Loan-To-Value Policy and Housing Loans: Effects on constrained borrowers.

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Motivation

- Housing sector macroprudential policies is widespread , with loan-to-value (LTV) limits one of the most common (Jacome and Mitra 2015)
- Rationale: Higher equity stake and lower household leverage increase borrower resilience and lower bank losses in downturns.
  - This is supported both by theory (e.g. Campbell and Cocco (2003)), and evidence (e.g. Demyanyk and Hemert (2011))
- Yet, many transmission mechanisms at the borrower level not well explored, including effect on delinquencies and on contract terms.
  - Campbell, Ramadori and Ranish (2015) show reduced delinquencies when risk weights are conditional on LTV. But three is no corresponding evidence for hard LTV limits.

Intuition

- LTV limits shift loan contract terms and therefore borrower behavior.
- We focus on the effect of the policy on the subset of borrowers constrained by the policy, that is the average treatment effect on the treateted (ATT).
- Natural to define constrained borrowers as the ones that would violate the LTV limit if allowed to do so.
  - Treatment status so defined is observed only before the policy
  - We may use borrower characteristics to infer treatment status
  - Botosaru and Gutierrez (2015) show this intuition is correct and propose a consistent and eficient GMM estimator for the ATT.
- We apply this to estimate the effect of the LTV limit imposed in Brazil on September 2013 with unique credit register and employment data.

Literature

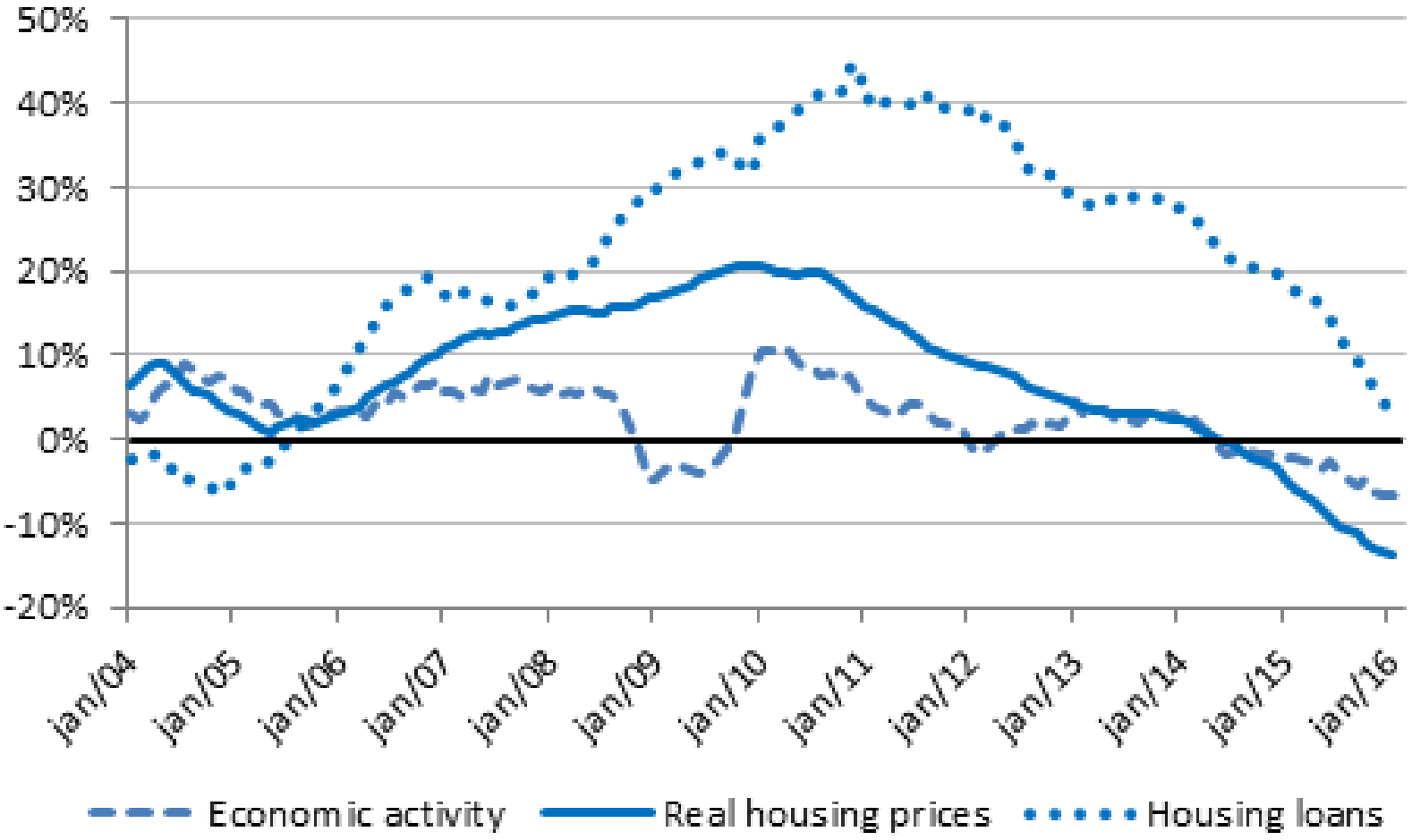
- Most of the literature focus on aggregate impact of LTV policies.
  - Igan and Kang (2011) find that the LTV cap in South Korea results in lower transaction activity and slower price increases.
  - Funke and Paetz (2012) find a small effect of LTV policy on housing prices, and a more lasting one in indebtedness.
- Smaller literature focus on the impact of LTV on mortgage risk.
  - Demyanyk and Hemert (2011) show high-LTV loans were more likely to be delinquent during the US sub-prime bust.
  - Hallisey et al. (2014) document the same effect in Ireland
  - Campbell et al. (2015) show LTV related risk weights reduce delinquencies using a discontinuity design
- No literature for the effect of hard LTV limits on delinquencies, or any LTV policy on house choice and contract terms.

Housing Finance in Brazil

- Brazil is one of the few jurisdictions that experienced a housing credit boom in the aftermath of the financial crisis (Cerutti et al. (2015))
- The cycle arguably started around 2004. This was mostly the result of legal improvements that promoted faster repossession processes, ("Alienação fiduciária" enters the civil code in 2004).
- In the vast majority of housing loans in Brazil, interest rates are subsidized (lower than sovereign rates), but with eligibility criteria.
  - The most relevant credit line is **SFH.** In this case, funding is redirected from savings accounts.
  - The only housing loan segment that could offer competitive terms to the SFH is the **FGTS** segment. Even lower interest rates than the SFH but stricter eligibility criteria. Funding from severity fund.

Housing Finance in Brazil

Economic activity, housing loans, and housing prices in Brazil, 2004-2015.
All series are real annual growth rates.



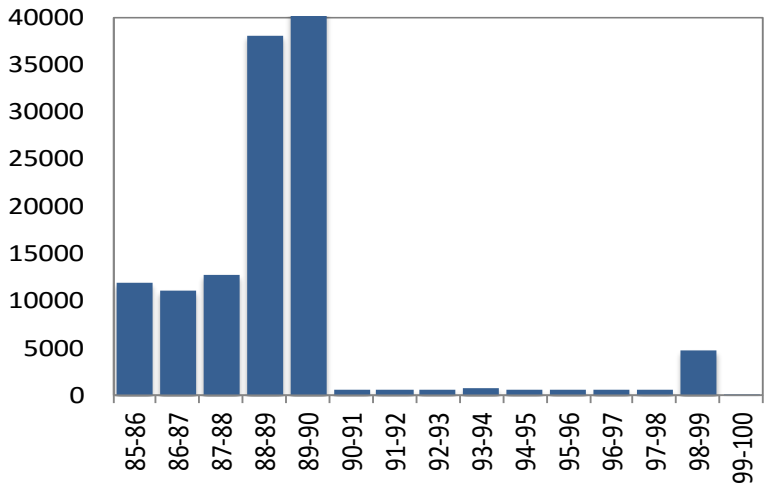
LTV limit policy

- In this context, the National Monetary Council (CMN) , introduced Resolution n. 4,271/2013 in September, 2013.
- The Resolution required that SFH loans with the widely-used constant amortization schedule have a maximum LTV of 90%.
- It also increased price eligibility cap (we look at loans below the old limit to control for the impact of this simultaneous measure)
- Segments other than the SFH are not addressed by the regulation and not mandated to comply with the LTV limit of 90%.
  - However, data shows this limit also affected the FGTS segment.
  - We could not find any external reason for this, and so attribute it to managerial decision at the bank level, that is, at Caixa, the government owned bank that operates these lines.

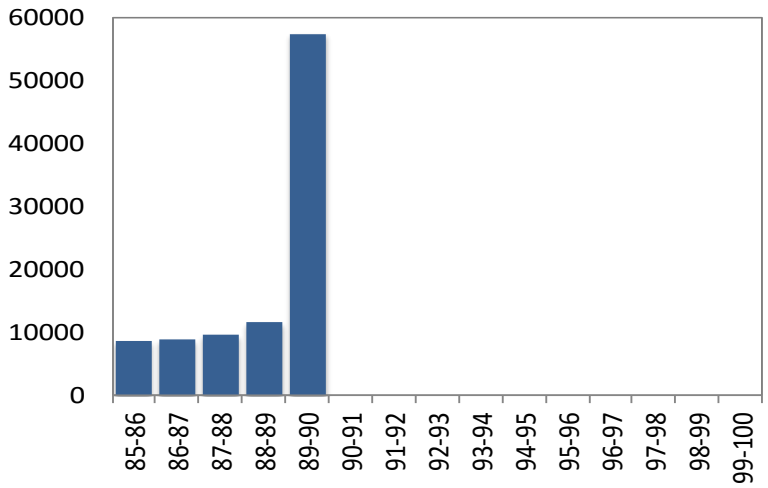
LTV limit policy

Frequency of new housing loans by LTV ranges

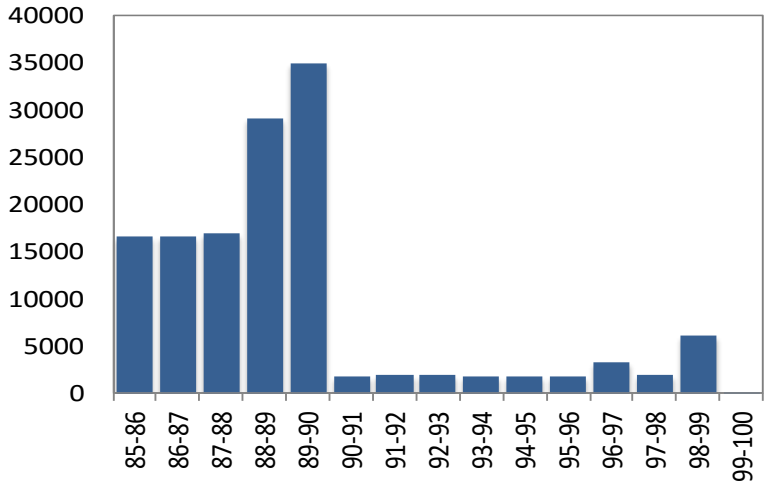
SFH - Before



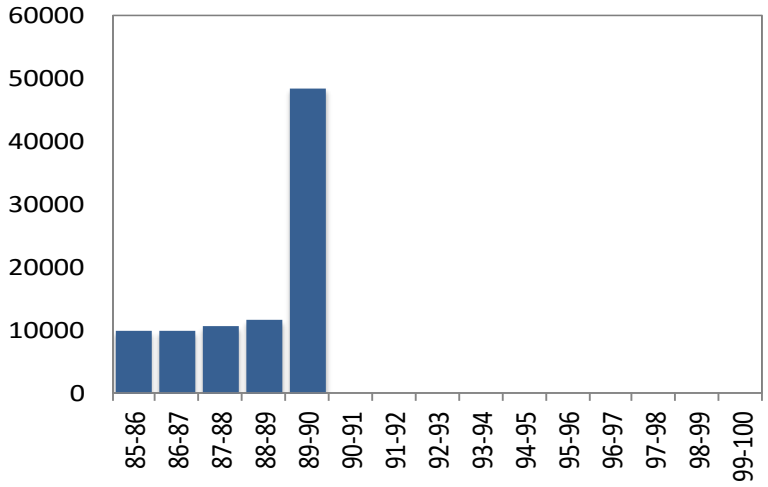
SFH - After



FGTS - Before



FGTS - After



Methodology

- Treated borrowers = would violate the LTV limit if allowed to do so.
- Before regulation we can observe the treatment status of the borrowers. (treated borrowers have LTV greater than the 90% limit)
- After regulation, we can no longer distinguish constrained borrowers based on the contract characteristics.
- The parameter of interest is the average treatment effect on the treated (ATT).
- Botosaru and Gutierrez (2015) is designed to this case.

Methodology

- Let $Y_t(D)$ be the potential outcomes on a variable, where D is the treatment indicator and t the time period
- Then ATT = $E(Y_1(1)-Y_1(0)|D=1)$
- Under the usual assumptions, $\theta=\Delta E(Y|D=1) - \Delta E(Y|D=0)$ identifies the ATT, with $\Delta E(Y|.) = E(Y_1|.) – E(Y_0|.)$. The assumptions are:

  (A1) Paralell paths for the treated and control groups

  (A2) No anticipation of the policy change
- We need to include more assumptions in the case of partially observed treatment status.

Methodology

- Let Z be a fixed borrower feature and consider the propensity score $e_t(Z)=Prob_t(D=1|Z)$. The new assumptions are:

  (A3) stationarity: the policy does not affect the propensity score.

  (A4) relevance: the variable is relevant to forecast treatment status.

  (A5) conditional independency: given treatment status, the proxy variable affects outcomes homogenously in both periods.

- Then $\Delta E(Y|Z) = \Delta E(Y|D=1)e(Z) - \Delta E(Y|D=0)(1-e(Z))$. Stack this over the support of Z, and solve for $\Delta E(Y|D=1)$ and $\Delta E(Y|D=0)$, from which we have the ATT.
- Botosaru and Gutierrez (2015) show this is a just identified GMM estimator, and inference takes care of uncertainty in e(.) estimation.

Data: Loan Contract

- The Credit Information System (SCR), the credit register managed by Central Bank of Brazil (BCB), centralizes information about loans.
- Our data includes all housing loans originated in the years 2012 to 2014, with repayment behavior up to one year of origination (so that we actually use data up to 2015).
- We summarize the data in the following slide.

Data: Loan Contract

SFH					N = 216,413
	Mean	St.Dev.	25%	50%	75%
Loan (Reais)	173,808	75,537	120,695	158,600	216,000
House Price (Reais)	196,049	85,188	136,260	179,866	245,401
Interest rate (p.p.)	9.08	0.48	8.85	8.85	9.14
Maturity (years)	29.88	6.60	26.92	32.08	35.00
	Yes	No			
Arrears next 12 months	2%	98%			

FGTS:					N = 228,313
	Mean	St.Dev.	25%	50%	75%
Loan (Reais)	88,084	21,685	74,638	83,363	99,800
House Price (Reais)	99,265	24,666	82,863	93,978	113,843
Interest rate (p.p.)	5.56	1.04	4.59	5.11	6.16
Maturity (years)	25.44	3.71	24.50	25.00	29.58
	Yes	No			
Arrears first 12 months	2%	98%			

Data: Borrower Controls

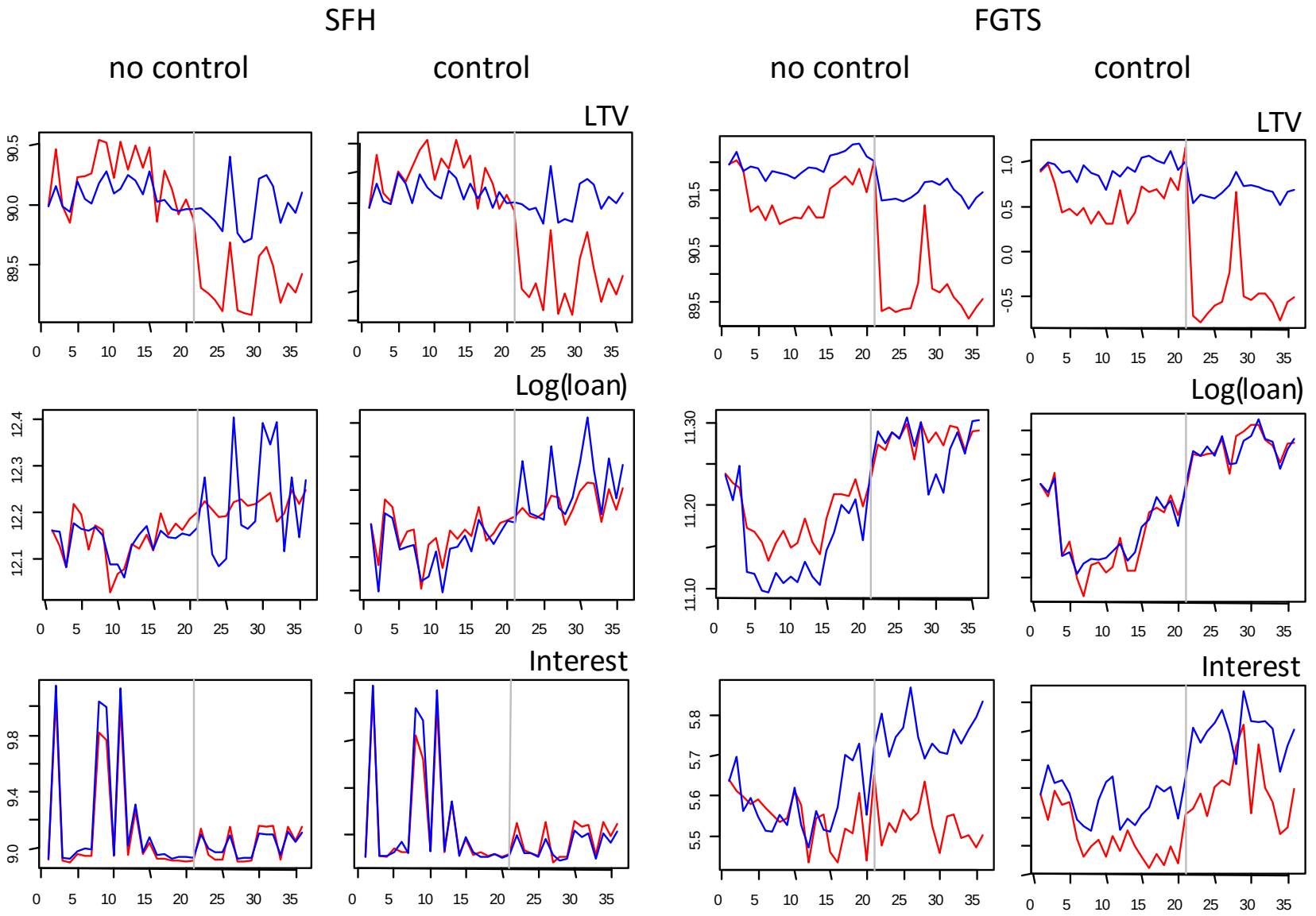
- We merge loan-level information from the SCR to the official employment register of the Brazilian Ministry of Labor and Employment.
- This database contains information about each natural person that has at least one documented employment relationship in Brazil in a given year, and data about the employment contract with the employer.
- These two sources are merged to enable the use of several controls at the borrower level, summarized in the following slide.

Data: Borrower Controls

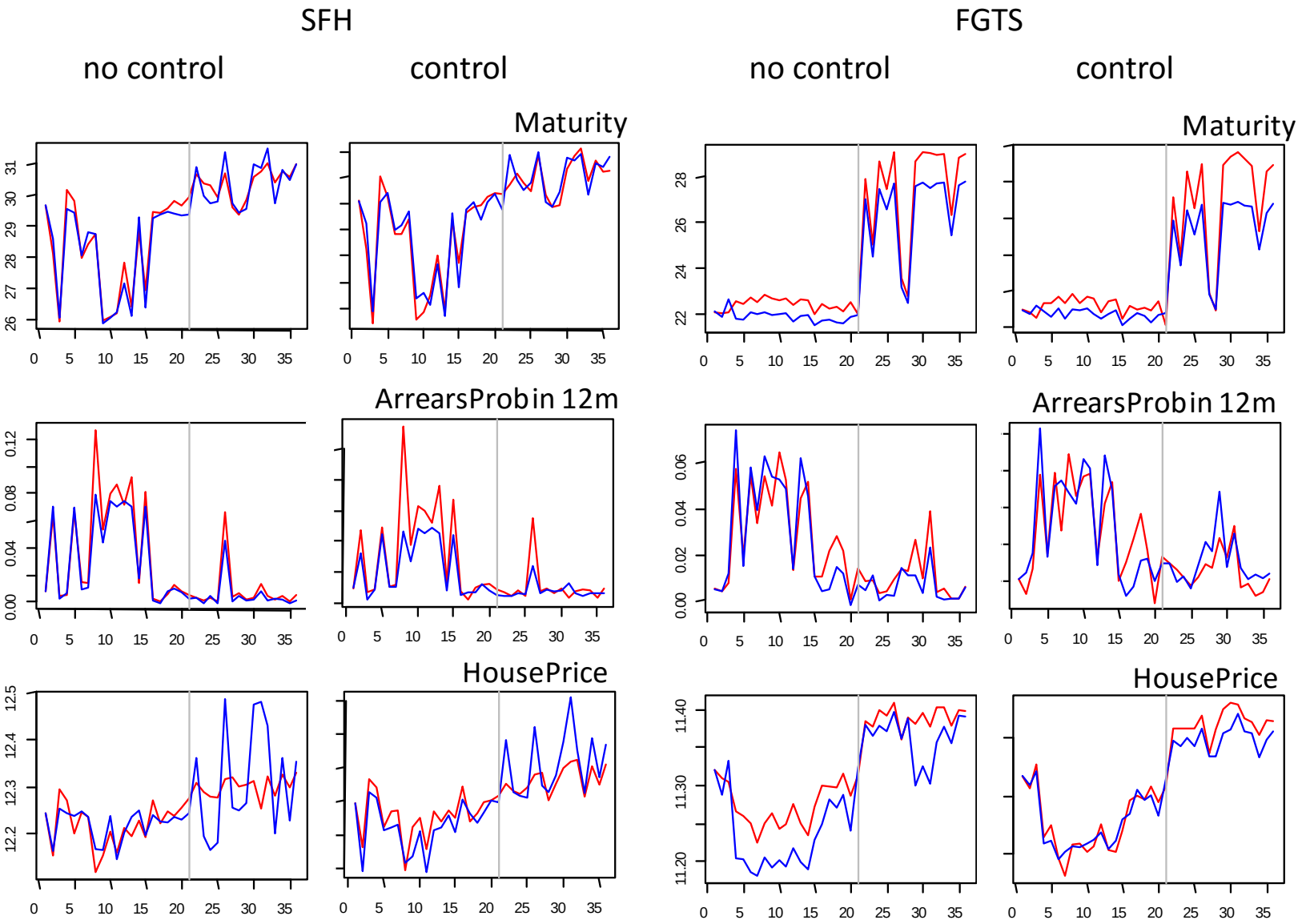
SFH:					N = 85,525
	Mean	St.Dev.	25%	50%	75%
Income (Reais)	7,203	7,165	3,594	5,657	8,755
Education (years)	8.15	1.33	7.00	9.00	9.00
Job Duration (years)	9.29	8.80	2.55	5.74	13.81
	Yes	No			
Male	63%	37%			
Govn. Employee	55%	45%			

FGTS:					N = 78,577
	Mean	St.Dev.	25%	50%	75%
Income (Reais)	2,437	1,557	1,465	2,160	2,989
Education (years)	6.92	1.63	7.00	7.00	8.00
Job Duration (years)	5.28	5.76	1.82	3.31	6.11
	Yes	No			
Male	67%	33%			
Govn. Employee	77%	23%			

Results


SFH
FGTS
no control
control
no control
control
LTV
LTV
Log(loan)
Log(loan)
Interest
Interest

Results


SFH
FGTS
no control
control
no control
control
Maturity
Maturity
ArrearsProbin 12m
ArrearsProbin 12m
HousePrice
HousePrice

Results: SFH, controls

Table 4. Average treatment effect on constrained borrowers, SFH loans only, with controls

	LTV>80%	LTV>85%	LTV>87%	LTV>88%
LTV [1]	-11.28 ***	-9.35 ***	-8.18 ***	-7.74 ***
	(2.67)	(1.49)	(0.99)	(0.77)
loan (log)	-0.43 ***	-0.46 ***	-0.49 ***	-0.42 ***
	(0.09)	(0.06)	(0.05)	(0.04)
interest (p.p.)	-0.04	0.39 ***	0.45 ***	0.42 ***
	(0.04)	(0.06)	(0.06)	(0.04)
maturity (years)	-0.30	-1.68 ***	-2.20 ***	-2.30 ***
	(0.58)	(0.40)	(0.37)	(0.34)
prob. arrears first 12 months (p.p.)	-16.69 ***	-11.09 ***	-9.34 ***	-8.60 ***
	(0.05)	(0.02)	(0.02)	(0.01)
house price (log) [2]	-0.49 ***	-0.34 ***	-0.34 ***	-0.28 ***
	(0.10)	(0.05)	(0.04)	(0.03)
F (first stage)	1,093	1,104	1,110	1,129
N	68,296	48,614	39,517	34,557

Results: FGTS, controls

Table 6. Average treatment effect on constrained households, FGTS segment, with controls

	LTV>80%	LTV>85%	LTV>87%	LTV>88%
LTV [/1]	-5.01 ***	-4.24 ***	-4.06 ***	-4.01 ***
	(0.17)	(0.11)	(0.10)	(0.10)
loan	-0.06 ***	0.00	0.02 *	0.02 **
	(0.01)	(0.01)	(0.01)	(0.01)
interest	-0.75 ***	-0.31 ***	-0.21 ***	-0.13 ***
	(0.04)	(0.03)	(0.03)	(0.03)
maturity	1.46 ***	1.93 ***	2.11 ***	2.13 ***
	(0.20)	(0.18)	(0.17)	(0.16)
arrears15	-0.04 ***	-0.03 ***	-0.02 ***	-0.02 ***
	(0.01)	(0.00)	(0.00)	(0.00)
log_price [/3]	0.19 ***	0.07 ***	0.01	-0.02
	(0.04)	(0.02)	(0.02)	(0.01)
F (first stage)	5,175	4,166	3,421	2,945
N	76,271	47,583	36,202	30,378

Conclusion

- We show evidence that unexpected LTV limit regulation affects housing loan contract terms and the subsequent behavior in the subset of borrowers constrained by the new regulation, when comparing their behavior with unconstrained borrowers
- Loan repayment behavior improves in both house loan segments considered in the paper…
- … but loan contract terms other than LTV become less favorable to the borrower depending on the segment.

Conclusion

- In the SFH segments, directly affected by the LTV regulation, the average housing loan contracts for treated borrowers have
  - higher down payment requirements
  - higher interest rates,
  - shorter maturities.
- Borrowers apparently compensate these factors by purchasing more affordable homes, therefore reducing the overall loan size.
- The resulting is an improved repayment behavior.

Conclusion

- In the FGTS segment, treated FGTS borrowers settle with housing loan contracts with
  - lower interest rates
  - longer maturities, and
  - finance homes at the same price level as before,
- with an overall positive effect on repayment behavior.

- **The less favorable terms offered to SFH borrowers may reflect, among other factors, the fact that the regulator signals there are prudential concerns only in this segment of the market.**

Future Work

- We still need to implement some robustness tests on the paper.
- We are gathering data do make placebo tests (we need to look further into 2016 for repayment behavior), but also considering shorter 6 month windows
- We are writing the code to use logit estimation of the propensity score in place of the ols, although results should not be sensible.

- Looking into the future, we think the methodology proposed in the paper is an interesting tool in the assessment of LTV regulation.
- It suggests it is important to control for the signaling strength of the policy, so it is interesting to propose associated metrics.

Thank you!

João Barata R. B. Barroso

Results: SFH, no controls

Table 3. Average treatment effect on constrained borrowers, SFH loans only, no controls

	LTV>80%	LTV>85%	LTV>87%	LTV>88%
LTV /1	-8.93	-9.65 **	-9.00 ***	-8.70 ***
	(5.89)	(4.42)	(3.22)	(2.60)
loan (log)	-0.25 *	-0.50 **	-0.64 ***	-0.59 ***
	(0.13)	(0.20)	(0.20)	(0.16)
interest rate (p.p.)	0.13	0.61 **	0.74 ***	0.70 ***
	(0.09)	(0.25)	(0.24)	(0.19)
maturity (years)	-2.25 **	-3.13 ***	-3.34 ***	-2.95 ***
	(1.06)	(0.96)	(0.86)	(0.76)
prob. arrears first 12 months (p.p.)	-10.52	-5.14	-3.31	-1.70
	(0.09)	(0.04)	(0.03)	(0.02)
house price (log) /2	-0.61	-0.33 **	-0.32 ***	-0.23 ***
	(0.37)	(0.13)	(0.10)	(0.07)
F (first stage)	1,093	1,104	1,110	1,129
N	168,588	121,812	99,305	86,868

Results: FGTS, no controls

Table 5. Average treatment effect on constrained households, FGTS segment, no controls

	LTV>80%	LTV>85%	LTV>87%	LTV>88%
LTV [/1]	-5.75 ***	-5.57 ***	-5.42 ***	-5.40 ***
	(0.58)	(0.43)	(0.38)	(0.37)
log_loan	-0.45 ***	-0.24 ***	-0.14 ***	-0.09 ***
	(0.04)	(0.02)	(0.02)	(0.02)
interest	-1.86 ***	-1.20 ***	-0.89 ***	-0.71 ***
	(0.20)	(0.10)	(0.08)	(0.07)
maturity	-1.49 ***	-0.60	-0.41	-0.43
	(0.48)	(0.50)	(0.53)	(0.56)
arrears15	-0.02 *	-0.01	-0.02 *	-0.02 *
	(0.01)	(0.01)	(0.01)	(0.01)
log_price [/2]	0.28	0.16	0.07	0.03
	(0.19)	(0.11)	(0.08)	(0.07)
F (first stage)	5,175	4,166	3,421	2,945
N	219,931	136,527	103,401	86,411