

# The Economics of Tax Administration

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- Tax administration refers to the *implementation* of tax policy
- In many countries there is a division of responsibility between choice of tax policy and implementation of policy
  - **US**: Treasury and IRS
  - **UK**: Treasury and HMRC
- The analytical questions raised by tax policy are clear and have led to a substantial literature
- There is much less literature on tax administration and it is scattered across disciplines

# The Cost of Administration

- One important question is the relationship between *tax structure* and *administration costs*
- Many examples show the nature of the relationship is far from obvious
- In the UK biscuits (US: cookies) are standard-rated for VAT (20%) but cakes are zero-rated (0%)



- UK HMRC argued that Jaffa Cakes were chocolate-covered biscuits not cakes:
  - Because of size and shape, and eaten in the same way as biscuits
- The classification was used to justify the imposition of VAT on the product
- The manufacturer objected and the ensuing litigation lasted for 7 years until a VAT tribunal ruled Jaffa Cakes were cakes

- Research in tax theory has focussed mostly on policy rather than administration
- There are some exceptions:
  - Slemrod (1990, 2002) has extended the Marginal Efficiency Cost of Funds to accommodate avoidance and evasion
  - A large literature has developed since Kolm (1973) on enforcement policy
- But the link between tax administration and tax policy has received less attention
- And there remain many fundamental aspects of tax administration on which we have little knowledge

- The standard analysis of optimal taxation can be formulated as

$$\max_{\{\tau\}} W(\tau)$$

subject to:

- (i)  $Z(\tau) \leq 0$ , (equilibrium conditions)
- (ii)  $G(\tau) \leq 0$ , (government revenue requirements)
- (iii)  $I(\tau) \leq 0$ , (incentive compatibility)
- $\tau \in \mathcal{T}$ . (set of feasible instruments)

- The choice of  $\mathcal{T}$  is determined by what is assumed possible
- This is the distinction between the many contributions

- How can we conceptualize tax administration within this framework?
- Access to *information* is central to both tax policy and tax administration
- From an administration perspective:
  - The cost of information collection makes non-compliance (*evasion*) possible
  - Information also determine the costs of collecting taxes
- Most models assume information costs are either *zero* or *prohibitive*:
  - Zero: permitting differentiation of commodity taxes (Diamond and Mirrlees, 1971)
  - Prohibitive: Inability to separate hours worked and wage rate (Mirrlees, 1971)

- The *operating costs* of a tax system are the sum of *administration costs* and *compliance costs*
- Administration costs are the direct cost of running the tax administration and compliance programme
- These are directly observable and relatively small: generally less than 1% of revenue (Evans, 2003)
- Compliance costs are borne by individuals and firms and are between 2% and 10% of revenue raised (Evans, 2003)
- What is not known is how these relate to *tax structure*
- It seems obvious that some tax systems should be more costly to operate than others:
  - For example, a flat tax system compared to a progressive tax system
- But it is here that the literature is weakest with little evidence base for modelling

# Incorporating Compliance

- The location of the compliance decision within the optimization programme is complex
- Evasion affects the welfare function (uncertainty in individual welfare levels) and raises the question of how to define welfare (what weight should be given to evaders?)
- Evasion also affects the revenue constraint,  $G(\tau)$
- The incentive compatibility constraints,  $I(\tau)$ , could force no-evasion but this need not be an optimal policy
- Inclusion is only worthwhile if we have a good model of compliance



# Individual Compliance Behaviour

- Research on compliance behaviour has built on the basic model of Allingham-Sandmo (1972)
- The evasion level is chosen to maximize expected utility

$$EU = pU(Y[1-t] - tE) + [1-p]U(Y[1-t] + tE)$$

- Where:
  - $p$  is the probability of audit
  - $Y$  is income
  - $t$  is the tax rate
  - $f$  is the fine levied on tax evaded
  - $E$  is the amount of evasion

- Social customs summarizing the *attitude* toward compliance (or *tax morale*) seem to matter
- Empirical evidence on tax morale and the observed levels of compliance (too high)
- A loss of utility is incurred if the custom is broken

$$V = \begin{cases} U(Y[1-t]) + \chi^i, & \text{if } E = 0 \\ \mathcal{E}U, & \text{if } E > 0 \end{cases}$$

- There will be a cutoff  $\chi^*$  such that  $\chi^i < \chi^* \implies E > 0$  and  $\chi^i > \chi^* \implies E = 0$
- If  $\chi^i = \chi^i(m, E)$ , ( $m$  the proportion of population evading) evasion becomes a social decision
- Myles and Naylor (1996) show that  $\chi_m^i(m, E) < 0$  opens the possibility of multiple equilibria

- Recent work has explored non-expected utility choice theory

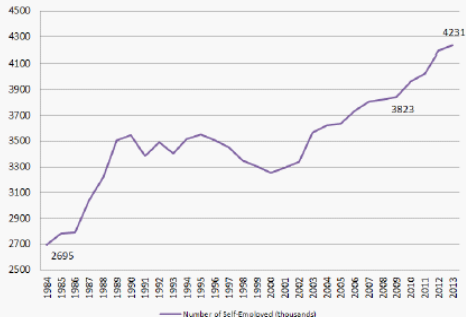
$$V = w_1(p, 1 - p)v(Y [1 - t] - tE) + w_2(p, 1 - p)v(Y [1 - t] + tE)$$

- Several alternatives have been proposed:
  - *Rank Dependent Expected Utility* imposes structure on the weighting functions
  - *Prospect Theory* uses weights, changes payoff functions, and comparison to a reference point
  - *Non-Additive Probabilities* do not require the normal consistency of aggregation for probabilities
  - *Ambiguity* permits uncertainty over the probability of outcomes
- The weighting functions (or *beliefs*) can improve predictions
- But these alternatives have their own shortcomings (Hashimzade, Myles, and Tran-Nam, 2013)

- The opportunities for non-compliance vary among occupations
- Employment income is generally subject to third-party reporting or withholding
- Self-employment income is not directly observed so non-compliance is possible
- The potential benefits of noncompliance must be taken into account in occupational choice
- There is self-selection into the opportunity for non-compliance
- Occupation and non-compliance are joint decisions

- The difference between the receipts HMRC actually collects and the amount of tax that should be collected if all taxpayers complied with the letter and spirit of the law.
- A difficult concept to measure because activity is not directly recorded
- HMRC is required by law to provide an annual estimate of the tax gap and has been publishing overall estimates since 2009
- Few countries do anything similar (Denmark, Mexico, US) though more intend to
- Work with Ana Cabral and Christos Kotsogiannis has estimated how much the under-reporting of the self-employed contributes to the tax gap

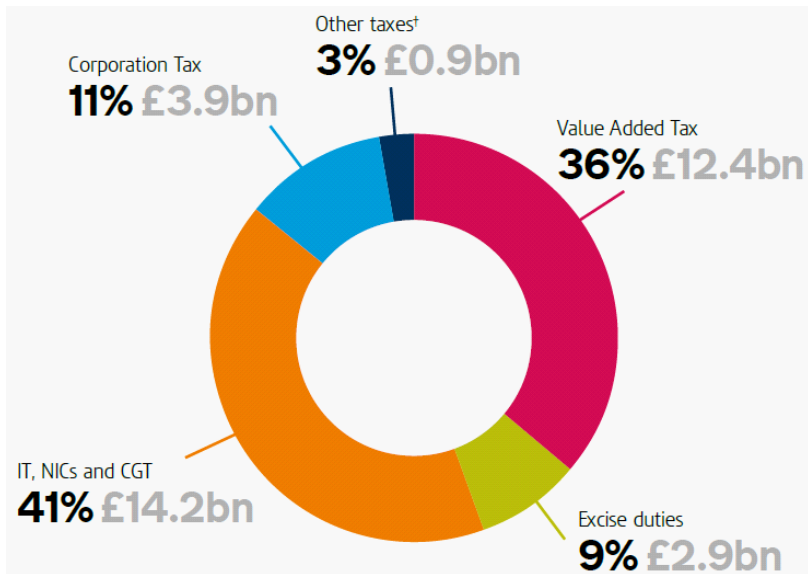
# Growth in Self-Employment



Source: Labour Force Survey 1984-2013

Figure 2: Historical Evolution of the Number of Self-Employed in the UK

# Tax Gap Components



# Income and Expenditure

Table 1: Summary Statistics for Categories of Expenditures for Employed and Self-Employed, 2010-2012. Pooled data.

Variable	Employed		Self-Employed	
	Mean	Std. Dev.	Mean	Std. Dev.
Ln Disposable Income	6.384	0.449	6.332	0.609
Total Expenditure	6.138	0.519	6.183	0.563
Total Food and non-alcoholic beverage	4.061	0.607	4.145	0.581
Total Alcoholic Beverages, Tobacco	2.479	1.068	2.575	1.133
Total Clothing and Footwear	3.029	1.205	3.081	1.279
Total Housing, Water, Electricity	3.941	0.747	3.921	0.730
Total Furnishings, HH Equipment, Carpets	2.670	1.489	2.720	1.529
Total Health Expenditure	1.168	1.520	1.293	1.534
Total Transport costs	4.124	1.030	4.132	1.120
Total Communication	2.606	0.620	2.631	0.657
Total Recreation - adult	3.870	1.066	3.850	1.114
Total Education	3.308	1.684	3.888	1.704
Total Restaurants and Hotels	3.522	1.085	3.575	1.172
Total Miscellaneous Goods and Services	3.594	0.834	3.650	0.838



- Data from the Living Costs and Food Survey 2010, 2011, and 2012
- All income groups report expenditure on food correctly (diary record)
- Employees in employment (EE) report income correctly
- The self-employed (SE) underreport their income
- The relationship between family expenditure and after-tax income is the same for all families in the survey (EE, SE)

Table 4: Estimated Regression Coefficients of Food Consumption, 2010-2012.

Pooled data

Disposable Income	0.340*** (0.06)	0.308*** (0.06)	0.313*** (0.02)
Self-Employment Dummy (SE)	0.109*** (0.02)	0.074*** (0.02)	0.074*** (0.02)
White-collar spouse	0.028 (0.02)	0.029 (0.02)	0.029 (0.02)
Blue-collar spouse	-0.036 (0.03)	-0.043 (0.03)	-0.042* (0.02)
Age of HRP	0.015*** (0.00)	0.016*** (0.00)	0.016*** (0.00)
Age of HRP squared	-0.000** (0.00)	-0.000** (0.00)	-0.000*** (0.00)
Number of Children	0.120 (0.08)	0.116 (0.08)	0.116 (0.13)
Number of Children squared	-0.041*** (0.01)	-0.041*** (0.01)	-0.041*** (0.01)
Local Authority Tenant	-0.106** (0.05)	-0.114** (0.05)	-0.113** (0.04)
Rented Property	-0.056** (0.03)	-0.058** (0.03)	-0.057** (0.03)
Owner with Mortgage	-0.024 (0.02)	-0.020 (0.02)	-0.021 (0.02)
Great Central London	0.103*** (0.03)	0.110*** (0.03)	0.110*** (0.03)
North	-0.022 (0.01)	-0.024* (0.01)	-0.024 (0.02)
Number of cars	0.015 (0.01)	0.019 (0.01)	0.018* (0.01)
Central Heating	0.015 (0.04)	0.018 (0.04)	0.017 (0.04)
Drier	0.057*** (0.02)	0.059*** (0.02)	0.059*** (0.02)

Table 5: Estimates of Self-Employment underreporting, 2010-2012. Pooled data

	IV (1)	IV (2)	OLS
$k_{\text{upper bound}}$	1.484	1.369	1.364
$k_{\text{lower bound}}$	1.279	1.181	1.176
Midpoint estimate	1.382	1.275	1.270

## Notes:

1. Residual income variance obtained from first stage regressions is 0.271 for the Self-Employed and 0.122 for the Employees.
2. The estimates provided in this table were obtained assuming the covariance between the evasion and reporting component was zero ( $v$  and  $u$  in the model) This implies that no matter the level of income obtained by the self-employed, they will always choose to underreport on the same manner. This is a particular identifying assumption in order to get the estimate as we cannot arrive at a certain value of the covariance. However, we can assess the effect of this covariance in our estimates. If the correlation between those two components is very strong, say 1, the estimate of the upper bound can increase by an average of 35%. As we suppose lower values of the correlation coefficient, the value of the bounds converges to the ones presented in this table as expected with lower deviations as the correlation coefficient approaches zero. This is a fact that has been overlooked by previous papers using the Pissarides and Weber method but that is extremely important in order to provide full information

# Noncompliance and Personal Characteristics

- Men are less compliant than women
- Age is inversely related to compliance: as individuals get older, they turn more compliant
- Higher underreporting in Greater Central London
- Blue-collar households underreport more than white-collar
- Households with two self-employed underreport more than households with one self-employed when the self-employed is a woman but less than when the self-employed is a male
- Households where the self-employed is the head underreport more than when the self-employed is the spouse
- Self-employed operating in partnerships underreport more than own-account self-employed.
- Self-employed who consider themselves having a business underreport more than those who consider themselves as having a job

- There have been many experiments since the original work of Friedland, Maital, and Rutenberg (1978)
- The typical experiment takes a subject group of university students who must choose how much income to declare to the tax authority
- This choice problem is repeated over a number of rounds
- Many different treatments can be applied within this structure:
  - Changes in exogenous variables
  - Probability and fine are public information or unknown
  - Including public goods can test reciprocity theories

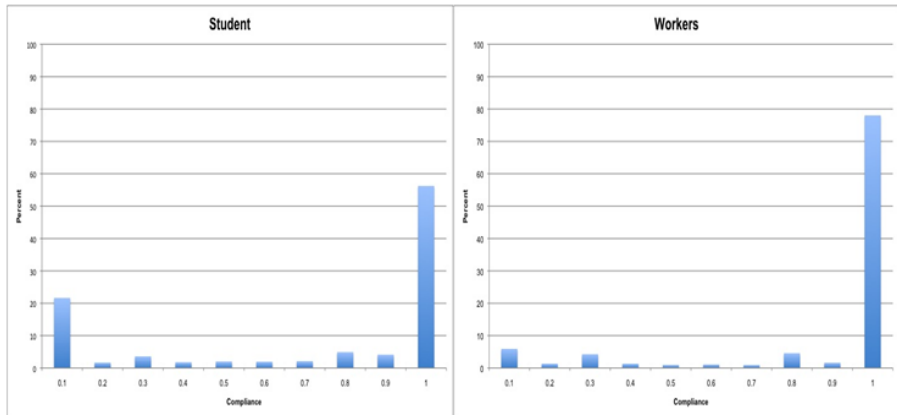
# Previous Experiments

Experiment	Subjects	Sample size	Income	Treatments
Friedland et al (1978)	Students	15	Allocated	Fine rate, tax rate
Spicer and Becker (1980)	Students	57	Allocated	Information on average tax rate
Friedland (1982)	Students	13	Allocated	Vague or precise information
Spicer and Thomas (1982)	Students	54	Allocated	Information on audit probability
Spicer and Hero (1985)	Students	36	Allocated	Level of compliance in prior game
Baldry (1986)	Unreported	Unknown	Allocated	Evasion or gambling
Becker et al (1987)	Students	116	Earned	Transfer of tax revenue
Alm et al (1990)	Students	60	Allocated	Probability, fine, amnesty
Beck et al (1991)	Students	112	Allocated	Uncertainty about tax liability
Collins and Plumlee (1991)	Students	120	Earned	Information used in audit rule
Alm et al. (1992)	Students	72	Random	Probability, multiplier, terminology
Alm et al. (1993)	Students	80	Random	Rule for audit selection
Alm and McKee (2004)	Students	40	Random	Audit rule and chat
Alm et al. (2004)	Students	326	Earned	Percentage of matched income

# Experimental Validity

- In an experiment conducted with Miguel Fonseca we have explored the validity of these results
- We used a large sample size (1000 subjects)
- And divided the sample between students (500 subjects) and workers (500 subjects)
- If tax compliance is a socialized activity then these subject pools will behave differently:
  - Students who have not paid tax will not have internalized the social custom of compliance

# Experimental Validity





- We found three significant differences between the two samples:
  - Workers have significantly higher compliance rates than students
  - Students are more responsive to incentives than workers
  - Workers respond to information about fines, while students respond to information about audit rates
- We conclude that compliance experiments should not rely on students as subjects

- Work with Nigar Hashimzade, Frank Page, and Matt Rablen has applied *agent-based modelling* to explore the effects of evasion
- An agent-based model:
  - Creates a set of agents
  - Assigns abilities, objectives, and knowledge
  - Allows them to interact
  - Observes the outcome
- The model has been used to analyse audit strategies and the consequences of *predictive analytics*

- The model allows each individual to make a choice of occupation (a generalization of Pestieau and Posse, 1991)
- *Employment* is safe (wage is fixed) but tax cannot be evaded (withholding, third-party reporting)
- *Self-employment* is risky but provides an opportunity to evade
- An individual is described by the characteristics  $\{w, \rho, s_1, s_2\}$  :
  - $w$  = wage in employment
  - $\rho$  = (relative) risk aversion
  - $s_i$  = skill in self-employment occupation  $i$

# Network and Meetings

- Individuals meet with their contacts in the network and meetings allow exchange of information on beliefs
- In each period a random selection of meetings occur between connected agents
- At a meeting there is a probability that information is exchanged
- The probability of information exchange depends on the occupational groups of the people meeting
- We assume information exchange is more likely between agents in the same occupation

# Audits and Belief Updating

- The belief about the probability of audit is determined by audits and interaction
- Occupational choice is made on the basis of the subjective belief about the probability of being audited
- We have considered two different processes for the formation of subjective beliefs:
  - *Target effect*: subjective belief increases after audit then decays
  - *Bomb-crater effect* (Guala and Mittone, 2005): subjective belief falls after audit then rises
- The evidence on which is correct now points toward the target effect (Advani et al., 2015)
- Individuals meet *after* audits take place and, *if an information exchange occurs* at a meeting, the belief is updated as a weighted average

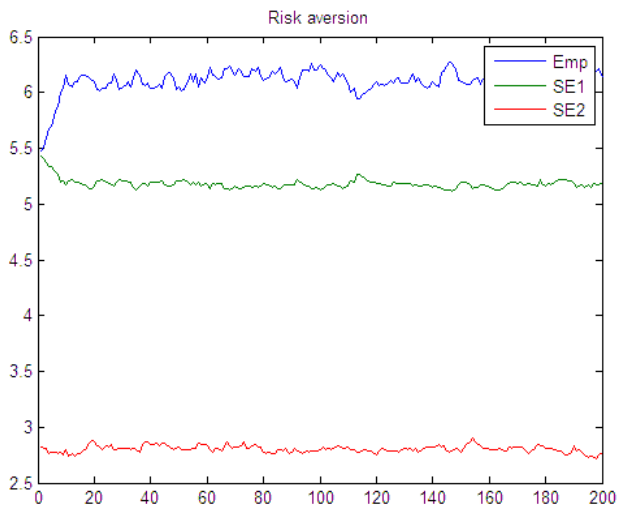
- The importance of the social custom is determined by interaction in the social network
- Each individual is randomly assigned a level of importance,  $\chi_0^i$ , at time 0
- This value is then updated each period *if* there is an information exchange between two individuals
- The updating process is described by

$$\chi_{t+1}^i = \frac{1}{X(i) + 1} \left[ \chi_t^i X(i) + \mathbf{1}_{[E_t^j=0]} \right]$$

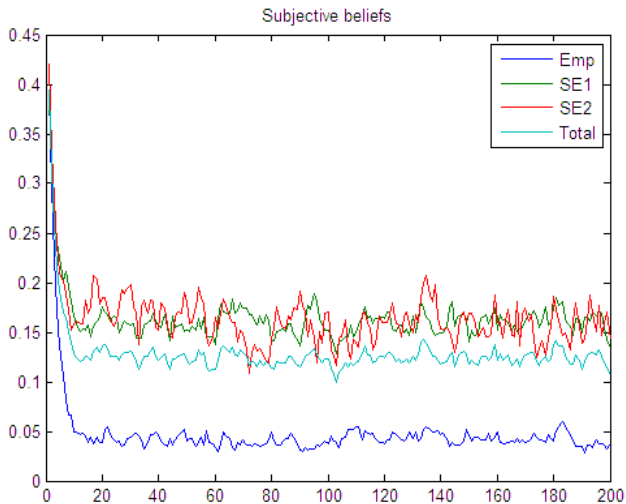
where  $X(i)$  is the number of previous meetings for  $i$  at which information was exchanged

- $\chi_{t+1}^i > \chi_t^i$  if information is exchanged with an honest taxpayer and  
 $\chi_{t+1}^i < \chi_t^i$  if information is exchanged with an evader

# Risk Aversion

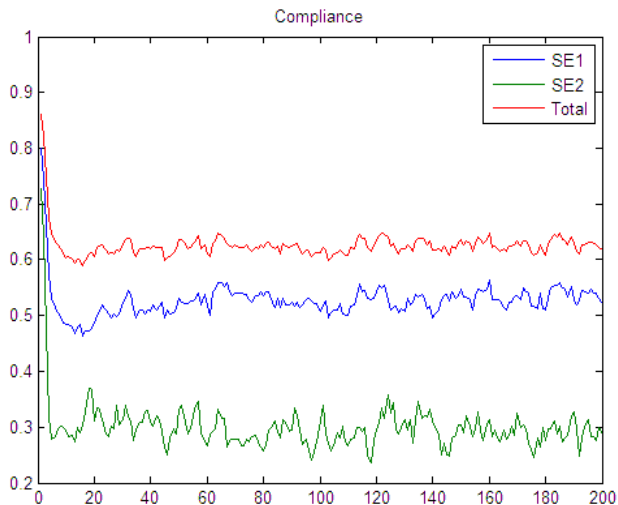


# Subjective Beliefs

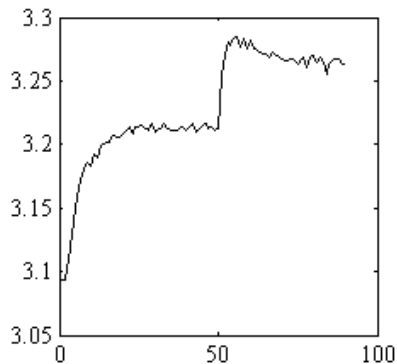




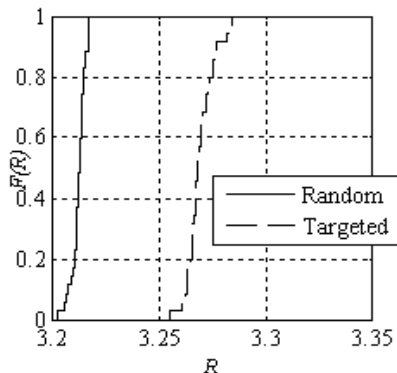
# Compliance



- The role of *predictive analytics* is to identify the best audit targets
- Predictive analytics are used by the IRS, HMRC etc.
- Various methods are used including credit scoring and econometric analysis
- We want to explore the effects of predictive analytics and the extent to which they improve on random audits
- The data from audits is collected and used to run a Tobit (censored) regression
- The amount of non-compliance is regressed on occupation, declaration, and audit history
- The estimated equation is used to predict non-compliance



Tax and fine revenues



Empirical cumulative distributions

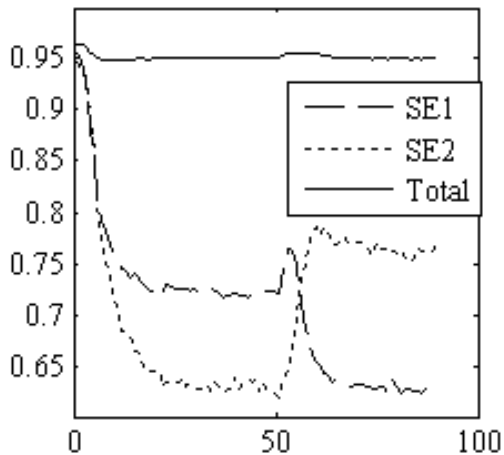


Figure: Compliance levels

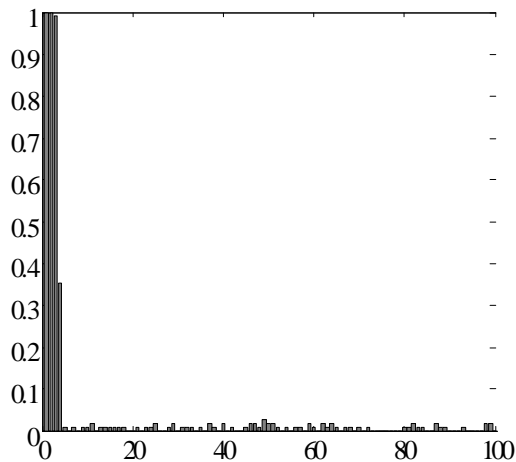


Figure: Audit rate by declaration percentile

- Tax administration is not distinct from tax policy: the two need to be analyzed in conjunction
- Public economic theory has focussed on policy leaving many open research questions in administration
- These question can be approached using a range of methodologies
- All approaches have value and will lead to an improved understanding of tax administration and policy
- The *Journal of Tax Administration* ([www.jota.website](http://www.jota.website)) now provides a focal publication