

# TAX EVASION ON A SOCIAL NETWORK

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# CONTENT

1. Introduction
2. Model
3. Optimal evasion
4. Revenue effects of interventions
5. Conclusions

# INTRODUCTION

# TAX EVASION - RELEVANCE AND RESEARCH

- Tax evasion causes **significant losses of public revenues** (£4.4 bn. in UK)
- Growing interest by tax agencies to exploit “big data” and network theory to **improve efficiency of deterrence measures**
- Predictive tools find **patterns in data arising due to the determinants of subjects' decisions**
- We investigate the **impact of social network on tax evasion decisions** and develop a framework to **asses the value of social network data**

# TAX EVASION AND REFERENCE DEPENDENCE

- We **relate tax evasion behaviour to** a substantial body of evidence that people seek to “**keep up with the Jones**”
- Specifically, **one way to keep up with the Jones’ is to evade** more tax than others do
- An immediate consequence is that **individual evasion behaviour is related to how others are behaving**
- A taxpayer takes into account the behaviour of others through his **reference income**, a “benchmark” of others’ consumption

## RELATED LITERATURE

- Kahneman and Tversky 1979  
*Reference-dependence of utility*
- Rablen 2008  
*Self and social comparison effects in utility*
- Ballester, Calvo, Zenou 2006  
*Network games with local payoff complementarities*
- Quah 2007  
*Monotone comparative statics on network games*

# MODELLING FEATURES

## Provide a model where:

- Taxpayers may engage in **risky** tax evasion
- Taxpayers differ in **income, probability of detection** and **reference group** (individuals in a taxpayer's social network)
- **Self** and **social** comparison shape the **reference income**
- **Social** comparison depends on taxpayer' **reference group**

# RESEARCH QUESTIONS

→ Our analysis has focused on **three** questions:

1. Is it possible to characterize **optimal evasion** when people evaluate their consumption relative to others?
  - How do **different conditions** like tax-schedule, deterrence policies or individual traits, affect it? (comparative statics)
2. Is it possible to characterise the **revenue effects** of interventions?
3. How much does the **availability of more information** (related to social networks) improve the capacity of a tax authority to **infer audit revenue effects**?



MODEL

# MODELLING OF EVASION

- We define **evasion** as the **tax liability not paid** by the taxpayer
  
- Evasion is a **risky** activity:
  - The **tax agency** is actively seeking to detect and **shut-down** evasion
  
  - There is a compound probability that:
    - **The taxpayer is discovered** under declaring
    - The **tax agency is successful** in shutting down evasion and imposes a fine on the evader

# TAXPAYERS CHARACTERISTICS

- Taxpayers are **distinguished** by:
  - **Probability** of being audited
  - Exogenous **Income**
  - Who they compare to in the social network:  
their **reference group**
- Taxpayers evaluate their **reference income** based on the individual characteristics and the tax-deterrence parameters.

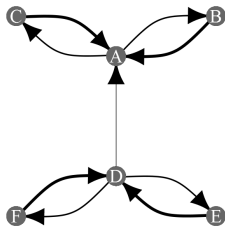
# REFERENCE INCOME

- Taxpayers determine their reference income based on **Social-** and **Self-**comparisons
  - **Self:**  
Own past consumption (**Habit income**)
  - **Social:**  
The (weighted) **average consumption** of individuals in a taxpayer's social network

# AN EXAMPLE OF A SOCIAL NETWORK

**Graph** and **matrix** form of a **weighted directed** network

Directed Network



$$\begin{array}{c} A \\ B \\ C \\ D \\ E \\ F \end{array} \begin{pmatrix} 0 & .5 & .5 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \\ .2 & 0 & 0 & 0 & .4 & .4 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix}$$

# OPTIMAL EVASION

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- Key theoretical result is that **evasion is closely related to the concept of (Bonacich) network centrality**
  - More "**central**" taxpayers evade more
    - A taxpayer is more "**central**" the more numerous the people comparing to him
- Network centrality is a concept developed in sociology
  - Measures the amount of influence/power players have within a network

# MONOTONE COMPARATIVE STATICS RESULTS

Habit consumption	+	Other's Income	+ / 0
Own comparison	+	Social comparison	+ / 0
Own audit prob.	-	Others audit prob.	- / 0
Risk Aversion	-	Fine	-
Tax rate	+		

Effect on **optimal evasion** of a change in parameters  
(taxpayer characteristics, tax-deterrence schedule)



# REVENUE EFFECTS OF INTERVENTIONS

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How does an audit to a taxpayer affects revenues collected?

1. **Direct effect**

Evaded liabilities recovered from the targeted taxpayer

2. **Indirect effects**

Expected additional revenue that arises **from future changes in evasion behaviour (negative externality)**

→ from the audited taxpayer

→ from non-audited taxpayers

→ Indirect effects are of primary importance since estimates are **2-6 X** direct ones

# TAX AGENCY'S INFERENCE PROBLEM

- Tax authorities engage in inferring both **direct effects**  $\mathbf{E}^{SS}$  and **aggregate gross indirect effects**  $\Sigma$ 
  - Taxpayers usually ranked by discriminant function and audited sequentially until budget is exhausted
- Crucial information for tax authorities is correct rank of  $\mathbf{E}^{SS}$  and  $\Sigma$ 
  - Optimal audit targeting if tax authorities were able to exactly infer **rankings** of direct and indirect effects.

Key finding:

A new measure of **Bonacich centrality** correctly ranks  
**own** and **cross indirect** effects

# INFERENCE OF REVENUE EFFECTS

→ What might be the value of “big data” tools that seek to construct social networks?

We estimate by simulation the **additional audit revenues**  $\Delta \mathcal{R}(\mathbf{G})$  from exploiting **network information** in targeting

→ Two settings considered:

1. **Full observability** ( $\mathcal{F}$ ): The tax agency observes all comparison intensities
2. **No observability** ( $\emptyset$ ): The tax agency observed no comparison intensities

→ Audit revenues increase by  $\Delta \mathcal{R}(\mathbf{G}) \approx 6\%$  when **social network information** is available

# CONCLUSIONS

## CONCLUDING REMARKS

- Social interaction may affect evasion behaviour
- Different **Bonacich** measures of centrality characterise optimal **evasion** and **revenues effects** of audits
- **Social network information** improves significantly the **prediction** of revenue effects from audits

## FURTHER RESEARCH

- Extend the analysis to **crime** as a whole
- Analyse how adding or **removing taxpayers (detention)** may affect compliance

# Thank You!

Questions?