The Deterrence Effect of Whistleblowing

Niels Johannesen *University of Copenhagen*
Tim B. M. Stolper *Max Planck Institute for Tax Law and Public Finance*

Abstract

We document that the first leak of customer information from a tax-haven bank caused a sudden flight of deposits from tax havens and a sharp decrease in the market value of banks known to be assisting with tax evasion. The loss of market value was largest for the banks most strongly involved in tax evasion. Subsequent leaks had qualitatively similar although smaller effects. Our findings suggest that whistleblowing in tax-haven banks deters offshore tax evaders by increasing the perceived risk of committing and assisting with tax evasion.

1. Introduction

In the digital age, whistleblowing affairs have become common. Anyone holding confidential information can easily make it available to the rest of the world by posting it online, and organizations like WikiLeaks specialize in receiving, processing, and disseminating leaked information. Some celebrate whistleblowers as "the heroes of our time" who are "contributing to ethics and integrity" (United Nations 2016, p. 15) and whose legal protection is therefore an important concern for public policy (*Economist* 2015). Others remain ambivalent about the overall benefits of whistleblowing, highlighting its inherent unlawfulness (Delmas 2015), the potential for fraudulent allegations (see Nyreröd and Spagnolo 2021), and the adverse effect on effort in organizations (Ting 2008).

At the heart of the positive view is the presumption 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. For instance, Yuliya Stepanova revealing the existence of a large-scale Russian doping program may have deterred other athletes from using illicit drugs (Ma-

We thank Kai Konrad, Ben Lockwood, Jim Omartian, Stefan Zeume, and Gabriel Zucman; conference audiences at the Tax Research Conference at Ross Parsons Centre at the University of Sydney and the Transatlantic Workshop on the Economics of Crime at the University of Pennsylvania; seminar participants at the Industrial Organization and Trade Seminar at Ludwig Maximilian University of Munich; and the board of trustees at Max Planck Institute of Tax Law and Public Finance for valuable comments. Johannesen gratefully acknowledges financial support from the Danish Council for Independent Research and the Danish National Research Foundation.

[*Journal of Law and Economics*, vol. 64 (November 2021)]

cur 2019), and former insider Abu Hamed exposing the identities of thousands of secretly enlisted jihadis may have discouraged other radicals from joining the Islamic State (Moore 2016). Such effects would be consistent with standard economic theories of crime (Becker 1968) in which whistleblowing may deter criminal behavior by increasing the likelihood of legal and other social sanctions. Despite the importance of normative debates about whistleblowing, there is virtually no empirical evidence of such a deterrence effect.

In this paper, we provide empirical evidence on the deterrence effect of whistleblowing in the context of offshore tax evasion. We investigate whether leaks of customer information from banks in tax havens deter 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.[1] Hence, for many owners of tax-haven accounts and for bankers in tax havens, leaks of customer files involve a risk of legal sanctions if the information is acquired by the tax authorities and public humiliation if it is posted online.

Our main results concern the first whistleblowing affair exposing tax evasion in tax havens: 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.[2] The leak became publicly known on February 14, 2008, when German police raided the premises of Klaus Zumwinkel, the chief executive of *Deutsche Post,* and detained him on charges of tax evasion (Schmid 2008). 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 País* in the following days.

In the first part of the analysis, we use country-level data from the Bank for International Settlements (BIS) to document that the data leak from LGT Bank coincided with a significant decrease in foreign-owned bank deposits in tax havens compared with other international banking centers. While cross-border deposits evolved very similarly in havens and nonhavens before the leak, we observe a sharp divergence during the first quarter of 2008, with deposits in havens decreasing by more than 10 percent relative to deposits in nonhavens. This striking pattern cannot be explained by concurrent tax-enforcement efforts, as the major initiatives to reign in offshore tax evasion esscalated around 6 months after the LGT leak.[3] Moreover, a range of robustness tests suggest that the estimate is

[1] Documents published in the context of a court case against the Swiss bank UBS show that around 90 percent 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 whistleblower Bradley Birkenfeld and the head of the bank's global wealth management division, Raoul Weil.

[2] Banks in tax havens have been subject to other types of whistleblowing cases, for instance the leak of documents concerning Nazi accounts at UBS in 1997.

[3] Notably, the legal cases against Swiss banks in US courts, most famously the case against UBS, began in August 2008. The crucial event in compelling tax havens to exchange information about suspected tax evaders occurred in April 2009 (Johannesen and Zucman 2014).

not confounded by events related to the 2008–9 financial crisis.[4] Finally, since the BIS data cover almost all cross-border deposits in the world, also when owned through shell companies or trusts, our results are unlikely to reflect shifting of assets to more secretive tax havens or more sophisticated evasion techniques.[5]

These results are thus consistent with a significant decrease in the use of criminal offshore banking services in response to the leak. Since offshore tax evasion had never previously been exposed in leaks, offshore account owners and bankers most likely did not consider this risk before the leak from LGT Bank.[6] 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 stock of deposits related to evasion in tax havens. While we cannot exclude that the LGT leak also caused a decrease in legitimate foreign accounts, this mechanism does not explain why deposits decreased differentially in havens relative to nonhavens.[7]

In the second part of the analysis, we study the deterrence effect of whistleblowing by analyzing stock market data. We use a standard event-study framework to estimate the effect of the LGT data leak on the stock prices of banks with known links to offshore tax evasion. To the extent that the leak deterred the use of offshore accounts, and thus decreased the expected profits associated with criminal offshore services, we should observe an immediate drop in the market value of

[4] The main result is robust to controlling for asset price shocks (for example, stock prices) and central bank initiatives to rein in the financial crisis (for example, swap agreements). Moreover, we find no evidence of a decrease in interbank deposits, which suggests that the decrease in customer deposits is not caused by a confounding shock to financial institutions in tax havens.

[5] The LGT leak may have induced individuals holding a bank account in, say, Switzerland to transfer ownership of the account to a fully controlled corporation in, say, Panama to add a layer of secrecy between themselves and their assets. However, such responses do not affect our results, as the total foreign-owned customer deposits in the bank, the outcome entering our analysis, is unchanged. As we do not observe asset classes other than deposits, our results could, in principle, be explained by a differential change in the composition of portfolios. We note, however, that financial assets such as stocks and bonds do not generally offer better protection against data leaks than deposits, so it seems unlikely that leaks would trigger significant behavioral responses in this dimension. Precious metals, however, may offer opportunities for anonymous ownership but account for a tiny fraction of the wealth managed in tax havens; for instance, less than .01 percent of fiduciary transactions conducted by Swiss banks concern precious metals (Swiss National Bank 2020).

[6] 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 (for example, Dekel, Lipman, and Rustichini 1998).

[7] Some individuals with legitimate foreign accounts may have chosen to repatriate funds in response to the LGT leak because they drew negative inferences about the trustworthiness of their foreign banks. There are two reasons why this is unlikely to be the main mechanism underlying our first set of results. First, many sources suggest that legitimate accounts constitute a small fraction of the wealth management business in tax havens (for example, US Senate 2008; Alstadsæter, Johannesen, and Zucman 2019). Second, it is unclear why the loss of trust would be specific to banks in tax havens, that is, why a data leak in Liechtenstein would reduce the overall trustworthiness of banks in, say, Luxembourg, Singapore, and the Bahamas relative to banks in Germany, France, and Canada.

banks providing such services (Fama 1991).[8] Since stock prices are available for each bank on each day, this data source allows us to zoom in on a narrow time window around the data leak and compare individual banks with different involvement in offshore tax evasion, which mitigates concerns about confounding shocks in the analysis of cross-border deposits.

The analysis focuses on banks that admitted to assisting US taxpayers with tax evasion through offshore shell corporations and undeclared Swiss bank accounts. Starting with the famous case against UBS in 2008, the US government investigated 16 banks for their complicity in tax evasion, which has led to settlements with a combined value of more than $5.5 billion. Furthermore, 80 banks admitted to tax-related criminal activities in the United States under the Swiss Bank Program, which allows banks to resolve criminal liabilities through full disclosure of their cross-border activities and payment of appropriate penalties. From this gross sample of 96 banks with a known link to offshore tax evasion, our estimating sample includes the 46 banks that are listed on a stock exchange. Around half of the banks are Swiss banks, while the remainder are based in other countries but offer wealth management services through a Swiss branch or subsidiary.

Our findings suggest that the LGT leak caused a significant decrease in the market value of banks involved in offshore tax evasion. The 46 banks in our sample tracked the normal return closely in the 10 days preceding the leak but earned an abnormal return of −2.2 percent over the first 4 days following the leak. The estimated stock market responses are larger and sharper when returns are weighted by market capitalization. In either case, the cumulative abnormal returns are statistically significant based on standard parametric tests and nonparametric tests comparing abnormal returns after the leak with the empirical distribution of abnormal returns in the preleak period.

These findings suggest that the leak from LGT Bank lowered expected future earnings of banks assisting foreign customers with tax evasion. This is consistent with markets perceiving the leak as an effective deterrent of offshore tax evasion and with the flight of deposits from tax havens observed in the first quarter of 2008. By contrast, the loss of market value is unlikely to reflect the anticipation of penalties. Since the LGT Bank is not part of our estimating sample, any anticipation in the markets that this bank would face penalties because of the secrets exposed in the leak should not affect our estimates. Moreover, the penalties ultimately paid by the banks were only a minor fraction of the estimated loss of market value of around $27 billion.

A number of additional empirical tests support our interpretation of the main result. First, probing the robustness of our findings, we show that the estimated drop in stock prices remains when we control for confounding shocks to the Swiss financial sector by including the returns earned by Swiss banks with no

[8] A decrease in expected profits could derive from either the offshore banking market's demand side (an inward shift in the demand curve) or the supply side (an outward shift of the cost curve), which in both cases would reflect a lower equilibrium quantity of offshore evasion.

known links to offshore tax evasion in the model. Second, exploring the heterogeneity in stock market responses, we show that stock prices dropped significantly more for banks with a stronger involvement in offshore tax evasion, as measured by two distinct proxies.[9] Both findings are consistent with a causal link between the banks' loss of market value around the time of the LGT leak and their role in offshore tax evasion.

The results concerning the LGT leak raise the question of whether subsequent leaks from tax havens had a similar deterrence effect. We study this question by manually searching all front pages of a major Swiss newspaper, *Neue Zürcher Zeitung,* between January 2008 and October 2016 and applying our empirical framework to the 12 other instances in which an article covered a newly leaked list of customers at offshore banks or service providers or a significant new dissemination of such a list. These events include the leak from HSBC Private Bank in Switzerland (later known as Swiss Leaks) and from the law firm Mossack Fonseca (known as the Panama Papers). We find evidence of modestly sized deposit responses but only weak signs of stock market responses to these leaks. Overall, the 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 associated with a much smaller, if any, updating of the beliefs about this risk.

While a number of studies investigate which conditions are conducive to whistleblowing (Dyck, Morse, and Zingales 1991), we are not aware of any existing quantitative evidence on the ability of whistleblowing to deter crime. Most related is a large literature with contributions from scholars in law, economics, and criminology that explores the role of transparency and public information in deterring criminal behavior more broadly. For instance, legal scholars argue that the public shaming of criminals is an efficient 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 (Bø, Slemrod, and Thoresen 2015).

Our study also contributes to an emerging literature investigating which factors shape offshore tax evasion, for instance, tax rates on capital income (Hanlon, Maydew, and Thornock 2015), tax enforcement (Johannesen and Zucman 2014; Menkhoff and Miethe 2019), and tax amnesties (Johannesen et al. 2020; Langenmayr 2017). 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 significantly. Some caution is warranted when making inferences about the magnitude of the deterrence effect based on our estimates because of deposit shifting across foreign banking centers: to the extent that depositors shifted funds from havens to nonhavens in response to the LGT leak, our estimate that deposits in havens dropped by 10 percent relative to deposits in nonhavens overstates

[9] Our two proxies for the extent of a bank's involvement in offshore tax evasion arethat US prosecutors initiated an investigation of the bank and the ultimate size of the penalties paid to the US government.

the true magnitude of the deterrence effect. For perspective, it is nevertheless useful to compare the estimated 15 percent decrease in offshore deposits following the signature of bilateral information exchange treaties found in the literature (Johannesen and Zucman 2014).

Finally, our study adds to an emerging literature on how stock prices respond to data leaks and other news about aggressive tax behavior. For instance, O'Donovan, Wagner, and Zeume (2017) document that firms whose offshore affiliates 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 studies are suggestive that media exposure of firms' aggressive tax planning may limit their 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.

The paper proceeds in the following way. Section 2 provides background information about the institutional setting and whistleblowing in tax havens. Sections 3 and 4 report the analysis of deposit data and stock market data, respectively. Section 5 concludes.

2. Background

2.1. Offshore Tax Evasion

A recent study estimates, exploiting systematic inconsistencies in international investment positions, that household wealth in tax havens globally amounts to at least $6,000 billion or, equivalently, around 8 percent of households' total financial assets (Zucman 2013). Most of this wealth is held in Switzerland, but there are other tax havens with major wealth management industries including Luxembourg, Singapore, Hong Kong, and the Bahamas. While holding assets in a tax haven is perfectly legal if the account is disclosed to the tax authorities, a recent study using leaked customer data from the bank HSBC Switzerland combined with tax return data from Denmark, Norway, and Sweden finds that the vast majority of the offshore wealth is, in fact, not disclosed (Alstadsæter, Johannesen, and Zucman 2019). Moreover, the same study finds that the assets hidden in HSBC Switzerland are extremely concentrated among the wealthiest persons and that as many as 50 percent of the Scandinavian households at the very top of the wealth distribution hide assets in offshore accounts. This figure is likely to be even higher in most other countries since Scandinavians own little offshore wealth by international standards (Alstadsæter, Johannesen, and Zucman 2018). Together, these studies suggest that offshore tax evasion is a fairly widespread criminal activity, at least in the wealthiest segments of the population, and a major challenge for policy.

In response to this challenge, governments have enacted a number of enforcement initiatives: in May 2005, the European Union agreed with a number of tax havens to tax the interest income accruing to accounts owned by European resi-

dents and remit the revenue to the home country (Johannesen 2014); in August 2008, the US Department of Justice started a series of legal cases against foreign banks, most famously UBS, for their role in assisting US citizens with tax fraud; in April 2009, the G20 compelled all tax havens in the world to accept a weak form of cooperation whereby they would lift the banking secrecy rules and provide information about account holders suspected of tax evasion when requested by foreign tax administrations (Johannesen and Zucman 2014); and most recently many tax havens have agreed to provide financial account information about foreign taxpayers on an automatic basis (De Simone, Lester, and Markle 2020; Casi, Spengel, and Stage 2020; Menkhoff and Miethe 2019; Stolper 2017; Omartian 2016; Dharmapala 2016).[10] In addition, many countries, including the United States, now operate voluntary disclosure programs under which cooperating tax evaders benefit from reduced penalties and avoid criminal sanctions (Johannesen et al. 2020; Langenmayr 2017).

2.2. Whistleblowing in Tax Havens

The offshore secrets of private individuals and multinational firms have been exposed numerous times in recent years by whistleblowers in banks (for example, HSBC Switzerland), accounting firms (for example, PricewaterhouseCoopers in Luxembourg), law firms (for example, Mossack Fonsecka in Panama), and governments (for example, corporate registry in the Bahamas). The secret documents leaked by the whistleblowers range from customer files related to offshore bank accounts and shell corporations to advance tax agreements between multinational firms and tax-haven governments. Across the world, the exposures have had tangible consequences in the form of political leaders leaving office, wealthy individuals paying significant tax penalties, and some of the world's largest firms facing public shaming over secret tax practices.

The offshore leaks have also sparked political debates about the legal status of whistleblowers. In some countries, in particular the United States, whistleblowers enjoy significant legal protection and can receive substantial monetary rewards from the government when the exposures help uncover tax fraud.[11] In many other countries, notably in tax havens, there is no legal protection of whistleblowers, and governments often seek to prosecute them for violation of privacy laws.[12] In the European Union, recent offshore leaks were instrumental in the decision to adopt comprehensive protection of whistleblowers in 2019 (Abazi 2020).

The main focus of this paper is the first instance of whistleblowing involving an offshore bank: the leak of customer data from the Liechtenstein-based LGT Bank.

[10] Account information is provided to the United States 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.

[11] For instance, the former banker and wealth manager Bradley Birkenfeld, who blew the whistle on UBS, received a reward of $104 million from the US Treasury because the exposures enabled the collection of more than $5 billion in unpaid taxes from US taxpayers (Givati 2018).

[12] For instance, Heinrich Kieber, who blew the whistle on LGT Bank, was indicted by the Liechtenstein prosecutor and became "State Enemy Number One" (Ritzer 2011).

According to journalistic accounts, the leak occurred in 2002 when a computer technician at the bank, Heinrich Kieber, extracted confidential customer information from the bank's information technology systems. After leaving the bank, he approached the German intelligence agency in 2006 and ultimately sold it a CD-ROM with information about the bank's customers in Germany for around €4.2 million. The data leak became publicly known on February 14, 2008, when the German police raided the premises of Klaus Zumwinkel, a prominent corporate executive, and detained him on charges of tax evasion after months of secret investigations (Teevs 2011). The case was immediately picked up by major media outlets, which also reported that the tax-evasion scandal involved hundreds of other suspects. On February 15, several news media reported that the German intelligence service, Bundesnachrichtendienst (BND), was involved in the case and, on February 16, the German magazine *Der Spiegel* (2008) reported that BND had paid a whistleblower for the information leading to the arrest of Zumwinkel.

The LGT leak in 2008 was, to our knowledge, the first data leak from a tax haven to expose offshore tax evasion; several other data leaks followed. We systematically collected information about the leaks by manually searching all front pages of *Neue Zürcher Zeitung* published between January 2008 and October 2016. We searched each front page for the key words *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 it referred to a data leak from a tax haven.[13] 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 a date, we assume that the leak occurred 1 calendar day prior to the article's publication date. The implicit assumption underlying this approach is that data leaks with sufficient significance for banks operating in Switzerland to move their stock prices would be reported on the front pages of Swiss newspapers.

As detailed in Table 1, we identified 13 front-page articles that concern new data leaks or significant new dissemination of information from existing leaks. Several articles report the major leak from HSBC Switzerland. First, on August 30, 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 December 9, 2009, French media reported an alleged data theft at HSBC Switzerland, which was confirmed on December 13, when Hervé Falciani revealed himself as the HSBC Switzerland whistleblower on French prime-time television. Eventually, in February 2015, the International Consortium for Investigative Journalists gained access to the HSBC Switzerland customer lists and pub-

[13] We excluded 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 1 month before the Swiss National Bank capped the exchange rate of the Swiss franc (*Neue Zürcher Zeitung* 2014). While the Hildebrand affair was triggered by a bank employee leaking information about the transaction, the data leak was limited to Hildebrand and was never intended to identify any foreign tax evaders. A list of the other articles can be requested from the authors.

Table 1

Events Related to Data Leaks from Tax Havens

Event	Event	Date of Article	Headline
1	February 14, 2008	February 16, 2008	Head of Deutsche Post Trips over Tax Affair: Eyeing Further Hundred Suspects
2	August 30, 2009	August 31, 2009	France Wants to Collect the Evaded Taxes: 3,000 Clients' Data Received from Switzerland
3		November 3, 2009	Also the Netherlands Buy Bank Data: A Blow against Tax Evasion
4		December 10, 2009	Data Theft at the HSBC in Geneva: Part of the Tax Evaders List?
5	February 1, 2010	February 2, 2010	All Set to Buy Data: Germany Risks New Tax Dispute
6		February 8, 2010	The Data Theft Affair Draws Circles: New Data CDs Surface
7	January 17, 2011	January 18, 2011	Elmer Appears with Julian Assange: Whistleblower Delivers Bank Information
8[a]	July 14, 2012	July 16, 2012	Blow against the Tax Agreement: North Rhine–Westphalia Acquired Bank Data CD from Switzerland
9	April 4, 2013	April 5, 2013	The Expulsion from the Tax Paradise: Revelations about Tax Havens Have Further Large Repercussions
10		April 17, 2013	Germany Acquires Another CD with Bank Data: Raids against Clients
11		February 10, 2015	"Swissleaks" Hitting Massive Headlines: HSBC Client Information Evaluated
12	April 3, 2016	April 4, 2016	Network of Offshore Companies Revealed: Allegedly, around Two Billion Dollars from the Vicinity of the Russian President
13	April 14, 2016	April 15, 2016	Stolen Bank Data Distributed across the EU: North Rhine–Westphalia Passes on Financial Account Information from Switzerland

Note. Headlines are the authors' translations from the front page of *Neue Zürcher Zeitung* from January 2008 to November 2016. The date of the event is either the date mentioned in the article or, in the absence of such information, the calendar day before the article was published.

[a] The article states that the event took place during the weekend of July 14–15, 2012, but the precise date is not given. As the event studies are concerned only with trading days, this has no bearing on the estimations.

lished them as Swiss Leaks, thereby exposing hundreds of prominent tax evaders to public scrutiny.

3. Analysis of Deposits

3.1. Data

In this section, we study the deterrence effect of the LGT leak and subsequent whistleblowing cases using data from the Locational Banking Statistics of the BIS. This publicly available data source provides information about foreign-owned bank deposits in 47 international banking centers at a quarterly frequency.[14] Drawing on the list of noncooperative jurisdictions published by the Organisation for Economic Co-operation and Development (OECD 2009) on the eve of the first global crackdown on tax havens in 2009 (Johannesen and Zucman 2014), we classify 18 of these banking centers as havens and the remaining 29 countries as nonhavens.[15] To our knowledge, the BIS data on cross-border deposits are the only aggregate statistic that capture activities in the wealth management sector in a large number of tax havens.[16]

Importantly, the BIS data distinguish between cross-border deposits that are owned by banks (interbank deposits) and nonbanks (customer deposits). We focus on customer deposits, which include deposits held by households for tax-evasion purposes whether directly or through shell corporations. By contrast, interbank deposits are presumably entirely unrelated to offshore tax evasion. As shown in Table 2, cross-border customer deposits amounted to around $7,700 billion globally just before the LGT leak. Havens such as the Cayman Islands, Switzerland, Singapore, and Luxembourg are among the largest banking centers in the world according to this measure.[17]

3.2. Empirical Model

Our goal is to investigate whether whistleblowing events in tax havens cause a decline in the use of secret offshore accounts. Our empirical strategy rests on

[14] An important property of the Locational Banking Statistics for our purposes is that it assigns deposits of multinational banks to the residence countries of the appropriate deposit-taking branches and subsidiaries. For instance, deposit accounts at HSBC Switzerland and HSBC London are assigned to Switzerland and the United Kingdom, respectively.

[15] Our list of tax havens includes Austria, the Bahamas, Bahrain, Belgium, the Cayman Islands, Curacao, Cyprus, Guernsey, Hong Kong, the Isle of Man, Jersey, Luxembourg, Macao, Malaysia, 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 Organisation for Economic Co-operation and Development (OECD) prior to the G20 summit in April 2009 except for Macao and Hong Kong, which were omitted from the OECD list because of political pressure from China (see *Guardian* 2009).

[16] The measure is used extensively in the emerging literature on offshore wealth (for example, Andersen, Johannesen, and Rijkers 2020; Casi, Spengel, and Stage 2020; Menkhoff and Miethe 2019; Andersen et al. 2017; Johannesen and Zucman 2014; Johannesen 2014; Zucman 2013).

[17] Note that assets such as bonds and shares are not included in the figures. The available evidence suggests that deposits account for around 25 percent of the total financial wealth managed in tax havens (Zucman 2013).

Table 2
Cross-Border Customer Deposits by Banking Center

Country	*N*	Country	*N*
United Kingdom	1,686	Greece	62
United States	1,078	Isle of Man[a]	58
Cayman Islands[a]	771	Canada	50
Switzerland[a]	548	Italy	46
Germany	445	Denmark	42
Belgium[a]	324	Portugal	35
Ireland	303	Taiwan	35
Netherlands	286	Sweden	34
Singapore[a]	231	Antilles[a]	12
Jersey[a]	220	Norway	12
Luxembourg[a]	208	Malaysia[a]	12
France	176	Panama[a]	10
Bahamas[a]	171	Macao[a]	9.4
Japan	169	Brazil	4.5
Hong Kong[a]	162	Finland	4.4
Australia	142	South Korea	4.2
Spain	103	Chile	4.0
India	70	Bermuda	2.1
Guernsey[a]	69	Mexico	.7
Bahrain[a]	65	Turkey	.4
Austria[a]	65	Total	7,729.7

Source. Bank for International Settlements, Locational Banking Statistics, table A2 (https://www.bis.org/statistics/bankstats.htm).
Note. Values of deposits (in billions of dollars) are of nonbank foreigners held in a banking center's banks as of December 31, 2007.
[a] Tax haven.

the assumption that secret accounts are concentrated in banking centers where the legal environment enables secrecy and anonymity. This is precisely the defining feature of the 18 tax havens that, often with reference to bank secrecy laws, refused to provide bank information to foreign tax administrations during our sample period.[18] By contrast, nonhavens were generally committed to assisting foreign countries with tax enforcement through various forms of information exchange. The notion that secret accounts are concentrated in havens is consistent with evidence from many sources that a large share of accounts in havens are not disclosed in the home country (Alstadsæter, Johannesen, and Zucman 2019; US Senate 2008; Londoño-Vélez and Ávila-Mahecha 2021).

These considerations motivate an empirical specification in which the effect of leaks on deposits is estimated as the differential change in customer deposits in havens at the time of the leaks relative to the change in customer deposits in nonhavens. The identifying assumption is that deposits in havens and nonhavens

[18] Many tax havens have adopted more cooperative policies and are currently involved in automatic information exchange with foreign countries under FATCA and the Convention on Mutual Assistance in Tax Matters.

are affected similarly by other shocks (for example, business cycles, exchange-rate movements, monetary policy) and thus exhibit parallel trends absent shocks specific to the use of secret offshore accounts. This idea is formalized in the following baseline model:

$$\Delta \log(\text{Deposits}_{it}) = \alpha_i + \gamma_t + \beta \text{Haven}_i \times \text{Leak}_t + \varepsilon_{it}, \quad (1)$$

where Deposits_{it} denotes cross-border deposits in banking center i at the time of quarter t, Haven_i indicates that banking center i is a tax haven, and Leak_t indicates that a leak occurred in quarter t. The dependent variable is the (approximate) percentage change in deposits in a banking center. The banking center fixed effects α_i allow for differential secular trends in deposits across banking centers. The time fixed effects γ_t absorb any shocks to deposits that are common to havens and nonhavens. The main coefficient of interest is β, which captures the differential change in haven deposits relative to the change in nonhaven deposits at the time of a leak. Standard errors are clustered on banking centers to allow for autocorrelation in the error term.

We also estimate a dynamic version of the model that includes leads and lags of Leak (all interacted with Haven). This is important for two reasons. First, the interactions with leads allow us to assess whether deposits in havens and nonhavens are on similar trajectories prior to a leak, as implied by the parallel-trends assumption. Second, the interactions with lags inform us about the dynamic effects of a leak.

In robustness tests, we augment the baseline model with controls serving to absorb confounding shocks that may affect deposits in havens and nonhavens differentially. Notably, the 2008–9 financial crisis is a potential confounder with its severe impact on banks, firms, and households through a host of different channels. First, monetary authorities in many countries concluded swap agreements with the US Federal Reserve during the financial crisis to secure local banks' access to liquidity in US dollars. To the extent that nonhavens were more likely than havens to conclude such agreements, it may have caused a differential drop in deposits in havens through its effect on depositors' confidence in local banking systems. We address this potential confounder by augmenting the baseline model with indicators for having a swap agreement in place interacted with time fixed effects: this allows for a differential effect of any shock depending on whether a swap agreement is in place. Second, household balance sheets were adversely affected by large drops in asset prices, which may have caused a differential change in deposits in havens. For instance, households may have preferred to liquidate loss-making stock portfolios on declared accounts (in nonhavens), so that losses could serve as a tax shield for other income, rather than on undeclared accounts (in havens). Similarly, commodity prices were highly volatile through the financial crisis, which may have caused significant shifts in global portfolios of foreign assets, for instance, because autocratic elites controlling oil revenues diverted funds to accounts in havens during the oil price boom (Andersen et al. 2017).

We address these potential confounders by augmenting the baseline model with a vector of asset and commodity price changes interacted with Haven.

Finally, it is important to note that our estimates effectively conflate three conceptually distinct behavioral responses. As the model outcome is net flows to deposit accounts in a given banking center in a given period, a negative estimate of β may reflect an increase in gross flows out of existing deposit accounts in havens, a decrease in gross flows into existing deposit accounts in havens, or a decrease in gross flows into new accounts in havens. While we are unable to disentangle these three types of responses, we note that they are all consistent with the incentives created by an increase in the perceived risk of offshore evasion. Reducing the balance on offshore accounts in any of these three ways limits the exposure to tax penalties and criminal sanctions, which are typically an explicit function of evaded taxes with important discontinuities where penalty rates jump or a prison sentence is triggered.[19]

3.3. Results

3.3.1. Raw Trends in Deposits around the LGT Bank Leak

Before reporting the results from the baseline model, we inspect the raw trends in deposits around the LGT leak. For each banking center, we scale customer deposits with the value in the fourth quarter of 2007, immediately before the leak, and display the mean value across havens and nonhavens in Figure 1*A*.[20] Customer deposits evolved very similarly in the two groups before the leak, with steady quarterly increases. However, between the end of the fourth quarter of 2007 and the end of the first quarter of 2008, we observe a sharp divergence, with a continued strong deposit growth in nonhavens and close to no growth in havens. This pattern suggests that the LGT leak deterred the use of offshore accounts for tax-evasion purposes. We conduct the same exercise for interbank deposits, which presumably play no role in offshore tax evasion, and display the results in Figure 1*B*. Interbank deposits evolved very similarly in havens and nonhavens throughout the period, with no signs of divergence at the time of the LGT leak. If anything, interbank deposits grew slightly faster in havens than in nonhavens during the first quarter of 2008. This suggests that the differential decrease in customer deposits was not caused by a confounding shock to the financial sector in havens affecting all types of deposits. In the regression framework, we attempt to account for confounding shocks that are specific to customer deposits.[21]

[19] Consistent with the first type of response, studies find that enhanced tax enforcement triggers significant repatriation of offshore funds (see, for example, Johannesen et al. 2020).

[20] This analysis excludes seven banking centers that started reporting after the beginning of the 2-year window and two small banking centers with foreign-owned deposits below $1 billion. Hence, the sample comprises 38 banking centers, of which 15 are havens and 23 are nonhavens.

[21] In Figure OA1 in the Online Appendix, we show the raw trend for each tax haven separately. While there is considerable variation across havens, our main results are not driven by a single large haven such as Switzerland.

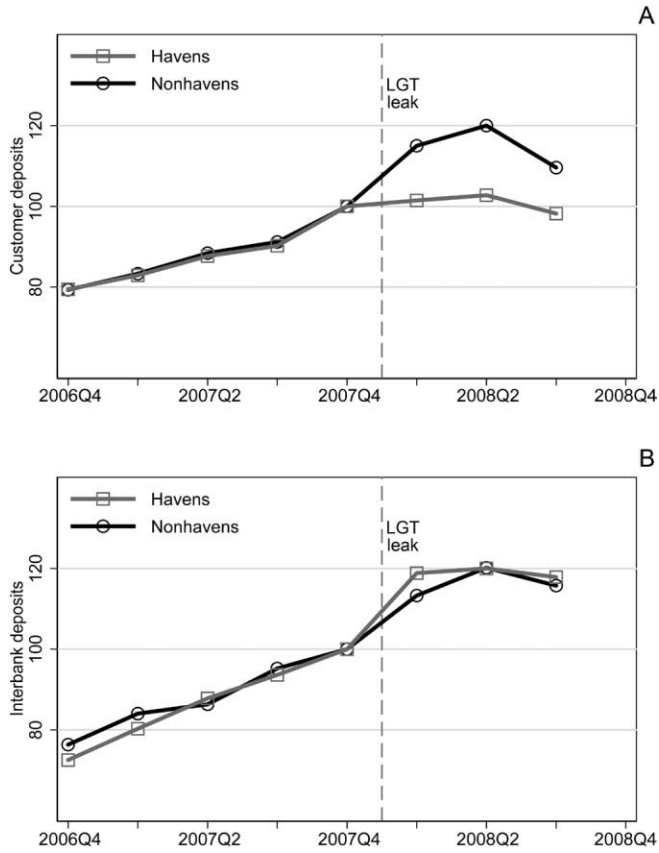

Figure 1. Trends in cross-border deposits around the LGT leak

3.3.2. Regression Results

We report the main regression results from equation (1) in Table 3. The results for all leaks imply that data leaks in tax havens are, on average, associated with a differential drop in customer deposits in havens of around 4.6 percent. When we estimate the effect of the LGT leak and subsequent leaks separately, we find a striking heterogeneity. The LGT leak is associated with a differential drop in customer deposits in havens of around 11.7 percent, whereas the corresponding effect of the subsequent leaks was only, on average, around 3.6 percent. The difference is statistically significant, with a p-value of .08.

We probe the robustness of these core results in a number of ways. First, we winsorize the dependent variable (at the first and 99th percentiles) and reestimate the model to investigate whether the results are driven by extreme observations. As shown in Table 3, the point estimates decrease somewhat when the tails are re-

Table 3

The Effect of Data Leaks on Customer Deposits

Variable	All Leaks	Separate Leaks	Winsorized	Oil Prices	Stock Prices	Gold Prices	All Price Controls	Swap Agreement	Salience
Haven × Any Leak	−.046**								−.039*
	(.015)								(.016)
Haven × LGT Leak		−.117*	−.096*	−.113*	−.119*	−.119**	−.120**	−.116*	
		(.046)	(.038)	(.046)	(.046)	(.043)	(.043)	(.049)	
Haven × Other Leak		−.036*	−.028*	−.034*	−.036*	−.036*	−.033*	−.047**	
		(.015)	(.011)	(.016)	(.015)	(.015)	(.016)	(.017)	
Haven × Δlog(Oil Price)				−.037			−.040		
				(.028)			(.029)		
Haven × Δlog(Stock Price)					−.015		−.003		
					(.053)		(.056)		
Haven × Δlog(Gold Price)						.010	.040		
						(.077)	(.079)		
Haven × Any Leak × Salience									−.001
									(.001)
LGT Leak = Other Leak (*p*-value)		.083	.087	.095	.073	.084	.096	.15	
R^2	.085	.086	.112	.086	.086	.086	.086	.093	.085

Note. Results are from the deposit model in which the dependent variable is the log difference in foreign-owned customer deposits in a given banking center. All specifications include banking center and time fixed effects. The explanatory variables are indicators for the banking center being a tax haven (Haven); for a leak occurring in the quarter (Any Leak); for the LGT Bank leak occurring in the quarter (LGT Leak); for another leak occurring in the quarter (Other Leak); the log difference in oil prices, stock prices, and gold prices; and a measure of the salience of a given leak. For salience, the time fixed effects are interacted with an indicator of a dollar swap agreement with the US Federal Reserve. Standard errors, in parentheses, are robust and clustered at the country level. $N = 3{,}560$.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

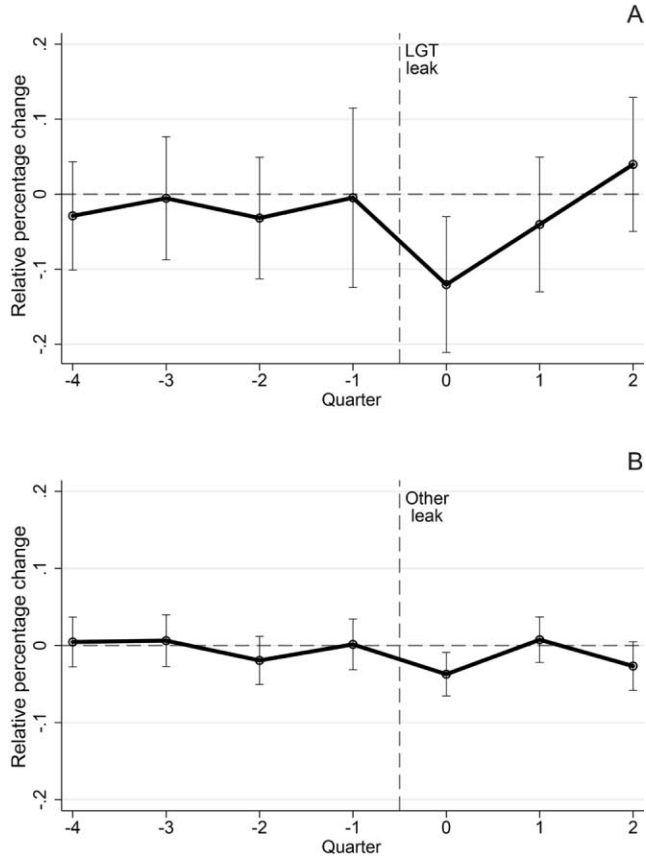

Figure 2. Differential change in customer deposits in havens

moved; for example, the estimate of the differential decrease in deposits in havens around the LGT leak falls to around 9.6 percent but remains statistically significant. Next we augment the model to allow for a differential effect of prices on oil prices, stock prices, and gold prices on deposits in havens. The estimates barely change when we introduce the quarterly percentage change in the Brent crude oil spot price interacted with Haven. Similarly, the estimates are robust to introducing the percentage change in the Standard & Poor's 500 and the gold spot price. When the baseline equation is augmented with all price controls simultaneously, the estimated effect of the LGT leak is −12 percent, slightly more negative than the baseline estimate, whereas the estimated effect of the subsequent leaks is 3.3 percent, slightly less negative than the baseline estimate. Finally, the estimates are robust to allowing the effect of shocks to depend on the existence of a swap agreement with the US Federal Reserve in place.

Finally, we turn to the results from the dynamic specification with leads and

lags of the leak indicators, each interacted with Haven. As shown in Figure 2*A*, there is no evidence of a differential change in haven deposits before the LGT leak. This is consistent with the counterfactual parallel-trends assumption that there would have been no differential change in haven deposits at the time of the LGT leak if the leak had not happened. The estimated differential drop in haven deposits at the time of the LGT leak is around 12 percent and statistically significant, as in the baseline model. In the periods after the LGT leak, deposits in havens and nonhavens exhibit similar growth rates, which suggests that the sharp drop observed around the leak was not reversed. As shown in Figure 2*B*, the qualitative pattern is very similar for the subsequent leaks, but the magnitude of the effects is smaller.[22]

The findings suggest that the first instance of whistleblowing in a tax haven, the leak from LGT, acted as a strong deterrent to offshore tax evasion, presumably by increasing the risk of involuntary exposure as perceived by account holders and banks. The subsequent leaks were also associated with significant behavioral responses but of a much smaller magnitude. It is intuitive that the first data leak had a larger effect on the perceived risks than subsequent leaks since offshore account owners and bankers most likely assigned a very small—or even 0—probability to the possibility of a leak before that event.

We note that our estimate of the differential decrease in deposits in havens may overstate the true magnitude of the deterrence effect if some depositors responded to the LGT leak by shifting funds from havens to nonhavens. Under the parallel-trends assumption, such responses imply that deposits in nonhavens grew more than haven deposits would have grown absent the LGT leak. However, deposit shifting from havens to nonhavens does not affect our qualitative conclusion. We can reject that deposits in havens and nonhavens grew at the same rate, which is the implication of the null hypothesis of no deterrence.

3.3.3. Salience

An alternative explanation for the finding that the LGT leak triggered larger responses than subsequent leaks relates to differences in salience; perhaps the first leak received the most news coverage and was therefore known by more owners of offshore accounts. By construction, all the leaks in our sample were covered on the front page of *Neue Zürcher Zeitung,* but even in this sample of relatively salient leaks, important differences may remain.

To explore this alternative hypothesis, we analyze the volume of Internet searches for four terms relating to data leaks from tax havens: "tax evasion," "data leak," "tax havens," and "whistleblowing." In the Online Appendix, we use the search volumes to construct a salience index. While we do not believe that wealthy individuals obtain information about the international tax environment

[22] We show similar results for interbank deposits in Figure OA2 in the Online Appendix. We find no differential change in interbank deposits in havens, neither around the LGT leak nor around subsequent leaks.

through simple searches, the index may capture the overall level of attention directed to the leak by the general public. As shown in the Online Appendix, the index does not detect any systematic difference in search volumes across the first leak and those that followed, which suggests that salience cannot explain the larger response to the first leak. More generally, we find no evidence that salience can explain heterogenous responses in our sample of leaks: when we augment the baseline model with an interaction of Leak and the salience index, we find no significant difference in the size of the responses across leaks with different salience, as shown in Table 3.

3.4. Discussion

A potential problem with the empirical framework employed in this section is that data leaks from tax havens may correlate with unobserved determinants of cross-border deposits. We study a period with prolific policy activity to combat offshore tax evasion at the national and international levels, from the start of the US case against UBS in August 2008 to the signing of bilateral tax treaties with tax havens in 2009–10 to the gradual extension of automatic information exchange in more recent years. Data leaks may coincide with enforcement initiatives either by chance or if whistleblowing is triggered by the increased public interest in offshore tax evasion created by enhanced enforcement. While we cannot generally rule out that our estimates are influenced by new enforcement policies targeting offshore evasion, it should be noted that the first leak from LGT Bank in February 2008 occurred 6 months before the first major policy event. This essentially rules out this source of endogeneity in the case of the LGT leak, which is our most important event, whereas some concern remains about the subsequent leaks.

Relatedly, the financial crisis in 2008–9 may confound our results if for some reason it induced individuals with foreign assets to withdraw deposits from havens to a larger extent than from nonhavens precisely during the quarters when the leaks occurred. The robustness tests controlling for asset prices, commodity prices, and swap agreements and the analysis of interbank deposits go some way toward addressing this concern. We are less concerned about confounding events related to the financial crisis in the context of the first leak because it occurred several months before the collapse of Lehman Brothers in September 2008 and the ensuing meltdown of global financial markets.[23] However, we cannot generally exclude the possibility that unobserved shocks to customer deposits in tax havens affect our results.

In light of these concerns, there are at least two ways to improve the empirical identification of the deterrence effects of data leaks. First, analyzing data at a higher frequency makes it more plausible that no other important events coincided with the leaks. Second, analyzing data for individual banks makes it possible to formulate and test predictions about the incidence of the leaks across het-

[23] For instance, as shown in Figure OA3 in the Online Appendix, stock prices were relatively stable through the first 2 quarters of 2008 and collapsed in the third quarter.

erogeneous banks, which is interesting in its own right and makes identification of the average effect more credible. Since no data source offers high-frequency information about foreign-owned wealth at the bank level, Section 4 turns to another type of outcome that can be observed for each bank on a daily basis: stock market returns.

4. Analysis of Stock Market Returns

In this section, we study the deterrence effect of whistleblowing by testing whether banks known to be assisting with offshore tax evasion suffered negative excess returns in the days following the LGT leak and the subsequent data leaks from tax havens. If the leaks caused a significant decrease in the use of secret bank accounts, as suggested by the analysis in Section 3, and if financial markets responded to these behavioral responses, we should expect an immediate decrease in the market value of banks deriving income from offshore tax evasion. In a first step, we discuss how the legal action in the United States against banks operating in Switzerland is helpful in delimiting a set of banks that were assisting with offshore tax evasion at the time of the LGT leak. In the next steps, we present the stock market data, develop the empirical methodology, and present the results.

4.1. Bank Sample

To assess how leaks of customer data affect the profitability of the wealth management industry, it is necessary to delimit a sample of banks with links to tax evasion. This task is not at all straightforward. First, not all banks in tax havens actively manage the wealth of foreign tax evaders. Notably, tax havens like Switzerland and Hong Kong with a sizable domestic economy also have important banks that mainly provide standard financial services to domestic customers. Second, not all banks catering to tax evaders are headquartered in tax havens. Many multinational banks based in nonhavens offer wealth management services out of subsidiaries in tax havens, most famously the UK-based bank HBSC, whose Swiss subsidiary was the source of Swiss Leaks.

To delimit the bank sample, we exploit the measures taken by the US Department of Justice against banks suspected of assisting US citizens with tax fraud involving anonymous shell companies and undeclared Swiss bank accounts. The first case, against UBS, ended with a $780 million settlement in February 2009, and another 15 banks were investigated on similar charges in the following years.[24] Eleven of the cases were settled at the time of writing, with combined penalties of $5.54 billion.[25] Subsequently, in August 2013, the US Department of Justice and the Swiss government announced the Swiss Bank Program, under which banks not already under investigation could resolve potential criminal li-

[24] We are not aware of an official list of all 16 banks under investigation, but they are mentioned in numerous news articles. See, for example, Allen (2014).

[25] The cases against two banks—Pictet and Rahn and Bodmer—are pending, while three of the investigated banks—Wegelin, Neue Zürcher Bank, and Bank Frey—have ceased operations.

abilities 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 payment of appropriate penalties. The program resulted in nonprosecution agreements with an additional 80 banks, with combined penalties of around $1.36 billion (US Department of Justice 2020).

The US enforcement initiatives are useful for our purposes because they identify a group of banks that derived income from assisting customers with offshore tax evasion at the time of the data leak from LGT Bank.[26] Following an increase in the risks associated with offshore tax evasion, we should expect precisely these banks to suffer a decrease in profits. Moreover, the outcomes of the enforcement initiatives allow us to make predictions about the heterogeneity in stock market responses in this sample of banks. First, if US prosecutors chose to investigate the 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 offenses under the Swiss Bank Program. Second, if ex post penalties contain a signal about the degree of involvement in offshore tax evasion and if that signal was at least partly observable to market participants at the time of the leak, we should expect market value losses to be larger for banks with higher penalties.

Starting with the sample of 96 banks that were subject to criminal investigations in the United States or 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. When a bank in our sample belongs to a multinational banking group, we include the parent company if listed; for instance, the Swiss bank HSBC Private Bank is owned by the UK-based holding company HSBC Holdings PLC.[27] This procedure reduces the sample to 49 banks. Second, we exclude three entities that are classified neither as a bank nor as a financial services company under the Industry Classification Benchmark, as we do not expect the data leaks to be relevant for those firms.[28] Finally, we exclude a few banks for which no stock return can be identified in the week after the event under consideration. These are typically small banks whose stock is not traded every day. This procedure yields an estimating sample of 38 banks for the LGT leak in February 2008 and a similar sample size for other events.

[26] 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).

[27] The current parent companies of Swiss banks are identified in Bloomberg, and any changes to the parent-subsidiary links are identified in extensive online research using the banks' own home pages, Wikipedia, and Schweizer-Banken.info. In case of multiple listed parent companies at different hierarchy levels in the company tree, we selected the lowest-ranked listed parent company to include as few unaffected entities as possible.

[28] We exclude American International Group Inc. (insurance), Assicurazioni Generali SpA (insurance), and Italmobiliare SpA (construction and materials).

Table 4
Summary Statistics on Stock Returns

	Mean	SD	Min	Max
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	0.0	2.1	−12.1	18.7
Stoxx Europe 600	0.0	1.6	−11.7	11.3

Note. All statistics are for January 1, 2007, to October 31, 2016. Portfolio returns are computed as simple averages of individual bank returns and the average of individual bank returns weighted by their market capitalization.

Table OA1 in the Online Appendix contains detailed information about the 46 banks that appear in the estimating sample at some point between January 1, 2007, and October 31, 2016, including an indication of whether they were subject to criminal investigations or participated in the Swiss Bank Program and the size of the resulting penalty. Around half of the banks are based in Switzerland, while the remainder are based in countries such as Germany, France, Italy, Spain, and the United Kingdom but offer wealth management services through a Swiss subsidiary.

4.2. Data

We use Bloomberg to collect financial information about the 46 banks from January 1, 2007, to October 31, 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 and capital gains:

$$\text{Return}_{n,t} = \frac{P_{n,t} - P_{n,t-1}}{P_{n,t-1}} \times 100, \tag{2}$$

where $P_{n,t}$ is the value of the total return index of bank n at time t. In the baseline estimations, all stock prices are denoted in Swiss francs to avoid any confounding effects of exchange-rate movements, but we conduct robustness tests using stock prices in local currencies.

We exclude observations for nontrading days in Switzerland to avoid that a small group of banks traded on stock exchanges outside Switzerland dominates the estimates on specific days; for instance, Israeli stocks traded on Sundays but not Fridays.[29] Moreover, we exclude observations if the end-of-day stock price remained constant or was missing for at least 5 consecutive Swiss trading days because such stale stocks could otherwise introduce a bias toward 0. Finally, we winsorize returns at the .1 and 99.9 percent levels to reduce the influence of extreme observations.

Table 4 provides summary statistics on the resulting sample of stock returns. We also provide summary statistics on the returns of the portfolios, including all

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

banks, unweighted and weighted by market capitalization, and a major European broad stock market index, Stoxx Europe 600. In the event studies, we chose this index to proxy for the overall 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.[30]

4.3. Empirical Approach

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

In a first step, for each event to be considered, we identify an event-specific bank sample and observation period. The sample contains banks for which stock market data are available for the entire week after the event.[31] The observation period includes the event window, consisting of the event date and 10 trading days before and after it, and an estimation window consisting of 250 trading days before the event window, which is roughly 1 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 banks in the event-specific sample:

$$\text{Portfolio Return}_t = \frac{1}{N}\sum_{n=1}^{N}\text{Return}_{n,t}, \tag{3}$$

where $\text{Return}_{n,t}$ is the return of bank n on day t and N is the number of banks in the event-specific sample. As the dependent variable, we use the portfolio return rather than the returns of individual banks to account for cross-sectional dependence. We also compute a weighted variant of the portfolio return, where the daily returns of individual banks are weighted by market capitalization.[32]

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

$$\text{Portfolio Return}_t = \alpha + \beta\text{Market Return}_t + \sum_{s=-10}^{10}\delta_s D_s + \varepsilon_t, \tag{4}$$

[30] These results are not reported.

[31] The most common reason stock market data are not available is that the bank went out of business. For multinational banking groups, we also require that the link to the Swiss bank with criminal liabilities in the United States be active in the week after the event; hence, if a UK banking group closed its Swiss branch or sold it to an unlisted investor by the time of the event, it does not enter the event-specific sample.

[32] 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 market capitalization before the leak from LGT Bank (see Table OA1 in the Online Appendix), and these banks are therefore not included in the weighted portfolio return.

where Market Return$_t$ is the return of the Stoxx Europe 600 on day t and D_s is a dummy indicating day s relative to the event. 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$_t$ expresses the normal portfolio return on day t conditional on the market return. 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 coefficients estimated in equation (4):

$$\text{CAR}(T) = \sum_{s=0}^{T-1} \delta_s. \tag{5}$$

However, simply cumulating abnormal returns does not deliver standard errors on the cumulated abnormal returns. In practice, we therefore estimate a reparameterized version of equation (4), which yields point estimates and standard errors of CAR(T) directly (Salinger 1992).

4.4. Results

4.4.1. Main Results

We start the empirical analysis by estimating the event-study model on the baseline sample of banks that have been under criminal investigation for their role in offshore tax evasion or have admitted to such a role by participating in the Swiss Bank Program. As shown in Figure 3, those banks earned abnormal returns of around −.5 percent on the first day of the LGT leak and on each of the subsequent 3 trading days. The cumulative abnormal return of around −2 percent over 4 trading days is statistically significant and remains roughly constant in the remainder of the event window. By contrast, abnormal returns are small and not systematically positive or negative in the 10 days before the leak. This reassures us that the negative abnormal returns observed after the leak are not driven by a differential underlying trend. The confidence intervals displayed in Figure 3 are computed under the usual parametric assumptions; however, the cumulative abnormal return remains significant when we take a nonparametric approach to statistical inference.[33]

Table 5 reports a number of additional results (reiterating the point estimates

[33] To test the statistical significance of CAR(5), we compute the cumulative abnormal return for each 5-day window in the estimation period (outside the event window) and plot the empirical distribution in Figure OA4 in the Online Appendix. The vertical line shows that our estimate of CAR(5) is around −2.1 percent, which corresponds roughly to the first 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 percent. In other words, the p-value associated with a two-sided test of the null hypothesis that CAR(5) equals 0 is around .02. Applying the same nonparametric test, we find that CAR(1) is significantly different from 0 with a p-value of .14, CAR(2) has a p-value of .06, CAR(3) has a p-value of .02, and CAR(4) has a p-value of .00.

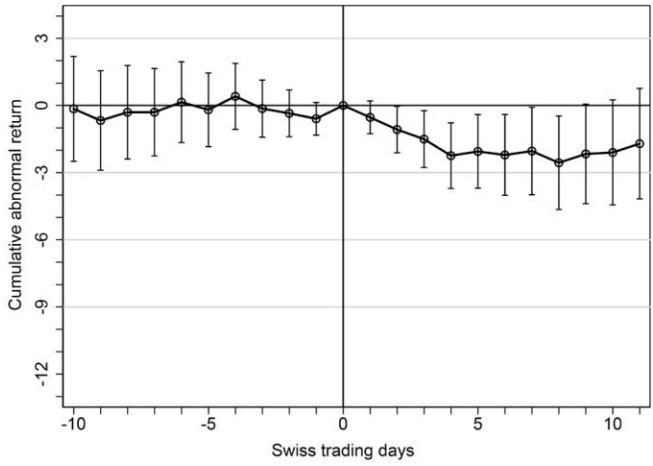

Figure 3. Cumulative abnormal returns around the LGT Bank leak

from Figure 3 for all leaks for ease of comparison).[34] First, we reestimate the model with a portfolio return that weighs the individual bank returns by market capitalization. As shown in column 2, the estimated stock market responses are both larger and sharper than in the baseline model when the returns are weighted, with the cumulative abnormal return reaching −2 percent already after 2 days and stabilizing at roughly −3 percent after 4 days.

The asset-weighted 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 portfolio was almost CHF 1,000 billion (around US$900 billion) immediately prior to the leak, so the 3 percent 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 listed banks due to the deterrence effect of the data leak. Recall that the estimate from the regression analysis of cross-border deposits concluded that the leak was associated with a decrease in foreign-owned wealth managed in tax havens of around 10 percent, which is equivalent to around CHF 300 billion (around US$270 billion) in the case of Switzerland.[35] It follows that the two estimates are consistent under plausible assumptions. Assuming, for instance, that the banks in our sample earn an annual profit margin of .5 percent on assets under management and stock market investors use a discount factor of 5 percent, we find that a per-

[34] The interpretation of the estimated coefficient on the index is that the return of the banks in the sample is expected to change by around .66 of a percentage point when the index changes by 1 percentage point.

[35] Zucman (2013) puts the foreign-owned wealth held in Switzerland by the end of 2007 at US$3.4 trillion. Recall that our estimate that deposits in havens dropped by 10 percent relative to deposits in nonhavens may overstate the magnitude of the deterrence effect if depositors responded to the leak by shifting funds from havens to nonhavens.

Table 5
Main Event-Study Results

	Baseline Model		Two-Factor Model		Other Swiss Banks		Original Currencies:
	Unweighted (1)	Weighted (2)	Unweighted (3)	Weighted (4)	Unweighted (5)	Unweighted (6)	Unweighted (7)
CAR(1)	−.5	−1.1^{+}	−.2	−.2	−.3	−.5	−.7^{+}
	(.4)	(.6)	(.3)	(.3)	(.7)	(.4)	(.4)
CAR(2)	−1.1*	−2.1*	−.6	−.9*	.7	−1.2*	−1.0^{+}
	(.5)	(.8)	(.4)	(.4)	(1.1)	(.5)	(.5)
CAR(3)	−1.5*	−2.2*	−1.2*	−1.4**	−.6	−1.4*	−1.5*
	(.6)	(1.0)	(.5)	(.5)	(1.3)	(.6)	(.7)
CAR(4)	−2.2**	−3.0*	−1.9**	−2.2**	.1	−2.3**	−2.2**
	(.7)	(1.2)	(.6)	(.5)	(1.5)	(.7)	(.8)
CAR(5)	−2.1*	−2.9*	−2.0**	−2.7**	−.3	−2.0*	−2.0*
	(.8)	(1.3)	(.7)	(.6)	(1.7)	(.8)	(.9)
Stoxx Europe 600	66.5**	108.2**	11.8*	−28.1**	65.0**	56.5**	61.2**
	(1.7)	(2.7)	(5.2)	(4.5)	(3.5)	(2.5)	(1.8)
Stoxx Europe 600 financials			48.1**	120.2**			
			(4.4)	(3.8)			
Other Swiss banks						15.3**	
						(3.0)	
Constant	0	0	0	0	.1	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)
R^2	.9	.9	.9	1.0	.6	.9	.8
Portfolio size	38	38	38	38	7	38	38

Note. Results are from the event-study model applied to the LGT Bank leak on February 14, 2008, and use the main sample, except for column 5, which uses the sample of other Swiss banks. In the two-factor model, the baseline model is augmented with a stock market index for financial firms. In column 5, the outcome is the portfolio return of Swiss banks with no known link to offshore tax evasion. In column 6, the outcome is the portfolio return of Swiss banks with known links to offshore tax evasion, but the baseline model is augmented with a control for the portfolio return for Swiss banks with no link to offshore tax evasion. In column 7, returns of individual banks are computed in original currencies before entering the portfolio return. All regressions include a set of event-time dummies. $N = 271$.

$^{+}$ Statistically significant at the 10% level.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

manent loss of assets under management of CHF 300 billion implies an annual loss of profits of CHF 1.5 billion, with a net present value of CHF 30 billion.

4.4.2. Robustness

We test whether the event-study results are robust to adding a second factor to the model of the normal return. While the gain from employing multiple factors is typically marginal in event studies with daily stock market returns and a short horizon, some scholars recommend that the market model be augmented with an industry index in cases in which all the firms in the sample belong to the same industry (Campbell, Lo, and MacKinlay 1997). As shown in the two-factor model in Table 5, both point estimates and standard errors tend to decrease somewhat when we add the major index for the European financial industry, Stoxx Europe 600 Financials, to the model. Note that the banks in our sample make up a non-negligible share of the European financial industry, which implies that part of the stock market response to the data leak may be absorbed by the financial index. For that reason, we continue the analysis with the one-factor model.

To address the concern that our core estimates may be affected by shocks to the Swiss financial sector unrelated to the LGT leak, we also collect stock price data for Swiss banks with no links to offshore tax evasion, which we exploit in two ways.[36] First, we apply the baseline model directly to this sample of banks. As shown in column 5, there is no clear trend in the abnormal returns for these banks around the LGT leak: the cumulative abnormal return stands at .1 percent after 4 days. These estimates suggest that the sharp drop in stock prices observed in the main sample reflects the deterrence effect of the LGT leak rather than other shocks common to all banks. However, the estimates have large standard errors and should be interpreted with caution. We therefore reestimate the baseline model for the main sample while controlling for the return of banks not involved in offshore tax evasion and thus purge our estimates for shocks affecting all banks. As shown in column 6, the estimates remain very similar to the baseline estimates, with a statistically significant cumulative abnormal return of around −2 percent over 4 trading days. Furthermore, we also show that the baseline estimates are robust to using stock prices denoted in original currencies rather than Swiss francs.[37]

Finally, we address the possibility of a confounding shock with a reading of the Swiss newspaper *Neue Zürcher Zeitung* for a 2-week period starting at the LGT leak. We identify nine front-page articles about Swiss banks; however, none of them concern events that could have caused a general decrease in the market

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

[37] This result is not surprising given that the exchange rate of the Swiss franc was highly stable during the event window, as shown in Figure OA5 in the Online Appendix.

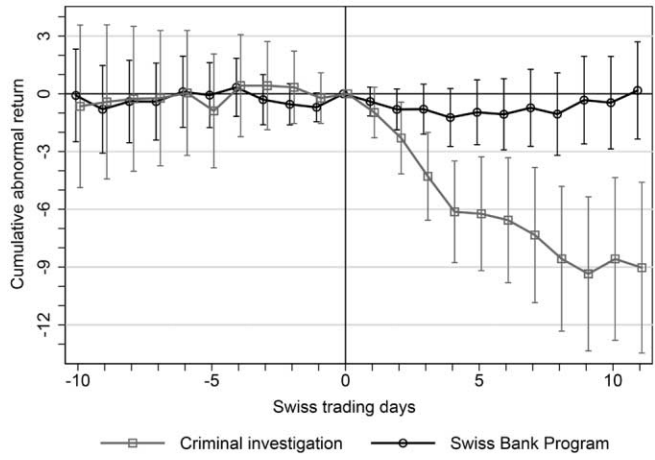

Figure 4. Heterogeneity in cumulative abnormal returns around the LGT Bank leak

value of the banks. Table OA2 in the Online Appendix provides a short description of each article.

4.4.3. Heterogeneity

This section explores how stock market responses to the leak from LGT Bank varied across banks in our main sample with different involvement in offshore tax evasion. As a first proxy for involvement, we distinguish between the banks that were investigated by US authorities for complicity in tax crimes and the banks that subsequently disclosed their cross-border activities under the Swiss Bank Program. Assuming that US authorities selected banks for prosecution on the basis of ex ante information about the extent of their involvement in offshore tax evasion, we should expect the stock prices of prosecuted banks to be most adversely affected. We estimate the baseline model for the two subsamples separately and plot the results in Figure 4. The results are strikingly different: the cumulative abnormal return after 4 days was −6.1 percent for the prosecuted banks but only −1.2 percent for the voluntary disclosers. The point estimates from Figure 4 are reported in columns 1 and 2 of Table 6. A similar pattern emerges when returns are weighted by market capitalization, although the difference between the two groups of banks is less stark.

Ultimately, the extent of the banks' involvement in offshore tax evasion should be reflected in the size of the penalties paid in the United States. We thus split the sample of banks by the size of the penalties and estimate the baseline model for the two subsamples. As shown in columns 5 and 6 of Table 6, the stock market responses to the first leak are stronger for banks with larger ex post penalties: the cumulative abnormal return after 4 days was −3.2 percent for banks with

Table 6

Event-Study Results by Involvement in Offshore Evasion

	Unweighted		Weighted		Unweighted		Weighted	
	Criminal Investigations	Swiss Bank Program	Criminal Investigations	Swiss Bank Program	High Penalty	Low Penalty	High Penalty	Low Penalty
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CAR(1)	−1.0	−.4	−1.9**	−.6	−.5	−.6	−1.3+	−.3
	(.7)	(.4)	(.7)	(.6)	(.5)	(.3)	(.7)	(.6)
CAR(2)	−2.3*	−.8	−3.1**	−1.5	−1.4+	−.8+	−2.3*	−1.2
	(.9)	(.5)	(.9)	(.9)	(.8)	(.5)	(.9)	(.8)
CAR(3)	−4.3**	−.8	−3.1**	−1.7	−2.4*	−.7	−2.6*	−.5
	(1.2)	(.7)	(1.1)	(1.1)	(.9)	(.6)	(1.2)	(1.0)
CAR(4)	−6.1**	−1.2	−4.6**	−2.1	−3.2**	−1.4*	−3.4*	−1.4
	(1.3)	(.8)	(1.3)	(1.3)	(1.1)	(.7)	(1.3)	(1.2)
CAR(5)	−6.2**	−1.0	−4.1**	−2.2	−3.3**	−.9	−3.3*	−1.4
	(1.5)	(.9)	(1.5)	(1.4)	(1.2)	(.8)	(1.5)	(1.3)
Stoxx Europe 600	69.7**	65.7**	92.0**	117.9**	85.6**	47.0**	108.3**	108.1**
	(3.1)	(1.8)	(3.0)	(3.0)	(2.5)	(1.6)	(3.1)	(2.7)
Constant	0	0	−.1+	0	0	0	−0.1	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
R^2	.7	.9	.8	.9	.8	.8	.9	.9
Portfolio size	8	30	8	30	19	19	19	19

Note. Results are from the main event-study specification applied to the LGT Bank leak on February 14, 2008. Weighted bank returns are weighted by market capitalization. The criminal investigations portfolio consists of Swiss banks that have been subject to criminal investigation in the United States. The Swiss Bank Program portfolio consists of Swiss banks that admitted to criminal tax-related offenses under the Swiss Bank Program. The high-penalty portfolio consists of Swiss banks that have paid penalties above the sample median. The low-penalty portfolio consists of Swiss banks that have paid penalties below the sample median. All regressions include a set of event-time dummies. $N = 271$.

+ Statistically significant at the 10% level.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

Table 7
Heterogeneity by Involvement in Evasion: Cross-Sectional Results

	(1)	(2)	(3)	(4)
Criminal Investigation	−5.1**	−5.5**		
	(1.6)	(1.8)		
Penalty (logs)			−.7+	−1.0+
			(.4)	(.6)
Market Capitalization (logs)		.2		.7
		(1.3)		(1.4)
Total Assets (logs)		.4		.1
		(1.1)		(1.2)
Swiss Bank		2.3		3.3*
		(1.5)		(1.7)
Major Bank		−3.0		−1.7
		(4.0)		(4.5)
Constant	−1.0	−7.3	.1	−7.5
	(.7)	(8.0)	(1.3)	(9.8)
N	38	37	38	37
R^2	.2	.3	.1	.2

Note. Results are from a cross-sectional regression in which the dependent variable is the 5-day cumulative abnormal return after the LGT Bank leak at the individual bank level. The sample is the 38 banks investigated for their role in offshore tax evasion in the United States or that admitted to tax-related criminal activities in the United States under the Swiss Bank Program. The explanatory variables are a dummy for having been under criminal investigation in the United States, the penalty paid in relation to assistance with offshore tax evasion, the total market capitalization of the bank, the total assets of the bank, an indicator for being headquartered in Switzerland, and an indicator for being a major international bank.

+ Statistically significant at the 10% level.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

above-median penalties and −1.4 percent for those with below-median penalties. This pattern also emerges when returns are weighted by market capitalization.

We test whether the heterogeneity in stock market responses is statistically significant and robust to controlling for bank characteristics in a simple cross-sectional model. We regress the 5-day cumulative abnormal returns, computed separately for each bank in the sample, on our indicators for involvement in offshore tax evasion and bank-level control variables. The results are reported in Table 7. As shown in columns 1 and 2, the difference in abnormal returns between banks subject to criminal investigations and banks disclosing tax-related offenses under the Swiss Bank Program is statistically significant and robust to market value, total assets, and indicators for being headquartered in Switzerland and for being a major international bank. As shown in columns 3 and 4, the relation between the strength of the stock market response and the ultimate size of the US penalties is also statistically significant and robust to controlling for bank characteristics.

The finding that banks' loss of market value around the time of the LGT leak

Table 8
Event-Study Results by Bank Type

	Swiss			Non-Swiss	
	Major Banks	Cantonal Banks	Private Banks	Major Banks	Minor Banks
CAR(1)	−4.2**	−.4	.7	−.5	−.7
	(1.0)	(.5)	(.7)	(.6)	(.7)
CAR(2)	−5.0**	.0	−.1	−1.7+	−1.3
	(1.4)	(.7)	(1.1)	(.9)	(1.0)
CAR(3)	−6.1**	−.2	.8	−1.7	−3.1*
	(1.7)	(.8)	(1.3)	(1.1)	(1.2)
CAR(4)	−9.6**	.1	.2	−2.2+	−4.5**
	(2.0)	(1.0)	(1.5)	(1.3)	(1.4)
CAR(5)	−8.0**	.1	.9	−2.3	−4.6**
	(2.3)	(1.1)	(1.7)	(1.4)	(1.6)
Stoxx Europe 600	106.3**	20.6**	35.9**	113.3**	64.7**
	(4.7)	(2.2)	(3.4)	(2.9)	(3.3)
Constant	−.1	0	0	0	0
	(.1)	(0)	(0)	(0)	(0)
R^2	.7	.3	.4	.9	.6

Note. Results are from the main event-study specification applied to the LGT Bank leak on February 14, 2008, for 38 banks. $N = 271$.

+ Statistically significant at the 10% level.

* Statistically significant at the 5% level.

** Statistically significant at the 1% level.

varied systematically with the intensity of their involvement in offshore tax evasion further strengthens the causal link between the leak and the observed decrease in stock prices. It seems unlikely that heterogeneity in this particular dimension would have emerged if the correlation were spurious and stock markets really responded to a simultaneous shock unrelated to offshore evasion.

Finally, we investigate how much different types of banks contribute to the negative stock market performance around the LGT leak by reestimating the baseline model for five bank types. The results are reported in Table 8. We find striking heterogeneity in the group of Swiss banks, with very large responses for major Swiss banks and virtually no response for cantonal and private banks. By contrast, we find notable negative responses for both major and nonmajor banks based outside of Switzerland, although in the former case the estimates are only borderline statistically significant. We are hesitant to interpret these differences as reflecting the causal effect of bank type. Rather, they are likely to reflect that different types of banks differ systematically in the extent of their involvement with offshore tax evasion, the causal mechanism studied above. For instance, stock market responses are plausibly small for cantonal banks whose business is centered around households and firms in the local economy and large for major Swiss banks that cater to wealthy international elites and where most undeclared financial assets are concentrated (Alstadsæter, Johannesen, and Zucman 2019; Londoño-Vélez and Ávila-Mahecha 2021).

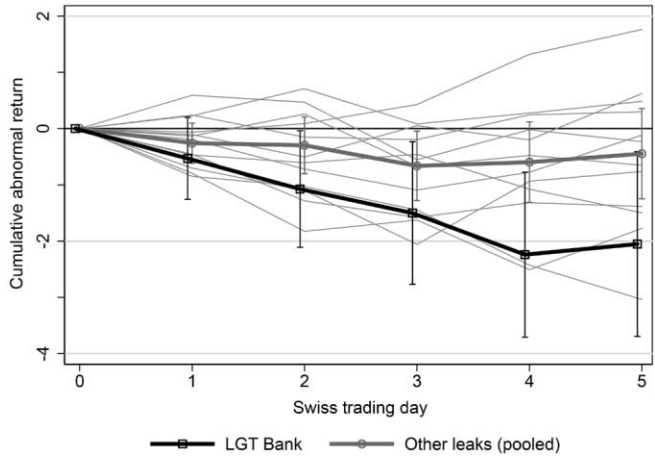

Figure 5. Cumulative abnormal returns around all data leaks

4.4.4. Other Whistleblowing Events

In the final step of the analysis, we study stock market responses to whistleblowing events other than the leak from LGT Bank. Figure 5 plots the estimated cumulative abnormal returns for the LGT leak, each of the 12 other data leaks identified in our news search (the thin gray lines), and a pooled group. The latter estimates are derived from a modified version of the baseline model that includes multiple event windows.[38] The output from each of the underlying regressions is reported in Table OA3 in the Online Appendix. On average, across the data leaks following the LGT leak, banks with known ties to tax evasion earned negative abnormal returns in the days following the event; however, the magnitude of the effects is modest. The accumulated stock market response is largest on the third day (CAR(3) $= -.7$ percent), when the effect is also statistically significant, but then declines again (CAR(5) $= -.4$ percent). Three events are associated with relatively large negative stock market responses, in particular the news on November 3, 2009, that the Netherlands joined Germany in buying customer data from tax havens (leak 3); the news on July 16, 2012, that the German state North Rhine–Westphalia acquired customer data from Switzerland despite an agreement between the German and Swiss federal governments that should have put an end to purchases of leaked data (leak 8); and the news on April 4, 2016, about a massive data leak from the Panamanian law firm Mossack Fonseca (leak 12). The other leaks are associated with small negative or even positive stock market developments. In accordance with the deposit analysis, we find no systematic

[38] The observation period of this modified event-study model includes all trading days from 1 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.

relation between the size of the stock market response and the salience of the leaks (results not reported).

The results are suggestive that the data leaks occurring after the first leak from LGT Bank were generally associated with much smaller, if any, reductions in the use of offshore banks. Plausibly, the first leak made offshore account holders and banks aware of the risk that customer information may be leaked, whereas subsequent leaks induced only a small or no upward adjustment in the probabilities assigned to such events. Prior to the first leak, account holders may have believed that data theft from providers of offshore banking and corporate service was impossible, that 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 prior beliefs, any effect of subsequent leaks on the perceived risk appears to be quite small and in most cases not statistically detectable.

5. Concluding Remarks

This paper studies the deterrence effect of whistleblowing in the context of offshore tax evasion. It documents that the first leak of customer files from a tax haven bank caused a significant decrease in foreign-owned deposits in accounts in tax havens and a decrease in the market value of 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 thus lowered the expected future profits of banks providing access to such tax-evasion technologies.

It is useful to consider how these empirical results can inform thinking about optimal legal regulation of whistleblowing.[39] Assume that banks and their wealthy customers collude about offshore tax evasion—balancing costs in the form of expected penalties and benefits in the form of lower tax payments—and governments engage in costly efforts to curb this evasion—conducting audits and negotiating with tax havens. In this simple framework, an increased likelihood of whistleblowing deters tax evasion by raising expected penalties and thus enhances welfare. To see the last point, note that the government is, in principle, able to neutralize the adverse effect on banks and their wealthy customers by scaling back costly enforcement measures and distributing the cost savings among all taxpayers. This reasoning suggests that whistleblowers provide a public good and that monetary rewards for blowing the whistle can potentially enhance welfare. There are obviously a number of caveats to this argument: it does not account for the inherent unlawfulness of whistleblowing (Delmas 2015), the potential for fraudulent allegations (see Nyreröd and Spagnolo 2021), or the adverse effect on effort in orga-

[39] In a recent theory model, the optimal reward is defined as the minimum reward necessary to induce an employee to blow the whistle in case the employer engages in some criminal activity given the economic environment (Givati 2018). In this model, whistleblowing never happens in equilibrium because the government provides the optimal reward, and the employer is thus deterred from engaging in the criminal activity by the threat of whistleblowing.

nizations (Ting 2008). Studying these trade-offs in the design of legal regulation of whistleblowing is a promising avenue for future research

References

Abazi, Vigjilenca. 2020. The European Union Whistleblower Directive: A "Game Changer" for Whistleblowing Protection? *Industrial Law Journal* 49:640–56.

Allen, Matthew. 2014. Remaining "Hit List" Banks Sweat over US Verdicts. SwissInfo.ch, May 22. http://www.swissinfo.ch/eng/credit-suisse-fallout_remaining–hit-list–banks-sweat-over-us-verdicts/38637818.

Alstadsæter, Annette, Niels Johannesen, and Gabriel Zucman. 2018. Who Owns the Wealth in Tax Havens? Macro Evidence and Implications for Global Inequality. *Journal of Public Economics* 162:89–100.

———. 2019. Tax Evasion and Inequality. *American Economic Review* 109:2073–2103.

Andersen, Jørgen Juel, Niels Johannesen, David Lassen, and Elena Paltseva. 2017. Petro Rents, Political Institutions, and Hidden Wealth: Evidence from Offshore Bank Accounts. *Journal of the European Economic Association* 15:818–60.

Andersen, Jørgen Juel, Niels Johannesen, and Bob Rijkers. 2020. Elite Capture of Foreign Aid: Evidence from Offshore Bank Accounts. Working Paper No. 9150. World Bank, Washington, DC.

Becker, Gary S. 1968. Crime and Punishment: An Economic Approach. *Journal of Political Economy* 76:169–217.

Bø, Erlend E., Joel Slemrod, and Thor O. Thoresen. 2015. Taxes on the Internet: Deterrence Effects of Public Disclosure. *American Economic Journal: Economic Policy* 7:36–62.

Campbell, John Y., Andrew W. Lo, and A. Craig MacKinlay. 1997. *The Econometrics of Financial Markets*. Princeton, NJ: Princeton University Press.

Casi, Elisa, Christoph Spengel, and Barbara M. B. Stage. 2020. Cross-Border Tax Evasion after the Common Reporting Standard: Game Over? *Journal of Public Economics* 190, art. 104240, pp. 1–22.

Dekel, Eddie, Barton L. Lipman, and Aldo Rustichini. 1998. Standard State-Space Models Preclude Unawareness. *Econometrica* 66:159–73.

Delmas, Candice. 2015. The Ethics of Government Whistleblowing. *Social Theory and Practice* 41:77–105.

De Simone, Lisa, Rebecca Lester, and Kevin Markle. 2020. Transparency and Tax Evasion: Evidence from the Foreign Account Tax Compliance Act (FATCA). *Journal of Accounting Research* 58:105–53.

Dharmapala, Dhammika. 2016. Cross-Border Tax Evasion under a Unilateral FATCA Regime. *Journal of Public Economics* 141:29–37.

Dyck, Alexander, Adair Morse, and Luigi Zingales. 1991. Who Blows the Whistle on Corporate Fraud? *Journal of Finance* 65:2213–53.

Economist. 2015. Corporate Crime: The Age of the Whistleblower. December 5.

Fama, Eugene F. 1991. Efficient Capital Markets: II. *Journal of Finance* 46:1575–1617.

Givati, Yehonatan. 2018. Of Snitches and Riches: Optimal IRS and SEC Whistleblower Rewards. *Harvard Journal on Legislation* 55:105–42.

Guardian. 2009. G20 Declares Door Shut on Tax Havens. April 2.

Hanlon, Michelle, Edward L. Maydew, and Jacob R. Thornock. 2015. Taking the Long Way Home: U.S. Tax Evasion and Offshore Investments in U.S. Equity and Debt Mar-

kets. *Journal of Finance* 70:257–87.
Hanlon, Michelle, and Joel Slemrod. 2009. What Does Tax Aggressiveness Signal? Evidence from Stock Price Reactions to News about Tax Shelter Involvement. *Journal of Public Economics* 93:126–41.
Johannesen, Niels. 2014. Tax Evasion and Swiss Bank Deposits. *Journal of Public Economics* 111:46–62.
Johannesen, Niels, Patrick Langetieg, Daniel Reck, Max Risch, and Joel Slemrod. 2020. Taxing Hidden Wealth: The Consequences of US Enforcement Initiatives on Evasive Foreign Accounts. *American Economic Journal: Economic Policy* 12:312–46.
Johannesen, Niels, and Gabriel Zucman. 2014. The End of Bank Secrecy? An Evaluation of the G20 Tax Haven Crackdown. *American Economic Journal: Economic Policy* 6:65–91.
Kahan, Dan M., and Eric A. Posner. 1999. Shaming White-Collar Criminals: A Proposal for Reform of the Federal Sentencing Guidelines. *Journal of Law and Economics* 42:365–92.
Kothari, Sagar P., and Jerold B. Warner. 2007. Econometrics of Event Studies. Pp. 1:3–36 in *Handbook of Corporate Finance,* edited by B. Espen Eckbo. Amsterdam: North Holland.
Langenmayr, Dominika. 2017. Voluntary Disclosure of Evaded Taxes: Increasing Revenue, or Increasing Incentives to Evade? *Journal of Public Economics* 151:110–25.
Londoño-Vélez, Juliana, and Javier Ávila-Mahecha. 2021. Enforcing Wealth Taxes in the Developing World: Quasi-Experimental Evidence from Colombia. *American Economic Review: Insights* 3:131–48.
Macur, Juliet. 2019. The Whistle-Blowers Next Door. *New York Times,* December 26. https://www.nytimes.com/2019/12/26/sports/olympics/yuliya-stepanova-russia-doping.html.
Menkhoff, Lukas, and Jakob Miethe. 2019. Tax Evasion in New Disguise? Examining Tax Havens' International Bank Deposits. *Journal of Public Economics* 176:53–78.
Moore, Jack. 2016. ISIS Whistleblower Leaks Identities of 22,000 Jihadi Recruits. *Newsweek,* March 10. https://www.newsweek.com/isis-whistleblower-leaks-identities-22000-groups-jihadi-recruits-435482.
Neue Zürcher Zeitung. 2014. Die wichtigsten Daten der Affäre Hildebrand. August 7. https://www.nzz.ch/philipp-hildebrand-daten-affaere-1.18048893?reduced=true.
Nyreröd, Theo, and Giancarlo Spagnolo. 2021. Myths and Numbers on Whistleblower Rewards. *Regulation and Governance* 15:82–97.
O'Donovan, James, Hannes F. Wagner, and Stefan Zeume. 2017. The Value of Offshore Secrets: Evidence from the Panama Papers. *Review of Financial Studies* 32:4117–55.
OECD (Organization for Economic Co-operation and Development). 2009. *A Progress Report on the Jurisdictions Surveyed by the OECD Global Forum in Implementing the Internationally Agreed Tax Standard.* April. Paris: OECD.
Omartian, James D. 2016. Tax Information Exchange and Offshore Entities: Evidence from the Panama Papers. Working paper. University of Michigan, Ross School of Business, Ann Arbor.
Ritzer, Uwe. 2011. How a Tax-Evasion Whistleblower Became One of Europe's Most Wanted. *Time,* August 3. http://content.time.com/time/world/article/0,8599,2086776,00.html.
Salinger, Michael. 1992. Standard Errors in Event Studies. *Journal of Financial and Quantitative Analysis* 27:39–53.
Schmid, Barbara. 2008. Authorities Investigating Deutsche Post CEO for Tax Evasion.

Spiegel International, February 14. https://www.spiegel.de/international/business/raid-on-zumwinkel-s-home-and-office-authorities-investigating-deutsche-post-ceo-for-tax-evasion-a-535230.html.

Spiegel. 2008. BND zahlte fünf Millionen für geheime Steuerdaten. February 16. https://www.spiegel.de/wirtschaft/finanzskandal-bnd-zahlte-fuenf-millionen-fuer-geheime-steuerdaten-a-535687.html.

Stolper, Tim B. M. 2017. A Step Change in Tax Transparency? An Event Study on How the Automatic Exchange of Information Did Not Affect Swiss Banks. Working Paper No. 2017-10. Max Planck Institute for Tax Law and Public Finance, Munich.

Swiss National Bank. 2020. *Banks in Switzerland 2019*. Zurich: Swiss National Bank.

Teevs, Christian. 2011. Meister der Manipulation. *Der Spiegel,* October 9. https://www.spiegel.de/wirtschaft/bankdatendieb-heinrich-kieber-meister-der-manipulation-a-790529.html.

Ting, Michael M. 2008. Whistleblowing. *American Political Science Review* 102:249–67.

United Nations. 2016. *Promotion of a Democratic and Equitable International Order*. Fifth report of Alfred-Maurice de Zayas to the General Assembly. Doc. No. A/71/286. August 4.

US Department of Justice. 2020. Swiss Bank Program. Justice.gov, October 28. https://www.justice.gov/tax/swiss-bank-program.

US Senate. 2008. Committee on Homeland Security and Governmental Affairs. *Tax Haven Banks and U.S. Tax Compliance*. Hearing before the Permanent Subcommittee on Investigations (staff report). 110th Cong., 2d Sess., July 18.

Zucman, Gabriel. 2013. The Missing Wealth of Nations: Are Europe and the U.S. Net Debtors or Net Creditors? *Quarterly Journal of Economics* 128:1321–64.