Welfare Analysis of Changing Notches: Evidence from Bolsa Família

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- Despite some evidence of such behaviors, little is known about the equity-efficiency trade-off of transfer programs
- Usual bunching approach relies on strong assumptions and typically informs optimal schedules

This Paper

1. Develop a novel sufficient statistics framework to *bound* welfare impacts of reforms to transfer programs featuring notches
   - B: # hhs bunching at old notch who move toward new notch
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   - June 2014 reform: eligible for R$77 per-month if report income below R$77 per-month
3. Estimate statistics for 2014 BF reform
   - $B \approx 27K$, $J \approx 22K \rightarrow$ MVPF$\in [0.9, 1.12]$
   - Welfare of spending R$1 on reform $>$ R$1.50 on non-distortionary UBI
   - Even in a setting with a prominent eligibility notch based on reported income, unlikely that efficiency cost outweighs equity benefit

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Baseline Model

Derive welfare bounds in simple misreporting model (bounds hold in a much more general model)

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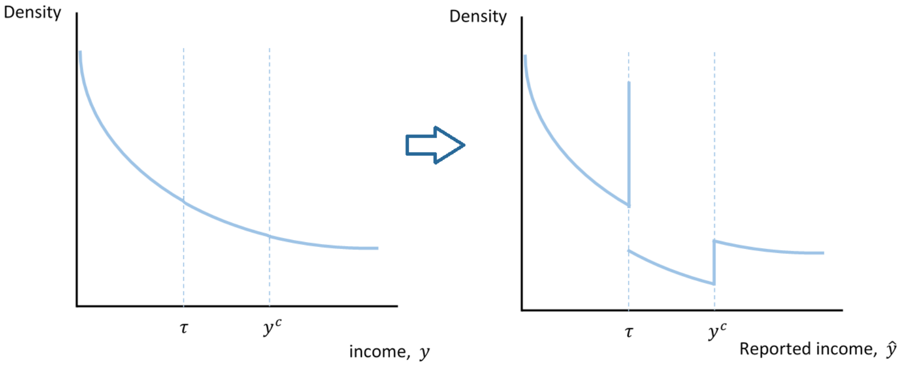
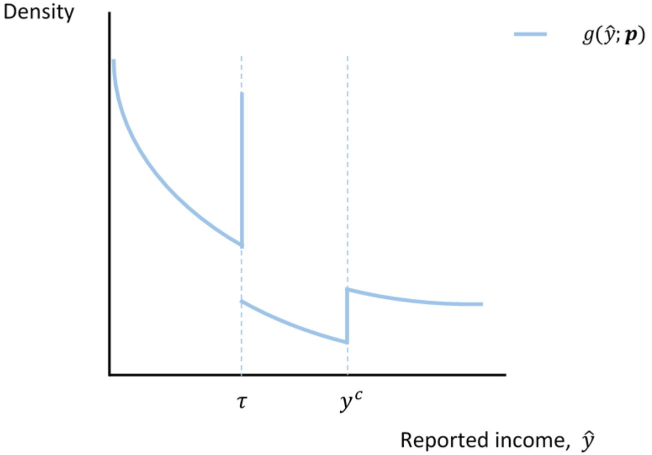
- Determine willingness-to-pay for reform, WTP

HH Problem

Model Solution: Density of Reported Incomes



Behavioral Responses to Reform



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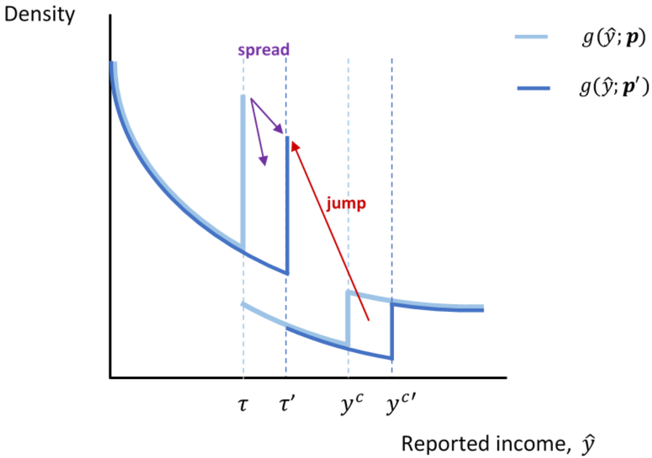

Bunchers spread to $(\tau, \tau']$ while "close-to-indifferent" hhs jump to τ'

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WTP math

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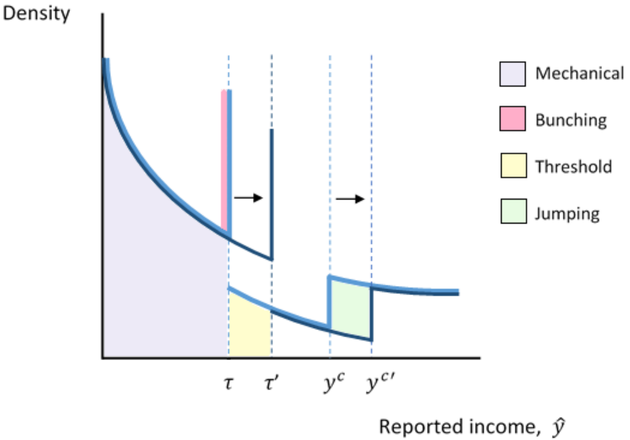
Groups Impacted by Reform

Four groups impacted by reform:



Bounds on MVPF

$$\text{MVPF} = \frac{\text{Total WTP}}{\text{Total Cost of Reform}}$$

math LB | math UB | welfare bounds | model robustness

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Using our bounds on WTP, we can bound the MVPF provided we can observe B and J:

$$\underbrace{1 - b' \frac{J}{Total\ Cost}}_{MVPF_L} \leq MVPF \leq \underbrace{1 + b \frac{B}{Total\ Cost}}_{MVPF_U}$$

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- MVPF_U: bunchers $\text{WTP}_U = b'$ but only cost $b' - b$ each

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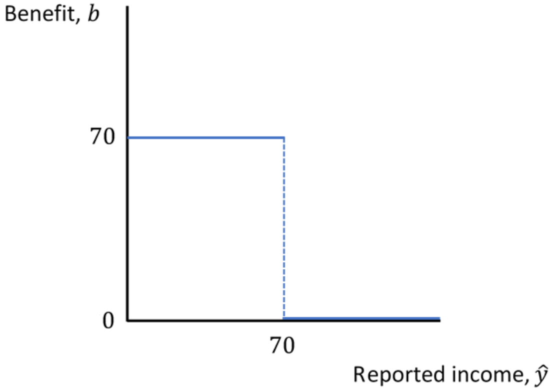
Bolsa Família Schedule: Pre June 2014

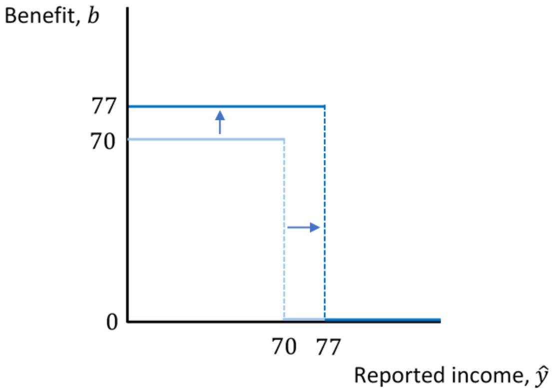
- Data for 2012-2016
- Focus on households with 1 adult
- If reported monthly income $\leq R\$70$, receive $R\$70$ per month



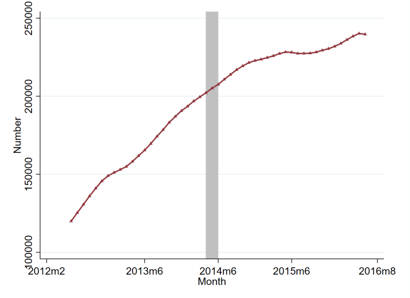
BF Details

June 2014 Reform

- June 2014 Reform: benefit and threshold both increased by 10%
- Reform announced by president on national TV in April 2014



Evidence of Behavioral Responses, Identification Challenge



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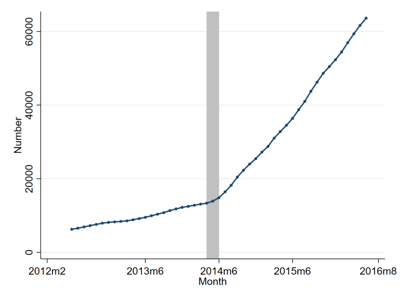

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Sufficient Statistics | 2 adult graphs

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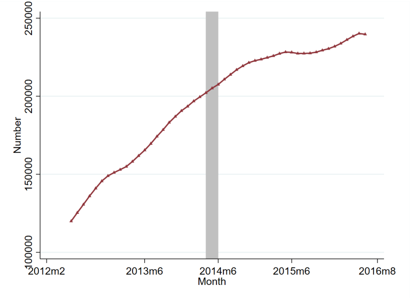

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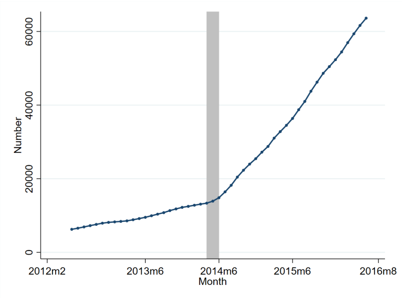

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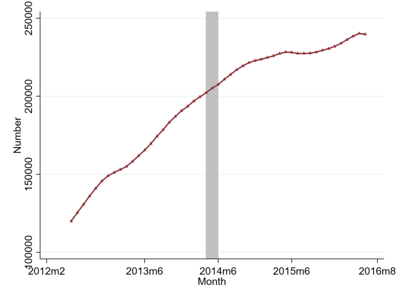

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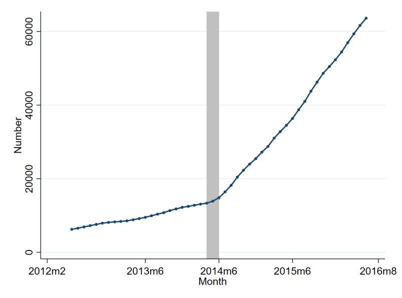

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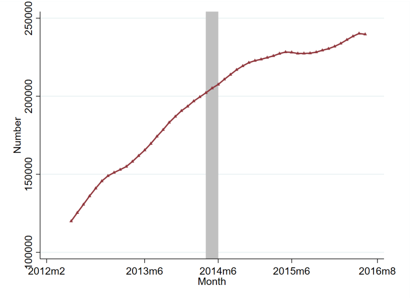

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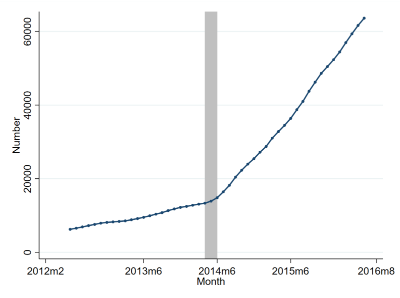

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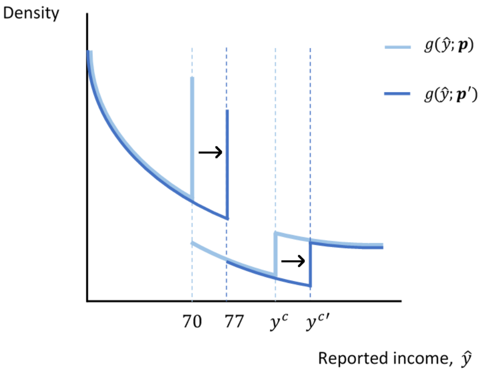
- #s reporting just below old & new notch changing prior to reform
- → Need control groups
- Use portions of distribution unaffected by reform as controls

Sufficient Statistics | 2 adult graphs

Identification Assumptions

1. Density of reported incomes below 70 is unaffected by reform so that $(0,7], \ldots, (54,63]$ serve as controls for $(63,70]$ and $(70,77]$ IA 1



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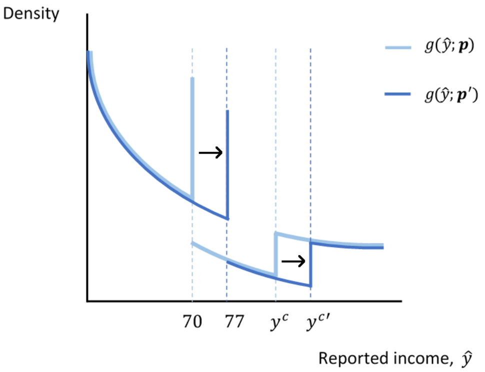

2. Diff btw treated and control bins evolves according to a stable polynomial IA 2

Generalized DID Specification

- Treated bins present a break from the polynomial trend:

$$log(N_{(x-7,x],t}) = \underbrace{\delta_t}_{\text{time trend}} + \underbrace{\alpha_{0,x} + \alpha_{1,x}t + \alpha_{2,x}t^2 + \alpha_{3,x}t^3}_{\text{bin-specific polynomial time trends}} +$$

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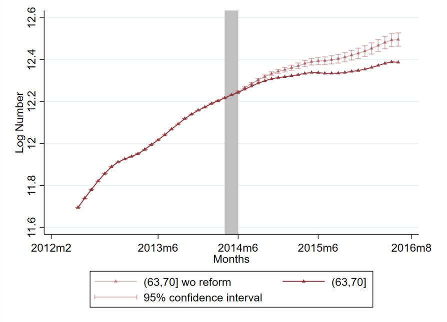
- Parallel trends: $\alpha_{i1} = \alpha_{i2} = \alpha_{i3} = 0$
- Show robustness to higher- and lower-order polynomials
- Key assumption: stable bin-specific polynomial trends that would persist in absence of reform (show placebos)

Main DID Results



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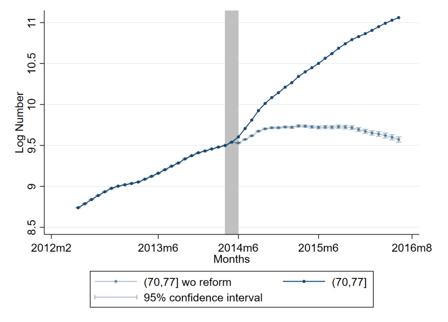

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MVPF placebo trend breaks higher poly. const comp 2 adult smaller bins excluding 56

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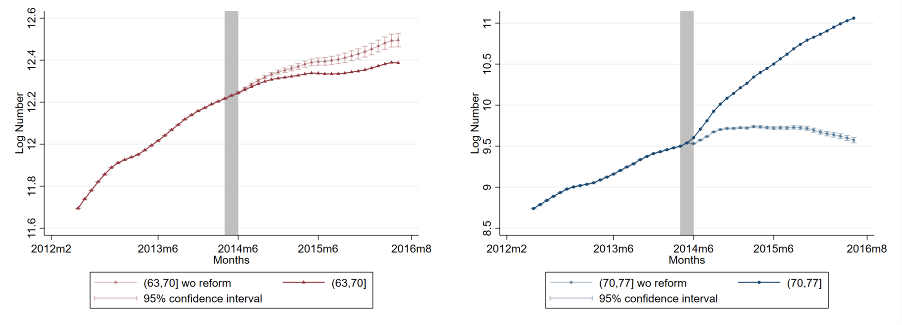

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- $\downarrow$ of $\approx 27K$ in (63,70] $\Rightarrow B = 27k$
- $\uparrow$ of $\approx 49K$ in (70,77] $\Rightarrow J = 22k$
- $\Rightarrow MVPF \in [0.9, 1.12]$

MVPF | placebo | trend breaks | higher poly. | const comp | 2 adult | smaller bins | excluding 56

Discussion

- $MVPF \in [0.9, 1.12]$
  - $\uparrow$ welfare if value R$0.90 to BF hhs $>$ R$1 to best alternative
  - $\downarrow$ welfare if value R$1.12 to BF hhs $<$ R$1 to best alternative
- What is the best alternative
  - Hard to say but let's consider UBI
  - Conservative back-of-envelope calculation: spending R$1 on reform $\equiv$ welfare gain of spending R$1.50 on UBI details
- Why? Strong coverage of extreme poor + misreporters fall in bottom half of income distribution (Lindert et al, 2007)
- Even in setting with prominent eligibility notch based on *reported* income, unlikely that efficiency cost outweighs equity benefit
- Given ubiquity of notches, hope method useful in other contexts, e.g., Medicaid reforms, reforms to tax schedules with notches

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- Thank you

Appendix Slides

Relationship to the Literature

Sufficient Statistics for Welfare Analysis: e.g., Chetty (2009), Kleven (2021),...

- Show B and J sufficient to bound welfare effect of **arbitrarily large** reforms
- Analyze welfare impacts even when cannot apply envelope theorem (notches)

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Bunching Methods: e.g., Kleven and Waseem (2013), Best and Kleven (2017), Bachas & Soto (2020),...

- Use bunching evidence to inform welfare in fairly model-free way
- Estimate changes in bunching as opposed to bunching at a notch/kink $\rightarrow$ different empirical strategy

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Welfare Analysis of CT programs: e.g., Bergolo and Cruces (2021), Bergstrom and Dodds (2021), Hanna and Olken (2018)

- Few papers analyze welfare impacts of CT programs
- Evidence against belief that programs targeted on self-reported income will have substantial efficiency costs in high-informality settings

Back to This Paper

Household Problem

$$\max_{\hat{y}} \quad c - \underbrace{v\left(y - \hat{y}\right) \mathbb{1}\left(y > \hat{y}\right)}_{\text{misreporting cost}}$$

$$\text{s.t. } c = y + b\mathbb{1}\left(\hat{y} \leq \tau\right)$$

- y = income, $\hat{y}$ = reported income
- $\mathbf{p} = \{b, \tau\} = \{\text{benefit, threshold}\}$
- Also assume some distribution of individuals who always report truthfully

back

WTP: Bunchers

- $WTP(\Delta b)$ is the WTP for the increase in benefit

$$y + b - v(y - \tau) = y + b' - WTP(\Delta b) - v(y - \tau)$$

$$\implies WTP(\Delta b) = b' - b$$

- $WTP(\Delta \hat{y})$ is the WTP for the decrease in misreporting

$$\begin{aligned} 0 &< WTP(\Delta \hat{y}) \text{ since the cost of misreporting is increasing} \\ &= v(y - \tau) - v(y - \tau') \\ &< v(y - \tau) \text{ since } v(\cdot) > 0 \\ &< b \text{ otherwise, hh would not bunch} \end{aligned}$$

$$\implies WTP = WTP(\Delta b) + WTP(\Delta \hat{y}) \in [b' - b, b')$$

back

Bolsa Família I

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[4] Show in paper that results very similar for 2 adult households

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- Targeted to families living in poverty
  - Unconditional transfer for those in extreme poverty: monthly per-capita income $\leq R\$70$ ($\approx$ US$30 in 2014)
  - Conditional, per-child transfer for those in poverty: monthly per-capita income $\leq R\$140$

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- Targeted to families living in poverty
  - Unconditional transfer for those in extreme poverty: monthly per-capita income $\leq R\$70$ ($\approx$ US\$30 in 2014)
  - Conditional, per-child transfer for those in poverty: monthly per-capita income $\leq R\$140$
- Main analysis: single adult household without kids $\rightarrow$ can only receive unconditional transfer[4]

[4] Show in paper that results very similar for 2 adult households

Bolsa Família II

- Eligibility: hh must be registered in Cadastro Único system
  - Cadastro Único: govt's single registry for all social programs

Back to BF Schedule

Bolsa Família II

- Eligibility: hh must be registered in Cadastro Único system
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- Information on hh income and family characteristics: self-reported & must be updated at least every 2 years
  - Reminded of penalty of losing eligibility for all govt. programs if lying
  - Conduct audits

Back to BF Schedule

Bolsa Família II

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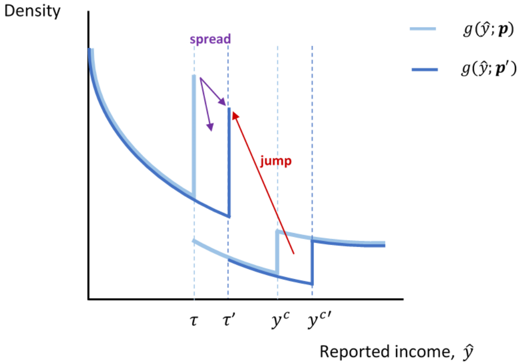
  - Reminded of penalty of losing eligibility for all govt. programs if lying
  - Conduct audits
- Access to universe of data from Cadastro Único registry from 2012-16

Back to BF Schedule

Number of Bunchers

Let $G(x; \mathbf{p})$ denote # reporting income $\leq x$ under $\mathbf{p}$

$$B = G(\tau; \mathbf{p}) - G(\tau; \mathbf{p}')$$



back to WTP back to suff stats

WTP: Jumping Households

$$y = y + b' - WTP - v(y - \tau')$$
$$\implies WTP = b' - v(y - \tau')$$

- Since misreporting cost is positive,

$$v(y - \tau') \geq 0 \implies WTP \leq b'$$

- By revealed preference, for any jumping hh:

$$y \leq y + b' - v(y - \tau')$$
$$\implies WTP \geq 0$$

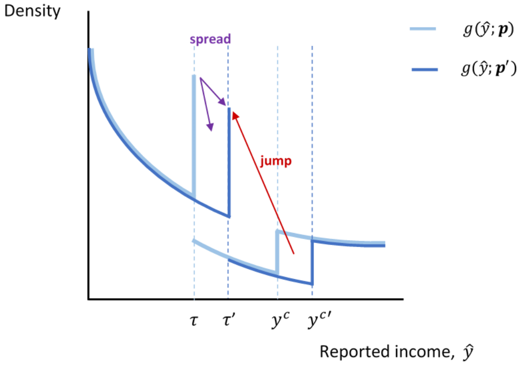
$$\implies WTP \in [0, b']$$

back

Number of Jumpers

Let $G(x; \mathbf{p})$ denote # reporting income $\leq x$ under $\mathbf{p}$

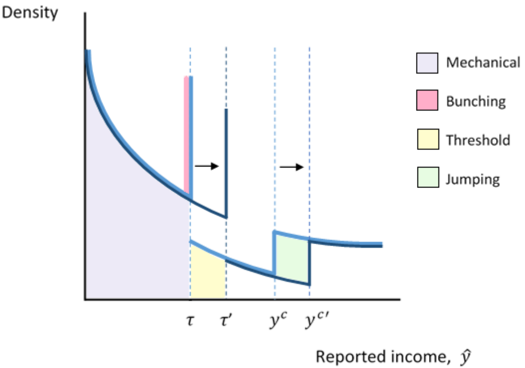
$$J = G(\tau'; \mathbf{p}') - G(\tau'; \mathbf{p})$$



back to WTP
back to suff stats

MVPF$_L$

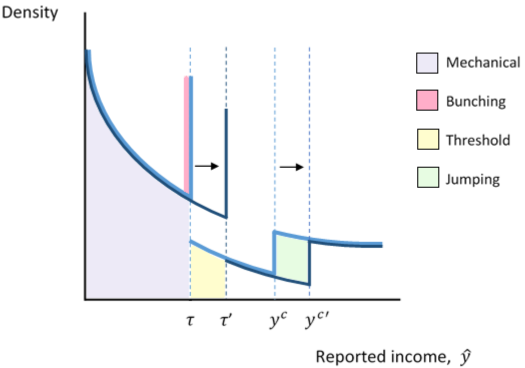
$$\frac{\text{Total WTP}_L}{\text{Total Cost}} = \frac{(b'-b)B + 0 \times J + (b'-b)M + b'T}{(b'-b)B + b'J + (b'-b)M + b'T} = 1 - b'\frac{J}{\text{Total Cost}}$$



back

MVPF$_U$

$$\frac{\text{Total WTP}_U}{\text{Total Cost}} = \frac{b'B + b'J + (b'-b)M + b'T}{(b'-b)B + b'J + (b'-b)M + b'T} = 1 + b\frac{B}{\text{Total Cost}}$$



back

Bounds on Welfare

Proposition 2

Welfare gain from reform:

$$\omega MVPF_L - \lambda \leq \frac{\Delta Welfare}{Total\ Cost} \leq \omega MVPF_U - \lambda$$

- ω = welfare weight on beneficiaries[5]
- λ = shadow value of public funds (opportunity cost)
- $\rightarrow$ J and B relevant statistics to bound welfare

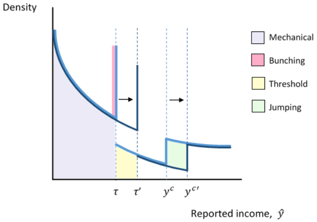
[5] Technically, have ω_L and ω_U. For ease of exposition, ignored for today's talk

back to mvpf bounds | welfare weights

Welfare Weights

$$\omega_L = \frac{\sum_g N_g \times \text{WTP}_{g,L} \times \eta_g}{\sum_g N_g \times \text{WTP}_{g,L}}$$

- N_g denotes number of hhs in group g impacted by reform
- η_g = welfare gain of splitting \$1 evenly among group g hhs
- ω_L (ω_U): welfare gain of splitting \$1 among all BF recipients, where dollar split is determined by lower (upper) bounds on WTP



back

Robustness to Model Specification

Proposition 1 still holds for far more general hh problem:

Back to Bounds | general problem | intuition | labor ss | adj costs | dynamics | FE | eligible ↛ entitlement

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- Allow for:
  - responding on different margins (e.g., labor supply),
  - frictions (adjustment costs, limited choice sets),
  - misperceptions
  - heterogeneity in preferences
  - multi-agent household

Back to Bounds | general problem | intuition | labor ss | adj costs | dynamics | FE | eligible ↛ entitlement

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Back to Bounds | general problem | intuition | labor ss | adj costs | dynamics | FE | eligible $\nrightarrow$ entitlement

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Back to Bounds | general problem | intuition | labor ss | adj costs | dynamics | FE | eligible $\nrightarrow$ entitlement

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  - multi-agent household
- Bounds for general dynamic model:
  - Need (expected) J and B for all periods post-reform
- Augment to allow for other fiscal externalities
  - But need to measure size of externalities
- J and B are no longer the number of jumpers and bunchers
  - J (B) becomes the increase (decrease) in the number of hhlds eligible under the new (old) schedule *because* of the reform

Back to Bounds | general problem | intuition | labor ss | adj costs | dynamics | FE | eligible $\nrightarrow$ entitlement

General Household Problem

$$\max_{x \in X} \ u(c, x; \theta)$$
$$\text{s.t. } c = y(x, \theta) + b\mathbb{1}(\hat{y}(x, \theta) \leq \tau)$$

back

Intuition for Robustness

Calculate bounds on $\mathcal{W}(x(\mathbf{p}'); \mathbf{p}') - \mathcal{W}(x(\mathbf{p}); \mathbf{p})$ via revealed preference:

- UB: $\mathcal{W}(x(\mathbf{p}'); \mathbf{p}') - \underbrace{\mathcal{W}(x(\mathbf{p}'); \mathbf{p})}_{<\mathcal{W}(x(\mathbf{p});\mathbf{p})}$
- LB: $\underbrace{\mathcal{W}(x(\mathbf{p}); \mathbf{p}')}_{<\mathcal{W}(x(\mathbf{p}');\mathbf{p}')} - \mathcal{W}(x(\mathbf{p}); \mathbf{p})$
- Note: for each bound, decisions held fixed under $\mathbf{p}$ or $\mathbf{p}'$
- $\rightarrow$ Bounds not impacted by changes in behavior
- $\rightarrow$ Not impacted by whether behavior change incurred adjustment cost, or whether responded via labor supply or misreporting, or whether faced frictions in choice sets

back

$$\max_x u(c, x; \theta)$$
$$\text{s.t. } c = y(x, \theta) + b\mathbb{1}(\hat{y}(x, \theta) \leq \tau)$$

- $x = y$
- $\theta = n$
- $y(x, \theta) = y$
- $\hat{y}(x, \theta) = y$
- $u(c, x; \theta) = c - v(y/n)$

$\Longrightarrow$

$$\max_y y + b\mathbb{1}(y \leq \tau) - v(y/n)$$

back

Adjustment Costs

$$\max_{x} u(c, x; \theta)$$
$$\text{s.t. } c = y(x, \theta) + b\mathbb{1}(\hat{y}(x, \theta) \leq \tau)$$

- $x = \hat{y}_t$
- $\theta = \{y_t, \hat{y}_{t-1}, k\}$
- $y(x, \theta) = y_t$
- $\hat{y}(x, \theta) = \hat{y}_t$

$$\max_{\hat{y}_t} y_t + b\mathbb{1}\left(\hat{y}_t \leq \tau\right) - v\left(y_t - \hat{y}_t\right) - k\mathbb{1}(\hat{y}_t \neq \hat{y}_{t-1})$$

back

Dynamics

Households solve very general dynamic problem:

$$V(\theta_t) = \max_{x_t} \; u(c_t, x_t; \theta_t) + \beta \mathbb{E}_{\theta_{t+1}|\theta_t, x_t} \left[V(\theta_{t+1}) \right]$$
$$\text{s.t. } \; c_t = y_t(x_t, \theta_t) + b \mathbb{1}(\hat{y}_t(x_t, \theta_t) \leq \tau)$$

$$\text{MVPF}_\text{L} = 1 - b' \frac{\sum_{t=0}^{T} \beta^t J_t}{\sum_{t=0}^{T} \beta^t \text{Total Cost}_t}$$

$$\text{MVPF}_\text{U} = 1 + b \frac{\sum_{t=0}^{T} \beta^t B_t}{\sum_{t=0}^{T} \beta^t \text{Total Cost}_t}$$

- Assumes value of public funds in period t: $\beta^t \lambda$
- $B_t, J_t, \text{Total Cost}_t$ denote expected bunchers, jumpers, and cost in period t (from perspective of period 0 when reform happens)

back

Fiscal Externalities

- Let $R(\mathbf{p})$ equal govt spending under policy $\mathbf{p}$ excl. spending on BF
- Fiscal externality of reform: $\Delta R = R(\mathbf{p}') - R(\mathbf{p})$
- Adjust MVPF bounds as total cost of reform now includes ΔR

$$\text{MVPF}_\text{L} = 1 - b' \frac{J}{\text{Total Cost}} - \frac{\Delta R}{\text{Total Cost}}$$

$$\text{MVPF}_\text{U} = 1 + b \frac{B}{\text{Total Cost}} - \frac{\Delta R}{\text{Total Cost}}$$

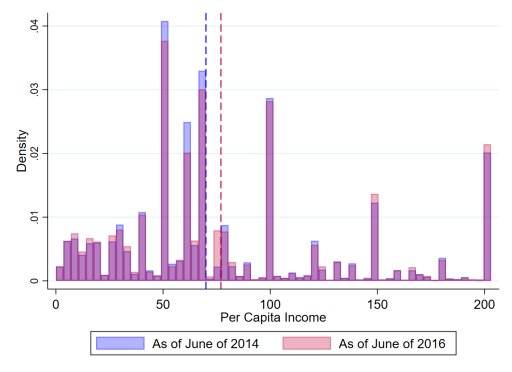
back

Eligibility $\nrightarrow$ Entitlement

- BF: not all eligible hhs receive the BF grant
- Why? Quota (cap) on number of beneficiaries per municipality (equal to 1.18 $\times$ predicted # below poverty threshold)
- $\implies$ Those reporting below threshold receive benefit with some probability
- Bounds are robust to this scenario
  - Need constant probability across reform and across reported incomes below the threshold
  - This is the case with BF: 78% of those reporting below R$70 get benefit; prob doesn't vary
- Intuition: multiply both numerator (WTP) and denominator (total cost) by probability $\rightarrow$ probability cancels out

back

Histogram Pre- and Post-Reform



Caution: distribution changing over time → can't interpret changes in histogram solely due to reform

back

Sufficient Statistics

$$1 - b' \frac{J}{\text{Total Cost}} \leq \text{MVPF} \leq 1 + b \frac{B}{\text{Total Cost}}$$

Back to Evidence B formula J formula histogram

Sufficient Statistics

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- Number of bunchers who moved with the notch:
  - $B = \downarrow$ in mass reporting below R$70
  - Why not just $\downarrow$ mass *at* R$70? Bunching isn't perfect

Back to Evidence | B formula | J formula | histogram

Sufficient Statistics

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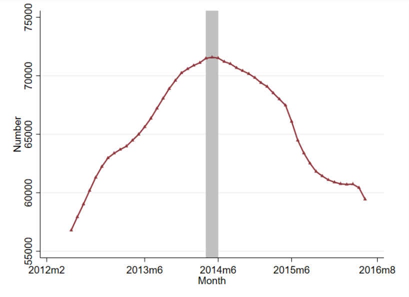
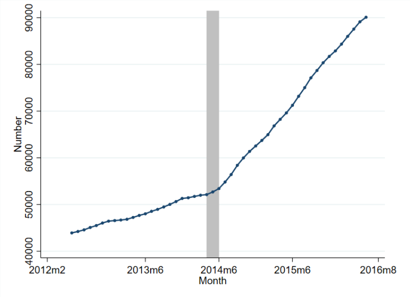
- Number of bunchers who moved with the notch:
  - $B =\downarrow$ in mass reporting below R$70
  - Why not just $\downarrow$ mass *at* R$70? Bunching isn't perfect
- Number of hhs who jumped down into the program:
  - $J =\uparrow$ in mass reporting at & below R$77
  - Or $\uparrow$ in (70,77] - B
  - Why subtract B? $\uparrow$ in $(70, 77]$ consists of both bunchers & jumpers

Back to Evidence | B formula | J formula | histogram

Raw Data: 2 Adult Households



(a) Number in R$(63,70]



(b) Number in R$(70,77]

back

Identifying Assumption 1

Assumption 1

Reported income density below $70 - \epsilon$ *is unaffected by the reform*

Back to IAs | control bins over time | all bins over time

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Reported income density below $70-\epsilon$ is unaffected by the reform

- If $\epsilon = 7$ (show robustness to different ϵ)
  - $B = \downarrow$ in $(63, 70]$ *due to reform*
  - $J = \uparrow$ in $(70, 77]$ *due to reform* $-$ B

Back to IAs | control bins over time | all bins over time

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Back to IAs | control bins over time | all bins over time

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  - $B = \downarrow$ in $(63, 70]$ *due to reform*
  - $J = \uparrow$ in $(70, 77]$ *due to reform* $-$ B
- Need counterfactual of $(63, 70]$ and $(70, 77]$ post-reform under old policy
- Use bins ≤ 63 to predict how $(63, 70]$, $(70, 77]$ would've evolved
  - Control bins: $(0, 7], ..., (56, 63]$
  - Treatment bins: $(63, 70]$, $(70, 77]$

Back to IAs | control bins over time | all bins over time

Identifying Assumption 2

- Standard DID: diff btw treat and control bins is constant over time

Back to IAs Trend Breaks

Identifying Assumption 2

- Standard DID: diff btw treat and control bins is constant over time
- Pre-reform: diff btw log number in treat and control bins evolve according to low-order polynomials (70,77] diff (63,70] diff

Back to IAs Trend Breaks

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Back to IAs Trend Breaks

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Assumption 2

In absence of the reform, the log number in each bin evolves according to:

$$log(N_{(x-7,x],t}) = h(t) + \sum_{j=0}^{J} \alpha_{j,x} t^j + \epsilon_{x,t} \quad for\ x \in \{7, 14, ..., 77\}$$

Back to IAs Trend Breaks

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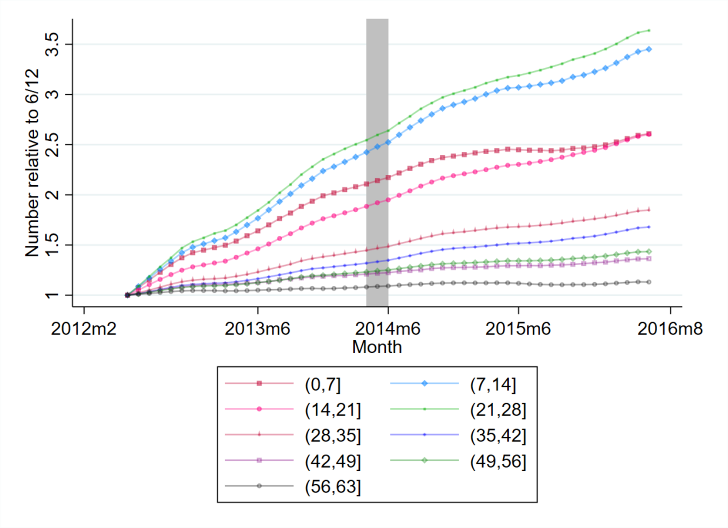
- $J = 0 \rightarrow$ standard DID

Back to IAs Trend Breaks

Control Bins Over Time



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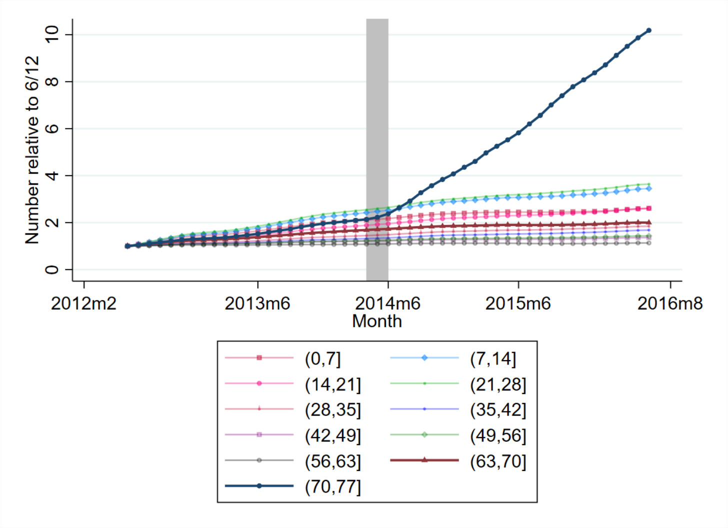
All Bins Over Time



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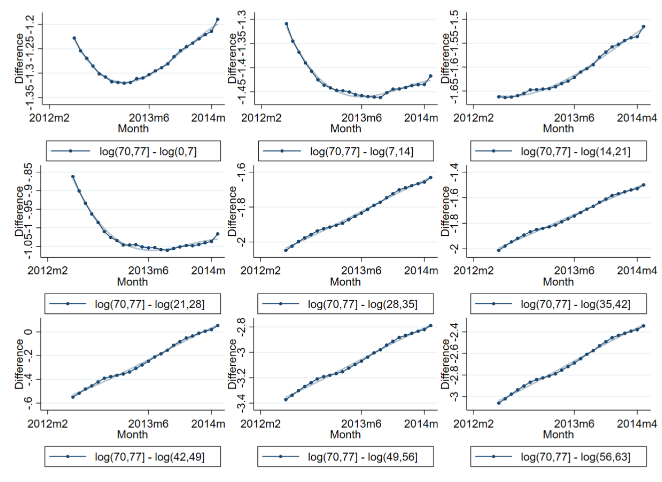
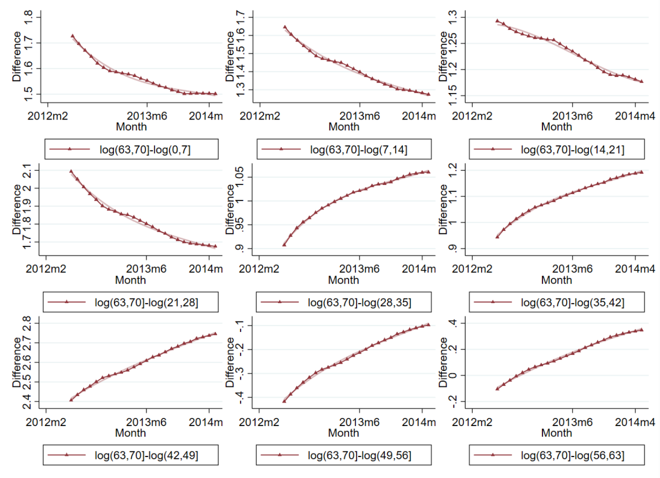
$log(N_{(70,77],t}) - log(N_{(x-7,x],t})$: Pre-Reform



back to IA2

back to gen. DID

$log(N_{(63,70],t}) - log(N_{(x-7,x],t})$: Pre-Reform



back to IA2
back to gen. DID

Bunchers, Jumpers, and MVPF Bounds

	(1)	(2)	(3)	(4)	(5)	(6)
Polynomial Degree	$\Delta(63,70]_{\bar{t}}$	$\Delta(70,77]_{\bar{t}}$	$B_{\bar{t}}$	$J_{\bar{t}}$	$MVPF_{L,\bar{t}}$	$MVPF_{U,\bar{t}}$
Quadratic	-26,279	51,759	26,279	25,480	0.88	1.11
	(6,163)	(2,160)	(6,163)	(6,659)	(0.03)	(0.03)
Cubic	-27,452	49,247	27,452	21,794	0.90	1.12
	(4,357)	(234)	(4,357)	(4,592)	(0.02)	(0.02)
Quartic	-29,338	50,873	29,338	21,535	0.90	1.13
	(6,257)	(1,345)	(6,257)	(6,503)	(0.03)	(0.03)
Quintic	-29,240	50,559	29,240	21,318	0.90	1.13
	(5,912)	(1,184)	(5,912)	(6,141)	(0.03)	(0.03)

Back to Results

Placebos in the Spirit of Randomization Inference

- Pretend x out of 9 control bins are treated

Back to Results more placebos

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- Pretend x out of 9 control bins are treated
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Back to Results more placebos

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Back to Results more placebos

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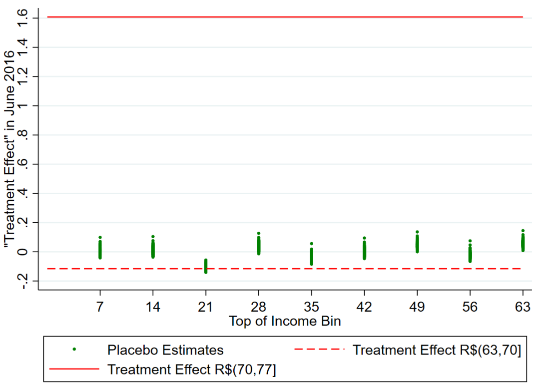
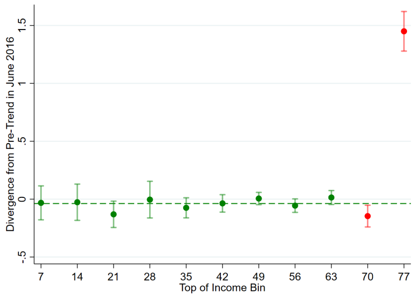


Back to Results
more placebos

Trend Breaks

- Sppse each bin evolves according to cubic + divergence post-reform

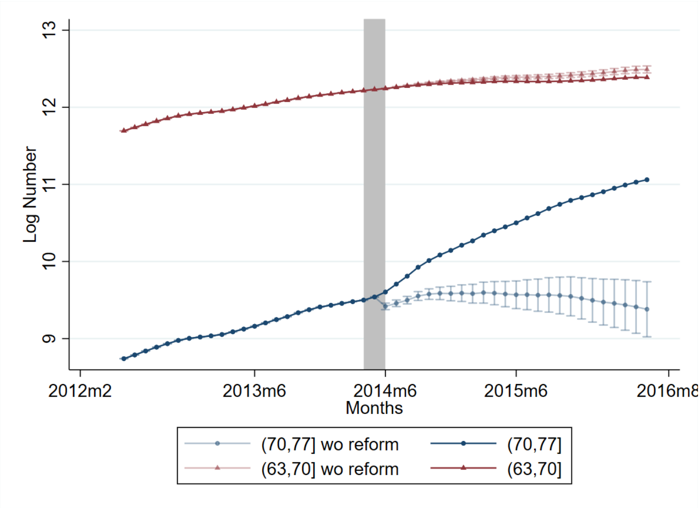
$$\underbrace{N_{(x-7,x],t}}_{\text{log \# in } (x-7,x]} = \underbrace{\sum_{j=0}^{3} \alpha_{jx} t^j}_{\text{bin-specific cubic}} + \underbrace{\beta_{1x} post_t + \beta_{2x} post_t \times t}_{\text{divergence from cubic post-reform}} + \epsilon_{xt}$$



back to IA2

Back to Results

Predicting $N_{(63,70]}$ and $N_{(70,77]}$ w Quadratic Trends



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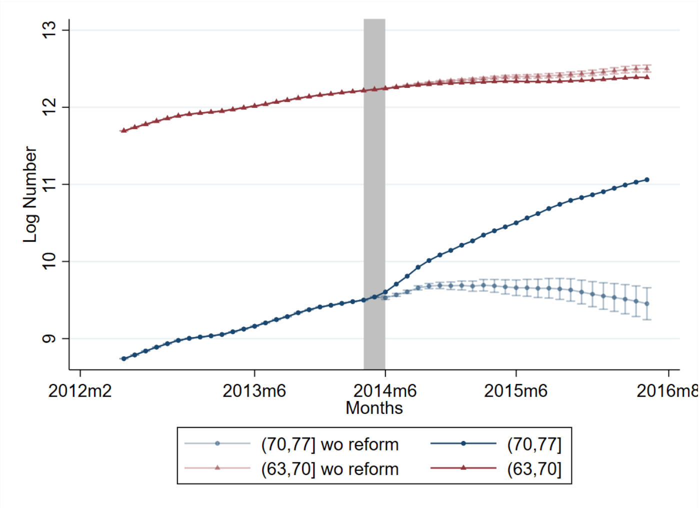
Predicting $N_{(63,70]}$ and $N_{(70,77]}$ w Quartic Trends



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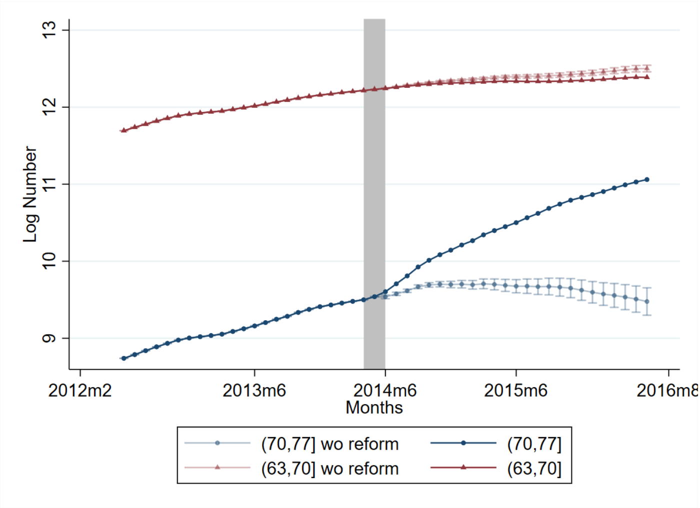
Predicting $N_{(63,70]}$ and $N_{(70,77]}$ w Quintic Trends



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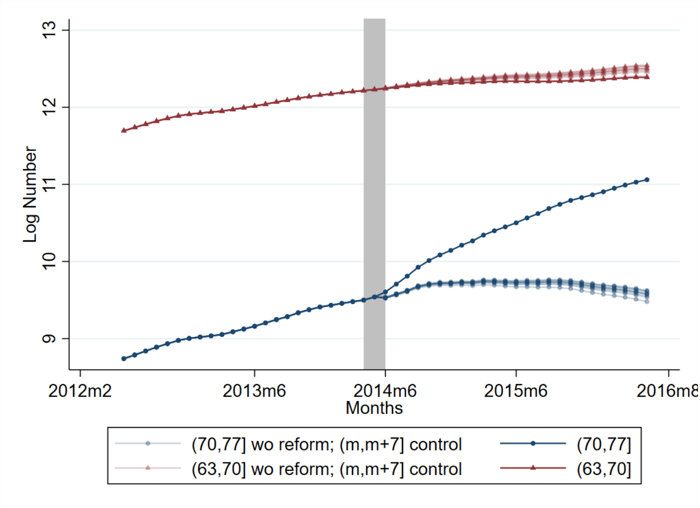
Using Each Bin Below 63 Individually



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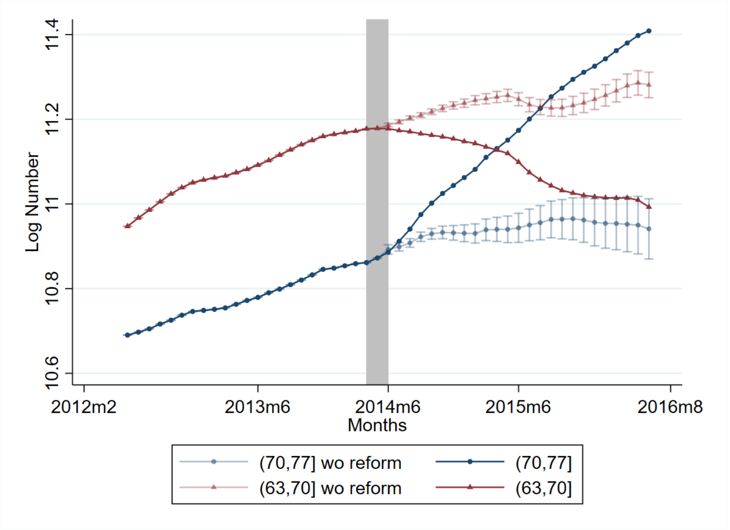
Predicting $N_{(63,70]}$ and $N_{(70,77]}$, 2 Adults Hhs



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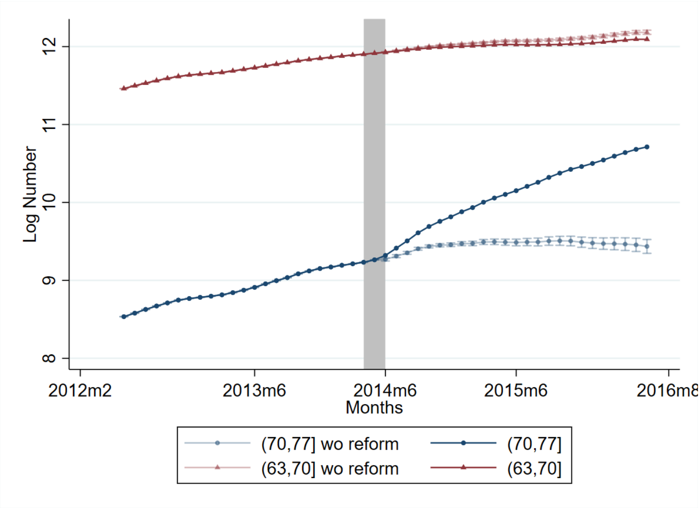
Predicting $N_{(63,70]}$ and $N_{(70,77]}$, Constant Composition



back

Excluding $(56, 63]$ as Control Bin w Quartic Trends

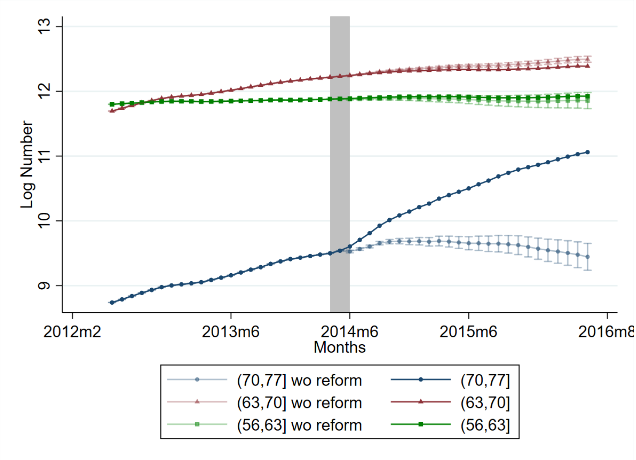


Figure 4: Predicting $N_{(56,63]}$, $N_{(63,70]}$, and $N_{(70,77]}$ using all bins below 56

back

Smaller Bin Sizes: $(x - 3.5, x]$

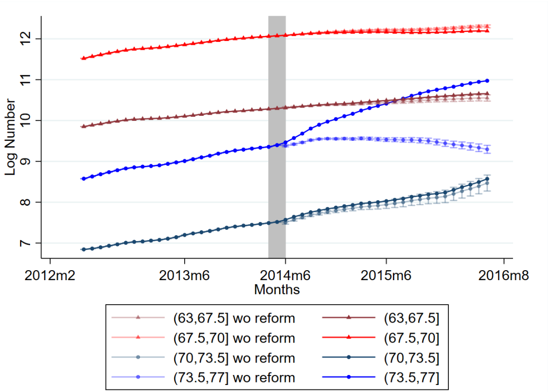


Figure 5: Predicting $N_{(63,66.5]}$, $N_{(66.5,70]}$, $N_{(70,73.5]}$ and $N_{(73.5,77]}$

back

Excluding $(56, 63]$ as Control Bin

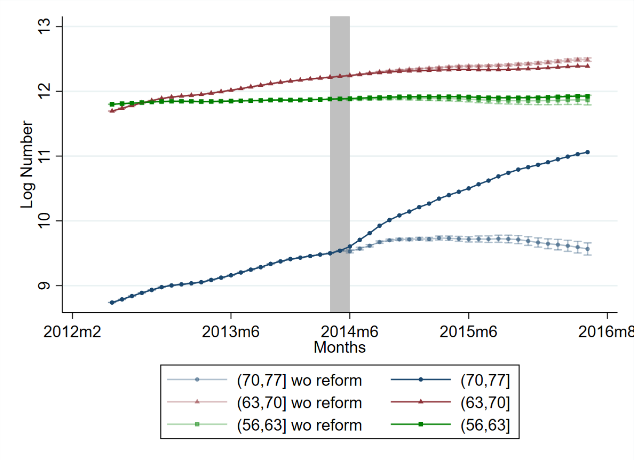


Figure 6: Predicting $N_{(56,63]}$, $N_{(63,70]}$, and $N_{(70,77]}$ using bins below 56 as controls

quarter trend

Placebo: Predicting $N_{(49,56]}$ and $N_{(56,63]}$

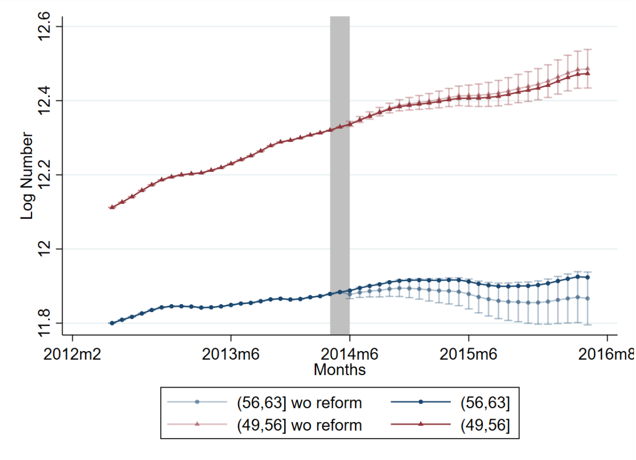


Figure 7: Predicting $N_{(49,56]}$ and $N_{(56,63]}$ using bins below 49 as controls

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Back-of-Envelope Calculation

- Assume: true income dist. of BF recipients $\equiv$ bottom half of Brazil's true income dist. (PovCalNet 2016)
  - Conservative assumption: bottom 20% receive 73% of BF transfers (Lindert et al, 2007)
- Govt is utilitarian and households have log utility over consumption
- Spending \$x on UBI: $\Delta W = \int_0^\infty [log(y+x) - log(y)] f(y) dy$
- Spending \$1 on BF (or \$2 for the bottom half valued at \$1.8): $\Delta W = \int_0^{y_{median}} [log(y+1.8) - log(y)] f(y) dy$
- Can calculate how much to spend on UBI to generate same welfare as spending \$1 on BF

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