

The Effects of Compliance Reminders on Tax Payments in Greece

Evidence from a Regression-Discontinuity Design

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Research Question

What **motivates** individuals to **pay** their **taxes**?

- ▶ **Deterrence**: Pr(audit), penalties; Allingham & Sandmo, 1972
Do not explain taxpayer behavior fully; Alm et al., 1992
Pr(tax debt collection enforcement); Paramonova, 2016
- ▶ **Voluntary Compliance**: information imperfections, intrinsic motivation, vertical and horizontal tax reciprocity, culture (Luttmer & Singhal, 2014)

Do **behavioral strategies of information provision** or does **tax debt collection enforcement** matter for compliance in a context of low tax morale?

Importance

Significant "tax gap"

- ▶ US: \$450bn in 2006, 85.5% compliance
- ▶ UK: \$48bn in 2013, 93.6% compliance
- ▶ Greece: \$68bn in 2013 $\approx \frac{1}{5}$ of govt debt of \$361bn (174.9% 2013 GDP), 75% compliance

Tax Debt Collection Enforcement in Greece in 2012

- ▶ €13.1bn of new tax debt (25% of total assessed taxes)
- ▶ Of this, only €1.4bn were collected (10.6% of new tax debt)
- ▶ Inadequate instruments for tax debt collection enforcement (IMF, 2013)

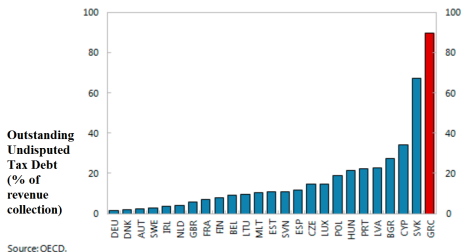


Figure: Outstanding Undisputed Tax Debt

Preview of Results

Effect of neutral information nudges on payments of overdue PIT

1. Reject with certainty a positive effect
2. Nudging can backfire under certain conditions
3. Tax Debt Collection Enforcement $>$ Information Provision
4. Suggestive evidence that effects may persist over short time
5. Larger behavioral responses to more salient delivery devices

Behavioral Tax Compliance Literature

Pecuniary Factors

Perceived Audit Probability and Sanction Threats

- ▶ Positive effects: Slemrod et al., 2001; Kleven et al., 2011; Pomeranz, 2013; Castro & Scartascini, 2015;
- ▶ Null effects: Ariel, 2012; Chirico, et al. 2015; Doerrenberg & Schmitz, 2015

Non-pecuniary Factors

Moral Costs

- ▶ Positive effects: Hallsworth et al., 2014; Perez-Truglia & Troiano, 2016

Moral Suasion

- ▶ Positive effects: Dwenger et al., 2014; Hallsworth et al., 2014;
- ▶ Null effects: Blumenthal et al., 2001; Fellner et al., 2009; Doerrenberg & Schmitz, 2015;
- ▶ **Negative Effects:** Ariel, 2012

Information Provision

- ▶ Positive and Persistent Effects: Hallsworth et al., 2014; Perez-Truglia & Troiano, 2016
- ▶ Two-way but Ephemeral Effects: Guyton et al., 2016

Questions that Remain

Nature of Effects & Delivery Device

1. Context-specific findings or generalizable?
2. Under what conditions can neutral nudges of information provision reduce tax revenues?
3. One-shot interventions or policies with persistent effects?
4. Does the salience of the nudge influence its effectiveness?

Study Contributions

1. Neutral nudges of information provision cannot increase tax payments in a context of low tax morale
2. Information nudging may backfire in a context of weak tax debt collection enforcement
3. Suggestive evidence that effects may persist over short time
4. Behavioral response is increasing in the salience of the nudging technologies (phone call > email)

Setup

- 2-period economy following Snow and Warren (2007)
- Continuum of taxpayers i with tax debt equal to 1, income y_i
- Taxpayer and tax agency discount rates are $R_i > 1$ and $R_g > 1$
- $k \in \{e, n\}$ states of the world of tax debt collection enforcement
- Tax agency observes, does not fully control objective $Pr(e) = p$
- Taxpayers form subjective beliefs $q_i \sim F(q_i)$ about p
- Tax agency can influence q_i by this communication strategy α such that effective subjective beliefs given by q_i^α , $\pi_i = \int_0^1 q_i^\alpha dF(q_i)$
- Communication strategy $\alpha \leq 1$, decreasing in salience of medium
- Payment decision x_i based on mean prior expectation about $Pr(e)$

$$x_i(R_i, \pi_i) = \begin{cases} 0, & \text{full compliance} \\ 1, & \text{full non-compliance} \end{cases} \quad (1)$$

- Tax agency imposes financial penalty $\theta > 1$ to non-compliers
- Period one income s_i is saved for period two.

The Taxpayer's Problem - Period 1

$$\max_{x_i^1, s_i \in [0,1]} EU(x_i^1; s_i) = (1 - \pi_i)[u(y_i + x_i^1 - s_i) + R_i \cdot V(s_i, \pi_i^n)] + \pi_i \cdot [u(y_i - \theta x_i^1 - s_i) + R_i \cdot V(s_i, \pi_i^e)] \quad (2)$$

FOC

$$\frac{\partial EU}{\partial x_i^1} = (1 - \pi_i) \cdot \frac{\partial u(c_i^n)}{\partial x_i^1} - \theta \cdot \pi_i \cdot \frac{\partial u(c_i^e)}{\partial x_i^1} = 0 \quad (3)$$

$$\frac{\partial EU}{\partial s_i} = -(1 - \pi_i) \cdot \left[\frac{\partial u(c_i^n)}{\partial s_i} - \delta \frac{\partial V(s, \pi^n)}{\partial s_i} \right] - \pi_i \cdot \left[\frac{\partial u(c_i^e)}{\partial s_i} - \delta \frac{\partial V(s, \pi^e)}{\partial s_i} \right] = 0 \quad (4)$$

The Taxpayer's Problem - Period 2

$$\max_{x_i^2 \in [0,1], \pi_i^k \in [0,1]} V(x_i^2; \pi_i^k) = (1 - \pi_i^k)u[(1+r)s_i + x_i^2] + \pi_i^k u[(1+r)s_i - \theta \cdot x_i^2] \quad (5)$$

FOC

$$\frac{\partial V}{\partial x_i^2} = (1 - \pi^k) \frac{\partial u(c_i^{kn})}{\partial x_i^2} - \pi^k \theta \frac{\partial u(c_i^{ke})}{\partial x_i^2} = 0 \quad (6)$$

Theoretical Prediction:

- ▶ If $k = n, p < \pi_i^k$ then Bayesian updating leads to tax revenue losses, inclusive of penalties.

Policy Implication:

- ▶ Reducing uncertainty about tax debt collection enforcement may enhance tax compliance.

The Government's Problem

$$T(\theta, \alpha) = (1 - p)[1 - x_i^*] \cdot R_g + p \cdot \theta \cdot x_i^*(R_i, q_i^\alpha) \quad (7)$$

$$PW(\theta, \alpha) = -\{(1 - p)[1 - x_i^*(R_i, q_i^\alpha)] \cdot R_i + p \cdot \theta \cdot x_i^*(R_i, q_i^\alpha)\} \quad (8)$$

$$\max_{\theta > 1, \alpha \leq 1} SW(\theta, \alpha) = \psi \cdot T(\theta, \alpha) + (1 - \psi) \cdot PW(\theta, \alpha) \quad (9)$$

where $\psi \in [\frac{1}{2}, 1]$ is government preference for an extra tax dollar in its coffers to the taxpayer.

Policy Implications:

- ▶ Eliminate (preserve) information asymmetries about p when the government is indifferent or favors private welfare (tax revenues) over tax revenues (private welfare).
- ▶ Amplify π_i by $\alpha < 1$ only when $k = e$.

Taxation in Greece

- ▶ \$31.6bn of 2009 income went unreported by self-employed; Artavanis et al., *QJE*, 2016
- ▶ 10% income tax under-reporting; Matsaganis et al., 2010
- ▶ 2nd largest shadow economy in OECD; Schneider et al., 2008
- ▶ Ever-changing tax code; 2 PIT code changes in 2013

Tax Evasion Pathways

Eroding Trust in the National Government

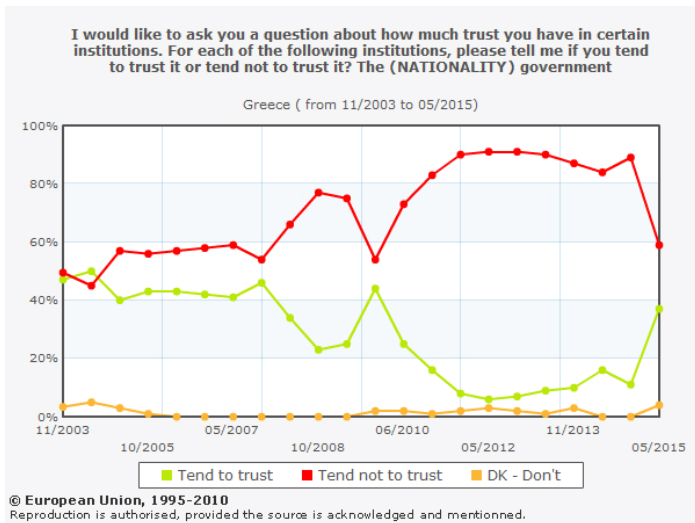


Figure: Trust in Government, Greece 11/2003 - 05/2015; Eurobarometer

2013 Tax Compliance Campaign in Greece

Targeted €1.039bn in PIT delinquencies by 517,943 individuals.

Neutral nudges of information provision by e-mail and phone call:

- ▶ Reminded about upcoming payment deadlines
- ▶ Warned about tax liens in the case of non-compliance

Message

Study Population

	Phone	Call	
E-mail	0	1	Total
0	40,159	1,340	41,499
1	472,132	4,312	476,444
Total	512,291	5,652	517,943

Estimands:

- ▶ Intensive Margin: Effect on Levels of Tax Payments
- ▶ Extensive Margin: Effect on Rate of Tax Payments
- ▶ Inverse Hyperbolic Sine Transformation of Outcome:

$$g(Y_i) = \log(Y_i + (Y_i^2 + 1)^{0.5}) = \sinh^{-1}(Y_i)$$

Identification: OLS

- ▶ Tax delinquents who received a phone call reminder were selected by a tax repayment risk-analysis.
- ▶ Raw, unadjusted difference in group means: €1199.81 (per tax delinquent) / €6.279mil. (in total)
- ▶ Adjusted with controls difference in group means: €310.68 (per tax delinquent) / €1.626mil. (in total) : **NAIVE ESTIMATES**

Identification: Matching

In the presence of cross-overs, use matching:

MATCHING ESTIMATES

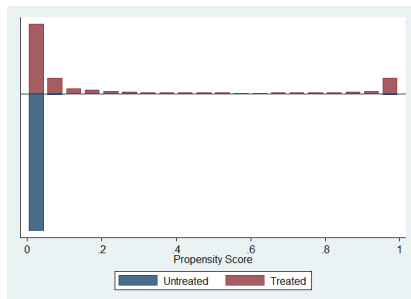


Figure: Propensity Score Histograms by Treatment

Identification: Fuzzy-Regression Discontinuity Design

- ▶ Arbitrarily, tax agency contacted only those with tax liabilities greater or equal to €500, giving rise to a natural experiment.
- ▶ Exploit discontinuity in probability of treatment at cutoff conditional on debt level to instrument treatment assignment
- ▶ Identify local average treatment effect (LATE) of the compliance reminders on payments of overdue tax liabilities
- ▶ Inference comes from the complier population, taxpayers just above and below the €500 cutoff which are assumed to be exchangeable.

Adherence to the Treatment Assignment Rule

Only 0.004% with total income tax liabilities under €500 received a reminder phone call.

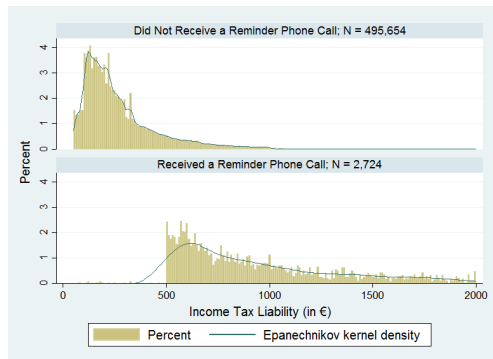
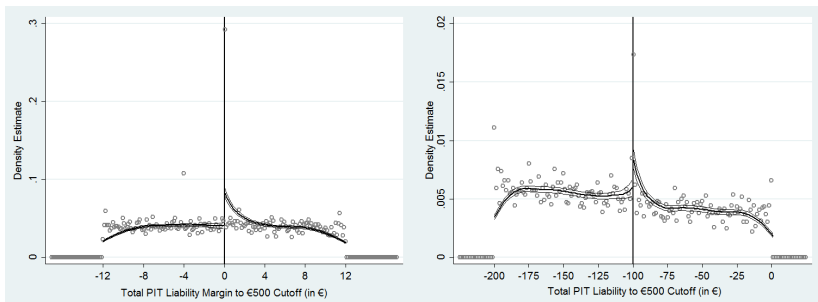


Figure: Histogram of Forcing Variable (Total Individual Income Tax Liabilities) by Treatment (Phone Call)

McCrary's Density Test



Even over irrelevant to assignment rule regions, sharp increase in density just above €400 due to rounding.

Cattaneo et al., 2016

OVERSMOOTHED DENSITY

McCrary's Density Test: Non-rounders Sample

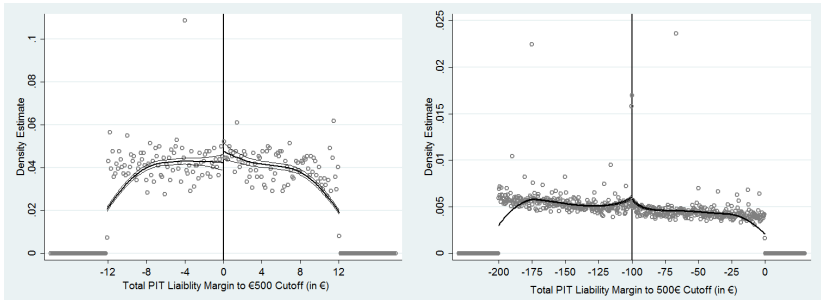


Figure: McCrary's Density Test of Manipulation of Forcing Variable - Non-rounders Sample

Smooth density in the absence of rounding.

Estimation: Fuzzy Regression Discontinuity

Local linear regression on both sides of cutoff using a triangular kernel. Following Imbens and Kalaynaraman (2009), the optimal bandwidth minimizes Mean Squared Error.

$$\rho = \frac{\lim_{c \rightarrow 500^+} E[Y|X = c] - \lim_{c \rightarrow 500^-} E[Y|X = c]}{\lim_{c \rightarrow 500^+} P[D = 1|X = c] - \lim_{c \rightarrow 500^-} P[D = 1|X = c]} \quad (10)$$

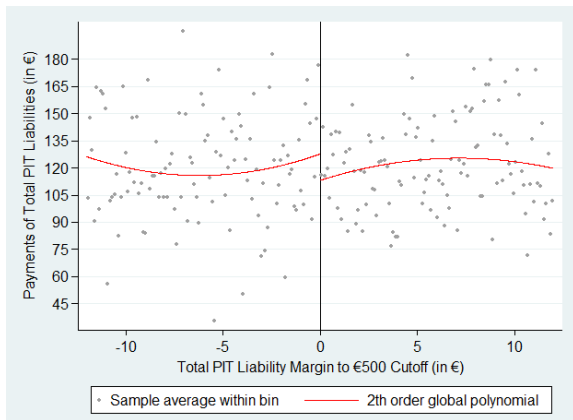
Equivalent to a local linear IV model estimated via 2SLS

$$D_i = \gamma_{00} + \gamma_{01}x_i + \gamma_0^*T_i + \gamma_1^*x_iT_i + \xi_{1i} \quad (11)$$

$$g(Y_i) = \alpha + \beta_{01}x_i + \rho D_i + \beta_1^*D_i x_i + \xi_{2i} \quad (12)$$

RD Estimates - Intensive Margin

Large (24%-41%) and significant (10%-5% levels) reduction in payments, robust to polynomial order



COVARIATE BALANCE

PERSISTENCE OF EFFECTS

Distribution of LATEs over Range of Bandwidths

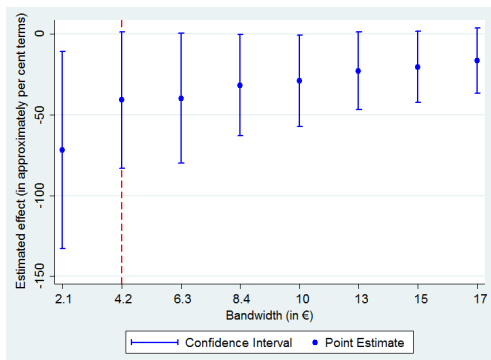


Figure: Incremental Effect of Phone Calls Relative to E-mails:

RD Estimates - Extensive Margin

Substantial (9%) drop in repayment rate, significance robust to pol. order.

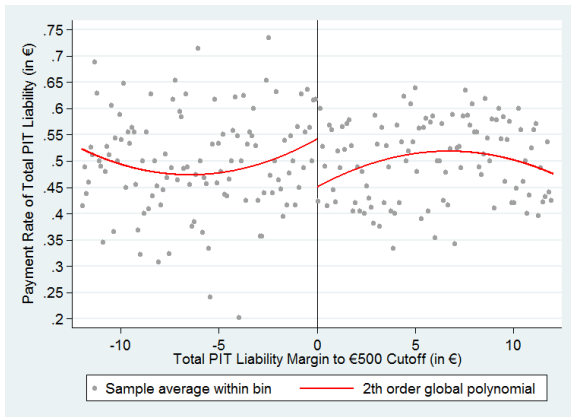


Figure: Discontinuity in Average Repayment Rate

Heterogeneity Analysis of PIT by Debt Vintage

Table 19: 2SLS Estimates of Compliance Reminders' LATEs on Payments of Total PIT Liabilities

Variables	(1)	(2)
	Phone Call vs E-mail	Phone Call vs E-mail
Compliance Reminder(s)	0.97 (4.39)	-28.05* (16.23)
Debt Vintage	New	Old
Polynomial Order	1	1
Bandwidth	11.67	250
# Treated Observations	41	117
Observations	1,415	121,037

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Standard errors in parentheses, clustered at the zip code level.

Placebo Test

Table: 2SLS Estimates of Compliance Reminders' LATEs on Payments of Total PIT Liabilities

Variables	(1) Levels	(2) Per Cent	(3) Rate
Old Debtor	-49.62*** (15.58)	-0.13 (0.24)	-0.01 (0.03)
Unemployed	2.34 (17.41)	0.03 (0.30)	0.01 (0.03)
Self-Employed	10.69 (17.16)	0.17 (0.31)	0.02 (0.04)
Distance to Cutoff	0.87* (0.49)	0.01 (0.01)	0.01 (0.01)
Distance to Cutoff Squared	-0.05 (0.04)	-0.01 (0.01)	-0.01 (0.01)
Age	1.85 (2.13)	0.02 (0.03)	0.01 (0.01)
Age Squared	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Male	18.32 (11.97)	0.34 (0.22)	0.04 (0.02)
Bandwidth (in €)	10.90	21.38	35.12
Observations	703	1, 277	2, 106

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. SEs clustered at the zip code level.

Tax Policy Design

Latest Developments in Tax Debt Collection Enforcement:

- ▶ Current goal for 100k tax liens/month
- ▶ Up from 30k tax liens/month in Jul 2016
- ▶ Substantially higher than 17k tax liens/month in Jan 2014

Conclusions

- ▶ Neutral nudges of information provision via phone calls ill-advised in a context of low tax morale and weak tax collection enforcement
- ▶ Effects may persist over short time
- ▶ Salience of nudging technology matters but does not necessarily guarantee better outcomes for the tax agency

Message in Tax Agency's Communication

Hellenic Republic
Ministry of Finance
General Directorate of Tax and Customs Affairs
General Directorate of Tax Audits and Public Revenues Collection
Tax Compliance Unit
1 Thessalonikis & Chandri
Moschato

Recipient: XXXXXX

Username: XXXXXXXX

Dear Sir/Madame,

Following an inspection of the electronic records of the General Directorate of Information Systems of the Ministry of Finance on 10/26/2012, due, and potentially overdue, tax delinquencies were determined. Especially, for the cases of overdue tax delinquencies we urge you to settle your outstanding debt.

If you have a counterclaim against the State on this outstanding debt, you are required to submit the necessary application at your local Tax Clearing House.

Warning: With regards to the tax delinquencies that have become overdue, the supervisor of your local Tax Clearing House reserves the right to enforce collection using all provisions in the legislation including non-negotiable administrative and financial measures to protect the State's interest.

Tax Compliance Unit Supervisor

Hara Mavridou

Note: Every electronic message we send you from the General Directorate of Information Systems, insofar it is not a response to one of yours, includes at the upper part your name and username. If you received a message suggesting it was sent from the General Directorate of Information Systems without the inclusion of this information and is not a reply to previous message of yours should be deleted since it is counterfeit and of possibly malicious content.

Figure: 2013 Compliance Reminder E-mail (translated from Greek by the author)

Non-normal Residuals

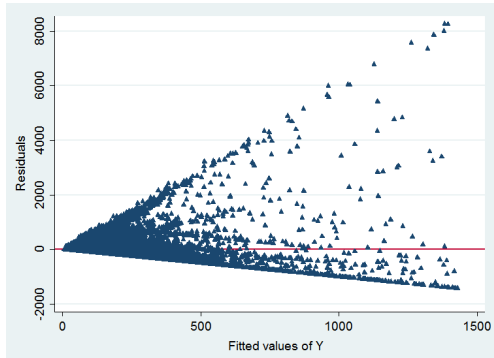


Figure: Evidence of Heteroskedasticity

Inverse Hyperbolic Sine Transformation

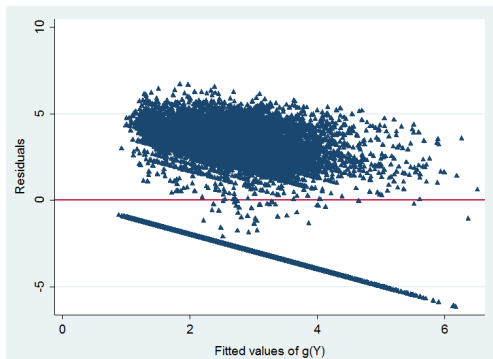


Figure: Normalized Residuals

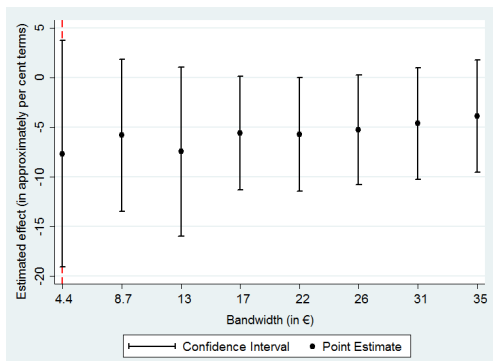


Figure: Effect of Phone Call: Distribution of LATEs over a Range of Bandwidths

main

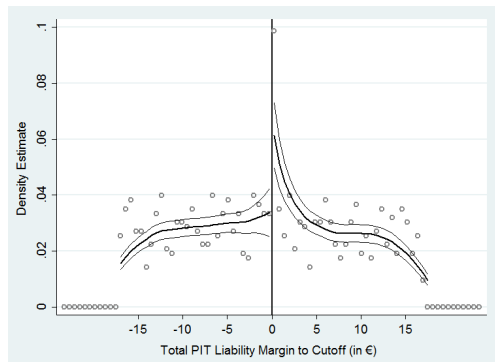


Figure: Test of Manipulation of Forcing Variable PIT Liability Level over [€483,€517] range

main

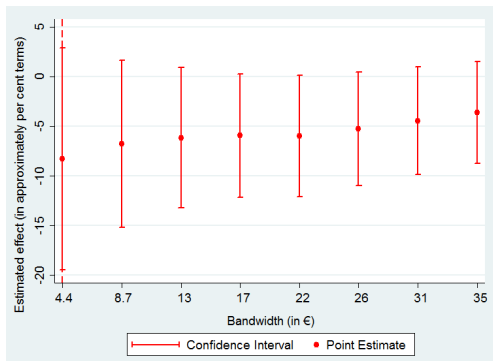


Figure: Combined Effect of E-mails and Phone Calls on PIT Payments: Distribution of LATEs over a Range of Bandwidths

main

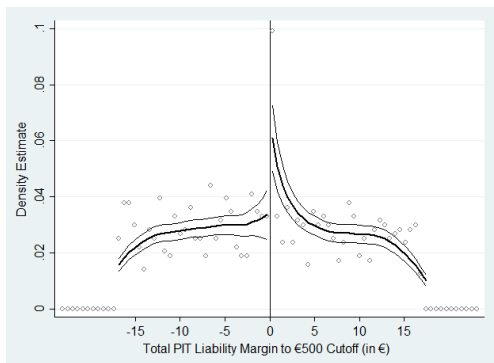


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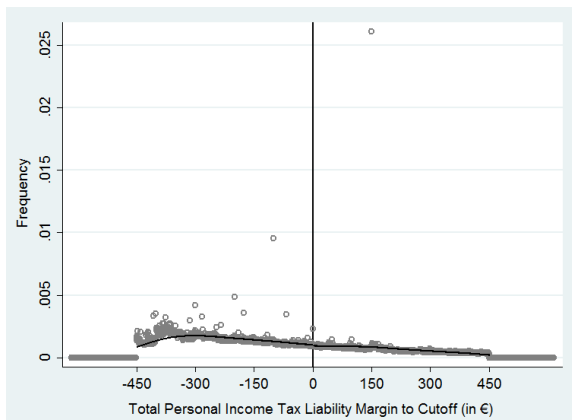


Figure: Smooth Density over a Large Window of the Running Variable

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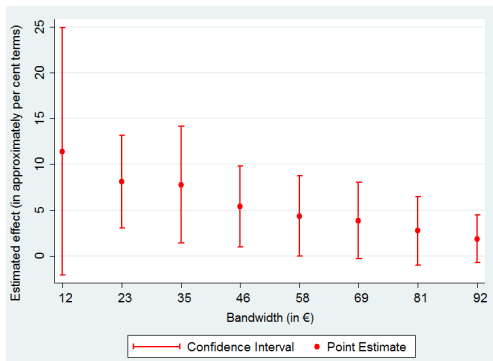


Figure: Combined Effect of E-mails and Phone Calls on VAT Payments: Distribution of LATEs over a Range of Bandwidths

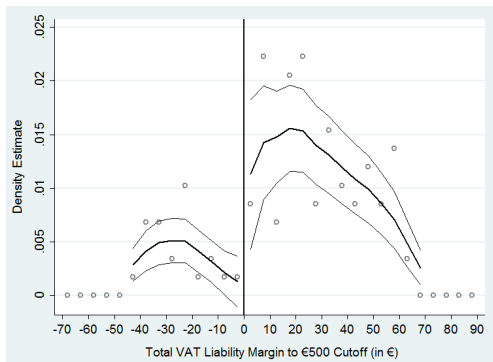


Figure: Test of Manipulation of Forcing Variable PIT Liability Level over [€446,€564] range

main

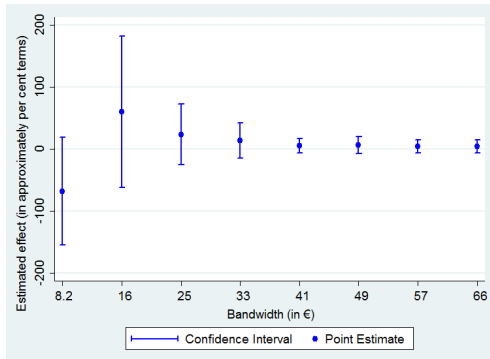


Figure: Incremental Effect of Phone Call relative to E-mail on VAT Payments: Distribution of LATEs over a Range of Bandwidths

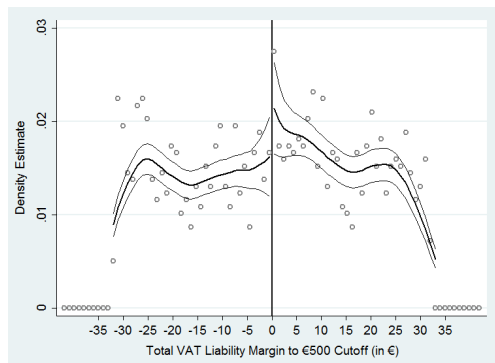


Figure: Test of Manipulation of Forcing Variable PIT Liability Level over [€468,€532] range

main

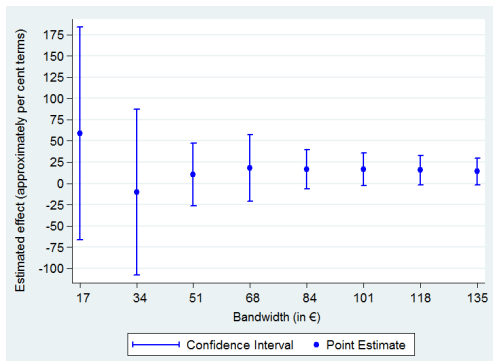


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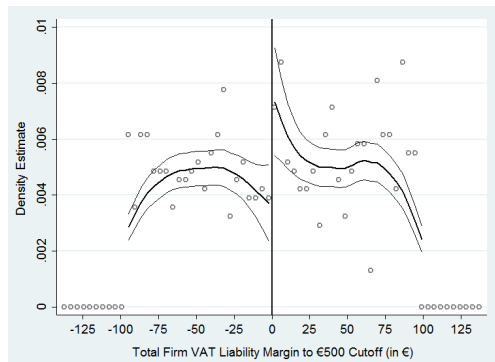


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main

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Cattaneo et al. (2016) Density Test

Novel local polynomial density estimation technique

- ▶ Avoids pre-binning of the data which improves size properties
- ▶ Allows for restrictions on other features of the model which improves power properties
- ▶ Chosen bandwidth minimizes the asymptotic MSE of the difference or sum (whichever smallest) of the density estimators

RD Manipulation Test Estimates:

- ▶ Conventional : $T = -0.7752$; $P > |T| = 0.4382$
- ▶ Robust Bias-Corrected: $T = 2.0162$; $P > |T| = 0.0438$

main

E-mail and Phone Call Recipients		N = 43		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	516.50	7.64	503.69	528.81
Payments of Total Liabilities	346.57	243.74	0	528.81
Male	0.534	0.504	0	1
Age	43.9	9.5	20	63
Self-employed	1	0	1	1
Salaried	0	0	0	0
Formerly Self-employed	0	0	0	0

E-mail Recipients		N = 1,363		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	499.32	18.42	468.02	531.99
Payments of Total Liabilities	185.03	221.24	0	531.99
Male	0.582	0.493	0	1
Age	43	10.5	19	82
Self-employed	0.942	0.233	0	1
Salaried	0.0579	0.233	0	1
Formerly Self-employed	0.057	0.232	0	1

Table: Covariate Balance by Treatment at Optimal Bandwidth - Individual VAT

E-mail and Phone Call Recipients		N = 43		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	503.92	3.87	500	511.85
Payments of Total Liabilities	78.02	124.08	0	502.1
Male	0.72	0.453	0	1
Age	55.8	19.4	22	96
Self-employed	0.116	0.324	0	1
Salaried	0.883	0.324	0	1
Formerly Self-employed	0.209	0.411	0	1

E-mail Recipients		N = 9,173		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	499.80	6.74	488	512
Payments of Total Liabilities	120.75	168.15	0	511.96
Male	0.747	0.434	0	1
Age	57.7	17.2	18	108
Self-employed	0.226	0.418	0	1
Salaried	0.773	0.418	0	1
Formerly Self-employed	0.155	0.362	0	1

Table: Covariate Balance by Treatment at Optimal Bandwidth

E-mail and Phone Call Recipients		N = 28		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	553.06	37.42	420.31	588.05
Payments of Total Liabilities	404.18	244.82	0	588.05
Firm Age	15.7	22.9	1	50
E-mail Recipients		N = 704		
Variable	Mean	Standard Deviation	Min	Max
Total Liabilities	500.17	56.76	403.06	596.72
Payments of Total Liabilities	173.07	221.76	0	596.39
Firm Age	10.94	15.16	0	55

Table: Covariate Balance by Treatment at Optimal Bandwidth - Corporate VAT

main

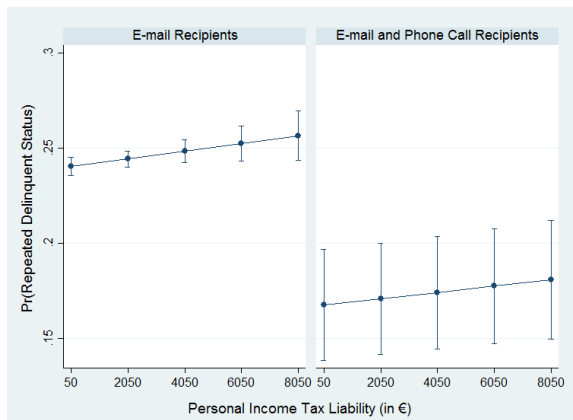
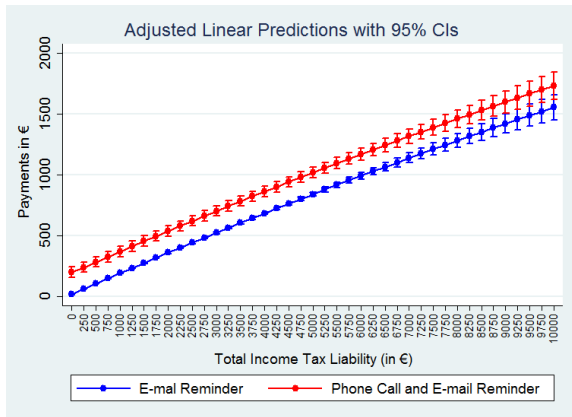


Figure: Likelihood of Becoming Delinquent Again



Raw difference of €180 in payments of tax liabilities up to €10,000 per €250 increment. [main](#)

Table: CEM Estimates of Effect of Combined Compliance Reminder on Payment

Variables	(1)	(2)	(3)	(4)	(5)
Combined Compliance Reminders	1.22** (0.47)	1.85*** (0.31)	1.20*** (0.16)	0.85*** (0.17)	0.1 (0.
Constant	3.239** (0.273)	2.805*** (0.187)	2.42*** (0.14)	2.79*** (0.18)	3.5 (0.
R-Squared	0.019	0.051	0.05	0.04	0.0
Pre-Matching Covariate Imbalance L_1	0.9593	0.9499	0.8024	0.8076	0.8
Post-Matching Covariate Imbalance L_1	0.2137	0.4783	0.4956	0.5861	0.5
Total Liability Range	[400, 600]	[600, 1000]	[1000, 2000]	[2000, 5000]	[50
# of Matched Strata	45	98	346	333	157
# of Matched Treated Observations	70	140	900	646	389
# of Matched Control Observations	241	538	1441	955	332
Observations	311	678	2, 341	1, 601	721

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Standard errors in parentheses, clustered at code level.

Tax Evasion Decision Tree

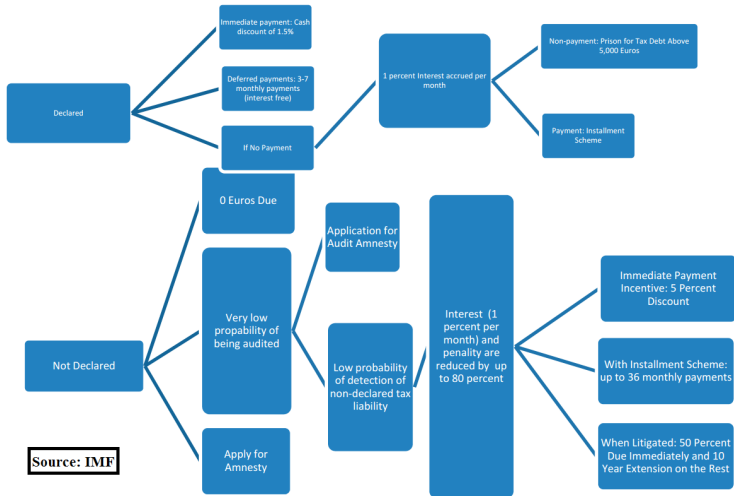


Figure: Universe of Tax Evasion Windows of Opportunity