the employment shares across exposed industries do not sum to one or the distribution of the industry shock is not exogenous. Our implementation is robust to these concerns. The main difference is that we exploit the time-variation of the instrument not the regional one, which allows us to include regional fixed effects to account

Table 6: Average Number of Units per Housing Project by Strata and Region

Region/Strata	High	Medium	Low	Total
Bogota D.C.	6	18	61	17
Antioquia	15	27	35	24
Cundinamarca	12	43	71	44
Atlantico	8	13	88	21
Valle del Cauca	25	61	129	58
Other Regions	12	24	64	25
Total	10	27	69	26

Source: Own computations using information from the Camacol's database.

for regional differences. That is, in Autor et al. (2013), they consider a cross-section with long-differences and exploit the regional difference in the instrument. They cannot include regional fixed effects because it would absorb the instrument. Another difference is that we have aggregate remittances, instead of industry-level imports, which implies that we do not have missing shares.

The specification of the model also takes into account the structure of the database to improve the identification of the transmission channels. In particular, the projects reported by construction companies contain heterogeneous number of housing units with similar attributes. For instance, in the case of big multifamily projects, it is possible to find single projects with more than 50 units with similar characteristics. There are also relatively small projects that contain only 2 or 3 units with similar characteristics. Given this heterogeneity, it is more convenient to use the housing unit as the unit of observation in our regressions by applying the methodology of frequency weights.

Table 6 shows the average number of units per housing project classified by regions and strata. For the whole sample, the average housing project has 26 housing units. Valle del Cauca is the region with the largest number of housing units per project (58). This number is much smaller (17) in the capital district, Bogota D.C., where available land is more limited. On the other hand, it is clear from Table 6 that multifamily housing projects located in low stratum neighborhoods tend to contain a higher number of units. Therefore, since the number of units is not uniformly distributed across regions or strata, it is important for the accuracy of the estimation that this information be explicitly included on the regression. Using frequency weights imply that each project is repeated in the database according to the number of reported units. Each repeated unit has identical information about determinants. Therefore, the regression is estimated on the cross-section of housing units instead of projects.

5.2 Empirical Results

Table 7 reports the main coefficients of running equation 7. The two coefficients of interest are the interactions between remittances and unemployment and the interaction between remittances and stratum. Column 1 reports the coefficient of the OLS regressions. Note that, consistent with our empirical prediction, the coefficient of the interaction with unemployment is positive and statistically signifcant. Also consistent with our prediction, the coefficient of the interaction with stratum is negative and statistically significant.

These coefficients are consistent with our theoretical framework. The interpretation of the positive coefficient of the interaction with unemployment is that since the proportion of financially constrained households increases during unemployment spells, remittances inflows have a larger positive effect. Similarly, the negative coefficient of the interaction between remittances and stratum is also the expected coefficient. Houses in lower stratum tend to have greater financing through remittances since their buyers have typically more financial constraints.

Regarding the other coefficients, the number of units per project has a positive and significant effect on returns which is related to buyers' preferences for housing units in large multifamily projects. Similarly, housing units with larger areas have higher returns. As expected, construction costs pass through prices and therefore affect housing returns. All three dummy variables have significant effects. First, houses built by bigger construction companies have lower returns perhaps as a pricing strategy. Second, houses have higher returns than apartments reflecting consumer's preferences for greater spaces. Third, houses with government subsidies have also a higher return due to their larger demand by buyers. We decided to exclude GDP growth from the final specification since its coefficients were not significant in similar regressions, and the unemployment rate already captures the relative strength of regional economic activity.

Column 2 reports the coefficient when using the Bartik instrument described above. The coefficients of interest are qualitatively the same. However, quantitatively, the coefficients are larger (in absolute terms). The reason is that IV estimation allows correcting the estimated coefficients for the endogenous reaction of remittances inflows to significant changes on housing returns. Finally, the IV estimation reports an under-identification test in which the null hypothesis is rejected with a high confidence degree confirming that the Bartik instruments, previously described, are useful to better identify the estimated effects.

We also compute the marginal effects of remittances on housing returns as functions unemployment rates and stratum using the coefficient of the IV estimations reported in column 2 in Table 7. We compute these effects for the six available strata and for several unemployment rates which correspond to the range observed across regions in Colombia between 2010 and 2019. We consider the effects of a 10% increase of remittances inflows which corresponds to one standard deviation of remittances variation across the cross-section. The computed effects are summarized in Table 8. For the lowest strata (1) the marginal effects are positive with a maxi-

Table 7: Regressions with Determinants of Housing Returns and Frequency Weights by Number of Units

Dep. Variable:	Returns (OLS)	Returns (IV)
Remittances	0.0151***	-0.0331*
	(7.79)	(-1.72)
Remit*unemploy	0.0006***	0.0109***
	(4.49)	(4.81)
Remit*stratum	-0.0094***	-0.0332***
	(-27.66)	(-9.95)
Stratum	0.3236***	0.4781***
	(47.97)	(20.60)
Unemployment	-0.0594***	-0.0696***
	(-9.33)	(-10.42)
Units	0.0007***	0.0007***
	(22.60)	(22.25)
Area	0.0021***	0.0020***
	(10.51)	(9.55)
Construction Costs	0.1543***	0.1407***
	(23.53)	(12.53)
Dummy Big	-0.4983***	-0.4786***
	(-53.63)	(-44.71)
Dummy Social	0.1715***	0.1723***
	(19.28)	(19.17)
Dummy House	0.3387***	0.3301***
	(23.70)	(21.89)
Observations	755143	755143
Uncentered R2	0.0879	0.3486
Underidentification Test	–	2044.7***

Notes: T-stats in parentheses. Standard errors are robust to heteroskedasticity. Remittances growth in Latin America (excluding Colombia) is the instrument. Regional and time fixed effects are included. ***, **, * denotes significance at 1%, 5%, and 10%, respectively.

mum of 1.08% for unemployment rates near 16%. For low strata (2 and 3), the marginal effects are positive only for high unemployment rates. For the remaining strata, these effects are close to zero or negative. According to our theoretical approach, households living in high-stratum neighborhoods usually have full access to the financial system and therefore do not require any remittances to finance housing transactions.

These results are likely related to the potential dutch-disease effects of remittances on the formal sectors of the economy as described by Chatterjee and Turnovsky (2018). According to their general equilibrium model, these effects are mostly driven by the negative effects of the real exchange appreciation, implied by remittances surges, on the export performance of mostly formal sectors such as manufacture and agriculture. Additionally, the model predicts

Table 8: Marginal Effects of Remittances on Housing Returns (%)

Unemployment rate/Strata	1	2	3	4	5	6
8	0.209	-0.123	-0.455	-0.787	-1.119	-1.451
10	0.427	0.095	-0.237	-0.569	-0.901	-1.233
12	0.645	0.313	-0.019	-0.351	-0.683	-1.015
14	0.863	0.531	0.199	-0.133	-0.465	-0.797
16	1.081	0.749	0.417	0.085	-0.247	-0.579

Source: Own computations using estimations from the IV column of Table 7 after a 10% increase of remittances inflows.

an increased informal sector which leads to a reduction of financial access and lower labor productivity. The model described by Lim et al. (2018) also shows that the macroeconomic effects of remittances are ambiguous and depend on factors such as the labor tax structure, the costs of duration of migration and the proportion of remittances allocated to savings or investments.

6 Robustness Exercises

In this section, we perform two exercises to provide further evidence consistent with our narrative that the effect of international remittances on local house prices is through borrowing constrained households.

6.1 Low-stratum neighborhoods

According to our theoretical framework, the effects of remittances inflows are exacerbated among households with restricted access to the financial system since they do not have good access to mortgages or long-term loans for housing finance. To provide additional evidence consistent with this view, we focus on houses located in low-stratum neighborhoods since their buyers usually have more financial restrictions than owners of houses in high-stratum neighborhoods.

Table 9 shows the results of the regression that includes only houses located in low-stratum neighborhoods. The specification is analogous to that presented on Table 7. The estimated coefficients, using least squares, imply positive effects of remittances on housing returns in the case of very low strata. Taking the interaction into account, the net effects are slightly negative in the case of the third stratum of the neighborhood classification. Overall, the estimated effects on Table 9 are stronger for low-stratum neighborhoods except for the interaction with the unemployment rate which is non-significant. In the case of the IV estimation, we obtain even stronger effects of stratum on housing returns, both by itself and interacted with remittances. In addition, the interaction with the unemployment rate becomes positive in line with our theoretical approach. Our interpretation is that the IV correction on the estimated coefficients, in the case of low strata, reveals the importance of neighborhood quality to identify which

Table 9: Regressions with Determinants of Housing Returns on Low-Stratum Neighborhoods

Dep. Variable:	Returns (OLS)	Returns (IV)
Remittances	0.0520***	0.5133***
	(23.33)	(19.61)
Remit*unemploy	-0.0002	0.0100***
	(-1.00)	(4.62)
Remit*stratum	-0.0222***	-0.2385***
	(-36.98)	(-18.43)
Stratum	0.5153***	2.1326***
	(40.40)	(20.56)
Unemployment	-0.0095	0.0890***
	(-1.10)	(7.21)
Units	0.0010***	0.0013***
	(30.45)	(33.48)
Area	0.0157***	0.0150***
	(35.99)	(30.91)
Construction Costs	0.2602***	0.2164***
	(33.00)	(14.42)
Dummy Big	-0.6224***	-0.6912***
	(-57.28)	(-52.20)
Dummy Social	0.4230***	0.4514***
	(41.16)	(3.98)
Dummy House	0.2849***	0.3016***
	(16.97)	(15.74)
Observations	510732	510732
Uncentered R2	0.0916	0.1924
Underidentification Test	–	705.71***

Notes: T-stats in parentheses. Standard errors are robust to heteroskedasticity. Remittances growth in Latin America (excluding Colombia) is the instrument. Regional and time fixed effects are included. ***, **, * denotes significance at 1%, 5%, and 10%, respectively. These regressions include only the lowest three strata of the Colombian neighborhood classification and incorporate frequency weights according to the number of units per project.

households receive remittances for housing motives. All the remaining coefficients have similar estimated values on both columns of Table 9, and their signs remain the same as in Table 7.

6.2 Social Interest Housing

As a second robustness exercise, we focus on houses which are classified as social interest housing by the Government. VIS[20] is the main program for affordable housing implemented by the Colombian Government and it consists of housing projects constructed with affordable

[20]This word corresponds to the initials of Social Interest Housing in Spanish

Table 10: Regressions with Determinants of Housing Returns on Social Interest Housing

Dep. Variable:	Returns (OLS)	Returns (IV)
Remittances	-0.0318***	0.4008***
	(-7.07)	(13.25)
Remit*unemploy	0.0016***	-0.0158***
	(5.81)	(-6.47)
Remit*stratum	0.0035***	-0.0599***
	(3.64)	(-11.92)
Stratum	-0.0749***	0.3271***
	(-5.54)	(8.92)
Unemployment	0.1253***	0.0831***
	(13.25)	(5.06)
Units	0.0031***	0.0030***
	(62.45)	(60.49)
Area	0.0041***	0.0031***
	(6.90)	(4.58)
Construction Costs	0.1326***	0.0733*
	(11.01)	(1.68)
Dummy Big	-0.6983***	-0.6826***
	(-54.50)	(-47.88)
Dummy House	0.8240***	1.0013***
	(38.11)	(41.43)
Observations	329992	329992
Uncentered R2	0.1400	0.3362
Underidentification Test	–	1195.54***

Notes: T-stats in parentheses. Standard errors are robust to heteroskedasticity. Remittances growth in Latin America (excluding Colombia) is the instrument. Regional and time fixed effects are included. ***, **, * denotes significance at 1%, 5%, and 10%, respectively. These regressions include only social interest housing and incorporate frequency weights according to the number of units per project.

features such as smaller areas, limited interior and less convenient locations. The government subsidizes a proportion of the total offer price for these houses if the corresponding household meets a set of requirements such us earning a low income and not being owner of additional houses. Therefore, this program is directed to households with limited access to the financial system who could use remittances income as a partial substitute for housing finance. According to Arbelaez et al. (2011) these programs have been successful to improve access to housing by low-income families in Colombia.

Table 10 reports the results of the regression that includes only social interest housing. The specification is analogous to that presented on Table 9. The estimated coefficients, using least squares, imply positive effects of remittances on housing returns for higher strata and unemployment rates. Overall, the estimated effects on Table 10 reveal a reversion of the role

of the stratum when compared with the theoretical predictions. However, the IV estimation corrects for this reversion showing stronger effects of remittances on housing returns for low strata just as also found on Table 9. In addition, the interaction with the unemployment rate becomes negative in contrast to previous results. Our interpretation is that the IV correction in this case, reveals that the demand for this type of housing is stronger during periods of higher unemployment since more households apply for government subsidies. All the remaining coefficients have similar values on both columns of Table 10, and their signs also remain the same as in Table 7.

7 Concluding Remarks

We have presented a new approach to measuring the effects of international remittances on housing prices. We analyzed a detailed database of new housing projects in Colombia in which the evolution of prices for every project is registered monthly during their selling period. We used this information to compute housing returns for each project and to match them with the average growth of remittances inflows during the same period in the corresponding region.

We empirically estimated the effects of remittances by performing cross-sectional least-squares. We also implemented a Bartik instrument using remittances inflows in Latin America (excluding Colombia). We found evidence that surges of remittances inflows have heterogeneous effects on housing prices. Specifically, these effects are significantly positive in the case of houses located in lower-quality neighborhoods and for higher unemployment regions (or periods).

These results are consistent with segmented housing markets and borrowing constrained households. Remittances inflows are an alternative cash-based source to acquire housing services. From a more general point of view, remittances inflows are therefore not only a source of additional consumption expenditures, but also a substitute of banking finance for housing investment. We confirm the strength of this mechanism with two additional regressions in which we restrict the sample to first, houses located in low-stratum neighborhoods, and second, to social interest houses which are eligible for Government subsidies.

Finally, these results also imply the existence of an additional transmission channel from global shocks to domestic asset prices in Colombia and other developing economies. For example, monetary policy tightening in the US also affects the housing markets and economic activity of developing economies through the potential effect of the higher interest rates on the amount of remittances sent by migrants living in the US to their home countries.

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A Appendix: Analysis of Domestic Determinants of Remittances Inflows

We compiled a panel of remittances inflows, using data for the 32 main regions of Colombia and during the period 2010-2019. This balanced panel also includes regional data on GDP growth and unemployment rate.

For remittances and real GDP data, we include in the panel their annual growth rates, region by region. In the case of the unemployment rate, the data released by the National Statistics Department (DANE) correspond to the main 23 cities. Therefore, we match each Colombian region with the unemployment data of its main city.

We estimate the following equation to analyze whether domestic macroeconomic shocks significantly influence remittances inflows at the regional level.

$$\Delta rem_{t,r} = \beta \Delta rem_{t-1,r} + \gamma \Delta GDP_{t,r} + \lambda U_{t,r} + \mu_r + \epsilon_{t,r} \tag{A.1}$$

In this dynamic panel equation, the dependent variable is the annual growth of remittances ($\Delta rem_{t,r}$), which is explained by its own lag, GDP growth ($\Delta GDP_{t,r}$) and the unemployment rate ($U_{t,r}$). In addition, the equation includes regional fixed effects (μ_r). The estimation method follows the system GMM methodology originally devised by Arellano and Bond (1991), Arellano and Bover (1995) an Blundell and Bond (1998) which allows using instrumental variables to control for endogenous feedback effects from remittances shocks to macroeconomic variables. The dynamic component of this equation, as well as the uncorrelated estimation residuals ($\epsilon_{t,r}$) allow capturing the effects of external factors which do not vary across regions.

We present the regression results on Table 11. A percentage point of additional regional GDP growth leads to a 6.3% reduction of remittances inflows. In addition, a percentage point of higher unemployment rate is associated to 12.6% higher growth of regional remittances. However, none of these effects are statistically significant with at least a 90% of confidence degree. Therefore, these results are consistent with remittances being mainly driven by macroeconomic developments in the advanced economies from where they are sent, essentially, Spain and the United States.

Table 11: Dynamic Panel Regression with Domestic Determinants of Remittances

Dep. Variable:	Remittances Inflows
Remittances (-1)	0.0356**
	(2.18)
GDP Growth	-6.364
	(-0.66)
Unemployment Rate	12.6148
	(0.81)
Intercept	-68.7998
	(-0.47)
Observations	288
Groups	32
Arellano-Bond Test (lag 2)	-0.9255

Notes: T-stats in parentheses. Standard errors are robust to heteroskedasticity and autocorrelation. ***, **, * denotes significance at 1%, 5%, and 10%, respectively.