Occupational Choice and Network Effects in Tax Evasion

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Introduction

- An understanding of the individual tax compliance decision is important for revenue services.
- Their aim is to design policy instruments to reduce the tax gap.
- Tax evasion is an area where orthodox analysis has been challenged by behavioural economics.
  - Non-expected utility theory
  - Social interaction
Standard model

- The probability of being detected is $p$
- Taxpayer chooses declaration $X$, or evasion $E = Y - X$, to maximize expected utility

\[
\max_{E \in [0,Y]} V = pU(Y^c) + (1-p)U(Y^n)
\]

$Y^c = (1-t)Y - f t (Y - X) = (1-t)Y - f t E$

$Y^n = Y - t X = (1-t)Y + t E$

- The sufficient condition for evasion to take place ($0 < E \leq Y$) is

\[
p < \frac{1}{1 + f} \iff \frac{pf}{1-p} < 1
\]

For $f = 1$ this requires $p < 0.5$ for everyone to evade. In practice, $p$ is much smaller but compliance rates are high.
Behavioural approach

- Behavioural economics can be seen as a loosening of modelling restrictions
- Two different directions can be taken:
  - Use an alternative to expected utility theory
  - Reconsider the context in which decisions are taken
Non-expected utility

- There are several non-expected utility models
- These have the general form

\[ V = w_1(p, 1 - p) \nu(Y^c) + w_2(p, 1 - p) \nu(Y^n), \]

- \( w_1(p, 1 - p) \) and \( w_2(p, 1 - p) \) are translations of \( p \) and \( 1 - p \) (probability weighting functions)
- \( \nu(\cdot) \) is some translation of \( U(\cdot) \)

- Different representations are special cases of this general form
Prospect theory does three things

(i) Translates the probabilities

(ii) Assumes payoff is convex in losses and concave in gains

\[ v'(y) > 0, \quad v''(y) < 0 \quad \text{for} \quad y > 0 \quad \text{and} \quad v''(y) > 0 \quad \text{for} \quad y < 0 \]

(iii) Measures payoffs relative to a reference point, \( R \)

The objective function is no longer globally concave

- This creates analytical problems

The results are sensitive to the choice of \( R \)
Subjective probabilities

One way to make progress is to assume probability of detection depends on declared income

- This can be incorporated in the prospect theory model or in the standard model
- Helps explain high compliance rate
- Can change the direction of the tax effect

Alternatively, assume subjective probabilities, or beliefs, are formed via social interaction

Important: access to evasion opportunities

- May not be possible if in employment
Social interaction

- Social interaction allows information to be transmitted through a network
- This information affects evasion behaviour by changing beliefs
- The exchange of information is determined endogenously through choices that are made
- The choices are:
  - Occupation (employed or self-employed)
  - Level of evasion if self-employed
Assume that a choice is made between employment and self-employment.

Employment is safe (wage is fixed) but tax cannot be evaded (UK is PAYE).

Self-employment is risky (outcome random) but provides opportunity to evade.

Selection into self-employment is dependent on personal characteristics.
A project is a pair \( \{ \pi_s, \pi_u \} \) with \( \pi_s > \pi_u > 0 \)

An individual is described by \( \{ w, q, \rho, \pi_s, \pi_u, \rho \} \)

Evasion level is chosen after outcome of project is known

So in state \( i \in \{ s, u \} \) \( E_i \) solves

\[
\max E [U_i] = pU((1 - t)\pi_i - ftE_i) + (1 - p)U((1 - t)\pi_i + tE_i)
\]

The payoff from self-employment is

\[
E [U(\pi)] = (1 - q)E [U_u] + qE [U_s]
\]
Occupational choice

- Occupational choice compares payoffs from the alternatives
- Self-employment is chosen if

\[ E[U(\pi)] > U(w) \]

- What is the outcome in this setting?
  - Example: CRRA utility
    \[ U(y) = \frac{y^{\rho-1} - 1}{\rho - 1} \]
  - \( \{q, \pi_s, \pi_u, p\} \) are fixed
Occupational choice

Cut-off wage with (solid line) and without (dash line) evasion

- Employment above the locus
- Self-employment below the locus
- The less risk-averse choose self-employment
- But these people will also evade more
  - Occupational choice acts as a self-selection device

\[ q = 0.5; \quad \pi_s = 3; \quad \pi_u = 1.5; \]
\[ p = 0.5; \quad f = 0.75 \text{ (solid)} \quad \text{and} \quad 1 \text{ (dash)} \]
Formation of beliefs

- A network is a set of bi-directional links, described by a symmetric matrix of zeros and ones.
- Example: the network shown in the diagramme is described by matrix $A$

$$A = \begin{bmatrix}
0 & 1 & 0 & 0 \\
1 & 0 & 1 & 0 \\
0 & 1 & 0 & 1 \\
0 & 0 & 1 & 0 \\
\end{bmatrix}$$
Formation of beliefs

- Each period an action is chosen
- The network is revised as a consequence of chosen actions
- A random selection of meetings occur (a matrix $C$ of 0s, 1s)
- Set of permissible meetings is determined by the network ($M = A \ast C$)
- At a meeting information is exchanged
- Beliefs are updated
Tax evasion network

- There are n individuals
- Individual characteristics, \( \{w, q, \rho, \pi_s, \pi_u, p_0\} \) are randomly drawn at the outset
- A choice is made between employment and self-employment
  - If self-employment is chosen, outcome \( \pi_s \) or \( \pi_u \) is randomly realised
  - Given the outcome evasion decision is made
- Those in self-employment are then randomly audited
Tax evasion network

- If audited, then $p$ goes to 1, otherwise $p$ decays:
  
  $$p_t = dp_{t-1}, \quad d \in [0, 1], \quad t = 1, 2, \ldots.$$ 

- Meetings occur randomly between linked individuals
  
  - Information on $p$ is exchanged:
    
    $$p_{t+1}^i = \mu p_t^i + (1 - \mu) p_t^j.$$ 

- Employed (self-employed) exchange information only with employed (self-employed)
Simulation results

Average subjective probability of detection: \( d = 0.95 \) (left) and 0.25 (right), \( \mu = 0.75; \ n = 1000; \ T = 200 \) (first 100 discarded)

\[ \rho \sim \text{uniform } [0, 10], \text{ true probability of audit } a = 0.05, \text{ tax rate } t = 0.25, \text{ fine } f = 1.5. \]
Simulation results

Average risk aversion: self-employed (left) and employed (right):
\( d = 0.95; \mu = 0.75; \ n = 1000; \ T = 200 \) (first 100 discarded).

\( \rho \sim \text{uniform } [0, 10], \text{ true probability of audit } a = 0.05, \text{ tax rate } t = 0.25, \text{ fine } f = 1.5. \)
Aggregate risk-taking

Is the aggregate degree of risk-taking socially efficient?

- Kanbur (1979), and Black and de Meza (1997):
  - In a competitive economy with costly state verification an inefficiently low proportion of individuals enter risky occupations
  - A direct or indirect subsidy to risky occupation, balanced by a tax on riskless occupation, may increase welfare for everyone

- If there is too little risk-taking without tax evasion, then the possibility of evading encourages risk-taking
  - Setting policy to reduce evasion will drive risk-taking further from the social optimum
  - A more relaxed tax enforcement would serve as an indirect subsidy and may, therefore, improve the welfare.
Aggregate risk-taking

Converse argument:
- Taxation has a variance-reducing effect on earnings from self-employment
  - Government engages in risk-sharing
  - Therefore, encourages self-employment
- Evasion has the opposite effect and raises the variance again
- So, from this argument, policy should try to reduce evasion.

Which of these two arguments is correct?
Aggregate risk-taking

Example of a relaxed tax enforcement policy

- Reduce evasion fine: $\Delta f < 0$
- Increase tax rate: $\Delta t > 0$
- Total revenue remains constant:

$$\Delta G \approx \frac{\partial G}{\partial f} \Delta f + \frac{\partial G}{\partial t} \Delta t = 0 \implies \Delta t = -\frac{\partial G}{\partial G/\partial t}$$

- Welfare effect:

$$\Delta W \approx \frac{\partial W}{\partial f} \Delta f + \frac{\partial W}{\partial t} \Delta t = \Delta f \left( \frac{\partial W}{\partial f} - \frac{\partial W}{\partial t} \frac{\partial G}{\partial f} \right)$$

- The policy is welfare-improving iff

$$\frac{\partial W}{\partial f} - \frac{\partial W}{\partial t} \frac{\partial G}{\partial f} < 0$$
Aggregate risk-taking

- A fall in the evasion fine attracts marginal individuals into self-employment
  - Average (expected) earnings increase for both employed and self-employed
  - Welfare rises

- A rise in tax decreases net income for both occupations
  - Welfare falls

- The net effect depends on the distribution of individual characteristics
  - In some circumstances the relaxed enforcement policy can increase welfare
Aggregate risk-taking

Welfare effect of relaxed enforcement with raised tax

- In all three cases
  \[ E[\pi] = E[w] \]

- Project value distribution is
  - Symmetric: solid
  - “Skewed to the right”: dash
  - “Skewed to the left”: dot

- Relaxed enforcement policy rises welfare when
  - Tax rate is high
  - Unsuccessful project value is low

\[ p = 0.5, f = 0.75, \{\rho, w\} \sim \text{uniform, independent} \]
Aggregate risk-taking

- Alternatively, one can consider reducing $p$ (monitoring effort)
  - Need to incorporate cost of monitoring
  - If government chooses monitoring effort optimally, then any change will reduce welfare

- Pareto-improvement (Black & de Meza, 1997) vs aggregate welfare-improvement

- Possible extensions (borrowing)
Concluding remarks

- Theory needs to incorporate access to evasion and the formation of beliefs
- Occupational choice and social networks do this
- Occupational choice places attention on self-selection based on risk aversion
- The network allows beliefs that depart from objective probability to be sustained
- Audit policy can affect aggregate risk taking so needs to be evaluated from this perspective
- Next step: look at audit policy taking into account the network effects