Finding tax loopholes with agent-based simulations

Internship. This M1/M2 research internship will take place under the supervision of Peter Fratrič and Nils Holzenberger, in the DIG team, at Télécom Paris, 19 place Marguerite Perey, 91120 Palaiseau. The intended duration is 6 months, with a start date between March and May 2024. The internship will take place in the context of a project conducted in collaboration with David Restrepo Amariles at HEC Paris.

Context. Taxpayers occasionally find clever ways to combine existing policies to achieve unexpected tax discounts. These combinations are often referred to as *tax loopholes*, and come up often enough in tax courts, likely causing a significant tax deficit to governments.[1] While policy-makers can use available historic data to guide their policy choices, unexpected reactions of entities to new policies can hardly be foreseen. We aim to discover tax loopholes by simulating a legal and economic environment and letting agents interact with the environment and possibly one another, guided by reward maximization. This exploration leads to the discovery of new schemes of behavior, including previously unknown tax loopholes. This tool for agent-based simulation — *Code ReCivil* — relies on *agent-based simulation environments*, *formalized legal rules*, *reward-oriented exploration* and *knowledge extraction*.[2]

Goals. *Code ReCivil* is designed around use cases. During this internship, you will build such use cases. There are at least three possible starting points:

1. The GDPR prescribes how companies headquartered in Europe manage customer data, and how they can use them for business purposes, with different implementations from one EU country to the other. This influence where companies set up headquarters.

2. Some stock transactions are taxed, with tax rates and basis depending on the type of transaction and on laws of individual countries. In this use case, you will try to uncover stock swapping schemes.

3. Card-based payment methods (e.g. Visa, Mastercard...) are regulated by agreements between merchants and payment providers. Merchants can freely choose what payment methods to support, with a tradeoff between costs and customer base.

You will have the opportunity to work with experts in law, finance and economy from HEC and Télécom Paris.

Responsibilities. As an intern, you will become familiar with research relevant to agent-based modeling and formal frameworks for the law. You will identify a relevant use case for *Code ReCivil*, as well as determine the best framework to model it. You will also contribute to the codebase of *Code ReCivil* as you implement the use case you have identified.

Abilities. We are looking for an excellent student currently in a Master's program, with experience programming in Python and applying tools from machine learning. Experience with Prolog or other formal language, and with expert systems and symbolic AI would be a plus.

Contact. Please send your CV and cover letter to nils.holzenberger@telecom-paris.fr

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[1] Andrew Blair-Stanek, Nils Holzenberger, and Benjamin Van Durme. "Shelter Check: Proactively Finding Tax Minimization Strategies via AI." in: *Tax Notes Federal, Dec* 12 (2022).

[2] Peter Fratric et al. "Do agents dream of abiding by the rules?: Learning norms via behavioral exploration and sparse human supervision." In: *ICAIL 2023*.