



**Do Remittances Affect Housing Prices in an Emerging Economy?
A Study Case from Colombia**

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Abstract

Remittances amounts on average two thirds of the FDI inflows of emerging economies. Literature on development and remittances coincides on the fact that when remittances are used as an investment, this investment generally materializes as housing. This work in progress proposes to fill a gap in the literature on remittances and development by studying what is the relation between remittances and housing prices at the aggregate level. This is done by regressing remittances against housing prices and housing approvals taking the Colombian economy as a case of study. The conclusions from the empirical analysis, suggest that remittances seem to increase the relative supply of housing which in turn reduces housing prices. In the long run, this effect seems to fade out as suggested by an estimated model adapted from [Blanchard and Quah \[1988\]](#).

JEL Classification: F24 (Remittances), O11 (Macroeconomic Analysis of Economic Development), R21 (Housing Supply and Markets), R31 (Housing Demand).

I. INTRODUCTION

THE present work intends to answer a question that seems to have been overlooked by the development literature: *how do remittances affect housing prices in an emerging economy?*. Such question is addressed by taking the Colombian economy as particular case of study because of the availability of data in remittances, the representativeness of such country as an average-emerging-economy receptor of remittances and the policies implemented by its government to channel remittances into housing projects.

Considering that remittances can have sizeable effects in the housing market in an emerging economy may seem a bit of an overstretch. Nonetheless, such overstretch

may seem more feasible if one notes that remittances often constitute a sizeable fraction of the GDP in emerging economies. According to statistics from the World Bank, the estimated value of remittances received by emerging economies was more than three times the value of the Official Development Aid (ODA) (135B\$) in 2014. Additionally, comparing the value of remittances to Foreign Direct Investment (FDI) and private debt and portfolio equity, the flow of remittances (431B\$) was equivalent to two thirds of the flow of FDI (662B\$) and almost as big as the flow of private debt and portfolio equity (443B\$). Not only that, but the data shows also that remittances are much less volatile than FDI and and private debt and portfolio equity [\[Ratha et al., 2016\]](#).

It then should not come as a surprise why there is an extensive literature studying the economic impact of remittances in emerging economies. A critical review of this literature presented by [Brown \[2006\]](#), which focuses

*The author kindly appreciates comments from the reader. The author asks kindly for the reader to please contact him by email in order to discuss the contents and improvements of this paper.

on the effect of remittances on economic development, shows that there is agreement on the academic community about the positive impact of remittances on development. The author concludes that the contribution of remittances on development can be enhanced by articulating remittances with public policies. In contrast, a more recent review by [Adams Jr \[2011\]](#) suggest that while remittances improve household welfare, the impact of remittances on economic growth is mixed and should be still considered as a topic in discussion.

In spite of the numerous works of the effect of remittances on development, to the knowledge of the author, the impact of remittances on housing or land prices *on a macroeconomic scale* seems to be overlooked by the literature. Although some studies have reported the impact of remittances on house and land prices, such studies have been mostly limited to a particular community or region. Nonetheless, these studies conclude that the rise of remittances flowing to these communities or regions increases both land and housing prices, concluding that these increments are explained by a growth on the demand.

The conclusions from this work mark a stark contrast with the evidence from the previous literature. The estimations performed here suggest that an increase in remittances will lead to a decrease in housing prices. This idea is assisted by further estimations that help to sustain these findings. Other estimations (not shown here) also confirm the results when using data from the three most important cities in Colombia. These remarkable results can be explained from the perspective of the housing supply. More specifically, they point toward the conclusion that remittances are used to increase the stock of housing, which in turn generate downward pressures on the housing prices which explains the negative correlation between housing prices and remittances.

The remaining of this work is divided in five

additional sections. The second section introduces the reader with a brief overview of some of the works that have reported effects of remittances on housing and land prices, dedicating a subsection to the literature that have dealt with this topic using Colombia as a case of study. The third section provides a brief overview of the Colombian economy by explaining the data used. In the fourth section the econometric exercises that point towards the interpretations highlighted on the introduction as findings is presented, with a subsection dedicated to perform some robustness checks. The dynamic relationship between remittances and the housing market is presented in the fifth section by the help of a simple model using the methodology proposed by [Blanchard and Quah \[1988\]](#). Finally, the sixth section wraps up this text by providing the conclusions.

II. LITERATURE REVIEW

Literature on remittances is extensive. When considering the reasons for remit, traditional literature in the subject differentiates two motives. The first motive is an altruistic one in the sense that emigrants send money to relatives or friends in their home country in order to contribute to some expenses of their families such as food, education, health, utilities and housing expenses [\[Fonchamnyo, 2012\]](#). The second motive is more self-interested. In this case the remittances are also spent on payment of debts, saving, investments and in entrepreneurial activities [\[Mazzucato, 2009\]](#), [\[Mazzucato, 2011\]](#).

More recently, it is being proposed that remittances are also used as a mechanism of insurance. According to this view, remittances can be seen as a method through which households diversify the risk of losing their income sources [\[Poza, 2005\]](#), [\[Ratha et al., 2016\]](#). Independent of the motives for remit, to the best of the author's knowledge, the literature reports that when remittances are spent on investing on emerging economies, such investing takes mostly the form of

housing [Maldonado et al., 2007], [Garay and Rodríguez, 2005], [Mazzucato, 2011], [Binford, 2003], among others.

i. Remittances as Housing Financing

When looking how remittances are spent in housing in developing economies, the literature show that communities close to the borders or communities of migrants spend a significant amount of it in housing. [Codesal, 2014] studies how remittances are spent in housing in the village of Xarabán in Ecuador. The survey shows that the 85% of the receivers of remittances have built a new house. Similarly, [Grant, 2007] reports that 61% of the people in their survey in Accra (Ghana) finance their investment in housing from savings mostly obtained from working abroad (61 %) and remittances (10 %).

Likewise, [Sa et al., 1981] find that for Bangladesh on a national level, 57% of remittances are spent on purchase of land (37%) or construction and improvement of Housing (20%) in the rural areas, whereas this percentage is 42% for the urban areas (23% and 19% for purchase of land and construction and improvement of housing respectively).

Nonetheless, few studies have reported on the relationship between remittances and the housing market. For example, both [Reichert, 1982] and [Wiest, 1984] found that remittances from temporal migration, increased land prices in non-disclosed communities, dubbed Guadalupe for the former and in Acuitzio for the latter, in the state of Michoacan in Mexico. On both papers, an excess of demand for housing originated by the influx of remittances is concluded as the reason for the increase in the housing prices.

However, the supply of housing is not fixed and a considerable number of studies report it. In the works of [Osili, 2004] and [Obeng-Odoom, 2010] both authors report the methods in

which emigrants invest in real estate in their home-countries by first purchasing land and later building on it. Similar reports are made in [Mazzucato, 2011] and [Zapata Araujo, 2017a], the latter reporting that migrants increase the supply of housing by constructing expansions on the properties.

In spite of the evidence that remittances are used to purchase housing on the remitter's home country, and the importance of the remittances as an income source in developing economies, the author is ignorant of any work that attempts to determine the impact of remittances on housing prices on a national level. That is precisely the gap that this work seeks to fill by performing an empirical analysis aimed to determine what is the effect of an increase in remittances on the housing prices in an emerging economy. In order to attain this objective, Colombia is taken as a case of study.

ii. Remittances and Housing financing in Colombia

As mentioned earlier, Colombia is taken as a case of study because of three reasons. The first one is the availability of quality data about remittances for a relatively long period of time. The second is the amount of remittances as a percentage of the GDP which permits to classify Colombia as an average developing-economy receptor of remittances and finally, the policies implemented by its government to channel remittances into housing projects.

In Colombia, some studies relate how remittances are spent. A descriptive analysis of data related to migration and remittances is presented by [Garay and Rodríguez, 2005]. In this study the whole population of the Metropolitan Areas of the Center-West region of Colombia (AMCO) was surveyed in 2004. The authors showed that about a 10% of the families that receive remittances use them for

financing the purchase of housing, and a 40% of these families use remittances for expand or improve their housing.

In a similar vein, the paper from Zapata Araujo [2017b] reveal in more detail how remittances are spent in housing. According to this study, receivers of remittances try to consolidate the stream of remittances into a source of permanent income. This is done by using the remittances to expand the dwelling, so that a portion of it can be either rented to generate a more secure stream of resources, or could be sold to capitalise on the investments.

More recent survey data on the relationship between housing financment and remittances is found from the LAMP¹ survey, a study that surveyed a total of 2.801 households in Colombia from the regions of Atlantico, Caldas, Cundinamarca, Quindio, Risaralda and Valle del Cauca in the years 2008, 2009, 2011, 2012 and 2013. Using this survey data, Table 1 shows the percentage of households that responded having financed their properties with remittances, ordered by type of property, for the households responding to posses 1 up to 3 properties.

Table 1: Percentage of Households using Remittances to finance property, by type of property.

<i>Property of Residence</i>	
Finced with Remittances	5.08%
<i>Second Property</i>	
House of Residence	5.88%
House	24.79%
Apartment	15.90%
Apartment Building	33.33%
<i>Third Property</i>	
H. of Residence	50.00%
House	9.09%
Apartment	0.00%
Apartment Building	0.00%

¹LAMP (Latin American Migration Project) is a collaborative research project based at Princeton University and the University of Guadalajara, supported by the MacArthur Foundation.

Table 1 evidences the importance of remittances on the financing of housing for the surveyed households, as it can be seen that a 5.08% of households reported to have financed their place of residency using remittances. For households with a second property, an important portion of households reported using remittances to finance the acquisition: 24.79% if the property is a house, 15.90% if it is an apartment, and 33.33% if it is an apartment building. Finally for households that reported having a third property, 9.09% reported having financed its acquisition using remittances.

A clearer depiction of how remittances are used to finance the acquisition of property, is presented on the next Table. Table 2 shows the percentage of persons, ordered by position in the household, reporting a particular purpose for the remittances sent by them while they were abroad and the savings brought by them after their migration period. For simplicity only Food or Maintenance, Construction or Repair of the dwelling and Purchase of housing or Lot are presented since those three categories resulted often being the most important.

Table 2: Purpose for Remittances and Saving brought after migration period by each household member with migratory experience.

<i>Purpose:</i>	<i>Position in the Household</i>				
	<i>Head</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th</i>
<i>Purpose of Savings brought after migration</i>					
Food or M.	44.17%	14.84%	7.32%	2.78%	11.11%
Construct.	9.58%	15.48%	4.88%	0.00%	5.56%
Purchase	10.83%	6.45%	13.41%	5.56%	0.00%
<i>Purpose of Remittances sent during migration</i>					
Food or M.	81.41%	8.99%	1.56%	1.59%	4.00%
Construct.	1.81%	14.23%	3.91%	4.76%	4.00%
Purchase	2.04%	2.25%	7.03%	0.00%	4.00%

The values from Table 2 indicate that when looking at remittances sent while abroad, household heads use remittances mainly for food and maintenance, whilst other members of the households remit with other purposes

in mind, such as payment of debts and health expenses (not shown) or Construction or repair of the Dwelling or Purchase of properties. Additionally, when looking for the purpose of the remittances brought to Colombia at the end of the migration period, the same Table shows that the percentage of people reporting the purposes of Construction or Repair of the dwelling or Purchase of property increase significantly.

On the institutional side, since the decade of 2000 the Colombian government have been implementing strategies trying to allocate remittances from consumption to production; particularly in housing. One of these strategies is "*Mi casa con remesas*" (My home with remittances) which permits for the residents abroad to finance buying housing in Colombia using remittances to pay the installments of the mortgage. Another strategy have been the sponsorship of housing/property fairs in some of the main cities where migrants reside. These fairs target residents abroad to invest in real state in Colombia. A more detailed explanation of these policies is found in Zapata [2016].

III. A BRIEF OVERVIEW OF COLOMBIAN DATASET

Using Colombian data as a case of study is explained by three particular reasons. The first reason is that Colombia is an emerging economy which receives a significant, but not exaggerated with respect to the GDP, inflow of remittances. In particular, according to the data on remittances from the world Bank, Colombia received around \$4.500 Millions of USD in remittances during 2015, which were equivalent to about 1/3 of the total FDI received during that year. This amount placed Colombia in the position 20 on the top remittances receivers countries by amount, but on the average position of 88 worldwide as a percentage of GDP. Ratha et al., [2016]

The second reason for choosing Colombia as a case of study is the availability of data on

housing supply. It was easy to find statistics of permits to construct new housing and new area approved for construction. The availability of this data is very important because it permits to estimate if remittances have an effect on the *supply* for housing. Finally, the third reason is the public policies that the Colombian government has put in practice to incentive its citizens to buy housing on Colombia using income from remittances, as discussed in the previous section.

For measuring the impact of remittances in the housing prices in Colombia, the Price Index of Housing (*IPVU*) collected by the Colombian Central Bank (Banco de La República) was used. The Figure 1 shows the evolution of the housing prices in Colombia discounting the effect of the inflation. A salient feature of the data is the housing crisis that occurred in Colombia dubbed the *UPAC crisis*. This crisis spanned from the end of the decade of 1990 to the beginning of the decade of the new millennium. The figure shows that the UPAC crisis led to a real depreciation of 30% on real housing prices with respect to the averages of the previous decade. From there on, real Housing prices seem to be increasing thereafter.

Figure 2 presents both the area in construction of housing on the left axis and the housing units in construction on the right axis. The data is collected by the Colombian Department of Statistics (DANE) and is available from 1997Q2 on area and of units from 2001Q1. The data shows a steady increase in the construction of housing in Colombia, with a slump during the 2008 financial crisis for both measures of construction.

Additionally, Figure 3 shows the value of remittances received in Colombia in Millions of Colombian Pesos discounted for inflation. Data of remittances is available from 2000Q1 from the Colombian Central Bank. The figure show that remittances seem to be reduced after the financial crisis of 2008. This should

Figure 1: Housing Real Price Index

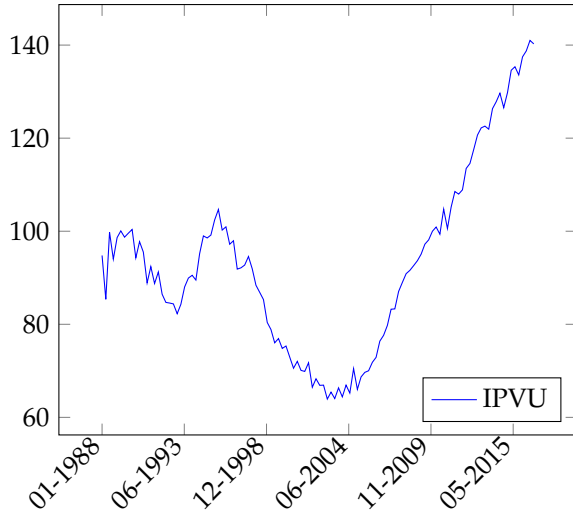


Figure 3: Remittances to Colombia in Millions of USD (1Q2000 - 1Q2017)

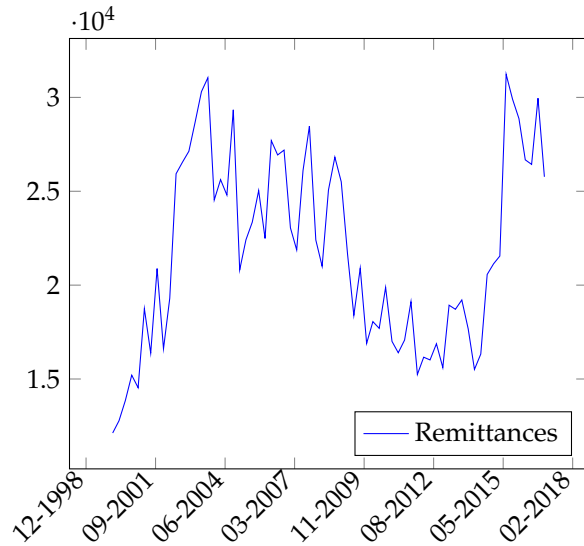
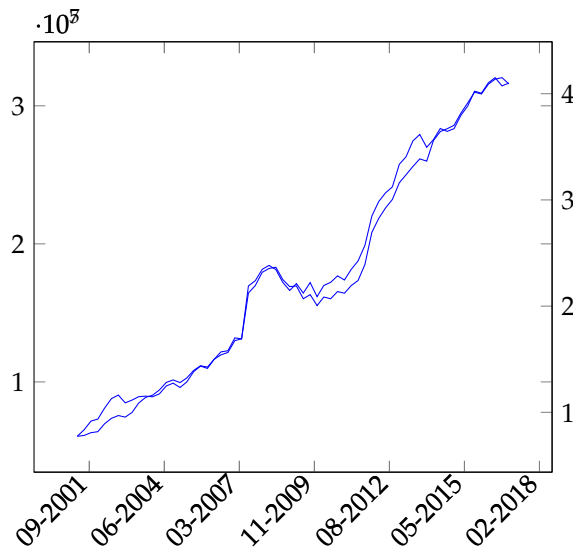


Figure 2: Construction of Housing by Area and by Units (1Q2001-1Q2017)



not come as a surprise since according to the data collected by the Colombian Central Bank, more than one half of the total remittances come from Spain and the United States; two countries that were acutely affected by the financial crisis. [de la República de Colombia, 2017]

Other series used in this study included the component of house rent from the Consumer Price Index, the number of housing units approved for construction as well as the area approved for construction. This data is available to the public from the Colombian Department of Statistics (DANE).

IV. EMPIRICAL EVIDENCE

The empirical influence of remittances on the housing market is measured in this work by using a battery of estimations relating macroeconomic and housing variables and remittances. All regressions were made using quarterly data from 2000Q1 to 2016Q4. Datasets on remittances, GDP, the central Bank’s intervention interest rate and the index of housing prices for sale came from

the National Central Bank of Colombia. ² Likewise datasets on housing permits and the index of housing prices for rent came from the Colombian National Bureau of Statistics. ³

i. How do remittances affect housing prices?

Due to the fact that there is no previous literature on the subject, as a starting point a VAR model was estimated to assess the macroeconomic links between the variables. This was done to remain agnostic about the relationship between the the Housing Prices and the Remittances.

For the VAR, the national GDP (y), index of housing prices for sale (π^H), interest rate (i) and remittances (rem) were used as endogenous variables, while a time trend, a dummy variable taking the value of 1 until 2009Q1 and a constant were included as exogenous variables. Unit root analysis using the augmented Dickey-Fuller test led to conclude that the series were stationary in differences, while ruling out the existence of persistent trends, except for the interest rate which in logarithm was already stationary.

In line with these results, all variables were transformed in logs and expressed in changes with respect to the previous year, implying that they represent yearly growth rates. Moreover, this transformations allows to mitigate seasonal effects. All variables were transformed this way, except for the interest rate which was not differentiated since it was already stationary in logarithmic levels. The number of lags in the VAR was chosen to be 2 according to the results of the Hannan-Quin, Akaike and Schwarz's Bayesian Information

²Banco de la República de Colombia. Data can be downloaded directly from the Bank's website <http://banrep.gov.co/> under the section "Statistics".

³Departamento Administrativo Nacional de Estadística: DANE. Data can be downloaded directly from the Bureau's website <http://dane.gov.co/> under the section "Statistics by topic" using the applet "Ventanilla Única Virtual".

Table 3: VAR(2) GDP, Housing Prices for Sale, Interest Rate and Remittances

	Dependent Variables			
	y_t	π_t^H	i_t	rem_t
y_{t-1}	.810*** (.146)	.474** (.232)	1.246** (.571)	-1.686* (.887)
y_{t-2}	-.412*** (.156)	-.389 (.248)	-.208 (.610)	-1.028 (.949)
π_{t-1}^H	-.024 (.079)	.097 (.126)	-.011 (.309)	.922* (.480)
π_{t-2}^H	.204** (.079)	.387*** (.127)	.024 (.311)	-.432 (.484)
i_{t-1}	.043 (.029)	.093** (.046)	1.425*** (.112)	.409** (.175)
i_{t-2}	-.073** (.030)	-.065 (.048)	-.552*** (.117)	-.488*** (.182)
rem_{t-1}	-.028 (.021)	-.068** (.034)	.090 (.084)	.297** (.130)
rem_{t-2}	.051*** (.020)	.043 (.031)	.151** (.077)	.310** (.120)
t	-.001*** (.000)	-.000 (.000)	.000 (.001)	-.006*** (.002)
$dummy$	-.007 (.009)	-.037*** (.014)	-.013 (.034)	-.039 (.054)
$const.$.046 (.036)	.155*** (.058)	-.511*** (.221)	.484** (.221)

Criteria. Additionally, cointegration tests were performed ruling out the existence of at least one, two or three cointegrating relationships. Table 3 show the results from the estimation of the VAR⁴

Similar VAR models were estimated to assess the robustness of these results; all of these checks lead to results very similar to those presented in Table 3. These estimations examined the variables in log-levels, as well as other forms of differentiations; consideration of different lags, different dummies accounting for the 2008 crisis and other periods, among others.

⁴From here on in all the tables, values in parenthesis show the standard deviation. ***, ** and * represents significance different from zero at a 1%, 5% and 10% confidence levels respectively.

The results from Table 3 reflect some stylized facts. In particular, starting from the positive and significant coefficients of the lags of output, housing prices, interest rates and remittances on themselves, confirms that the series show some persistence. Furthermore, the results show that GDP reacts negatively to increases on the interest rates (within two lags for the data studied) which is a standard macroeconomic result. Moreover, GDP seems to react positively to housing prices and remittances. This last result should not be surprising since remittances are also spent on consumption, providing a stabilizing mechanism to the economy [Buch and Kukulenz, 2004]. Finally, the positive coefficient associated to the effect of GDP on the interest rate reflects the backward component of the Taylor Rule of the Monetary Policy.

The results relevant for this study are the coefficients associated to the effect of remittances on the housing prices. The estimations concluded very consistently that remittances have a negative and statistically significant effect on the housing prices at the aggregate level.⁵ This negative relation could be interpreted as the idea that remittances are being used to finance the expansion the supply of housing in Colombia.

Because of the fact that sale and rent housing are substitute goods, it is to be expected that housing prices for rent and for purchase should respond in a similar way. Further estimations were performed taking the housing price index of properties for rent. This series was extracted as a component on the computation of the Colombian consumer price index. These series provide more detail on the price index of housing for rent because it can be distinguished by socioeconomic level and by region. The results from the estimations

⁵It is worth noticing that in spite of the relatively limited number of observations and the relative large VAR estimated, the increased variance for the estimated parameters showed consistently that remittances have the negative and statistically significant impact on housing prices, which on itself speaks of the robustness of the estimations.

using the price index of housing for rent are shown in Table 4 and provided results that mirrored the ones from Table 3, with the exception that the impact of remittances was again negative but not statistically significant at a national level.

Table 4 presents also the results from the estimations when discriminating by income level, which reveal an interesting pattern. Table 4 show (for concision) only the results of the equation of the VAR associated to the housing prices of the different estimations using the price index of housing for rent on a national level for high income (High), mid income (Mid), low income (Low) and the aggregate income level (All Inc.). These estimations show that remittances have a negative and statistically significant correlation with housing prices for rent on low income level housing and for all income levels. Similar estimations (not shown here) were performed using ARIMAX models (which allowed the inclusion of contemporaneous relations), leading to nearly identical conclusions.

ii. Addressing the Causality

The causality of the relationship between remittances and housing prices could also be explained on an inverse direction; namely, that remittances could respond to a fall in the wealth represented in housing. In order to assess whether the increase in remittances causes a decrease in the housing prices, or that a decrease in the housing prices creates an increase in the flow of remittances, additional tests and estimations were performed. As a point of start, the Granger Causality Test was computed on the estimated VARs. This test was used to exploit the temporal relationship between the variables, so that the causal relationship could be interpreted based on the temporal one.

A priori, if increased remittances lead to a decrease in housing prices, it could be expected that housing prices do not Granger-cause re-

Table 4: VAR(2) GDP, Housing Prices for Rent (by income level), Interest Rate and Remittances

	Dependent Variable: π_t^H (by Income)			
	All Inc.	Low	Mid	High
y_{t-1}	-.001 (.025)	.026 (.030)	-.024 (.034)	.073 (.047)
y_{t-2}	.016 (.025)	-.017 (.031)	.048 (.035)	-.010 (.051)
π_{t-1}^H	.663*** (.121)	.839*** (.120)	.606*** (.122)	.632** (.121)
π_{t-2}^H	.118 (.117)	-.080 (.126)	.154 (.119)	.082 (.107)
i_{t-1}	.003 (.005)	.006 (.007)	-.002 (.007)	.006 (.010)
i_{t-2}	-.008** (.003)	-.005 (.007)	-.004 (.007)	.002 (.010)
rem_{t-1}	-.005 (.004)	-.011** (.005)	-.000 (.005)	-.010 (.008)
rem_{t-2}	.008** (.003)	.010** (.004)	.007 (.005)	.010 (.007)
t	-.000 (.001)	-.000 (.000)	-.000 (.000)	.000** (.498)
$dummy$	-.001 (.001)	-.002 (.002)	-.002 (.002)	.009*** (.003)
$const.$.013* (.007)	.016** (.008)	.0131 (.010)	-.000 (.012)

mittances, while at the same time remittances do Granger-cause the housing prices. If, on the contrary, a fall in housing prices cause an increase in remittances, the opposite should be expected. Table 5 shows the results of the granger causality tests for all variables of the VAR.

Table 5: Granger causality test

Regressor s	Dependent Variables			
	y	π^H	i	rem
y	–	.494	.001	.122
π^H	.278	–	.870	.328
i	.023	.102	–	.540
rem	.602	.006	.472	–
all	.131	.014	.001	.362

Again, the results from Table 5 show features that are expected in the macroeconomic literature. In particular, the null hypothesis that the interest rate does not Granger-causes GDP is rejected at a 5% confidence level [.023]. This results reflect the empirical principle behind the use of the interest rate as the main instrument of the monetary policy. In a similar vein, the null hypothesis that the GDP does not Granger-causes the interest rate is rejected at a 1% confidence level [.001], which evidence the active policy of inflation targeting, in line with a Taylor Rule including a backward looking component.

With respect to housing prices and remittances, Table 5 reveals that the null hypothesis that any or all of the variables considered do not Granger-cause the remittances, cannot be rejected. This feature is consistent the empirical finding reported in the literature about remittances being mostly acyclical, confirming that the flow of remittances remain remarkably constant during the economic cycles. In particular, it is worth noticing that the null hypothesis that GDP or housing prices do not Granger-cause remittances is not rejected with p-values of 0.122 and 0.328 respectively.

When considering the causality of the

interest rate on the housing prices, the null hypothesis is rejected with an almost 10% [0.102] confidence level, showing the effect of the interest rates on the cost of financing housing. Finally, and most importantly for the objective of this work, the null hypothesis that remittances do not Granger-cause the housing prices is further rejected with a 1% [.006] confidence level, suggesting in conclusion, a causal relationship from remittances towards housing prices.

Moving forward, variables other than the housing prices were also used as a method to further assess the causality between housing prices and remittances. In particular, the construction permits both in housing units as well as in meters was used to measure the supply of housing. It should be expected that if remittances are being used to finance the supply of housing, there should be a positive and significant contemporaneous relationship between remittances and either the number of housing units approved for construction, the number of meters approved for construction, or both. Table 6 shows the results from estimating an ARIMAX(2,1,0) on the number of units approved for construction for different income levels against the GDP, the interest rate and the remittances⁶

The results from the estimations show that remittances have a positive and statistically significant effect on the number of housing units approved for construction, result which suggest a positive correlation between housing supply and remittances. The effect of remittances on housing supply, seems to be stronger on low and mid income housing as the coefficient associated to remittances is not statistically significant on high income housing. The results presented on Table 6 are robust to specifications using different lags for both the explanatory and explained variables, as well as using the area approved for construction as explained variable.

⁶The number of lags was chosen to be 2 according to the results of the Akaike and Bayesian Information Criteria.

Table 6: ARIMAX(2,1,0) Housing Approved vs GDP, Interest Rate and Remittances

	Dependent Variable: $\Delta HousingAprv_t$ (by income level)			
	All Inc.	Low	Mid	High
Δy_t	.525 (.638)	.307 (1.118)	.513 (.561)	1.084*** (.368)
Δi_t	-.030 (.060)	-.105 (.109)	-.022 (.070)	.012 (.086)
Δrem_t	.167*** (.053)	.253** (.101)	.140** (.060)	.058 (.050)
<i>const.</i>	.013 (.017)	.011 (.030)	.014 (.015)	.004 (.029)
π_{t-1}^H	-.052 (.224)	.033 (.178)	.012 (.172)	.372*** (.092)
π_{t-2}^H	.040 (.212)	.285* (.169)	.245 (.243)	.396*** (.132)

V. LONG RUN DYNAMICS OF REMITTANCES ON HOUSING PRICES

The previous section presented some empirical evidence that supports the hypothesis that remittances seem to have an effect on the supply of housing. Nonetheless, it is worth noticing that the estimated parameters are useful to understand the short run effects that remittances have on housing prices. To determine the long run effect that remittances have on housing prices, it is common to use using Impulse Response Functions (IRFs). The evidence collected in the previous section can be incorporated in the computation of the IRFs in order to impose some *structure* that could help to provide an economic interpretation of the dynamic behavior of shocks to the variables.

In this writing this *structure* is provided by using the methodology proposed by Blanchard and Quah [1988] which allows to identify supply and demand shocks by imposing restrictions on the temporal effects that the different shocks have on the variables. In the

light of the results from Section IV suggesting that remittances may have an effect on the supply of housing, this procedure seems an adequate straightforward way to identify the long run dynamics of the remittances on the housing prices from the data.

In a nutshell, the methodology proposed by Blanchard and Quah [1988] relies of the assumption that only supply disturbances will have a long run effect on output levels, whereas demand disturbances will only have short run effects. Both supply and demand shocks will have a short run effect on output and unemployment levels but neither of them will have long run effect on unemployment. These restrictions are imposed during the computation of the IRFs, which allow to provide an economical interpretation of the shocks to the variables.

i. A simple model

In order to identify the temporal dynamics of shocks of remittances on the housing prices, this section proposes a simple economic model. The model proposed is an adaptation of a Keynesian model presented in Blanchard and Quah [1988] which was a modified version of Fischer [1977]. The use of this model is justified because of its simplicity and specially because it allows to individually identify macroeconomic fluctuations arising from either supply or demand.

The model introduced here consists on aggregate demand and production functions for both output and the housing market, price setting behavior and wage setting behavior equations and the law of motion of the disturbance terms.

$$Y_t^d = M_t - P_t + a\theta_t + bT_t \quad (1)$$

$$Y_t^s = N_t + \theta_t + cT_t \quad (2)$$

$$P_t = W_t - \theta_t \quad (3)$$

$$W_t = W|E_{t-1}\{N_t = \bar{N}\} \quad (4)$$

$$H_t^d = N_t + T_t - eP_t^H + d\Gamma_t \quad (5)$$

$$H_t^s = \theta_t + T_t + gP_t^H + f\Gamma_t \quad (6)$$

The variables Y_t , θ_t , and H_t represent the log levels of Output, productivity, and housing units respectively. The Log level of Prices, wages, the monetary supply and the inflow of remittances is denoted by P_t , W_t , M_t and T_t respectively. Γ_t represents shocks that affect housing such as preferences of government policies and, finally, the log level of employment is represented by N_t with \bar{N} being the full employment level.

Equation (1) follows the lines of Blanchard and Quah [1988] by describing the aggregate demand as a function of real balances and productivity with the addition of the resources obtained from remittances. Productivity is allowed to affect the demand directly; it can be done through demand for investment, in which case $a > 0$. Moreover, the inclusion of remittances as determinant of demand is straightforward as remittances increase disposable income. Equation (2) also tracks Blanchard and Quah [1988] stating that the production function depends both on the productivity and the employment level having constant returns to scale. Remittances are introduced to account for remittances being used as productive capital.

Additionally, Equation (3) describes the price setting behavior, defining the price level as a function of the nominal wage and the productivity. Finally, Equation (4) describes the wage setting behavior of the economy which is set one period in advance to achieve an expected full employment level.

To introduce the housing market, Equation (5) presents the housing demand as a function of the employment level, the remittances, the housing prices and the housing

policies developed by the government. It is supposed that higher housing prices will decrease the demand for housing, while higher remittances and employment levels will have positive effects on the demand of housing. Similarly, Equation (6) presents the housing supply function as dependent on the productivity, the remittances and the housing prices. The introduction of remittances on the supply of housing is justified by the results obtained from the previous sections. Moreover, it is expected that the government policies in housing and/or the preferences for housing affect both the supply and the demand of housing which explains its inclusion in Equation (5) and Equation (6).

The model is closed by specifying the laws of motion of M_t , θ_t , T_t and Γ_t which are assumed to be:

$$M_t = M_{t-1} + \varepsilon_t^d \quad (7)$$

$$\theta_t = \theta_{t-1} + \varepsilon_t^s \quad (8)$$

$$T_t = T_{t-1} + \varepsilon_t^T \quad (9)$$

$$\Gamma_t = \Gamma_{t-1} + \varepsilon_t^\Gamma \quad (10)$$

With ε_t^d , ε_t^s , ε_t^T and ε_t^Γ serially uncorrelated orthogonal demand, productivity, remittances and preferences shocks respectively. Solving for ΔY_t , ΔH_t and U_t , being $U_t = \bar{N} - N_t$ the unemployment level, yields the following set of structural equations:

$$U_t = -\varepsilon_t^d - a\varepsilon_t^s - (b-c)\varepsilon_t^T \quad (11)$$

$$\Delta Y_t = \Delta\varepsilon_t^d + a\Delta\varepsilon_t^s + (b-c)\Delta\varepsilon_t^T + c\varepsilon_t^T + \varepsilon_t^s \quad (12)$$

$$\Delta P_t^H = \frac{1}{g+e}[\Delta\varepsilon_t^d + a\Delta\varepsilon_t^s + (b-c)\Delta\varepsilon_t^T + (d-f)\varepsilon_t^\Gamma - \varepsilon_t^s] \quad (13)$$

In line with the results from [Blanchard and Quah \[1988\]](#), Equation (12) shows that shocks

of demand, productivity and also remittances will have short run effect on the output level. At the same time, Equation (12) shows that only productivity and remittances shocks will have a long term effect on the output level, allowing them to be identified as supply shocks for the output level. ⁷

In a similar way, Equation (13) shows that shocks on demand, productivity and remittances will affect housing prices in the short run, but only productivity and housing shocks will have a permanent effect on housing prices. This result permits to identify productivity as a pure supply shock for the housing market, with the long run effect of the government policy affecting positively or negatively the prices depending on the government policy or the preferences affecting predominantly the supply or the demand. Finally Equation (11) show that remittances, demand and productivity shocks will have a temporal effect in the unemployment rate but neither of those shocks will have an impact in the long run, a feature that resembles [Blanchard and Quah \[1988\]](#).

ii. Identification strategy

To use the technique proposed by [Blanchard and Quah \[1988\]](#), the VAR used to compute the IRFs contains four stationary variables in their respective order: log differences of output, log differences of housing prices, unemployment rate and log differences of remittances.

Defining \mathbf{X}_t the vector containing these variables in the respective order, the structural-form of the VAR can be expressed as follows:

$$\mathbf{A}\mathbf{X}_t = \sum_{i=1}^p \mathbf{C}_i \mathbf{X}_{t-i} + \mathbf{B}\mathbf{v}_t \quad (14)$$

with \mathbf{v}_t a vector of structural disturbances, assumed to be orthogonal and of unitary variance. \mathbf{A} and \mathbf{B} are two squared matrices and \mathbf{C}_i are the matrices associated to \mathbf{X}_{t-i} for

⁷This is so because the sum of the coefficient associated to this shock are different from zero

the p lags.

Since the structural form is not directly observable, the estimation is done using a reduced form of the underlying structural model:

$$\mathbf{X}_t = \mathbf{A}^{-1} \sum_{i=1}^p \mathbf{C}_i \mathbf{X}_{t-i} + \mathbf{e}_t \quad (15)$$

where \mathbf{e}_t is the vector of the reduced form disturbances of the VAR, which is defined by a full matrix of covariances Σ . The relationship between the reduced-form residuals \mathbf{e}_t and the structural disturbances \mathbf{v}_t is of the form:

$$\mathbf{e}_t = \mathbf{A}^{-1} \mathbf{B} \mathbf{v}_t \quad (16)$$

From where the relationship between the covariance matrices of the observed reduced form \mathbf{e}_t and the unobserved structural form \mathbf{v}_t can be derived as:

$$E\{\mathbf{e}_t \mathbf{e}_t'\} = \mathbf{A}^{-1} \mathbf{B} E\{\mathbf{v}_t \mathbf{v}_t'\} \mathbf{B}' \mathbf{A}^{-1} \quad (17)$$

As the variables in \mathbf{X}_t are stationary, the vector \mathbf{X}_t is covariance-stationary and so the reduced-form Equation (15) admits a Wold decomposition to transform it into a infinite order moving-average process:

$$\begin{aligned} \mathbf{X}_t &= \left[\mathbf{I} - \mathbf{A}^{-1} \sum_{i=1}^p \mathbf{C}_i \right]^{-1} \mathbf{e}_t \\ &= \mathbf{D} \mathbf{E} \mathbf{v}_t \end{aligned} \quad (18)$$

with $\mathbf{D} = \left[\mathbf{I} - \mathbf{A}^{-1} \sum_{i=1}^p \mathbf{C}_i \right]^{-1}$ and $\mathbf{E} = \mathbf{A}^{-1} \mathbf{B}$.

In order to apply the restrictions imposed by the Equation (12) and Equation (13) using the methodology proposed by Blanchard and Quah (1988), it is necessary to establish some restrictions on the product of the matrices \mathbf{D} and \mathbf{E} . With the structural shocks ordered as $\mathbf{v}_t = [\varepsilon_t^s, \varepsilon_t^r, \varepsilon_t^d, \varepsilon_t^T]'$, the restrictions arising from Equation (12) are:

$$0 = D_{11}E_{12} + D_{12}E_{22} + D_{13}E_{32} + D_{14}E_{42} \quad (19)$$

$$0 = D_{11}E_{13} + D_{12}E_{23} + D_{13}E_{33} + D_{14}E_{43} \quad (20)$$

These restrictions establish that only productivity and remittances shocks will have a long run effect on the output level. In a similar fashion, the restrictions arising from Equation (13) are:

$$0 = D_{21}E_{12} + D_{22}E_{22} + D_{23}E_{32} + D_{24}E_{42} \quad (21)$$

$$0 = D_{21}E_{14} + D_{22}E_{24} + D_{23}E_{34} + D_{24}E_{44} \quad (22)$$

These two restrictions formulate that only supply and remittances will affect housing prices on the long run. Equation (11) does not impose any long run restriction, so the product of the matrices \mathbf{D} and \mathbf{E} in the third row is unconstrained. Finally, Equation (9) imposes the following restrictions implying that only a shock in remittances will have long run effects on the growth rate of that same variable:

$$0 = D_{41}E_{11} + D_{42}E_{21} + D_{43}E_{31} + D_{44}E_{41} \quad (23)$$

$$0 = D_{41}E_{12} + D_{42}E_{22} + D_{43}E_{32} + D_{44}E_{42} \quad (24)$$

$$0 = D_{41}E_{13} + D_{42}E_{23} + D_{43}E_{33} + D_{44}E_{43} \quad (25)$$

In the next section, Impulse-Responses are computed using these restrictions to show the long-run dynamics of shocks to the different variables, and most importantly for the objective of this paper, of remittances to the housing prices.

iii. Impulse-Response functions

To show the dynamic response of the housing price level to variations in remittances, the cumulative Impulse-Response Functions (IRFs) where computed using the identification strategy proposed by the model of the previous section. Non-cumulative IRFs were calculated for the unemployment level since this variable is stationary in levels. The cumulative IRFs are presented in Figure 4.⁸

⁸Robustness checks using as identification strategy a Cholesky decomposition with the variables in the following order: GDP, price index of housing for sale, interest rate and remittances, lead to similar results. The results of these robustness checks were also robust to other different orderings.

Figure 4: Impulse Response Functions

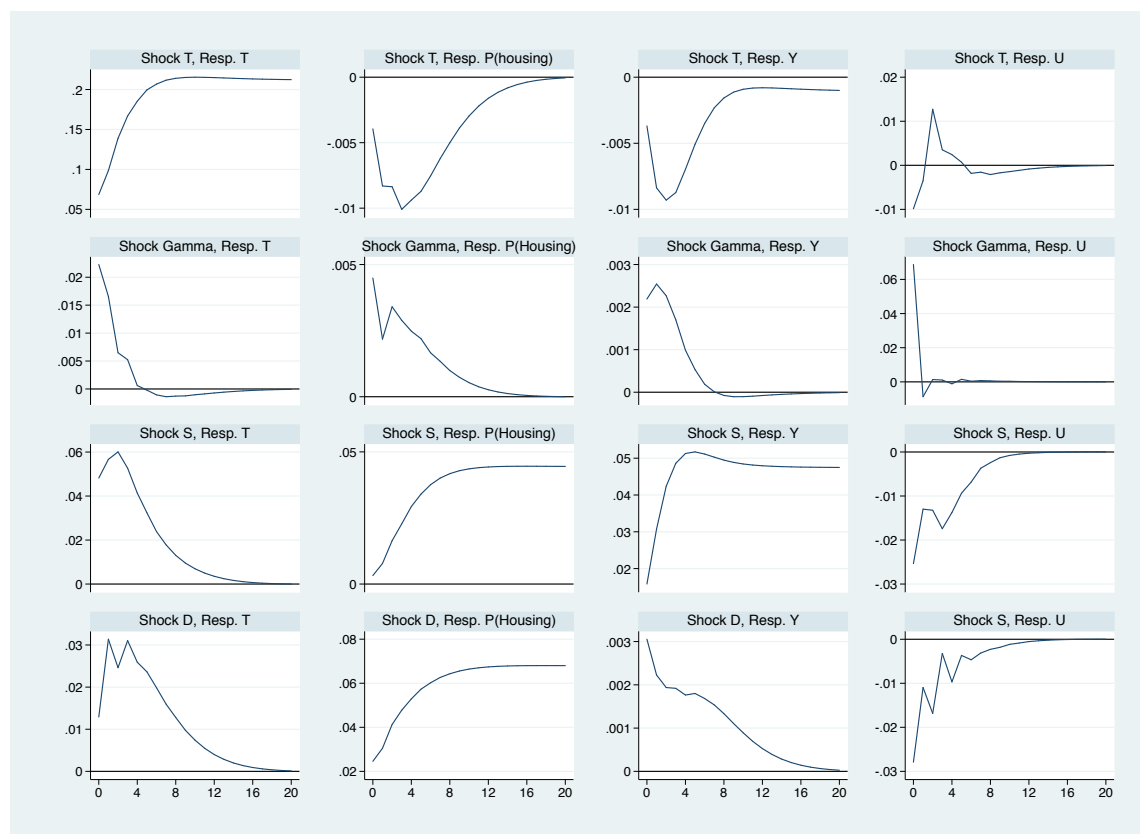


Figure 4 shows the impulses on the rows from up to down in the following order: Remittances (T), Policy Shocks (Γ), Supply (S) and Demand (D). The responses are shown in the columns from left to right in the following order: Remittances (T), Housing prices ($P_{(Housing)}$), Output (Y) and Unemployment (U).

Starting from shocks to the remittances as appear in the first in the first row of Figure 4, a positive shock in *remittances* will have a permanent effect on the level of remittances, reaching a total increase of 20% after 2 years. Shocks in remittances could be interpreted as coming from emigration waves of Colombians to other countries which in turn creates a permanent increase in the level of remittances. When looking at the housing market, Figure 4 shows that a shock in remittances will create

an initial decrease in the level of the housing prices, reaching a minimum decrease of 1% after one year and reverting back to its original level after about 4 years. This comportment could be interpreted as indicating that the initial increase in the supply of housing is later compensated by a posterior increase in the demand of housing, presumably fueled by the multiplicative effects that the investments in housing generate.

Similarly, the output level seems to have a negative response to shocks in remittances, reaching a maximum dip of about 1% after one year and reverting back to nearly its original level after two years. An opposite figure is shown with the unemployment level which on impact decreases the unemployment level by 1%, bouncing back to reach an increase of 1%

after one year and returning to its initial level after two years. Output and unemployment moving in opposite directions is not a surprising fact and several explanations could account for such behavior. A first explanation could indicate an *endowment effect* for the workers receiving the remittances or the proceeds coming from the revenues obtained from the influx of remittances. This endowment effect could initially remove them from the active population and delaying their working decisions, increasing the unemployment and thus affecting negatively the output. Another possible explanation follows the argument of considering the shock of remittances as coming from seasonal emigration waves. The initial decrease could account for the workers leaving the country to find seasonal job offers abroad with the posterior increase in unemployment reflecting the return of these emigrants to Colombia. Finally, the output movement could also reflect a *revenue effect* of the households receiving remittances, which substitute the consumption of inferior domestic goods for imported goods of higher quality.

The second row of Figure 4 shows the responses to a shock in *housing*. It seems that housing shocks does not generate long run impacts over all the variables. Remittances show to increase 2% on impact, returning to their original levels after one year. Similarly, unemployment increases about 6% on impact but quickly reverts to its original level after one quarter. Likewise, output seems to be weakly affected, increasing 0.2% on impact reaching a maximum increase of 0.25% after two quarters and reverting to its original level after 2 years. Finally, housing prices seem to have the longest effect, increasing on impact and returning to their original levels after three and half years.

The third row shows the dynamic behavior to a *supply* shock. The supply shock increase the flow of remittances which reach a maximum of 3% after three quarters and returning to their original levels after about three and

half years. Housing prices respond positively and permanently to supply shocks increasing to 4% after two years. Supply shocks also have a permanent effect on the GDP level, increasing 5% after one year. Finally, supply shocks decrease unemployment in 2.5% on impact, taking about two and half years to return to its original level.

Finally, *demand* shocks are presented in the fourth row. Demand shocks seem to increase 3% the influx of remittances after two to four quarters, returning to their original levels after four years. The level of the Housing Prices shows a permanent increase of 7% reaching its maximum in about two to three years. GDP increases 0.03% on impact but reverts to its initial level after about four years. Unemployment reacts in an opposite way when comparing to GDP, decreasing 3% after the shock, and reverting back to its original level after about 3 and half years.

VI. CONCLUSIONS

This work attempts to fill a gap in the literature by determining the relationship between remittances and housing prices. To attain this objective different measures of house price index were analyzed against remittances, GDP as a measure of income and interest rates as a measure of cost of financing home. Data from Colombia was considered because of the availability of data, the policies implemented to financing housing using remittances and the fact that this country can be considered as a typical example of an emerging economy that receives moderate amounts of remittances as a percentage of its GDP.

The results from the estimations point towards the hypothesis that remittances are being used to increase the supply of housing. This interesting finding is justified by recognizing that the additional supply of housing creates a downward pressure on the housing prices. In this work, this hypothesis was

supported by the fact that both housing prices for sale and for rent seem to have a negative and significant correlation with remittances. Additionally, other estimations suggested that both the approved area and units for construction have a positive and significant correlation with remittances. Furthermore, some tests suggests that the temporal causality comes from remittances towards housing variables. The intuition behind these results is that the income from remittances is being used to finance the construction of new housing; this increased supply of housing generates downward pressures on the housing prices. This seems to be more relevant on low and mid income housing as evidenced by the estimations. Finally, the dynamic effect of the remittances on the housing market, suggests that the relationship between remittances and housing prices fades completely after about four years.

The conclusions from this work could find a purpose in the institutions that are concerned with housing on emerging countries. The finding that remittances create downward pressures on the housing prices at the aggregate level, is an interesting result because it can be articulated into policies that search for providing more access to housing by means of reducing housing market prices. Furthermore, the conclusion that remittances do have an effect on the supply of housing is also relevant because it open the doors to incorporating remittances as a source of financing in the construction sector.

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