APPENDIX FOR ONLINE PUBLICATION

Additional Figures

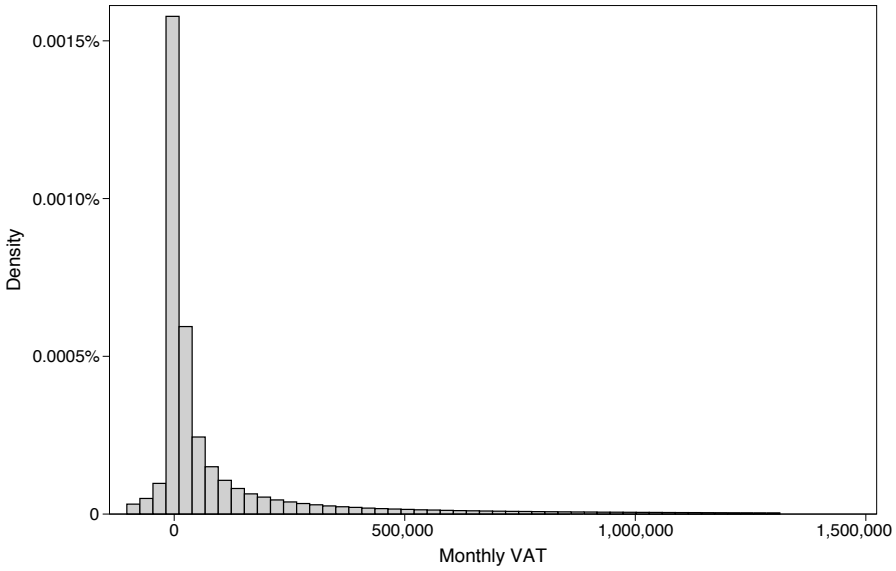


Figure A1. Distribution of monthly declared VAT for the full study sample, twelve months prior to treatment to twelve months after treatment, excluding the top and bottom 5%.

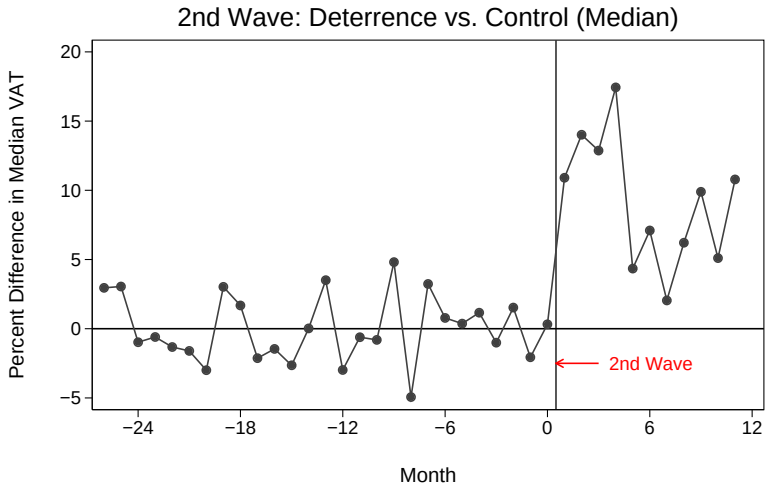
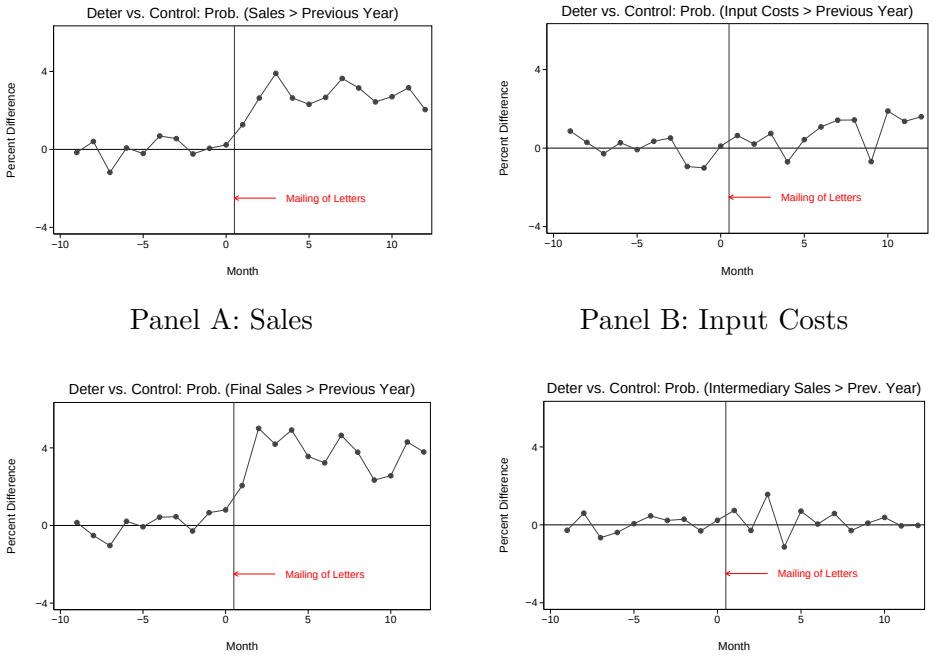


FIGURE A2. IMPACT OF DETERRENCE LETTER: SECOND WAVE OF MAILING

Notes: This figure plots the monthly percent difference between the medians of the treatment and the control group of the deterrence letter for the second wave of mailing: (median VAT treatment group - median VAT control group) / (median VAT control group), normalizing the average of pre-treatment months percent difference to zero. The y-axis indicates time, with monthly observations, and zero indicates the last month before the mailing of the letters. The vertical line marks mailing of the letters. Since the second wave of mailing is much smaller than the first, the figure shows a more noisy pattern than the first wave displayed in Figure 2, Panel A.



Panel A: Sales

Panel B: Input Costs

Panel C: Final Sales

Panel D: Intermediary Sales

FIGURE A3. IMPACT OF DETERRENCE LETTER ON DIFFERENT TYPES OF TRANSACTIONS

Notes: This figure plots the percent difference between deterrence letter and control group of the probability that a line item (total sales, total input costs, intermediary sales or final sales) is larger than in the same month of the previous year, normalizing the average of pre-treatment months percent difference to zero. The y-axis indicates time, with monthly observations, and zero indicates the last month before the mailing of the letters. Figures show the first wave of mailing.

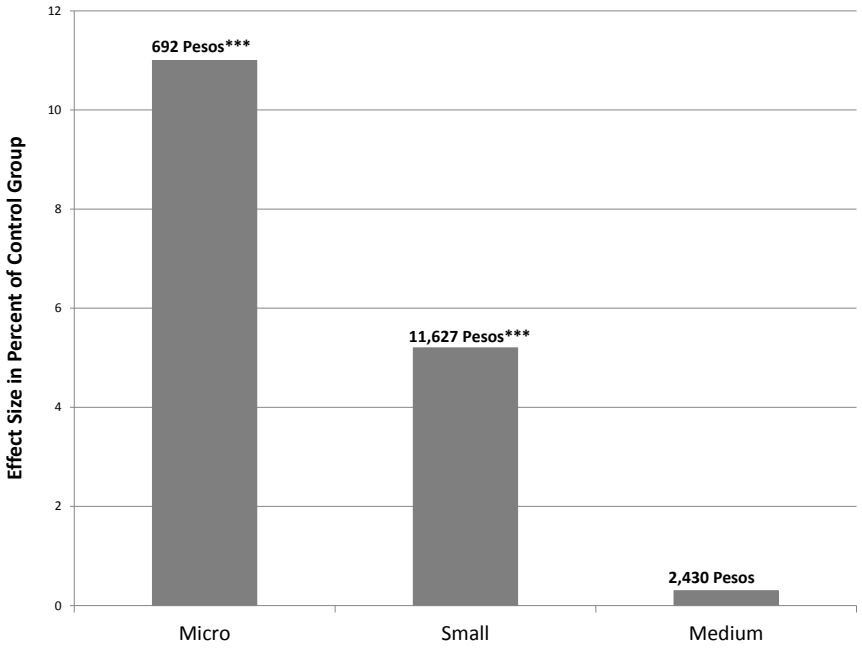
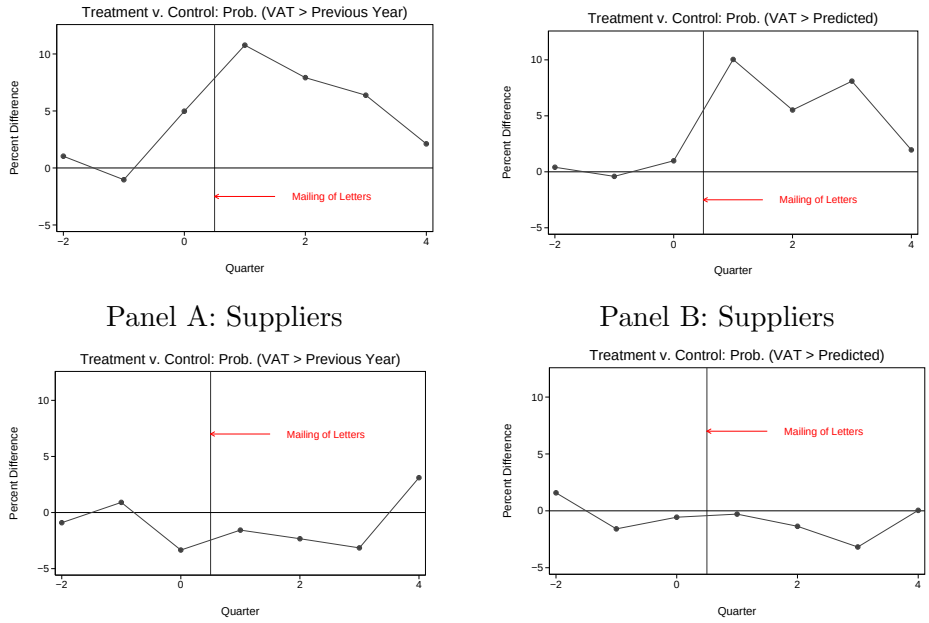


FIGURE A4. IMPACT BY FIRM SIZE (MEDIAN REGRESSION)

Notes: Each bar represents a separate median regression for each size category. The numbers on top of the bars indicate the coefficient on being in the deterrence letter treatment group of a median regression of mean monthly VAT payments in the four months following treatment. The height of the bar indicates the effect in percent relative to the mean in the control group in that size category. *** = p<0.01, ** = p<0.05, * = p<0.1



Panel A: Suppliers

Panel B: Suppliers

Panel C: Clients

Panel D: Clients

FIGURE A5. SPILLOVER EFFECTS ON TRADING PARTNERS' VAT PAYMENTS, QUARTERLY

Notes: This figure plots the percent difference between the group receiving a pre-announcement and the control group of the probability that declared VAT is larger than in the same month of the previous year (Panels A and C) and the probability that declared VAT is larger than predicted (Panels B and D), normalizing the average of pre-treatment months percent difference to zero. The y-axis indicates time, with observations aggregated at the quarterly level because monthly observations are very noisy, and zero indicates the last quarter before the mailing of the letters.

Additional Tables

Table A1—Deterrence Letter Experiment: Monthly Effects on VAT Payments

	(1) Percent VAT > Previous Year	(2) Percent VAT > Predicted	(3) Percent VAT > Zero
Deterrence $\times t-5$	-0.02	-0.12	-0.07
	(0.17)	(0.18)	(0.17)
Deterrence $\times t-4$	0.26	0.03	0.02
	(0.17)	(0.18)	(0.17)
Deterrence $\times t-3$	0.10	-0.29*	-0.03
	(0.17)	(0.18)	(0.17)
Deterrence $\times t-2$	0.05	-0.30*	-0.14
	(0.17)	(0.18)	(0.17)
Deterrence $\times t-1$	0.19	-0.07	-0.09
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+1$	1.07***	1.17***	0.48***
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+2$	1.76***	1.73***	0.56***
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+3$	1.46***	1.30***	0.48***
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+4$	1.64***	1.21***	0.46***
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+5$	0.99***	0.83***	-0.15
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+6$	0.94***	0.72***	0.12
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+7$	0.88***	0.59***	0.04
	(0.17)	(0.18)	(0.17)
Deterrence $\times t+8$	0.92***	0.63***	0.17
	(0.19)	(0.20)	(0.20)
Deterrence $\times t+9$	0.85***	0.75***	0.31
	(0.19)	(0.20)	(0.20)
Deterrence $\times t+10$	0.87***	0.68***	0.10
	(0.19)	(0.20)	(0.20)
Deterrence $\times t+11$	0.73***	0.82***	0.16
	(0.19)	(0.20)	(0.20)
Deterrence $\times t+12$	0.77***	0.04***	0.12
	(0.19)	(0.20)	(0.20)
Constant	45.00***	48.28***	63,73***
	(0.09)	(0.09)	(0.09)
Month fixed effects	Yes	Yes	Yes
Number of obs.	6,859,747	6,859,747	6,859,747
Number of firms	408,636	408,636	408,636
R^2	0.004	0.000	0.005

Notes: Each column shows a linear probability regression on interaction terms of being assigned to receive a deterrence letter with month dummies. Coefficients and standard errors are multiplied by 100 to express effects in percent. Sample includes all firms in the deterrence treatment and the control group. Robust standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table A2—Robustness Checks of Intent-to-Treat Effects on VAT Payments

	Letter Message Experiment						Spillover Experiment		
	Median VAT			Percent VAT > Previous Year			Percent VAT > Previous Year		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deterrence letter × post	1,258***			1.96***					
	(287)			(0.27)					
Tax morale letter × post		36			0.49				
		(522)			(0.57)				
Placebo letter × post			476			-0.52			
			(603)			(0.56)			
Audit announcement × Post							3.99		
							(2.75)		
Audit announcement × supplier × post								7.17**	
								(3.54)	
Audit announcement × client × post									0.78
									(3.92)
Number of observations	782,446	644,024	643,908	782,446	644,024	643,908	5,658	3,196	3,196
Number of firms	391,223	322,012	321,954	391,223	322,012	321,954	2,829	1,598	1,598

Notes: Non-linear estimation strategies based on Athey and Imbens (2006) (Columns (1)-(3)) and Blundell and Dias (2009)(Columns (4)-(9)). Columns (1)-(6) show robustness checks for Table 4, Columns (7)-(9) for Table 7. Observations affected by the other treatments are excluded, since all treatment groups are non-overlapping. Standard errors bootstrapped using 1,000 replications. Coefficients and standard errors of the Blundell Costa-Dias regressions are multiplied by 100 to express effects in percent. Monetary amounts are in Chilean pesos, with 500 Chilean pesos approximately equivalent to 1 USD. *** p<0.01, ** p<0.05, * p<0.1.

Table A3—Effects Including Carry-Overs

	Letter Experiment	Spillover Experiment: Trading Partners	
	(1)	(2)	(3)
	Percent VAT > Previous Year	Percent VAT > Previous Year	Percent VAT > Previous Year
Deterrence letter × post	1.35***		
	(0.137)		
Tax morale letter × post	0.237		
	(0.296)		
Placebo letter × post	-0.413		
	(0.297)		
Audit announcement × supplier × post		3.49*	3.29*
		(1.8)	(1.79)
Audit announcement × client × post		-2.01	-2.10
		(2.08)	(2.12)
Supplier × post		-1.17	-1.38
		(2.03)	(2.12)
Constant	46.71***	49.63***	50.40***
	(0.075)	(0.93)	(0.94)
Controls × post	No	No	Yes
Controls × audit announcement × post	No	No	Yes
Month fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Number of observations	7,892,076	45,264	44,288
Number of firms	445,734	2,829	2,768
Adjusted R^2	0.18	0.13	0.13

Notes: Regressions of the probability that monthly declared VAT including carry-overs from previous declarations is higher than in the same month of the previous year. Column (1) corresponds to Column (3) of Table 4. Columns (2) and (3) correspond to Columns (3) and (5) of Table 7. The controls in Column (3) are firm sales, sales/input-ratio, share of sales going to final consumers, and industry categorized as "hard-to-monitor." Coefficients and standard errors are multiplied by 100 to express effects in percent. Robust standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

TABLE A4—INTENT-TO-TREAT EFFECTS FOR COST-BENEFIT CALCULATIONS (FOR MICRO-SIZE FIRMS)

	Four Months Post-Treatment	Twelve Months Post-Treatment
	(1)	(2)
Deterrence × post	2,523**	1,360
	(1,086)	(931)
Tax morale × post	3,231	1,259
	(1,997)	(1,657)
Placebo × post	-2,934	-1,649
	(1,996)	(1,795)
Constant	58,872	58,841
	(621)	(642)
Adjusted R^2	0.16	0.16
Winsorized at 5th and 95th Percentile		
Deterrence × post	1,550***	1,093***
	(182)	(175)
Tax morale × post	585	783
	(392)	(367)
Placebo × post	379	463
	(401)	(369)
Constant	48,163	48,134
	(120)	(125)
Adjusted R^2	0.47	0.47
Month fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Number of observations	5,879,337	6,916,536
Number of firms	332,048	314,388

Notes: Regressions of mean declared VAT on treatment dummies among micro-size firms. Observations are monthly for ten months prior to treatment and four months or twelve months after treatment, respectively. Column (2) excludes firms in the second wave of mailing because there are not 12 post-treatment months available for these firms. The first set of estimates are winsorized at the top and bottom 0.1% to deal with extreme outliers, as is in Table 4. Monetary amounts are in Chilean pesos, with 500 Chilean pesos approximately equivalent to 1 USD. Robust standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table A5—Cost-Benefit Calculations for Micro-Size Firms

(1) Winsorization	(2) Number of months	(3) Monthly effect (Pesos)	(4) Overall effect (Pesos)	(5) Overall effect (USD)	(6) Number of firms	(7) Total additional tax revenue (USD)	(8) Additional tax revenue net of mailing cost (USD
0.1 Percent	4	2,523	10,092	19	75,994	1,452,522	1,376,528
5 Percent	4	1,550	6,200	12	75,994	893,505	816,360
5 Percent	12	1,093	13,116	25	63,041	1,565,996	1,502,955

Notes: 102,031 firms received a deterrence letter. Out of these, 75,994 are micro-size (i.e. firms with up to 100,000 USD in annual sales.) When calculating the additional tax revenue for twelve post-treatment months, firms from the second wave of mailing are excluded because there are not 12 post-treatment months available for these firms. The cost of sending a letter through certified mail was 528 pesos or approximately 1 USD.

Additional Cost Considerations

In addition to the marginal cost of mailing for each letter, the tax authority also incurred a fixed cost of setting up the intervention. Namely, there was a time cost of the tax authority staff in the development of the specific wording of the letter, informing their representatives on how to respond to inquiries to the letter, etc.

Finally, and importantly, as noted in footnote 17 of the paper and in Pomeranz, Marshall and Castellon (2014), sending out deterrence letters that are not backed up by a strong increase in the audit probability can lead to a reputational cost for the tax authority and can undermine its deterrence power. To make this a sustainable policy, the tax authority has to increase the probability of audits, with corresponding costs. To calculate the full cost of the intervention, one would therefore need to include the reputation cost or alternatively the cost of additional audits. However, the strong response to the second wave of this experiment, 5 months after the first wave, suggests that the deterrence letters did not lead to an immediate loss in deterrence power.

Table A6—Impact of Deterrence Letter on Different Types of Transactions, Sample Including Pure Retailers and Intermediary Firms

	(1) Percent Sales > Previous Year	(2) Percent Input Costs > Previous Year	(3) Percent Intermediary Sales > Previous Year	(4) Percent Final Sales > Previous Year
Deterrence × post	1.01***	-0.02	0.22**	0.90***
	(0.12)	(0.12)	(0.10)	(0.10)
Constant	50.07***	48.94***	29.40***	29.03***
	(0.07)	(0.07)	(0.06)	(0.06)
Month fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Number of observations	7,340,994	7,340,994	7,340,994	7,340,994
Number of firms	408,636	408,636	408,636	408,636
Adjusted R^2	0.28	0.25	0.38	0.47

Notes: Regressions of the probability of the line item (total sales, total input costs, intermediary sales, and final sales) being higher than in the same month the previous year, among the full sample including pure retailers and intermediary firms. Coefficients and standard errors are multiplied by 100 to express effects in percent. Sample includes all firms in the deterrence treatment and the control group. Robust standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

Table A7—Differential Impact of Deterrence Letter within Firms by Type of Transaction

	Percent Line-Item > Previous Year	
	(1) Comparing Sales vs. Input Costs	(2) Comparing Final vs. Intermediary Sales
Deterrence letter × post × sales dummy	1.26***	
	(0.17)	
Deterrence letter × post × final sales dummy		1.23***
		(0.23)
Sales dummy	1.98***	
	(0.51)	
Final sales dummy		5.64***
		(0.12)
Sales dummy × post	Yes	
Final sales dummy × post		Yes
Firm fixed effects × post	Yes	Yes
Month fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Number of observations	4,785,058	4,785,058
Number of firms	133,156	133,156
R^2	0.32	0.24

Notes: Regression of the probability of the line item being higher than in the same month of the previous year. Each observation is one of two line items for a given firm in a given month: Sales and input costs in Column (1), final and intermediate sales in Column (2). Column (1) compares the impact on sales with the impact on input costs within a given firm. Column (2) does the same for final sales vs. intermediate sales. The reg2hdfe routine (Guimaraes and Portugal, 2010), used to produce the large number two-level fixed effects (firm fixed effects and firm fixed effects × post), does not produce a constant term. The four months after the second wave exclude firms treated in the first. Coefficients and standard errors are multiplied by 100 to express effects in percent. Sample contains all firms that have both final and intermediary sales in the period prior to treatment. Robust standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.