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Policy Reform Effects in the Tax Ecosystem

An Agent-Based Simulation Approach

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14.1 Introduction

This chapter analyses the effects of two recent tax policy reforms: Country-by-Country Reporting (CbCR) and Automatic Exchange of Information (AEoI) in the tax ecosystem. These two reforms have different goals: while the former aims at reducing tax avoidance of corporations, the latter one focusses on reducing tax evasion by individuals. How successful have these policies been and how successful will they be when implemented fully in all EU countries?

So far, policy analyses have concentrated either on studying effects of reforms on tax avoidance (the legal part of not paying taxes by using loopholes in the international tax system) or on tax evasion (the illegal part of not declaring taxes). Following this logic, so far, the effects of reforms of CbCR and AEoI have also been analysed separately in the literature.

We will present a model that allows the study of both reforms and their interaction simultaneously. Policy reforms, when happening at the same time, can reinforce or counteract each other. Our model allows us to simulate the isolated effects of both reforms and to study them jointly. We evaluate the effects of these reforms by comparing them to what would have happened to tax compliance in the absence of these reforms (if they would never have happened), to a baseline model (what had happened until 2019 without implementing them further) and to full implementation of each reform by all 33 European countries studied. We do so over ten years, from 2019 to 2029 to allow the tax ecosystem to adjust and in order to see the long-term reactions to the reforms.

Our model views tax avoidance and tax evasion as sharing one crucial feature: the non-compliance of some of the actors of the tax ecosystem, which leads to unpaid taxes depriving the public sector of resources needed for public spending. Hence, the policy effects that we study are effects on tax compliance, which we can separate into effects on tax avoidance and tax evasion.

The model offers a tool for regulators to find out what makes companies and individuals within the EU 27 Member States and five additional European

countries become more compliant, and what deters them from doing so. With this, policy recommendations for improvement of reforms, which aim at collecting more tax revenues in order to fill the public COFFERS, can be derived.

In the following, we will first describe the two policy reforms CbCR and AEoI and existing analyses of their effects (Section 14.1). We will then describe why we think that our model—an agent-based simulation model—might be more appropriate (Section 14.2). We then describe the theoretical model of tax compliance from which we start, the slippery slope of Kirchler et al. (2008) (Section 14.3) and how we modify it for analysing an international tax system (Section 14.4). We then give an overview of the data collected (Section 14.5) and present our results (Section 14.6). We conclude (Section 14.7) and point at future research needed.

14.2 Tax Policy Reforms and Their Effects in the Literature

14.2.1 Country-by-Country Reporting (CbCR)

As of 2017, Council Directive 2016/881/EU[1] requires Multinational (MNE) Groups in the EU, with total consolidated revenue of 750 million Euro or more, to file A Country-By-Country Report. The Country-by-Country Report will include information, for every tax jurisdiction in which the MNE group does business, on the amount of revenue, the profit before income tax, the income tax paid and accrued, the number of employees, the stated capital, the retained earnings and the tangible assets. This allows to control for profit shifting by big corporations (see Chapter 6). The competent authority of the Member State that receives the Country-by-Country Report shall, by automatic exchange, communicate the report to any other Member States in which one or more Constituent Entities (i.e. companies) of the MNE Group are either resident for tax purposes, or are subject to tax with respect to the business carried out through a permanent establishment there.[2]

The introduction of CbCR reporting among banks provided insight into the behaviour of tax avoidance. In a European Commission discussion paper (Bouvatier et al. 2017) CbCR data shows that tax havens attract excessive banking activity and that the estimated tax losses generated by European banks range between 1 and 3.6 billion Euro. Overesch and Wolff (2017) find that banks with a significant presence in tax havens, significantly increase their effective tax rate and therefore conclude that CbCR is an effective policy instrument to counter corporate tax avoidance.

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[1] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016L0881
[2] For details see: see https://ec.europa.eu/taxation_customs/business/tax-cooperation-control/administrative-cooperation/enhanced-administrative-cooperation-field-direct-taxation/country-country-reporting_en

Adding corporations to file private CbCR reports allowed De Simone and Olbert (2019) to focus on the location of corporate economic activity rather than banking, and found CbCR to be effective. Using similar data but adopting a difference-in-difference approach (which is also used in Chapter 7), Hugger (2019) finds that the effective tax rate of included multinational corporations has increased by 0.8 percentage points. Because the total tax payments have not changed, and the intended effect of countering tax avoidance to redistribute the income according to apportionment factors of the European Commission (2007)[3] has not emerged, the author concludes that evidence of CbCR effectiveness is weak. Also, the findings of Chapter 8 still see many loopholes preventing CbCR effectiveness, such as lack of exchange of information on CbCR, and too high thresholds for CbCR obligations of companies.

Though, as has been shown above, there are studies in support of CbCR being effective in combating aggressive tax planning (companies' relocations, higher tax rates paid by them), we do not know whether the observed effects in economic activity are truly caused by the reform or are just confounding factors resulting from many of the economic and political turbulences.

14.2.2 Automatic Exchange of Information (AEoI)

The Automatic Exchange of Information (AEoI) Directive (Council Directive 2014/107/EU) aims at exposing the capital positions of foreign residents to their native country as to combat tax evasion practices. In March 2014, Luxembourg and Austria finally agreed to participate in the Directive, due to the pressure generated by the United States to comply with a similar agreement, the Foreign Account Tax Compliance Act (Hakelberg 2015).

Fuelled by the pressure of AEoI, a tax amnesty programme in Norway demonstrated that this pressure resulted in a significant rise in tax payments. According to Alstadsaeter et al. (2018), AEoI is, therefore, an effective tool to repatriate assets and reduce tax evasion. Contrary to popular belief, their Norwegian tax data does not show a substitution effect towards more tax avoidance. One could question whether there was enough hidden wealth to repatriate in the first place. Shifting profits via earlier bilateral treaties, treaty shopping (Davies 2004), could have obfuscated hidden wealth prior to the implementation of AEoI in 2014. Using collected data from a G-20's earlier bank secrecy initiative, Johannesen and Zucman (2014) find evidence to support this claim of treaty shopping and find that relocation of bank deposits is a likely scenario, arguing that AEoI is insufficient and withholding taxes are also needed since not all countries

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[3] European Commission (2007). CCCTB: Possible elements of the sharing mechanism, Common Consolidated Corporate Tax Base Working Group Document: CCCTB/WP060/doc/en.

participate in AEoI (notably the US does not participate, see Chapter 3 and Chapter 7).

Ahrens et al. (Chapter 7) and Ahrens and Bothner (2019) conduct difference-in-difference analysis that finds that after AEoI, household assets in tax havens reduced by 67 per cent. Unfortunately, assets hidden behind corporate structures remain obfuscated due to limited reporting of ultimate beneficial owners and as such the individuals for which this wealth is accrued.

While the use of AEoI is seemingly highly effective, privacy considerations create legal ways around sharing tax information with foreign authorities (Gupta 2019; Xiaoqing 2018) and IT related technical aspects affect the successful adoption and implementation of AEoI standards (Kurnia et al. 2019). Another concern of increasing the level of information exchange is the potential reduction of the inflow from offshore hiding spots and as such reduce general welfare. The reason for this is that cash that is hidden offshore and eventually returns to its country of origin, round-tripping (Marchiori and Pierrard 2018) will under the new regime not come back home any more.

The issues above show the importance of framing a policy's effectiveness and of taking into account substitution effects. Even if in terms of tax revenue, a policy might be effective, it may also deteriorate privacy laws, increase IT costs or have other adverse effects on the economy. We think that taking into account the manifold behaviour of actors and linking micro-and macro approaches is a more promising way to study policy reform effects. When confronted with reforms, actors adapt their tax compliance behaviour to their new environment.

14.3 Studying Tax Reforms in an Agent-Based Simulation Model

Tax policy reforms can be studied in macroeconomic models (see the studies shown under 14.1, such as repatriation of wealth or difference-in-difference methods of household assets held in tax havens). However, finding their true effects on tax revenue losses is obfuscated by the secretive nature of tax avoidance and tax evasion. At best, macroeconomic indicators can be used to proxy the impacts of such policies, but the need for a micro-level foundation remains. Micro-studies suffer from limitations for extensive data exchange due to privacy considerations. Tax evaders will hardly identify themselves as such; companies will hardly display their tax avoidance strategies; and authorities' hands to expose data about suspicious, but perhaps innocent. citizens are bound. Even if both macro- and micro-level data would be present, analysing tax compliance behaviour would still be distorted. Especially the endogeneity of policy changes in their possibilities to evade and avoid taxation complicates the empirical analysis.

Seen the complexity of the tax ecosystem, endogeneity of policies and associated problems, and confounding factors, agent-based models (ABM's) provide a good alternative (Axelrod 2003; Flache and Macy 2017) to existing tax policy models. An agent-based model (ABM) is a class of computational models for simulating the actions and interactions of autonomous agents (this can be individuals or collective entities such as organizations or groups) in order to assess their effects on the system as a whole. Agent-based models are a kind of micro model that simulate the simultaneous operations and interactions of multiple agents. Macro changes emerge from micro agents' behaviour. Individual agents have typically boundedly rationality, are acting in what they perceive as their own interests, such as reproduction or economic benefit, and are using heuristics or simple decision-making rules. ABM agents may experience 'learning', adaptation, and reproduction.

ABMs allow for high complexity and stochastic interactions, not restricting any unexpected emergent behaviour, create the opportunity to run 'counterfactual' simulations, i.e. what-if scenarios, and they can control for real-life confounding factors, such as individuals orienting themselves at their neighbours' behaviour rather than making rational decisions.

Especially when large shocks and non-calculable uncertainty are created by tax policy reforms, traditional models might face problems. Actors may not always react rationally but might follow Keynes' (1936, ch. 12, 'The State of Long-term Expectation') advice on how to behave under uncertainty, and assume that their past behaviour is a good guide for future behaviour. When there are major economic shocks, future events cannot be predicted from past development; this is why traditional macroeconomic models are doomed to fail. Still, shocks in the tax ecosystem—like new international regulations for transparency and information exchange—can be analysed, when assuming that people's behavioural intent remains quite stable. The advantage of an agent-based simulation model is that it can predict future effects of policy reforms.

Another complication in assessing a policy's impact is the inability to isolate the policy change from other events that take place in the real world. Given that actors are interconnected, adapt their behaviour based on their environment, learn from their experience, and have specific attitudes towards taxation, the tax ecosystem is a complex adaptive system for which traditional analysis approaches are seemingly not well equipped.

In order to deal with the dynamics of the tax ecosystem and analyse policy reforms, with the behavioural intention of agents to keep on going as usual, and with the high level of interaction among agents, we opted for an agent-based model (ABM). ABMs are considered a promising way forward (Foster 2005; Macal and North 2010; Smith and Conrey 2007), which have several advantages. First, an ABM enables the use of generic standards found by macroeconomic models and allows for creating a heterogeneous population that deviates from

the standards by using knowledge from case studies or other sources. Having generated micro-level data, the researcher can intervene and alter the circumstances in different simulations, creating the option to assess counter-factual scenarios (de Marchi and Page 2014). Second, Agent-Based models (ABM's) can relax the macroeconomic equilibrium micro-foundations and allow for the emergence of unplanned aggregate outcomes (Gatti et al. 2010). Third, ABM's can support the interaction between agents, influencing both changes in individual behaviour as in the social norms and allowing for (social) learning (Laver and Sergenti 2012).

We, for the first time, analyse tax avoidance and tax evasion jointly in one ABM, which allows to include spillover effects from corporate tax avoidance behaviour to individual tax evasion behaviour. In a comprehensive literature review on the use of ABM's to analyse tax evasion, Hokamp et al. (2018) list 60 publications from 32 different research groups (i.e. developed simulations) of agent-based simulations that focus on tax evasion published between 2000 and 2017. Reviewing these and 12 extra, previously unlisted, publications shows that none of them analyse both tax avoidance and evasion as distinct factors within the same environment. However, tax avoidance and tax evasion are interdependent. The intrinsic motivation to pay taxes, tax morale (Frey 1992; Luttmer and Singhal 2014), affects both tax avoidance and evasion and is also affected (crowded out) by government policy (Frey 1997) as well as subject to social norm-setting (Alm et al. 1999). The effect of tax avoidance on tax morale, in turn, affects tax evasion and vice versa. To give an example: if big corporations avoid taxation, this reduces the tax morale of individuals and will increase tax evasion. If individuals evade taxes, big corporations might feel less threatened by consumer sanctioning, when exposed as not paying their fair share of taxes. For this reason, this chapter argues that tax avoidance and tax evasion should be analysed within the same model.

The agent-based simulation model allows us to capture the tax ecosystem perspective because it allows taking into account the multitude of actors and interactions that are involved in tax policy reforms. In an influential book, Holland (1992) provides an example that resembles the problem of fighting tax evasion and avoidance. The author considers the immune system in which antibodies continuously combat ever-changing antigens. Given the ongoing evolution of antigens, the system is unable to list all the potential types and must adapt to relevant threats. The same evolutionary character can be recognized in the corporate structures used to avoid corporate income taxation.

The evolutionary character of the tax ecosystem is partly driven by governments changing their ways through implementing new policies, and through altering existing policies, to gain or retain tax revenues. Perpetrators, in turn, reorganize themselves into new corporate forms and permanent establishments to circumvent or use the policies at hand. A comprehensive analysis of the

tax-ecosystem should, therefore, include the heterogeneity and different intentions of the agents, their limited views of the environment and the evolutionary succession of the system's entireness.

While Chapter 2 gives an overview of different actor types and political drivers for change, this chapter goes one step deeper by providing psychologically and behavioural driven analysis of their compliance, as the following section will show.

14.4 The Theoretical Model

14.4.1 Tax Compliance Behaviour in the Economic Literature

The traditional economics of crime answer to increasing compliance is simple: more auditing and punishment will make people pay more taxes. Based on a rational choice approach in which the effect of punishment on the prevalence of crime is mathematically optimized (Becker 1968), Allingham and Sandmo (1972) developed and analysed a model focused on tax evasion, further called the AS-model. After changing the penalty base from undeclared income to evaded tax (Yitzhaki 1974), the model has strongly influenced subsequent literature even to date. Unfortunately, compared to empirical observations, the AS-model does not predict the observed level of tax compliance accurately (Dubin and Wilde 1987).

To explain this discrepancy, Alm et al. (1992) developed an experiment and concluded that to some extent, an extreme level of risk aversion could be the cause and suggested that compliance is justified based on a personal evaluation of the public goods consumed. In a footnote, the authors suggest that the psychological predisposition of taxpayers or tax morale also affects tax behaviour but it is left out given the focus on the role of public goods. This paper assumes that one's development of tax morale is a complex multi-directional process which affects the rationality of the decision making.

Several additions to the standard AS-model adopt an intrinsic tax morale and involve allocating different weights to the expected utilities of tax evasion, making evasion less profitable than the purely risk-based decision (Fortin et al. 2007; Gordon 1989; Kim 2003; Myles and Naylor 1996). In the same way, Traxler (2010) embedded an extrinsic ethical component, defending the bidirectional interaction between the individual tax identity and the associated social norm. Further exploring this interaction in terms of sympathy and empathy provides conflicting counter-intuitive results (Calvet and Alm 2014), which demonstrates the assumed complexity, and finding good proxies for such recondite factors is difficult.

Given the amount of effort invested in developing an expected utility model for tax evasion, why do the results remain questionable? According to Schoemaker (1982), rational models are flawed due to the non-rationality of people. People are

unable to interpret probabilities accurately, to comprehend the problem space fully, and not to be influenced by social norms and other contextual factors. But for well-structured repetitive tasks, optimizing expected utility models could have credible results, because long-term learning by the decision-maker converges towards the optimal choice. The author concludes that these models are worthwhile as long as no viable alternatives emerge. Have these alternatives emerged to date?

One alternative is using case studies, which provide relevant information on methods of corporate tax avoidance like transfer pricing (Asongu et al. 2019) or treaty shopping (Candau and Le Cacheux 2018) and the administrative tools of corporate tax evasion (Nawawi and Salin 2018). Some focus on specific concepts like corporate social responsibility (CSR) and review some organizations' response (Ylönen and Laine 2015). Others focus on the domestic policies of a specific country (Ceccato and Benson 2016; Courakis 2001; Dinis et al. 2017; Duncan 2019; Finér and Ylönen 2017; Fjeldstad and Semboja 2001; Mróz 2018; Stewart 2018). Case studies generally have too many details to generalize the findings effectively or suffer from limited numerical representation.

Reviewing the different methodological approaches to tax compliance makes clear that while expected utility models and experiments may provide useful indications on different aspects of tax evasion and avoidance, they capture far too little details to provide a comprehensive analysis of the effects of tax policy. Besides, these models are based on aggregated data and hence ignore individual differences among the population and potential unexpected behaviour that may emerge from new policies. While case study approaches include much more detail to explain non-compliant behaviour and policy responses, they often lack the power to be generalized into a useful prediction, given the few cases such studies contain due to the high costs for analysing each case. Tax evasion and avoidance cannot be captured in simple models and requires a more elaborate approach.

14.4.2 The Slippery Slope Framework

The slippery slope framework, as developed by Kirchler (2007) and Kirchler et al. (2008) suggests that not only economic but also psychological factors, determine tax compliance. An overview of the inconsistent empirical findings in the literature with regard to the economic factors income, tax rate, audit probability, and severity of fines is reported in Kirchler, Muehlbacher, Kastlunger, and Wahl (2010).

There is, on the one hand, the coercive power of the state as reflected in audit rates and punishment but also the persuasive power of the state (Alm 2007; Prinz et al. 2014) to convince its citizens about the usefulness of paid taxes.

Psychological factors like social norms or the perceived fairness with regard to the tax system and the authorities were identified as relevant influences

concerning tax honesty of citizens. Social norms relate to the acceptance of tax evasion among a relevant reference group, and a number of studies confirmed that perceived tax evasion among friends and colleagues is correlated with hypothetical, as well as, self-reported tax evasion (e.g. Bergman et al. 2005; Cullis and Lewis 1997; Webley et al. 2001).

The 'slippery slope framework' suggests two main determinants of tax compliance: trust in authorities and power of authorities. When both trust and power are low, taxpayers will evade taxes as much as they can. Increasing the power of authorities leads to forced compliance, whereas boosting trust results in enhanced voluntary compliance. Hence, high compliance can be accomplished either by pronounced trust in authorities or under conditions of the strong power of authorities, but the quality of cooperation differs. Reforms can result in more (or less) forced compliance or in more (or less) voluntary compliance. If the tax burden is perceived to be heavier than that of comparable others, compliance is to decrease.

Tyler (2006) and Kirchler (2007), claim that tax authorities can encourage compliance not only by enforcing it, e.g. using audits and penalties policies related to financial transparency, but also by fairness and quality of service, and other means of persuasion. The slippery slope framework typically presents the persuasive power as 'trust in authorities' (Kirchler et al. 2008; Prinz et al. 2014) but also the concept of 'legitimate power' is used (Hartl et al. 2015; Kastlunger et al. 2013). Fairness and quality of service are also considered to affect compliance (Braithwaite 2007), independently of coercive power.

As mentioned above, the slippery slope graph suggests two factors determining tax compliance, trust (or persuasive power) and enforcement power (or coercive power), but there are also interdependent factors involved. Social norms, in this framework, are said to be related to both power and trust. On the one hand, they affect the tax laws and the role given to authorities which directly influence power, and on the other hand, social norms may help to decrease or increase trust, depending on the message (Kirchler et al., 2008). Also, fines can in an antagonistic climate, be part of a 'cops and robbers'-game, whereas in a synergistic climate they may be perceived as adequate retribution for behaviour that harms the community. Thus, deterrence might be connected to both trust and power.

There is also an indirect mediation effect of both, trust on the relation between retributive justice and voluntary compliance, as well as power on the relation between retributive justice and enforced compliance. Thus, it might be possible to influence perceptions of trust and power by changing the prevailing impression of retributive justice (Kogler et al. 2015).

The slippery slope framework has been extensively tested in multiple experiments (Batrancea et al. 2019; Benk and Budak 2012; Kastlunger et al. 2013; Kogler et al. 2013; Kogler et al. 2015; Lisi 2012a; Muehlbacher et al. 2011; Wahl et al. 2010). In these studies, coercive power represents 'taxpayers' perception of tax

authorities' capacity to detect and sanction tax evasion' and 'persuasive power' or 'trust in the state' is defined as 'taxpayers' perception that tax authorities act benevolently and work for the common good'(Batrancea et al. 2019).

14.4.3 Modifications of the Slippery Slope Model for an International Tax System

The slippery slope model focusses on one country. Taxpayers comply or do not comply within their country, but they do not look for loopholes in the international tax system in order to evade or avoid paying taxes. The tax reforms we analyse, take place in an international context of tax competition between countries. Policy reforms of one country will affect compliance in neighbouring or other countries, since actors are connected through media reports on the internet, and interact in global (professional) networks.

In an open economy, where many forms of tax evasion and tax avoidance consist in finding loopholes between jurisdictions, the coercive power of the state deteriorates even when audit rates and fines stay constant. In a global setting where residents can circumvent national tax laws, the coercive power of the state will decline. Audits and punishment might become less effective.

Also, the persuasive power needs reinterpretation, because, e.g. lowering corporate tax rates may not be considered beneficial for the common good, while stopping companies from relocating or decreasing the competition between multinationals and local companies that have fewer abilities to avoid taxation may be perceived to support the common good.

The slippery slope framework consists of surveys and experiments, which concentrate on domestic tax compliance and do not assess the effects of other countries on tax compliance in the country of interest specifically. This spillover effect is only implicitly embedded in the answers of survey respondents. This has inspired the authors of this chapter to redefine the core concepts within an open economy in which policy spillover effects are included explicitly.

In an open economy, the coercive power of the state continues to focus on policy measures and policy enforcement, forcing compliance by threatening with audits and penalties and pushing for financial transparency and exposure. Nevertheless, if other countries compete with lower audits or fines, this might affect the coercive power of the state in question.

Also, the notion of the persuasive power of the state—the ability of the state to convince its residents that paying national taxes is a meaningful thing to do to contribute to the welfare of the country—needs reinterpretation in an international setting. Citizens' perception of 'meaningful state expenditures' will change when tax money by some of them can desert the country without the state being able to recuperate it.

This chapter, inspired by the slippery slope framework of Kirchler et al. (2008) and Kirchler and Wahl 2010), distinguishes the national/domestic components relevant for tax compliance (audit rates, fines, trust in the state, fairness, etc.) and the 'relative state power' which is the capacity of the state when compared to other states which might offer loopholes or more favourable tax conditions. Other states can influence compliance behaviour in a country. Therefore, we introduce the concept of 'relative state power', which is defined by the differences between national policies. The model in this chapter considers that the relative power relies mainly on policy advantages that a state can provide, through different tax policies[4] (tax havens) and different reporting requirements (secrecy havens). We assume that in an open global economy, tax compliance depends on the combination of the coercive and persuasive national power and of the relative international power of the state.

For example, governments try to attract corporations to establish themselves in the country they represent offering special deals, as known from literature on tax competition (Candau and Le Cacheux 2018; Devereux et al. 2008; McCarthy et al. 2008; Slemrod and Wilson 2009). Figure 14.1 shows our modified 'slippery slope'
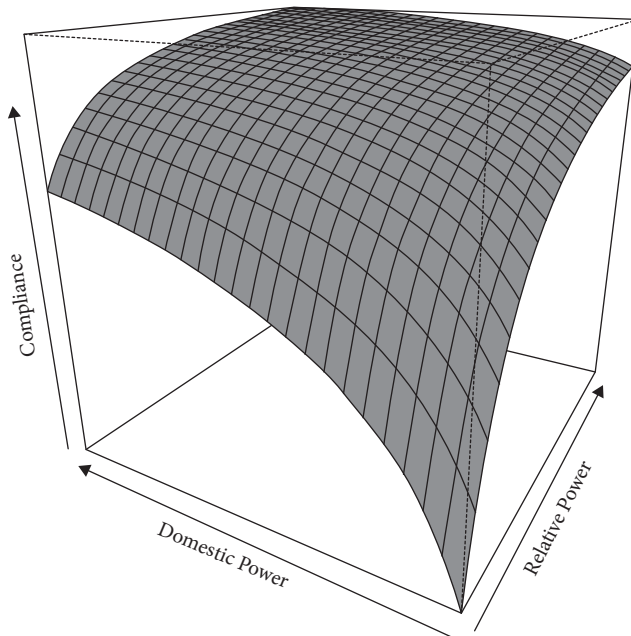

Figure 14.1 Theoretical model of tax compliance as a function of domestic and relative power of the state.

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[4] See (Bunn and Asen 2019) for a good overview of different advantageous tax policies.

model, where domestic power and spillover effects from other countries (relative power vis à vis other countries) determine tax compliance.

14.4.4 Developing the Theoretical Agent-Based Model

This agent-based simulation adopts the mathematical formalization of the slippery slope framework developed by Prinz et al. (2014) in which the perceived governments' coercive and persuasive powers and the observed environment affect the agent's compliance decision. Instead of focusing on trust or persuasive power and coercive power (as used in the works of Kirchler et al.), the open economy model presented here adopts domestic power and relative power and implements two more significant changes. First, the dichotomous difference between either evasion or compliance minded agents is converted into a continuous, linear scale defined by the degree of the agent's tax morale. Second, the network effect on which the agent responds is considered to be a local partial network that differs per agent, instead of a complete network representing the whole society. It is the local neighbourhood which influences tax morale and not the whole country or the overall European tax morale.

In our model, as said in the previous section, while the coercive power is based on audits and punishment, the persuasive power is based on trust in the state to provide adequate services to its residents, the relative power of the state as defined here is based on this ability to do so when compared to another state. An important indicator of 'service quality' is the level and inequality of income. For example, when two countries provide similar income and inequality levels, the country with a lower tax rate is considered to be more trustworthy and thus persuades its citizens to pay taxes locally. At the same time, a country with higher tax rates might still convince its citizens to pay taxes locally when the state's quality is much better even though the costs are somewhat higher. In an open economy where agents can reallocate their wealth freely, the quality of the state compared to others, i.e. the relative position influences the attitude towards tax compliance.

Changes in tax policy can change tax behaviour of those affected in unforeseen ways, and therefore it is difficult to assess the implications of the policy change. Within the literature on planned behaviour, Ajzen (1991) provides a framework that explains the origins of behavioural intent which eventually translates into the observed behaviour. The author defines three core components that determine the agent's intentions, which are the attitude towards the behaviour, subjective norms, and perceived behavioural control. Then, based on the perceived limitations of its behavioural control, true behaviour is enacted. In this agent-based simulation model, these core components are the government's ability to persuade the taxpayer to comply, the agent's tax morale and how others influence it, and finally the perceived ability of the state to coerce compliance respectively.
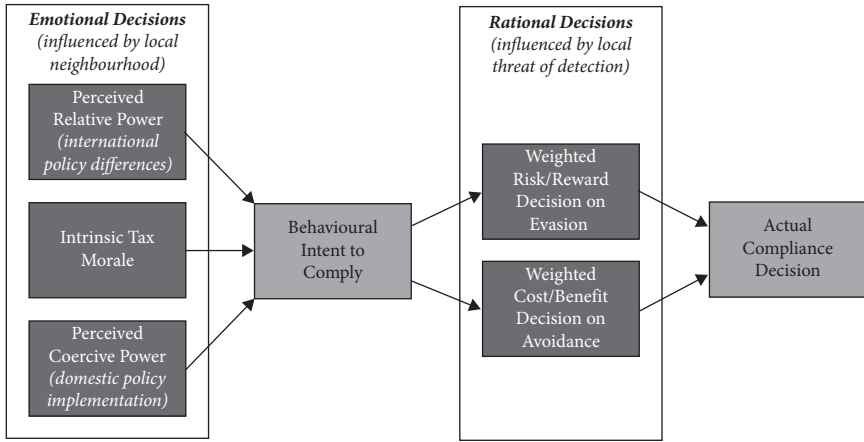
Figure 14.2 Conceptual framework for an agent's planned behaviour.
Source: Author-made.

Figure 14.2 shows how the agent-based model operates. All agents have an individually assigned intrinsic tax morale, which is more or less influenceable by their local neighbourhoods. Based on the tax policy regime of the home country, agents perceive the government's domestic power (p_d) of collecting taxes. Also, based on the differences between the country of origin and a potential target country, to which the avoidance or evasion stream could flow, the relative power of the home country (p_r) is perceived.

The behavioural intent to comply with respect to tax evasion (c_e) is defined as (for avoidance (c_a) α and β are replaced by δ and ε respectively):[5]

$$c_e = \max\left[1 - p_d^{-\alpha} \cdot p_r^{-\beta} \cdot s^{\eta}, 0\right].$$

The domestic and relative power of the state affect the agent's behavioural intent to comply (c) with the weights of α an β (which are a function of the tax morale) and by the compliance behaviour of its neighbours (s^{η}). These psychological, emotional or moral components of decision making, which determine the agent's behavioural intent to comply, are followed by a rational decision-making process. Each agent makes a personal rational decision regarding the payoff for evasion or avoidance. This depends on the risks of being detected versus the benefits of doing so. For tax evaders, it is the chance of being audited and punished. For tax avoiders, it is the costs involved in setting up tax avoidance schemes or the

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[5] For details on the specification of this equation, please refer to (Prinz, Muehlbacher, and Kirchler 2014).

implications of being publicly exposed. By comparing costs and benefits of compliance, tax avoidance and evasion, the agent acts.

The local neighbourhood affects the individual perception of agents. Strong differences between the perceived coercive and relative power affect one's tax morale (e.g. substituting voluntary compliance with forced compliance when the state has strong enforcement power, like audits and fines, while providing poor services). The outcome of the agent's decision-making process, in turn, affects the other agents' local perceptions.

The entire framework is implemented as an agent-based model in the NetLogo software (Wilensky 1999), using the belief-desire-intent (BDI) agents framework (Bratman 1987; Rao and Georgeff 1995). This allows agents to first observe their environment (with errors and a local view, for example, tax rates in the neighbouring country, compliance of the agent's closest to them, and whether enforcement activity takes place in their neighbourhood), learn from their experience (earlier audits), construct their belief system, after which they define their desires in that system (intention to comply), upon which they act (actual evasion and avoidance decision). Knowing the general concept of the agent's logic, coercive and relative power needs to be defined and operationalized.

14.4.5 How the Agent-Based Simulation Process Works

The model always works when comparing a home country to another foreign country. In short, after defining the source and target countries, the system sets up the environment variables (such as the tax system and all other initial values as shown in Table 14.1) after which the following simulation steps take place each period (year):

1. Agents observe their environment and determine their perceived domestic and relative power of the state. This can include special tax rulings, the provision of infrastructure and network opportunities for research and development or sales compared to another country, which are encoded through the financial secrecy and tax haven levels. Based on the results, their local neighbourhood and their intrinsic tax morale (or need for social responsibility due to shareholders or consumer pressures), agents set their behavioural intent to comply within this country.

2. Based on their intention to comply, the agents calculate their benefit of evading taxes using an updated weighted AS-model and the weighted utility for avoiding taxes, which are linked to the costs for implementing the tax scheme and the tax gain received by it.

3. The corporations choose whether to comply, evade or avoid, determine the amount associated to it, and report their taxes. Next, to simulate the

Table 14.1 Overview collected data points used in the model

Datapoint	Description
Country	Country name and ISO3 code, no measurement required.
Rule of law	To proxy the coercive power of the government, the 'rule-of-law' indicator from the World Bank is used (Kaufmann, Kraay, and Mastruzzi 2010).
Trust in authorities	To proxy the persuasive power of the government for which trust is associated as a good indicator, Transparency International's Corruption Perceptions Index is used (https://www.transparency.org/cpi2018).
Initial tax morale	Question V234 of the European Values Surveys of 2008 and 2017 (Gedeshi et al. 2016, 2019).asking about the justification of tax evasion practices. If no 2017 data is available, the 2008 data is used adjusted with the average change of all countries for which this data is available. The final score is rescaled from 0 (no morale) to 1 (full morale).
Financial secrecy level	Uses the 2018 secrecy score of the financial secrecy index reported per country by the Tax Justice Network. The score ranges from the theoretical minimum of 0 to a maximum of 100.
Maximum secrecy level	Represents the secrecy score in the case a country has no implementation of CbCR and AEoI.
AEoI implementation level	The AEoI level as implemented by the financial secrecy score (to compensate for the maximum level, higher scores refer to the lower level of policy implementation). In the simulation, the scale is reversed (higher level of implementation results in a higher score).
Corporate tax haven level	Uses the haven score as reported by the Tax Justice Network's Corporate Tax Haven Index 2019.
Maximum corporate tax haven level	Represents the tax haven score in the case a country has no implementation of CbCR and AEoI.
CbCR Implementation level	Uses the CbCR level as implemented by the corporate tax haven index. Just like the AEoI level, also here, the scale is reversed in the simulation model.
CbCR local access level	Uses the local filing of CbCR indicator as implemented by the corporate tax haven index 2019. Just like the AEoI level, also here, the scale is reversed in the simulation model.
Withholding tax rate	Calculates the average of the reported withholding tax rates for dividends, interest and royalty payments, per source (reported online by EY, KPMG, Deloitte and PWC). Finally, the total average is calculated.
FTE employed by tax authorities	Reports the number of full-time equivalents employed by the national tax authorities, Table 5.6 (OECD 2015).
FTE allocated to auditing activities	Reports the percentage of FTE allocated to tax auditing activities, as reported in Table D.4 (OECD 2019b).

Country population	Indicates the population count per square kilometre, retrieved from the UN's 2018 World Population (https://population.un.org/wpp/Download/Standard/Population/)
Population per allocated auditing FTE	Reporting resource ratio's in Table D.3 of (OECD 2019a), reporting the population per FTE.
Prescription time tax evasion	Prescription times for tax evasion as reported by (Rossel et al. 2019) in this book complemented with best practice information retrieved online for missing or unspecified values.
Expected audit rate	Assuming a maximum of 12 audits per year per FTE (as deemed reasonable by an expert on the Dutch tax authorities) this rate is calculated by the reciprocal of FTE allocated to auditing, multiplied by the population per FTE, multiplied by the prescription time.
Maximum imprisonment tax evasion	Maximum years in prison as reported by (Rossel et al. 2019) in this book complemented with information from Thomson Reuters Practical Law.[6]
Criminalization threshold for tax evasion	Threshold value after which criminalization occurs as reported by (Rossel et al. 2019) in this book. If not provided, the level is calculated using the prescription time and average income.
Average income level	From USD to EUR converted amounts of the national average income as reported by UNDP (http://hdr.undp.org/en/content/gni-capita-ppp-terms-constant-2011-ppp).
Income inequality level	Consists of the GINI index, retrieved from the WorldBank (https://data.worldbank.org/indicator/SI.POV.GINI).
Indicator for personal and corporate liability	An indicator that states if legal liability for tax evasion can be prosecuted At the personal or corporate level, or both, as reported by (Rossel et al. 2019) in this book.
Expected penalty rate for tax evasion	The expected penalty rate is calculated using the average income, maximum imprisonment, crime threshold and legal liability measures. For some countries, legal documentation was available that provided penalty rates.
Income level per tax bracket	For each country, the corporate income taxes are retrieved using the PwC Worldwide Tax Summaries (https://www.pwc.com/gx/en/services/tax/worldwide-tax-summaries.html) for which the income level and associated tax rate are collected.
Tax rate per tax bracket	For each country, the corporate income taxes are retrieved using the PwC Worldwide Tax Summaries (https://www.pwc.com/gx/en/services/tax/worldwide-tax-summaries.html) for which the income level and associated tax rate are collected.

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[6] https://uk.practicallaw.thomsonreuters.com

dynamic environment of a society, agents move in social space, changing their local environment by losing and creating connections with other agents. Similar agents tend to attract each other.

4. Based on the audit rate, tax enforcers select zero or more agents in their neighbourhood and will detect evasion if it took place (i.e. an audit will always reveal the truth), after which they penalize the perpetrators. By definition, tax avoidance is not illegal and thus cannot be prosecuted.

5. Finally, the corporations learn from their auditing experience, share new insights with their neighbourhood. They also respond to their auditing experience according to the 'bomb crater effect' (Kastlunger et al. 2009), where some significantly increase compliance after being audited while others completely decrease it. Finally, larger imbalances between the domestic and relative power cause an increase or decrease in the tax morale, similar to the differences between coercive and persuasive power (Kastlunger et al. 2013; Mas'ud, Manaf, and Saad 2014).

14.5 Data Collection

In order to operationalize domestic (coercive and persuasive) power and international relative power of the state and the environment for each of the 27 European member-states and some additional European countries (UK, Iceland, Liechtenstein, Norway, Switzerland), 26 variables are collected or calculated, shown in Table 14.1.

In order to measure the domestically determined and the internationally determined relative powers, defined in the previous section, data on the enforcement capacity of the state and their tax policies is collected. Given that the differences between countries' policies define the relative power, it uses the same data points but calculates the bilateral differences.

The first two variables of Table 14.1, the rule of law and trust in authorities, proxy the coercive and persuasive power respectively in the literature, see, e.g. Lisi (2012b) and Mas'ud et al. (2014). The initial tax morale provides the starting point after which the dynamics of the simulated system influence its development. As a starting point for tax morale, question v234 of two European Values Studies (Gedeshi et al. 2016, 2019) is rescaled (from 1–10 to 0–1) and used.

All other variables used to identify the underlying sources that construct these powers were inspired by the tax compliance literature, by policy reforms being discussed and by data available.

Country population is of importance because, in high density populations, the number of interactions among agents is typically higher. Hence agents get more input than in less dense countries. Finally, the average income level and income inequality level provide insight into the wealth distribution, which reflects the

agent's abilities and impacts when evading or avoiding taxes. The individual agent's income levels remain constant, based on GDP per capita (United Nations 2014) and the GINI measure of inequality (World Bank 2019).

In particular, variables that point at international tax competition and implementation of international tax regulations in the books and practice were added. Since we capture both tax avoidance and tax evasion in this model, also criminal punishment data were added for the latter.

Detailed analysis performed by the Tax Justice Network led to the development of the financial secrecy index (FSI),[7] which indicates to what extent countries contribute to tax evasion possibilities and obfuscate avoidance practices (Cobham et al. 2015) and the corporate tax haven index (CTHI),[8] focusing on preferential tax policies that tax avoidance schemes use (Tax Justice Network 2019 and Chapter 6). Policies that provide or remove veils of financial secrecy are collected and coded by the Tax Justice Network (2018) and used in the model's variable financial secrecy level.

In order to isolate the AEoI policy changes, the secrecy index is recalculated to the hypothetical situation in which no AEoI is available, the maximum secrecy level. The level of implementing AEoI is coded separately (AEoI implementation level) and offsets the maximum secrecy level. The same logic is applied to assess targeted corporate tax advantages (Tax Justice Network 2019), captured as the corporate tax haven level. Again, the policies of interest, CbCR implementation level and CbCR local access level are isolated to specifically assess their influence, leading to the maximum corporate tax haven level.

Besides the targeted policies, some other factors are used in the tax system, such as the use and height of the withholding tax rate and the income level per tax bracket, as well as the tax rate per tax bracket. The simulation considers both regressive and progressive CIT schemes but simplifies different withholding taxes to one average withholding tax rate. For foreign entities, the simulation uses the 'LACIT', the lowest possible tax rate developed by Tax Justice Network (Tax Justice Network 2019).

Little data is available about criminalization and enforcement policies. Based on legal analysis (Chapter 13) and reported resource allocation to tax auditing (OECD 2019b), an expected audit rate is calculated. In order to identify the enforcement capacity of the state, several different variables are used. Governments do not provide details on their enforcement policy since this may support tax evaders to find better ways to evade. An approximation of the probability to get audited is calculated using the FTE employed by tax authorities and FTE allocated to auditing together with the population, the population per allocated auditing FTE and defines the chance to get audited, the expected audit rate.

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[7] https://www.financialsecrecyindex.com/   [8] https://www.corporatetaxhavenindex.org/

Once caught, what are the consequences? If the penalties are low, then even when the probability of getting caught is high, the total risk for evasion remains limited. To measure the expected penalty rate for evasion, the legal study in this book is used (see Chapter 13). Based on the maximum imprisonment tax evasion, an indicator of the severity of punishment, and criminalization threshold for tax evasion which defines at what level tax evasion is considered a criminal offence, one can calculate the penalty. Using the average income level, one can proxy the personal losses for the time spent in prison. Finally, the indicator for personal and corporate liability identifies whether corporations can be charged, the management can be held responsible and if they can be accountable for both the corporate behaviour as their own behaviour (trialled twice for the same offence) which may strongly increase the penalty.

Besides the policy indicators, the perceived powers are also affected by the income inequality level of the state. For example, when the government has low power to enforce tax compliance, inequality should be higher.

14.6 Calibration of the Tax Policy Reform Model

In order to construct the baseline of the model that allows comparing the effects of different policy reforms, one first needs a well-calibrated agent-based model. Ideally, a well-calibrated agent-based model leads to consistently replicating known results, as is the case in, e.g. Franke and Westerhoff (2012). The problem with this policy simulation, though, is that estimation of the amounts of tax avoidance and evasion needed for calibration are still vague, as shown in Chapter 5, which is the main reason for developing this model in the first place. Therefore, the chosen alternative calibration process here uses known data from a Danish investigation on tax non-compliance, in combination with an arbitrary selection of a known tax haven, namely Ireland. The calibration is then validated using another pair of countries, namely an expected tax gap estimated in the United Kingdom, using Luxembourg as the tax haven of choice.

Based on a report (FISCALIS 2018) which provides clear information on the Danish situation in 2012, 80 per cent of the corporations demonstrate compliant behaviour. Half of the 20 per cent of non-compliant corporations are non-compliant by mistake. Together they account for a corporate income tax loss of approximately 20 per cent of the collected CIT. By running the simulation many times and altering different parameters (the calibration process), the configuration which simulates the expected behaviour most closely was retrieved.

The calibration shows that the costs associated with restructuring financial assets and corporate forms are, with 0.01 per cent of the transferred amount, considered negligible. The influence of the external local environment of an agent on its tax morale is expected to be around 52 per cent. This means that the average

tax morale of the neighbours is slightly more important than the agent's internal morale, which demonstrates the power of the local social environment. Since coercive power decreases voluntary compliance (i.e., tax morale) while the persuasive power increases it (Wahl, Kastlunger, and Kirchler 2010), our model calculates that the difference between the powers results in an overall effect, for which the maximum change is calibrated to be 10 per cent (so if the coercive power is highest, 7, and the relative power the lowest, 1, the new tax morale will be around 90 per cent of the old level).

With respect to the slippery slope framework as it is implemented in this model (Kirchler et al. 2008; Prinz et al. 2014), the domestic power of the government affects corporations with a near-zero tax morale to comply with the regulation (α-low = 0.15) and becomes much more relevant for those with a higher tax morale (α-high = 0.49). A similar effect applies to the relative power (β-low = 0.19 and β-high = 0.82), but this effect is much stronger. With respect to tax avoidance the domestic power starts much weaker (δ-low = 0.19, δ-high = 0.45) while the relative power is somewhat stronger (ε-low = 0.11, ε-high = 0.76). Compared to the perceived relative power of the state, the perceived domestic power has a stronger effect on low-morale agents but remains small as tax morale grows, the opposite is true for the perceived relative power.

After the model is calibrated, using a high-performance cluster computer, each possible scenario is executed six times, resulting in 61,440 simulations, of which the average result is used for further analysis. The simulation uses the first ten steps (years) as an initialization period for the simulation in which the agents create the 'memory' they need for learning the expected audit rate. Then, the simulation starts in 2004 and ends in 2034. The results for Denmark with respect to Ireland indicates a CIT loss of approximately 16.1 per cent (CI: 11.9–20.2 per cent) and on average a compliance rate of 81.3 per cent of corporations (CI: 77.5–85.1 per cent) in the year 2012, as shown in Figure 14.3. This means that the
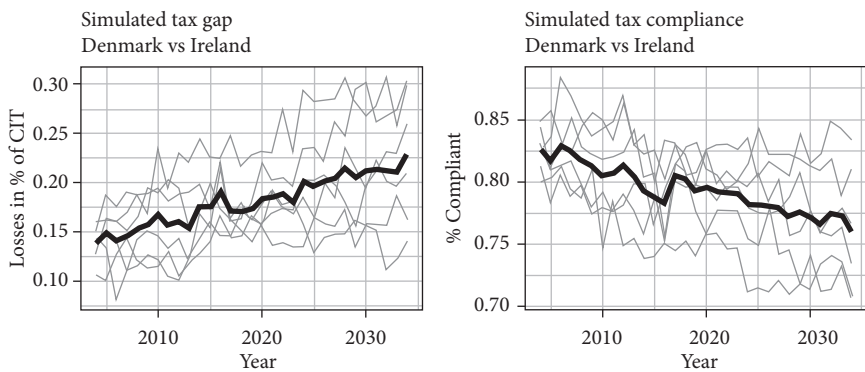

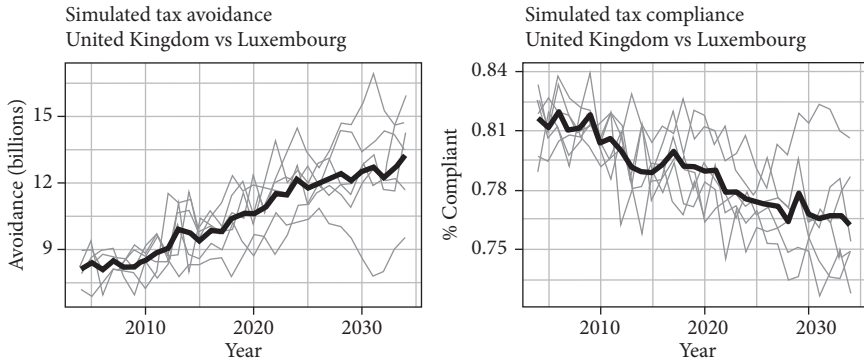**Figure 14.3** Simulation results of avoidance and compliance in Denmark.

Figure 14.4 Simulation results of avoidance (amount) and compliance in the United Kingdom.

calibration worked properly and the model predicts within the range that was found, approximately 20 per cent, in the earlier study (FISCALIS 2018).

Continuing the simulation under the current policies, clearly shows a decline in corporate compliance in Denmark, losing approximately 0.35 percentage points per year, increasing the total loss from 16.1 per cent in 2012 to 23.0 per cent of the collected CIT in 2034.

To validate the results, another country must yield proper results too. Therefore, using the breakdown on page 17 of the tax gap reported by HM Revenue & Customs (2019), the expected gap of 2017–18 should be £4.0 bn for business taxpayers' self-reported income tax and £5.2 bn. in corporation taxes, totalling to £9.2 bn. or €10.9 bn. This estimate comes close to the avoidance estimates of this simulation as depicted in Figure 14.4 (which are €9.7bn in 2017 and €10.4bn in 2018).

14.7 Simulation Results of Different Scenarios of Tax Policy Reforms

As already shown in the calibration and validation section, to define the impact of the different policies, the analysis is separated into five scenarios. The baseline scenario, in which the status quo is being simulated, thus the AEoI level, CbCR level, and CbCR local access policies as indexed by Tax Justice Network are used for both the source and target country. Also, no further change in these indices is implemented. This baseline scenario is compared to the 'Nothing' scenario, a counterfactual scenario that shows what would have happened if none of the policies had ever been implemented at all. Figure 14.5 shows the two scenarios to date, which visually indicate the effectiveness of the current policies. While tax avoidance seems to be little affected by the currently implemented policies, tax
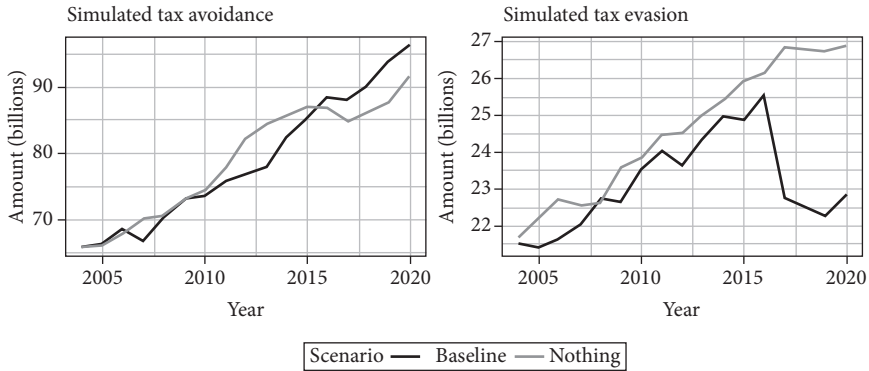
Figure 14.5 Comparing the baseline scenario with a counterfactual of no policies at all.

evasion practices seem to be significantly reduced. Nevertheless, tax evasion is higher in 2020 than in 2005.

Given that tax avoidance does not show an apparent change over time (left chart), the implementation of CbCR seems not very effective or the results have many caveat's and uncertainties (Hugger 2019; Overesch and Wolff 2017; De Simone and Olbert 2019) while AEoI appears effective (right chart) in fighting tax evasion showing a big drop after 2015 (Marchiori and Pierrard 2018 and Chapter 7). Reality might be more complex, CbCR and AEoI might have spillover effects, thus CbCR might influence tax evasion and AEoI might influence tax avoidance. Therefore, we simulate what would happen if we fully implement one policy while leaving the other unchanged.

The 'CbCR Full' and 'AEoI Full' scenario's test compliance behaviour in which the continuation of full implementation of one of the respective policies in all EU member states is simulated while the other policy remains unchanged. The 'Cancel Both' scenario depicts the case in which both policies are dropped. Finally, there is the 'Both Full' scenario in which both policies are fully implemented.

Figure 14.6 shows that CbCR has had a strong effect on both avoidance (left) and evasion (right) practices but only temporarily, which seems to be caused by a large drop in tax morale (see Figure 14.7). The implementation of AEoI seems to have affected tax evasion, but its effect remains quite unclear with respect to tax avoidance practices, which is explained by the fact that many countries already fully implemented the policy. Cancelling all policy actions, as of 2019, increases the expected corporate tax evasion and avoidance indicating that doing away with the policy reform would worsen the situation and that the policy reforms had some positive impact on tax compliance.

Looking at the results in numbers, for each of the scenarios, the total amounts of tax avoided and evaded are calculated for all European source countries and
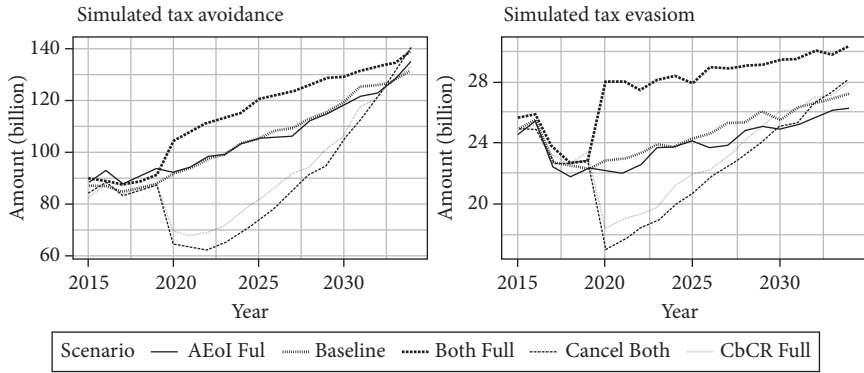
Simulated tax avoidance

Simulated tax evasiom

Scenario —— AEoI Ful ········ Baseline •••••• Both Full ------ Cancel Both ········ CbCR Full

Figure 14.6 Simulation results of total European CIT avoidance and evasion.

Simulated tax morale

Scenario

—— AEoI Full

········ Baseline

- - Both Full
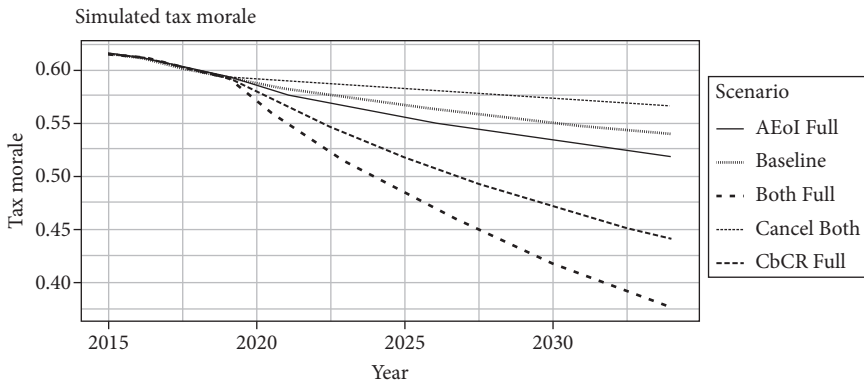
········ Cancel Both

---- CbCR Full

Figure 14.7 Development of tax morale due to policy implementations.

added together per destination (European countries only) to get the full extent of
the tax-losses due to avoidance and evasion combined within Europe, as provided
in billions of Euro in Table 14.2.

In the European context, the current estimate of tax non-compliance is
€104.9bn and is expected to rise with 29.5 per cent to €135.8bn ten years later,
ceteris paribus. Dropping the implemented policies leads to the largest increase in
revenue losses of 39.9 per cent, an annual extra 43.2 billion Euro. Any other
scenario, AEoI, CbCR, and both, results in lower total losses in 2029 compared to
the baseline scenario, but its long-term validity needs a closer look especially given
the steep decrease of tax morale (as shown in Figure 14.7).

If EU member states continue to implement the CbCR and AEoI policies
equally, they increase their domestic coercive and persuasive power, but their
relative power is not affected by these actions. Especially in the 'Both Full' scenario
in which all policies are implemented fully by all countries, this change affects the

Table 14.2 Overview of expected tax losses due to avoidance and evasion within Europe

Scenario	2009	2019	Diff.	2029	Diff.
Baseline	€90.9bn	€104.9bn	+15.4%	€135.8bn	+29.5%
Cancel both	€92.8bn	€108.4bn	+16.8%	€151.6bn	+39.9%
CbCR full	€87.9bn	€106.3bn	+20.9%	€121.2bn	+14.0%
AEoI full	€91.3bn	€110.5bn	+21.0%	€134.0bn	+21.3%
Both full	€90.8bn	€104.5bn	+15.1%	€113.5bn	+8.6%

tax morale to such an extent that both tax evasion and avoidance become more popular after the initial dip.

According to the simulation results, the AEoI policy seems the most promising in reducing tax evasion, but the policy will not be able to curb the CIT evasion and avoidance problem into decline. The reason is that the tax morale of agents declines. The domestic power of the state, which increases, is not compensated by an increase in relative power within EU countries since they did the same policy reform. Perhaps European countries will have to accept some increase of non-compliance in order to achieve a fairer distribution of tax revenues. (As long as there are differences with the rest of the world there might still be some effects not caught in the model.)

14.8 Simulation Results for Individual European Countries

The amounts of tax evasion and tax avoidance that are flowing from a source country into the destination country as a consequence of tax policy reforms (full CbCR implementation, full AEoI policy reforms, both reforms, or fictitiously cancelling them all) can be calculated by summarizing the agents' decisions to move revenues (legally or illegally) from the source country to the destination in order to identify which countries are the real secrecy jurisdictions and corporate tax havens in Europe.

For each country, Figure 14.8 shows on the horizontal axis how much taxes are avoided using that country, while the vertical axis shows the amount of taxes evaded. The known tax havens like Luxembourg, Switzerland, The Netherlands, and Ireland score high in receiving avoidance flows, but surprisingly Austria, Finland, and Belgium receive large flows too. From a CIT evasion perspective, Liechtenstein provides the best secrecy, but Norway, Denmark, and Sweden also receive many funds, possibly because the penalty rates are considered to be low compared to the other countries. The importance levels are calculated using a normalized scale of the total amount avoided and evaded, but the number of levels displayed in the legend is automatically determined and may differ between figures.
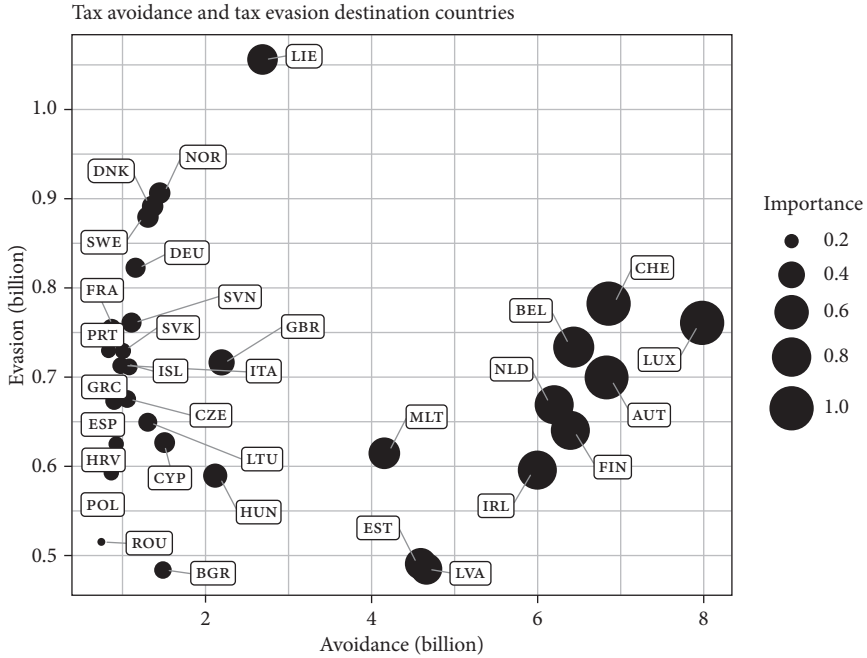
Tax avoidance and tax evasion destination countries

Figure 14.8 Simulated destinations for taxes avoided and evaded in 2019 in the baseline model.

Reversing the picture, looking at the countries where the biggest losses take place, leads to Figure 14.9, where the countries most affected by CIT loss due to tax avoidance are Spain, the UK, and Italy. France loses around €3.7bn per year due to tax evasion practices, but the UK, Spain, and Italy lose significant revenues caused by evasion as well.

Continuing the simulation from the status quo until 2029, without making any further changes in policies, leads to a strong increase of attractiveness for all existing tax and secrecy havens and thus a redistributive effect among countries will not take place. Figure 14.10 shows the sum of the amounts avoided and evaded per destination country and indicates that the distribution in 2029 resemble the current distribution indicating that no redistributive effect takes place.[9]

When comparing the incoming tax avoidance flows of the baseline scenario with the 'Both Full' scenario, meaning that AEoI and CbCR will be fully implemented by all countries, the same effect is observed: tax havens remain attractive, but as intended, the increase of tax avoidance between the two scenario's is reduced.

While the amounts are important to get a sense of urgency and the lost opportunities, a comparable view on the effects of specific policies is gained by

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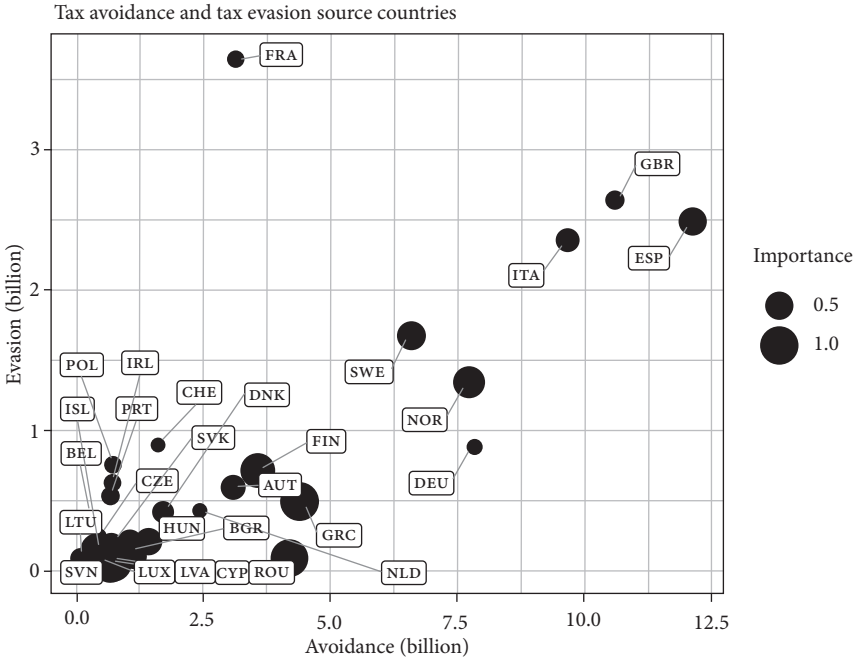[9] The Pearson's correlation coefficient is 0.997.

Tax avoidance and tax evasion source countries

Figure 14.9 Simulated sources for taxes avoided and evaded in 2019 in the baseline model.

Corporate tax and secrecy havens
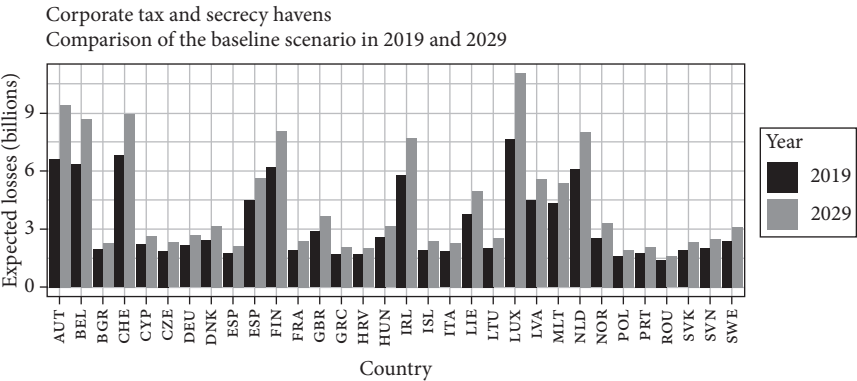Comparison of the baseline scenario in 2019 and 2029

Figure 14.10 Overview of current simulated tax and secrecy haven ranking 2019 and 2029.

rescaling the results into relative positions so that the differences between years (Figure 14.11) or scenarios (Figure 14.12) can be compared.

Figure 14.11 and Figure 14.12 show the position of all European countries as a destination for tax avoidance (horizontal axis) and tax evasion (vertical axis). The further to the right, or to the top, a country is positioned, the more taxes are
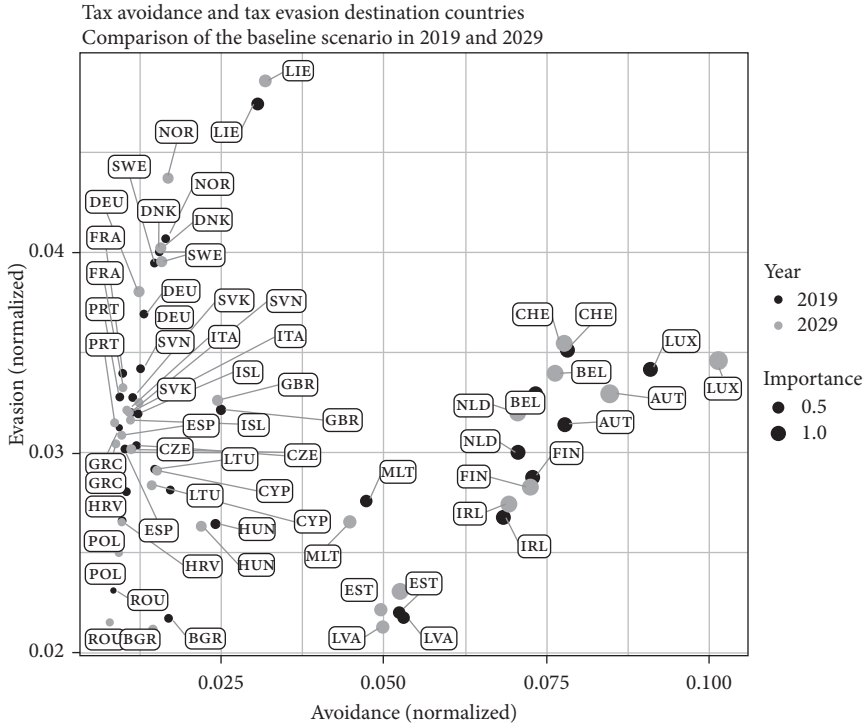
Tax avoidance and tax evasion destination countries
Comparison of the baseline scenario in 2019 and 2029

Figure 14.11 Temporal changes in the baseline scenario.

avoided or evaded due to that country. While in total the amounts of tax evasion and avoidance increase, it is clear that the relative positions of the tax destinations change little. Luxembourg, for example, becomes more attractive for tax avoidance while Norway strongly increases its evasion position (Figure 14.11). While the scenario in which both policies are fully implemented has the highest absolute impact, the relative impact per country seems to have little effect, i.e., the known tax havens remain the same (Figure 14.12).

By aggregating the average increase or decrease in the relative position for the top, middle and bottom evasion and avoidance flow receiving countries for each scenario compared to the baseline, an expected total change is calculated (see Table 14.3). Dropping all policies increases the position of the top ten tax havens while deteriorating the relative position of all others. Implementing CbCR or both CbCR and AEoI increases the position of both the middle and lower receivers, the latter scenario, 'Both Full', has the strongest effect. Only implementing AEoI helps the receivers in the middle but hurts the redistribution effect since the top ten is losing very little while the bottom ten loses a lot.

In Table 14.3, the first line reads that the most significant tax haven, Luxembourg, under the baseline scenario is the recipient for about 10.1 per cent
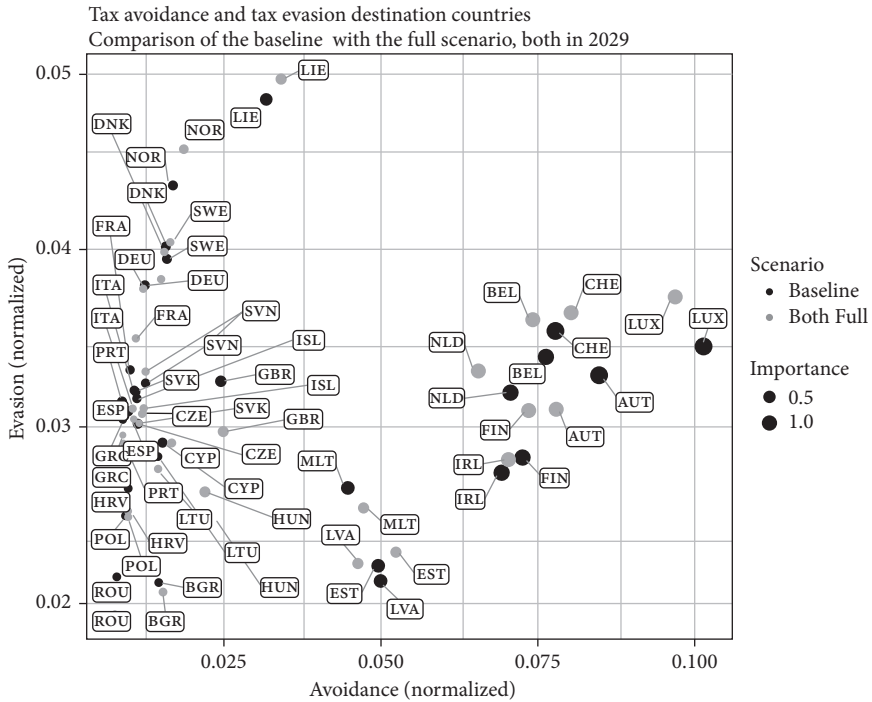
Tax avoidance and tax evasion destination countries
Comparison of the baseline with the full scenario, both in 2029

Figure 14.12 Changes between 'baseline' and 'both full' scenarios for 2029.

(second column) of all the outbound flows. The next two columns show that fully implementing CbCR decreases the position of Luxembourg to 9.9 per cent (which is a change of −2.0 per cent). By aggregating the change in receiving inflows for the current winners, middle, and losers (bottom four rows in Table 14.3) one can see that by fully implementing both scenarios, the highest increase for the losers is realized (0.311) and the current tax havens lose the most (−0.175). Figure 14.13 presents geographically the increase or decrease in relative position for European countries presented in Table 14.3 for the four alternative scenarios explored.

Countries that increase their relative position, i.e. the relative amount of inflowing avoidance and evasion streams, are marked darker, while those losing their position are lightly coloured. The shading is not linked to the monetary amounts (Table 14.2), but rather provides insight into the countries that, relative to all others, profit or lose the most. A geographical visualization of the differences between the baseline and all other scenario's is displayed in Figure 14.13, where the dark countries represent those who benefit most from the scenario and the lighter ones gain least or lose most.

As can be seen from Figure 14.13, where darker countries gain from the specific scenario and lighter countries suffer from these policy initiatives, for example,

Table 14.3 Scenario comparison of normalized tax avoidance flows

Target Country	Baseline	Cancel Both		CbCR Full		AEoI Full		Both Full	
Luxembourg	0.101	0.101	0.000	0.099	−0.020	0.105	0.040	0.097	−0.040
Austria	0.085	0.077	−0.094	0.081	−0.047	0.081	−0.047	0.078	−0.082
Switzerland	0.078	0.077	−0.013	0.080	0.026	0.078	0.000	0.080	0.026
Belgium	0.076	0.076	0.000	0.076	0.000	0.074	−0.026	0.074	−0.026
Finland	0.073	0.078	0.068	0.071	−0.027	0.073	0.000	0.074	0.014
Netherlands	0.071	0.073	0.028	0.071	0.000	0.071	0.000	0.065	−0.085
Ireland	0.069	0.069	0.000	0.066	−0.043	0.068	−0.014	0.070	0.014
Estonia	0.050	0.053	0.060	0.053	0.060	0.055	0.100	0.052	0.040
Latvia	0.050	0.048	−0.040	0.047	−0.060	0.046	−0.080	0.046	−0.080
Malta	0.045	0.047	0.044	0.044	−0.022	0.046	0.022	0.047	0.044
Liechtenstein	0.032	0.031	−0.031	0.034	0.063	0.031	−0.031	0.034	0.063
United Kingdom	0.024	0.025	0.042	0.026	0.083	0.024	0.000	0.025	0.042
Hungary	0.022	0.023	0.045	0.023	0.045	0.022	0.000	0.023	0.045
Norway	0.017	0.017	0.000	0.018	0.059	0.016	−0.059	0.019	0.118
Denmark	0.016	0.015	−0.063	0.015	−0.063	0.015	−0.063	0.015	−0.063
Sweden	0.016	0.014	−0.125	0.016	0.000	0.015	−0.063	0.016	0.000
Bulgaria	0.015	0.013	−0.133	0.015	0.000	0.016	0.067	0.015	0.000
Cyprus	0.015	0.016	0.067	0.016	0.067	0.015	0.000	0.017	0.133
Lithuania	0.014	0.014	0.000	0.013	−0.071	0.015	0.071	0.014	0.000
Germany	0.012	0.011	−0.083	0.012	0.000	0.012	0.000	0.012	0.000
Slovenia	0.012	0.013	0.083	0.013	0.083	0.013	0.083	0.012	0.000
Czechia	0.011	0.011	0.000	0.011	0.000	0.012	0.091	0.012	0.091
Iceland	0.011	0.011	0.000	0.013	0.182	0.012	0.091	0.012	0.091
Italy	0.011	0.010	−0.091	0.011	0.000	0.011	0.000	0.010	−0.091
Slovakia	0.011	0.011	0.000	0.011	0.000	0.011	0.000	0.011	0.000
Croatia	0.010	0.009	−0.100	0.009	−0.100	0.009	−0.100	0.010	0.000
France	0.010	0.010	0.000	0.011	0.100	0.010	0.000	0.011	0.100
Spain	0.010	0.010	0.000	0.010	0.000	0.010	0.000	0.011	0.100

Greece	0.009	0.008	−0.111	0.009	0.000	0.009	0.000	0.000
Poland	0.009	0.009	0.000	0.010	0.111	0.009	0.000	0.111
Portugal	0.009	0.008	−0.111	0.009	0.000	0.009	0.000	0.000
Romania	0.008	0.008	0.000	0.007	−0.125	0.007	−0.125	0.000
Change winners			*0.054*		*−0.134*		*−0.006*	*−0.175*
Change middle			*−0.198*		*0.266*		*0.097*	*0.429*
Change losers			*−0.413*		*0.168*		*−0.134*	*0.311*
Total change			*−0.557*		*0.300*		*−0.043*	*0.566*

(additional columns shown with values 0.009/0.009/0.009/0.008, 0.010/0.009/0.010, 0.009/0.009/0.009, 0.008/0.008/0.008)

Cancel Both Scenario

CbCR Full Scenario
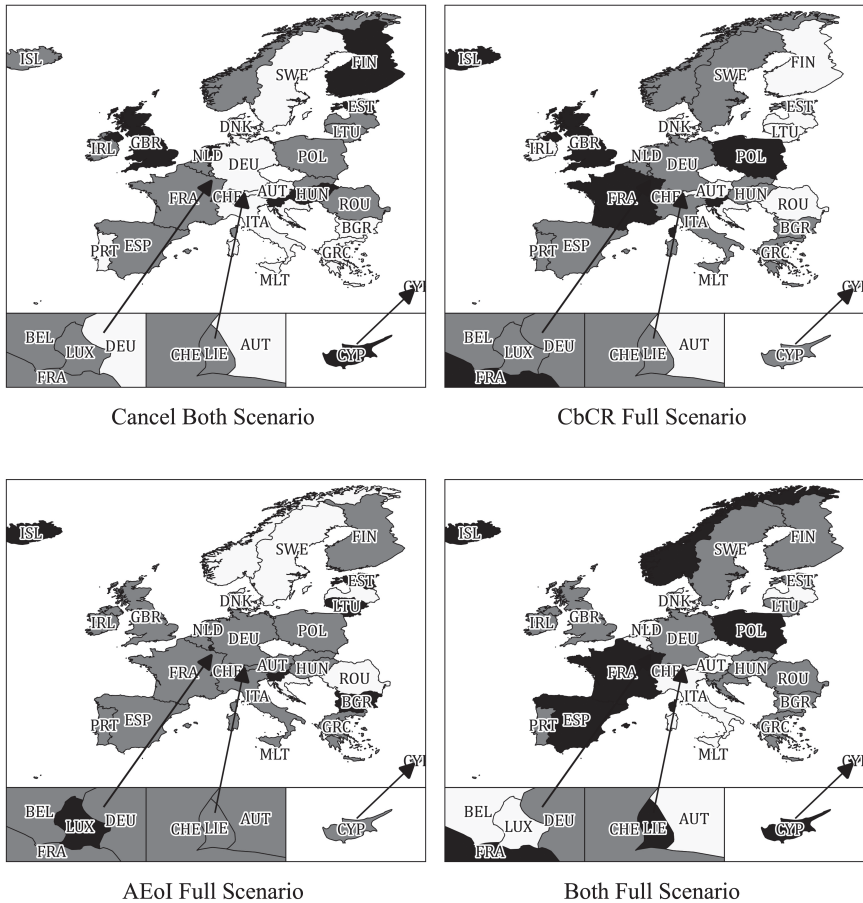
AEoI Full Scenario

Both Full Scenario

Figure 14.13 Comparison of relative impacted winners (dark) and losers (light) per scenario.

shows that fully implementing both CbCR and AEoI (bottom right) supports Norway, Poland, France, and Spain, increase their incoming foreign flows, but also that of Liechtenstein and Cyprus. On the other hand, Austria, Luxembourg, The Netherlands, and Belgium loose foreign flows relative to their previous position. The United Kingdom would have profited from stopping both scenarios after 2019 or implementing only CbCR,

14.9 Conclusion and Future Research Needed

This chapter provides a model that allows evaluating tax policy reforms. It first reviews some of the difficulties in assessing the effectiveness of tax policy

implementation and provides an alternative approach based on the psychological foundations of tax compliance, a redefined slippery slope framework for an international tax regime. Within the concept of a tax ecosystem, a self-organizing complex system, the chapter describes and applies an agent-based simulation. Afterwards, the simulation tests the effect of both country-by-country reporting and automatic exchange of information on corporate tax avoidance and evasion within all EU member states and five more European countries.

The model estimates that without new developments corporate tax avoidance schemes will increase the CIT losses from €104.9 to €135.8 billion, while fully implementing both Country-by-Country Reporting and Automatic Exchange of Information is expected to decrease the total CIT losses with 16.4 per cent (resulting in €113.5 billion in 2029 instead). So, policy reforms were better than doing nothing but were not able to reverse non-compliance.

While both AEoI and CbCR do have intended effects of reducing tax avoidance and tax evasion, they did not manage to turn around the trend of increasing avoidance and evasion. Tax avoidance and tax evasion increased less than without reforms. However, overall tax compliance did not increase. This is because these reforms had negative effects on tax morale. This means that additional policies must be added which do not allow for loopholes to escape taxation. Tax avoidance must be perceived as tackled in order to affect tax evaders' moral positively.

The power of this agent-based model lies in its ability to deal with a complex adaptive system, and to apply a model of planned behaviour to virtually test and predict policy effects. Also, the model allows relating publicly available data, e.g. the government revenue dataset of the UNU Wider project (ICTD/UNU-WIDER 2017) to estimations of the associated tax gap.

The model shows the larger effect of implementing Country-by-Country Reporting compared to AEoI, which contrasts with current literature. A possible explanation for this result is the extensive effect policies have on the development of tax morale. In our model, corporations and (wealthy) individuals are treated both as agents, treating individuals and companies as interchangeable. At the same time, the effect of CbCR on the tax morale of all taxpayers might be underestimated in the current literature.

This model is the first one to jointly include tax avoidance and tax evasion. Future research may benefit from a model in which different agents represent corporations and individuals with ties between them, where the corporate behaviour would depend indirectly on the management's joint tax morale. Another potential factor that may alter the results is the hidden development of the perceived coercive and relative power of the government, e.g. the insignificant coefficients (large variance) for the level of AEoI. Therefore separating the coercive power in a truly coercive power and a legitimate power as done by Hartl et al. (2015) may provide additional insight.

Although the current CbCR policy does not show a strong effect to date on corporate tax avoidance, its power to affect the tax morale is of key importance for the long-term development of non-compliance. Also, the effect of AEoI would not have been as large if CbCR was not implemented as well. Therefore, it concludes that the series of policy changes combined is of critical importance in a complex adaptive system.

Perceived from a bilateral stance, this agent-based simulation model will be useful and can be extended for policymakers to assess the effectiveness of a potential policy change and can thus determine the best response to counter the spillover effect due to tax competition.

Some of the results are surprising, such as the relatively high position of Norway as a secrecy jurisdiction and Finland as a tax haven. The most likely explanation for this phenomenon is the fact that the simulation only includes two countries at a time. Additionally, in terms of Garcia-Bernardo et al. (2017), this model only recognizes tax evasion and avoidance end-points, the so-called 'sinks', while 'conduit' countries remain missing. An extension of this model in which agents may compare and choose from multiple countries, multiple times, could, therefore, be of interest, especially when pathways via multiple jurisdictions can be formed. Also, more complex corporate structures could be introduced.

14.10 Acknowledgements

14.11 References

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