Essays on the Fight against Offshore Tax Evasion

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Tim B. M. Stolper

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Referent: Prof. Dr. Kai A. Konrad
Korreferentin: Prof. Dr. Monika Schnitzer

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Introduction

By the end of 2013, private households worldwide held financial assets worth about US $8 trillion in offshore financial centers, where strict banking secrecy laws and other opaque regulations help to conceal information on who owns these funds and what income they generate.[1] This secretive environment induces many owners of offshore accounts to evade taxation in their home countries, which earned such financial centers the name of tax havens.[2] The associated evasion is estimated to reduce government revenues worldwide by around US $200 billion every year (Zucman 2014, p. 141f).

Given the sizeable losses in tax revenues, recent years have witnessed a variety of initiatives at the highest levels of national and international politics in an attempt to fight offshore tax evasion. Among others, these have included reduced penalties for tax evaders who voluntarily disclose their offshore assets,[3] an anonymous withholding tax on interest income of non-residents,[4] acquisitions of stolen customer files from banks in tax havens,[5] criminal prosecutions of financial institutions assisting with offshore tax evasion, [6]

[1] Zucman (2014, p. 139) estimates the private financial wealth held offshore by the end of 2013 at US $7.6 trillion or, equivalently, at 8% of the global private financial wealth. The Boston Consulting Group (BCG, 2014, p. 9f) puts that number at US $8.9 trillion.

[2] For example, Zucman (2014, online appendix) estimates that, by the end of 2013, 80% of the European-owned funds in Switzerland were not taxed. A report by the US Senate (2014, p. 61) estimates that, until 2008, between 85 to 95% of the US-linked accounts with Credit Suisse in Switzerland had been undeclared to US authorities.

[3] For an overview of voluntary disclosure programs in OECD countries and a study on how they affect offshore tax evasion and tax revenues net of administrative costs, see Langenmayr (2015).

[4] Since 2005 pursuant to the European Savings Directive, EU and participating third countries provide mutual assistance in taxing their residents' interest incomes derived in countries other than the respective residence country. The countries either exchange information on that income or impose an anonymous withholding tax and pass on most of the tax revenue to the residence country. For more information on the Savings Directive and an analysis of its impact on deposits in Switzerland, see Johannesen (2014).

[5] In 2006, for the first time, German tax authorities acquired stolen banking data to identify the owners of secret accounts at LGT Bank in Liechtenstein. The data was extracted by a former computer technician at the bank, Heinrich Kieber. Many more similar data leaks were to come, which were acquired by Germany and also other countries. For more information and an analysis of how such leaks affected offshore tax evasion, see Chapter 2.

[6] Most prominently, starting in 2007, the US Department of Justice prosecuted UBS, Credit Suisse, and further predominantly Swiss banks as part of its Offshore Compliance Initiative. See https://www.justice.gov/tax/offshore-compliance-initiative (last accessed on 15 February 2017).

a program to resolve the potential criminal liability of tax haven banks which disclose their cross-border activities,[7] and new international agreements on the exchange of financial account information for tax purposes –on request [8] as well as automatically.[9] The level of tax compliance in offshore financial centers increased throughout these initiatives, but empirical evidence suggests that it remains on a low level.[10]

This dissertation addresses the optimal design of policies to fight offshore tax evasion. In the first chapter, it studies the strategic interactions of the decisions of a haven country whether to operate as a secretive tax haven or to comply with international standards of transparency and of many individual investors whether to be tax compliant or to conceal wealth in this country. It also analyzes how these decisions are influenced by external policy parameters. In the subsequent two chapters, the dissertation provides empirical evidence examining the effects of two recent policy initiatives in the fight against offshore tax evasion –the automatic exchange of financial account information and the acquisitions of stolen customer files from banks in tax havens.

Chapter 1 studies the compliance decisions of a haven country and its potential investors. For the haven country, operating a secrecy regime comes at the cost of international pressure imposed by high-tax countries. On the other hand, operating a secrecy regime also generates benefits as it can attract large amounts of international capital, which creates private gains in the financial sector that manages the attracted wealth and ultimately also generates tax revenues. The benefits from being a tax haven are larger if more wealth is attracted by the secrecy regime. The amount of capital deposited in the haven country depends, in turn, on the decisions of many individual investors. For them, concealing funds in the tax haven has the advantage of bypassing taxation in their home countries, but may trigger severe penalties if the tax evasion is exposed should the haven country choose to cooperate and exchange information with foreign tax authorities.

The analysis identifies the decisions of a haven country and the set of its potential investors as well as the decisions of the many individual investors to be strategic complements. These complementarities create a coordination problem and support multiple equilibria –a successful coordination may have large amounts of wealth held offshore, which makes the tax haven regime profitable and resilient against international pressure, and induces each investor to conceal capital in the haven country; while a coordination failure may cause no or small offshore deposits, tax transparency, and no evasion. Whether

[7] After several Swiss banks had been investigated individually, the US Department of Justice announced the Swiss Bank Program in 2013. It allowed Swiss banks not already under investigation to resolve their potential criminal liability if, among others, they fully disclosed their US cross-border activities and paid appropriate penalties. See https://www.justice.gov/tax/swiss-bank-program (last accessed on 15 February 2017).

[8] At their summit in April 2009, the G20 countries strongarmed all haven countries to adopt an exchange of information for tax purposes in cases with reasonable grounds to suspect tax non-compliance. For more information on the information exchange on request and a study on its impact on deposits in tax havens, see Johannesen and Zucman (2014).

[9] Financial account information is automatically provided to the US under the Foreign Account Tax Compliance Act (FATCA) as amended in 2010 and to other countries under the Convention on Mutual Assistance in Tax Matters as amended in 2014. For more information on the latter and an analysis how it affected offshore tax evasion, see Chapter 3.

[10] Johannesen and Zucman (2014, p. 87ff) and Zucman (2014, online appendix) report that the compliance rate among European holders of Swiss bank accounts has increased since 2006, but remains low at around 20%.

or not the fight against tax havens will be successful is determined in a many-player coordination game.

In order to assess which coordination outcome will prevail, the study applies a standard equilibrium selection argument from the *global games* literature. The equilibrium selection reflects the informational setting in the environment of offshore tax evasion and derives a unique outcome prediction depending on the amount of international pressure on tax havens. A haven country and its potential investors will coordinate on an active tax haven business if and only if the international pressure creates costs below an equilibrium threshold. If the pressure exceeds that threshold, the equilibrium predicts tax transparency and no evasion. Notably, the cost threshold is smaller than the potential earnings from the tax haven business. Above the threshold, a tax haven business would need to attract large amounts of wealth to still be profitable, which makes it considerably risky for each individual investor to conceal capital therein. Therefore, in equilibrium, every investor abstains from offshore tax evasion and the haven country complies with international standards of transparency. That is, sufficiently strong international pressure will induce tax transparency even though the costs it generates may still be small relative to the gains of a tax haven.

Furthermore, the equilibrium cost threshold depends on several policy parameters, which has implications as to which conditions facilitate and which conditions impede a coordination failure for more tax transparency. For example, the analysis points out a trade-off between the fight against tax havens and a high level of taxation, as high taxes give investors a strong incentive to evade taxation. For a similar reason, tax havens can withstand fierce pressure if the penalties for revealed offshore tax evasion are low. Finally, the tax haven business is most robust if the fees for concealment services in the haven country are priced below the tax rate in high-tax countries to attract investors, but also larger than zero to make the haven country resilient against political pressure from abroad. This may explain why the profits of tax havens are not competed away in international financial markets.[11]

The following two chapters provide empirical evidence on the effects of two recent policy initiatives against offshore tax evasion. As the concealment activities make it inherently difficult to observe tax evasion, the analyses rely on an indirect measure of tax evasion – they apply standard *event studies* to identify abnormal returns in the stock prices of Swiss banks. They have been subject to strict banking secrecy regulations and many of them were identified by the US Department of Justice to have assisted foreign clients with offshore tax evasion. These banks have attracted many international customers, the majority of whom are suspected to evade taxation, and the service and transaction fees from managing their wealth enter into the banks' profits.[12] The underlying reason to

[11] The summary of Chapter 1 may in parts resemble Konrad and Stolper (2016b), which also summarizes the chapter.

[12] Zucman (2014, Table S.1 and online appendix) estimates the foreign-owned wealth held in Switzerland by the end of 2013 at US $2.4 trillion, of which he suspects 80% were not taxed.

study stock prices is that they reflect the net present value of expected future profits. If a new policy initiative reduces the extent of offshore tax evasion, this will also most likely reduce the market for evasion-related banking services, and be immediately reflected by a decrease in the banks'stock prices.

Chapter 2 addresses incidents when foreign tax authorities acquired stolen customer files from (former) employees of banks in tax havens, or when such information was leaked to public media. The first data leak of this kind occurred at LGT Bank in Liechtenstein and reached public awareness on 14 February 2008 when the premises of Klaus Zumwinkel, at that time chief executive of Deutsche Post, were raided on charges of tax evasion. The leak caused a significant drop in the stock prices of Swiss banks with a known link to offshore tax evasion. The drop varied systematically across the banks and was as large as 6% for those banks most strongly involved with foreign tax evaders. Other Swiss banks with no identified link to offshore tax evasion experienced no such reduction in their market values. The study also reports weak signs of negative stock market responses to subsequent data leaks, but the effects were relatively modest in size and typically not statistically significant at conventional levels.

The results suggest that financial markets expected the data leak from LGT Bank to reduce the future profits of Swiss banks. As tax evasion in haven banks had never previously been exposed by data leaks, the most plausible interpretation is that the first leak increased the perceived risk of involuntary exposure and contracted the market for tax non-compliant banking services. Subsequent data leaks seemingly induced no more significant updating of the beliefs about the detection risk. A back-of-the-envelope calculation suggests that the deterrence effect of the first leak might have reduced the hidden wealth in Switzerland by around 10%. Moreover, this drop in the amount of offshore wealth in Swiss banks is also supported in international investment statistics by the Bank for International Settlements on foreign-owned bank deposits in all tax havens.

Furthermore, this study is the first to provide empirical support that whistleblowing can deter criminal behavior. Whistleblowing has become increasingly important and, for example, is reported to be the prime mechanism to detect corporate fraud.[13] Therefore, implications of the results may extend beyond the application of offshore tax evasion.

Chapter 3 addresses the automatic exchange of financial account information. For decades, the Swiss banking secrecy was renowned for concealing information on who owns the wealth in Swiss banks and what income they generate from it. As of 2018, Switzerland will exchange information about its banks'foreign customers and their financial accounts with the respective home countries on an automatic basis.[14] The analysis tracks the transition from banking secrecy into tax transparency by systematically searching the front

[13] A survey by the Association of Certified Fraud Examiners finds that around 40% of the detected corporate fraud causes were identified based on tips from whistleblowers. See "Corporate crime: The age of whistleblower," *The Economist*, 5 December 2015.

[14] The analysis studies the automatic exchange of information pursuant to the Convention on Mutual Assistance in Tax Matters as developed by the OECD and which, by the time of writing, more than 100 countries had committed to

pages of a leading Swiss newspaper, Neue Zürcher Zeitung. Any major change to the banking secrecy that has the potential to systematically affect the banks'stock prices is expected to be reported on the front pages of Swiss newspapers. The main focus of the study is the date when Switzerland committed to implement the new information exchange. Furthermore, it also addresses a set of events that can be considered particularly important and might have changed financial markets expectations. None of the events triggered significant or sizeable responses in the stock prices of Swiss banks, neither in the full sample nor for the banks most strongly involved in offshore tax evasion. The minimum detectable effect sizes are moderately sized and well below the estimates for the data leak from LGT Bank. This suggests that the null results are not a consequence of low statistical power, but rather due to a lack of effect. Finally, the study estimates the stock price reactions of Swiss banks to every front page article mentioning the automatic exchange of information. Only two articles were followed by a sizeable abnormal drop in the stock prices. However, the exact timing of the decline in stock prices and the similarity to the abnormal performance of the Swiss Market Index, a major index for the entire Swiss stock market, suggest that the stock price drops might have been driven by factors other than the new tax transparency.

The results are suggestive that financial markets expected the automatic exchange of financial account information to have no significant impact on Swiss banks'future profits. While it is possible that previously tax non-compliant accounts became compliant and remained with the banks, it seems unlikely that a significant increase in the level of tax compliance would have no impact on the banks'future earnings. A more plausible explanation for the results is that the new transparency standard might not have significantly increased tax compliance among the owners of offshore accounts. In fact, loopholes in the new information exchange, which allow tax evaders to keep their wealth with Swiss banks and still remain anonymous to their home tax authorities, already feature prominently in the media and are said to have attracted large sums of capital.[15]

implement. The US exchanges financial account information on an automatic basis pursuant to the Foreign Account Tax Compliance Act, which is not a subject of the analysis.

[15] One such loophole that is said to have attracted large amounts of capital is described in "Financial transparency: The biggest loophole of all," *The Economist*, 20 February 2016.

1

Coordination and the fight against tax havens

This chapter is based on joint work with Kai A. Konrad.[1]

1.1 Introduction

Offshore tax evasion poses a serious challenge to countries all over the world. Zucman (2013) estimates that households hold financial assets worth US $5.9 trillion through tax havens, or equivalently 8% of their global net financial wealth, most of which is believed to go unrecorded.[2] Various countries and supranational organizations, such as the OECD, have launched several initiatives against tax havens, effectively making it more costly for a country or jurisdiction to offer tax sheltering opportunities. This process, sometimes referred to as the *fight against tax havens*, has partially succeeded. Some countries chose to become compliant and have abandoned their tax sheltering practices, while others have resisted and remain active as tax havens. For observers it is difficult to understand why and when haven countries change their attitudes.

With regard to tax evasion by private investors, the term tax haven is primarily used for countries with no or only nominal taxation and strict secrecy rules that enable foreign investors to conceal capital and capital income from the tax authorities in their respective home countries.[3] As one of the most prominent players, the OECD strives for an inter-

[1] See Konrad and Stolper (2016).

[2] The total wealth hidden in tax havens is likely to be even higher because Zucman's (2013) estimate does not include non-financial wealth, such as art or real estate, and accounts for the year 2008 when global stock markets were low. A detailed industry report estimates the private offshore wealth for the same year at US $6.7 trillion (The Boston Consulting Group (BCG) 2009, p. 30). The corresponding estimate for 2015 is US $9.8 trillion (The Boston Consulting Group (BCG) 2016, p. 11).

[3] The OECD report on harmful tax competition (Organisation for Economic Co-operation and Development (OECD) 1998, pp. 21–25) presents a number of factors to identify tax havens. One of these are no or only nominal taxes combined with laws or administrative practices that prevent an effective exchange of information for tax purposes.

national exchange of tax information and exerts political pressure on all non-cooperative jurisdictions. The pressure has included blacklisting and the threat of economic sanctions, and peaked at the G20 summit in April 2009.[4] In response, many haven countries agreed to an exchange of tax information on request. Other haven countries, however, either refused to enter such treaties, or signed them but did not implement them effectively.[5] A thorough understanding of why and when a haven country adapts to the international standard of transparency, and when it does not, is important for taking the next steps to an effective automatic exchange of tax information.

This chapter develops an equilibrium framework for the decision of a haven country as to whether to operate as a tax haven or to adopt a transparency regime. In our formal framework, a single haven country may provide a secrecy regime in which investors can hide otherwise taxable capital from their respective residence countries. The investors decide individually whether to use the concealment opportunity or to face full taxation in their residence country. A capital-concealing investor must pay a fee for the wealth management in the tax haven, and the haven country benefits from this economic activity, e.g. by taxing the financial sector. Even though the fee and the government revenue are related more indirectly (see Schoen 2005) we treat them as equal in size. For each investor, the fee may be a small percentage of the funds sheltered but, given the large sums of capital that can be concealed by a haven country, even very small fees can add up to large earnings and can make the tax haven business very attractive. However, the provision of a secrecy regime creates not only benefits but also some political cost. It originates from international pressure that involves economic sanctions, forgone beneficial treaties or the potential loss in business reputation for being blacklisted as a tax haven. While most of our analysis focuses on a single haven country, we also discuss competition between haven countries and the robustness of our results to the presence of multiple tax havens.

We focus on the role of coordination among individual investors, and the role of coordination between a haven country and the set of its potential investors. We note that beliefs are of key importance in this process, and these beliefs are themselves endogenous. Our analysis provides insights into what factors drive the beliefs, the flow of financial capital and ultimately countries' decisions as to whether they will pursue a tax haven business. Specifically, we consider the role of the residence countries' level of taxation, penalties for disclosed offshore tax evasion, service fees in tax havens, and different types of international pressure. The framework also sheds light on the question of why countries

[4] Cf. G20 (The Group of 20 (G20) 2009, p. 4): "In particular we agree [...] to take action against non-cooperative jurisdictions, including tax havens. We stand ready to deploy sanctions to protect our public finances and financial systems. The era of banking secrecy is over. We note that the OECD has today published a list of countries assessed by the Global Forum against the international standard for exchange of tax information."

[5] The Global Forum on Transparency and Exchange of Information for Tax Purposes (Organisation for Economic Co-operation and Development (OECD) 2016, pp. 24, 28) evaluates jurisdictions with respect to their effective implementation of the information exchange on request. As of July 2016, it has rated 22 jurisdictions as *compliant*, 60 jurisdictions as *largely compliant*, and 12 jurisdictions as *partially compliant*. Eight jurisdictions revealed shortcomings in their legal and regulatory frameworks and were blocked from moving to the final phase of revision in order to be rated.

would ever choose to comply with international standards of transparency despite the substantial returns in the tax haven business.

Switzerland, for instance, used to be highly successful in attracting a major share of the private financial wealth held offshore from all possible origins and was renowned for its strict bank secrecy laws.[6] However, Switzerland has also been a prime target in the fight against tax havens and, seemingly, has given in to the international pressure in recent years. It joined the EU Savings Directive, entered information exchange treaties with several EU countries, and enabled its banks to disclose client information to the US tax authorities after the banks were indicted in the US for assisting American citizens with tax evasion.[7] Also, investors from Europe and North America relocated their funds away from Switzerland, often just before the initiatives came into effect or were ultimately decided.[8] Our analysis suggests that Switzerland's compliance choice and such investment decisions are complementary and mutually reinforcing.

For tax-evading investors, it is important whether a tax haven abandons its secrecy regime after they have located their assets there. A haven country that decides to adopt a transparency regime causes risks for those investors who have concealed capital therein. They may be worse off than they would have been had they simply paid the taxes in their residence countries. One of the risks is that lifting the secrecy regime may unmask the investors' identities and reveal information about previously accrued capital income to the tax offi ces of the investors' home countries, which may trigger severe penalties. If the regime change toward transparency comes with an information exchange about previously accrued income, tax-evading investors cannot avoid such penalties. In particular, a relocation of their funds to another tax haven would come too late, as it would not clean their records. The traces from tax evasion in previous years are not erased. A prominent example of a change in the concealment policy that also affected past transactions are the negotiations between the US and Swiss banks, which eventually revealed tax evasions by individual US taxpayers who were then prosecuted.[9]

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[6] Zucman (2013) and BCG (2009, 2016) estimate Switzerland to be the world market leader for offshore private wealth management, accounting for a market share of more than one quarter.

[7] For an account of the change in Switzerland's attitude toward its strict bank secrecy, see, for example, "Swiss banking secrecy: Dont ask, wont tell," *The Economist*, 11 February 2012.

[8] For anecdotal evidence of such capital relocations during the negotiations between Switzerland and Germany for a new tax treaty, see "Ermittlungen: Steuerfahnder verfolgen Spur nach Asien," *Financial Times Deutschland*, 10 August 2012, and more generally, see "Switzerland and its rivals: Rise of the midshores," *The Economist*, 16 February 2013, and regular remarks in the annual global wealth reports by The Boston Consulting Group, e.g., BCG (2009, 2016).

[9] In the first deal of its kind, Switzerland empowered UBS to turn over information on 4,450 clients to the US tax authorities. The accounts in question cover the years 2001 through 2008, that is, before the investigations against UBS became publicly known in 2008. (See "Swiss approve deal for UBS to reveal US clients suspected of tax evasion," *The New York Times*, 18 June 2010.) By now, almost every Swiss bank has entered a similar information exchange based either on individual settlements or on the Swiss Bank Program by the US Department of Justice. (See "US settles last Swiss bank case in US $1.3 billion program," *Reuters*, 27 January 2016.)

Not all regime changes necessarily lead to an indictment for past tax evasions.[10] However, the type of agreement to be struck depends on unforeseeable contingencies of international politics and political majorities.[11] The precise nature of a possible regime transition is difficult to predict. Hence, what matters is the expected cost that comes with a regime change. If the prosecution and imprisonment of tax evaders is sufficiently likely, its threat is sufficient to make honest tax payment more attractive than concealing capital in a haven country that is likely to convert to a compliance regime within a foreseeable time frame.[12]

Turn now to the decision problem of a haven country. It is willing to offer a secrecy regime only if that attracts a sufficiently large revenue pool. Without a sufficient number of investors, a haven country bears the cost that results from international pressure, but enjoys little benefits from the tax haven business. On the other hand, a tax haven can only attract business if the investors can rationally expect the country to provide concealment opportunities in the future. This creates an important feedback loop in the choices of the haven country and the secrecy-seeking investors.

Moreover, this complementarity raises deeper issues than some coordination problem between two players, because the investors themselves do not constitute a single player. They are many, independent decision-makers. Every single investor assesses whether it is likely that the country will act as a tax haven in the future, and this likelihood depends, among other things, on the number of other investors moving their funds to this country. This generates a second complementarity that exists among investors.

These two complementarities are at the core of our analysis. We show that they generate a multiplicity of equilibria and create strategic uncertainty in a context that is otherwise a complete information framework. Yet, in a more realistic setup, investors face a non-negligible degree of uncertainty as regards the choice of the haven country. The decision on the concealment policy is made by political actors who may differ in their personal convictions about secrecy laws or the international pressure associated with it. These psychic costs and benefits enter into the cost of operating as a tax haven and

[10] Some initiatives have provided opportunities to channel funds from one haven country that is about to become compliant to another tax haven. Johannesen (2014) estimates that the EU Savings Directive reduced EU-owned bank deposits in Switzerland by 30-40%, and that the drop was driven by a relocation of funds or formal ownership to other offshore centers. Similarly, Johannesen and Zucman (2014) find that the bilateral information exchange treaties following the G20 summit in 2009 caused a relocation of assets to non-compliant tax havens rather than their repatriation.

[11] The German-Swiss Tax Treaty (*Abkommen zwischen der Schweizerischen Eidgenossenschaft und der Bundesrepublik Deutschland über Zusammenarbeit in den Bereichen Steuern und Finanzmarkt),* for instance, failed to pass the parliamentary hurdles in the second chamber in Germany 2012, which eventually led to a more far-reaching transparency regime. Many tax evaders who relied on this agreement were caught and prosecuted around that time due to data leaks and tax authorities purchasing these data. This also alludes to the risks involved with an imminent regime change.

[12] This is not to claim that the relocation of funds to non-compliant tax havens is not important. However, for many tax evaders it is not the preferred option. Between 2009 and June 2014, the US received more than 45,000 voluntary disclosures of offshore accounts which created US $6.5 billion in taxes, interest and penalties. (See https://www.irs.gov/uac/newsroom/irs-offshore-voluntary-disclosure-efforts-produce-6-5-billion-45-000-taxpayers-participate.) In the fiscal year 2014-2015 alone, Canada received 19,134 voluntary disclosures on Can$1.3 billion of unreported income, of which Can$780 million originated offshore. (See the Annual Report to Parliament 2014–2015 by the Canada Revenue Agency.) Finally, between 2010 and 2015, Germany received 123,278 voluntary disclosures. (See "Die späte Reue der Steuersünder. Der Fall Hoeneßwirkt nach: Die Zahl der Selbstanzeigen bleibt auch 2015 hoch," *Handelsblatt*, 20 January 2016.)

are not observable for the investors. We demonstrate that a slight amount of incomplete information can overcome the problem of strategic uncertainty and result in a unique equilibrium.

This equilibrium contains a limit regarding the political cost of running a tax haven. For political costs below the limit, a haven country attracts large capital inflows from tax-evading investors and provides a secrecy regime. For costs above it, investors do not locate their funds in the haven country, which in turn maintains a transparency regime. This critical cost limit is a function of the exogenous parameters of the model and has implications for the design of optimal policies. We find a trade-off between a successful fight against tax havens and high tax rates, for example, in the course of an international tax harmonization. High tax rates make it attractive for investors to evade taxes and render haven countries robust toward political pressure. A similar effect exists for low penalties for disclosed offshore tax evasion, for instance, in the context of special programs with reduced fines for tax evaders who voluntarily report their undeclared offshore wealth. Many countries apply such programs to reduce administrative costs, encourage the repatriation of offshore funds or to enlarge the group of tax evaders that can be targeted with a single initiative.[13] However, our results suggest that they also strengthen the resistance of tax havens against costly pressure. Moreover, we can explain why service fees in tax havens need not be competed down to zero despite a highly competitive, international financial market with multiple active tax havens. Intuitively, high revenues make haven countries robust toward international pressure and hence trustworthy for secrecy-seeking investors.

1.2 Literature and empirical review

Our analysis is related to a growing literature on tax havens surveyed in Dharmapala (2008) and Keen and Konrad (2013). Dharmapala and Hines (2009) and Slemrod (2008) provide empirical support for the widespread view that tax havens tend to be small, affluent island countries that have American or British colonial or territorial roots, and score particularly well on indices measuring aspects of governance quality, such as the protection of property rights.[14] As tax havens typically attract large amounts of investments relative to the size of their own economy and population, earnings from or taxes on the haven industry account for a major share of their public revenues.[15] The importance of the investor protection is studied by Bucovetsky (2014) who focuses on the possibility that foreign investors might be expropriated by the haven country. Slemrod and Wilson (2009) argue that small countries have a comparative advantage in becoming tax havens.

[13] For an overview of voluntary disclosure programs in different countries and an analysis of the effect of such programs on compliance rates and public revenues, see Langenmayr (2015).

[14] The colonial or territorial roots influence, among other things, a country's legal and political system, its official language, and its degree of sovereignty/dependency.

[15] A comparison of the size of tax havens and the amount of international investment that they attract can be found in Hines (2010, pp. 105-111).

These analyses identify natural candidate countries, some of which act or have acted as tax havens in the past and may continue this business in the future. A related, empirical question asks which active tax havens are likely to terminate their provision of tax sheltering opportunities if offering them also generates a political cost.[16]

Another domain in the literature evaluates particular initiatives in the fight against tax havens. Hemmelgarn and Nicodeme (2009), Johannesen (2014), and Klautke and Weichenrieder (2010) study the EU Savings Directive. For an assessment of the G20 Tax Haven Crackdown, see Johannesen and Zucman (2014). Although most studies address the effectiveness of the current initiatives, little has been done to understand the incentives for a haven country when exposed to international pressure. As an exception, Elsayyad and Konrad (2012) consider the interaction between several tax havens and the consequences of a sequential exit for those haven countries that remain active. They show that the increase in market shares and market power which these remaining tax havens enjoy makes them increasingly resistant toward international pressure. Pieretti et al. (2016) contribute to the analysis of the dynamics in the compliance decisions of multiple tax havens, by allowing them to compete for international flows of offshore capital and also for real economic activity. We consider a single haven country in most parts of our analysis and discuss generalizations in Section 1.6. Another exception is Pieretti and Pulina (2015) who study the optimal response by haven countries if the stigmatization of tax havens makes it more costly for multinational firms to not only shift their profits to these countries but to also to set up real economic activities there. We look at tax evasion by private investors and the legal risk that they face when concealing capital in a tax haven.

Furthermore, the current initiatives against tax havens have triggered a controversial discussion about the effects of tax havens on global welfare, surveyed by Hines (2010). Most of this literature considers corporate tax avoidance rather than private tax evasion. On the upside, tax havens allow high-tax countries to levy a de facto differentiated tax rate on mobile capital (Hong and Smart 2010), effectively limiting the consequences of a harmful tax competition to a subset of the tax base (Keen 2001), economic activities in haven and nearby non-haven countries are found to be complements rather than substitutes (Desai et al. 2006a, 2006b), total tax revenues may increase as non-haven countries face weaker incentives to enter an aggressive tax competition (Johannesen 2010), and investors may benefit from fiercer institutional competition (Pieretti et al. 2013). On the downside, tax havens may also contribute to excessive tax competition by lowering equilibrium tax rates, cause wasteful resource expenditures for purely tax arbitrage activities and the attempt to limit those activities, and increase the shadow price for public revenues in high-tax countries (Slemrod and Wilson 2009). These are important questions, but they are only tangential to our analysis. We focus on tax havens that offer tax shelter-

[16] Bilicka and Fuest (2014) and Elsayyad (2012) study the role of haven country characteristics and bilateral country pair attributes for the likelihood of international agreements being signed in the aftermath of the G20 Tax Haven Crackdown in 2009.

ing opportunities to private capital investors and an important strategic complementarity that emerges in this context.[17]

Several authors describe tax havens as juridical entrepreneurs who sell protection from foreign taxation whenever they find it profitable to do so. [18] These analyses typically treat the demand for tax sheltering services as a quantity that smoothly reacts to parameter changes. For the phenomenon we study, the decisions of individual investors, the strategic complementarity among them, and the self-fulfilling effect of investors'beliefs on a haven country's actual behavior are crucial and create discontinuous jumps in the tax haven's revenue pool. We deal with the beliefs as to the stability of a country's potential tax haven endogenously, and we identify the key drivers for a country's decision of whether to provide a secrecy or a transparency regime.

1.3 The role of beliefs

For a start we consider the most simple environment with one haven country H and a continuum of homogeneous investors $i \in I$. The mass of I is normalized to 1. Investors reside somewhere outside H, and we call this place country R. One can think of R as a representative high-tax country.

Each individual investor i holds one unit of capital and chooses between two actions $a_i \in \{0, 1\}$. An investor can locate the capital in R, denoted by $a_i = 0$, or can locate it in H, denoted by $a_i = 1$. The individual choices then add up to a total share of capital located in H

$$a = \int_{i \in I} a_i di. \tag{1.1}$$

The amount $a \in [0, 1]$ is observed by the haven country H. This completes stage 1. In stage 2, country H has the capabilities to operate as a tax haven and chooses $h \in \{0, 1\}$. The choice $h = 0$ refers to a behavior in compliance with international standards of transparency. The choice $h = 1$ refers to a secrecy regime with concealment opportunities.

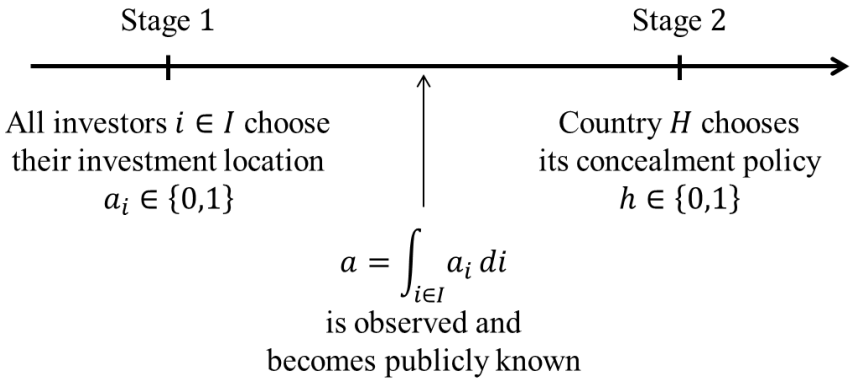
The sequencing of choices naturally maps the situation in which investors make long-term decisions about whether or not to locate their capital in a haven country (stage 1), and in which the haven country makes a time-consistent decision that maximizes its genuine interests some, possibly considerable, time later (stage 2).[19] Tax evaders are then,

[17] Strategic complementarities are known to generate multiple equilibria in many contexts. Prominent examples are bank runs (Diamond and Dybvig 1983), currency crises (Obstfeld 1996 and Morris and Shin 1998), sovereign public debt sustainability (Cole and Kehoe 2000), political accountability and the role of elections as a coordination mechanism (Fearon 2011), capital formation with a time-consistent taxation of capital (Persson and Tabellini 1990), and network effects (Katz and Shapiro 1994).

[18] Palan (2002) refers to this process as the *commercialization of state sovereignty.*

[19] Alternatively, the haven country may irreversibly commit to whether to offer concealment services or not prior to stage 1 and it sticks to this commitment even if no or very few investors show up compared to a high costly pressure. Tax evaders would not face any risk of being disclosed. This time structure would change our results. However, such a commitment assumption is diffi cult to justify as the haven countries are sovereign countries and a commitment is not time-consistent. In

FIGURE 1.1: Time structure of the coordination game



over time, increasingly vulnerable to the possibility that the haven country will not offer concealment opportunities but will participate in an exchange of tax information in the future (stage 2). Also note that we study a static setting in which the haven country decides on h only once, based on the amount of capital a attracted in stage 1.[20] A more generous interpretation of our setup is that H is a country that qualifies as a potential tax haven, for instance, by having been a tax haven in the past. In this case the decision $h = 1$ can be interpreted as a continuation of the secrecy regime, and the decision $h = 0$ can be interpreted as a policy change, an *exit* from the tax haven business, and the adoption of a transparency regime. This possible exit decision may take place years later. The time structure of the game is summarized in Figure 1.1 and is common knowledge for all players.

If an investor locates the capital in R, the capital is taxed at rate $t \in (0, 1)$ and the investor receives a final income of $1 - t$.[21] Suppose the investor locates the capital in H. Then the final income depends on the haven country's decision. If H offers concealment opportunities, i.e. $h = 1$, the investor can successfully evade taxes in R but has to pay some service fee $s \in (0, t)$ in the tax haven, and ends up with $1 - s$. As discussed in the Introduction, s should not be interpreted as a specific tax or administration fee on concealed capital earnings, but it results more indirectly from the institutional setup (see, e.g. Schoen 2005).[22]

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fact, many haven countries recently changed their concealment policies when this seemed to be in their national interest, including Switzerland –the country whose bank secrecy was considered to be part of its national identity.

[20] The static analysis drops a number of relevant dynamic issues from the picture. Some of these have been dealt with in other analyses, such as the *last-haven-standing effect* in an exit game studied by Elsayyad and Konrad (2012). However, the complementarities of this framework remain an issue for analyses that adopt dynamic aspects, as we discuss in Section 1.6.

[21] Our results remain qualitatively unchanged if we consider instead a homogeneous return on capital and a tax thereon.

[22] Banking and asset management fees, for instance, are a major share of the fees paid by investors who conceal their capital in a tax haven. These fees depend on the legal and institutional structure of the haven country as well as on the structure of and competition within the financial sector. Similarly, the governmental surplus from this type of asset management emerges indirectly. It includes fees and taxes on the business of financial institutions, wage taxes in this sector, and further indirect spillovers. Therefore we do not consider s to be a straight choice variable. We take s as given. We also assume that what investors pay as fees equals the government revenue. The indirect channels that determine s also make it less straightforward, but potentially interesting, to study the effects of competition between tax havens.

If H operates a transparency regime, i.e. $h = 0$, the tax authorities in R learn about the investor's offshore funds and impose some detection and/or compliance cost τ, leading to a payoff $1 - \tau$. We allow $\tau(t, z)$ to be a function of the tax rate t and a possible fine $z > 0$ for previously concealed capital, which may also include some transaction costs for relocating the funds. Generally, we expect that $\tau(t, z) > t$, and that $\tau(t, z)$ is increasing both in t and z. We also assume that $\frac{d\tau}{dt} < \frac{\tau - s}{t - s}$. The assumption is fairly weak as $\frac{\tau - s}{t - s} > 1$ and is used only for Corollary 1.[23] The payoff for an investor can therefore be written as

$$\pi_i(a_i, h) = \begin{cases} 1 - t & \text{if } a_i = 0 \\ 1 - \tau & \text{if } a_i = 1 \text{ and } h = 0 \\ 1 - s & \text{if } a_i = 1 \text{ and } h = 1 \end{cases} . \tag{1.2}$$

We note that investors may also invest in offshore centers for reasons other than to evade taxes, such as diversification, strong institutions, financial expertise or insurance against leviathan governments. Some investors may also enjoy the combination of concealment opportunities and the quality of the property rights regime in the haven country. An important paper by Pieretti et al. (2014) focuses precisely on the conditions for which offshore financial centers operate as tax havens only, i.e. undercut tax rates, and the conditions for which they also operate as safe havens, i.e. provide a better institutional framework.[24] Within our more narrow framework, all investors are homogeneous and these additional motives are absent. As tax-compliant investors in the tax haven have to pay the service fee s and the tax t, they would not like to locate their capital in the haven country.

The haven country's payoff depends on the aggregate investment it can attract and on its own decision. If H operates a transparency regime, its payoff is normalized to zero. If H acts as a tax haven, it benefits to the extent of s from each investor whose capital is deposited therein.[25] This yields total revenues equal to sa. However, the haven country also bears an operating cost, which is higher if the amount of international pressure on tax havens is higher. We assume that it consists of a fixed cost θ, a unit cost $c \in [0, s)$, and sums up to

$$\theta + ca. \tag{1.3}$$

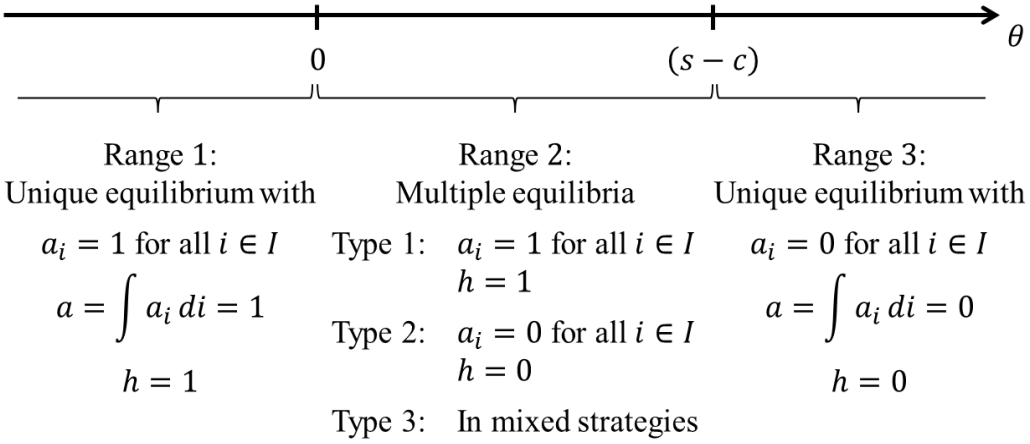
We allow $\theta \in \left[\underline{\theta}, \overline{\theta}\right]$, where $\underline{\theta} < 0 < s - c < \overline{\theta}$. One might expect that $\theta > 0$, but a country may also derive some intrinsic benefit from running a secrecy regime. For instance, its decision-makers may be proud to be helping honest business people from abroad avoid

[23] Note that $\frac{d\tau}{dt} \leq 1$ is a natural assumption. Consider the case $h = 0$ when capital-concealing investors cannot avoid being taxed in R at rate t. If, in this case, the tax rate applies to the initial capital stock, this leads to $\tau = 1 - t - z$. If the tax rate applies to the capital stock net of fines, this results in $\tau = (1 - t)(1 - z)$. In both cases, it is true that $\frac{d\tau}{dt} \leq 1$.

[24] To account for fully tax-compliant investors who enjoy other qualities of offshore centers requires heterogeneity among investors and additional qualities of the haven country. Such a generalized framework need not affect the central results of our analysis, provided that there are no strategic links between the two types of asset management.

[25] In the literature, tax havens are usually assumed to charge a flat service fee per account or per investor. However, an investor with offshore deposits worth several hundred million dollars can still be expected to pay more than a middle-class wage earner. In our model with homogeneous investors, both interpretations of a fixed or a proportional service fee are equivalent.

FIGURE 1.2: Equilibrium characterization with complete information



illegitimate expropriation claims, may feel that giving up its bank secrecy is a sacrifice of the national identity, or some such reason. The resulting profit for the haven country upon providing concealment opportunities is $(s-c)\,a-\theta$. Summarized, the payoff for the haven country is given by

$$\pi_H(a,h) = \begin{cases} 0 & \text{if } h = 0 \\ (s-c)\,a - \theta & \text{if } h = 1 \end{cases} . \tag{1.4}$$

We assume the service fee s, the tax rate t, and the detection cost τ to be finite and exogenous. In a more general setup, one could consider the residence country to determine t and τ, and the haven country to influence s. We discussed in the Introduction that s need not be a variable of direct choice, but we consider the impact of these parameters on the equilibrium outcome in more detail in Section 1.5. Furthermore, to make our analysis economically interesting and non-trivial, we restrict the allowed parameter ranges such that $s < t < \tau$. If the service fee in the tax haven exceeds the tax rate $s \geq t$, an investor would have nothing to gain from locating capital in H. Similarly, if $\tau \leq t$, an investor would have nothing to lose when trying to evade taxes. We also restrict the tax havens' variable cost c in comparison to the service fee such that $s - c > 0$, which refers to a situation in which a country that operates as a tax haven prefers to have a larger pool of investment.

In the following we solve for the equilibrium of the game for every possible combination of θ, c, and s satisfying the previously discussed parameter conditions. We impose the standard requirement of subgame perfection and obtain the equilibrium characterization as stated in Proposition 1 and graphically summarized in Figure 1.2.

Proposition 1 (i) *For $\theta < 0$, the unique subgame perfect equilibrium is characterized by $a_i = 1$ for all $i \in I$ and $h = 1$. All investors evade taxes and the haven country provides a secrecy regime.*

(ii) For $\theta > s - c$, the unique subgame perfect equilibrium is characterized by $a_i = 0$ for all $i \in I$ and $h = 0$. All investors meet their tax liabilities and the haven country provides a transparency regime.
(iii) For $0 \leq \theta \leq s - c$, both ($a_i = 0$ for all $i \in I$ and $h = 0$) and ($a_i = 1$ for all $i \in I$ and $h = 1$) are subgame perfect equilibria. Furthermore, there exist equilibria in mixed strategies.

Proof. Consider (i): If $\theta < 0$, then $(s - c)\, a - \theta > 0$ for all possible $a \in [0, 1]$. This makes $h = 1$ a dominant choice for the haven country, independent of the investors' behavior. Anticipating that the haven country will offer concealment opportunities, the investors' unique optimal choice in stage 1 is $a_i = 1$.

Consider (ii): If $\theta > s - c$, then $(s - c)\, a - \theta < 0$ for all possible $a \in [0, 1]$. This makes $h = 0$ a dominant choice for the haven country, independent of the investors' behavior. Anticipating that the haven country will not offer concealment opportunities, the investors' unique optimal choice in stage 1 is $a_i = 0$.

Consider (iii), when $0 \leq \theta \leq s - c$. In stage 2, the haven country knows the amount of attracted capital a. So H's optimal choice is $h = 1$ if $a > \theta/(s - c)$, and $h = 0$ if $a < \theta/(s - c)$. For $a = \theta/(s - c)$, H is just indifferent and any pure action or randomization thereof is an optimal choice. In stage 1, the investors decide where to locate their capital depending on what they expect of h in stage 2, which, given the optimal reply by the haven country, depends on the aggregate outcome of the other investors' actions $a = \int a_j dj$. Note that an individual investor i's choice a_i does not significantly affect the aggregate outcome a, as there is a continuum of investors. If all investors believe that $a \geq \theta/(s - c)$, leading to $h = 1$, then their optimal choices are $a_i = 1$ for all $i \in I$. These actions result in $a = 1$ and $h = 1$, confirming the investors' beliefs. This establishes that ($a_i = 1$ for all $i \in I$ and $h = 1$) is a subgame perfect equilibrium. If all investors believe that $a \leq \theta/(s - c)$, leading to $h = 0$, then their optimal choices are $a_i = 0$ for all $i \in I$. These actions result in $a = 0$ and $h = 0$, confirming the investors' beliefs. This establishes that ($a_i = 0$ for all $i \in I$ and $h = 0$) is a subgame perfect equilibrium.

We now turn to the case $a = \theta/(s - c)$. If this equality holds, the haven country is just indifferent and any pure action $h \in \{0, 1\}$ or randomization thereof is optimal. This allows for the further equilibria in mixed strategies for the range $\theta \in [0, s - c]$. Let $\Pr(h = 1 \,|a = \theta/(s - c))$ denote the probability that H will choose $h = 1$ when being indifferent. For $0 < \theta < s - c$, $a = \theta/(s - c)$ implies that only a fraction of investors will locate their capital in H. For that to be optimal, the investors must be indifferent between $a_i = 0$ and $a_i = 1$. This indifference holds if $\Pr(h = 1 \,|a = \theta/(s - c)) = p$, where p is the solution to the investors' indifference condition

$$p(1 - s) + (1 - p)(1 - \tau) = (1 - t). \tag{1.5}$$

There are many combinations of investors'choices that result in an aggregate investment of $a = \theta/(s-c)$ in H.[26] Any of these, together with $\Pr(h=1\,|a=\theta/(s-c)) = p$ constitutes a subgame perfect equilibrium in mixed strategies.

Finally, consider the borders of the interval $[0, s-c]$. For $\theta = s-c$, the choice $h=1$ is inside the set of optimal choices if all investors, except for a set of measure zero, choose $a_i = 1$. This is optimal for them if H randomizes with some probability $\Pr(h=1\,|a=\theta/(s-c)) \in [p,1]$. Similarly, for $\theta = 0$, optimality of $h=0$ requires that all investors, except for a set of measure zero, choose $a_i = 1$. This is optimal for them if H randomizes with some probability $\Pr(h=1\,|a=\theta/(s-c)) \in [0,p]$. ■

For the range $\theta \in [0, s-c]$, Proposition 1 identifies the decisive role of the investors' beliefs for the actual equilibrium outcome. If investors believe that the haven country will comply with international standards of transparency, they will prefer to stay away from H. In response, the haven country will choose to avoid international pressure and pursue a transparency regime. If instead investors believe that the haven country will provide effective protection against inquiries from the domestic tax authorities, they prefer to evade taxes and locate their capital in H. This makes the concealment business profitable and the haven country will then choose to provide concealment opportunities. We find that the haven country's decision to provide a secrecy regime and the investors'decisions to locate their capital in the tax haven are strategic complements. As the investors move first, their beliefs about the haven country's choice establish an investment behavior that makes the country act in line with their beliefs. Therefore, several sets of mutually consistent investors' beliefs exist, and these beliefs then determine whether the haven country will pursue a secrecy or a transparency regime.

Moreover, these self-enforcing beliefs create a strategic complementarity among the group of individual investors. When deciding where to locate the capital, each investor individually assesses the likelihood of a secrecy regime. As we show above, this probability depends among other things on the amount of capital deposited in the tax haven, and hence, on the actions of the other investors. If an individual investor expects a large share of the other investors to locate their capital in H, the individual investor can be confident of the haven country offering concealment opportunities and will consider it profitable to locate the capital in the haven country, too. Inversely, if an individual investor believes that no or only few other investors will locate their capital in H, the haven country is likely to divulge tax information to the residence country and the individual investor is better off not trying to hide capital in H. So there is a coordination problem among many individual investors in which the outcome and whether the haven country will operate as a tax haven or not is determined by the investors'beliefs, the beliefs as to the other investors'beliefs, and even higher-order beliefs.

[26] For instance, there is one equilibrium that has all investors playing the same mixed strategy in which each investor chooses $a_i = 1$ with probability $\theta/(s-c)$. Other equilibria contain all investors playing pure strategies that differ across investors. Again, other equilibria have some investors playing pure strategies and other investors playing mixed strategies.

Intuitively, we expect that these beliefs are driven by the fundamentals of a haven country, such as institutional aspects, a country's track record of its secrecy regime, and norms and values that are anchored in the society of the haven country.[27] However, except for extreme values with $\theta < 0$ or $\theta > s - c$, Proposition 1 comes with little predictive power. An optimistic interpretation suggests that even a small amount of pressure, in terms of a small but positive θ, may be enough to destroy the tax haven business model. But in fact we cannot even conclude that increased international pressure will make it more likely that a haven country will comply with international transparency standards.

The indeterminacy is caused by the particularly simple information structure considered so far. Common knowledge of the cost parameters θ and c allows the players' equilibrium beliefs and actions to be perfectly aligned contingent on the combination of θ and c that is known to prevail. While this approach underlines the importance of investors' first and higher-order beliefs for the haven country's concealment policy, the set of beliefs that prevails is in the end determined exogenously, pointing to factors outside the model. In a more realistic setup, investors face incomplete information on the true cost of operating a tax haven. Including some small amounts of incomplete information in our framework is not just some tool to introduce another grain of reality to our model, it will also allow us to deal with the investors' beliefs endogenously and yield a unique equilibrium prediction that depends on the parameters of the model. Such a setup is commonly referred to as a *global game*, which was initiated by Carlsson and van Damme (1993) and Morris and Shin (1998), and is reviewed, for example, in Morris and Shin (2003).[28]

1.4 Small amounts of incomplete information

The cost of providing a secrecy regime is given by (1.3) and was common knowledge in Section 1.3. For reasons explained above and in the Introduction, we now assume that the fixed cost parameter θ is incompletely observed by the investors.[29] More specifically, we assume that nature determines the true values of θ and c. The value of c remains common knowledge, but the value of θ is known only to the haven country. Each investor receives an individual and private signal $x_i = \theta + \sigma\varepsilon_i$, where $\sigma \in (0, 1]$ is a scaling parameter and ε_i is

[27] For empirical analyses on the characteristics that make countries likely to operate as tax havens, see Dharmapala and Hines (2009) and Slemrod (2008). Some of the driving factors are also mentioned in Section 1.2.

[28] The global game approach has already been applied to many different environments with a coordination problem and can be considered a standard tool in the coordination literature. Applications include studies on currency crises, debt pricing, bank runs, political revolutions, and the adoption of new network technologies. See, e.g., Morris and Shin (2003, pp. 71–77) for a review of the most common applications. The approach has been broadened in many directions, for example, to allow for heterogeneous agents, such as including single investors with a non-negligible influence on the aggregate outcome (Corsetti et al. 2004), or allowing for different wealth levels and/or payoff variables (Sakovics and Steiner 2012).

[29] Recall from the Introduction that the decision on the concealment policy is made by political actors such as country leaders. Emotionally, they may cope differently with international pressure or may differ in their personal convictions. We assume that their psychic costs and benefits enter into the fixed cost component θ and are not publicly observable. A similar reason for incomplete information in the context of international bargaining that draws on the mental constitution and the potential psychic elements of costs and benefits in the minds of political decision-makers is applied in Konrad and Thum (2014).

the realization of a random variable $\widetilde{\varepsilon}_i$ with a continuous cumulative distribution function $F(\cdot)$, which has support on the interval $\left[-\frac{1}{2}, \frac{1}{2}\right]$.[30] We require $\widetilde{\varepsilon}_i$ to be identically and independently distributed across investors and to be independent of the true operating cost θ. Similarly, x_i is the realization of a random variable $\widetilde{x}_i = \theta + \sigma\widetilde{\varepsilon}_i$. Investors have no prior information on the true cost and learn about θ only through their private signals. So we assume that θ is the realization of a random variable $\widetilde{\theta}$ that is uniformly distributed over $\left[\underline{\theta}, \overline{\theta}\right]$, where $\underline{\theta} < -\sigma$ and $\overline{\theta} > s - c + \sigma$.[31] We discuss the importance and validity of the assumption on the allowed parameter range below. Then, except for signals close to the boundaries $\underline{\theta}$ and $\overline{\theta}$, an investor with signal x_i forms the belief that $\widetilde{\theta}$ is distributed as $x_i - \sigma\widetilde{\varepsilon}_i$, and for a given θ an investor's signal $\widetilde{x}_i$ is distributed according to $F\left(\frac{x_i - \theta}{\sigma}\right)$. Everything apart from the true underlying θ and the actual values of the other investors' signals remains common knowledge.

For reasons of clarity and brevity, we restrict our attention to symmetric equilibria in which all investors follow the same cut-off strategy. A cut-off strategy for an investor i is described by a cut-off value x of the investor's signal x_i such that i chooses $a_i = 1$ if $x_i \leq x$, and $a_i = 0$ otherwise. The assumption can be weakened and the uniqueness result can be generalized using standard reasoning.[32] Moreover, to avoid technical complications that arise if a player's optimal choice is on the boundary of an open set, we impose tie-breaking rules as follows. If indifferent, the haven country operates a secrecy regime, and an investor who is indifferent locates the capital in H.[33]

Proposition 2 *The game with incomplete information has a unique symmetric perfect Bayesian Nash equilibrium in cut-off strategies. In this equilibrium, the haven country provides a secrecy regime* $(h = 1)$ *if and only if*

$$\theta \leq \theta^E(s, c, t, \tau) = (s - c)\frac{t - s}{\tau - s}, \tag{1.6}$$

and each investor locates the capital in the haven country $(a_i = 1)$ *if and only if*

$$x_i \leq x^E(s, c, t, \tau, \sigma) = (s - c)\frac{t - s}{\tau - s} + \sigma F^{-1}\left(\frac{t - s}{\tau - s}\right). \tag{1.7}$$

[30] Note that we will solve for the equilibrium of the game for any level of $\sigma \in (0, 1]$ including very small but positive values of σ.

[31] A uniform prior probability distribution can be seen as a limiting case when the individual signals become very precise compared to any prior information of θ. For a discussion on how this assumption can be significantly weakened, see Morris and Shin (2003, pp. 77-86). They show that any well-behaved prior distribution becomes approximately uniform as $\sigma \to 0$. Hence, for a small σ, our setting approximates one with a non-uniform prior.

[32] There is a standard proof in the literature showing that the derived equilibrium is the only one in the entire strategy space to survive the iterated elimination of strictly dominated strategies. For example, see Morris and Shin (2003, pp. 64-67).

[33] In the literature on global games, the equilibrium is sometimes described as being essentially unique because the players are indifferent at their cut-off values, where any action can be rationalized. Note, however, that this situation occurs with a zero probability mass.

Proof. Consider stage 2. The haven country observes a, knows θ, and requires an investment pool of $\theta/(s-c)$ to break even. So H chooses $h=1$ if $a \geq \theta/(s-c)$, and $h=0$ if $a < \theta/(s-c)$.

Consider now stage 1. We show that there is a unique cut-off value $x = x^E$ such that, if a mass of investors of size 1 follows the cut-off strategy characterized by x^E, it is optimal for every individual investor to also follow this strategy. The amount a in the haven country is not significantly affected by the choice of an individual investor, but is fully determined by the decisions of all other investors. It is therefore a function of the investors'common cut-off value x and the set of realized signals to the investors $j \in I \setminus \{i\}$. As the error terms $\widetilde{\varepsilon}_j$ are identically and independently distributed, and because there is a continuum of investors, the share of investors who locate their capital in H is equal to the probability of any single investor j observing a signal $\widetilde{x}_j \leq x$. Given θ, this probability is $\Pr(\widetilde{x}_j \leq x \mid \theta) = F\left(\frac{x-\theta}{\sigma}\right)$. So we can write

$$a(x,\theta) = F\left(\frac{x-\theta}{\sigma}\right), \tag{1.8}$$

which is continuous in both arguments and non-increasing in θ.

Figure 1.3 illustrates the aggregate investment a flowing to the haven country as a function of θ for three different levels of x. The figure also depicts the required investment for the tax haven to break even, $\theta/(s-c)$. We see that (1.8) and H's break even condition have a single crossing point $\theta^*(x)$, defined by

$$\theta^*(x) = (s-c)F\left(\frac{x-\theta^*(x)}{\sigma}\right). \tag{1.9}$$

For a given cut-off strategy with x being chosen by a mass of investors of size 1, H provides a secrecy regime for all $\theta \leq \theta^*(x)$, and a transparency regime for $\theta > \theta^*(x)$. Note that θ^* as in (1.9) is continuous in x, equal to 0 for $x \leq -\frac{1}{2}\sigma$, equal to $s-c$ for $x \geq s-c+\frac{1}{2}\sigma$, and strictly increasing in x with a slope of

$$\frac{d\theta^*(x)}{dx} = \frac{(s-c)F'\left(\frac{x-\theta^*(x)}{\sigma}\right)}{\sigma + (s-c)F'\left(\frac{x-\theta^*(x)}{\sigma}\right)} < 1 \tag{1.10}$$

for $x \in \left(-\frac{1}{2}\sigma, s-c+\frac{1}{2}\sigma\right)$.

Let us now turn to the decision of an individual investor i. Given the observed signal x_i, the cut-off value x characterizing the strategy of all other investors, and anticipating that H provides concealment opportunities if and only if $\widetilde{\theta} \leq \theta^*(x)$, i assesses the likelihood of a secrecy regime to be

$$p(x_i,x) = \Pr\left(\widetilde{\theta} \leq \theta^*(x) \mid x_i\right) = 1 - F\left(\frac{x_i-\theta^*(x)}{\sigma}\right). \tag{1.11}$$

The investor i chooses $a_i = 1$ if $p(x_i, x) \geq p$, and $a_i = 0$ if $p(x_i, x) < p$, where p is the solution to the investors'indifference condition

$$p = \frac{\tau - t}{\tau - s}, \tag{1.12}$$

also given in (1.5). The subjective probability $p(x_i, x)$ that i assigns to the outcome with a sustained tax haven business is equal to 1 for $x_i \leq \theta^*(x) - \frac{1}{2}\sigma$, equal to 0 for $x_i \geq \theta^*(x) + \frac{1}{2}\sigma$, and is strictly decreasing in x_i for $x_i \in \left(\theta^*(x) - \frac{1}{2}\sigma, \theta^*(x) + \frac{1}{2}\sigma\right)$. So for a given cut-off strategy played by all other investors, i's best response is to also follow a cut-off strategy around some x^*, defined by

$$p(x^*, x) = p\,. \tag{1.13}$$

Inserting the expressions from Equations (1.11) and (1.12) into (1.13) and subsequently solving the equation for x^* yields

$$x^*(x) = \theta^*(x) + \sigma F^{-1}\left(\frac{t - s}{\tau - s}\right). \tag{1.14}$$

Any equilibrium requires $x^* = x$. For all common cut-off values $x \leq -\frac{1}{2}\sigma$, $x^*(x) = \sigma F^{-1}\left(\frac{t-s}{\tau-s}\right) > -\frac{1}{2}\sigma$. Similarly, for all $x \geq s-c+\frac{1}{2}\sigma$, $x^*(x) = s-c+\sigma F^{-1}\left(\frac{t-s}{\tau-s}\right) < s-c+\frac{1}{2}\sigma$. In the intermediary range $x \in \left(-\frac{1}{2}\sigma, s-c+\frac{1}{2}\sigma\right)$, $x^*(x)$ is strictly increasing with a slope of $\frac{dx^*}{dx} = \frac{d\theta^*(x)}{dx} < 1$. Therefore, there is one and only one intersection of $x^*(x)$ with the locus $x^* = x$, which defines $x = x^*(x) \equiv x^E$, the unique symmetric equilibrium in cut-off strategies.

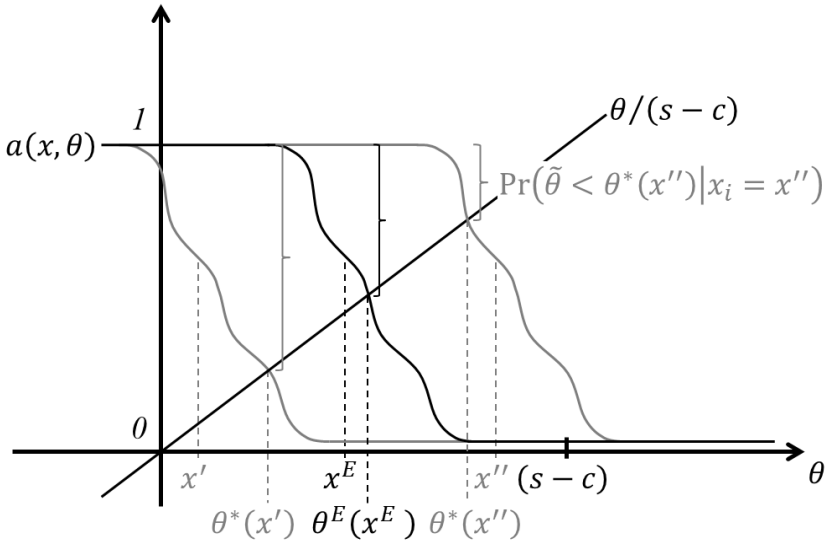
Finally, it remains to derive x^E and θ^E as stated in Proposition 2. We define θ^E by $\theta^E \equiv \theta^*\left(x^E\right)$. Evaluating (1.14) at x^E gives $x^E = \theta^E + \sigma F^{-1}\left(\frac{t-s}{\tau-s}\right)$. Substituting it into (1.9), also evaluated at x^E, yields

$$\theta^E = (s-c)\,F\left(\frac{\theta^E + \sigma F^{-1}\left(\frac{t-s}{\tau-s}\right) - \theta^E}{\sigma}\right) = (s-c)\,\frac{t-s}{\tau-s}. \tag{1.15}$$

■

For an intuition for the unique equilibrium cut-off strategy, assume all investors coordinate to switch around some common cut-off value x. Figure 1.3 depicts three potential candidates: x', x^E, and x''. An investor i who then receives the critical signal $x_i = x$ believes that all investors with a smaller signal $x_j \leq x$ will locate their capital in H and investors with a larger signal $x_j > x$ will locate their capital in R. Also, except for small boundary regions close to $\underline{\theta}$ and $\overline{\theta}$, the investor has no information other than the individually observed signal. So regardless of whether the investors coordinate on a high or low cut-off value, an investor who then observes the critical signal always expects the same amount of investments in H, $E\left[a(x,\theta)\,|x_i = x\right] \overset{iid}{=} \Pr\left(\widetilde{x}_j \leq x\,|x_i = x\right) = \Pr\left(\widetilde{\varepsilon}_j - \widetilde{\varepsilon}_i \leq 0\right)$,

FIGURE 1.3: Amount of capital in the haven country for different cut-off strategies plotted against the required investment for the tax haven to break even



which is independent of x. On the other hand, the required revenue pool for a tax haven to break even is strictly increasing. Hence, there is a unique x for which an investor, upon observing the critical signal $x_i = x$, is indifferent, and for which it is indeed optimal to follow a cut-off strategy around this value. Figure 1.3 also illustrates the subjective probability that such an investor will assign to the outcome with a secrecy regime, $p(x_i = x, x) \overset{(1.8),(1.11)}{=} 1 - a(x, \theta(x))$. The probability is monotonically decreasing in x and satisfies the investors'indifference condition only if $x = x^E$.

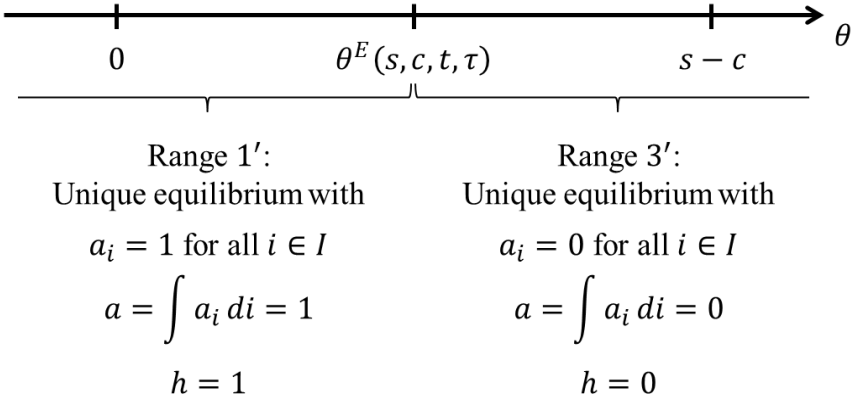
Proposition 2 does not make an equilibrium selection argument based on axiomatic considerations. Instead, the equilibrium is derived from plausible assumptions on the information available to investors. To arrive at this equilibrium, we require very few additional assumptions. One of them is that the support of the prior probability distribution of θ covers a suffi ciently wide range. In particular, investors must have a dominant action to locate their capital in H for very low levels of θ, and to locate their capital in R for very large levels of θ. Still, it seems plausible that investors perceive tax evasion as being risky, and think that such cost levels are possible.

The proposition provides a clear-cut equilibrium prediction for the outcome of the fight against tax havens. It identifies a hyperplane

$$\theta^E(c) = s\frac{t-s}{\tau-s} - c\frac{t-s}{\tau-s} \tag{1.16}$$

and characterizes the equilibrium depending on the haven country's operating cost parameters (θ, c). For combinations of (θ, c) below the hyperplane the equilibrium predicts an effective secrecy regime, and above it the equilibrium predicts that the haven country will comply with the standards of transparency. Notably, there are combinations of (θ, c) for which the equilibrium predicts a compliant behavior $(h = 0)$ although an active tax

FIGURE 1.4: Equilibrium characterization with incomplete information



haven business with all investors locating their funds therein would yield higher payoffs for both the haven country and the investors.

In the equilibrium, a single investor's decision to locate capital in H need not be perfectly aligned with the haven country's decision to operate as a tax haven for two reasons, both depend on the degree of uncertainty σ and the shape of the noise distribution F. First, an investor can observe a signal that is too far away from the true θ. Second, the equilibrium cut-off value x^E may differ slightly from the haven country's equilibrium cost threshold $\theta^E(\cdot)$. As the amount of uncertainty becomes very small, i.e. $\sigma \to 0$, both sources of coordination failure disappear and $x^E(\cdot) \to \theta^E(\cdot)$.[34] To simplify interpretations and enhance the tractability of the subsequent calculations, we assume this limiting case from here on for the remainder of the chapter. We will point out when the assumption becomes important and discuss how the results would change with a larger σ. The equilibrium for this limiting case is illustrated in Figure 1.4.

With the clear-cut equilibrium prediction at hand, we are able to derive implications for the design of optimal policies in the fight against tax havens.

1.5 Policy implications

The cost limit identified by Proposition 2 is a function of the parameters s, c, t, and τ, where $\tau(t,z)$ is a function of the tax rate t and the fine z. It thereby carries further implications about how changes in these parameters affect the equilibrium interaction between the haven country and its potential investors. One may argue that all variables such as s, c, t, z, and θ along with a and h are endogenous choice variables. However, decisions on s, t, and z are predominantly influenced by many factors, including a country's attitude toward redistribution, its needs or opportunities for publicly provided goods, its ability

[34] Remember that we solved for the equilibrium of the game for any level of $\sigma \in (0,1]$ including very small but positive values of σ. For a discussion on the difference between common knowledge and very small amounts of incomplete information, see, e.g., Carlsson and van Damme (1993, pp. 1,008-1,010).

to generate tax revenue, and its exposure to international tax competition. Also, general attitudes and value judgements may play a role. Similarly, the size of c and θ may be strongly influenced by institutional and technological factors. In this line of reasoning, we apply comparative static analyses in which the variables are predetermined and fixed at the stage when the haven country and the investors interact. This approach is different from considering an extended game in which a high-tax country or a group thereof are players in a game theoretic sense or in which the service fee in the tax haven becomes part of the strategy choices.

First, our model relates the residence country's level of taxation and the penalties for disclosed offshore tax evasion to the amount of international pressure that a haven country can resist and still operate a secrecy regime. So we can study the implications of the tax rate t and the fine z on the prospects of the fight against tax havens. Corollary 1 describes this relationship in more detail.[35]

Corollary 3 *The required amount of international pressure to make the haven country comply with international transparency standards is higher for a higher t, and lower for a higher z.*

Proof. For a given a, the cost of providing a secrecy regime as in (1.3) is higher if the level of international pressure is higher. Hence, everything else being constant, a higher equilibrium cost threshold $\theta^E(\cdot)$ requires a larger amount of international pressure to make the haven country compliant. Now, note that the function $\theta^E(s, c, t, \tau)$ is increasing in t

$$\frac{d\theta^E(\cdot)}{dt} = \frac{s-c}{(\tau-s)^2}\left[\tau - t + (t-s)\left(1 - \frac{d\tau}{dt}\right)\right] > 0 \tag{1.17}$$

as $\frac{d\tau}{dt} < \frac{\tau-s}{t-s}$, and decreasing in z

$$\frac{d\theta^E(\cdot)}{dz} = (-1)\frac{s-c}{(\tau-s)^2}(t-s)\frac{d\tau}{dz} < 0. \tag{1.18}$$

■

Intuitively, a high tax rate or a low fine creates a high relative payoff for tax evaders. So for the investors to be indifferent to the location decision, the probability of an active tax haven must only be moderate. This translates into a wide range of signals for which the investors locate their capital in H. In turn, the haven country attracts a large revenue pool for a large space of cost parameter combinations. As the decisions of the investors and of the haven country are strategic complements, they mutually reinforce each other

[35] Strictly speaking, a high-tax country cares about the amount of evaded tax revenue, which is determined by the cut-off value x^E characterizing the investors' strategy rather than the haven country's cost threshold θ^E. However, the effects of the tax rate and the fine on x^E are qualitatively the same and even slightly stronger than the effects on θ^E, with the exact magnitude depending on σ and the shape of F.

and the haven country will pursue a secrecy regime even for large amounts of international pressure.

For this result, we require that $\frac{d\tau}{dt} < \frac{\tau - s}{t - s}$. Note that a change in t has two direct effects on θ^E: a positive effect via the tax liability that an investor can possibly evade and a negative effect via the cost that a disclosed tax evader has to face. Our assumption ensures that the variable t denotes primarily a tax rate rather than a penalty for disclosed tax evasion. All additional compliance/detection costs for identified tax evaders are included in z.

Our results suggest that the chances for a transparency regime and no offshore tax evasion are better if high-tax countries impose low tax rates and severe penalties for disclosed tax evasion. This reveals an inherent trade-off between the fight against tax havens and high tax rates, for instance, in the course of an international tax harmonization. If tax competition is overly excessive and considered harmful, it is a popular countermeasure to harmonize tax rates in order to maintain or possibly increase the level of taxation. However, Corollary 1 shows that a high level of taxation renders haven countries robust against costly pressure and thereby deteriorates the prospect of a successful initiative against them. Similarly, in order to increase public revenues, many countries offer special programs with reduced fines for tax evaders who voluntarily report their undeclared offshore wealth. We find that such arrangements not only encourage tax evasion on the personal level but also strengthen the resistance of haven countries against international pressure.

Second, we can consider the impact of the service fee s on the haven country's equilibrium concealment policy, which is characterized in Corollary 2.

Corollary 4 *The maximum $\theta^E(c)$ for which the haven country provides a secrecy regime in equilibrium is obtained for an interior service fee of*

$$s^* = \tau - \sqrt{(\tau - c)(\tau - t)}. \tag{1.19}$$

Proof. The service fee s^* which maximizes $\theta^E(c)$ must be positive. If, on the contrary, the service fee is weakly negative $s \leq 0$, an active tax haven yields non-positive unit profits of $s - c$.[36] Inserting non-positive unit profits into the haven country's break even condition implies that H will not provide a secrecy regime for positive levels of θ, which contradicts a maximum of $\theta^E(c)$. Similarly, the service fee s^* must be smaller than the tax rate t. If the service fee equals the tax rate $s = t$, the same logic as in the proof of Proposition 2 yields $\theta^E(c) = 0$, which is clearly not a maximum of $\theta^E(c)$. If the service fee exceeds the tax rate $s > t$, no investor will locate capital in H, i.e. $a = 0$, and H will again not provide a secrecy regime for positive levels of θ.

[36] Note that for negative levels of the service fee $s < 0$ the allowed parameter range for the unit cost of pursuing a secrecy regime $c \in [0, s)$ is an empty set. The statement above holds true for any weakly positive unit cost $c \geq 0$.

In the interior range $s \in (0,t)$, the function $\theta^E(s,c,t,\tau)$ has a maximum at (1.19) because its second derivative $\frac{d^2\theta^E(\cdot)}{ds^2} = -2\frac{\tau-t}{(\tau-s)^2} - 2(s-c)\frac{\tau-t}{(\tau-s)^3} < 0$ is negative for all $s \in (0,t)$ and its first derivative $\left.\frac{d\theta^E(\cdot)}{ds}\right|_{s=s^*} = \frac{t-s^*}{\tau-s^*} - (s^*-c)\frac{\tau-t}{(\tau-s^*)^2} = 0$ equals zero for $s = s^*$. ■

Neither a very high nor a very low service fee are best for the haven country. Rather, interpreting θ as being positively related with the international pressure, Corollary 2 suggests that the haven country can withstand larger amounts of international pressure if the service fee is at an interior level. For a very small service fee, the haven country will pursue a transparency regime even for small amounts of international pressure because, even if all investors located their capital in H, the return on supplying concealment opportunities is simply very low. For a very large service fee close to the residence country's tax rate and for low values of θ, the haven country will also pursue a transparency regime as it can barely attract a revenue pool. Even if it provided concealment opportunities, investors would benefit only very little from them and would therefore be reluctant to locate their funds in H. Taking both effects together, the haven country is more likely to operate as a tax haven if the service fee is at an interior level.

Corollary 2 provides insights into the pricing of services in tax havens. It contributes to the explanation of why tax haven businesses typically yield large profits despite being active in a competitive, global financial market. It is those profits that render haven countries robust against international initiatives and make them trustworthy for tax-evading investors. Competition between multiple tax havens may of course exert downward pressure on the service fees in tax havens, but it is unlikely to drive equilibrium prices down to zero. Investors would not trust a tax haven with concealment opportunities and a service fee close to zero, because international initiatives that push the fixed cost θ of providing a secrecy regime above zero will automatically drive such a tax haven out of the market.

Third, our analysis contains two parameters that determine the haven country's cost of providing a secrecy regime as given in (1.3), a fixed component θ and a proportional component c. Both parameters may be influenced by international pressure. Corollary 3 exploits the incentives for a residence country or a group thereof, such as the OECD, to influence one or the other component, or both.

Corollary 5 *The two types of cost θ and c are substitutes, with $\frac{d\theta^E}{dc} = -\frac{t-s}{\tau-s}$.*

The result follows directly from (1.16) and is intuitive. It is, however, less obvious, given the non-monotonic relationship between θ^E and s in Corollary 2 and the similarity between an increase in s and a decrease in c in the model framework. Note that a change in s has two direct effects: one for the objective function of the haven country and one for the objective function of the investors. In contrast, a change in c affects only the objective function of the haven country and, much like a higher θ, a higher c makes it less profitable to provide a secrecy regime.

1.6 Accounting for multiple tax havens

For the remainder, we discuss a setting with multiple haven countries. This will lead further to several issues. We show how the results from the static, complete information game with one haven country can be generalized to include multiple haven countries. For that, some changes in the notation are needed. We denote the set of haven countries as $\mathcal{H} = \{H_1, H_2, ..., H_n\}$. The set I is the set of investors, which has the measure $m > 0$. The investor is pure strategy is denoted as a choice $a_i \in \{0, 1, 2, ..., n\}$, such that $a_i = 0$ if i invests in R, and $a_i = k$ if i invests in H_k. Investors could also randomize, but for the remainder we will focus on pure strategies only. Each haven country H_ks pure strategy is a choice $h_k \in \{0, 1\}$, i.e. whether to comply with transparency standards ($h_k = 0$) or to operate as a tax haven ($h_k = 1$). We define

$$(a_R, a_{H_1}, a_{H_2}, ..., a_{H_n}) \equiv \left(\int_{a_i=0} 1di, \int_{a_i=1} 1di, ..., \int_{a_i=n} 1di \right), \tag{1.20}$$

where $\int_{a_i=k} 1di$ denotes the mass of investors who locate their capital in H_k. Suppose further that the parameters s, t, z, and τ are defined as in the previous sections, but allow for the haven countrys specific cost parameters (θ_k, c_k).

Proposition 6 *Investors'location choices a_i leading to $(a_R, a_{H_1}, a_{H_2}, ..., a_{H_n})$ and a vector $(h_1, h_2, ..., h_n)$ constitute a subgame perfect equilibrium, if*

$$h_k = \begin{cases} 0 & \text{if } a_{H_k} < \theta_k / (s - c_k) \\ 1 & \text{if } a_{H_k} \geq \theta_k / (s - c_k) \end{cases} \tag{1.21}$$

and each a_i fulfills the following conditions: $a_i = 0$ if $a_{H_k} < \theta_k / (s - c_k)$ for all $k = 1, ..., n$; $a_i \neq 0$ and $a_i \neq j$ for all j with $a_{H_j} < \theta_j / (s - c_j)$ if $a_{H_k} \geq \theta_k / (s - c_k)$ holds for at least one haven country H_k.

A proof follows the same logic as in the first paragraphs of *(iii)* in the proof of Proposition 1. (1.21) describes the time-consistent choice of haven countries. Given (1.21), the individual investors have an incentive to locate their capital in R if they anticipate that none of the haven countries attracts the critical amount of investment. If investors anticipate that one or several of the haven countries attract at least the critical quantity of investment, the investors have an incentive to locate their capital in one of the haven countries that is anticipated to attract suffi cient funds. If several countries fulfill the condition $a_{H_k} \geq \theta_k / (s - c_k)$, the investors are indifferent between them and may make decisions such that the resulting capital allocation $(a_R, a_{H_1}, a_{H_2}, ..., a_{H_n})$ confirms their expectations. However, the investors prefer each of these location choices to locating the capital in R or in one of the haven countries that has too little funds and will choose to comply with the transparency standards.

As a result, none, one, or several haven countries may attract the critical amounts of investment that are needed to make the tax haven business sufficiently profitable. All other haven countries attract zero investment and do not offer concealment opportunities. The equilibrium with $a_i = 0$ for all $i \in I$ and $h_k = 0$ for all $k \in \{1, 2, ..., n\}$ from Proposition 1 is in this set. Also, the equilibrium in which one haven country monopolizes the whole market and attracts all investment m is in this set, if $(s - c_k)\, m \geq \theta_k$ is fulfilled for at least one haven country $H_k \in \mathcal{H}$. The complementarities are still in place but the multiplicity of available haven countries allows for further equilibria and also creates additional coordination problems.

We may also consider and allow for a relocation of funds between haven countries. Consider a haven country H that operates in an extended framework in which there is a second haven country $\hat{H}$ that investors may use to shift their funds to should the haven country under consideration choose to pursue a transparency regime. Let us take this second investment opportunity as guaranteed and exogenous, basically assuming away the profitability considerations for $\hat{H}$ that drive the logic of the time-consistent choices of sovereign countries in the main part of our chapter. If the service fee in this second tax haven is lower than the tax rate t in country R, the payoff outcome $1 - \tau$ is to be interpreted as the return on relocating the funds to $\hat{H}$. Apart from this, the logic of the equilibrium analysis remains unaffected. A relocation of the offshore wealth to $\hat{H}$ typically does not solve an investor's problem when being identified as a tax evader, particularly if we adopt the more generous interpretation of the model alluded to in Section 1.3. In the more generous interpretation, the decision on h is the decision between a haven policy continuation or a policy change, which is made much later than the investment decisions and under the influence of international pressure. If funds were located in a tax haven that some years later decides to lift its secrecy regulations and agree to full transparency, a relocation of the funds to a different tax haven may come too late. The tax evasion on previously accrued capital income becomes visible and cannot be neutralized or concealed by shifting the capital to another haven. In the Introduction we referred to a recent empirical example, when the policy change in Switzerland revealed previous tax evasions by US citizens, who were then prosecuted by the US authorities.[37] Fines z apply and the tax rate t, which has been evaded, may influence the cost that accrues to a tax-evading investor if $h = 0$, even if the funds are not repatriated but are relocated elsewhere.

There are further dynamic issues which we bypass because they are orthogonal to the problem we study. A truly dynamic framework would endogenize many of the competition parameters that are exogenous in our analysis. Elsayyad and Konrad (2012) address competition aspects in an exit game among several haven countries, but they removed

[37] Recall from the Introduction the example of the recent crackdown on Swiss banks by US courts, explained in detail in Footnote 9. There might be other empirical examples in which investors were able to keep their identities a secret by relocating their funds to a different tax haven early enough. But it is the mere possibility that a haven country can release information on past transactions and make a tax evading investor worse off than by simply paying the tax due in country R that drives the logic of our analysis.

the issue of strategic complementarity in the decisions of investors from the picture. They assume that investors make a uniform choice as a group, and act as a single player. They highlight that a *last-haven-standing effect* can make it attractive for a haven country to persist, because the fees that tax havens attract in the equilibrium are to some extent a function of the market concentration and the competitive pressure among havens. The results of this analysis ask for a coordinated fight against tax havens that increases the operating costs for all haven countries. Otherwise, with a sequential approach, haven countries may try to hold out in order to obtain higher earnings in a more concentrated market for concealment services.

1.7 Concluding remarks

Our model provides insights into why and when haven countries choose to provide a secrecy regime, and when they decide to comply with international standards of transparency. We identify a key factor driving their decisions: a many player coordination game between a haven country and its potential investors. Investors must anticipate corresponding reactions when making the decision as to whether or not to locate their assets in a haven country. Strategic complementarities between a haven country and investors as well as among investors play a crucial role and suggest a multiplicity of equilibrium outcomes.

Accounting for the incomplete information that investors typically face, we derive an endogenous cost limit of operating as a tax haven above which a haven country will comply with an exchange of tax information, and below which it will pursue a secrecy regime. Notably, this cost limit lies below the potential revenues for an active tax haven. So there are circumstances for which the equilibrium predicts a transparency regime although an active tax haven could yield positive profits. In these situations, a coordination failure precludes a secrecy regime and explains why a haven country might be compliant despite the positive returns on operating as a tax haven.

Furthermore, we derive policy implications. First, we find an inherent trade-off between the fight against tax havens and high tax rates, for example, in the course of an international tax harmonization. Second, low penalties for disclosed offshore tax evasion not only make it attractive for investors to evade taxes, but also render haven countries resistant against costly pressure. Third, we give insights into the pricing of services in tax havens and explain why positive service fees need not be competed away in a competitive, international financial market with multiple active tax havens. Large profits make haven countries robust toward international initiatives and therefore trustworthy for investors.

2

The deterrence effect of whistleblowing: An event study of leaked customer information from banks in tax havens

This chapter is based on joint work with Niels Johannesen.[1]

2.1 Introduction

In the digital age, whistleblowing scandals have become the order of the day. Anyone holding confidential information can easily make it available to the rest of the world by posting it online, and organizations like *WikiLeaks* have specialized in receiving, processing, and disseminating leaked information.

Whistleblowers are celebrated as "the heroes of our time" who are "contributing to ethics and integrity" (UN 2016) and whose legal protection is considered an important concern for public policy.[2] These views presume that whistleblowing does not merely lead to sanctions against the individuals and companies whose illegal or immoral actions are exposed, but affects and improves behavior more broadly. This view is consistent with standard economic theories of crime (Becker 1968), in which whistleblowing should act as a deterrent of criminal behavior by increasing the likelihood of involuntary exposure and, thus, of legal as well as other social sanctions.

Concretely, we should expect that athletes were deterred from using illicit drugs when whistleblower Yuliya Stepanova revealed the existence of a large-scale Russian doping program, which led to the exclusion of hundreds of athletes from the 2016 Olympic Games; that radical islamists became less inclined to join the army of the Islamic State when the former insider Abu Hamed exposed the identities of 22,000 secretly enlisted jihadis; and that firms became more compliant with environmental laws when leaked

[1] See Johannesen and Stolper (2017).

[2] See "Corporate crime: The age of the whistleblower," *The Economist*, 5 December 2015.

reports documented the dumping of toxic waste by the Dutch multinational trading company Trafigura.

This study provides empirical evidence on the deterrence effect of whistleblowing in the context of offshore tax evasion. Specifically, we investigate whether leaks of customer information from banks in tax havens have deterred the criminal use of offshore banking services. While bank accounts in tax havens are not illegal *per se*, they often serve to evade taxes, which makes account holders and sometimes also the bankers assisting with the tax evasion liable to criminal prosecution.[3] Hence, for owners of tax haven accounts as well as for bankers in tax havens, leaks of customer files involve a risk of legal sanctions if the information is acquired by tax authorities, and public humiliation if posted online.

The key empirical challenge is that the criminal use of offshore banking services is not directly observable. Our main empirical approach is therefore indirect and amounts to estimating the effect of data leaks on the stock prices of banks that provide such services. Stock prices reflect the net present value of expected future profits given all available information (Fama 1991); hence, if we observe a drop in the stock prices of these banks precisely at the time when customer information is leaked, this is plausibly because financial markets expected the profits associated with criminal offshore services to decrease. Intuitively, a decrease in profits could derive from either the demand side or the supply side of the offshore banking market with account holders or bankers perceiving the participation in tax evasion to be more risky.[4]

For the purposes of this analysis, we carefully select a sample of offshore banks that are *known* to have foreign tax evaders among their customers. We start from the full sample of banks in Switzerland. Although its banking secrecy rules have recently been moderated, Switzerland dominates the global wealth management industry with a market share of around 30% (Zucman 2013, p. 1,341). Within this sample, we focus on a subsample of banks that have admitted to assisting US taxpayers with tax evasion. Starting with the case against the Swiss bank UBS in 2008, the US government has investigated 16 Swiss banks for their complicity in tax evasion leading to settlements with a combined value of more than US $4.29 billion. Subsequently, another 80 Swiss banks have admitted to tax-related criminal activities in the US under the *Swiss Bank Program*, which allowed banks to resolve criminal liabilities through the full disclosure of their cross-border activities and the payment of appropriate penalties. From this gross sample of 96 Swiss banks with a known link to offshore tax evasion, our estimating sample includes the 46 banks that are listed on a stock exchange.

[3] Documents published in the context of a court case against the Swiss bank UBS show that around 90% of the bank's US customers were not tax compliant (US Senate 2008). Besides hundreds of account holders, several UBS bankers were prosecuted for assisting with tax evasion including the whistleblower, Bradley Birkenfeld, and the head of the bank's global wealth management division, Raoul Weil.

[4] Alstadsæter et al. (2017) develop a formal model of the supply side of the market for offshore services where an exogenous shock to the risk of detection induces offshore banks to shed customers with relatively few assets under management.

Our main analysis concerns the first data leak from a tax haven bank: customer files from *LGT Bank* in Liechtenstein were extracted by a former computer technician at the bank, Heinrich Kieber, and distributed to tax authorities in several countries. The leak became publicly known on 14 February 2008, when German police raided the premises of Klaus Zumwinkel, the chief executive of Deutsche Post, and detained him on charges of tax evasion. It soon became clear that the charges were based on leaked customer files that also contained incriminating information about hundreds of other German tax evaders. The affair attracted global attention and was prominently covered by media such as The New York Times, Le Monde, Die Welt, and El Pais in the following days.

Employing a standard event study framework (Kothari and Warner 2007), we find that the LGT leak caused a significant decrease in the market value of Swiss banks involved in offshore tax evasion. The banks in our sample tracked the normal return closely in the ten days preceding the leak, but earned an abnormal return of -1.1% over the first two days after the leak and -2.2% over the first four days following the leak. The estimated stock market responses are larger and sharper when returns are weighted by market capitalization; here, we find an abnormal return of -2.1% over two days and -3% over four days. In either case, the cumulative abnormal returns are statistically significant based on standard parametric tests and also non-parametric tests comparing abnormal returns after the leak to the empirical distribution of abnormal returns in the pre-leak period.

These findings are suggestive that the leak from LGT Bank lowered market expectations about the future earnings of tax haven banks that assist foreign customers with tax evasion. The most plausible interpretation is that markets perceived the leak as an effective deterrent of offshore tax evasion. Since offshore tax evasion had never previously been exposed in leaks, offshore account owners and bankers most likely did not account for this risk before the leak from LGT Bank.[5] Alternatively, they may have assigned a very small probability to the possibility of a leak and updated their beliefs about this probability the first time a leak occurred. In either case, an increase in the perceived probability of a leak should be expected to deter the demand and supply of criminal offshore banking services and reduce the earnings of offshore banks.

A number of additional empirical tests support this interpretation of the main result and provide further evidence of the mechanisms at play.

First, we show that other Swiss banks than those with known links to offshore tax evasion did not earn abnormal returns in the days after the leak. This reassures us that our results are not driven by confounding shocks affecting the entire Swiss financial sector and is strongly suggestive that the negative abnormal returns earned by banks in the baseline sample are related to their role in tax evasion.

[5] Formal models of choice under uncertainty typically assume that decision-makers are aware of all possible outcomes, but unawareness has been studied theoretically in the literature on bounded rationality (e.g., Dekel et al. 1998).

Second, we explore the heterogeneity of the stock market responses within the baseline sample and find a much larger decrease for the banks that were investigated by US prosecutors (abnormal return of -6.1% over four days) than for the banks that subsequently resolved their criminal liabilities through a voluntarily disclosure of their cross-border activities (abnormal return of -1.2% over four days). Presumably, US prosecutors selected Swiss banks for investigation based on *ex ante* information about their involvement in offshore tax evasion, so market participants with a similar information set would plausibly expect the same banks to be most adversely affected by an increase in the risk associated with offshore tax evasion. We obtain similar results with an *ex post* measure of the involvement in offshore evasion based on the size of the penalties paid to the US. Specifically, we find a larger decrease for banks with above-median penalties (abnormal return of -3.2% over four days) than for banks with below-median penalties (abnormal return of -1.4% over four days). This set of results further strengthens the causal link between the banks'losses in market value around the time of the LGT leak and their role in offshore tax evasion.

Third, we apply the same event study design to subsequent leaks from other tax haven banks. We manually searched all front pages of a major Swiss newspaper, *Neue Zürcher Zeitung*, between January 2008 and October 2016 and identified 13 instances where an article covered a newly leaked list of bank customers or a significant new dissemination of such a list, for example, when a customer list previously leaked to foreign tax authorities was made publicly accessible. We generally find weak signs of stock market responses to major events, such as the leak from the Swiss wealth management branch of HSBC in 2009, but the effects are relatively modest in size and typically not statistically significant at conventional levels. Overall, these results are suggestive that the very first leak led offshore account owners and bankers to incorporate the risk of whistleblowing into the calculus of tax evasion whereas subsequent leaks were not associated with a significant updating of the beliefs about this risk.

Fourth, we explore the alternative hypothesis that leaks do not themselves deter offshore tax evasion, but drive down the expected earnings of murky offshore banks by exposing them to unwanted media attention, for instance, because exposure fosters public demand for political action. In an attempt to distinguish this exposure hypothesis from the deterrence hypothesis, we apply our model to an event that made offshore tax evasion feature prominently in international media, but contained no new information about its potential costs: the investigation against Uli Hoeness, president of the soccer club FC Bayern Munich, for his use of Swiss bank accounts for tax evasion purposes after his voluntary self-disclosure was considered incomplete. Consistent with the deterrence hypothesis, we find no significant stock market responses to this event.

Finally, we provide a complementary analysis of the deterrence effect of the LGT data leak using country-level data on foreign-owned bank deposits from the Bank for International Settlements. While foreign-owned deposit stocks evolved very similarly in tax

havens and non-haven countries before the leak, we observe a sharp divergence during the first quarter of 2008 with deposits in tax havens decreasing by more than 10% relative to deposits in non-tax havens. This estimate is clearly consistent with a significant drop in the use of criminal offshore banking services following the leak and the magnitude is similar to what is implied by the drop in market value by the Swiss sample banks under plausible assumptions about discount rates on financial markets and profit margins in the wealth management industry.

While a number of studies have investigated which conditions are conducive to whistleblowing (Dyck et al. 2010), we are not aware of any existing quantitative evidence on the ability of whistleblowing to deter crime. A large related literature with contributions from scholars in law, economics, and criminology explores the role of transparency and public information in deterring criminal behavior more broadly. For instance, legal scholars have argued that the public shaming of criminals is an effi cient way to deter white-collar crime (Kahan and Posner 1999) and economists have documented that publishing individual-level information about reported taxable income reduces tax evasion (Bo et al. 2015).

Our study also contributes to a small literature investigating the factors that shape offshore tax evasion, for instance, tax rates (Hanlon et al. 2015), tax enforcement (Johannesen and Zucman 2014), and tax amnesties (Johannesen et al. 2017 and Langenmayr 2015). Our results suggest that the emergence of whistleblowers from the ranks of employees in tax haven banks has the potential to curb offshore tax evasion.

Finally, our study adds to an emerging literature studying how stock prices respond to data leaks and other news about tax aggressive behavior. For instance, ODonovan et al. (2017) document that firms whose offshore affi liates were exposed in the *Panama Papers* suffered significant losses in market value when the leak was published, and Hanlon and Slemrod (2009) show a similar pattern around news stories documenting firms' use of domestic tax shelters. While these papers are suggestive that media exposure of firms' aggressive tax planning may limit these firms' ability to avoid taxes in the future, they do not provide evidence of a broader deterrence effect extending beyond the specific taxpayers exposed in the media.

2.2 Background and data

2.2.1 Offshore tax evasion and Swiss banks

Recent studies estimate that household wealth hidden in tax havens amounts to at least US $6,000 billion (Zucman 2013). The hidden wealth predominantly belongs to the very wealthiest households (Alstadsæter et al. 2017) and largely escapes taxation (US Senate 2008).

Governments wanting to tax the wealth hidden in tax havens have recently enacted a number of enforcement initiatives: in 2005, the European Union agreed with a number of tax havens to tax the interest income accruing to accounts owned by European residents and remit the revenue to the home country (Johannesen 2014); in 2009, all tax havens in the world were compelled to accept a weak form of cooperation whereby they would lift the banking secrecy and provide information about specific account holders suspected of tax evasion when requested by foreign tax administrations (Johannesen and Zucman 2014), and most recently, tax havens agreed to provide financial account information of foreign taxpayers on an automatic basis (Stolper 2017).[6]

An enforcement initiative of particular interest to this study are the criminal cases in the US against Swiss banks for assisting US citizens with tax fraud involving anonymous shell companies and undeclared Swiss bank accounts. The first case, against UBS, ended with a US $780 million settlement in February 2009, and another 15 Swiss banks were investigated on similar charges in the following years.[7] At the time of writing, six of these cases had been settled with combined penalties of US $4.29 billion while seven are still pending, and three of the investigated banks have ceased their operations.[8] Finally, in August 2013, the US Department of Justice and the Swiss government announced the *Swiss Bank Program* under which banks not already under criminal investigation could resolve potential criminal liabilities related to undeclared US-owned accounts in Switzerland by satisfying a list of requirements, including full disclosure of their cross-border activities, cooperation with future information requests under the US-Swiss double tax treaty, and the payment of appropriate penalties. This program resulted in non-prosecution agreements with an additional 80 banks with combined penalties of around US $1.36 billion.[9]

These US enforcement initiatives are useful for our purposes because they identify a group of banks that derived income from assisting US customers with offshore tax evasion prior to the investigations.[10] Upon an increase in the risks associated with offshore tax evasion, we should expect precisely these banks to suffer a loss in market value. Moreover, the outcomes of the enforcement initiatives allow us to make predictions about the heterogeneity in stock market responses *within* this sample of banks. First, if US prosecutors chose to investigate the Swiss banks, which they believed *ex ante* were the most likely to be involved in offshore tax evasion, and if market participants had similar beliefs, we should expect investigated banks to suffer larger market value losses than banks subsequently admitting to criminal offences under the Swiss Bank Program. Second, if

[6] Account information is provided to the US under the Foreign Account Tax Compliance Act (FATCA) and to other countries under the Convention on Mutual Assistance in Tax Matters as amended in 2014.

[7] There is no official list of all 16 banks under investigation, but they are mentioned in numerous news articles. One article that lists all the banks can be found on the Swiss public service news and information platform Swissinfo, see http://www.swissinfo.ch/eng/credit-suisse-fallout_remaining-hit-list-banks-sweat-over-us-verdicts/38637818 (last accessed on 15 February 2017).

[8] The three banks that have dropped out of business are Wegelin, Neue Zürcher Bank, and Bank Frey.

[9] See https://www.justice.gov/tax/swiss-bank-program (last accessed on 15 February 2017).

[10] Of course, Swiss banks also assist taxpayers from other countries in evading taxes. In fact, most Swiss bank deposits are owned by Europeans (Zucman 2013, pp.1,332ff).

ex post penalties contain a signal about the degree of involvement in offshore tax evasion that was at least partly observable by market participants at the time of the leak, we should expect market value losses to be larger for banks with higher penalties.

Starting from the gross sample of 96 Swiss banks that have been subject to criminal investigations in the US or have participated in the Swiss Bank Program, we arrive at the estimating sample in the following steps. First, our empirical approach requires daily publicly available stock prices, so we disregard banks that are not listed on a stock exchange. However, when a Swiss bank in our sample belongs to a multinational banking group, we include the parent company if listed; for instance, the Swiss entity *HSBC Private Bank* is owned by the UK-based holding company *HSBC Holdings PLC*.[11] This procedure yields 49 Swiss entities. Second, we exclude three entities that are classified neither as a bank nor as a financial services company under the Industry Classification Benchmark (ICB) as we do not expect the data leaks to be relevant for these firms.[12] Finally, as particularly smaller entities are not always being traded, we exclude entities for which no stock return can be identified in the week after the event under consideration. This yields an estimating sample of 38 Swiss entities for the data leak from LGT Bank in February 2008 and a similar number of entities for other events. While the sample varies slightly across events and, strictly speaking, includes both Swiss banks and multinational banking groups with an office in Switzerland, we shall refer to the banks in our sample as "Swiss banks" for simplicity of the exposition.

Table 2.A in the Appendix to this chapter contains detailed information about all 46 banks that appear in the estimating sample at some point between 1 January 2007 and 31 October 2016, including an indication of whether a bank has been subject to criminal investigations or has participated in the Swiss Bank Program, and the size of the penalty in the US related to its involvement in offshore tax evasion.

2.2.2 Data leaks

The main focus of the analysis is to study banks'stock market responses to the leak of customer data from the Liechtenstein-based LGT Bank. According to journalistic accounts, the leak occurred in 2002 when a computer technician at the bank, Heinrich Kieber, extracted confidential customer information from the banks' IT systems. After leaving the bank, he approached the German intelligence agency, Bundesnachrichtendienst (BND), in 2006 and ultimately sold them a CD-ROM with information on the banks' customers in Germany for around €4.2 million.

[11] The current parent companies of Swiss banks are identified in Bloomberg and any changes to the parent-subsidiary links are identified in an extensive online research using the banks'own homepages, Wikipedia, and http://www.schweizer-banken.info/ (last accessed on 15 February 2017). In case of multiple listed parent companies on different hierarchy levels in the company tree, we selected the lowest ranked listed parent company in order to include as few unaffected entities as possible.

[12] Here, we drop American International Group Inc (insurance), Assicurazioni Generali SpA (insurance) and Italmobiliare SpA (construction & materials).

The data leak became publicly known in 2008. After months of secret investigations, on 14 February, the German policy raided the premises of Klaus Zumwinkel, a prominent corporate executive, and detained him on charges of tax evasion. The case was immediately picked up by major media outlets which also reported that the tax evasion scandal involved hundreds of further suspects. On 15 February, several news media reported that the German intelligence service was involved in the case and, on 16 February, the German magazine *Der Spiegel* was first to report that the BND had allegedly paid a whistleblower around €5 million for the information leading to the arrest of Klaus Zumwinkel.[13] On 18 February, the news reports contained regular references to the data leak in 2002. While we treat the arrest of Mr. Zumwinkel on 14 February as the event day, we should not expect to see the full effect on the stock prices until three to four days after the event, given the staggered dissemination of information.

While the LGT leak in 2008 was, to our knowledge, the first data leak from a tax haven bank, several others followed in the subsequent years. We have systematically collected information about these leaks by manually searching all front pages of a major Swiss newspaper, *Neue Zürcher Zeitung*, for the period between January 2008 and October 2016. Concretely, we searched each front pages for the keywords *Steuer* ("tax"), *Bank* ("bank"), *Info* ("information"), and *Daten* ("data"), and manually screened the headlines of all articles on the front pages. For every hit, we read the article to determine whether or not it referred to a data leak from a tax haven.[14] Finally, we searched the articles about data leaks for a reference to the date when the leaks became publicly known; when an article does not mention any date, we assume that the leak occurred one calendar day prior to the article's publication date. The implicit assumption underlying this approach is that data leaks with sufficient significance for Swiss banks to move their stock prices would be reported on the front pages of Swiss newspapers.

As detailed in Table 2.1, we identified 13 front page articles that concern new data leaks or significant new dissemination of information from existing leaks. Several of the articles reported the major leak from HSBC Private Bank in Switzerland. First, on 30 August 2009, the French budget minister Eric Woerth announced that his ministry was in possession of a list of 3,000 French taxpayers holding a total of €3 billion in Swiss bank accounts, but he did not disclose the source of the leak. Then, on 9 December 2009, French media reported an alleged data theft at HSBC, which was confirmed on 13 December 2009, when *Hervé Falciani* revealed himself as the HSBC whistleblower on French prime time television. Eventually, in February 2015, the *International Consortium for Investigative*

[13] See http://www.spiegel.de/wirtschaft/finanzskandal-bnd-zahlte-fuenf-millionen-fuer-geheime-steuerdaten-a-535687.html (last accessed on 15 February 2017).

[14] We excluded all articles about the Hildebrand affair. Philipp Hildebrand is a former president of the Swiss National Bank whose wife bought more than half a million US dollars in August 2011, just one month before the Swiss National Bank capped the exchange rate of the Swiss franc. While the Hildebrand affair was triggered by a bank employee leaking information of this transaction, the data leak was limited to Philipp Hildebrand and was never intended to identify any foreign tax evaders. A list of all other articles can be requested from the authors.

TABLE 2.1: Events related to data leaks from tax havens

Event number	Date of event	Date of front page article	Event
#1	14 feb 2008	16 feb 2008	Head of Deutsche Post was detained on charges of tax evasion; investigators target hundreds of suspects and might have obtained data from *LGT Bank*
#2	30 aug 2009	31 aug 2009	French budget minister announced to possess data on 3,000 customers of three Swiss banks
#3	-	3 nov 2009	Dutch authorities acquired data from whistleblower on foreign accounts of alleged Dutch tax evaders
#4	-	10 dec 2009	French media report that an employee of the Swiss HSBC branch has stolen thousands of customer files and handed them over to French authorities
#5	1 feb 2010	2 feb 2010	German finance minister announced the acquisition data that was stolen from a Swiss bank and offered to German authorities
#6	-	8 feb 2010	Two states in Germany were offered further banking information on potential tax evaders; it seems likely that the data will be acquired
#7	17 jan 2011	18 jan 2011	Former employee of Julius Baer, Elmer, publicly delivered further banking data to WikiLeaks
#8	14 jul 2012	16 jul 2012	German state said to again have acquired banking information of 1,000 German clients at Coutts
#9	4 apr 2013	5 apr 2013	Offshore Leaks with information on 130,000 individuals and 122,000 trusts and corporations hit media headlines around the world
#10	-	17 apr 2013	German authorities have acquired new banking data from Switzerland and have started raiding clients of Credit Suisse and its subsidiaries
#11	-	10 feb 2015	Swiss Leaks with information on 100,000 customers of the Swiss HSBC branch which was stolen by the former employee Falciani hit international headlines
#12	3 apr 2016	4 apr 2016	Panama Leaks with information on 214,000 shell companies affecting former and current heads of states hit the international news headlines
#13	14 apr 2016	15 apr 2016	German state announced to distribute information from 11 data acquisitions and covering offshore deposits worth CHF 101.6 billion across the EU

Note: The table provides information on all the data leaks from banks in tax havens, and significant new disseminations of such data, mentioned on the front page of the Swiss newspaper *Neue Zürcher Zeitung* between 1 January 2008 and 31 October 2016. The date of the event is the date mentioned in the article. The storylines are the authors'own summaries and translations from German. The front page article on event #8 states that a leak occurred during the weekend of 14/15 July 2012, but not the precise date; however, as the event studies are only concerned with trading days, this has no bearing on the estimations.

TABLE 2.2: Summary statistics on stock market returns

	Mean	Standard deviation	Minimum	Maximum
Individual banks	0.0	2.3	-19.9	25.0
Portfolio of banks, unweighted	0.0	1.2	-8.2	8.9
Portfolio of banks, weighted by market capitalization	0.0	2.1	-12.1	18.7
Stoxx Europe 600	0.0	1.6	-11.7	11.3

Note: The table provides summary statistics for the stock market returns (in percent) of the 46 Swiss banks in the estimating sample and for the return of a major European stock market index. All statistics are for the period between 1 January 2007 and 31 October 2016. The first line refers to the stock returns of individual sample banks; the second to the portfolio return computed as the simple average of individual bank returns; the third to the portfolio return computed as the average of individual bank returns weighted by their market capitalization; and the fourth to the stock market index Stoxx Europe 600.

Journalists (ICIJ) gained access to the HSBC customer lists and published them as the *Swiss Leaks*, thereby exposing hundreds of prominent tax evaders to public scrutiny.

2.2.3 Stock market data

We use Bloomberg to collect financial information about the 46 Swiss banks in our estimating sample for the period 1 January 2007 to 31 October 2016. We calculate the daily return on each stock as the simple rate of return of the stock's total return index, which accounts for dividends as well as capital gains

$$Return_{n,t} = \frac{P_{n,t} - P_{n,t-1}}{P_{n,t-1}}, \tag{2.1}$$

where $P_{n,t}$ is the value of the total return index of bank n at time t. All prices are denoted in Swiss francs to avoid any confounding effects of exchange rate movements.

We exclude observations from non-trading days in Switzerland to avoid a small group of banks which is traded outside of Switzerland from dominating the estimates on specific days, such as Israeli stocks which are traded on Sundays but not Fridays.[15] Moreover, we exclude observations if the end-of-day stock price remained constant or was missing for at least five consecutive Swiss trading days because such stale stocks could otherwise introduce a bias toward zero. Finally, we winsorize returns at the 0.1 and 99.9% level to reduce the influence of outliers.

Table 2.2 provides summary statistics on the resulting sample of stock returns: the mean daily return across all banks over the entire sample period is 0.0% with a minimum return of -19.9%, a maximum return of 25%, and a standard deviation of 2.3%. We also

[15] We define Swiss trading days as days when the Swiss Market Index is traded. Non-trading days in Switzerland are typically Saturdays, Sundays, and bank holidays.

provide summary statistics on the returns of the portfolios including all banks, unweighted and weighted by market capitalization, as well as a major European broad stock market index, *Stoxx Europe 600*.[16] In the event studies, we choose this index to proxy for the general market return because almost all the banks in our sample are listed in Europe and because it explains more of the variation in stock returns outside of the event windows than the blue chip index *Stoxx Europe 50* or leading Swiss market indices such as the *Swiss Market Index* or the *Swiss Performance Index*.[17]

2.3 Empirical methodology

The aim of the empirical analysis is to estimate how the market values of Swiss banks with ties to offshore tax evasion responded to leaks of customer files and other unanticipated events. For this purpose, we employ a standard event study framework (e.g., Kothari and Warner 2007).

In a first step, for each event to be considered, we identify an event-specific sample of banks and an event-specific observation period. The sample includes all banks, according to the rules described above, that are a Swiss bank or own subsidiaries that are Swiss banks for the entire week following the event. The observation period includes the event window, consisting of the event date and 10 trading days before and after the event date, and an estimation window consisting of 250 trading days before the event window, which is roughly one calendar year. So for every analysis, we consider 271 trading days $t \in [-260, 10]$ and the event is normalized to take place on $t = 0$.

In a second step, we calculate the daily portfolio return as the average daily stock return across all Swiss banks in the event-specific sample

$$Portfolio\ return_t = \frac{1}{N} \sum_{n=1}^{N} Return_{n,t}, \tag{2.2}$$

where $Return_{n,t}$ is the return of bank n on day t and N is the number of banks in the event-specific sample. We use the portfolio return rather than bank individual returns as the dependent variable in the event study regressions to account for any cross-sectional dependence in the returns of individual banks.

[16] To be precise, Table 2.2 uses an unbalanced portfolio accounting for the trading day specific company structures and ownership links, which sometimes change over time. The event study regressions use event-specific balanced portfolios of those listed companies that are a Swiss bank or own subsidiaries that are Swiss banks for the entire week following the event.

[17] These results are not reported.

In a third step, we regress the portfolio return on the market return and dummies for the symmetric 21-day window around the event

$$Portfolio\ return_t = \alpha + \beta\ Market\ return_t + \sum_{s=-10}^{10} \delta_s D_s + \varepsilon_t, \tag{2.3}$$

where $Market\ return_t$ is the return of the Stoxx Europe 600 on day t, and D_t is a dummy indicating day t.

The parameter β captures the correlation between the portfolio return and the market return in the period before the event window, and the term $\alpha + \beta\ Market\ return_t$ thus expresses the normal portfolio return on day t conditional on the market return and absent the leak. The parameter δ_t captures the abnormal return of the portfolio on day t, $AR(t)$, which is simply the difference between the actual and the normal portfolio return.

The main parameter of interest is the cumulative abnormal return over the first T days after the event, $CAR(T)$, where $T = 1, 2, 3, 4, 5$. The point estimate can be obtained directly from the coeffi cients estimated in equation (2.3) as

$$CAR(T) = \sum_{s=0}^{T-1} \delta_s. \tag{2.4}$$

In practice, we estimate a slightly modified version of equation (2.3) that yields point estimates and standard errors of $CAR(T)$ directly and corrects for potential intertemporal correlation in the error terms (Salinger 1992).

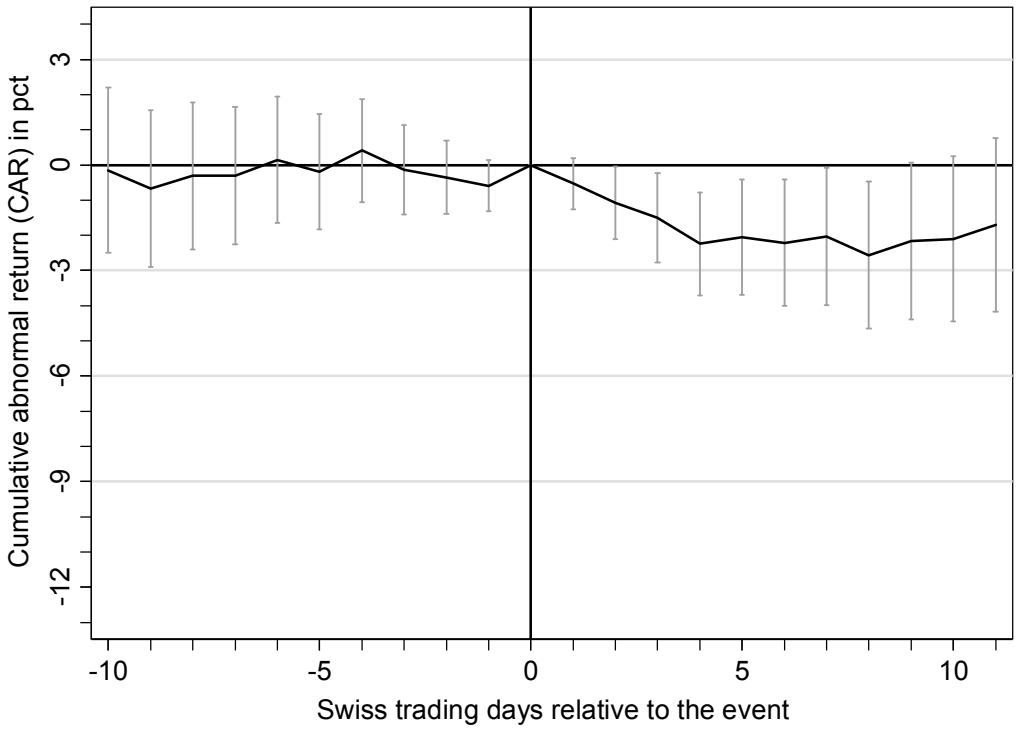
2.4 Results: Stock prices

2.4.1 Average effect

We start the empirical analysis by estimating the event study model on the baseline sample of Swiss banks that have either been under criminal investigation for their role in offshore tax evasion or participated in the Swiss Bank Program.

As illustrated in Figure 2.1, these banks earned abnormal returns of around -0.5% on the first day of the LGT leak and on each of the subsequent three trading days. The cumulative abnormal return of around -2% over four trading days is statistically significant and remained roughly constant in the remainder of the event window. By contrast, abnormal returns were small and not systematically positive or negative in the ten days before the leak. This reassures us that the negative abnormal returns observed after the leak were not driven by a differential underlying trend.

FIGURE 2.1: Cumulative abnormal return of Swiss banks around the leak from LGT Bank



Note: The figure illustrates the results from the main event study specification applied to the first event, the leak from *LGT Bank* on 14 February 2008. The line shows the estimates of the cumulative abnormal return. The gray bars indicate 95% confidence intervals of the estimates accounting for cross-sectional and intertemporal correlation in the abnormal returns.

While the confidence intervals plotted in Figure 2.1 are derived under the usual parametric assumptions, we also take a non-parametric approach to statistical inference. For instance, to test the statistical significance of $CAR\,(5)$, we compute the cumulative abnormal return for each five-day window in the estimation period (outside of the event window) and plot the empirical distribution as illustrated in Figure 2.2. Intuitively, this distribution provides a sense of the variability of abnormal returns in normal times and thus allows us to assess whether the abnormal return observed at the time of the leak is statistically significant. Specifically, as illustrated with a vertical line in the figure, our estimate of $CAR\,(5)$ is around -2.1%, which corresponds roughly to the 1^{st} percentile in the distribution. It follows that the probability of observing a more extreme outcome than $CAR\,(5)$ under the pre-event distribution of returns is around 2%. Or in other words, the p-value associated with a two-sided test of the null hypothesis that $CAR\,(5) = 0$ is around 0.02. Applying the same non-parametric test, we find that $CAR\,(1)$ is significantly different from zero with a p-value of 0.14, $CAR\,(2)$ with a p-value of 0.06, $CAR\,(3)$ with a p-value of 0.02, and $CAR\,(4)$ with a p-value of 0.00.

Table 2.3 reports additional results with Column (1) showing the baseline estimates from Figure 2.1 for ease of comparison. While the baseline specification defines the portfolio return as the simple average of the individual banks'stock returns, we re-estimate the model with a portfolio return that weighs the individual bank returns by market capitalization and report the results in Column (2).[18] The estimated stock market responses are both larger and sharper than in the baseline model with the cumulative abnormal return reaching -2% already after two days and stabilizing at roughly -3% after four days.

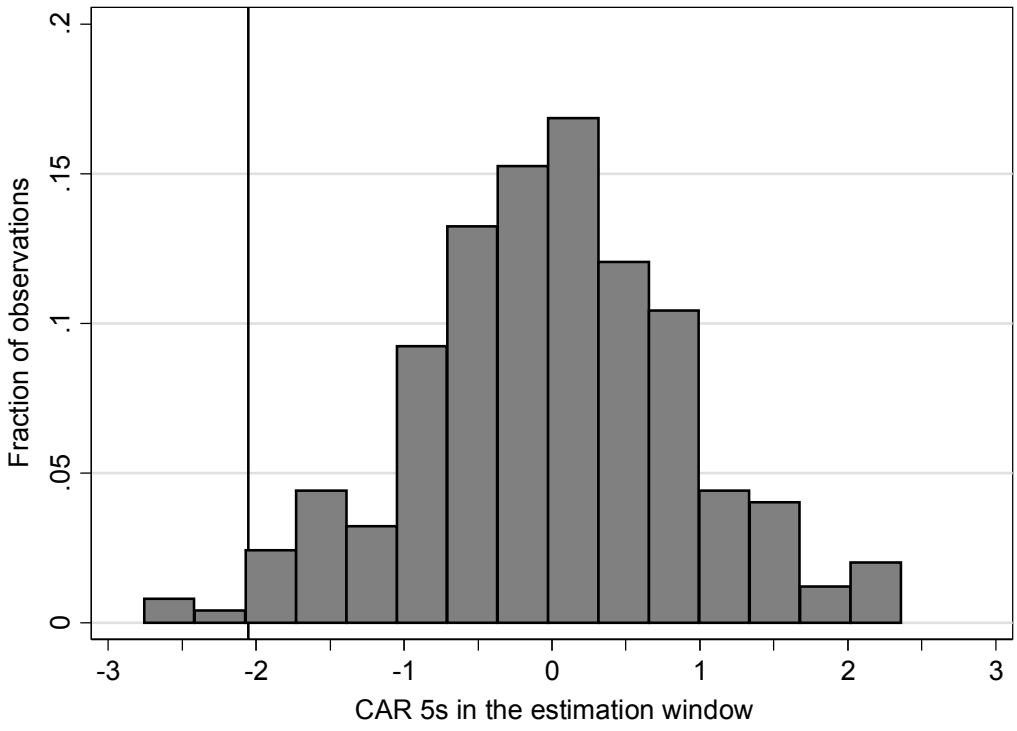
These results are instructive by providing a sense of the economic significance of the stock market responses: the combined market value of the 37 banks in the weighted portfolio was almost CHF 1,000 billion (around US $900 billion) immediately prior to the leak, so the 3% decrease corresponds to a loss in market value of around CHF 30 billion (around US $27 billion). Taken at face value, this measures the net present value of the income losses suffered by Swiss banks due to the deterrence effect of the data leak. Assuming that Swiss banks earn an annual profit margin of 0.5% on assets under management and that stock market investors use a discount factor of 5%, these estimates suggest that the foreign-owned assets managed by Swiss banks in the portfolio are expected to permanently decrease by around CHF 300 billion (around US $270 billion).[19] This decrease corresponds to around 10% of the total foreign-owned wealth managed in Switzerland.[20]

[18] We use the latest available pre-event information on banks' market capitalization so that the weights are unaffected by the leak. For four banks there is no available information on pre-event market capitalization (see Table 2.A in the Appendix), and these banks are therefore not included in the estimation.

[19] Note that these figures only account for assets held in listed Swiss banks. Assuming that customers in unlisted Swiss banks were deterred to the same extent as customers in listed Swiss banks and that penalties were proportional to the value of foreign-owned assets under management, the implied decrease in assets under management is around CHF 190 billion (around $170 billion) or around 7% of the total foreign-owned assets managed in Switzerland.

[20] Zucman (2013, Table A.23 and A.24) puts the foreign-owned wealth held in Switzerland by the end of 2007 at US $3.4 trillion.

FIGURE 2.2: Distribution of five-day cumulative abnormal returns before the leak from LGT Bank



Note: The figure illustrates the distribution of cumulative abnormal returns for all five-day windows in the estimation period (outside of the event window) of the first event, the leak from *LGT Bank* on 14 February 2008. The vertical line indicates the estimated cumulative abnormal return in a five-day window starting at the time of the first leak, that is $CAR(5)$.

TABLE 2.3: Main regression results

	Unweighted portfolio (1)	Weighted portfolio (2)	Other Swiss banks (3)
CAR 1	-0.5	-1.1*	-0.3
	(0.4)	(0.6)	(0.7)
CAR 2	-1.1**	-2.1**	0.7
	(0.5)	(0.8)	(1.1)
CAR 3	-1.5**	-2.2**	-0.6
	(0.6)	(1.0)	(1.3)
CAR 4	-2.2***	-3.0**	0.1
	(0.7)	(1.2)	(1.5)
CAR 5	-2.1**	-2.9**	-0.3
	(0.8)	(1.3)	(1.7)
Stoxx Europe 600	66.5***	108.2***	65.0***
	(1.7)	(2.7)	(3.5)
Constant	-0.0	-0.0	0.1
	(0.0)	(0.0)	(0.0)
Observations	271	271	271
R-squared	0.9	0.9	0.6
Banks in sample	38	37	7
Market capitalization	980,402	980,402	26,977

Note: The table shows the results (in percent) from the main event study specification applied to the first event, the leak from *LGT Bank* on 14 February 2008. Column (1) indicates the results with the unweighted portfolio return; Column (2) indicates the results with the portfolio return weighted by market capitalization; Column (3) indicates the results for an unweighted portfolio of Swiss banks with no known link to offshore tax evasion. All regressions include a set of event time dummies as described in the main text. Standard errors are provided in parentheses and take account for cross-sectional and intertemporal correlation in the abnormal returns. *** Significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

Having established an economically sizable and statistically significant decrease in the market value of Swiss banks associated with offshore tax evasion precisely at the time of the LGT leak, one may still be concerned that the stock market response was in fact not caused by the leak itself but by an unrelated shock coinciding with the leak. We address this concern by applying the baseline model to a sample of Swiss banks *not* associated with offshore evasion.[21] For most types of shocks unrelated to offshore evasion, for instance, monetary policy changes, macroeconomic news, and exchange rate fluctuations, we should expect the two groups of banks to be similarly affected and, thus, stock prices to follow similar patterns. However, as shown in Column (3), there is no clear trend in the abnormal returns earned by banks not associated with offshore evasion after the leak: the cumulative abnormal return in this group was 0.7% after two days and 0.1% after four days. These results are strongly suggestive that the responses identified in the main sample are in fact caused by the leak.

2.4.2 Heterogeneous effects

This section explores how stock market responses to the leak from LGT Bank varied *within* the estimating sample across Swiss banks with different involvement in offshore tax evasion. We exploit two distinct measures of involvement.

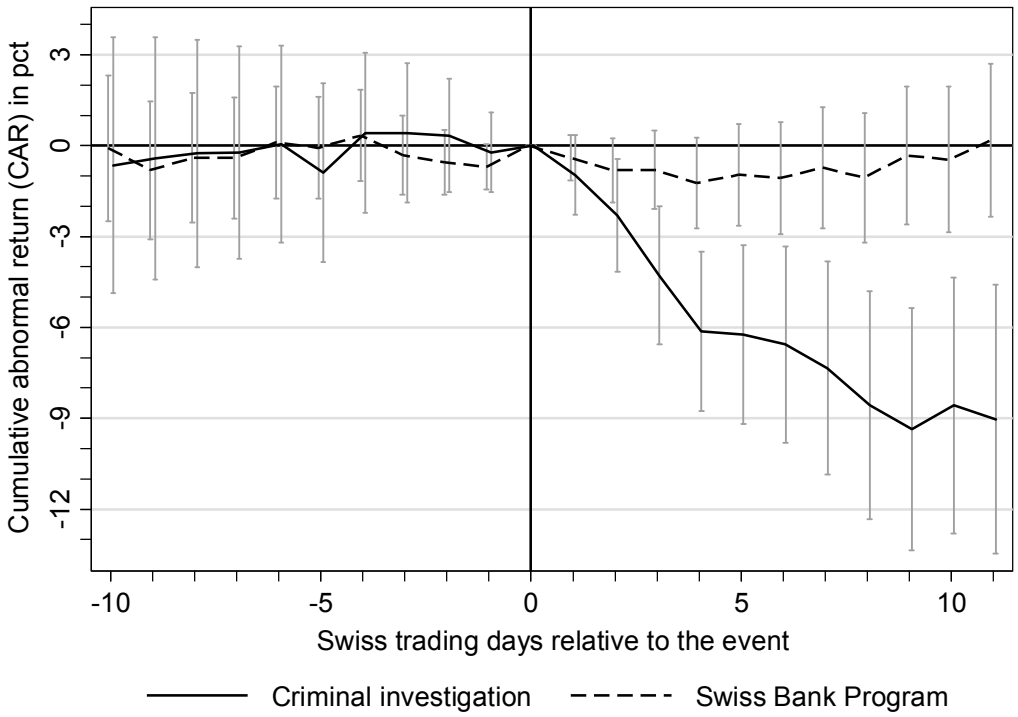
Most importantly, we distinguish between the eight banks that were investigated by US authorities for complicity in tax crimes and the 30 banks that subsequently disclosed their cross-border activities under the Swiss Bank Program. Assuming that US authorities selected Swiss banks for prosecution based on *ex ante* information about their involvement in offshore tax evasion and further assuming that market participants had access to a similar information set, we should expect the stock prices of prosecuted banks to be most adversely affected by a general drop in the demand for offshore financial services triggered by the leak. We estimate the baseline model for the two subsamples separately and plot the results in Figure 2.3. The results are strikingly different: the cumulative abnormal return after four days was -6.1% for the prosecuted banks, but only -1.2% for the voluntary disclosers.

Table 2.4 reports additional results with Columns (1)–(2) showing the estimates from Figure 2.3 for ease of comparison. Columns (3)–(4) show that a similar pattern prevails if bank returns are weighted by market capitalization in the portfolio return, although the difference between the two groups of banks is less stark: the cumulative abnormal return after four days was -4.6% for the prosecuted banks and -2.1% for the voluntary disclosers.

Ultimately, the involvement of Swiss banks in offshore tax evasion should be reflected in the size of the penalties paid in the US. We thus split the sample of banks on the size

[21] We identified this set of placebo banks in the equity screen of Bloomberg. Specifically, we searched for all actively traded banks and asset managers in Switzerland, and excluded all banks that were investigated in the US for assisting in offshore tax evasion or participated in the Swiss Bank Program.

FIGURE 2.3: Heterogeneity in the cumulative abnormal returns of Swiss banks around the leak from LGT Bank



Note: The figure illustrates the results from the main event study specification applied to the first event, the leak from *LGT Bank* on 14 February 2008. The two lines show the estimates of the cumulative abnormal returns for the sample of Swiss banks that were subjected to criminal investigations in the US for their role in offshore tax evasion (solid) and the sample of Swiss banks that admitted to criminal tax-related offences under the Swiss Bank Program (dash), respectively. The gray bars indicate 95% confidence intervals of the estimates accounting for cross-sectional and intertemporal correlation in the abnormal returns.

TABLE 2.4: Regression results, heterogeneity

	Unweighted portfolio		Weighted portfolio		Unweighted portfolio		Weighted portfolio	
	Criminal investigation	Swiss Bank Program	Criminal investigation	Swiss Bank Program	High penalty	Low penalty	High penalty	Low penalty
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAR 1	-1.0	-0.4	-1.9***	-0.6	-0.5	-0.6*	-1.7**	-0.3
	(0.7)	(0.4)	(0.7)	(0.6)	(0.5)	(0.4)	(0.8)	(0.6)
CAR 2	-2.3**	-0.8	-3.1***	-1.5	-1.3*	-0.9*	-2.6**	-1.2
	(0.9)	(0.5)	(0.9)	(0.9)	(0.8)	(0.5)	(1.1)	(0.8)
CAR 3	-4.3***	-0.8	-3.1***	-1.7	-2.4**	-0.7	-3.5***	-0.5
	(1.2)	(0.7)	(1.1)	(1.1)	(0.9)	(0.6)	(1.3)	(1.0)
CAR 4	-6.1***	-1.2	-4.6***	-2.1	-3.2***	-1.4*	-4.4***	-1.5
	(1.3)	(0.8)	(1.3)	(1.3)	(1.1)	(0.7)	(1.5)	(1.2)
CAR 5	-6.2***	-1.0	-4.1***	-2.2	-3.2***	-0.9	-4.2**	-1.4
	(1.5)	(0.9)	(1.5)	(1.4)	(1.2)	(0.8)	(1.7)	(1.3)
Stoxx Europe 600	69.7***	65.7***	92.0***	117.9***	85.1***	49.4***	116.8***	109.6***
	(3.1)	(1.8)	(3.0)	(3.0)	(2.5)	(1.7)	(3.5)	(2.7)
Constant	-0.0	-0.0	-0.1*	-0.0	-0.0	0.0	-0.1	0.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Observations	271	271	271	271	271	271	271	271
R-squared	0.7	0.9	0.8	0.9	0.8	0.8	0.8	0.9
Banks in sample	8	30	8	29	17	17	17	16
Market capitalization	366,045	614,358	366,045	614,358	578,949	197,055	578,949	197,055

Note: The table shows the results (in percent) from the main event study specification applied to the first event, the leak from *LGT Bank* on 14 February 2008. Columns (1)-(2) and (5)-(6) show results for the unweighted portfolio return while Columns (3)-(4) and (7)-(8) show results for the portfolio return weighted by market capitalization. In Columns (1) and (3), the portfolio only includes Swiss banks that have been subject to criminal investigations in the US for their role in offshore tax evasion. In Columns (2) and (4), the portfolio only includes Swiss banks that have admitted to criminal tax-related offences under the Swiss Bank Program. In Columns (5) and (7), the portfolio only includes Swiss banks that have paid penalties above the sample median. In Columns (6) and (8), the portfolio only includes Swiss banks that have paid penalties below the sample median. All regressions include a set of event time dummies as described in the main text. Standard errors are provided in parentheses and take account for cross-sectional and intertemporal correlation in the abnormal returns. *** Significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

of the penalties and estimate the baseline model for the two subsamples separately. As shown in Columns (5)-(6) of Table 2.4, the stock market responses to the first leak are stronger for banks with larger *ex post* penalties: the cumulative abnormal return after four days was -3.2% for banks with above-median penalties and -1.4% for those with below-median penalties. As shown in Columns (7)-(8), a similar pattern emerges when bank returns are weighted by market capitalization in the portfolio return.

By showing that banks'losses in market value around the time of the LGT leak vary systematically with the intensity of their involvement in offshore tax evasion, these results further establish the causal link between the leak and the observed decrease in stock prices; it is highly unlikely that heterogeneity in this particular dimension would have emerged if the correlation was spurious and stock markets really responded to a simultaneous shock unrelated to offshore evasion.

2.4.3 Other events

This section studies the stock market responses to events other than the leak from LGT Bank with the aim of gaining a deeper understanding of the mechanism by which whistleblowing affected the stock prices of Swiss banks involved in offshore tax evasion. The results are reported in Table 2.5.

We first apply the baseline model to three key dates associated with the leak of customer files from HSBC: 30 August 2009 when Éric Woerth, the French budget minister, announced that the French government had acquired a list of 3,000 French customers of three banks in Switzerland with assets worth US $3 billion (Column 1); 9 December 2009 when, for the first time, French media reported an alleged data theft at HSBC (Column 2); and 9 February 2015 when the *International Consortium of Investigative Journalists* (ICIJ) announced that they were in possession of the complete set of leaked documents from HSBC and published the identity of hundreds of prominent customers in a global wave of news stories (Column 3). We also estimate the average stock market response to the remaining nine leaks in our database with a modified version of the baseline model that includes multiple event windows (Column 4).[22]

The results show that stocks of Swiss banks in the estimating sample generally earned negative abnormal returns in the days following news about a leak, however, the effects were relatively modest in size and typically not statistically significant at conventional levels. The results are suggestive that the data leaks occurring after the first leak from LGT Bank did not cause a significant reduction in the use of offshore bank accounts. Plausibly, the first leak made offshore account holders and banks aware of the risk that customer information may be leaked whereas subsequent leaks did not induce any signif-

[22] The observation period of this modified event study model includes all trading days from one year prior to the event window of the first leak until the event window of the last leak. The sample includes all banks that satisfy the requirements outlined above for all leaks under consideration.

TABLE 2.5: Regression results, other events

	Leak #2: Woerth	Leak #4: Falciani	Leak #11: Swiss Leaks	Other leaks	Hoeness
	(1)	(2)	(3)	(4)	(5)
CAR 1	-0.7	-0.1	-0.2	-0.3	-0.2
	(1.0)	(0.8)	(0.3)	(0.2)	(0.5)
CAR 2	-1.1	0.3	-0.7	-0.3	-0.6
	(1.4)	(1.1)	(0.5)	(0.3)	(0.7)
CAR 3	-2.1	-0.7	-1.1*	-0.5	-0.5
	(1.7)	(1.3)	(0.6)	(0.4)	(0.9)
CAR 4	-0.9	-0.5	-0.8	-0.5	-0.6
	(1.9)	(1.6)	(0.7)	(0.5)	(1.0)
CAR 5	-0.8	-0.7	-0.1	-0.2	-0.3
	(2.2)	(1.7)	(0.7)	(0.5)	(1.1)
Stoxx Europe 600	73.5***	81.2***	62.4***	78.7***	71.4***
	(2.2)	(2.6)	(1.6)	(1.0)	(3.2)
Constant	0.1	0.1**	-0.0	0.0	0.0
	(0.1)	(0.0)	(0.0)	(0.0)	(0.0)
Observations	271	271	271	1,890	271
R-squared	0.8	0.8	0.9	0.8	0.7
Banks in sample	38	40	36	30	36
Market capitalization	842,491	813,818	668,437	759,968	622,445

Note: The table shows the results (in percent) from the main event study specification applied to various events. Column (1) concerns leak #2 where the French Budget Minister announced the acquisition of a list with French owners of undeclared Swiss accounts; Column (2) concerns leak #4 when Hervé Falciani revealed himself as the source of the data leak from HSBC; Column (3) concerns leak #11 where ICIJ published the HSBC customer lists as the Swiss Leaks; Column (4) concerns leaks #3, #5–#10, and #12–#13; Column (5) concerns the date when it became publicly known that Uli Hoeness was under investigation for offshore tax evasion. All regressions include a set of event time dummies as described in the main text. Standard errors are provided in parentheses and take account for cross-sectional and intertemporal correlation in the abnormal returns. *** Significant at the 1% level, ** significant at the 5% level, and * significant at the 10% level.

icant upward adjustment in the probabilities assigned to such events. Prior to the first leak, they may have believed that data theft from Swiss banks was impossible; that bank employees had no incentive to blow the whistle or that intelligence services and tax authorities were not able or willing to use leaked data to prosecute tax evaders and bankers. While the first leak changed these priors, any effect of subsequent leaks on the perceived risk appears to be too small to be statistically detectable.

Finally, we apply the baseline model to an event that is entirely unrelated to whistleblowing, but received enormous attention in international media: 20 April 2013 when it became apparent that Uli Hoeness, president of the soccer club FC Bayern Munich and a prominent public person with contacts to high-level politicians including the German chancellor Angela Merkel, was under investigation for tax evasion through accounts in Swiss banks.[23] As shown in Column (5), banks in the baseline sample earned very small and statistically insignificant abnormal returns in the days following the news.

This result suggests that media exposure in itself does not decrease the market value of offshore banks. This has important implications for the interpretation of the main findings: it is consistent with the notion that the LGT leak decreased the market value of Swiss banks through the deterrence of offshore tax evasion, but not consistent with the alternative hypothesis that stock markets responded adversely to offshore evasion having caught the attention of media, voters, and, ultimately, policy makers.

2.5 Results: bank deposits

In this section, we study the deterrence effect of the LGT leak by exploiting an entirely different data source: the Locational Banking Statistics from the Bank for International Settlements (BIS). This publicly available data source provides information on the stock of foreign-owned bank deposits in 47 international banking centers including major tax havens such as Switzerland, Luxembourg, Cayman Islands, Singapore, and Hong Kong. The deposit information in the BIS statistics is reliable because the primary data source is the banks'own balance sheets. To our knowledge, this is the only aggregate statistic of activities in the wealth management sector which covers all tax havens, and it is used extensively in the recent literature on hidden wealth (e.g. Andersen et al. 2016, Johannesen and Zucman 2014, Johannesen 2014, and Zucman 2013).

Our main variable of interest in this analysis is the stock of bank deposits owned by foreign non-bank residents. This variable excludes inter-bank deposits, which is presumably entirely unrelated to tax evasion, and thus captures deposits held by households and firms. The main weakness of the measure in this context is the fact that only deposits are covered whereas other types of assets under management, e.g. bonds and shares, are

[23] For summaries of the Uli Hoeness case, see "Uli, Uli, Uli: Secret Swiss bank accounts suddenly have a famous face," *The Economist*, 27 April 2013, and "Germany's Hoeness trial: Uli goes to jail," *The Economist*, 13 March 2014.

not. Recent estimates suggest that deposits account for around 25% of the total financial wealth managed in tax havens (Zucman 2013).

We investigate whether the LGT leak caused a detectable decline in the use of secret offshore accounts by comparing the evolution of deposits in tax havens and non-haven countries around the time of the leak. Concretely, we define a list of 17 tax havens, corresponding roughly to the list of non-cooperative jurisdictions published by the OECD at the eve of the first global crackdown on tax havens in 2009 (Johannesen and Zucman 2014, OECD 2009), and define the remaining countries that report to the BIS statistics as non-tax havens.[24] To be able to meaningfully compare countries with very different deposit stocks, we base the analysis on a country-level deposit index expressing the stock of deposits in a given quarter relative to the stock at the end of the fourth quarter of 2007, 2007q4, the last observation before the data leak.

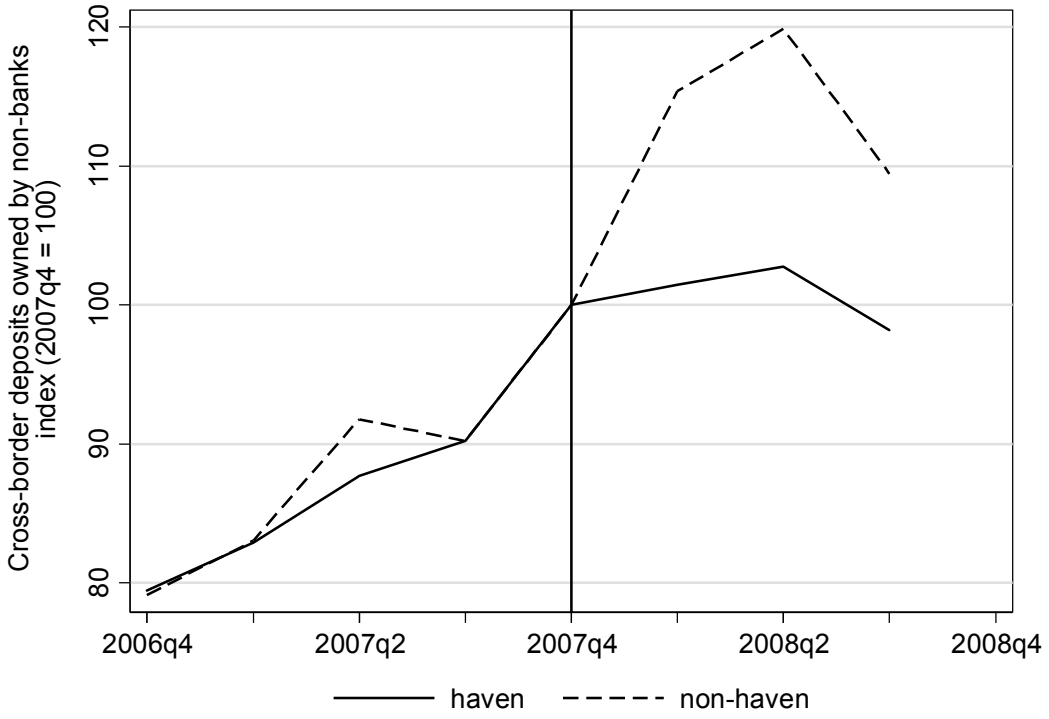
We first plot the average index value for tax havens and non-haven countries in a narrow window around the data leak. As shown in Figure 2.4, deposit stocks evolved very similarly in the two groups before the data leak with steady quarterly increases. Between the end of 2007q4 and the end of 2008q1, however, we observe a sharp divergence with a continued strong deposit growth in non-haven countries, and a close to zero growth in tax havens. The level difference of between 10 and 15 index points remains roughly constant through the bust of Lehman Brothers in September 2008 and the onset of the global financial crisis in 2008q3.

Next, for the purposes of statistical inference, we run a simple linear regression with the deposit index as dependent variable and a tax haven dummy, a full set of time dummies, and their interactions as explanatory variables. Figure 2.5 plots the estimated coeffi cients on the interaction terms as well as their confidence intervals, based on standard errors clustered at the country-level, and shows that the divergence in 2008q1 and 2008q2 is strongly statistically significant.

Under the identifying assumption that deposits held by foreign firms and households would have evolved similarly in tax havens and non-haven countries in the absence of the leak of customer information from LGT Bank, the results suggest that the leak caused a sudden decrease in the deposits held in tax havens by around 10 to 15%. The decrease is consistent with the notion that the first data leak reduced the use of offshore bank accounts by increasing the risk of involuntary exposure as perceived by account holders and banks. Note that the magnitude of the estimate is similar to what is implied by the estimated drop in market value of the Swiss sample banks, as shown above, under

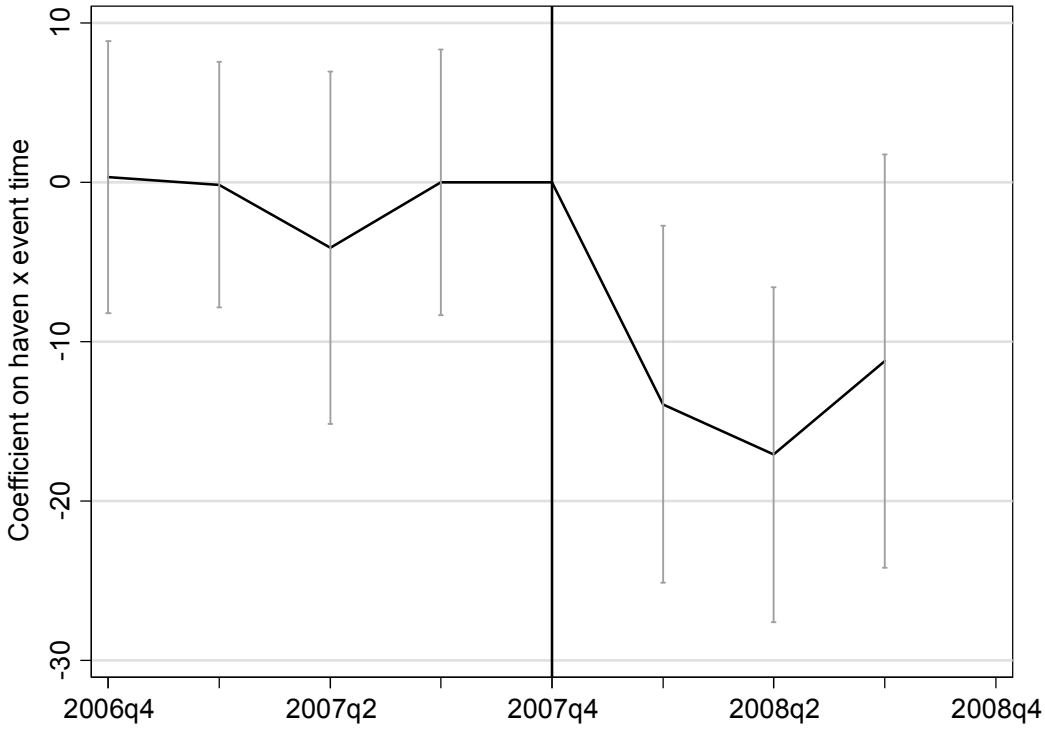
[24] Our list comprises the following countries: Austria, Bahamas, Bahrain, Belgium, Cayman Islands, Curacao, Cyprus, Guernsey, Hong Kong, Isle of Man, Jersey, Luxembourg, Macao, Netherlands Antilles, Panama, Singapore and Switzerland. These are all on the list of jurisdictions that had not implemented the global standard of international cooperation in tax matters published by the OECD prior to the G20 summit in April 2009 except for Macao and Hong Kong, which were omitted from the OECD list due to political pressure from China (see "G20 declares door shut on tax havens," *The Guardian*, 2 April 2009).

FIGURE 2.4: Foreign-owned deposits in tax havens and non-haven countries



Note: The figure illustrates the trend in foreign-owned bank deposits in tax havens and non-haven countries respectively. For each country reporting to the BIS Locational Banking Statistics,we computed a country-level deposit index expressing the stock of deposits in a given quarter relative to the stock at the end of the fourth quarter of 2007. The two lines show the average index value for tax havens (solid) and non-haven countries (dash) for the period 2006q4 to 2008q3.

FIGURE 2.5: Estimated effect of the LGT leak on deposits in tax havens



Note: The figure illustrates the difference-in-differences estimate of the effect of the LGT leak on foreign-owned bank deposits in tax havens. For each country reporting to the BIS Locational Banking Statistics, we first computed a country-level deposit index expressing the stock of deposits in a given quarter relative to the stock at the end of the fourth quarter of 2007. We estimated a linear regression model with the index as dependent variable and time dummies, a haven dummy, and the interactions between them as explanatory variables. The line shows the estimates for the interaction terms. The gray bars indicate 95% confidence intervals of the estimates based on standard errors clustered at the country level.

plausible assumptions about discount rates on financial markets and profit margins in the wealth management industry.

2.6 Concluding remarks

While whistleblowing has become the order of the day in politics, business, sports, and many other domains of society, we know little about its consequences. Some argue that it deters criminal activity by increasing the risk of exposure, but, to our knowledge, there is no systematic evidence documenting such an effect.

This chapter studies whistleblowing in the context of offshore tax evasion and an environment in which data leaks were thought to be impossible or at least very unlikely. It documents that the first leak of customer files from a tax haven bank caused a significant decrease in the market value of Swiss banks *known* to derive revenues from offshore tax evasion. Our preferred interpretation is that the leak induced a shock to the detection risk as perceived by offshore account holders and banks, which curbed the use of offshore bank accounts and ultimately lowered the expected future profits of banks providing access to such tax evasion technologies.

We address other possible interpretations, for instance, that the negative stock market responses were driven solely by the media attention to the business model of offshore banks. However, such interpretations are less plausible given that we find no stock market responses to other events covered intensively in international media and directly related to offshore tax evasion, but carrying no new information about the risk of exposure for offshore account owners and banks.

Appendix

Table 2.A: Swiss banks in the estimating sample

Name of listed Swiss bank or its listed parent	Source	Penalty (US $ million)	Market capitalization (US $ million)	Start of holding period	End of holding period	Country	Sector
Credit Suisse Group AG	Criminal investigation	2,600.0	66,248	-	-	CH	Banks
UBS Group AG	Criminal investigation	780.0	84,725	-	-	CH	Banks
Julius Baer Group Ltd	Criminal investigation	547.0	-	-	-	CH	Banks
Bank Leumi Le-Israel BM	Criminal investigation	270.0	7,576	-	-	IL	Banks
Liechtensteinische Landesbank AG	Criminal investigation	24.0	3,098	-	-	LI	Banks
Bank Hapoalim BM	Criminal investigation	pending	6,380	-	-	IL	Banks
Basler Kantonalbank	Criminal investigation	pending	3,453	-	-	CH	Banks
HSBC Holdings PLC	Criminal investigation	pending	19,2547	-	-	UK	Banks
Mizrahi Tefahot Bank Ltd	Criminal investigation	pending	2,016	-	-	IL	Banks
BTG Pactual Group	Swiss Bank Program	211.0	-	14 jul 2014	22 feb 2016	BR	Financ svcs
Credit Agricole SA	Swiss Bank Program	99.2	50,893	-	-	FR	Banks
Bank J Safra Sarasin AG	Swiss Bank Program	85.8	2,930	-	31 jul 2012	CH	Banks
Royal Bank of Scotland Group PLC	Swiss Bank Program	78.5	80,371	-	-	UK	Banks
St Galler Kantonalbank AG	Swiss Bank Program	60.3	2,770	14 dec 2007	27 jun 2013	CH	Banks
BNP Paribas SA	Swiss Bank Program	59.8	89,516	-	-	FR	Banks
Edmond de Rothschild Suisse SA	Swiss Bank Program	45.2	3,555	-	-	CH	Financ svcs
Banque Cantonale Vaudoise	Swiss Bank Program	41.7	4,381	-	-	CH	Banks
Deutsche Bank AG	Swiss Bank Program	31.0	66,499	-	-	DE	Banks
EFG International AG	Swiss Bank Program	30.0	4,840	-	-	CH	Banks
Societe Generale SA	Swiss Bank Program	19.2	59,832	-	-	FR	Banks
KBC Group NV	Swiss Bank Program	18.8	48,165	-	10 oct 2011	BE	Banks
Rothschild & Co	Swiss Bank Program	11.5	1,318	-	-	FR	Financ svcs
Luzerner Kantonalbank AG	Swiss Bank Program	11.0	2,233	-	-	CH	Banks

Note: The table provides information about all the banks in the estimating sample. The information can vary over time as parent-subsidiary links sometimes change. The table states the latest available information for each bank from before the first leak from *LGT Bank*.

Continued on the next page.

Table 2.A *(continued)*: Swiss banks in the estimating sample

Name of listed Swiss bank or its listed parent	Source	Penalty (US $ million)	Market capitalization (US $ million)	Start of holding period	End of holding period	Country	Sector
CIC	Swiss Bank Program	10.5	12,004	-	-	FR	Banks
Banco Bilbao Vizcaya Argentaria SA	Swiss Bank Program	10.4	83,604	-	-	ES	Banks
Schroders PLC	Swiss Bank Program	10.4	6,252	-	-	UK	Financ svcs
Dexia SA	Swiss Bank Program	9.7	30,516	-	20 dec 2011	BE	Banks
Standard Chartered PLC	Swiss Bank Program	6.3	49,060	-	-	UK	Banks
Vontobel Holding AG	Swiss Bank Program	5.4	2,763	4 sep 2015	-	CH	Banks
Berner Kantonalbank AG	Swiss Bank Program	4.6	2,122	-	-	CH	Banks
Bank Linth LLB AG	Swiss Bank Program	4.2	399	-	-	CH	Banks
Zuger Kantonalbank AG	Swiss Bank Program	3.8	1,067	-	-	CH	Banks
Graubuendner Kantonalbank	Swiss Bank Program	3.6	2,550	-	-	CH	Banks
Valiant Holding AG	Swiss Bank Program	3.3	3,057	-	-	CH	Banks
Bank Coop AG	Swiss Bank Program	3.2	1,347	-	-	CH	Banks
Walliser Kantonalbank	Swiss Bank Program	2.3	-	-	-	CH	Banks
Aabar Investments PJSC	Swiss Bank Program	1.8	1,285	1 dec 2008	12 jul 2010	AE	Financ svcs
BHF Kleinwort Benson Group	Swiss Bank Program	1.8	1,165	7 jul 2011	27 nov 2015	BE	Financ svcs
SB Saanen Bank AG	Swiss Bank Program	1.4	-	-	-	CH	Banks
Mercantil Servicios Financieros CA	Swiss Bank Program	1.2	1,637	-	-	VE	Banks
Irish Bank Resolution Corp Ltd/Old	Swiss Bank Program	1.1	11,747	-	14 dec 2007	IE	Banks
Banque Cantonale du Jura SA	Swiss Bank Program	1.0	192	-	-	CH	Banks
Medibank	Swiss Bank Program	0.8	76	-	-	CH	Banks
Hypothekarbank Lenzburg AG	Swiss Bank Program	0.6	359	-	-	CH	Banks
Banco di Desio e della Brianza SpA	Swiss Bank Program	0.3	1,458	-	8 jun 2012	IT	Banks
Banca Intermobiliare SpA	Swiss Bank Program	-	1,433	-	-	IT	Financ svcs

Note: The table provides information about all the banks in the estimating sample. The information can vary over time as parent-subsidiary links sometimes change. The table states the latest available information for each bank from before the first leak from *LGT Bank*.

3

A step change in tax transparency? An event study on how the automatic exchange of information did not affect Swiss banks

3.1 Introduction

The wealth management business in tax havens is currently experiencing fundamental change. For decades strict banking secrecies have concealed who owns the offshore wealth in tax havens and what income they derive from it. This environment has given rise to flourishing banking industries attracting many international customers, of whom many are believed to evade taxation in their home countries. As of 2018, more than one hundred countries have committed to exchanging financial account information for tax purposes on an automatic basis, including many of the countries that were previously renowned for their banking secrecies.[1]

The country which is possibly best known for its banking secrecy, and which is the world market leader for offshore wealth management, is Switzerland. It entrenched its banking secrecy into law in 1934, making it a criminal act to reveal the identity of a bank customer. Information on financial accounts and their owners could only be obtained with the subpoena by a Swiss judge in cases of severe criminal acts. Tax evasion, simply through the non-reporting of taxable income, is considered merely a misdemeanor, and not a criminal offense. Zucman (2013, 2014) estimates that 8% of the global financial wealth of households is held in tax havens, about one third thereof or, equivalently by the end of 2013, US $2.4 trillion in Switzerland.[2] He also estimates that 80% of the European-owned wealth in Switzerland goes untaxed.[3]

[1] For a list of all jurisdictions that have committed to implementing the automatic exchange of financial account information (AEoI), see http://www.oecd.org/tax/transparency/AEOI-commitments.pdf (last accessed on 15 February 2017).

[2] Zucman's estimates are smaller than other, non-academic estimates. In an industry survey, The Boston Consulting Group (BCG) (2014, p. 9f) estimates the global offshore wealth by private individuals at US $8.9 trillion by the end of 2013, of which US $2.3 trillion were held in Switzerland.

[3] A report by the US Senate (2014, p. 61) estimates that, until 2008, between 85 and 95% of the US-linked accounts with Credit Suisse in Switzerland had been undeclared to US authorities.

On 6 May 2014, Switzerland joined the declaration on the automatic exchange of information in tax matters (AEoI) by the Organisation for Economic Co-operation and Development (OECD 2014) and committed to the implementation of the information exchange by 2018.[4] According to the AEoI, countries will obtain information from their financial institutions on financial accounts held by foreign investors and will automatically exchange that information with the investors' participating home countries. In order to prevent taxpayers from bypassing the new information exchange, the reporting standard was designed with a particularly wide scope –the information to be exchanged includes broad types of investment income, account balances, and sales proceeds from financial assets; the financial institutions required to report include banks, custodians, and certain investment vehicles; and the accounts to be reported include not only accounts held by individuals but also accounts held by entities, such as trusts and foundations. The reporting standard also requires to look through passive entities so as to identify the ultimate owner in control of an account. The OECD calls the implementation of the AEoI as the new global standard "another step change in international tax transparency" (OECD 2013). On the contrary, Knobel (2015) points out significant loopholes in the reporting standard. Most prominently, he reports that tax evaders can circumvent the new information exchange by acquiring sham residency certificates or by setting up a cleverly designed trust structure in the US.

This study provides the first empirical evidence on the impact of the automatic information exchange on the extent of offshore tax evasion in Swiss banks. Providing compelling evidence comes with two major challenges. First, the extent of offshore tax evasion is inherently difficult to observe[5]. Second, the time span between Switzerland's agreement to the new transparency and the first time the country will collect information on foreign account owners includes 2.5 years. It is therefore not clear when exactly banks and their customers would react to the new legal environment. This study applies a standard *event study* approach to analyze how the stock prices of banks in Switzerland reacted to news concerning the AEoI. This approach has two major advantages. First, stock prices are publicly available. Second, they capture the net present value of a firm's expected future profits. In an efficient market, any new information that interferes with a firm's future profitability will be immediately reflected in the stock price (Fama 1991). If financial markets expect the AEoI to contract the market for evasion-related banking services, this will also most likely reduce the future earnings of Swiss banks and should be reflected by a decrease in their stock prices within a few trading days after it became more likely that Switzerland would participate in the AEoI.

[4] Note that Switzerland participates in the international exchange of financial account information on request since 2009, as studied in by Johannesen and Zucman (2014). Furthermore, financial account information is provided on an automatic basis to the US pursuant to the Foreign Account Tax Compliance Act (FATCA) as amended in 2010. Nevertheless, the offshore wealth in Switzerland is close to an all-time-high (Zucman 2014, pp. 140f).

[5] Slemrod (2016, pp. 11f) reviews recent work on tax compliance and enforcement, and notes that almost all empirical analyses on tax evasion rely on indirect measures of evasion.

The events that made the participation of Switzerland in the AEoI more likely were identified by systematically screening all front pages of *Neue Zürcher Zeitung* (NZZ), a leading newspaper in Switzerland. Any event that is important enough to affect the stock prices of Swiss banks is expected to appear on the front pages of Swiss newspapers. For the period January 2013 to October 2016, the screening identified 44 articles on the front pages of NZZ mentioning the AEoI. The main focus of the study is 6 May 2014, when Switzerland joined the OECD declaration committing to implement the AEoI by 2018. The following day, the NZZ headline declared "farewell to banking secrecy." Furthermore, the analysis addresses important events prior to that date which may have signaled the increasing political pressure on Switzerland and the country's changing attitude toward the AEoI. It also addresses an important event after that date which substantiated the actual implementation of the information exchange. Finally, the study provides an aggregated analysis of all 44 front page articles referring the AEoI.

Of course, not every bank in Switzerland engages in and benefits from the tax evasion of its foreign customers. The analysis therefore considers a sample of banks that were identified by the US Department of Justice (DoJ) for having assisted US customers with offshore tax evasion. The first bank that faced criminal investigations in the US for its involvement in offshore tax evasion schemes was UBS in 2008. In the subsequent years, another 15 Swiss banks were subjected to criminal proceedings by the US. Ultimately, the US DoJ announced the *Swiss Bank Program*, in which banks could resolve their potential criminal liability if they fully disclosed their US cross-border activities and paid appropriate penalties. This program was used by a further 80 Swiss banks. By the time of writing, the vast majority of legal proceedings has been settled and produced penalties in the amount of US $5.65 billion.[6] After restricting the attention to listed banks with regular stock returns, the estimating sample for 6 May 2016 includes 37 banks with a known link to the offshore tax evasion business. The sample varies slightly over time because the ownership structures of banks sometimes change.

The event study specification regresses the return of the portfolio of Swiss banks on a major European stock market index and dummies indicating the days around important events concerning the AEoI. The European stock market index controls for normal or expected returns due to variations in the general market conditions. The main variables of interest are the dummies, which measure the daily abnormal returns in the stock prices of Swiss banks. By studying the return series of one portfolio instead of many individual stock return series, the analysis accounts for any cross-sectional correlation between the banks'stock returns. Moreover, the dummies are specified so as to account for any intertemporal correlation in the estimated abnormal returns.

[6] For more information on the legal proceedings, see https://www.justice.gov/tax/offshore-compliance-initiative, and for more information on the Swiss Bank Program, see https://www.justice.gov/tax/swiss-bank-program (last accessed on 15 February 2017).

The results suggest that Switzerland's commitment to implementing the AEoI was followed by a modest negative return in the stock prices of Swiss banks, which was limited to a small number of banks. The cumulative abnormal return over four days was as small as -0.2% for the entire sample of Swiss banks and -0.7% for those Swiss banks that were subject to individual investigations in the US. Both estimates are statistically not different from zero for conventional significance levels. That is although the standard errors are moderately sized and the resulting minimum detectable effect sizes are well below the estimates of a similar event study on data leaks from banks in tax havens (Johannesen and Stolper 2017). This suggests that the null results are not a consequence of low statistical power, but rather that they are caused by a lack of effect. The null results are also robust for further selected events that might have affected the financial market expectations. Finally, of the total of 44 NZZ front page articles with a reference to the AEoI, only two were followed by a sizeable abnormal drop in the stock prices of Swiss banks. However, the exact timing and the close similarity with the abnormal performance of the *Swiss Market Index*, a major index for the entire Swiss stock market, suggest that the stock price drops might have been driven by factors other than the new tax transparency.

These findings are suggestive that financial markets expected the AEoI to have no sizeable impact on the future profits of Swiss banks. This does not necessarily imply that the AEoI had no effect on offshore tax evasion. Previously tax non-compliant customers may become compliant and still keep their assets with banks in Switzerland. However, I am not aware of any evidence suggesting that funds in Swiss banks have been disclosed to foreign tax authorities in a similar amount like the offshore wealth in Switzerland that was estimated to go untaxed by the end of 2013 – around US $2 trillion. It seems also unlikely that the entire undeclared offshore wealth in Swiss banks becomes tax compliant and remains in Switzerland. A more plausible explanation seems to be that the market for evasion-related banking services remained unaffected, and that the AEoI might not have increased the level of tax compliance among the owners of Swiss bank accounts.

To my knowledge, this study is the first to provide empirical evidence on the effect of the automatic exchange of information on offshore tax evasion. It contributes to the literature assessing previous policy initiatives in this field. Johannesen and Zucman (2014), for example, address the information exchange on request, which was implemented as the new global standard in 2009. They find that, rather than repatriating funds, tax evaders relocate their offshore wealth to less compliant tax havens in an attempt to circumvent the new information exchange. Johannesen (2014) identifies similar relocation patterns in response to the European Savings Directive. The directive was implemented in 2005 and included an anonymous withholding tax on interest income from countries with banking secrecies. The Savings Directive has also been studied by Hemmelgarn and Nicodeme (2009) and Klautke and Weichenrieder (2010) with no evidence on an increase in the level of tax compliance. Langenmayr (2015) shows that programs with reduced penalties for tax evaders who voluntarily disclose their offshore assets increase the extent of evasion,

but also increase tax revenues net of administrative costs by tax authorities. Finally, in a similar event study to this one, Johannesen and Stolper (2017) provide evidence that the acquisition of stolen customer files from banks in tax havens by authorities in high-tax countries did reduce the hidden wealth in Switzerland.

Furthermore, as an empirical evaluation of a policy initiative, this study is closely related to the theoretical literature on how policy initiatives should be designed to effectively reduce offshore tax evasion. Elsayyad and Konrad (2012) argue for a simultaneous approach against all tax havens rather than addressing one haven after the other. In a sequential approach, the fewer active tax havens there are, the more market power they concentrate. The last tax havens are therefore very profitable and resilient against political pressure from the international community. Konrad and Stolper (2016) identify strategic complementarities in the compliance decisions of a haven country and many individual tax evaders. Whether or not the fight against tax havens will be successful is therefore determined in a many-player coordination game. Their analysis highlights a trade-off between the fight against tax havens and high tax rates or, similarly, low penalties for revealed tax evasion. Finally, Dharmapala (2016) argues that an information exchange regime can increase evasion by increasing the costs of tax compliance.

3.2 Background and data

3.2.1 Important milestones toward the AEoI

The study tracks the development from Switzerland's banking secrecy to the new global standard of tax transparency as captured on the front pages of the leading Swiss newspaper *Neue Zürcher Zeitung* (NZZ).[7] The underlying reasoning is to use the front page of NZZ as a proxy for important events in and concerning Switzerland. As the banking secrecy was long considered to be part of Switzerland's national identity and as an automatic exchange of information (AEoI) stands in strong conflict with it, any important step toward the new information exchange is expected to show up on the front pages of Swiss newspapers. To identify such events, all NZZ front pages between January 2013 and November 2016 were systematically screened for references to the AEoI. The screening included a keyword search for "steuer" (tax), "info" (information), "daten" (data), and "bank" (bank), and manually reading all headlines on the front pages. The article of every potential hit was then checked for a reference to the AEoI. Each article was also searched for an indication of when the event under consideration took place. If an article did not mention the time of event, it was assumed that it had taken place one calendar day prior

[7] This is neither to assume that traders who drive market prices read NZZ nor that they read only the front page.

to the articles' date of publication. [8] This approach identified 44 front page articles that refer to the AEoI.

Most prominently, NZZ headline read "farewell to banking secrecy" after, on 6 May 2014, Switzerland joined the OECD declaration on the automatic exchange of information in tax matters. In the declaration, all 34 OECD member countries along with 13 non-member countries committed to implementing the AEoI (OECD 2014). Because this declaration was Switzerlands first official confirmation that it would comply with the new global standard of tax transparency and because NZZ called it the end of the Swiss banking secrecy on its next days front page, this date is the main focus of the analysis.

Furthermore, it is conceivable that major events prior to Switzerlands commitment might have indicated the rising international pressure on Switzerland and the countrys changing attitude toward the AEoI, and made stock markets anticipate the political decision later on. Similarly, the commitment does not yet ensure the actual implementation of the information exchange. Stock markets might still have been in doubt as to whether or not Switzerland will live up to its promise. The analysis therefore addresses further selected events which might have been particularly important for the market expectations regarding the future of the Swiss banking secrecy. The selected events are listed in Table 3.1.

Events #1–#5 account for the potential anticipation effects on stock markets. Luxembourg and Austria are the two countries in the EU that used to have banking secrecies similar to the one in Switzerland. Their agreements to the AEoI created the necessary unanimity to adjust EU regulations and induced the EU to increase political pressure on nearby third countries, such as Switzerland, to also join the new information exchange. Also, when the information exchange on request was implemented as the new global standard in 2009, Luxembourg, Austria, and Switzerland aligned their strategies and announced their cooperation on the very same day. The decision of one of the countries to cooperate might therefore have been interpreted as a signal about the bargaining power of the two other countries. Moreover, the first endorsement of the AEoI as the expected global standard by the G20 countries might have signaled a new international consensus on the future of tax transparency. Switzerlands willingness to contribute to the development of the AEoI standard as well as to negotiate on the AEoI with the EU might have indicated a change in the countrys strategy regarding the new information exchange. Event #6 concerns Switzerlands commitment to the AEoI and is the main focus of the analysis. Ultimately, Event #7 concerns the treaty signature for the AEoI between Switzerland and the EU. Because most of the offshore wealth in Switzerland is owned by Europeans (Zucman 2013, pp. 1,332ff), the exchange of information with the EU substantiates Switzerlands willingness to cooperate.

[8] As newspapers merely mention the time of day when events take place, it was assumed that the events happened before the stock exchanges in Switzerland closed. If an event actually took place after stock markets had closed, the events impact on the banks'stock prices is measured with a delay of one day.

TABLE 3.1: Important milestones toward the AEoI

Event number	Date of event	Date of front page article	Event	Acronym
#1	10 apr 2013	11 apr 2013	Luxembourg announced the implementation of the AEoI with the EU as of 2015	LUX
#2	-	22 apr 2013	G20 countries endorsed the AEoI as the expected new standard	G20
#3	26 apr 2013	29 apr 2013	Austria announced the approval of the AEoI with the EU	AUT
#4	-	15 jun 2013	Switzerland decided to contribute to the OECD developing a new global standard but not to offer the AEoI to the EU	OECD
#5	18 dec 2013	19 dec 2013	Switzerland passed a mandate for negotiations on the AEoI with the EU	EU I
#6	6 may 2014	7 may 2014	Farewell to banking secrecy: Switzerland joined the OECD declaration and committed to the implementation of the AEoI	Main
#7	27 may 2015	28 may 2015	Switzerland signed the treaty concerning the AEoI with the EU	EU II

Note: The table provides information on all events that are considered important milestones in the development from Switzerlandš banking secrecy to the automatic exchange of financial account information (AEoI). The date of event is the date mentioned in the article, the storylines are the authorš own summaries and translations from German, and the acronyms are used for cross-referencing in Table 3.4.

Finally, the study also includes an aggregated analysis of all front page articles with a reference to the AEoI. This ensures that the selection of events above does not disregard an important milestone in Switzerland's transition to the new tax transparency.

3.2.2 Swiss banks benefiting from offshore tax evasion

Of course, not every Swiss bank is involved in offshore tax evasion schemes, and including banks that derive no earnings from the evasion business would bias the estimation results toward zero. In order to limit the focus on affected banks, the analysis considers a sample of banks that were identified by the US Department of Justice (DoJ) for having assisted US clients with offshore tax evasion.

The first bank that was identified in 2008 is UBS. When the former customer Igor Olenicoff was sentenced for evading taxes offshore, he blamed his evasion on bad financial advice from, among others, his UBS banker Bradley Birkenfeld. The bank employee, when charged with conspiracy to defraud the US of tax payments, cooperated with the US authorities and pointed them toward systematic tax evasion practices of UBS. The following legal proceedings against the bank for conspiracy to evade taxes resulted in a settlement including not only a penalty of US $780 million but also an extensive exchange of information on 4,450 US customers, including where customers transferred their money to if they had closed the account in the recent years before the settlement.[9]

Potentially due to the resulting information from the UBS case, the US authorities investigated another 15 Swiss banks on similar charges throughout the following years.[10] At the time of writing, six of these cases had been settled with combined penalties of US $4.29 billion, seven are still pending, and three of the investigated banks have ceased their operations.[11] Finally, in August 2013 and in consultation with the Swiss government, the US DoJ announced the *Swiss Bank Program*, which allowed Swiss banks not already under investigation to resolve potential criminal liabilities from their US cross-border business. A participation in the program required, among others, complete disclosure of a bank's cross-border activities, cooperation with future information requests, and the payment of appropriate penalties. The last banks in the Swiss Bank Program entered non-prosecution agreements with the US DoJ in January 2016. In total, the program has produced non-prosecution agreements for a further 80 Swiss banks and has resulted in payments of more than US $1.36 billion in penalties.[12]

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[9] For more information on the settlement between the US DoJ and UBS, see https://www.justice.gov/opa/pr/ubs-enters-deferred-prosecution-agreement (last accessed on 15 February 2017).

[10] To my knowledge, there is no official list of all 16 banks under investigation, but they are mentioned in numerous news articles. One article that lists all the banks can be found on the Swiss public service news and information platform Swissinfo, see http://www.swissinfo.ch/eng/credit-suisse-fallout_remaining-hit-list-banks-sweat-over-us-verdicts/38637818 (last accessed on 15 February 2017).

[11] The three banks that have gone out of business are Wegelin, Neue Zürcher Bank, and Bank Frey. For more information on the legal proceedings of the US DoJ against offshore tax evaders and the financial institutions assisting them, see https://www.justice.gov/tax/offshore-compliance-initiative (last accessed on 15 February 2017).

[12] For more information on the Swiss Bank Program, see https://www.justice.gov/tax/swiss-bank-program (last accessed on 15 February 2017).

The identification of Swiss banks by the US DoJ comes with two advantages. First, it yields a sample of banks that are known to derive earnings from the offshore tax evasion of their customers. If the automatic information exchange contracts the market for evasion-related banking services in Switzerland, the future profits and so also the stock prices of these banks can be expected to decline.[13] Second, the identification allows for heterogeneity analyses in the cross-section of Swiss banks and thereby for inference on the subsample of banks that are likely to be most strongly involved in the business with the offshore secrecy. For example, it is possible to distinguish the banks as to the size of the penalty they paid in the US, and as to whether they were investigated individually or entered the group resolution program.

Because event studies rely on stock returns, the estimating sample disregards all banks that are not listed on a stock exchange. Banks can either be listed themselves or have a listed parent entity –for example, the Swiss bank *HSBC Private Bank*, as identified by the US DoJ, is a subsidiary of the listed, UK-based company *HSBC Holdings PLC*.[14] This approach yields 44 entities that are a Swiss bank or own subsidiaries that are Swiss banks for some period between 2012 and 2016. For simplicity, these companies are referred to as *Swiss banks* throughout the chapter, while strictly speaking they also include non-Swiss companies and other companies than banks. Two of these companies are excluded from the estimating sample because they are classified neither as a bank nor as a financial services provider according to the Industry Classification Benchmark (ICB). A change in the Swiss banking secrecy is therefore not expected to have a strong impact on their stock prices.[15] This yields an estimating sample of 42 Swiss banks, which are listed in Table 3.A in the Appendix to this chapter.

3.2.3 Stock market data

All stock market information was downloaded from Bloomberg for the period 1 January 2012 to 31 October 2016. It includes daily stock and index prices as well as banks'industry classification. As most banks under consideration are listed in Switzerland and their stock prices are denoted in Swiss francs, all prices were downloaded as denoted in Swiss francs to alleviate exchange rate effects.

The simple stock return $sreturn_{n,t}$ for bank n on trading day t is derived from the banks' daily total return index, which accounts for all stock earnings including capital

[13] The prevalence of tax evaders with accounts in Swiss banks might have declined in response to the American and other enforcement initiatives, but they are unlikely to have vanished completely by May 2014, which is the period of main interest in this study shortly after the Swiss Bank Program was announced. Furthermore, the enforcement initiatives by the US targeted US tax evaders and are likely to have mainly reduced their occurrence in Swiss banks. The AEoI targets tax evaders from almost all other countries.

[14] The current parent entities of Swiss banks are identified in Bloomberg, and any changes to the parent-subsidiary links are identified in an extensive online research using the banks' own homepages, Wikipedia, and http://www.schweizer-banken.info/ (last accessed on 15 February 2017). In case of multiple listed parent entities on different hierarchy levels, the lowest ranked listed parent entity was chosen in order to include as few unaffected entities as possible.

[15] Here, Assicurazioni Generali SpA, an insurance company, and Italmobiliare SpA, a construction and materials company, are excluded from the estimating sample.

TABLE 3.2: Summary statistics on stock market returns

	Mean	Standard deviation	Minimum	Maximum
Individual banks	0.0	1.8	-11.5	11.0
Portfolio of banks	0.0	0.9	-7.6	3.0
Stoxx Europe 600	0.0	1.2	-11.7	4.3

Note: The table provides summary statistics for the stock market returns (in percent) of the 42 Swiss banks in the estimating sample and of a major European stock market index. All statistics are for the period between 1 January 2012 and 31 October 2016. The first line refers to the stock returns of individual sample banks; the second line to the portfolio return computed as the average of individual bank returns; the third line to the stock market index *Stoxx Europe 600*.

gains and dividend payments. It is calculated as

$$sreturn_{n,t} = \frac{p_{n,t} - p_{n,t-\tau}}{p_{n,t-\tau}}, \tag{3.1}$$

where $p_{n,t}$ denotes the total return index of bank n on trading day t, and $t - \tau$ denotes the latest Swiss trading day with a total return index observation for bank n prior to day t. All observations from non-trading days in Switzerland are excluded to rule out a small subset of banks, which are listed outside of Switzerland, from dominating the analysis on such days.[16] For example, three banks investigated in the US for their involvement in offshore tax evasion are listed in Israel, where stocks are typically traded from Sunday through Thursday. Again, for the sake of simplicity, this chapter refers to trading days, while strictly speaking it considers only trading days in Switzerland.

Furthermore, to ensure that stale stocks which are rarely traded do not bias the estimates toward zero, a bank's return observations are excluded from the analysis during times when the bank's end-of-day stock price remained constant or was missing for at least five consecutive trading days. Also, to reduce the impact of outliers, stock returns are winsorized at the top and bottom $1/1{,}000^{th}$ of returns.[17] Table 3.2 provides summary statistics of the resulting stock market returns. Across all Swiss banks, the daily stock returns varied between -11.5% and 11.0%, with a mean of 0.0% and a standard deviation of 1.8%. Table 3.2 also includes the statistics for an equally weighted portfolio of the Swiss banks and a major index for the European stock market, the *Stoxx Europe 600*.[18]

[16] Trading days in Switzerland are defined as days when the *Swiss Market Index* was traded. They typically include weekdays from Monday through Friday except bank holidays.

[17] For an event study with similar adjustments of the stock returns, see, e.g., Della Vigna and La Ferrara (2010).

[18] Precisely speaking, the portfolio in Table 3.2 is an unbalanced portfolio that reflects the time-varying parent-subsidiary links. In contrast, the event study specification considers an event-specific balanced portfolio. Furthermore, the index return is calculated similarly to the stock returns, ignoring observations from non-trading days in Switzerland.

3.3 Event study methodology

The effect of the AEoI on the Swiss banks is inferred using a standard event study specification.[19] It elicits how the stock prices of Swiss banks responded to important events which made it more likely that Switzerland would exchange information for tax purposes on an automatic basis. The analysis proceeds in three steps.

The first step determines an event-specific sample and observation period for each event under consideration. The sample includes all Swiss banks identified by the US DoJ and listed in Table 3.A, which are Swiss banks themselves or own subsidiaries which are Swiss banks for the entire week after the event under consideration, which is when the effect of main interest is estimated. Furthermore, the sample requires the banks to have at least one return observation during that week. The observation period includes five stock market closures before and after the event, which constitutes the event window, and 250 trading days prior to the event window, which constitutes the estimation window and depicts roughly one calender year. The period of main interest are the days after an event, but the event window also includes some days prior to the event to identify potential anticipation effects. Each event-specific observation period thus includes 260 trading days $t \in \{-254; 5\}$, and $t = 1$ marks the respective event date. The number of banks included in each sample varies slightly across events as parent-subsidiary links sometimes change, and it is included in the regression tables.

The second step compiles the sample banks into a daily rebalanced, equally-weighted portfolio. By studying the return series of one portfolio instead of many stock return series of individual banks, the analysis does not require the stock returns of individual banks to be independent. Rather it takes into account any cross-sectional correlation between them. This step is particularly important because many unaccounted sources for variation in the stock prices, such as changes in the general market conditions in Switzerland, might affect many sample banks similarly and may induce a correlation in the banks'stock returns. The equal weighting of the banks and the daily rebalancing of the portfolio gives each bank in the sample an equal emphasize when eliciting the effect size. Note that the simple portfolio return on a given day t is thereby just the average of the individual stock returns of all sample banks on that day $\frac{1}{N}\sum_{n=1}^{N} sreturn_{n,t}$, where $n \in \{1, ..., N\}$ is the set of banks included in the event-specific sample with a return observation on day t. Moreover, to permit for the aggregation of returns over multiple days, the portfolio return $preturn_t$ for day t is calculated as the continuously compounded return and is given by

$$preturn_t = \ln\left(1 + \frac{1}{N}\sum_{n=1}^{N} sreturn_{n,t}\right). \tag{3.2}$$

[19] An introduction to the methodology of event studies can be found, e.g., in the textbook by Campbell et al. (1997) and the handbook article by Kothari and Warner (2007).

The third step regresses the portfolio return on the return of major index for the European stock market and dummy variables for each day in the event window. The main interest concerns the cumulative abnormal return CAR of the portfolio in the event window, which is defined as the sum of the daily abnormal portfolio returns AR_t such that

$$CAR_T = \sum_{t=1}^{T} AR_t \qquad \text{for } 1 \leq T \leq 5 \tag{3.3}$$

$$CAR_T = \sum_{t=0}^{T} AR_t \qquad \text{for } -4 \leq T \leq 0. \tag{3.4}$$

In order to directly estimate CARs and their correct standard errors, which account for any intertemporal correlation in the estimated abnormal returns, the dummies in the event window are specified according to Salinger (1992). The dummy specification uses the fact that the abnormal return on the event day AR_1 is also the cumulative abnormal return on that day $CAR_1 = AR_1$, and that the abnormal returns on subsequent days AR_t for $t > 1$ can be written as the difference of two cumulative abnormal returns $AR_t = CAR_t - CAR_{t-1}$. A similar logic applies to the (cumulative) abnormal returns in the event window prior to the event. The resulting regression equations are

$$preturn_t = \alpha + \beta\ mreturn_t + \varepsilon_t \qquad \text{for } t \leq -5 \tag{3.5}$$

$$preturn_1 = \alpha + \beta\ mreturn_1 + CAR_1 + \varepsilon_1 \qquad \text{for } t = 1 \tag{3.6}$$

$$preturn_t = \alpha + \beta\ mreturn_t + CAR_t - CAR_{t-1} + \varepsilon_t \qquad \text{for } t \geq 2, \tag{3.7}$$

where $mreturn_t$ is the continuously compounded return of the Stoxx Europe 600 on day t and CAR_v, for $1 \leq v \leq 5$, are coeffi cients of dummy variables that are equal to1 for $t = v$, equal to -1 for $t = v + 1$, and zero otherwise.[20] For $-4 \leq t \leq 0$ the regression equations are similar to the equations for $1 \leq t \leq 5$ with CAR_{-w}, for $1 \leq w \leq 5$, as coeffi cients of dummy variables that are equal to1 for $t = 1 - w$, equal to -1 for $t = -w$, and zero otherwise.[21]

The coeffi cient β reflects the correlation of the portfolio return with the return of the Stoxx Europe 600. So $\alpha + \beta\ mreturn_t$ captures the expected or normal portfolio return conditional on the European market return on that day and in the absence of any particular event affecting Swiss banks. The abnormal return is the actual portfolio return minus its expected or normal return if there had not been an event. Finally, the

[20] The Stoxx Europe 600 was chosen to control for general market conditions because almost all sample banks are headquartered in Europe and because, in regressions not reported in this dissertation, it explained more of the variation of the portfolio return than the major European blue chip index Stoxx Europe 50. It also qualifies as a control as changes in the Swiss banking secrecy are unlikely to affect the entire European market. This seems less clear for indices of the Swiss market – for example, UBS and Credit Suisse alone account for around 10% of the Swiss Market Index. (See the factsheet for the Swiss Market Index-family, available at https://www.six-swiss-exchange.com/indices/data_centre/shares/smi_en.html, last accessed on 15 February 2017).

[21] Note that CAR_5 is equal to 1 for $t = 5$ and zero otherwise, as $t = 6$ is not included in the observation period. Similarly CAR_{-5} is defined to be equal to 1 for $t = -4$ and zero otherwise.

coeffi cientsCAR_T capture the portfolios' cumulative abnormal return during the event window.

3.4 Results

3.4.1 Switzerland's commitment to the AEoI

The main event under consideration took place on 6 May 2014, when Switzerland joined the declaration of the OECD Council Meeting, in which all 34 OECD member countries along with 13 non-member countries committed to the implementation of the AEoI. NZZ reported about the event as the "farewell to banking secrecy."

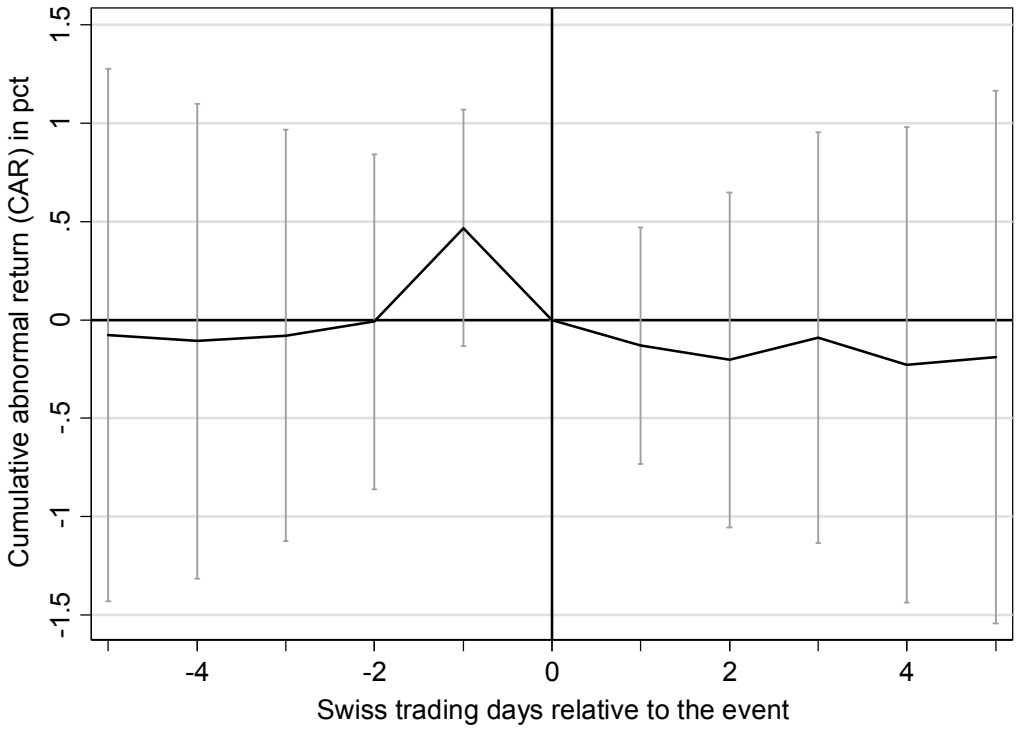
Figure 3.1 illustrates the cumulative abnormal return of Swiss banks immediately before and after Switzerland's commitment. In the week after the declaration, the stock prices of Swiss banks experienced a persistently negative yet very small cumulative abnormal return of between -0.1 and -0.2%. The cumulative abnormal return in the week before the commitment was not persistently positive or negative and accumulative to +0.1%, which does not suggest a significant anticipation effect. Neither the cumulative abnormal return before nor after the commitment are statistically significantly different from zero.

In order to investigate whether the sample of Swiss banks may be too broad and include too many banks for which the banking secrecy is not important enough such that changes thereof would move their stock prices, the same event study specification is performed on two sample splits. The aim is to explore whether or not there exists a subsample of banks that experienced a sizeable and significant decrease in their market values after Switzerland committed to the AEoI.

The first sample split distinguishes the nine banks that were subjected to criminal investigations by US authorities and the 28 banks that voluntarily disclosed their US cross-border activities in the course of the Swiss Bank Program. It is plausible to assume that the US authorities selected Swiss banks for investigation based on *ex ante* information about the banks' involvement in offshore tax evasion schemes. If financial market participants had similar information, a contraction in the market for evasion-related banking services should affect the stock prices of the banks that were investigated more strongly than those that entered the self-disclosure program.

The second sample split distinguishes the banks according to the penalties that they ultimately paid in the US. The size of the penalty can be expected to reflect a bank's criminal exposure from assisting US customers in tax fraud and can therefore serve as an *ex post* measure of a bank's involvement in offshore tax evasion. Again, a contraction in the market for evasion-related banking services can be expected to affect banks with higher

FIGURE 3.1: Cumulative abnormal return of Swiss banks around Switzerland's commitment to the AEoI



Note: The figure illustrates the results from the event study specification applied to the event of main interest, Switzerland's commitment to the automatic exchange of financial account information (AEoI) at the OECD Ministerial Council Meeting on 6 May 2014. The line shows the estimates of the cumulative abnormal return. The gray bars indicate 95% confidence intervals of the estimates accounting for cross-sectional and intertemporal correlation in the abnormal returns.

penalties more strongly than banks with smaller penalties.[22] Note that both measures for the banks'exposure to offshore tax evasion are closely related as the penalties which were paid by the banks under investigation were typically higher than the penalties paid by the banks that participated in the resolution program.[23]

Table 3.3 provides the results from the event study on Switzerlands commitment to the AEoI for different subsamples of Swiss banks. The results for the entire sample of Swiss banks are shown in Column (1) for ease of comparison. With regard to the first sample split, Column (2) shows the results for the Swiss banks under investigations in the US, and Column (3) for the banks that participated in the Swiss Bank Program. The investigated banks experienced a stronger cumulative abnormal decrease in their stock prices of up to -0.7% over four days after the commitment, and which were persistently negative. The banks in the Swiss Bank Program experienced cumulative abnormal variations in their stock prices between -0.2 and +0.1%. A similar pattern exists for the second sample split as reported in Columns (4)-(5). Stock prices of banks that paid a penalty weakly above the sample median responded more strongly with a persistently negative cumulative abnormal return of up to -0.6% over four days after the commitment, while stock prices of banks that paid a penalty below the sample median responded with a cumulative abnormal return of between -0.2 and +0.2%. Still, for all subgroups and the entire week after Switzerland committed to the AEoI, cumulative abnormal returns were statistically not significantly different from zero.

The results suggest that the modest abnormal return of the portfolio of all Swiss banks after Switzerlands commitment to the AEoI was driven by those banks that are most strongly involved in the offshore tax evasion business. However, even for those banks, independent of how they were defined, the cumulative abnormal return was small and statistically not significantly different from zero.

In order to distinguish between a lack of effect and a lack of statistical power, the remainder of this section computes and discusses the minimum detectable effect sizes (MDE) for the cumulative abnormal return over four days, which is when the estimates are the largest. For a statistical power of 80% and a significance level of 5%, the MDE is given by

$$MDE = -\left(t_{(1-0.8)} + t_{0.05/2}\right) \cdot SE\left(\widehat{CAR}_4\right), \tag{3.8}$$

where t is obtained from a standard t-distribution and $SE\left(\widehat{CAR}_4\right)$ is the standard error of the cumulative abnormal return coeffi cient. With$t_{0.2} = 0.84$ and $t_{0.025} = 1.97$, the expression simplifies to

$$MDE = -2.81 \cdot SE\left(\widehat{CAR}_4\right). \tag{3.9}$$

[22] The results are qualitatively similar if the sample is split according to the banks' penalties relative to a measure of their size, such as total assets or market capitalization.

[23] See Table 3.A in the Appendix to this chapter for information on all the Swiss banks in the estimating sample and the penalties they paid.

TABLE 3.3: Regression results for Switzerland's commitment to the AEoI

	All	Criminal investigation	Swiss Bank Program	High penalty	Low penalty
	(1)	(2)	(3)	(4)	(5)
CAR 1	-0.1	-0.0	-0.2	-0.4	0.1
	(0.3)	(0.5)	(0.3)	(0.4)	(0.4)
CAR 2	-0.2	-0.5	-0.1	-0.1	-0.2
	(0.4)	(0.8)	(0.5)	(0.6)	(0.5)
CAR 3	-0.1	-0.7	0.1	-0.2	0.1
	(0.5)	(0.9)	(0.6)	(0.7)	(0.6)
CAR 4	-0.2	-0.7	-0.1	-0.6	0.2
	(0.6)	(1.1)	(0.6)	(0.8)	(0.7)
CAR 5	-0.2	-0.4	-0.1	-0.6	0.2
	(0.7)	(1.2)	(0.7)	(0.9)	(0.8)
Stoxx Europe 600	68.1***	87.7***	62.1***	85.6***	43.9***
	(2.1)	(3.7)	(2.2)	(2.9)	(2.5)
Constant	0.0	0.0	0.0	0.0	0.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Observations	260	260	260	260	260
R-squared	0.8	0.7	0.8	0.8	0.6
Banks in sample	37	9	28	17	16

Note: The table shows the results (in percent) from the event study specification applied to Switzerland's commitment to implement the automatic exchange of financial account information (AEoI) at the OECD Ministerial Council Meeting on 6 May 2014. Column (1) refers to all Swiss banks; Column (2) to Swiss banks that were subjected to criminal investigations in the US for their role in offshore tax evasion; and Column (3) to Swiss banks that have admitted to criminal tax-related offences under the Swiss Bank Program. Column (4) includes only the Swiss banks that have paid penalties weakly above the sample median; Column (5) includes only the Swiss banks that have paid penalties below the sample median. All regressions include a set of event time dummies as described in the main text. Standard errors are provided in parentheses and take account for cross-sectional and intertemporal correlation in the abnormal returns. *** Significant at the 1% level.

The minimum effects that would have been detected at a 5% significance level with a probability of 80% are therefore -1.7% for the entire sample of Swiss banks and -3.1% for the Swiss banks under investigation.

For comparison, in a similar event study, Johannesen and Stolper (2017) assess the abnormal stock price performance of Swiss banks after former employees of banks in tax havens leaked information on the owners of secret offshore accounts to foreign tax authorities or public media. Four days after the first data leak of this kind, they estimate abnormal drops in the stock prices of Swiss banks of -2.2% for the entire sample of Swiss banks, and -6.1% for the Swiss banks under investigation in the US. Both estimates are well above the MDE of this study.[24] Rather than a lack of statistical power, the moderately sized standard errors and the resulting minimum detectable effect sizes indicate that financial markets expected Switzerland's commitment to the AEoI to have no sizeable impact on the future profits of Swiss banks.

3.4.2 Further selected milestones toward the AEoI

One criticism on the analysis above is that the OECD declaration, including Switzerland's commitment to the new standard of tax transparency, might not have been the one single event indicating that Switzerland would participate in the AEoI. This section therefore addresses further important milestones toward the new tax transparency standard.

Table 3.4 provides estimates from the same event study specification applied to further events that are selected in Section 3.2.1 and listed in Table 3.1. To account for indications of the increasing international pressure on Switzerland and the country's changing attitude prior to the OECD declaration, the following events are considered: 10 April 2013, when Luxembourg announced the implementation of the AEoI with the EU by 2015 (Column 1); 21 April 2013, when for the first time the G20 finance ministers and central bank governors endorsed the AEoI as the expected new global standard (Column 2); 28 April 2013, when Austria announced its approval of the AEoI with the EU (Column 3); 14 June 2013, when Switzerland announced its willingness to contribute to the development of, but not to participate in, the AEoI (Column 4); and 18 December 2013, when Switzerland passed a mandate for negotiations on the AEoI with the EU (Column 5). For ease of comparison, Column (6) provides the results for 6 May 2014, the date of main interest discussed previously, when Switzerland joined the OECD declaration committing to the AEoI. Moreover, to account for doubts as to whether or not Switzerland would live up to its commitment, Column (7) refers to 27 May 2015, when Switzerland signed the AEoI treaty with the EU, which substantiated its willingness to cooperate.

[24] The results of Johannesen and Stolper (2017) shall serve as an example of how the stock prices of Swiss banks can react to important events concerning the Swiss banking secrecy. Note, however, that the effects in both setups may differ for several reasons. On the one hand, for example, a data leak is arguably more surprising than a political decision, and may therefore cause stronger stock price reactions. On the other hand, data leaks typically affected between some hundreds and several thousands of bank customers from one financial institution, whereas the AEoI is designed to systematically reveal foreign account holders and should therefore be expected to cause a stronger increase in the level of tax compliance.

TABLE 3.4: Regression results for further important milestones toward the AEoI

	LUX	G20	AUT	OECD	EU I	Main	EU II
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CAR 1	0.2	-0.2	0.3	0.1	-0.0	-0.1	-0.2
	(0.5)	(0.5)	(0.5)	(0.5)	(0.4)	(0.3)	(0.3)
CAR 2	-0.1	-0.6	0.7	0.0	-0.4	-0.2	-0.1
	(0.7)	(0.7)	(0.7)	(0.6)	(0.5)	(0.4)	(0.5)
CAR 3	0.3	-0.5	1.5*	0.0	0.1	-0.1	0.3
	(0.8)	(0.8)	(0.8)	(0.8)	(0.6)	(0.5)	(0.6)
CAR 4	0.6	-0.6	1.8*	-0.3	0.3	-0.2	0.5
	(1.0)	(1.0)	(1.0)	(0.9)	(0.7)	(0.6)	(0.7)
CAR 5	1.2	-0.3	1.6	-0.2	-0.1	-0.2	1.0
	(1.1)	(1.1)	(1.1)	(1.0)	(0.8)	(0.7)	(0.8)
Stoxx Europe 600	71.7***	72.0***	71.4***	72.7***	68.3***	68.1***	56.7***
	(3.2)	(3.2)	(3.2)	(3.0)	(2.4)	(2.1)	(1.7)
Constant	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Observations	260	260	260	260	260	260	260
R-squared	0.7	0.7	0.7	0.7	0.8	0.8	0.8
Banks in sample	36	36	36	36	36	37	37

Note: The table shows the results (in percent) from the event study specification applied to important milestones toward the automatic exchange of financial account information (AEoI) that are considered particularly important. Column (1) concerns when Luxembourg announced the implementation of the AEoI with the EU; Column (2) when the G20 countries endorsed the AEoI as the expected new global standard; Column (3) when Austria announced the implementation of the AEoI with the EU; Column (4) when Switzerland announced it would contribute to developing the new standard for the AEoI; Column (5) when Switzerland agreed to negotiate on the AEoI with the EU; Column (6) when Switzerland committed to implementing the AEoI; and Column (7) when Switzerland signed a treaty with the EU for the AEoI. Standard errors are provided in parentheses and take account for cross-sectional and intertemporal correlation in the abnormal returns. *** Significant at the 1% level and * significant at the 10% level.

The results show that the stocks prices of Swiss banks generally experienced small abnormal returns in the days following the selected events. The largest cumulative abnormal return in absolute terms and the only one that was temporarily statistically significant at the 10% level occurred after Austria committed to the AEoI, and was positive. The largest negative cumulative abnormal returns occurred two and four days after the G20 countries endorsed the AEoI, and were as small as -0.6%. While some events were followed by persistently negative or positive cumulative abnormal returns, over all selected events, cumulative abnormal returns were neither systematically positive or negative. The results do not suggest that any of the selected events had a sizeable or significant impact on the stock prices of Swiss banks.

3.4.3 An aggregated analysis of all front page articles

Finally, to validate that there was no other event that caused a strong and negative cumulative abnormal return in the stock prices of Swiss banks and to justify the event selection above, this section provides an aggregated analysis on (almost) every trading day.

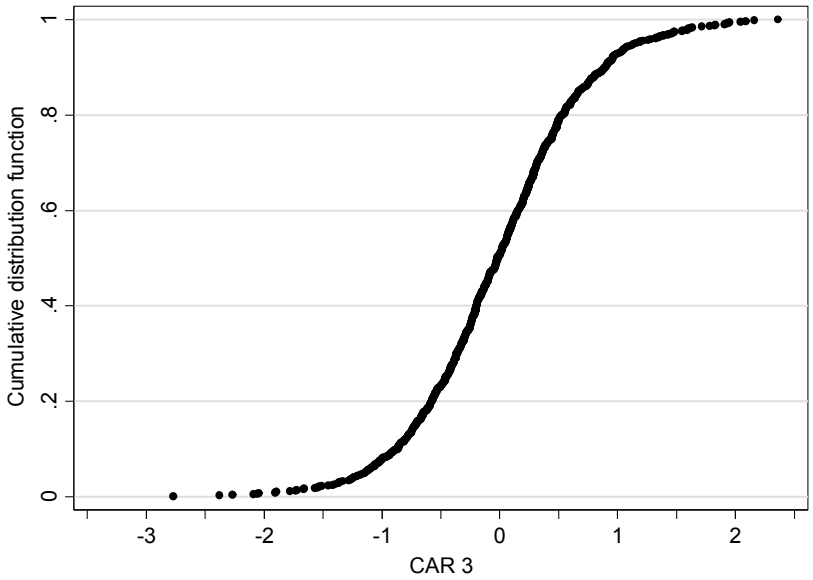
First, the analysis identifies all three-day windows between January 2013 and October 2016 with *no* event concerning the AEoI as reflected on the front page of NZZ. This yields a set of 845 three-day event windows which reflect normal times without important news relating to the AEoI. The analysis then applies the previous event study specification to estimate the cumulative abnormal return for each of these three-day windows. Figure 3.2a illustrates the cumulative distribution function of the resulting estimates.

Second, the analysis estimates the three-day cumulative abnormal returns after each of the 44 NZZ front page articles mentioning the AEoI. This yields estimates for the effect of every event concerning the AEoI that was important enough to be reported on the front page of NZZ. The cumulative distribution function of the resulting estimates is illustrated in Figure 3.2b.

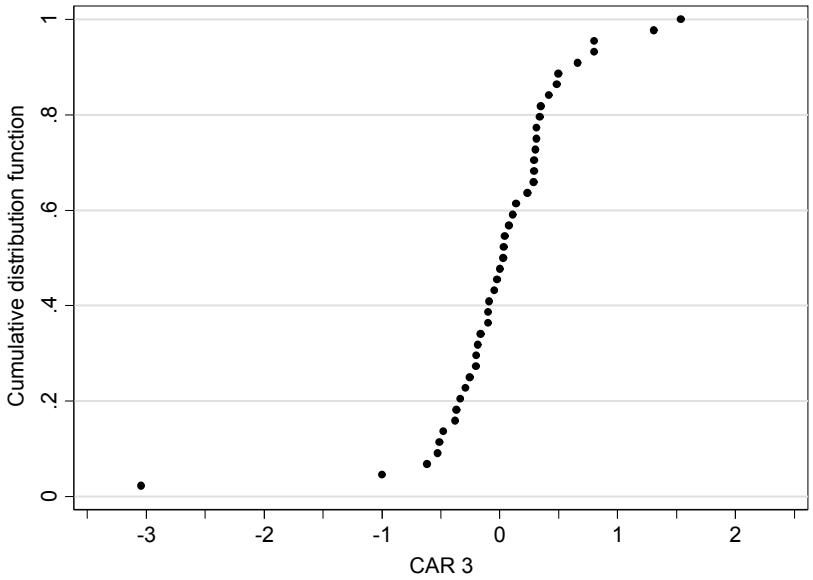
Cumulative abnormal returns during normal times in the absence of important news regarding the AEoI, as illustrated in Figure 3.2a, appear to be distributed similarly to a normal distribution with a mean close to zero. This suggests that the underlying event study specification works well to account for normal returns, and that the parametric tests above are meaningful.

Cumulative abnormal returns after events concerning the AEoI were reported on the front page of NZZ, as illustrated in Figure 3.2b, seem to be distributed similarly. Most cumulative abnormal returns lie between -0.6 and +0.6%. Only two negative cumulative abnormal returns stand out: -3.0% upon 14 January 2015, and -1.0% upon 14 November 2013.

FIGURE 3.2: Distributions of three-day cumulative abnormal returns after and in the absence of important news concerning the AEoI



(a) Three-day cumulative abnormal returns when the AEoI was not mentioned on the front page of NZZ



(b) Three-day cumulative abnormal returns after the AEoI was mentioned on the front page of NZZ

Note: The figures illustrate the distributions of the cumulative abnormal returns of Swiss banks for (almost) all three-day windows between January 2013 and October 2016 depending on whether or not the automatic exchange of financial account information (AEoI) was mentioned on the front page of Neue Zürcher Zeitung (NZZ). Figure (a) refers to all three-day windows with no reference to the AEoI, and (b) to all three-day windows after the AEoI was mentioned on the front page of NZZ.

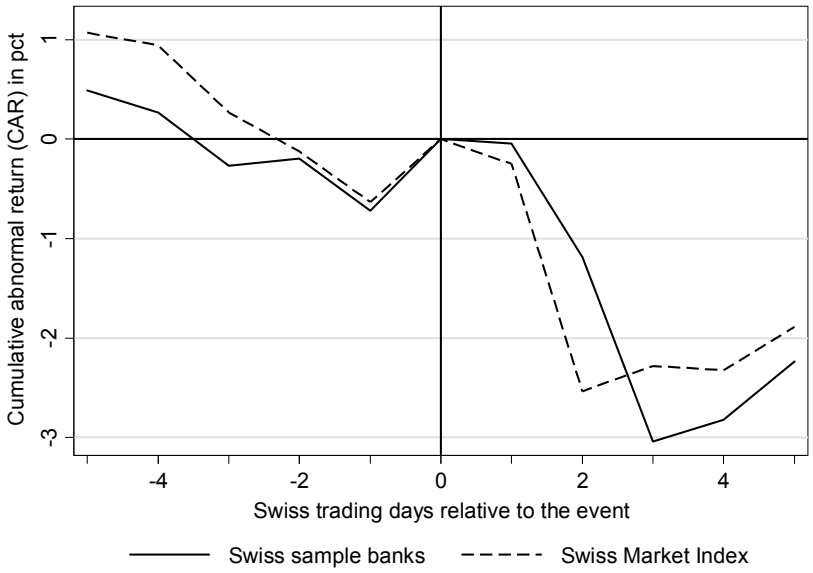
The remainder of this section addresses these two dates and applies the event study specification to both dates individually. The results are illustrated in Figure 3.3. The figures depict the estimated cumulative abnormal returns in the stock prices of Swiss banks as well as of the Swiss Market Index (SMI), a major index for the broad Swiss stock market, around the two dates. As the event study specification controls for general market conditions on the European level, the abnormal performance of the SMI indicates changes of the conditions in the entire Swiss market relative to the European market. If the abnormal drops in the stock prices of Swiss banks are indeed caused by the events concerning the AEoI, this should have no strong effects on the entire Swiss market and the abnormal returns of the SMI should be close to zero.

Figure 3.3a illustrates the cumulative abnormal returns around 14 January 2015, when the Swiss government submitted the draft law for the AEoI into the consultation process. By coincidence, just one day later, the Swiss National Bank abandoned the exchange rate cap of a minimum of 1.20 Swiss francs per euro. The strong abnormal drop in the stock prices of Swiss banks of -3.0% occurred swiftly within two days, but started only one day after the Swiss government submitted the draft law into consultation. The SMI experienced a comparable drop of -2.3% at the very same time. The exact timing of the stock price drop and its similarity to the abnormal performance of the SMI suggest that the drop was caused by some event which happened one day after the submission of the draft law and had implications for the entire Swiss market –potentially the new exchange rate regime by the Swiss National Bank.

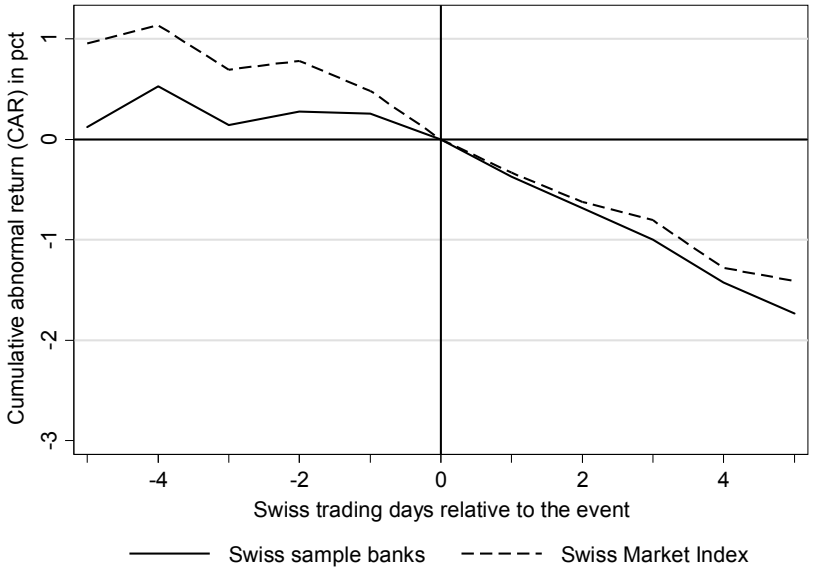
Figure 3.3b illustrates the cumulative abnormal returns around 14 November 2013, when Liechtenstein committed to the AEoI. In contrast to Austria and Luxembourg, Liechtenstein is not a member country of the EU. Its commitment therefore had no implications for the EU decision-making process and, in turn, for the Swiss banking secrecy. In the week after Liechtenstein's commitment, the stock prices of Swiss banks experienced a gradual abnormal decline of around -0.3% per day, which very closely resembles the abnormal performance of the SMI. Moreover, the abnormal decline in both return series seemingly started at least two days prior to Liechtenstein's commitment. Again, the timing of the stock price decline and its similarity with the abnormal performance of the SMI suggest that the decline was driven by unfavorable general market conditions in Switzerland rather than the new tax transparency.[25]

[25] While I was not able to identify an obvious source for the stock price decline, a cumulative abnormal return of -1.0% over four trading days does not seem to be very uncommon with around 8% of the cumulative abnormal returns during normal times being smaller (see Tabel 3.2a).

FIGURE 3.3: Most negative cumulative abnormal returns of Swiss banks after important news concerning the AEoI



(a) Cumulative abnormal returns around 14 January 2015



(b) Cumulative abnormal returns around 14 November 2013

Note: The figures illustrate the cumulative abnormal returns of Swiss banks and the Swiss Market Index, a major index for the Swiss stock market, around important news concerning the automatic exchange of financial account information (AEoI) upon which Swiss banks experienced strong abnormal drops in their stock prices. Figure (a) refers to 14 January 2015, when the Swiss government submitted the AEoI draft law into the consultation process and, by coincidence, one day before the Swiss National Bank unpegged the Swiss franc from the fixed exchange rate to the euro; and (b) refers to 14 November 2013, when Liechtenstein committed to the AEoI.

3.5 Concluding remarks

Switzerland has undergone a radical change with regard to its banking secrecy. For decades, the Swiss banking secrecy was commonly considered a reliable protection against investigations by foreign tax authorities. This environment has attracted large amounts of international wealth into Swiss banks. Zucman (2014, Table S.1) puts the foreign-owned wealth in Switzerland by the end of 2013 at US $2.4 trillion. Although the level of tax compliance among the owners of Swiss bank accounts has recently increased, it remains low at around 20%. Swiss banks still profit from the service and transaction fees from managing that wealth. As of 2018, Switzerland will participate in the international exchange of financial account information for tax purposes on an automatic basis.

This study examines how the new information exchange affected the stock prices of Swiss banks as an indicator of the banks' future profitability. It documents a modest negative effect which was limited to a small number of banks and is statistically not significantly different from zero. The minimum detectable effect sizes in this study are moderately sized and well below the estimated effects in a similar event study on data leaks from banks in tax havens (Johannesen and Stolper 2017). This suggests that the null results are not a consequence of low statistical power, but rather that financial markets expected the new tax transparency to have no sizeable impact on the future profits of Swiss banks.

While it is possible that previously tax non-compliant accounts will now become compliant and remain with banks in Switzerland, it seems unlikely that a significant increase in the level of tax compliance among the customers of Swiss banks will have no effect on the banks' future earnings. A more plausible explanation for the results seems to be that the new tax transparency might not have significantly increased the level of tax compliance among the owners of Swiss bank accounts. In fact, media articles are already reporting on loopholes in the new information exchange, which are said to attract large amounts of capital and allow tax evaders to keep their assets with Swiss banks and still remain anonymous to the tax authorities in their home countries.[26]

[26] One such loophole that is said to attract large amounts of capital is described in "Financial transparency: The biggest loophole of all," *The Economist*, 20 February 2016.

Appendix

Table 3.A: Swiss banks in the estimating sample

Name of listed Swiss bank or its listed parent	Source	Penalty (US $ million)	Market capitalization (US $ million)	Start of holding period	End of holding period	Country	Sector
Credit Suisse Group	Criminal investigation	2,600.0	43,734	-	-	CH	Banks
UBS Group	Criminal investigation	780.0	70,142	-	-	CH	Banks
Julius Baer Group	Criminal investigation	547.0	9,172	-	-	CH	Banks
Bank Leumi Le-Israel	Criminal investigation	270.0	5,072	-	-	IL	Banks
Liechtensteinische Landesbank	Criminal investigation	23.8	1,287	-	-	LI	Banks
HSBC Holdings	Criminal investigation	pending	171,194	-	-	UK	Banks
Bank Hapoalim	Criminal investigation	pending	6,565	-	-	IL	Banks
Mizrahi Tefahot Bank	Criminal investigation	pending	2,709	-	-	IL	Banks
Basler Kantonalbank	Criminal investigation	pending	2,243	-	-	CH	Banks
BTG Pactual Group	Swiss Bank Program	211.0	11,213	14 jul 2014	22 feb 2016	BR	Financ svcs
Credit Agricole	Swiss Bank Program	99.2	34,260	-	-	FR	Banks
Bank J Safra Sarasin	Swiss Bank Program	85.8	1,683	-	31 jul 2012	CH	Banks
Royal Bank of Scotland Group	Swiss Bank Program	78.5	55,759	-	-	UK	Banks
BNP Paribas	Swiss Bank Program	59.8	79,555	-	-	FR	Banks
St Galler Kantonalbank	Swiss Bank Program	59.2	1,998	-	-	CH	Banks
Banque Cantonale Vaudoise	Swiss Bank Program	57.0	4,176	8 dec 2010	-	CH	Banks
Edmond de Rothschild Suisse	Swiss Bank Program	45.2	1,423	-	-	CH	Financ svcs
Deutsche Bank	Swiss Bank Program	31.0	38,739	-	-	DE	Banks
EFG International	Swiss Bank Program	30.0	1,597	-	-	CH	Banks
Societe Generale	Swiss Bank Program	19.2	43,224	-	-	FR	Banks
Rothschild & Co	Swiss Bank Program	11.5	1,540	-	-	FR	Financ svcs

Note: The table provides information about all the banks in the estimating sample. The information can vary over time as parent-subsidiary links sometimes change. The table states the latest available information for each bank from before Switzerland committed to the implementation of the automatic exchange of financial account information (AEoI).

Continued on the next page.

Table 3.A *(continued)*: Swiss banks in the estimating sample

Name of listed Swiss bank or its listed parent	Source	Penalty (US $ million)	Market capitalization (US $ million)	Start of holding period	End of holding period	Country	Sector
Luzerner Kantonalbank	Swiss Bank Program	11.0	3,098	-	-	CH	Banks
CIC	Swiss Bank Program	10.5	7,549	-	-	FR	Banks
Banco Bilbao Vizcaya Argentaria	Swiss Bank Program	10.4	63,268	-	-	ES	Banks
Schroders	Swiss Bank Program	10.4	10,420	-	-	UK	Financ svcs
Standard Chartered	Swiss Bank Program	6.3	46,376	-	-	UK	Banks
Vontobel Holding	Swiss Bank Program	5.4	2,187	4 sep 2015	-	CH	Banks
Berner Kantonalbank	Swiss Bank Program	4.6	2,006	-	-	CH	Banks
Bank Linth LLB	Swiss Bank Program	4.2	368	-	-	CH	Banks
Zuger Kantonalbank	Swiss Bank Program	3.8	1,384	-	-	CH	Banks
Graubuendner Kantonalbank	Swiss Bank Program	3.6	3,113	-	-	CH	Banks
Valiant Holding	Swiss Bank Program	3.3	1,540	-	-	CH	Banks
Bank Coop	Swiss Bank Program	3.2	748	-	-	CH	Banks
Walliser Kantonalbank	Swiss Bank Program	2.3	-	-	-	CH	Banks
BHF Kleinwort Benson Group	Swiss Bank Program	1.8	388	7 jul 2011	27 nov 2015	BE	Financ svcs
SB Saanen Bank	Swiss Bank Program	1.4	60	-	-	CH	Banks
Mercantil Servicios Financieros	Swiss Bank Program	1.2	10,636	-	-	VE	Banks
Banque Cantonale du Jura	Swiss Bank Program	1.0	189	-	-	CH	Banks
Medibank	Swiss Bank Program	0.8	13	-	-	CH	Banks
Hypothekarbank Lenzburg	Swiss Bank Program	0.6	308	-	-	CH	Banks
Banco di Desio e della Brianza	Swiss Bank Program	0.3	496	-	8 jun 2012	IT	Banks
Banca Intermobiliare	Swiss Bank Program	-	664	-	-	IT	Financ svcs

Note: The table provides information about all the banks in the estimating sample. The information can vary over time as parent-subsidiary links sometimes change. The table states the latest available information for each bank from before Switzerland committed to the implementation of the automatic exchange of financial account information (AEoI).

Concluding remarks

Large amounts of the global private wealth are held in tax havens, where the majority of it is believed to go untaxed. This dissertation addresses the optimal design of policies in the fight against offshore tax evasion.

The first chapter sheds light on the question of why haven countries comply with international standards of transparency despite sizeable returns in the tax haven business. Whether haven countries operate as a secretive tax haven or comply with transparency standards is determined in a many-player coordination game between a haven country and its many potential investors. This non-standard market for concealment services may explain why the profits of tax havens are not competed away in international financial markets –these profits make a haven country resilient against political pressure by the international community and therefore trustworthy for tax evading investors. Furthermore, the analysis points out a trade-off between the fight against tax havens and a high level of taxation, because high tax rates induce a strong incentive for taxpayers to engage in evasion. A similar argument applies to weak penalties for revealed offshore tax evasion, such as in voluntary disclosure programs.

The subsequent two chapters provide empirical evidence on the effects of two recent policy initiatives in the fight against offshore tax evasion. As tax evasion is inherently difficult to observe due to the concealment activities, the studies rely on an indirect measure –the stock prices of Swiss banks which are known to be involved in offshore tax evasion.

The first initiative under consideration are the acquisitions of stolen banking data from tax havens by foreign tax authorities. The first leak of this kind caused a significant drop in the stock prices of Swiss banks with a known link to offshore tax evasion. A back-of-the-envelope calculation suggests that the leak might have reduced the hidden offshore wealth in Switzerland by around 10%, most plausibly by increasing the perceived risk of

involuntary exposure. This drop in the amount of offshore wealth in Swiss banks is also supported in international investment statistics by the Bank for International Settlements on foreign-owned bank deposits in all tax havens.

The second initiative is the automatic exchange of financial account information for tax purposes, which substantially weakened the Swiss banking secrecy for foreign investors. Stock prices of Swiss banks showed no significant or sizeable reactions to important news concerning the new information exchange despite a high level of statistical power. The results suggest that the automatic exchange of information might not have significantly increased the level of tax compliance among owners of offshore accounts.

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