Quantifying Loss-Averse Tax Manipulation

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Abstract

Alex Rees-Jones (2018) "Quantifying Loss-Averse Tax Manipulation"
Review of Economic Studies (2018) 85, 1251–1278

- Presents the effects of *loss-aversion* from the evidence of US taxpayers.
- Taxpayers are engaged to persue tax reduction activity especially when they have some positive due near the date of payment.
- Distribution of reported tax bill has excess mass around the border whether they must pay or not.

Institutional Background

- In the US, one's tax payment in each year is determined by the Internal Revenue Service (IRS), based on the difference between the reported taxable income and the her/his payment in advance: "balance due."
- If the balance due (denoted by b) is positive, the tax filer must that amount to the IRS, and if negative, then s/he can receive a refund.
- Balance due can be "manipulated," by reporting donation they did, or enrollment in charitable contribution.

  $\Rightarrow$ Loss-Averse affects the tax filers' behavior according to their initial balance due, resulting in the bunching of the reported (observed) payment.

contribution

This paper contributes in three ways:

1. Illustrate robust and observable features of the presence of loss-aversion with minimal assumptions.
2. Estimate the impact of loss-aversion measured in dollers.
3. Specify the way to apply similar settings:

   loss-averse individual is able to manipulate an observable outcome.

Procedure of the Manipulation

Every April, taxpayers go through the process below:

1. Report their taxable income, such as wages, salaries, tips, business income, investment income, and so on.
2. Report "adjustments," to claim for things such as donations or payments for alimony

   $\Rightarrow$ Adjusted Gross Income (AGI) is calculated: balance due before manipulation.
3. Accept AGI or complete an additional form of reduction: Itemization

   –Report deductable activities such as charitable contributions, medical and dental expenses, home mortgage interest payments.
4. Final balance due is confirmed:

   Claim credits for pursuing tax incentivised behaviour and report other taces paid, payments already made to IRS .

Sequential Manipulation

- Given b_{PM}: balance due prior to manipulation, taxpayers face a sequense of manipulation opportunities, each of which is charactarized by the parameters : $\{m_i, c_i\}_{i=1}^{J}$

  m_i denotes the tax reduction by the ith manipulation

  c_i is the intrinsic cost

Cost by manipulation

Taxpayers consider their benefits and costs to decide whether to make efforts to tax manipulation.

- Blumenthel and Slemrod (1992)

  It spend on average 27 hours documenting and reporting for tax reduction

- Benzarti (2015)

  They dislike tasks for tax 4.2 times as that for working with same time length

- Ordinary gain-loss function:

$$\Phi(x|r) = \begin{cases} x - r & \text{if } x \geq r \\ \lambda(x - r) & \text{if } x < r \end{cases}$$

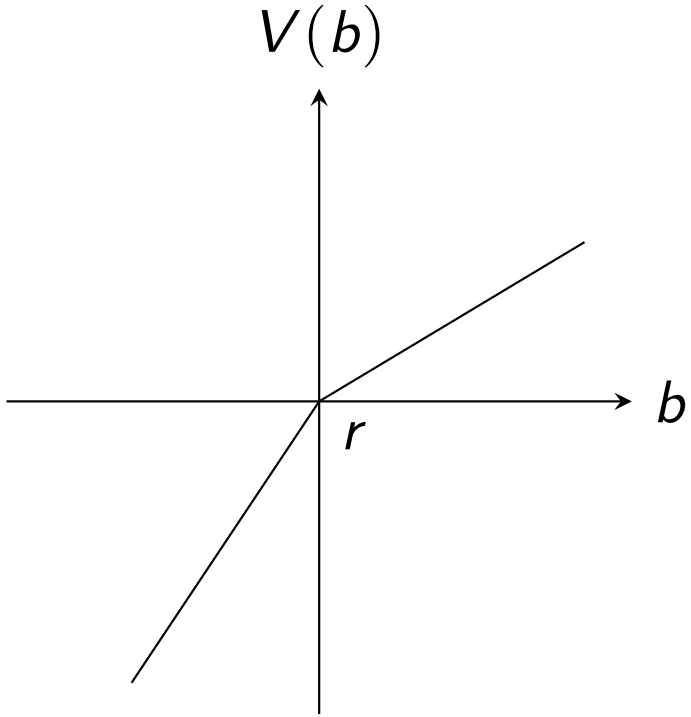
- Applying this structure, loss-averse taxpayers' evaluattion of the benefit from each manipulation:

$$\begin{aligned} V(m_i|b, r) &= \Phi(-b + m_i|r) - \Phi(-b|r) \\ &= \begin{cases} m_i & \text{if } -b \geq r \\ \lambda(r + b) + (m_i - b - r) & \text{if } -b \in [r - m_i, r] \\ \lambda m_i & \text{if } -b \leq r - m_i \end{cases} \end{aligned}$$

- Taxpayers continue to manipulate iff $m_i < c_i$.

Gain-Loss Function

- If there remains tax due after reduction, then all the value of the manipulation is evaluated as loss.
- When, on the other hand, manipulation cancels out the due before, the margin to be refunded is evaluated as gain.
- If s/he does not have to pay more, then the reduction by the manipulation is fully counted as gain.



gain-loss function

Assumption

Assume tax filers consder the most efficient manipulation.

- For $i < j$, $m_i / c_i \geq m_j / c_j$.

  : They considers each oppoturnity of manipulation, in the most efficient order.

- $m_1 / c_1 > 1$.

  : There exists at least one desirable manipulaton oppoturnity.

- As $n \to \infty$, $m_n / c_n \to 0$.

  : The number of desirable opportunity is finite.

Taxpayers continue manipulating as long as $V(m_i | b, r) \geq c_i$, and stop when $V(m_i | b, r) < c_i$.

Thresholds

They define two thresholds of $i \in J$ that stop the manipulation depending on the gain-loss situation.

$$L = \max\left\{ i : \frac{m_i}{c_i} > 1 \right\}$$
$$H = \max\left\{ i : \frac{m_i}{c_i} > \frac{1}{\lambda} \right\}$$

- L is the threshold for gain phase, while H is the one for loss phase.
- $L \leq H$, where equality holds if there is no i s.t. $m_i / c_i \in (1/\lambda, 1]$.

Example

TABLE 1
An example sequential manipulation problem

(1)	(2)	(3)	(4)	(5)	(6)	(7)
i	m_i	c_i	Takes opportunity if	Terminal opportunity if	Manipulated balance due range	Alt. cost sequence
1	10	5	Always	Never	—	5
2	10	8	Always	$b_{PM} \leq 22$	$(-\infty, 2]$	8
3	10	12	$b_{PM} > 22$	$b_{PM} \in (22, 35]$	$(-8, 5]$	16
4	10	15	$b_{PM} > 35$	$b_{PM} \in (35, 48]$	$(-5, 8]$	25
5	10	18	$b_{PM} > 48$	$b_{PM} > 48$	$(-2, \infty)$	34
6	10	22	Never	Never	—	44

$$\lambda = 2$$

When balance initial balance due $b_{PM} \leq 22$, s/he continues to manipulate until $i = 2$, while one with $b_{PM} > 48$ goes till $i = 5$: $L = 2, H = 5$.

- Expected range of the balance due after manipulation is $(-8, 8)$, which generates excess mass or bunching.

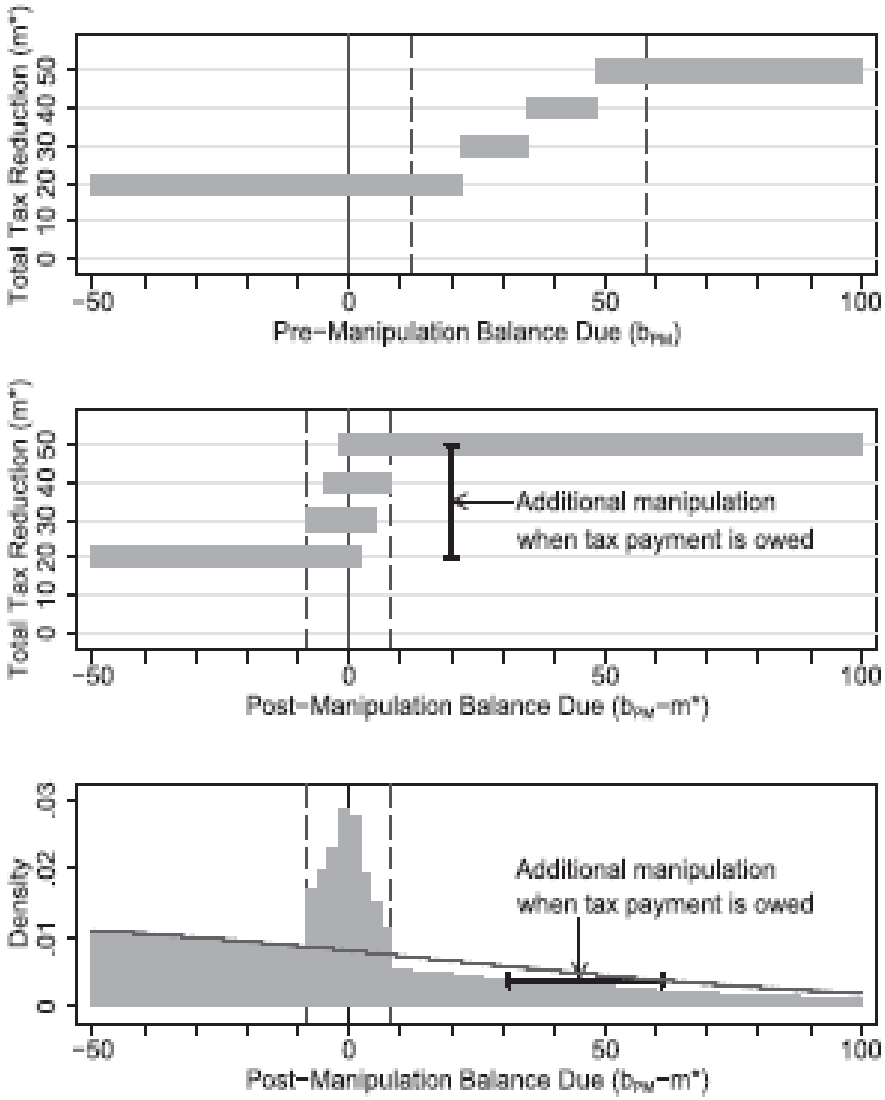


FIGURE 1

Predictions of loss-averse tax manipulation.

Total Amount of Manipulation

Total manipulation is expressed as a function of the taxpayer's pre-manipulation balance due b_{PM}:

$$m^*(b_{PM}|r) = \begin{cases} \sum_{i=1}^{L} m_i & \text{if } b_{PM} \leq T_1 \\ \sum_{i=1}^{L+1} m_i & \text{if } b_{PM} \in (T_1, T_2] \\ \dots & \\ \sum_{i=1}^{L+J-1} m_i & \text{if } b_{PM} \in (T_{J-1}, T_J] \\ \sum_{i=1}^{H} m_i & \text{if } b_{PM} > T_J \end{cases}$$

where T_j denotes

$$T_j = \max \left\{ b_{PM} : V\left(m_{L+j} | b_{PM} + \sum_{i=1}^{L+j-1} m_j, r \right) \leq c_{L+j} \right\}$$

Distribution after Manipulation

- $f^{\mathrm{PM}}(b)$ denotes the ditribution of the pre-manipulation balance due, while $f(b)$ is that of post-manipulation.
- All the taxpayers make manipulation of $i = 1$ to L, so the distribution at least shift to the left uniformly, denoted with $g(b)$.
- Furthermore, those with positive balance due after the Lth manipulation continue to reduce tax, until H or when their balance due is in the stop range.

$$f(b) = f^{\mathrm{PM}}(b + m^*) = \begin{cases} g(b) & \text{if } b \leq B_1 \\ g(b) + E_1(b) & \text{if } b \in (r - B_1, r] \\ g(b + \tilde{m}) + E_2(b) & \text{if } b \in (r, r + B_2) \\ g(b + \tilde{m}) & \text{if } b \geq r + B_2 \end{cases}$$

where $\tilde{m} = \sum_{i=L+1}^{H} m_i$, and

$$E_1(b) = g(b + \tilde{m}) \times I\left(b + \sum_{i=1}^{H} m_i > T_J\right) + \sum_{j=1}^{J-1} g\left(b + \sum_{j=1}^{L+j} m_i\right) \times I\left(\left(b + \sum_{i=L+1}^{L+j} m_i\right) \in (T_j, T_{j+1})\right)$$

$$E_2(b) = g(b) \times I\left(b + \sum_{i=1}^{L} m_i \leq T_1\right) + \sum_{j=1}^{J-1} g\left(b + \sum_{j=1}^{L+j} m_i\right) \times I\left(\left(b + \sum_{i=L+1}^{L+j} m_i\right) \in (T_j, T_{j+1})\right)$$

E_1, E_2 generates the excess mass.

Data

- Satatistics of Income Panel of Individual Returns
  - Random sample of tax filers, according to the Social Security Numbers
  - contain many line items reported on the tax return allowing the direct observation of balance due and many steps of its calculation
  - Data years:1979-1990
  - 229,116 tax returns filed by 53,177 taxpayers: exculudeing those with zero-tax liability, in order to eliminate the excess mass owing to non-preference-based discontinuities.

Quantification

- Fitting Distribution

$$\min_{(\tilde{m},B_1,B_2,\theta_g,\theta_e)} \sum_k \left(C_k - \hat{C}(k|\tilde{m},-B_1,-B_2,\theta_e,\theta_g)\right)^2$$

where

$$\hat{C}(k|\tilde{m},-B_1,-B_2,\theta_e,\theta_g) = v_g \cdot g(k+\tilde{m}\cdot I(k>0)|\theta_g) + v_E \cdot E(k|\theta_e,-B_1,B_2)$$

$$v_E = \frac{N}{\sum_k E(k|\theta_e,-B_1,B_2)} \cdot \int_0^{\tilde{m}} g(x|\theta_g)dx$$

$$v_g = \frac{N}{\sum_k g(k+\tilde{m}\cdot I(k>0)|\theta_g)} \cdot \left(1-\int_0^{\tilde{m}} g(x|\theta_g)dx\right)$$

Observed Distribution

- Full-sample application

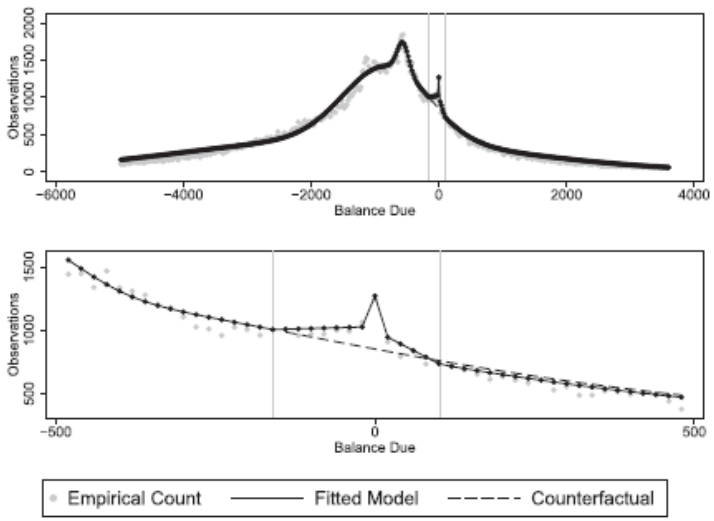


FIGURE 2
Distribution of balance due.

- Sharp spike ofserved near zero balance-due:

  excess mass range is -\$159.7(S.E.=27.00) to \$103.2(S.E.=36.20)

- Estimated value of $\tilde{m} = 33.8$:

  When facing losses, they made approximately \$34 additional tax reduction,as opposed to facing gains.

Difference among the Groups

TABLE 3
Estimates of additional manipulation when facing a loss

Panel A: full sample estimate and heterogeneity by income

	Full sample	Income quartiles			
		1	2	3	4
Extra manip. for loss ($\bar{m}$)	33.8	20.8	20.5	33.4	45.0
	(2.89)	(5.59)	(4.76)	(10.11)	(9.18)
N	206,188	57,126	55,986	52,354	40,722

Panel B: restricting sample by presence of tax reductions

	Itemized deductions		Adjustments to income		Credits	
	claimed	not claimed	claimed	not claimed	claimed	not claimed
Extra manip. for loss ($\bar{m}$)	45.6	26.0	47.3	29.9	19.6	33.9
	(6.96)	(3.59)	(7.06)	(3.71)	(5.72)	(3.32)
z-test p-value	0.012		0.029		0.031	
N	70,278	135,910	39,611	166,577	65,433	140,755

Notes: This table presents parameter estimates of the extra manipulation pursued when facing a loss ($\bar{m}$) based on the estimation strategy described in Section 3. Estimation sample restricted to balance due values between the 5^{th} and 95^{th} percentile. Block-bootstrapped standard errors, resampling by taxpayer ID and based on 5,000 simulations, are presented in parentheses. Plots of the fitted distributions are presented in Figures 3 and 4. All monetary amounts are expressed in 2016 dollars. Assignment to income quartiles is evaluated according to filing-year-specific AGI distributions.

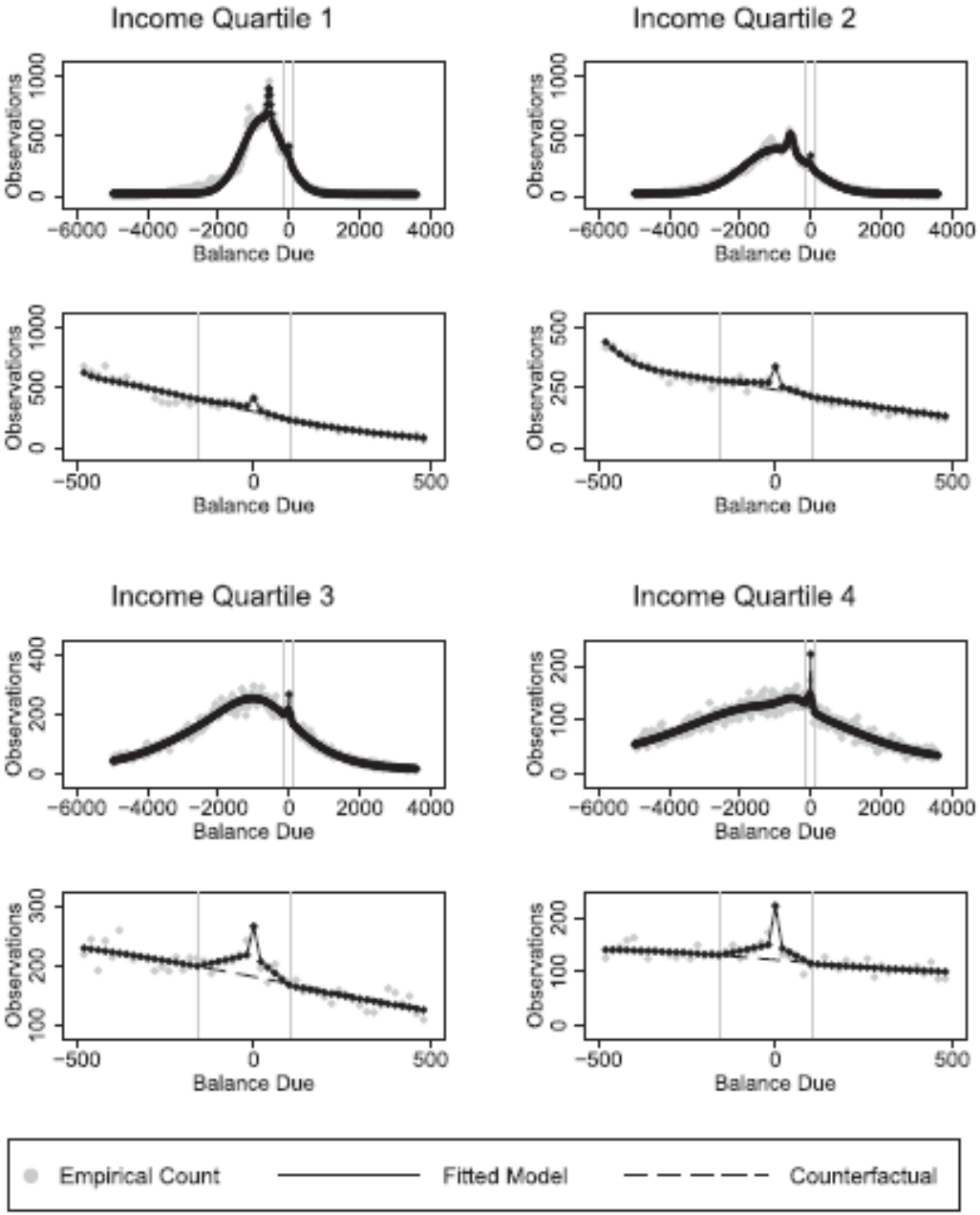

Income Quartile 1
Income Quartile 2
Income Quartile 3
Income Quartile 4
Observations
Balance Due
Empirical Count
Fitted Model
Counterfactual

FIGURE 3

- By income levels
  - Loss-aversion pattern was more pronounced among higher income filers than those with lower ones:
    higher income tax filers have more options of manipulation.
  - This supports the hypothesis that the observe behaviour is caused by the income distribution, not by the financial sophistication.
- By categories of reduction.
  - When itemized reduction or adjustment to income are present, the tendency of loss aversion is more pronounced.
  - Claiming credit, however, showed the opposite pattern:
    it may be relatively small component of overall tax manipulations, or it is likely a less suitable proxy for total manipulation.

"Residual" Tax Reductions Approach

- R = (credits) + (marginal tax rate) $\times$ (adjustments + deductions).
- Then, they regressed R on filing-year dummies and individual fixed effects, and estimate the remaining residual.

  $\Rightarrow$ Loss-averse tax reduction is strongly associated with "unusual" tax reduction activity, rather than the year/ individual specific effect.

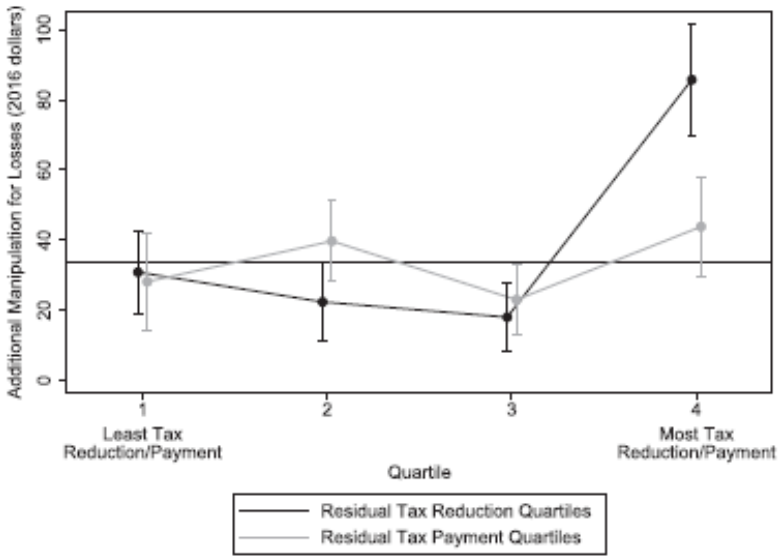


FIGURE 5
Association of manipulation measure with tax reduction and tax payment.

Earlier Tax Payments

- Individuals evaluate their balance due by that on the tax day, so the payment in advance can be interpreted as another opportunity of manipulation.
- They made another regression, using total tax prepayment instead of R.

  $\Rightarrow$ No association was observed(Figure 5).

Alternative Forms of Reference Dependence

Two additional forms of reference dependence:

1. Notch

   – direct discontinuity in utility levels at the reference point, arise if there is a fixed psychological cost when making manipulation.

2. Diminishing Sensitivity

   – utility function which is concave over gains and convex over losses, making individual more loss-averse.

Observed results did not support these two assumptins.

Financial Constraints

- Tax Evasion

  – A risky substitute for a loan, implicitly trading present income for future penalties.

- Tax filers with financial constraint may take such a loan, but low-income filers have low access to savings or credit.

- Restricted sample: Tax filers with positive interest income, 41 % of the whole sample

  $\Rightarrow$ The estimate of loss averse manipulation is \$30.4, indicating little influence on the patterns.

Tax Preparer

- Many taxpayers have paid tax preparer file their tax returns.

  $\Rightarrow$ Conditional sample on whether filed by tax preparer also shows loss-averse result ($\tilde{m} = 22.6$), but the effect was weakened relative to self-filing sample ($\tilde{m} = 43.7$).

- Possible Interpretation

  1. Tax preparers themselves are also loss-averse.
  2. They believe the cliants are loss-averse and so incorporate them.

- Distribution of tax preparers-sample has more sharp spike around zero balance due: they have greater access to manipulation.

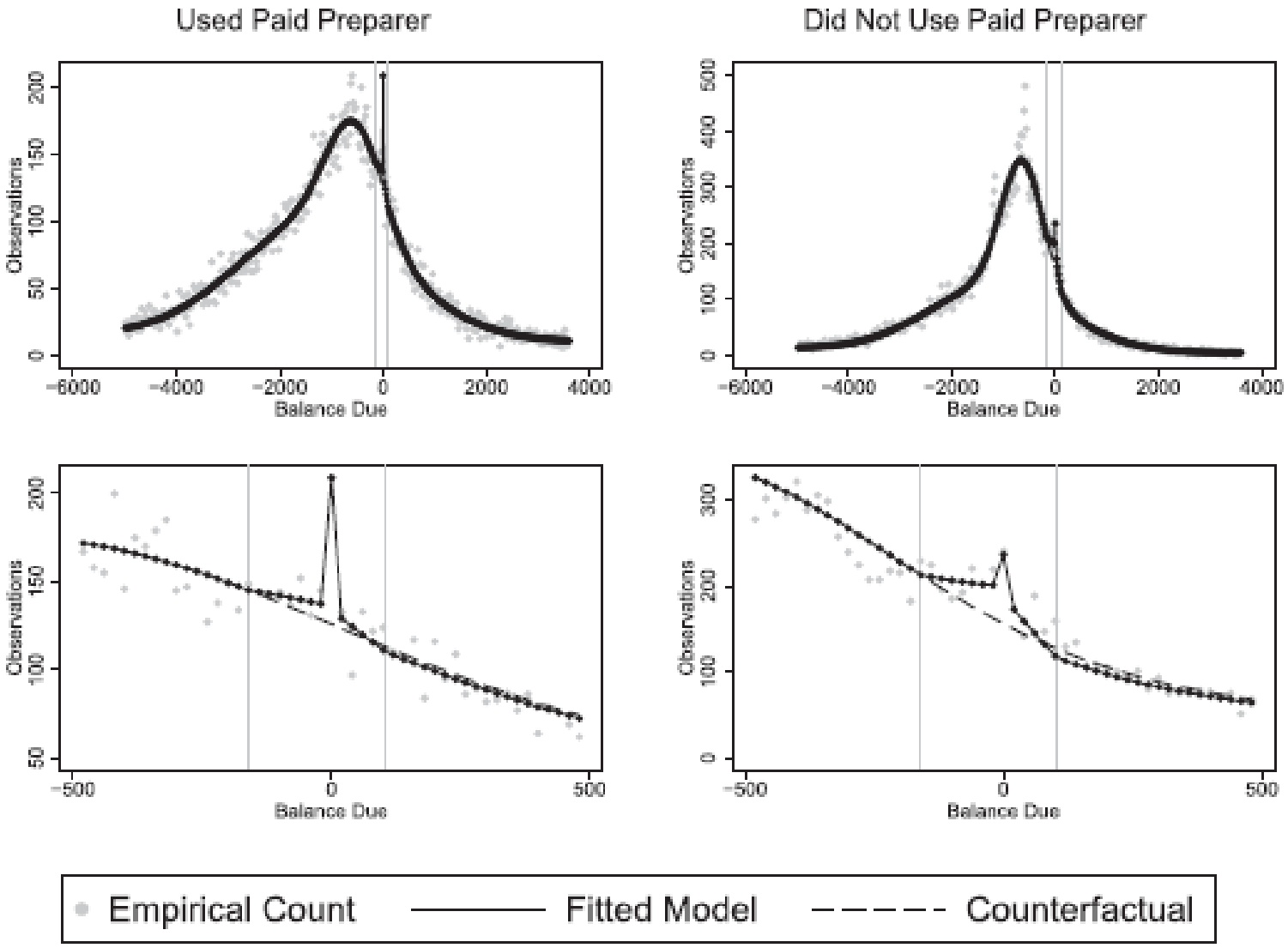


FIGURE 7

Distribution of balance due by use of tax preparer.

Underwithholding Penalty

- Underwithholding penarlty is not imposed until substantial one has occurred:

  Observed balance-due is interpreted as the manipulation is not observed at zero.

- Misunderstandings that any positive balance due leads to a penalty may lead the results

  1. Manipulation still occurs for the tax preparers sample.
  2. Restricted samples into those who previously have faced a loss show the same results.

Discussion

- The nature of the observed reaction to loss framing has important implications for tax policy and behavioral economics.

  – Facing losses pursues \$34 of additional manipulation, resulting in \$3.7 billion of additional reduction.

- Loss-aversion provide a quantification of effect sizes tie to more concrete policies and accounts for a significant portion of the costs or benefits to changing withholding policy:

  Incentives for early payment

- Gain-loss framing can assist in controlling tax morale:

  Gain framing could reduce evasion motives in a more cost-effective manner.

Beyond Tax Policy

- Techniques to identify loss-averse behavior from bunching.

Related Papers

- Pope and Simonsohn (2011) "round numbers as goals"
- Abeler *et al* (2011) "effort provision in the lab"
- Becker *et al* (2012) "price targets in mergers and acquisitions"
- Allen *et al* (2017) "goal-setting behavior of marathon runners"