

# UNWILLING OR UNABLE TO CHEAT? EVIDENCE FROM A TAX AUDIT EXPERIMENT IN DENMARK

Econometrica (forthcoming)

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# Motivation

- Seminal work on tax evasion: Allingham and Sandmo (1972), henceforth AS.
- In AS taxpayers self-report income to the tax authorities to maximize expected utility taking into account: probability of audit ( $p$ ) and penalty for cheating ( $\theta$ ).
- **Low  $p$  or low  $\theta$**   $\Rightarrow$  Expected return to evasion is high. So, the model predicts **substantial non-compliance in these cases**. However evidence says that:
  - **Compliance levels are high** in modern tax systems **despite low audit rates** and fairly **modest penalties**.
- **Question:** What is missed in the AS model that cannot account for the observed low evasion?

# Motivation

- The answer to this question in **previous literature**: *psychological* or *cultural* aspects play a role in determining the tax compliance.
- **This paper**: AS focuses on a situation of pure self-reporting when in the real world (advanced economies specially) the **use of third-party reporting is widespread**
  - Taxpayers with only third-party reported income may be unable to cheat on their taxes.

# What do they do

- 1 Extend the basic AS model to include third-party reporting. How?: The probability of detection is endogenous on the type of income that is underreported. **Model predictions:**
  - **Evasion** is **very low for third-party** reported income, but **substantial for self-reported** income.
  - Effects of **enforcement** (audit, penalties) and **tax policy** on evasion are **larger for self-reported** income.
- 2 **Empirical tests** of model predictions by means of a large **field experiment** carried out with the Danish tax collection agency (SKAT). Analysis is done on three dimensions:
  - Anatomy of tax compliance: Who evades and why?
  - Effect of the marginal tax rate on evasion.
  - Effect of tax enforcement on evasion.

# A simple model of tax evasion

- A version of AS with risk neutral taxpayers and an endogenous probability of detection that depends on reported income.
- Risk neutrality makes their case harder.
- Proportional tax  $\tau$ .
- True income  $\bar{y}$ , reported income  $y$ , and undeclared income  $e = \bar{y} - y$ .
- $p$  is the prob. that the gov. detects  $e$ . Note that:

$$p = \text{prob. of auditing} \times P(\text{detection}|\text{auditing})$$

- $p$  is an increasing and convex function of undeclared income:  $p'(e) > 0$  and  $p''(e) > 0$ .
- Penalty if detected: proportional to evaded tax ( $\theta\tau e$ ).

# How much evasion is optimal?

- The taxpayer solves:

$$\max_e (1 - p(e)) \cdot [\bar{y}(1 - \tau) + \tau e] + p(e) \cdot [\bar{y}(1 - \tau) - \theta \tau e].$$

- FOC:  $[p(e) + p'(e) \cdot e](1 - \theta) = 1$ .
- Also, in terms of the elasticity of prob of detection wrt to  $e$  ( $\varepsilon \equiv p'(e) \frac{e}{p}$ ) we have

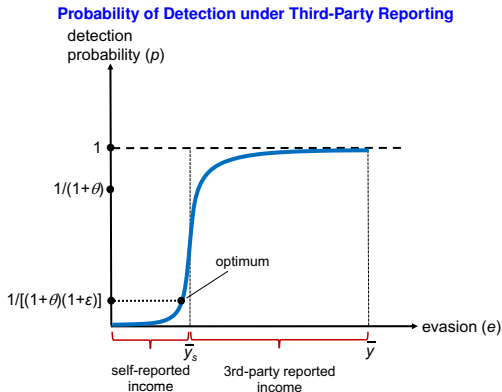
$$p(e) \cdot (1 + \theta) \cdot (1 + \varepsilon(e)) = 1,$$

where the RHS is the MB and the LHS is the expected MC of an extra dollar of evasion.

- Notice that this model is consistent with less than full evasion even for  $\theta = 0$ : *partial evasion may be better than full evasion because it involves a lower probability of being detected and thus having to pay the full statutory tax.*
- **Comparative statics:** higher prob and penalty are associated with lower evasion and the  $\tau$  has no effect on  $e^*$ .
- In a **non-linear tax** system,  $\tau$  can have a SE on evasion (it depends on the second deriv. of the audit prob.). In general, the **SE** of the  $\tau$  is theoretically ambiguous and its **sign** is an open **empirical question**.

# Shape of $p(e)$ and $\varepsilon(e)$ with third-party reporting

- Let true income be  $\bar{y} = \bar{y}_t + \bar{y}_s$ .
- For  $y_t$  (assuming that there is no collusion between the taxpayer and the third-party)  $p \rightarrow 1$ .
- For  $y_s$ ,  $p$  is very low (no smoking gun for tax evasion).
- Sequence of underdeclaration: first evade on items with low  $p$  and then on items with higher  $p$ .
- Optimal evasion will be just below  $\bar{y}_s$ .



# Heterogeneity of taxpayers: more or less self-reported income

- Taxpayers may differ in their  $\frac{\bar{y}_t}{\bar{y}_s}$ .
- Notice that if underdeclaration of self-reported income is very obvious, tax authorities may use other sources to audit evaders (financial institutions, credit card records, etc).
- **Predictions:**
  - Those with little self-reported income should almost fully evade self-reported income, while those with substantial self-reported income evade less as a share of self-reported income (but evade more in total).
  - Deterrence effect of enforcement should be significant on self-reported income but insignificant in third-party reported income.

# Experimental design and data: Structure of taxes in Denmark

**Table 1. Danish Individual Income Tax in 2006**

## A. Income Concepts

Income Concept	Definition
(1) Labor Income	Salary, wages, honoraria, fees, bonuses, fringe benefits, business earnings
(2) Personal Income	Labor Income (1) + social transfers, grants, awards, gifts, received alimony - payroll tax, and certain pension contributions.
(3) Capital Income	Interest income, rental income, business capital income - interest on debt (mortgage, bank loans, credit cards, student loans)
(4) Deductions	Commuting costs, union fees, unemployment contributions, other work related expenditures, charitable contributions, alimony paid
(5) Taxable Income	= Personal income (2) + Capital income (3) - Deductions (4)
(6) Stock Income	Dividends and realized capital gains from corporate stock

## B. Tax Rates and Tax Bases

Tax Type	Tax Base	Bracket (DKK)	Tax Rate
(1) Payroll Tax	Labor Income	All income	8.0%
(2) National Income Tax	Personal Income + max(Capital Income,0)	38,500-265,500	5.5%
		265,500-318,700	11.5%
(3) Regional Income Tax	Taxable Income	318,700-	26.5% [1]
		38,500-	32.6% [2]
(4) Stock Income Tax	Stock Income	0-44,400	28.0%
		44,400-	43.0%

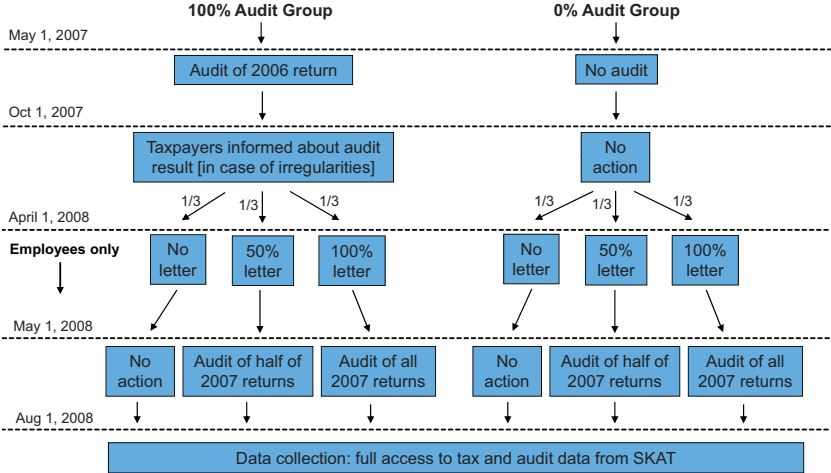
# Experimental design and data: Timing of tax filing

- Income tax filing occurs in the Spring of year  $t + 1$  for income earned in  $t$ .
- By the end of January in year  $t + 1$ , the SKAT will have received most of third-parties reports.
- Based on these third-parties reports, SKAT constructs pre-populated tax returns (with also other hard info) that are sent to taxpayers by mid-March.
- Upon receiving the pre-populated return, the taxpayer may make some adjustments and has to submit the final return by May 1  $\Rightarrow$  The difference between income items in the final return and the pre-populated return is a measure of item-by-item self-reported income.
- SKAT generates audit flags (4.2% of total returns) based on an algorithm to detect under-declarations.
- In the case of underreporting the taxpayer has the option of pay the taxes immediately or postpone the payment (at an interest). If there is deliberate cheating, a fine may be imposed.

# Experimental design and data: Randomization

- Stratified random sample of 17.764 self-employed and 25.020 not self-employed (stratified by return complexity, oversampling complex returns).
- OBJECTIVES:
  - 1 Study anatomy of compliance in the baseline.
  - 2 Study effects of tax policy on compliance (use quasi-experimental evidence, using kinks in the tax schedule).
  - 3 Estimate the causal effects of audits on future reporting behavior.
  - 4 Study the effect of threat to audits in the reporting behavior.
- **First stage:** taxpayers were randomly assigned to a **0% audit** group or a **100% audit** group (comprehensive *unannounced* audits). The cost of implementing the experimental audits were 21% of SKAT's total annual audit resources.
- **Second stage:** Pre-announcements of audits one month before the filing deadline (May 1). Three groups:
  - Received letter saying that will be audited for sure.
  - Received letter saying that have 50% chances of being audited.
  - Did not receive letter (prob of audit is the prior: 4.2%).

# Experimental Design



# Results: Anatomy of compliance

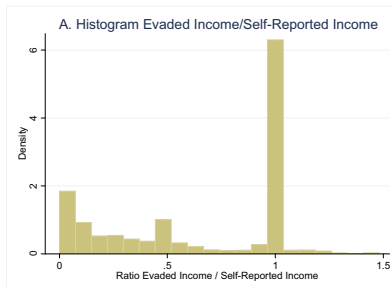
**Table 2. Audit Adjustments Decomposition**

		A. Total income reported				B. Third-party vs. self-reported income			
		Pre-audit Income	Audit adjustment	Under- reporting	Over- reporting	Third-party income	Third-party under- reporting	Self- reported income	Self-reported under- reporting
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Net Income and Total Tax</b>									
<b>Net Income</b>	Amounts	206,038	4,532	4,796	-264	195,969	612	10,069	4,183
		(2,159)	(494)	(493)	(31)	(1,798)	(77)	(1,380)	(486)
	% non zero	98.38	10.74	8.58	2.16	98.57	2.31	38.18	7.39
		(0.09)	(0.22)	(0.20)	(0.10)	(0.08)	(0.11)	(0.35)	(0.19)
<b>Total Tax</b>	Amounts	69,940	1,980	2,071	-91				
		(1,142)	(236)	(235)	(11)				
	% non zero	90.76	10.59	8.41	2.18				
		(0.21)	(0.22)	(0.20)	(0.10)				
<b>Positive and Negative Income</b>									
<b>Positive Income</b>	Amounts	243,984	3,776	3,943	-167	223,882	516	20,102	3,427
		(2,511)	(485)	(485)	(27)	(1,860)	(76)	(1,693)	(478)
	% non zero	98.24	5.80	4.78	1.02	98.15	1.60	19.53	3.41
		(0.09)	(0.17)	(0.15)	(0.07)	(0.10)	(0.09)	(0.28)	(0.13)
<b>Negative Income</b>	Amounts	-37,946	756	853	-97	-27,913	97	-10,033	756
		(1,014)	(71)	(69)	(14)	(406)	(12)	(862)	(68)
	% non zero	79.09	6.45	5.13	1.32	78.21	0.75	29.49	4.99
		(0.29)	(0.18)	(0.16)	(0.08)	(0.29)	(0.06)	(0.33)	(0.16)
<b>Income Components</b>									
<b>Personal Income</b>	Amounts	210,178	2,327	2,398	-71	211,244	463	-1,066	1,936
		(1,481)	(399)	(399)	(11)	(1,385)	(74)	(548)	(392)
	% non zero	95.22	2.49	1.99	0.50	95.20	1.30	11.95	0.82
		(0.15)	(0.11)	(0.10)	(0.05)	(0.15)	(0.08)	(0.23)	(0.06)
<b>Capital Income</b>	Amounts	-11,075	254	286	-32	-14,556	98	3,481	188
		(340)	(49)	(49)	(6)	(602)	(11)	(542)	(47)
	% non zero	93.93	2.10	1.69	0.41	94.91	0.79	12.29	1.28
		(0.17)	(0.10)	(0.09)	(0.05)	(0.16)	(0.06)	(0.23)	(0.08)
<b>Deductions</b>	Amounts	-9,098	148	197	-49	-5,666	18	-3,432	179
		(104)	(17)	(15)	(7)	(48)	(3)	(85)	(15)
	% non zero	60.07	3.45	2.56	0.89	57.61	0.31	22.60	2.49
		(0.35)	(0.13)	(0.11)	(0.07)	(0.35)	(0.04)	(0.30)	(0.11)
<b>Stock Income</b>	Amounts	5,635	259	281	-22	3,783	30	1,852	251
		(1,405)	(45)	(45)	(8)	(976)	(12)	(943)	(43)
	% non zero	22.47	0.95	0.80	0.15	22.44	0.07	2.45	0.75
		(0.30)	(0.07)	(0.06)	(0.03)	(0.30)	(0.02)	(0.11)	(0.06)
<b>Self-Employment</b>	Amounts	10,398	1,544	1,633	-89	1,164	4	9,234	1,630
		(812)	(280)	(279)	(26)	(177)	(2)	(816)	(279)
	% non zero	7.63	3.43	3.02	0.41	1.40	0.04	7.66	3.00
		(0.19)	(0.13)	(0.12)	(0.05)	(0.08)	(0.01)	(0.19)	(0.12)

# Anatomy of compliance: Heterogeneity and the role of self-reporting.

- Even though third-party is pervasive in the Danish tax system (95%), there are some differences across items.
- **Items with more or less third-party reporting: Substantial** third-party reporting for **personal income** and **very little** for **self-employment income** (only 11% is third-party).
- For some items, evasion is high: For total self-reported net income, the tax evasion rate is equal to 41.6%.
- This evidence is in line with the predictions of the augmented-AS model.

# Results: Analysis of the underreporting of self-reported income



# Conclusions on the anatomy of compliance

- Tax evasion is very low overall, but substantial once we zoom in on purely self-reported income.
- Analysis on self-reported income: Those with little self-reported income almost fully evade self-reported income.
- This is consistent with the model, that shows that overall compliance is high not because taxpayers are **unwilling** to cheat, but because they are **unable** to do so.

# Social versus information factors

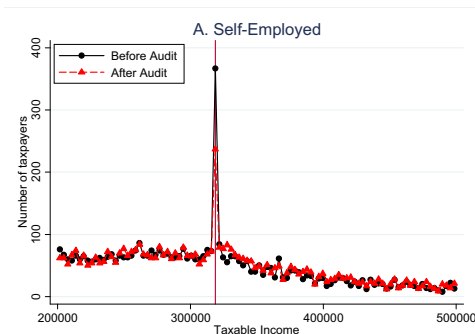
Only information environment (the portion of third party reporting) plays a role in explaining evasion.

Table 3. Probability of Under-reporting: Socio-economics vs. Tax Return Factors

Coefficients are in percent	A. Basic Variables				B. Detailed Variables			
	Social factors	Socio-economic factors	Tax return factors	All factors	Social factors	Socio-economic factors	Tax return factors	All factors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	12.72 (1.06)	10.13 (1.12)	1.18 (0.25)	3.72 (1.01)	6.95 (1.64)	5.55 (2.16)	0.95 (2.04)	2.24 (2.99)
Female Dummy	-5.56 (0.63)	-4.17 (0.65)		-2.06 (0.62)	-5.29 (0.62)	-3.33 (0.67)		-1.02 (0.62)
Married Dummy	1.22 (0.70)	-0.55 (0.72)		-1.50 (0.72)	-0.72 (0.77)	-1.98 (0.78)		-1.70 (0.75)
Member of church	-1.59 (0.98)	-2.27 (0.97)		-0.94 (0.92)	-1.54 (1.02)	-1.88 (0.99)		-0.71 (0.92)
Geographical Location	Copenhagen dummy	-1.49 (1.52)	-0.01 (1.51)	-0.25 (1.47)	6 location dummies	p-value	p-value	p-value
Age	Age>45 dummy	-0.72 (0.67)	-0.63 (0.67)	-0.56 (0.61)	4 age group dummies	6.86 p-value	8.87 p-value	33.53 p-value
Home Ownership		5.49 (0.65)	0.15 (0.66)	0.15 (0.66)		0.00	3.72 (0.73)	-0.88 (0.71)
Firm Size	Firm size<10 dummy	5.07 (1.26)		3.47 (1.05)	5 firm size dummies	p-value	p-value	p-value
Industrial Sector	Infomal sector dummy	4.37 (1.15)		0.27 (0.92)	22 industry dummies	0.00	0.00	0.00
Self-Reported Income Dummy			5.58 (0.75)	5.59 (0.80)			3.49 (0.80)	3.75 (0.78)
(Self-Reported Income>20,000DKK)			21.68 (1.38)	21.09 (1.40)			9.79 (1.62)	8.76 (1.61)
(Self-Reported Income<10,000DKK)			14.99 (1.42)	14.74 (1.42)			14.56 (1.41)	14.24 (1.38)
Auditing Flag Dummy			13.22 (1.58)	13.07 (1.53)			12.26 (1.61)	12.37 (1.56)
Self-Employed Dummy							17.03 (1.14)	13.47 (1.39)
Capital Income Dummy							-0.75 (1.58)	-0.47 (1.57)
Stock Income Dummy							0.33 (0.65)	1.21 (0.66)
Deduction Dummy							-1.12 (0.72)	-0.76 (0.88)
Audit Adjustment in 2004 or 2005 Dummy							7.22 (1.58)	6.86 (1.55)
Income controls					6 income group dummies	p-value	p-value	p-value
R-square	1.16%	2.46%	16.15%	16.53%		2.16%	7.76%	18.72%
Adjusted R-square	1.14%	2.42%	16.14%	16.48%		2.11%	7.58%	18.66%

# The effect of the marginal tax rate on evasion

- Quasi-experiment based on the analysis of bunching of taxpayers around the top-bracket threshold in the income tax (49% to 62% jump) and stock income tax (28% to 43% jump).
- The difference between the actual and counterfactual distributions (assuming no kink in tax rate and that without the kink there would not be any jump in the density at the kink) allows to estimate the elasticities of evasion to changes in the tax rate.



# The effect of the marginal tax rate on evasion

- Pre and post audit data allows to separately identify elasticities of illegal evasion from legal avoidance.
- Elasticities: pre-audit (for self-employed) is 0.16 and post-audit is 0.085  $\Rightarrow$  compensated evasion elasticity is 0.076.

## Conclusion:

- The marginal tax rate has at most a small positive substitution effect on tax evasion for individuals with substantial self-reported income.
- Information environment is much more important than marginal tax rates to explain evasion.

# The effect of tax enforcement on evasion

- Recall

$$p = \text{prob. of auditing} \times P(\text{detection}|\text{auditing})$$

- Effect of past audits on prob. of auditing is positive.
- Effect of past audits on  $\times P(\text{detection}|\text{auditing})$  is ambiguous.
- Model predicts that past audits will increase  $p$ , making self-reported income to increase (and not so much third-party reported income).

# The effect of tax enforcement on evasion

Table 5. Effects of Randomized Prior Audits on Year to Year Income Changes

	Baseline Audit adjustment	Change in Reported Income (Panels A1, B1) and Probability of Income Increase (Panels A2, B2) from 2006 to 2007			IV Effect of Audit Adjustment on Income Change
		Total Income	Self-Reported Income	Third Party Reported Income	
	(1)	(2)	(3)	(4)	(5)
<b>A. Full Sample</b>					
<b>A1. Amounts [difference between the 100% and the 0% audit groups]</b>					
Net Income	8491 (827)	2557 (787)	2331 (658)	225 (691)	0.301 (0.098)
Total Tax	3295 (257)	1375 (464)			0.417 (0.144)
<b>A2. Probability of audit adjustment and income increase [difference between the 100% and the 0% audit groups]</b>					
Net Income	19.09 (0.28)	0.89 (0.48)	2.11 (0.48)	0.24 (0.48)	0.047 (0.025)
Total Tax	19.17 (0.28)	0.99 (0.49)			0.052 (0.025)
Number of observations	41,571	41,571	41,571	41,571	41,571
<b>B. Sample Limited to those Receiving No Threat-of-Audit Letter</b>					
<b>B1. Amounts [difference between the 100% and the 0% audit groups]</b>					
Net Income	12835 (1,310)	2904 (1117)	3086 (1008)	-182 (962)	0.228 (0.091)
Total Tax	5019 (406)	1732 (677)			0.345 (0.137)
<b>B2. Probability of audit adjustment and income increase [difference between the 100% and the 0% audit groups]</b>					
Net Income	25.75 (0.39)	0.73 (0.61)	2.12 (0.61)	-0.52 (0.61)	0.028 (0.024)
Total Tax	25.93 (0.39)	0.98 (0.61)			0.038 (0.024)
Number of observations	26,180	26,180	26,180	26,180	26,180

- 30.1 cents per additional kroner of audit is the causal effect of an additional dollar of audit adjustment on total reported income.
- Experiencing an audit adjustment raises the probabilities of increasing reported income and tax liability the following year by about 1 percentage point.

# The effect of tax enforcement on evasion: effect of threat of audit letters

- Audit threats have a significant positive effect on self-reported income.
- The effect of 100% audit threats is significantly larger than the effect of 50% audit threats.
- However, the quantitative magnitudes of the letter effects are modest compared to the effects of actual audits: audit-threat letters create less variation in the perceived probability of detection than actual audit experiences.

# Final Remarks

- To explain evasion better, models and empirical analysis should take into account the information environment in which income reporting takes place.
- Using third-party reporting seems to be a more effective way to reduce evasion than increasing tax enforcement (increasing the  $p(e)$ ) or reducing tax rates.