House Prices and International Remittances: Evidence from Colombia

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October 2023

Abstract

International remittances are a large fraction of external inflows in emerging economies. In this paper, we exploit the regional and temporal variation of international inflows of remittances to empirically examine their effects on the Colombian housing prices. We construct a cross-section of housing returns at the individual new housing projects level for the period 2010-2019. Our econometric estimations show that remittances inflows significantly raise average housing returns in regions and periods with higher unemployment and for neighborhoods with fewer amenities. We develop a model with borrowing constrained households and segmented housing markets to rationalize these results. These findings imply that international remittances strengthen the transmission channel from macroeconomic shocks in developed economies to housing prices and economic activity in developing economies.

Keywords: House Prices, International Remittances, Borrowing Constraints
JEL Codes: F32, F41, F44, O15, R31

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Basco acknowledges financial support from Catalan Agency for Management of University and Research Grants (2017SGR1301) and Spanish Ministry of Science, Innovation and Universities (PID2019-104723RB-I00)

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] Recent literature has shown that one of the drivers of housing booms is capital inflows (see, e.g., Laibson and Mollerstrom, 2010 or Basco, 2014). In addition, international remittances are an important fraction of those inflows in emerging and developing economies. The impact of international remittances on the housing prices of recipient economies has been scarcely studied.

One salient difference between international remittances and capital inflows is that remittances are mostly determined by economic conditions in foreign countries, which makes them, arguably, more exogenous to outcomes in the recipient country. In addition, the economic effects on the recipient countries may vary across different segments of the housing market within and between regions. To better understand these effects on recipient economies, we investigate the effects of international remittances on the housing market of Colombia.

Colombia is an ideal country to perform this exercise. Remittances inflows are an important 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). Furthermore, there exist good quality micro-data for the housing market as well as remittances inflows data decomposed by regions. These facts allow exploiting the within-market variation to identify the effects on housing prices and explore heterogeneous results across regions and municipalities.

Our empirical estimations use a database of new housing projects which has been compiled by CAMACOL, the main association (guild) of construction companies in Colombia, 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. 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.

We perform cross-sectional instrumental-variable (IV) regressions in order to control for the potential endogenous reaction of remittances to periods of strong house-price variations. We use data on remittances inflows to Latin American economies, excluding Colombia, as our instrument. We distribute regionally the aggregate instrument using the share of each region's on total population. Additionally, to better take into account the structure of the data, we explicitly incorporate in the regressions the heterogeneous number of similar units reported by each project.

Our main contribution is to empirically document that the effects of remittances on housing

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

prices are heterogeneous across and within regions. Indeed, we find that these effects tend to be positive during periods (or in cities) with higher unemployment rates and within neighborhoods with lower-quality houses. We interpret these results through the lens of a segmented housing-market model with financially constrained agents. Remittances inflows help these agents increase their demand for housing implying higher average housing returns. The heterogeneous results can be rationalized by making the plausible assumption that agents are more likely to be financially constrained in regions with more unemployment and in lower-quality neighborhoods. This research 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[2].

Related Literature This paper relates to two different strands of the literature. On the one hand, it is related to the work examining 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) and Basco (2018) construct a model of rational bubbles with several countries that differ about their degree of financial development. The main implication of this model is that financial globalization leads to the formation of housing bubbles along with higher current-account deficits. In addition, such framework demonstrates the importance of financial development and financial constraints for the evolution of housing prices.

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 San Diego (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. The current analysis of the Colombian case also shows the importance of housing financing within segmented markets, through remittances, to better understand the determination of housing returns.

Therefore, our contribution with respect to this literature is twofold. First, we consider remittances, which are an important component of external inflows in developing economies,

[2]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.

to study housing markets. Second, our project by project database allows doing econometric exercises with rich housing market data. Most of the related empirical work focuses on housing markets in developed economies due to data limitations in other economies. This paper is organized in the following way. After this introduction, Section 2 describes the macroeconomic background. Section 3 presents the theoretical framework. Section 4 describes the data. Section 5 shows the main empirical results. The last section makes some concluding comments.

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, see for example Rapaport and Docquier (2006). 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 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 are 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 the value of exported goods) between 2000 and 2020. On average, remittances have represented 2% of GDP and 10% of exports during the same period.[3] Therefore, remittances fluctuations have potentially non-negligible effects on economic activity. Figure 1 also shows that the evolution of these ratios is volatile, which is driven not only by fluctuations of remittances but also by the cyclical movements of GDP and exports, respectively, in Colombia.

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. Recent studies have 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). These studies also detect that remittances have a counter-cyclical role with respect to domestic GDP fluctuations. However, our

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

Figure 1: Remittances Inflows in Colombia

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

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.[4] This lack of explanatory power of regional economic activity is interesting for our analysis because on the theoretical framework we assume that remittances inflows are exogenous. However, for the empirical exercise we use instrumental-variable regressions to take into account that remittances inflows can react, as investment motive, during periods of higher housing returns in specific regions.

We emphasize that remittances are not a trivial source of income. 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, this effect is heterogeneous across regions and households since there are a few regions in which a higher percentage of households are recipients and thus remittances represent a larger fraction of their total income. For instance, remittances received by households in the regions of Valle del Cauca and Risaralda represent more than 5.2% of their total income.

Figure 2 shows the evolution of remittances and house-price annual growth in Colombia. The contemporaneous correlation between these series is slightly negative (-0.15) due to the different domestic and external shocks affecting house prices and remittances. For example, while remittances tend to be acyclical with respect to the domestic business cycle, housing

[4]Formally, we consider a dynamic-panel regression with remittances as the dependent variable. See Annex 1 for more details on these results.

Figure 2: Remittances and House-Price Growth in Colombia

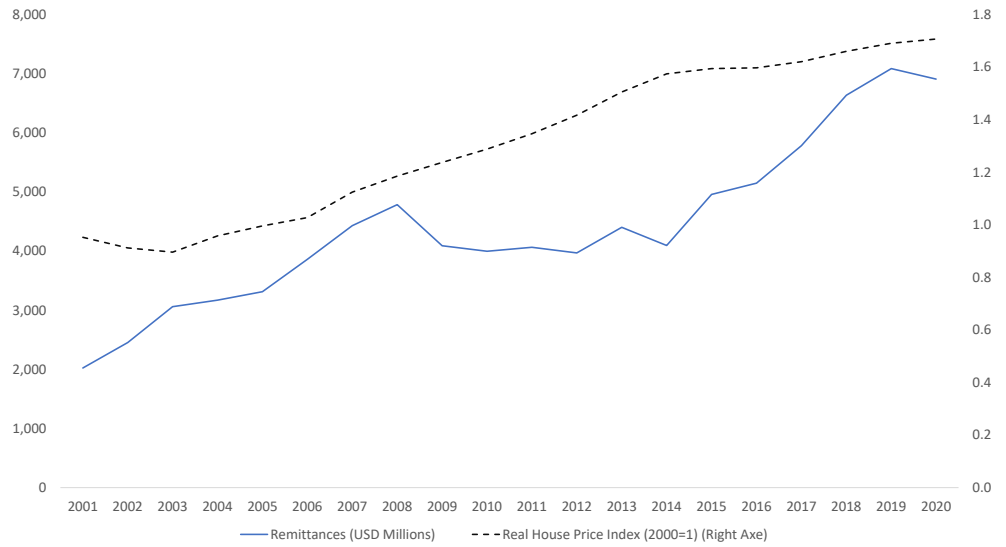
Notes: The dotted line shows the evolution of annual house-price growth for new houses in Colombia. The blue line shows the evolution of annual remittances income growth in Colombia. Source: Own calculations with information from the Central Bank of Colombia and the National Statistics Office.

prices are usually procyclical. However, we can identify two boom periods of housing-price growth (2007 and 2013) which are both preceded by accelerating remittances growth. We also show both series in levels in Figure 3; in this case it is evident that both series have upward trends during the analysis period. However, remittances had a decreasing episode in 2008 and then slowly recovered during the following years catching up with the initial trend around 2019. The goal of this paper is to use a rich data set behind these aggregate series to empirically analyze the effects of remittances variations on housing-price growth.

It is important to highlight that the potential transmission channels from remittances to housing prices in Colombia are exacerbated by the predominant use of cash during 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

Figure 3: 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.

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.[5] 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.[6] 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.

The stratum is an official neighborhood classification in the main Colombian cities which

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

[6]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.

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.[7].

3 Theoretical Framework

In this section, we develop a simple theoretical model to guide our empirical analysis. The goal is illustrating a possible channel through which international remittances can affect house prices. Our theoretical model is based on two assumptions consistent with the housing market in Colombia. 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 empirically test these predictions using micro-data.

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 groups 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. 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

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

[7]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.

where H_{PI} is 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 rate. 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 both types is given by,

$$H_q^S = Q_q \tag{3}$$

for q=H,L. We assume that the housing supply is inelastic. This 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 to low quality housing and permanent-income consumers 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 low quality housing. 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 is 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 in 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 the remittances on average house prices depends on the composition of households in the municipality. The larger is the fraction of hand-to-mouth consumers, the larger the increase in 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., $r_{HTM} = r_{PI} = r$).[8] 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 a house.

A related result is that the effect of a remittances increase on prices is higher for low quality houses. The reason is that we have assumed that only hand-to-mouth consumers purchase this houses and, we have already seen, that hand-to-mouth consumers use a larger fraction of the remittances to housing. Note that we would obtain the same result if we allow permanent-income consumers to also 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 in municipalities (regions) with larger fractions of hand-to-mouth households (financially constrained). The effect on house prices is also larger in the case of low quality houses.*

In the next section we describe the data we use to perform empirical tests of these predictions. In the following Section, 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 feeds a database of new housing projects that includes features such as monthly prices, number of sold units, location and a description of their amenities. 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 the same company, in the same location and with similar characteristics.[9]

Affiliated construction companies monthly report 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 dates of construction and selling periods,

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

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

finishing dates, numbers of units, areas, current prices, numbers of rooms and bathrooms among others. We highlight that these companies also report the monthly number of units sold and the current inventory pending for sale for each project. The latter information allows tracking the price evolution of each housing unit during the selling period. We use such price evolution to compute housing returns.

Construction companies report to the housing survey that information once they start the selling period for each of their projects. We use this information to compute house-price variations, project by project, during the whole selling period. These price variations can be positive or negative depending on the pricing decisions made by these construction companies. These price 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 pricing in Colombia.

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 the date 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 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 housing-price returns, project by project, is not distorted by hedonic price effects since this return is computed for housing units with very similar amenities such as area, number of rooms, bathrooms and parking spaces that do not change during the selling period. Additionally, these returns do not contain any spatial effects since every project has the same exact location. These returns in Equation 6 are calculated as annual equivalent and therefore, they can be compared among different projects despite their diverse selling durations.[10] It is also interesting to highlight that these housing returns include no 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 new buyers.

We use information in the database for all new projects with selling periods located in the period 2010-2019.[11] 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 consisting of a discrete number between 1 and 6. A neighborhood with a higher stratum has overall better roads and livability indicators but also higher fees for public utilities and higher property taxes. In the tables below we use a simplified classification into high (5 and 6), medium

[10] See for example, Baltagi et al. (2015) for further descriptions and evidence about the importance of hedonic effects for the study of housing prices

[11] The reason for this decision is that the database has low coverage before 2010. During 2020 and 2021 there were important disruptions to the housing market due to the COVID pandemic.

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.

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.

(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 in the first lines of this table are those with the highest number of new housing projects during the whole period. The remaining regions are aggregated as "other regions". The participation of 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 is classified as medium stratum.

Table 2 shows the average selling duration of these housing projects. The selling period starts with the initial opening of the housing project, and ends when all units are completely sold out, which sometimes happens when the constructions are not 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 houses usually take shorter in average (26 months) to be completely sold out.

Finally, Table 3 shows the average annual return of the housing projects. While it is 2.4% for the whole period, these returns have important variations across regions. For example, there are lower average returns (1.9%) in the capital district (Bogota D.C.) and higher returns in

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.

the Atlantico region (3.5%). Additionally, low stratum projects show lower housing returns on average (1.9%) which is consistent with lower housing demand in those neighborhoods.

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 disaggregated 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 can be associated to the same remittances variation only if their selling periods are similar. This matching is necessary to perform cross-sectional regressions with housing returns as the left-hand side variable, and using 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 disaggregation.

Table 4 shows annual remittances income in the five greatest recipient regions and aggregating the other 27 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 higher remittances income the whole period. In addition, while Antioquia was the second recipient in 2011, this position was taken over by Cundinamarca since 2017.

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.

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).

4.3 Macroeconomic controls

Our goal is to apply Instrumental-Variable (IV) regressions to estimate the effects of remittances variations on new housing prices. To appropriately identify this effect, we include time and regional fixed effects which allow absorbing aggregate cyclical shocks and controlling for the fact that housing markets have some idiosyncratic differences across Colombian regions. In addition, we control for some time-varying regional macroeconomic variables which are also house-price determinants. The annual evolution of these controls 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 during each 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 proportion of the population without access to the banking system.[12] All these three macroeconomic controls are calculated and published by the Colombian Department of Statistics (DANE).

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

5 Empirical Results

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

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

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 corresponding to project j is denoted as Δrem_{trj}.[13] The vector of macroeconomic controls for the region r and selling period of project j is denoted as X_{tr}. 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. Therefore the coefficient 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. In addition, we include time fixed effects δ_t to capture the effects of specific macroeconomic developments on housing returns across all regions of the country.

For the empirical estimation of Equation 7, we initially use Ordinary Least Squares (OLS) with robust error estimation. However, this estimation may have endogeneity issues since remittances flows can react to housing prices at certain specific periods. Therefore, we also report Instrumental Variable (IV) estimations in which we use the annual growth of international remittances inflows in Latin America (excluding Colombia) as the instrument. This methodology corrects the estimated parameters for the potential endogenous reactions of remittances inflows sent to Colombia during periods of abnormal housing returns. We follow the methodology by Autor et al. (2013) in which analogous international flows in similar economies are found to be good instruments since they are driven by common external determinants. The instrument is distributed on the cross-section of housing projects using the share of regional population on the total population as the corresponding weight. [14] Equation 8 shows this distribution in which regional remittances growth rates are instrumented with the product of the region's population share (α_r) and Latin American remittances growth for the same period.

$$\Delta remcol_{tr} = \alpha_r * \Delta remlat_t \quad (8)$$

International remittances flows to Latin American economies are highly correlated among

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

[14] This methodology is also known as a shift-share research design or Bartik instruments. This exercise meets the requirements for the instrumental-variable design to be valid, according to Borusyak et al. (2022). In particular, we do not study the variation of population shares across regions because we are interested only in the time variation of remittances.

countries since the migration patterns and destination countries have been similar during the last 50 years. For example, Figure 4 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.

Figure 4: 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 statistics.

Our regression also includes two interactions: first between remittances project stratum, and second, between remittances and regional unemployment rate. Estimating these interactions is important to better understand the mechanisms described in our theoretical framework which predicts that the effects of remittances on housing returns should be stronger for projects located in neighborhoods with lower stratum. This is because households living in these neighborhoods have a higher probability of bearing financial constraints, implying that β_1 should be negative. On the other hand, households living on periods or in neighborhoods with a higher unemployment rate should have a lower access probability to financial services, therefore, β_2 should be positive. Therefore our empirical specification in Equation 7 implies that the effect of remittances on housing returns is a function of unemployment and strata as in Equation 9.

$$\frac{\delta R_j}{\delta rem_{tr}} = \beta_0 + \beta_1 * str_j + \beta_2 * ur_{tr} \tag{9}$$

In addition to macroeconomic determinants, we control for some microeconomic determinants such as 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.[15] 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 would show up as outliers in the data-set.

Table 6 shows the results for the initial specification of the empirical model according to Equation 7. This is a cross-sectional IV regression in which housing returns are the dependent variable, remittances and their interactions are right hand-side variables along with the macroeconomic controls, housing attributes, project-specific dummy variables and fixed effects. The interactions allow studying the influence of unemployment and stratum on the transmission channel from remittances to housing prices.

The results on Table 6 show a positive and significant coefficient for the interaction between remittances and unemployment. This finding implies that the effects of remittances are exacerbated during higher unemployment periods, which is consistent with our theoretical model as the proportion of financially constrained households increases during unemployment spells. On the other hand, the interaction between remittances and stratum has the expected sign but it is not statistically significant. Other determinants with non significant effects are stratum, unemployment, area and construction costs. 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. All three dummy variables have significant effects. Houses built by bigger construction companies and social interest houses have lower returns. In contrast, houses have higher returns than apartments.

Some of the results in Table 6 show features of the consumer preferences for new houses in Colombia. For example, consumers like large multifamily projects since these usually contain more amenities such as sports facilities, gym and rooms for special events. On the other hand, social interest housing have very limited amenities. Finally, it seems that projects by big construction companies have more limited amenities so that their return is lower. We decided to exclude GDP growth from the final specification since the unemployment rate already captures the relative strength of regional economic activity.

We also implement a second specification of the model which takes into account the structure of the database to improve the identification of the transmission channels. Specifically, we use the fact that construction companies report a monthly survey response for those housing

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

Table 6: IV Regression with Determinants of Housing Returns

Dep. Variable:	Housing Returns
Remittances	-0.3594*
	(-1.96)
Remit*unemploy	0.0350*
	(1.93)
Remit*stratum	-0.0163
	(-1.54)
Stratum	0.1140
	(1.41)
Unemployment	-0.0523
	(-1.30)
Units	0.0027***
	(5.70)
Area	-0.0006
	(-1.16)
Construction Costs	0.0845
	(1.04)
Dummy Big	-0.2312***
	(-3.33)
Dummy Social	-0.1461**
	(-2.29)
Dummy House	0.2187**
	(2.30)
Observations	29446
Uncentered R2	0.2143
Underidentification Test	7.889***

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.

projects that contain several units with similar attributes. For instance, in the case of big multifamily projects, it is possible to find construction companies reporting a single project that includes more than 50 units with similar attributes. There are also, relatively small construction companies which report projects that contain only 2 or 3 units with similar characteristics. There seems to be plenty of heterogeneity about the number of units reported in our database.

Table 7 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 in Table 7 that multifamily housing projects located in low stratum

Table 7: 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.

neighborhoods tend to contain a higher number of units. 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. Therefore, we perform a new regression of the same specification but now with frequency weights. In this case, each project is repeated in the database according to the number of reported units, in other words, the IV regression is estimated again for the cross-section of housing units (instead of projects).

Table 8 describes the output from the frequency weighted IV regression. In this case both interactions have significant effects showing that the transmission from remittances to housing returns tends to be stronger in periods (or regions) with higher unemployment rates or in neighborhoods with lower stratum. These results are consistent with our theoretical model of housing prices in which financially constrained households use a higher proportion of remittances to buy housing services. In this sense, this specification better captures the transmission mechanisms from remittances to housing prices. The remaining estimated coefficients in Table 8 are statistically significant and most of the estimated signs in Table 6 are confirmed in this new regression. There are only two sign changes in the new estimation as a result of the frequency weights. First, social interest housing has now a positive effect on returns and second, houses bigger area imply higher returns. We believe these results make sense with standard consumer preferences since for example, social interest houses have price price subsidies and lower financing requirements despite having fewer amenities.

We also compute the marginal effects of remittances on housing returns as function unemployment rates and strata as previously stated in Equation 9 and using the estimations presented in Table 8. 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. The effects are computed assuming a 10% increase of remittances inflows which correspond to a standard deviation of remittances variation across the cross-section. The computed effects are summarized in Table 9. For the lowest strata (1) the marginal effects are positive with a maximum of 1.1% for unemployment rates near 16%. For low strata (2 and 3), the

Table 8: IV Regression with Determinants of Housing Returns and Frequency Weights by Number of Units

Dep. Variable:	Housing Returns
Remittances	-0.0331*
	(-1.72)
Remit*unemploy	0.0109 ***
	(4.81)
Remit*stratum	-0.0332***
	(-9.95)
Stratum	0.4781***
	(20.60)
Unemployment	-0.0696***
	(-10.42)
Units	0.0007***
	(22.25)
Area	0.0020***
	(9.55)
Construction Costs	0.1407***
	(12.53)
Dummy Big	-0.4786 ***
	(-44.71)
Dummy Social	0.1723***
	(19.17)
Dummy House	0.3301***
	(21.89)
Observations	755143
Uncentered R2	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.

marginal effect is positive only for high unemployment rates. For the remaining strata, the marginal effect of remittances is close to zero or negative, since, according to our theoretical model, families living in those neighborhoods should have full access to the financial system and therefore do not require remittances for housing transactions.

Table 9: 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 Table 9 after a 10% increase of remittances inflows.

6 Concluding Remarks

This paper presents a new approach to measuring the effects of international remittances on housing prices. We analyze 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 use this information to compute housing returns for each project and match them with the average growth of remittances inflows during the same period in the corresponding region.

We empirically estimate the effects of remittances by performing cross-sectional Instrumental Variable (IV) regressions which include controls for regional macroeconomic variables, project-specific attributes as well as regional and time fixed-effects. We find significant evidence that increases remittances inflows have heterogeneous effects on housing prices. Such effect is positive in the case of houses located in lower-quality neighborhoods and high unemployment cities.

These results are consistent with our housing-price determination framework. In this model, the presence of financially constrained households and segmented housing markets makes remittances inflows 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. Finally, these results also imply the existence of an additional transmission channel from global shocks to domestic asset prices. For example, monetary policy tightening in developed economies would also affect the housing markets and economic activity in developing countries through the potential effect of higher interest rates on the amount of remittances sent back home by migrants living in those countries.

References

Arellano, C. and S. Bond (1991): "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." *Review of Economic Studies*, 58, 277–297.

Autor, D., D. Dorn, and G. Hanson (2013): "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review*, 103.

Badev, A., T. Beck, L. Vado, and S. Walley (2014): "Housing Finance Across Countries: New Data and Analysis," *Policy Research Working Paper, World Bank*, 6756.

Baltagi, B., G. Bresson, and J. Etienne (2015): "Hedonic Housig Prices in Paris: An Unbalanced Spatial Lag Pseudo Panel Model with Nested Random Effects," *Journal of Applied Econometrics*, 30, 509–528.

Basco, S. (2014): "Globalization and financial development: A model of the Dot-Com and the Housing Bubbles," *Journal of International Economics*, 92, 78–94.

——— (2018): *Housing Bubbles*, no. 978-3-030-00587-0, Palgrave Macmillan. Springer Books. Cham, Switzerland.

Basco, S., D. Lopez-Rodriguez, and E. Moral-Benito (2021): "House prices and misallocation: The impact of the collateral channel on productivity," Working Papers 2135, Banco de Espana.

BBVA-Research (2021): "Housing Market Perspective in Colombia 2021," *Bogota, Colombia.*

Bonilla-Mejia, L. (2017): "External Shocks and International Remittances in Colombian Regions," *ESPE Journal*, 35, 189–202.

Borusyak, K., P. Hull, and X. Jaravel (2022): "Quasi-experimental shift-share research designs," *Review of Economic Studies*, 89, 181–213.

Ferrero, A. (2015): "House Price Booms, Current Account Deficits, and Low Interest Rates," *Journal of Money, Credit and Banking*, 47, 261–293.

Garavito, A., E. Montes, J. Toro, C. Agudelo, V. Alfonso, A. Carmona, M. Collazos, C. Gonzalez, M. Hernandez, D. Lopez, A. Martinez, N. Rodriguez, S. Salamanca, J. Santos, and H. Zarate (2020): "External Real Income in Colombia: Export Performance Evolution and Challenges," *ESPE journal*, 95.

Gutierrez, M. and P. Acosta (2019): "Determinant Factors of Financial Access in Colombia across Socioeconomic Strata and Regions," *Dissertation, Economics Department, University Los Andes.*

Hou, Y. and S. Jia (2023): "Do remittances react to commodity windfall? Evidence from Latin America and the Caribbean," *Economic Modelling*, 121.

Jorda, O., K. Knoll, D. Kuvshinov, M. Schularick, and A. M. Taylor (2019): "The Rate of Return on Everything, 1870 - 2015," *The Quarterly Journal of Economics*, 134, 1225–1298.

Jorda, Ã., M. Schularick, and A. M. Taylor (2015): "Leveraged bubbles," *Journal of Monetary Economics*, 76, 1–20.

Laibson, D. and J. Mollerstrom (2010): "Capital Flows, Consumption Booms and Asset Bubbles: A Behavioural Alternative to the Savings Glut Hypothesis," *Economic Journal*, 120, 354–374.

Landvoigt, T., M. Piazzesi, and M. Schneider (2015): "The Housing Market(s) of San Diego," *American Economic Review*, 105, 1371–1407.

Mian, A., K. Rao, and A. Sufi (2013): "Household Balance Sheets, Consumption, and the Economic Slump," *The Quarterly Journal of Economics*, 128, 1687–1726.

Mian, A. and A. Sufi (2011): "House Prices, Home Equity-Based Borrowing, and the US Household Leverage Crisis," *American Economic Review*, 101, 2132–2156.

——— (2014): "What Explains the 2007-2009 Drop in Employment?" *Econometrica*, 82, 2197–2223.

——— (2022): "Credit Supply and Housing Speculation," *Review of Financial Studies*, 35, 680–719.

Rapaport, H. and F. Docquier (2006): "The Economics of Migrants' Remittances," *Handbook on the Economics of Giving, Reciprocity and Altruism*, 1, 1135–1198.

Sa, F. and T. Wieladek (2015): "Capital Inflows and the U.S. Housing Boom," *Journal of Money, Credit and Banking*, 47, 221–256.

Tamayo, C. and J. Malagon (2017): "Essays about Financial Inclusion in Colombia," *Asobancaria and Interamerican Development Bank, Washington D.C.*

A Appendix: Analysis of Domestic Determinants of Remittances Inflows

We compiled a panel of remittances inflows by region and year, 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 USD million variations and growth rates by regions, respectively. In the case of the unemployment rate, the regional data released by the National Statistics Department (DANE) correspond to the main 23 cities. Therefore, we match each housing project with the unemployment data of its closest 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 fixed effects by region (μ_r). The estimation method follows the GMM methodology originally devised by Arellano and Bond (1991) 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 10. A percentage point of additional regional GDP growth leads to fewer USD 7 million of regional remittances inflows. In addition, a percentage point of higher unemployment rate is associated to an increase of regional remittances inflows of USD 19 millions. 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 an the United States.

Table 10: Dynamic Panel Regression with Domestic Determinants of Remittances

Dep. Variable:	Remittances Inflows
Remittances (-1)	0.0503
	(1.61)
GDP Growth	-6.9627
	(-0.57)
Unemployment Rate	19.1365
	(1.52)
Intercept	-152.56
	(-1.50)
Observations	256
Groups	32

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