Local-average games

- This paper considers a tax evasion game between $n > 1$ individuals and the tax authority, who seeks to maximize the aggregate fiscal revenues collected from individual tax payments.

- It is assumed that taxpayer communication happens truthfully and voluntarily (Andrei et al., 2014), and where individuals assimilate the **average** value of the new information received from their neighbors (Hokamp & Pickhardt, 2010).

- The presence of social interactions leads taxpayers to experience **peer effects** (Fortin et al., 2007; Alm et al., 2017).

- The **local-average** or linear-in-means model is the workhorse model in empirical work on peer effects (Blume et al., 2015; Kline & Tamer, 2019; Ushchev & Zenou, 2020).

Taxpayer network $\mathbb{g}$

- Consider $\mathcal{N}$ a set of $n > 1$ taxpayers which coexist in a connected network $\mathbb{g}$, with a $n \times n$ adjacency matrix $\mathbf{H} = [h_{i,j}]$ with entries $\{0, 1\}$, where $h_{i,j} = 1$ if and only if there is a direct connection between agents i and j; otherwise $h_{i,j} = 0$.
  - The network is undirected and does not include any self-loops.
  - We say two agents or taxpayers are 'neighbors' if they share a direct link between each other.
- Define $\mathbf{G} = [g_{i,j}]$ with entries $[g_{i,j}] \in [0, 1]$ as the $n \times n$ row-normalized adjacency matrix obtained from diving each entry of matrix $\mathbf{H}$ by the degree of node i. Hence, $[g_{i,j}] = [h_{i,j}]/N_i$, where N_i represents the node-degree of taxpayer i.
  - One can interpret the value of $[g_{i,j}]$ as the *influence* which agent j exerts on agent i, in the sense of Degroot (1974).

Local-average games: utility function

- Local-average games (Blume et al., 2015; Kline & Tamer, 2019) have a linear-quadratic utility function of the form:

$$U_i(x_i, \mathbf{x}_{-i}, \mathrm{g}) = \alpha_i x_i - \frac{1}{2}x_i^2 - \frac{\theta}{2}(x_i - \bar{x}_i)^2, \tag{1}$$

  - x_i is the outcome (e.g. tax payment) exerted by agent i,
  - $\mathbf{x}_{-i}$ is the vector of outcomes exerted by all other players,
  - g is the social network,
  - $\alpha_i > 0$ is an individual *productivity* parameter,
  - θ is the *social interaction effect* which measures an agent's reaction to the average outcome of its neighbors (e.g. *alla romana*).
  - $\bar{x}_i$ is the individual-specific *social norm*, defined as the average outcome exerted by agent i's neighbors weighted by the influence exerted by each player $j \neq i$ on taxpayer i. Namely:

$$\bar{x}_i = \sum_{j=1}^{n} g_{ij} x_j. \tag{2}$$

A quick look from the taxpayer's perspective

- Assume a taxpayer's value function (or expected utility) is:

$$V = \hat{p} \cdot \upsilon(audited) + (1 - \hat{p}) \cdot \upsilon(not\_audited). \quad (3)$$

- The generalized taxpayer's problem is to maximize the value function V in terms of the payoffs υ of being audited or not:

$$\max_{\{d\}} V(\hat{p}, d, I, \tau, \phi, \cdot) \quad (4)$$

  where agents optimize only over the declared income d. Notice that the subjective audit rate $\hat{p}$ is endogenous; while income, taxes, penalties and most other parameters are exogenous.

- A higher perceived audit rate, *ceteris paribus*, would induce taxpayers to be more compliant (Casal & Mittone, 2016).
  - Optimal d is (weakly) **increasing with respect to $\hat{p}$**.
    - Hence, tax payments $(x_i) \propto$ declared income $(d_i) \propto \hat{p}_i$.

Mathematically equivalent problems

- Define individual tax payments as $x_i := d_i I_t \tau$
  - d_i is the individual fraction of income disclosed,
  - I_i is the taxpayer's exogenous given income,
  - τ is the societal tax rate (flat or stepped).

Claim (1)

From the point of view of the tax authority, in a local-average game, the two problems are mathematically equivalent:

$$\text{argmax}_{\{\mathcal{A}\}}\, \mathbf{e}^\top \mathbf{x} = \text{argmax}_{\{\mathcal{A}\}}\, \frac{1}{n}\mathbf{e}^\top \hat{\mathbf{p}},$$

where $\mathcal{A}$ is the set of possible actions of the tax authority (e.g. audit probabilities, sequence of audits, targeted audits, etc.).

$\mathbf{x} := (x_1, x_2, ..., x_n)^\top \in \mathbb{R}^n_+$ is the vector of tax payments and $\hat{\mathbf{p}} := (\hat{p}_1, \hat{p}_2, ..., \hat{p}_n)^\top$ is the vector of subjective audit rates of all players in network $\mathbb{g}$, and $\mathbf{e} \in \mathbb{R}^n$ is a column-vector of ones.

Local-average games: Nash Equilibrium

- We redefine the local-average game in terms of $\hat{p}_i$ as:

$$U_i(\hat{p}_i, \hat{\mathbf{p}}_{-i}, \mathrm{g}) = \alpha_i \hat{p}_i - \frac{1}{2}\hat{p}_i^2 - \frac{1}{2}\left(\frac{\lambda}{1-\lambda}\right)(\hat{p}_i - \bar{\hat{p}}_i)^2, \quad (5)$$

  - where $\theta = \frac{\lambda}{1-\lambda}$ and $0 < \lambda < 1$.

- The best-reply function for each taxpayer i is given by:

$$\hat{p}_i = (1-\lambda)\alpha_i + \lambda \bar{\hat{p}}_i, \quad (6)$$

Proposition (1)

Solving for $\hat{\mathbf{p}}$ the Nash Equilibrium ($\hat{\mathbf{p}}^*$) is defined by:

$$\hat{\mathbf{p}}^* = (1-\lambda)[\mathbf{I} - \lambda \mathbf{G}]^{-1}\boldsymbol{\alpha}.$$

Local-average games: Heterogeneity

Proposition (2)

The matrix $\mathbf{M} := (1-\lambda)[\mathbf{I} - \lambda\mathbf{G}]^{-1}$ *is well-defined and row-normalized for any* $\lambda \in (0,1)$. *Hence one has:* $\hat{\mathbf{p}}^* = \mathbf{M}\boldsymbol{\alpha}$.

Proposition (3)

Since $\mathbf{G}$ *is a row-normalized adjacency matrix, the Nash Equilibrium exists, is unique and is interior for any* $\lambda \in (0,1)$.

Claim (2)

If individuals are ex ante homogeneous, that is if $\alpha_i = \alpha_j$ *for all* $\{i,j\} \in \{1,2,...,n\}$, *then the aggregate and individual Nash Equilibrium outcome levels will be independent of the network structure, rendering network-based policies useless.*

Threat-to-audit message

- Threat-to-audit messages can affect taxpayer behavior (Boning et al., 2018; Lopez-Luzuriaga & Scartascini, 2019).

Tax authority's message:

Dear citizen,
A new audit regime is in place. Last year the societal audit probability was of p and equal for all taxpayers. As of now, the probability of being audited will be proportional to the income level of each taxpayer. Hence, the individual-specific audit rate for each taxpayer i is now defined as:

$$p_i = p \cdot \frac{I_i}{\sum_{j=1}^{n} I_j} \cdot n, \tag{7}$$

where p is the homogeneous true audit rate from last year, I_i denotes the gross earned income of taxpayer i, n is the total number of individuals in the society, and $p_i \in [0, 1]$ for all $i \in \{1, 2, ..., n\}$.

- The average and aggregate probabilities have not changed, just **shifted**.

Ensuring taxpayer *productivity* heterogeneity

- Following the threat-to-audit message, taxpayers compute their income heterogeneity with respect to society.
- Let α_i be determined by an agent's income divided by the average income of all the agents in the network. The value of such individual-specific heterogeneity level α_i is defined as:

$$\alpha_i = \frac{I_i}{\sum_{j=1}^{n} I_j} \cdot n \tag{8}$$

- The interpretation of α_i would be a taxpayer's exogenous-given **income productivity** with respect to society.
  - E.g. if j's income is twice the average income level, then $a_j = 2$.
- Averaging on both sides, it is easy to see that the average and aggregate productivity in the network have not been modified.

Subjective probability of being audited

- Individual **belief dynamics in tax compliance** are strongly path-dependent with respect to the average past behavior of other players (Alm et al., 2017; Gächter & Renner, 2018).
- In general, subjective audit rates may be affected by **three channels**: prior beliefs, empirical audit rates and the socially-learned value of the audit rate in its neighborhood.
- In a dynamic framework, the endogenous and *post-message* heterogeneous subjective audit rates can be formulated as:

$$\hat{p}_{i,t+1} = \frac{1-\omega}{2}\hat{p}_{i,t} + \frac{1-\omega}{2}\frac{1}{m}\sum_{s=1}^{m} A_{i,t-s} + \omega(\alpha_i \bar{\hat{p}}_{i,t}), \quad (9)$$

where $\omega \in (0,1)$ is the weight given to the newly acquired information, $A_{i,t-s} = 1$ if agent i was audited at time $t-s$ and zero otherwise, and $\alpha_i > 0$ is the income productivity level.

First-best outcomes and restorations

- Local-average game first-best outcomes and restorations are well-defined (Ushchev & Zenou, 2020).

Proposition (4)

Given a local-average game as previously characterized, the first-best outcome, $\hat{\mathbf{p}}^o$, is a solution to:

$$\hat{\mathbf{p}} = (1-\lambda)\boldsymbol{\alpha} + \lambda\mathbf{G}\hat{\mathbf{p}} + \lambda\mathbf{G}^\top(\mathbf{I}-\mathbf{G})\hat{\mathbf{p}},$$

whose solution is unique, and it is given by:

$$\hat{\mathbf{p}}^o = \left[\boldsymbol{I} + \frac{\lambda}{1-\lambda}(\boldsymbol{I}-\boldsymbol{G})^\top(\boldsymbol{I}-\boldsymbol{G})\right]^{-1}\boldsymbol{\alpha}.$$

- The first-best outcome is expressed in function of the productivity ($\boldsymbol{\alpha}$), taste for conformity (λ) and network structure ($\mathbf{G}$).

First-best outcomes and restorations

- When the players in a local-average game do not reach the first-best equilibrium, the social planner (tax authority) may try to restore it by *subsidizing* or *taxing* specific individuals.

Proposition (5)

The first-best outcome is restored when the social planner endows agents with the following subsidy/tax per unit of effort:

$$\mathbf{S}^o = \frac{\lambda}{1-\lambda}\mathbf{G}^\top(\mathbf{I}-\mathbf{G})\hat{\mathbf{p}}^o,$$

where the optimal per-effort subsidy for each agent i is:

$$S_i^o = \frac{\lambda}{1-\lambda}\sum_{j\neq i} g_{ji}(\hat{p}_j^o - \bar{\hat{p}}_j^o).$$

Maximizing the aggregate outcome

- The objective of the tax authority is to audit the set of taxpayers, $\mathcal{M} \subset \mathcal{N}$, such that the global subjective audit probability is maximized, and constrained by a finite number of audits $\lfloor np \rfloor$.

$$\begin{aligned} \max_{\{\mathcal{M}\subset\mathcal{N}\}} \quad & \frac{1}{n}\sum_{i=1}^{n} \hat{p}_{i,t+1}(A_{i,t}, \mathbf{A}_{-i,t}, \cdot) \\ \text{s.t.} \quad & A_{i,t} = 1 \iff i \in \mathcal{M}, \\ & A_{i,t} = 0 \iff i \notin \mathcal{M}, \\ & |\mathcal{M}| \leq \lfloor np \rfloor, \end{aligned} \tag{10}$$

where the individual subjective probability for all taxpayers at time $t+1$ is dependent on whether they have been audited or not $(A_{i,t})$, and on who else was audited or not $(\mathbf{A}_{-i,t})$.

- The **solution of the tax authority's problem** is to compute the vector of optimal individual subsidies (S_i^o) and to audit the $\lfloor np \rfloor$ taxpayers with the maximal individual subsidy values.

Taxpayer simulation

- Let us define a **dynamic game** in a taxpayer network with social interactions. First, agents and society are characterized and the social network is built. Then, the tax authority emits a message to incentive tax compliance.
- Each period, agents disclose a share of their income, may or may not be audited, and then exchange information with their neighbors and update their subjective audit rates.

Step	Description
Step 1	Agents (taxpayers) are parameterized.
Step 2	The social network is built.
Step 3	The tax authority emits a threat-to-audit message.
Step 4	Agents hold social interactions and share information.
Step 5	Agents choose their optimal declared income.
Step 6	The tax authority applies its optimal audit strategy.
Loop	Go back to *Step 4*.

Taxpayer characterization

- Social networks of tax evasion consider **homophily** behavior and **cohesive** relations among individuals (Andrei et al., 2014; Gamannossi degl'Innocenti & Rablen, 2020). That is, taxpayers tend to form links with peers who are akin to them and with whom they share similar traits and characteristics.

Parameter	Exog.	Endog.	Societal	Individual
I: Earned income	X			X
τ: Tax rate	X		X	
ϕ: Penalty rate	X		X	
m: Fiscal memory length	X		X	
n: Number of taxpayers	X		X	
ω: Weighting parameter	X		X	
θ: Taste for conformity	X		X	
p: True audit rate	X		X	
$\hat{p}$: Subjective audit rate		X		X
d: Declared income		X		X
q: Global subjective audit rate		X	X	

Comparing audit strategies: convergence levels

- The proposed *Subsidy* strategy secured the highest average **convergence level** over 100 simulations per audit scheme.

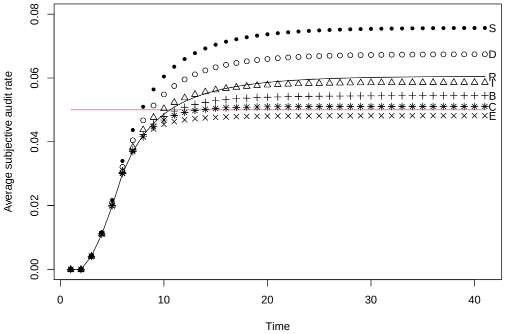


Figure: Convergence level of the global subjective audit rate for different audit schemes: *Subsidy* (S), *Degree* (D), *Random* (R), *Intercentrality* (I), *Betweenness* (B), *Closeness* (C) and *Eigencentrality* (E).

Comparing audit strategies: outcome distributions

- The proposed *Subsidy* strategy obtained the highest convergence level **distribution** of the global (average) subjective audit rate at a 0.001% confidence level.

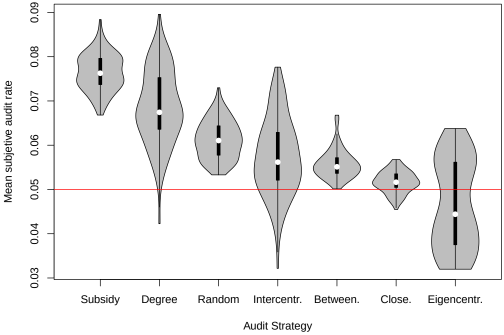
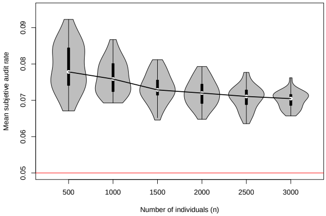
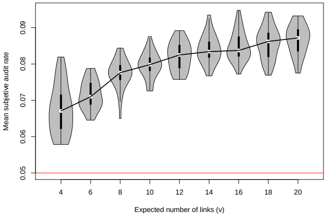


Figure: Distributions of the convergence levels of the global subjective audit rate for diverse audit strategies.

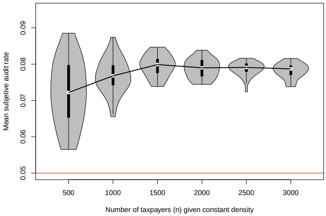
Testing parameter effects



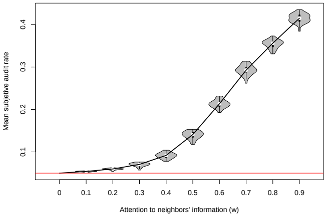
(a) Number of taxpayers (n)



(b) Expected node-degree (μ)

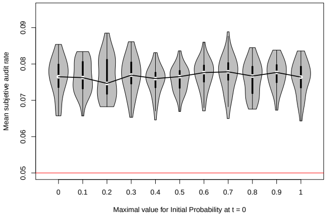


(c) Constant density (δ)

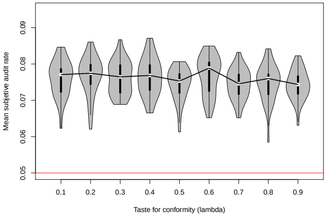


(d) Attention to neighbors (ω)

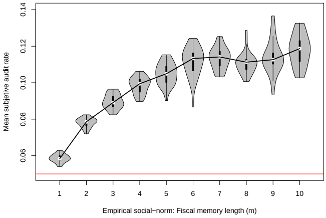
Assessing robustness



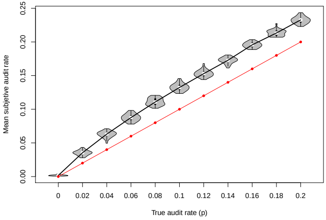
(a) Initial subjective audit rate



(b) Taste for conformity (λ)



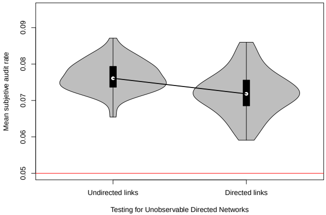
(c) Fiscal memory (m)



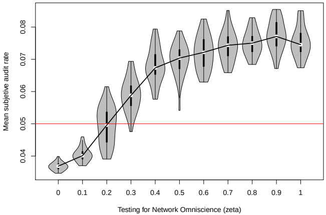
(d) Societal true audit rate (p)

Model extensions

- The proposed audit scheme would outperform random auditing and most policies if at least **35%** of the links would be known.
- The tax authority could fully enforce the proposed optimal audit strategy if at least **70%** of the links would be known.



(a) What if the tax authority cannot observe link directions?

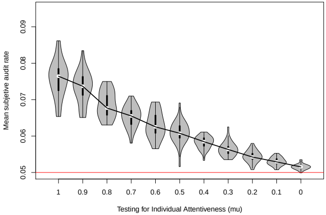


(b) What if the tax authority's omniscience is limited?

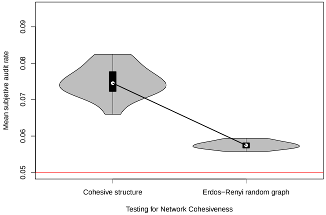
Figure: Which would be the cost of discovering all taxpayer links?

Limitations of network-based strategies

- If taxpayers do not pay **attention** to the *threat-to-audit message* they will not be *post-message* heterogeneous ($\alpha_i = \alpha_j$).
- If the taxpayer network lacks all **cohesiveness**, the strategy would be useless. Fortunately, social networks are cohesive (McPherson et al., 2001; Moody, 2001; Currarini et al., 2009).



(a) Attention placed to the threat-to-audit message



(b) Cohesive and non-cohesive taxpayer networks

Figure: Graphical representation of the two model limitations.

Policy implications and concluding remarks

- This paper proposes a two-step game-theoretic optimal audit strategy from the point of view of the tax authority.
  - First step: Credible threat-to-audit message.
  - Second step: Network-based audit policy.

1. The proposed enforcement regime targets taxpayers in function of their *productivity* and their position in the network.
2. To the best of my knowledge, it is the **first audit strategy** that is robust to individual and societal parameters, such as:
   - Number of taxpayers, network density, true audit rates...
   - Taxpayer heterogeneity: attentiveness, memory, endogenous p.
   - Expected and Non-expected utility theories.
   - Invariant to any plausible utility and payoff functions.
3. Notwithstanding, the costs and plausibility of observing a given fraction of taxpayer links remain open questions.

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References I

Allingham, M. G., & Sandmo, A. (1972). Income tax evasion: A theoretical analysis. *Journal of Public Economics*, *1*(3-4), 323–338.

Alm, J., Bloomquist, K. M., & McKee, M. (2017). When you know your neighbour pays taxes: Information, peer effects and tax compliance. *Fiscal Studies*, *38*, 587–613.

Alm, J., Jackson, B., & McKee, M. (1992). Estimating the determinants of taxpayer compliance with experimental data. *National Tax Journal*, *45*(1), 107–14.

Alm, J., Jackson, B. R., & McKee, M. (2009). Getting the word out: Enforcement information dissemination and compliance behavior. *Journal of Public Economics*, *93*(3-4), 392–402.

Alm, J., Mcclelland, G., & Schulze, W. (1992). Why do people pay taxes? *Journal of Public Economics*, *48*, 21–38.

Andrei, A. L., Comer, K., & Koehler, M. (2014). An agent-based model of network effects on tax compliance and evasion. *Journal of Economic Psychology*, *40*(C), 119–133.

Andreoni, J., Feinstein, J., & Erard, B. (1998). Tax compliance. *Journal of Economic Literature*, *36*, 818–860.

Ashby, J., Webley, P., & Haslam, S. (2009). The role of occupational taxpaying cultures in taxpaying behaviour and attitudes. *Journal of Economic Psychology*, *30*, 216–227.

References II

Bernasconi, M., & Zanardi, A. (2004). Tax evasion, tax rates, and reference dependence. *FinanzArchiv*, *60*(3), 422–445.

Bloomquist, K. (2004). Multi-agent based simulation of the deterrent effects of taxpayer audits. *Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association*, *97*.

Blume, L. E., Brock, W. A., Durlauf, S. N., & Jayaraman, R. (2015). Linear social interactions models. *Journal of Political Economy*, *123*(2), 444–496.

Boning, W. C., Guyton, J., Hodge, R. H., Slemrod, J., & Troiano, U. (2018). *Heard it through the grapevine: Direct and network effects of a tax enforcement field experiment* (NBER Working Papers). National Bureau of Economic Research, Inc.

Calimani, S., & Pellizzari, P. (2014). *Tax enforcement in an agent-based model with endogenous audits* (Lecture Notes in Economics and Mathematical Systems: Artificial Economics and Self Organization No. 669). Springer, Cham.

Casal, S., & Mittone, L. (2016). Social esteem versus social stigma: The role of anonymity in an income reporting game. *Journal of Economic Behavior & Organization*, *124*(C), 55–66.

Currarini, S., Jackson, M., & Pin, P. (2009). An economic model of friendship: Homophily, minorities, and segregation. *Econometrica*, *77*(4), 1003–1045.

Davis, J., Hecht, G., & Perkins, J. (2003). Social behaviors, enforcement, and tax compliance dynamics. *The Accounting Review*, *78*, 39–69.

References III

Degroot, M. H. (1974). Reaching a consensus. *Journal of the American Statistical Association*, *69*(345), 118–121.

Drago, F., Mengel, F., & Traxler, C. (2020). Compliance behavior in networks: Evidence from a field experiment. *American Economic Journal: Applied Economics*, *12*(2), 96–133.

Fortin, B., Lacroix, G., & Villeval, M. C. (2007). Tax evasion and social interactions. *Journal of Public Economics*, *91*(11-12), 2089–2112.

Galbiati, R., & Zanella, G. (2012). The tax evasion social multiplier: Evidence from Italy. *Journal of Public Economics*, *96*(5), 485–494.

Gamannossi degl'Innocenti, D., & Rablen, M. D. (2020). Tax evasion on a social network. *Journal of Economic Behavior & Organization*, *169*(C), 79–91.

Gächter, S., & Renner, E. (2018). Leaders as role models and 'belief managers' in social dilemmas. *Journal of Economic Behavior & Organization*, *154*.

Hashimzade, N., Myles, G., Page, F., & Rablen, M. (2015). The use of agent-based modelling to investigate tax compliance. *Economics of Governance*, *16*(2), 143–164.

Hashimzade, N., Myles, G., & Rablen, M. (2016). Predictive analytics and the targeting of audits. *Journal of Economic Behavior and Organization*, *124*(C), 130–145.

Hashimzade, N., Myles, G. D., Page, F., & Rablen, M. D. (2014). Social networks and occupational choice: The endogenous formation of attitudes and beliefs about tax compliance. *Journal of Economic Psychology*, *40*(C), 134–146.

References IV

Hokamp, S., & Pickhardt, M. (2010). Income tax evasion in a society of heterogeneous agents - Evidence from an agent-based model. *International Economic Journal*, *24*(4), 541–553.

Kleven, H. J., Knudsen, M. B., Kreiner, C., Pedersen, S., & Saez, E. (2011). Unwilling or unable to cheat? Evidence from a tax audit experiment in Denmark. *Econometrica*, *79*(3), 651–692.

Kline, B., & Tamer, E. (2019). Econometric analysis of models with social interactions. In B. Graham & A. De Paula (Eds.), *The econometric analysis of network data* (p. Forthcoming). Elsevier, Amsterdam.

Korobow, A., Johnson, C., & Axtell, R. (2007). An agent–based model of tax compliance with social networks. *National Tax Journal*, *60*(3), 589–610.

Kukk, M., Paulus, A., & Staehr, K. (2020). Cheating in Europe: Underreporting of self-employment income in comparative perspective. *International Tax and Public Finance*, *27*(2), 363–390.

Lopez-Luzuriaga, A., & Scartascini, C. (2019). Compliance spillovers across taxes: The role of penalties and detection. *Journal of Economic Behavior & Organization*, *164*(C), 518–534.

McPherson, M., Smith-Lovin, L., & Cook, J. (2001, 01). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*, 415–444.

Mittone, L. (2006). Dynamic behaviour in tax evasion: An experimental approach. *Journal of Behavioral and Experimental Economics (formerly The Journal of Socio-Economics)*, *35*(5), 813–835.

References V

Mittone, L., & Patelli, P. (2000). *Imitative behaviour in tax evasion* (Economic simulations in swarm: Agent-based modelling and object oriented programming).

Moody, J. (2001, 11). Race, school integration, and friendship segregation in America. *American Journal of Sociology*, *107*, 679–716.

Myles, G., & Naylor, R. (1996). A model of tax evasion with group conformity and social customs. *European Journal of Political Economy*, *12*(1), 49–66.

Onu, D., & Oats, L. (2015). "Paying tax is part of life": Social norms and social influence in tax communications. *Journal of Economic Behavior & Organization*, *124*.

Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economic Perspectives*, *14*, 137–158.

Pellizzari, P., & Rizzi, D. (2014). Citizenship and power in an agent-based model of tax compliance with public expenditure. *Journal of Economic Psychology*, *40*(C), 35–48.

Phillips, M. D. (2014). Deterrence vs. gamesmanship: Taxpayer response to targeted audits and endogenous penalties. *Journal of Economic Behavior & Organization*, *100*(C), 81–98.

Pomeranz, D. (2015). No taxation without information: Deterrence and self-enforcement in the Value Added Tax. *American Economic Review*, *105*(8), 2539–2569.

References VI

Prinz, A., Muehlbacher, S., & Kirchler, E. (2014). The slippery slope framework on tax compliance: An attempt to formalization. *Journal of Economic Psychology*, *40*(C), 20–34.

Riedel, N., Strohmaier, K., & Lediga, C. (2019). *Spatial tax enforcement spillovers: Evidence from South Africa* (Annual Conference 2019 (Leipzig): 30 Years after the Fall of the Berlin Wall - Democracy and Market Economy). Verein für Socialpolitik / German Economic Association.

Scartascini, C., & Castro, L. (2015). Tax compliance and enforcement in the pampas evidence from a field experiment. *Journal of Economic Behavior & Organization*, *116*, 65—82.

Slemrod, J., Blumenthal, M., & Christian, C. (2001). Taxpayer response to an increased probability of audit: Evidence from a controlled experiment in Minnesota. *Journal of Public Economics*, *79*(3), 455–483.

Srinivasan, T. (1973). Tax evasion: A model. *Journal of Public Economics*, *2*(4), 339–346.

Stalans, L., Kinsey, K., & Smith, K. (2006). Listening to different voices: Formation of sanction beliefs and taxpaying norms. *Journal of Applied Social Psychology*, *21*, 119–138.

Ushchev, P., & Zenou, Y. (2020). Social norms in networks. *Journal of Economic Theory*, *185*.

Yaniv, G. (1999). Tax compliance and advance tax payments: A prospect theory analysis. *National Tax Journal*, *52*(4), 753–764.

References VII

Yitzhaki, S. (1974). Income tax evasion: A theoretical analysis. *Journal of Public Economics*, *3*(2), 201–202.