

# THE BRAZILIAN HOUSING PROGRAM - *MINHA CASA MINHA VIDA* - EFFECT ON URBAN SPRAWL

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# The MCMV Program

## Main Characteristics

- From 2009 to 2016, more than US\$60 billions of investments;
- Three brackets, *Faixa 1* is the social housing - 42% of the Program - the research focus;
- For families with monthly income up to US\$600, installments of maximum 10% of families income, in 120 months and no collateral;
- The total subsidy can reach 96% of the property;

# The MCMV Program

## The Political Equilibrium

- *Caixa Econômica*<sup>1</sup> wants to produce as many units as possible since they have to execute the budget;
- The municipalities have all incentives to bring as many units as possible since this would be a pork barrel for voters;
- From developer perspective, considering that this is a profitable business with assured demand and no credit risk, *Caixa Econômica* faces all the credit risk;
- The dweller has no decision making power.

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<sup>1</sup>Bank controlled by the Federal government, the financial institution responsible for the credit provision and Program administration

# The MCMV Program

## Program Failures from Literature

- Maximum value of UH, without clear quality guarantees;
- Builders maximizes margin of profit, decide the location and the some construction standards;
- The shortage of available land in neighborhoods with better infrastructure and urban services leads housing developers to search peripheral places to implement housing projects;
- Lack of urban infrastructure;
- Distant from urban centers;
- There is a pattern of social housing segregation;
- Non-adherence to the housing deficit.

But the PMCMV is really responsible for “social peripherization”?

# PMCMV and the urban sprawl

## Urban sprawl particularities

- Lack of regulation contributes to urban expansion;
- Other factors may influence expansion, such as the cost of transportation or land, for example;
- It can be seen as a measure of inefficiency in the occupation of urban spaces - in LA case;
- New development metrics developed by Angel et al. (2011) - pixels classified as urban, suburban and rural build-up; and fringe, captured urbanized and exterior open space.

# Dataset and Methodology

## Urban Sprawl metrics and Municipalities data

- Satellite images (LandSAT) processed by INPE<sup>2</sup>, in pixels and calculou em  $m^2$  - build-up, non build-up and water.
- Leapfrog, Infill and Extension: three types of new development, measured in  $t_1$  (1995-2005) e  $t_2$  (2005-2015).
- PMCMV<sup>3</sup> data (2009-2015)
- Municipal demographic and revenue data<sup>4</sup> in 2000 and 2010;
- Distance from the Metropolitan Region City Center;
- Municipal annual voters<sup>5</sup> growth as a proxy of population growth in  $t_1$  (1996-2006) and  $t_2$  (2006-2016).
- Calculated land open space and ruggedness as the standard deviation of the terrain elevation in the fringes of the urban footprint for each of the municipalities - in 2005 and 2015.
- Municipal land use regulation in 2002 and 2012;
- 20 Brazilian metropolitan regions - 304 municipalities.

<sup>2</sup>*Instituto Nacional de Pesquisas Spaciais - Nacional Institute of Space Research*

<sup>3</sup>Ministry of Cities

# PMCMV and the urban sprawl

## Methodology - OLS

$$y_i = \beta_0 + \delta MCMV_i + \beta_1 x_{(1,i)} + \beta_2 x_{(2,i)} + \dots + \beta_k x_{(k,i)} + \mu_i$$

Where:

- $y_i$  is the new development (leapfrog, extension or infill) logarithm between 2005-2015, for each city  $i$ ;
- $MCMV_i$  the variable of interest that might be a dummy of PMCMV presence in municipalities from 2009 and 2015; or the natural logarithm of municipal HU plus one;
- $x_{(1,i)}$  through  $x_{(k,i)}$  are control variables from 2010 census, housing deficit, land characteristics as well as use land regulations;
- $\mu_i$  is a spherical error with the desirable properties.

# PMCMV and the urban sprawl

OLS Results - New Development x MCMV logarithm of HU

Table: OLS - New development X MCMV HU

Dep. Var.	espec. 1	espec. 2	espec. 3	espec. 4	espec. 5	espec. 6	espec. 7	espec. 8	espec. 9
leapfrog	0.41*** (0.10)	0.43*** (0.10)	0.43*** (0.10)	0.41*** (0.10)	0.41*** (0.10)	0.36*** (0.10)	0.34*** (0.10)	0.35*** (0.10)	0.35*** (0.10)
extensio	0.40*** (0.08)	0.43*** (0.08)	0.42*** (0.08)	0.40*** (0.08)	0.40*** (0.08)	0.35*** (0.07)	0.33*** (0.07)	0.31*** (0.07)	0.31*** (0.06)
infill	0.65*** (0.10)	0.70*** (0.09)	0.70*** (0.09)	0.64*** (0.09)	0.64*** (0.09)	0.62*** (0.09)	0.62*** (0.09)	0.60*** (0.09)	0.60*** (0.09)
	espec. 10	espec. 11	espec. 12	espec. 13	espec. 14	espec. 15	espec. 16	espec. 17	
leapfrog	0.28** (0.11)	0.20* (0.11)	0.19* (0.10)	0.19* (0.10)	0.19* (0.10)	0.19* (0.10)	0.19* (0.10)	0.19** (0.10)	
extensio	0.11 (0.07)	0.01 (0.06)	-0.03 (0.05)	-0.03 (0.05)	-0.03 (0.05)	-0.03 (0.05)	-0.03 (0.05)	-0.04 (0.05)	
infill	0.26*** (0.09)	0.18** (0.08)	0.18** (0.08)	0.18** (0.08)	0.17** (0.08)	0.17** (0.08)	0.17** (0.08)	0.18** (0.08)	



# PMCMV and the urban sprawl

## Main Findings - OLS

- No significant difference in the dynamic of land use between municipalities that did and didn't receive the Program;
- Program is correlated to sprawl just one it is sizeable in the municipality - strong correlation between the number of units produced and leapfrog, extension or infill;
- For the first specifications (spec.1 - 9) the coefficient on infill is larger than the coefficients observed for leapfrog or extension.
- Specifications (2) through (5) socio-demographic variables: poverty, school, over 60, housing deficit - coefficients are very stable;
- Spec. (6) to (9) - open space, revenue, roughness and voters, reduce the magnitude;
- Specification (10) (and onward) *Faixas* 2 and 3 added - reduction in the magnitude of the coefficients. As well as when we control for available land - specs 11 and 12 (infill, extension or leapfrog)

# PMCMV and the urban sprawl

Methodology - Dif-in-Dif

$$y_{it} = \beta_0 + \delta_1 \text{treated}_i + \delta_2 \text{time}_t + \delta_3 (\text{treated}_i \times \text{time}_t) + \beta_1 X_{(1,it)} + \beta_2 X_{(2,it)} + \dots + \beta_k X_{(k,it)} + \mu_{it}$$

Where:

- $\text{treated}_i$  the treatment dummy, assumes value 1 for municipalities with PMCMV agreements and zero in the opposite case; or the logarithm of total HU;
- $\text{time}_t$  the time dummy, is 1 for time  $t_2$  (2005-2015) and zero for  $t_1$  (1995-2005) for new development and 1 for time  $t_2$  (2000) and zero for  $t_1$  (2010) for municipalities data;
- $(\text{treat} \times \text{time})_{it}$  the interaction between  $\text{treated}_i$  (dummy or logarithm of HU) e  $\text{time}_t$ ;

# PMCMV and the urban sprawl

Results - New Development  $\times$  MCMV logarithm of HU

Table: Dif-in-Dif - New development  $\times$  UH MCMV ( $treat \times time$ )<sub>it</sub>

Dep. Var.	espec. 1	espec. 2	espec. 3	espec. 4	espec. 5	espec. 6	espec. 7	espec. 8
leapfrog	0.20 (0.16)	0.20 (0.16)	0.25 (0.15)	0.25 (0.15)	0.24 (0.15)	0.24 (0.16)	0.23 (0.15)	0.18 (0.15)
extensio	-0.10 (0.12)	-0.10 (0.12)	-0.08 (0.12)	-0.07 (0.12)	-0.08 (0.12)	-0.08 (0.12)	-0.09 (0.10)	-0.03 (0.09)
infill	-0.14 (0.14)	-0.13 (0.13)	-0.13 (0.13)	-0.10 (0.13)	-0.13 (0.13)	-0.14 (0.13)	-0.14 (0.12)	-0.15 (0.13)
	espec. 9	espec. 10	espec. 11	espec. 12	espec. 13	espec. 14	espec. 15	espec. 16
leapfrog	0.10 (0.16)	0.13 (0.16)	0.17 (0.15)	0.19 (0.15)	0.19 (0.15)	0.19 (0.15)	0.18 (0.15)	0.18 (0.15)
extensio	-0.22** (0.09)	-0.07 (0.08)	-0.09 (0.08)	-0.08 (0.08)	-0.08 (0.08)	-0.08 (0.08)	-0.07 (0.08)	-0.07 (0.08)
infill	-0.41*** (0.13)	-0.26** (0.11)	-0.25** (0.11)	-0.25** (0.11)	-0.25** (0.11)	-0.24** (0.11)	-0.24** (0.11)	-0.24** (0.11)

# PMCMV and the urban sprawl

## Main Findings - Dif-in-Dif

- The rhythm of leapfrog, extension and infill observed from 1995 to 2005 was not significantly changed from 2005 to 2015, in case of dummy. But cities that picked up more units of the social housing Program were infilling slower than other cities.
- Looking at the magnitude of the coefficients, leapfrog has now the positive magnitude, not statistically significant, and extension and infill are, if something, negative.
- When added the other metrics to control for the supply of land in the city, the coefficient on infill is significant and negative for any other specification. Nothing changes for leapfrog. So, PMCMV might be selecting cities that were infilling slower and possibly, as well with slow extension, but with faster leapfrog.

# PMCMV and the urban sprawl

## Conclusion

- The PMCMV is the largest social housing Program in Latin America in many decades and might not providing adequate urban infrastructure and choosing inappropriate locations for the settlements. Since, there are very few people living on the streets, the housing deficit is mainly due to the lack of infrastructure and remote location, so it is a paradox!
- The leapfrog trend in the city was not changed. However, those cities were infilling faster before the Program was implemented. It means a reduction in the opportunities for poor dwellers inside the urban footprint.
- The reduction in the rate of infilling suggests that it is possible to better locate de HU - infilling does not mean increasing downtown use. It is possible and usually efficient to infill inside a peripheral area.

# PMCMV and the urban sprawl

## Conclusion

- Metropolitan regions with poorly located houses, usually deliver more HU, so it is more difficult politically and administratively to deliver better localized HUs, which is not always in the interest of the Program's decision makers, they benefit from volume and not from quality.
- There is a political equilibrium on the Program design. The dweller does not have decision-making power and may end up living in a inadequate location.