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Voluntary disclosure of evaded taxes — Increasing revenue, or increasing incentives to evade?☆

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ABSTRACT

Many countries apply lower fines to tax evading individuals when they voluntarily disclose the tax evasion they committed. I model such voluntary disclosure mechanisms theoretically and show that while such mechanisms increase the incentive to evade taxes, they nevertheless increase tax revenues net of administrative costs. I confirm the importance of administrative costs in a survey of German competent local tax authorities. I then test the effects of voluntary disclosure on the tax evasion decision, using the introduction of the 2009 offshore voluntary disclosure program in the U.S. for identification. The analysis confirms that the introduction of voluntary disclosure increases tax evasion.

1. Introduction

Households worldwide hold about 8% of their total financial wealth, almost U.S.-$ 6 trillion, in tax havens (Zucman, 2013). Correspondingly, tax authorities forego high tax revenues: The United States loose tax revenues of around $ 70 billion annually because of personal income tax evasion via offshore accounts (Gravelle, 2009). The need for tax revenues in the wake of the financial crisis has now rekindled governments' efforts to curb such income tax evasion.

Principally, governments can fight tax evasion by individuals who hold their wealth offshore in two ways. First, they can negotiate with tax havens to share information regarding foreigners' accounts. An example is the recent agreement between the United States and Switzerland forcing Swiss banks to provide information on accounts owned by U.S. citizens. However, such treaties are not very effective, as tax evaders rather shift their funds to another tax haven instead of repatriating them (Johannesen and Zucman, 2014). Second, governments can set incentives for individual taxpayers to declare foreign wealth and the tax evaded on it.

Many countries incentivize individuals to come clean with "voluntary disclosure" programs. Such programs require individuals to report all their foreign asset holdings. The income on these assets is then taxed retroactively at the standard tax rate, but no or a reduced fine is levied. Only individuals not yet under investigation for tax evasion can make use of these programs. Voluntary disclosure programs exist in many countries (see Table 1 for an overview), and are often part of the general law and valid for an unlimited period. However, some commentators fear that the option of voluntary disclosure increases the incidence of tax evasion, as these programs offer the possibility to escape high punishments if individuals feel that the probability of detection has increased.

The economic literature has so far barely studied voluntary disclosure programs. Using both a theoretical model and empirical tests, the paper aims to shed some light on this topic. First, I ask how the existence of a voluntary disclosure program affects individuals' tax evasion decision. In both the theoretical model and the empirical test I show that the existence of such a program increases tax evasion. Second, I consider the government's point of view, studying whether the tax authorities should offer voluntary disclosure, despite the increase in tax evasion it causes. In my model, governments should offer voluntary disclosure only when a disclosure lowers the administrative costs related to

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Table 1
Voluntary disclosure in OECD countries.

Country	Legal basis	Tax & interest		Penalty	
		Tax	Interest	Monetary	Imprisonment
Australia	General law	Full amount	Varies	Varies	Possible
Austria	General law	Full amount	2.38%	No	No
Belgium	General law	Full amount	7.00%	0–10% of tax	No
Canada	General law	Full amount	Yes	No	No
Chile	General law	Full amount	1.50%	10–300% of tax	≤15 years
Czech Rep.	General law	Full amount	Ca. 15%	No	No
Denmark	General law	Full amount	Varies	50% of tax	Possible
Estonia	General law	Full amount	0.06%/day	≤18,000 EEK	Possible
Finland	General law	Full amount	Yes	30% of tax	≤4 years
France	Special program (2009, 2013–14)	Full amount	0.4%/month	Varies	No
Germany	General law	Full amount	6.00%	No	No
Greece	Special program	5% to 8% of total capital		No	No
Hungary	General law	Full amount	1.5–1.75x std. rate	Only heightened interest	No
Iceland	None	–	–	–	–
Ireland	General law	Full amount	Varies	3–10% of tax	No
Israel	Special program (2011–2012)	Full amount	No	No	No
Italy	General law	Full amount	Varies	Reduced	No
	Special program in 2008	5% of assets		No penalty	
Japan	General law	Full amount	4–14.6%	Varies	≤10 years
Korea	General law	Full amount	0.03%/day	Reduced	Varies
Luxembourg	General law	Full amount	0.6%/month	≤10% of tax	No
Mexico	General law	Full amount	Yes	No	Rarely
	Special program in 2009		4–7%	No	No
Netherlands	General law	Full amount	Varies	≤300% of tax	No
	Special program in 2009, 2013	Same as general law		No penalties	
New Zealand	General law	Full amount	Varies	Reduced	No
Norway	General law	Full amount	Yes	No	No
Poland	General law	Full amount	75% of regular rate	No	No
Portugal	General law	Full amount	4.08%	Reduced	No
	Special program in 2009	5% of discl. assets	None	No	No
Solvak Republic	General law	Full amount	Yes	No	No
Slovenia	General law	Full amount	Increased	No	Possible
Spain	General law	Full amount	Yes	5–20%	No
Sweden	General law	Full amount	Yes	No	No
Switzerland	General law (since 2010)	Full amount	Yes	None, if repeat offender ≥ 20% of tax	No
Turkey	General law	Full amount	Yes	No	No
	Special program in 2009	2% or 5% of tax base		No	No
United Kingdom	General law	Full amount	Varies	Reduced	No
	Special program in 2009/2010	Full amount		10–20% of tax	No
United States	Special program 2009, 2011, 2012	Full amount	Varies	20% of tax, 20–27.5% of offshore balance	No

Table based on information from OECD (2010), updated with information from tax authority and tax consultancy homepages.

assessing taxes of evaders. I then confirm the importance of administrative costs in a survey of German competent local tax authorities and use the acquisition of whistle-blower information in Germany to quantify the revenues brought in by voluntary disclosure. Lastly, I analyze how governments should fine tax evaders after a voluntary disclosure.

In more detail, my theoretical model frames tax evasion as a rational choice of individuals that bear a moral (psychic) cost when evading taxes. There is ex—ante uncertainty about the probability of being caught and fined, and individuals have the possibility to voluntarily disclose the tax evasion they committed after the detection probability is revealed. In equilibrium, the individuals with the lowest moral cost will evade taxes, those with intermediate moral costs will first evade taxes but voluntarily disclose later if the detection probability is high, and those with the highest moral costs will never evade taxes. In this model I show that the existence of voluntary disclosure increases the number of individuals who evade taxes. This result arises as voluntary disclosure allows individuals to better differentiate their actions according to the detection probability.

I later test this result empirically, using the introduction of the first Offshore Voluntary Disclosure Program in the U.S. in 2009 for identification. Employing a synthetic control approach, I analyze how U.S. deposits in offshore banking centers have changed compared to deposits from other countries. This analysis confirms that the existence of a voluntary disclosure program indeed increases tax evasion, in line with the theoretical model.

I also model how the government should employ voluntary disclosure. In the model, voluntary disclosure increases net tax revenue if there are administrative costs of fining tax evaders in the absence of a voluntary disclosure. Voluntary disclosures allow the government to save such administrative costs. The government then sets the fine that applies after a voluntary disclosure to trade off the higher tax evasion with these administrative cost savings. I confirm the importance of such administrative cost savings in a survey among German competent local tax authorities.

Several strands of literature are relevant to this paper. First, there is a large literature on tax evasion by individuals (see Slemrod (2007) for an overview). The theory goes back to Allingham and Sandmo (1972) and Yitzhaki (1974), who model tax evasion analogous to portfolio choice. Sandmo (2005) provides a review of this line of literature. Despite the obvious difficulties to measure tax evasion, there is also a large empirical literature, which Alm (2012) summarizes.

To my knowledge, no paper studies a voluntary disclosure program as described above. However, there is some literature on tax amnesties, which are short-run programs (often about three months long) that usually do not fine tax evaders. Also in contrast to voluntary disclosures, tax amnesties often include those already under investigation for tax evasion and allow only a partial reporting of prior tax evasion. In this literature, Malik and Schwab (1991) propose a model with uncertainty about the disutility from tax evasion to explain why individuals take up the offer of a tax amnesty (which they never would in the standard

Allingham-Sandmo model). Alm and Beck (1990) set up a prospect theory model in which the share of evaded tax that is declared in the amnesty is the main decision parameter. Stella (1991) discusses the interaction between future enforcement and tax amnesties, predicting that amnesties are unlikely to generate additional revenue. Alm and Beck (1993) confirm this result empirically in a time-series analysis. Bayer et al. (2015) study the timing of tax amnesties.[1]

Closer to this paper is an analysis by Andreoni (1991), who asks how a "permanent tax amnesty" (in effect, a voluntary disclosure program in the sense discussed above) would affect the efficiency and equity of the tax system. He proposes a model in which people use the amnesty when shocks to their consumption make them unwilling to bear the risk of audit. In this model, the tax amnesty acts similar to social insurance, allowing those in bad luck to eliminate some of their risk. He does not consider administrative costs or the optimal fine set by the government, but assumes (as common in this literature) that there is no fine after a disclosure.[2]

Section 2 provides a model of a voluntary disclosure program. Section 3 presents survey evidence on the importance of administrative costs for tax authorities. Section 4 empirically tests the effect of a voluntary disclosure program on tax evasion. Section 5 concludes.

2. Model

2.1. Framework

To illustrate the consequences of voluntary disclosure, I set up a model in which individuals may evade capital income taxes by transferring money to an offshore account. The government can set incentives for tax evaders to come clean by offering them the possibility to voluntarily disclose the tax evasion they committed. Offshore income indicated in a voluntary disclosure is then taxed, and fined at a rate chosen by the government.

Individuals in the model face ex-ante uncertainty about detection probabilities. This uncertainty reflects, for example, that there is a certain probability that an informant offers the government information about offshore accounts. Fig. 1 clarifies the real-world significance of changes in detection probabilities using the example of Germany, which has bought at a large scale whistle-blower information offered by former bank employees in tax havens. The acquisition of such data from February 2010 onward was widely discussed in the media.[3]

The model reflects such changes in the underlying detection probabilities. With probability q, a high detection probability p_H occurs (e.g., because the government receives whistle-blower information). Correspondingly, with probability $1 - q$ there is no leak and the detection probability is low (p_L). This uncertainty not only reproduces the real-world facts described above, but is also necessary for the model, as rational individuals will only voluntarily disclose tax evasion they optimally chose to commit earlier if they have received new information.

Not all individuals have the same willingness to evade taxes. Kleven et al. (2011) show that among Danish taxpayers who self-report their income (and thus have the opportunity to evade taxes), less than 40% actually evade taxes. I model such heterogeneity among individuals with a moral cost of tax evasion $\alpha_i \in [0; A]$, which is specific to the individual. In equilibrium, there will be three different groups of individuals: First, a group of "non-evaders", who have high moral costs and never evade taxes; second, "disclosers", who evade taxes but voluntarily disclose if the detection probability is high; and lastly "evaders", who evade no matter which detection probability occurs.

Individuals decide about tax evasion and voluntary disclosure by maximizing their expected utility.[4] I assume risk neutral individuals, whose utility is

$$U_i = y - \tau_{is} - 1\alpha_i. \quad (1)$$

y is the pre-tax capital income, τ_{is} is the tax (and fine) payment that depends on individual i's tax evasion and disclosure decisions as well as the state of the world s, and 1 is an indicator function that is equal to one if the individual evades taxes and zero otherwise. Due to the linear structure of the utility function, it is never optimal to declare only a share of the true income.

Individuals are liable to pay taxes at the statutory rate t. They can evade this tax by hiding their money in an offshore account and not declaring the income derived from it. If the tax authorities detect the tax evasion, the individual pays a fine $F > 1$ that is proportional to the evaded tax. I treat this fine for tax evasion, F, as exogenous, assuming that it is set in an appropriate relation to punishments for other crimes.[5]

The government may allow voluntary disclosures of prior tax evasion. As is common practice, a voluntary disclosure requires that the tax evader reports all income on which he or she evaded taxes. It is costly for individuals to prepare a voluntary disclosure, as they have to collect all information necessary to assess their taxes.[6] I model this with a compliance cost c^c that arises when preparing a voluntary disclosure. The government retroactively collects taxes on the income declared in the voluntary disclosure. Additionally, it imposes a fine f ($1 \le f \le F$), which is proportional to the evaded tax. The government sets this fine to maximize revenues. I assume that a voluntary disclosure clears the conscience of the individual, i.e., that after a voluntary disclosure the individual no longer has moral qualms about the tax evasion committed earlier.

The government incurs administrative costs c^a for each tax evading individual it detects, as it checks and audits the tax return and collects information from offshore banks. For the tax authorities, these costs are significantly higher than the costs that a tax evader incurs when preparing a voluntary disclosure: The tax authorities have to investigate to detect all foreign accounts and asset holdings, and then have to obtain detailed information on the movements of funds from (perhaps less-than-cooperative) offshore banks. In contrast, the individuals themselves either have all this information already available, or can (as the account holders) easily request it from their banks.

[1] Other papers have studied behavioral responses of individuals to temporary decreases of other taxes. For example, Agarwal et al. (2013) show very large behavioral responses to sales tax holidays, brief periods in which sales taxes are reduced or eliminated. They find little evidence of substitution across products or over time. In contrast, Cole (2009) estimates that sales tax revenues decrease by up to 8% during tax holiday months. Studying a stamp duty holiday in the UK, Besley et al. (2014) similarly find that the tax holiday mostly leads to short-term retiming of transactions. However, due to the specific situation of prior tax evasion, it is unclear how well these results transfer to voluntary disclosure.

[2] Some further papers study the optimal self-reporting of violations of the law in a non-tax context. A first contribution is Kaplow and Shavell (1994), who show that self-reporting increases welfare as it saves enforcement resources and reduces uncertainty for individuals facing potential sanctions. Their model has been extended to consider ex-post asymmetric information (Feess and Heesen, 2002) or self-reporting at different stages of an investigation (Feess and Walzl, 2005).

[3] In 2011, it emerged that Germany and Switzerland had negotiated a tax treaty under which undeclared accounts of German nationals in Switzerland would be subject to a one-time tax payment. This single tax payment was supposed to be collected anonymously and to exempt the account holder from prosecution for tax evasion committed in the past. However, in November 2012, the upper house of the German parliament did not pass this tax treaty, thus making voluntary disclosure again the only possibility to come clean on past tax evasion. See Pfisterer (2013) for an overview of these developments.

[4] There is also a part of the literature on tax evasion that does not rely on expected utility theory. Alm et al. (1992) show in an experiment that some individuals overweight the low probability of audit. Dhami and Al-Nowaihi (2010) model such behavior using prospect theory and predict a positive relationship between tax rates and tax evasion. However, when testing whether expected utility theory or prospect theory provide a better explanation of individuals' behavior regarding tax evasion, King and Sheffrin (2002) find experimental evidence in favor of expected utility theory.

[5] As Kolm (1973) shows, with positive marginal costs of auditing, the government optimally sets the fine for tax evasion to the maximum level that is in line with moral and legal constraints. This is the implicit assumption in the model presented here.

[6] Tax advisors have confirmed in private discussions that a voluntary disclosure often has several hundred to thousand pages, as the individual not only has to disclose all capital income over a certain period, but also prove that the disclosure is complete.

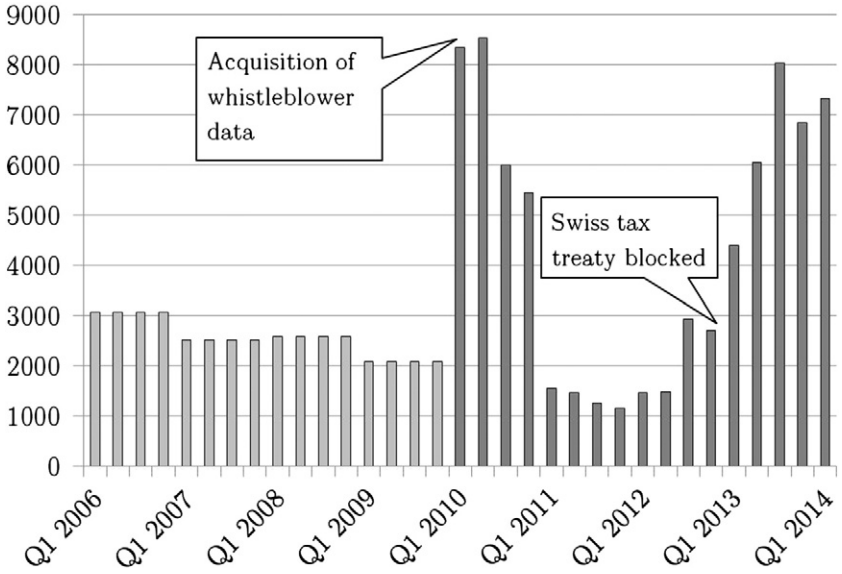

Fig. 1. Voluntary disclosures per quarter in Germany. Voluntary disclosures per quarter in Germany, Q1 2006–Q1 2014. Graph based on information from state finance ministries, data for 2006–2009 is extrapolated based on information for Lower Saxony and Schleswig-Holstein.

I assume that the administrative costs of the government are sufficiently small that fining tax evaders is still worthwhile for the government. Additionally, I assume that the costs of preparing a voluntary disclosure (c^c) are sufficiently lower than the administrative costs of fining tax evaders (c^a), so that voluntary disclosure will take place in equilibrium. Both conditions are met when c^a is such that

$$\frac{c^c}{(1-q)(p_H-p_L)} \leq c^a < Fty. \tag{2}$$

The right part ensures that the government fines evaders despite the administrative cost, and the left part ascertains that individuals are willing to disclose.[7]

Fig. 2 describes the stages of the game in detail. First, the government sets the voluntary disclosure fine f. In the second stage, individuals decide whether to evade taxes. They anticipate that nature will draw the detection probability in the next stage. After the detection probability is revealed, individuals may have the option to voluntarily disclose the tax evasion they committed. Lastly, the government audits some taxpayers, and individuals accordingly pay taxes and fines.

2.2. Benchmark without voluntary disclosure

As a benchmark, consider first the case when voluntary disclosure is not possible, i.e., the game without the fourth stage. Individuals then base their evasion decision on the expected detection probability, $\overline{p}$, with $\overline{p} = qp_H + (1-q)p_L$. Denoting variables in this benchmark with a superscript 0, individuals' expected payoffs are:

$$EU^0(\text{Don't evade}) = y - ty$$
$$EU^0(\text{Evade}) = y - \overline{p}Fty - \alpha_i.$$

Comparing the expected utility in these two cases shows that individuals with a moral cost $\alpha_i < \alpha^0$ evade taxes, with α^0 given by

$$\alpha^0 = ty(1-\overline{p}F). \tag{3}$$

The number of evaders is higher the higher the potential gain from tax evasion (ty), and lower the higher the expected fine ($\overline{p}Fty$).[8]

For later use, tax revenues net of administrative costs, T^0, are

$$T^0 = \int_0^{\alpha^0} \overline{p}(Fty - c^a)\, dG(\alpha_i) + \int_{\alpha^0}^{A} ty dG(\alpha_i). \tag{4}$$

The first term denotes the taxes and fines net of administrative costs that the tax authorities collect from evaders; the second term are taxes that non-evaders pay.

2.3. Voluntary disclosure

A voluntary disclosure implies that an individual reports all income on which he or she evaded taxes to the authorities. In most countries voluntary disclosures are associated with a fine (see Table 1 for details). The voluntary disclosure fine $f \geq 1$ is always lower than the fine for tax evasion ($f < F$), and in some countries no fine is levied ($f = 1$). The individuals' choice set is (Evade, Disclose), (Evade, Don't disclose), (Don't evade, Disclose), (Don't evade, Don't disclose), and the corresponding payoffs are

$$EU(\text{Evade, Disclose}) = y - fty - c^c$$
$$EU(\text{Evade, Don't disclose}) = y - p_j Fty - \alpha_i$$
$$EU(\text{Don't evade, Disclose}) = y - ty - c^c$$
$$EU(\text{Don't evade, Don't disclose}) = y - ty,$$

where p_j is the detection probability drawn by nature in the third stage. Knowing these different outcomes, individuals decide about tax evasion anticipating the full sequence of events. The government, in turn, takes individuals' decisions into account and sets the voluntary disclosure fine accordingly. I solve the game by backward induction.

2.3.1. 4th stage: disclosure decision

Voluntary disclosure is only attractive for individuals who have evaded taxes.[9] Depending on the realization of the detection probability in stage 3, individuals may decide to voluntarily disclose to lower their

[7] The derivation of the left part of cond. (2) will become clear after deriving the equilibrium behavior of individuals (see Eqs. (10) and (11)).

[8] As common in the literature I assume that $\overline{p}F < 1$, i.e. that tax evasion is worthwhile in expectation.

[9] For an individual who has *not* evaded taxes in the second stage, a voluntary disclosure does not change the tax payment, but entails positive compliance costs c^c. Thus, (Don't evade, Disclose) is a dominated strategy.

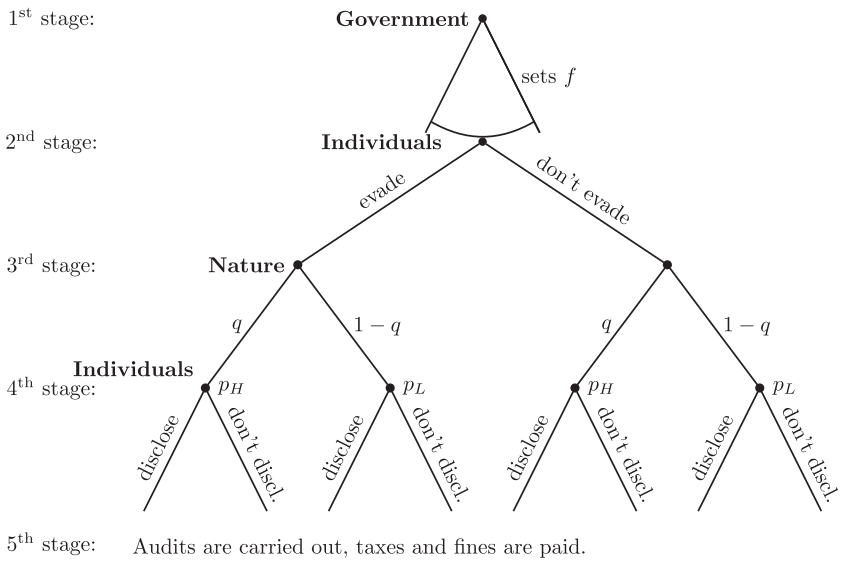

Fig. 2. Game tree.

expected fine and to avoid the moral cost associated with tax evasion. Comparing *EU*(Evade, Disclose) and *EU*(Evade, Don ' t disclose) shows that for a detection probability $p_j, j \in [L, H]$, voluntary disclosure is optimal for tax evaders with moral costs $\alpha_i \geq \alpha_j^{vd}, \alpha_j^{vd} \in [\alpha_L^{vd}, \alpha_H^{vd}]$, with

$$\alpha_j^{vd} = ty\left(f - p_j F\right) + c^c. \tag{5}$$

This cutoff is lower (that is, more individuals voluntarily disclose) when nature draws the high detection probability ($\alpha_H^{vd} < \alpha_L^{vd}$). Moreover, more individuals voluntarily disclose when the fine associated with voluntary disclosure is lower. Even when there is no fine after a voluntary disclosure ($f = 1$), not all individuals will voluntarily disclose, as long as there still is an expected gain from tax evasion. Higher compliance costs associated with preparing the voluntary disclosure also make it less attractive.

2.3.2. 3rd stage: detection probability

Nature draws the high detection probability p_H with probability q, and the low detection probability p_L with probability $1 - q$. The detection probability is exogenous for the individuals. While the government could affect the detection probability in the medium to long term, I abstract from this possibility to keep the focus on voluntary disclosure.[10]

2.3.3. 2nd stage: evasion decision

The evasion decision depends on the individual's moral cost of tax evasion. First, consider individuals with moral costs $\alpha_i \in [0, \alpha_H^{vd})$, who will not voluntarily disclose in stage four. Comparing their expected utilities *EU*(Evade, Don ' t disclose) and *EU*(Don ' t evade, Don ' t disclose) shows that it is optimal for these individuals to evade taxes. Thus, their equilibrium strategy is {Evade, (Don't disclose if p_L), (Don't disclose if p_H)}. Off the equilibrium path, i.e., if they had chosen not to evade taxes, they would also choose {(Don't disclose if p_L), (Don't disclose if p_H)}.

Next, consider individuals with moral costs $\alpha_i \in [\alpha_H^{vd}, \alpha_L^{vd})$. We know that these individuals choose {(Don't disclose if p_L), (Disclose if p_H)} if they evaded in the first stage, and {(Don't disclose if p_L), (Don't disclose if p_H)} if they did not evade in the first stage. Comparing the expected utilities for these two options shows that tax evasion is only optimal for individuals with moral costs $\alpha_i < \alpha^t$, with

$$\alpha^t = ty\frac{1-qf-(1-q)p_L F}{1-q} - \frac{q}{1-q}c^c. \tag{6}$$

Note that α^t is indeed between α_H^{vd} and α_L^{vd}: $\alpha^t \leq \alpha_L^{vd}$ holds as $c^c \geq -(f-1)ty$ (as $f \geq 1$ and $c^c > 0$). $\alpha^t \geq \alpha_H^{vd}$ when $ty[1 - f + (1 - q)(p_H - p_L)F] \geq c^c$. After deriving the equilibrium fine it will become clear that this condition holds when Eq. (2) is met.

Lastly, we know that individuals with $\alpha_i \in [\alpha_L^{vd}, A]$ always disclose after evading taxes, no matter which detection probability arises. They do so because of their high moral cost of tax evasion, and because of this they also prefer not to evade taxes in the 2nd stage.

Fig. 3 summarizes these equilibrium strategies for both a world with and without voluntary disclosure. It shows that when nature draws the low detection probability, in equilibrium it is never rational to voluntarily disclose — after all, the same individual chose to evade taxes when it was still unclear whether the low or the high detection probability would occur. However, if nature draws the high detection probability, some evaders with relatively high moral costs of tax evasion opt for a voluntary disclosure, preferring a certain, but lower, fine payment and clear conscience over the tax saving with the risk of a high fine if the evasion is detected.

2.3.4. 1st stage: government

In the first stage, the government sets the voluntary disclosure fine to maximize expected net tax revenue. Ex ante, i.e., before the detection

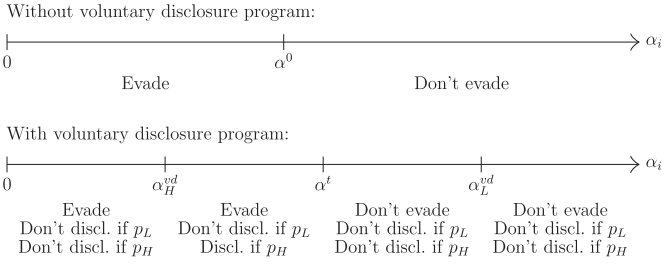

Fig. 3. Equilibrium behavior of individuals with different moral costs α_i.

[10] In the short run, governments can do little to influence detection probabilities. Tax authorities usually do not hire short-term workers as employees have to handle sensitive tax data, and training new employees takes time. Moreover, strong job protection rules in the public sector make short-term adjustments very costly. Other short term actions, such as negotiating new information sharing agreements with tax havens, can be understood as an occurrence of p_H.

probability is revealed, expected tax revenues net of administrative costs are

$$T = \int_0^{\alpha_H^{vd}} \overline{p}(Fty - c^a)dG(\alpha_i) + \int_{\alpha_H^{vd}}^{\alpha^t} [qfty + (1-q)p_L(Fty - c^a)]dG(\alpha_i) \quad (7)$$
$$+ \int_{\alpha^t}^{A} ty \; dG(\alpha_i).$$

The first term refers to the revenue collected from evaders, the second term to the expected revenue from those who voluntarily disclose when the detection probability is high, and the last term to the revenue collected from non-evaders. Note that no administrative costs arise after a voluntary disclosure, as the disclosure has to contain all information necessary to assess the tax liability.[11]

The government sets the fine that applies after a voluntary disclosure to maximize its expected tax revenue. Assuming that there is a mass M of taxpayers with moral costs α_i distributed uniformly in the interval $[0, A]$, Eq. (7) can be rewritten as

$$T = \overline{p}(Fty - c^a)\frac{\alpha_H^{vd} M}{A} + [qfty + (1-q)p_L(Fty - c^a)]\frac{(\alpha^t - \alpha_H^{vd})M}{A}$$
$$+ ty\frac{(A - \alpha^t)M}{A}, \quad (8)$$

with α_H^{vd} and α^t given by Eqs. (5) and (6). Maximizing Eq. (8) over f yields the optimal voluntary disclosure fine f^*:

$$f^* = 1 + (1-q)(p_H - p_L)F - \frac{(1-q)(p_H - p_L)c^a + c^c}{2ty}. \quad (9)$$

The optimal fine for voluntary disclosures is higher when the fine for tax evasion (F) is higher, and lower when the administrative costs associated with tax evasion or the compliance costs associated with preparing the voluntary disclosure are higher. When the difference between the detection probabilities in the two states of the world is large, the voluntary disclosure fine is higher, because the difference in detection probabilities increases the incentive for individuals to come clean.[12] I consider the optimal fine for tax evasion, F, as exogenous, as this fine has to be set in relation to other crimes.[13]

For further interpretation, consider the cutoffs α_H^{vd*} and α^{t*} as a function of the underlying parameters:

$$\alpha_H^{vd^*} = ty(1 - \overline{p}F) - \frac{1}{2}(1-q)(p_H - p_L)c^a + \frac{1}{2}c^c, \quad (10)$$

$$\alpha^{t^*} = ty(1 - \overline{p}F) + \frac{1}{2}q(p_H - p_L)c^a - \frac{1}{2}\frac{q}{1-q}c^c. \quad (11)$$

Clearly, when there are no administrative or compliance costs, $\alpha_H^{vd*} = \alpha^{t*}(= \alpha^0)$, i.e., the revenue-maximizing government then sets the fine so high that voluntary disclosure is not attractive for any evader. Comparing Eqs. (10) and (11) shows that for voluntary disclosure to take place in equilibrium, it has to hold that $c^c \leq c^a(1-q)(p_h - p_L)$, as was assumed in Eq. (2).

Next, consider how the existence of a voluntary disclosure mechanism affects the tax evasion decision. Comparing α^{t*} with α^0 from the benchmark model without voluntary disclosure yields the following proposition:

Proposition 1. *The introduction of a voluntary disclosure program with a fine set optimally in the presence of administrative costs increases the number of individuals who evade taxes.*

Proof. Proof by contradiction: Assume $\alpha^{t*} < \alpha^0$. Then, from Eqs. (3) and (11),

$$0 > (p_H - p_L)c^a - \frac{c^c}{1-q},$$

which is a contradiction whenever parameters are such that voluntary disclosure takes place in equilibrium (i.e., when condition (2), which followed from comparing α_H^{vd*} and α^{t*}, holds).

To understand this result, consider how voluntary disclosure affects the tax evasion decision. Voluntary disclosure can be interpreted as an option that an individual may exercise when the detection probability proves to be high. Without this option (i.e., in an economy without voluntary disclosure), individuals come to a decision about evading taxes based on the expected probability of detection, $\overline{p}$. In contrast, if voluntary disclosure is possible, individuals anticipate that they can voluntarily disclose when the detection probability is high and thus decide about tax evasion based on the low detection probability p_L and the voluntary disclosure fine f. In the extreme case of no voluntary disclosure fine ($f = 1$) and no compliance cost ($c^c = 0$), they evade as if the detection probability was p_L for sure. As more people evade taxes when the detection probability is lower, the possibility of voluntary disclosure increases the number of individuals who evade taxes.

For a revenue-maximizing government, the higher tax evasion when a voluntary disclosure program exists seems to be an argument against introducing such a program. However, voluntary disclosure also has several other effects on tax revenues. With voluntary disclosure, more individuals pay tax (and the low fine f) in the state of the world with the high detection probability, and administrative costs are lower. In contrast, in the low detection probability state, is has clear negative effects as there is more evasion but no voluntary disclosures take place.

To see the overall effect on expected tax revenues, I compare the equilibrium tax revenues T^*, derived by inserting the optimal fine f^* and α_H^{vd*} and α^{t*} in Eq. (8), with Eq. (4), assuming a uniform distribution of α_i also in this case. This shows

$$T^* > T^0 \Leftrightarrow$$
$$\frac{[c^c - c^a(p_H - p_L)(1-q)]^2 q}{4(1-q)} > 0. \quad (12)$$

When administrative costs are positive, Eq. (12) is always fulfilled. Then, the existence of voluntary disclosure increases tax revenues net of administrative costs. Individuals' disclosure of tax evasion leaves rents on the table, as the individuals have a lower cost of preparing the information for assessing previously evaded taxes than the tax authorities themselves. A voluntary disclosure program offers the government a way to share into these rents. Thus, the government decides to use voluntary disclosure despite the increase in tax evasion it causes.

When there are no administrative costs ($c^a = 0$), $T^* = T^0$.[14] In this case, the government optimally sets the voluntary disclosure fine so high that no voluntary disclosure takes place in equilibrium (see Eqs. (10) and (11)). This behavior is optimal as an attractive voluntary disclosure program (i.e., a program with a fine sufficiently low that there is some uptake) would increase tax evasion, without the corresponding benefit of lower administrative costs.

[11] In principle, a much lower administrative cost also arises after a voluntary disclosure or when assessing the tax returns of non-evaders. This cost is here normalized to zero.

[12] $\frac{df^*}{d(p_H - p_L)} = (1-q)(F - \frac{c^a}{2ty})$, which is positive given the restrictions placed on parameters in Eq. (2).

[13] If the government set F purely to maximize tax revenues, it would set the fine so high that no tax evasion takes place. Instead, I treat F as exogenous, assuming that the government is constrained by moral and legal concerns and thus has to set a fine at which some tax evasion takes place in equilibrium.

[14] When $c^a = 0$, it follows from Eq. (2) that $c^c = 0$ as it cannot be more expensive for tax evaders to gather information on their tax evasion than for the tax authorities.

The following proposition summarizes these results:

Proposition 2. *The existence of a voluntary disclosure program raises expected tax revenues net of administrative costs if and only if there are administrative costs when assessing evaded taxes.*

Proof. See Eq. (12).

Intuitively, when administrative costs are positive, the voluntary disclosure mechanism generates efficiency gains, as the tax evaders can collect information at lower cost than the government. The government can increase these efficiency gains by drawing people into the voluntary disclosure scheme, but this implies setting a low fine and foregoing additional tax revenue. In addition, a low fine implies that evasion becomes more attractive ex ante.

2.4. Discussion

So far I have assumed risk neutral, heterogeneous individuals as these assumptions allow a tractable model that fits well to the stylized facts described at the beginning of Section 2. To provide robustness and make sure that risk averse individuals would not change the main implications of the model, Appendix 1 provides a model that focuses on the tax evasion decision of risk averse individuals in the presence of a voluntary disclosure mechanism. In that model, every individual evades some (but not all) tax. In the presence of voluntary disclosure, all individuals evade more taxes than in the benchmark case without voluntary disclosure. In sum, the main results concerning aggregate tax evasion and tax revenues are very similar to the main model.

In the model proposed in the appendix, all individuals evade taxes, and all disclose voluntarily when the detection probability is high. As mentioned before, this is not the case empirically: not all individuals evade taxes, and not all tax evaders voluntarily disclose. A possible way to reconcile these observations with a model with risk aversion is to assume that individuals differ in their risk aversion. While such a model would be analytically challenging, the intuition is straightforward: The most risk-averse individuals would never evade taxes (as long as there is some fixed cost of tax evasion); individuals with an intermediate degree of risk-aversion would evade taxes but disclose when the detection probability is high; and the least risk-averse individuals would always evade taxes, and never voluntarily disclose. The existence of a voluntary disclosure program would then affect the tax evasion decision on two margins. First, it increases the amount of tax each tax evader evades. Second, the number of tax evading individuals would rise, as individuals who were just so risk averse that they are indifferent between evading taxes and not evading in a world without voluntarily disclosure would start evading taxes.

3. Administrative costs in Germany

Proposition 2 has shown that the government should implement a voluntary disclosure program if such a program is associated with lower administrative costs. If this is not the case, the government should not use this instrument (in the model, the government sets the fine such that no individual voluntarily discloses).

The crucial assumption is that the administrative costs for the tax authorities are lower when they assess evaded taxes on the basis of a voluntary disclosure, compared to a situation in which the tax authorities have detected the tax evasion themselves. A voluntary disclosure has to contain all information necessary to assess taxes, and usually includes a revised tax return. Having this information prepared in a structured form likely lowers administrative costs for the tax authorities. However, it is also possible that most work arises when checking the accuracy of the disclosure. In that case, voluntary disclosures would not save administrative costs.

Only the tax authorities themselves can answer which of these arguments dominates in reality. Therefore, I have carried out a survey among all regional tax offices in Germany. I received answers from 12 of the 16 federal states. In eight cases, an agency at the level of the state answered, usually based on its own survey among the competent local tax authorities. From four other states, I directly received answers from competent local tax authorities, so that I have a total of 18 individual answers. All my questions were in the context of capital income tax evasion via foreign accounts.

First, I asked whether a voluntary disclosure increased or decreased the work time necessary to assess taxes, compared to a situation where the evasion has already been detected (e.g., by receiving whistle-blower information). A strong majority (~60%) noted that administrative effort is significantly lower after a voluntary disclosure. When asked to quantify by how much the working time decreased, the answers ranged from 30% to 90%, with two thirds citing a decrease in the necessary work time above 80%.[15] Overall, a majority of respondents confirmed the argument made above that a voluntary disclosure strongly decreases the administrative effort necessary to assess previously evaded taxes.

A second question gauged the absolute volume of administrative costs, by asking about the hours of work necessary to assess taxes after a voluntary disclosure. The answers ranged from "minutes" to several months, with an average of six and half days. This range has to be expected, given that the voluntary disclosures concern very different cases: They range from individuals who forgot to file a foreign account in a single year, to others who have multiple offshore accounts with holdings in several funds, where all realizations of capital gains in the last ten years have to be retraced. Interestingly, those competent local tax authorities who gave relatively high work time estimates also were more likely to answer that voluntary disclosure substantially lowers administrative costs. Possibly these local authorities deal predominantly with large cases, where the potential gains from voluntary disclosures are higher than for small cases.

All in all, the survey evidence confirms that for many competent tax authorities, voluntary disclosures imply administrative costs that are substantially (up to 90%) lower than when assessing taxes based on whistle-blower information. In this situation the model predicts that the government allows voluntary disclosures and imposes a voluntary disclosure fine at a relatively low rate, as is the case in Germany (see Table 1).

Some back-of-the-envelope calculations yield estimates for the monetary value of these administrative costs. The average full cost per hour of a tax inspector in Germany is about 50.[16] Excluding the two most extreme answers, the tax authorities in my survey gauged the work time after a voluntary disclosure between one and eleven days, averaging 6.55 days. With eight working hours per day, this implies administrative costs of 400 to 4400 after a voluntary disclosure, with an average of 2620. Using the estimated work time savings after a voluntary disclosure, work time to assess evaded taxes without a voluntary disclosure ranges from twelve to one hundred days, with an average of 56 days. This corresponds to administrative costs of 4800 to 40,000, with an average of 22,400, for the evaluation of cases of capital income tax evasion via foreign accounts.

To judge the relevancy of administrative costs, they have to be related to the average size of voluntary disclosures. Appendix 2 estimates the tax revenues collected in voluntary disclosures in Germany. First, employing a difference-in-difference design, it compares revenues of self-reported income tax that include voluntary disclosures with payroll tax revenues and uses the acquisition of whistle-blower data in

[15] About 16% of participants answered that the necessary work time increased, giving fact-checking efforts as the main reason. However, none of these respondents gave a numerical estimate by how much the required work time increased. The remainder stated that the work time does not change or did not answer, noting that the answer varies too much case by case.

[16] According to the Bavarian finance ministry, an experienced tax inspector (Steueroberinspektor) costs the government 50.62 per hour, including insurance and a surcharge for overhead costs (Personalvollkosten). Tax authority employees at other levels cost the government between 40 and 70 per hour.

Germany as a shock to detection probabilities. Second, it uses information about voluntary disclosure revenues reported by some state-level governments. In all, the results indicate that on average a voluntary disclosure brings in 38,000–51,000.

As Germany does not fine evaders after a voluntary disclosure, these numbers also give an estimate of the average evaded tax in these cases. Thus, the administrative cost of fining tax evaders without a disclosure are substantive compared to the amount of evaded tax. In this case, offering voluntary disclosure is a valuable policy for a revenue-maximizing government.

4. Voluntary disclosure and tax evasion in the United States

In the following, I empirically test Proposition 1, i.e., whether voluntary disclosure increases tax evasion. To do so, I study the introduction of a voluntary disclosure program in the U.S. in 2009. This corresponds to comparing the case with voluntary disclosure with the one without it in the model (see Fig. 3). To measure tax evasion, I use aggregate data on offshore account balances. I then compare the offshore deposits of U.S. residents with those from various control countries using a synthetic control method.[17]

4.1. Background

The U.S. introduced a voluntary disclosure program in 2009. The Internal Revenue Service (IRS) already experimented with voluntary disclosure programs in the first half of the twentieth century. However, between 1952 and 2009, no formal policy regarding the civil penalties for intentional tax evaders existed.[18] In the criminal prosecution of tax evaders, individuals who came forward voluntarily have long been treated more favorably. Nevertheless, the 2009 initiative was the first large program to introduce a significantly more favorable civil tax penalty. Therefore, the introduction of the voluntary disclosure program significantly affected the expected penalties perceived by U.S. residents.

The 2009 program ran from mid-March till mid-October 2009 and was considered a success: About 15,000 taxpayers voluntarily disclosed prior tax evasion (U.S. Government Accountability Office, 2014). In February 2011, the IRS announced a follow-up program (the 2011 Offshore Voluntary Disclosure Initiative), which ended in mid-September 2011. Again, a large number of taxpayers (about 18,000) took advantage of this program. Ultimately, the IRS began an open-ended offshore voluntary disclosure program (OVDP) in January 2012. Table 2 provides an overview of some of the locations of foreign accounts declared in the 2009 program, showing that they referred to many different countries.

All three initiatives had relatively similar requirements.[19] They referred specifically to unreported income from undisclosed offshore accounts for years after 2003. Individual taxpayers disclosing income in the program have to pay the full amount of tax, plus interest, and a monetary penalty of up to 25% of unpaid taxes. Moreover, there is an additional penalty of 20% (2009 program), 25% (2011 initiative) or 27.5% (2012 program) of the value of the assets in the foreign bank accounts. These penalties are significantly lower than the general punishments for tax evasion or failure to declare foreign accounts.[20] Table 3 gives an overview of the taxes and penalties paid by participants in the 2009 OVDP.

Table 2
Location of foreign bank accounts, 2009 OVDP.

Country	Frequency	Percent
Switzerland	5427	42%
United Kingdom	1058	8%
Canada	556	4%
France	528	4%
Israel	510	4%
Germany	484	4%
Hong Kong	362	3%
Singapore	156	1%
Cayman Islands	148	1%
Isle of Man	90	1%
Jersey	72	1%
Bahamas	69	1%

Locations of foreign bank accounts reported in the 2009 offshore voluntary disclosure program, selected countries. Data from U.S. Government Accountability Office (2014).

I use the introduction of the first program in 2009 to estimate how the existence of voluntary disclosure has affected tax evasion activities. While the 2009 program was only temporary, it marked a definite change in the IRS' policy towards tax evaders: for the first time since 1952, a broad and encompassing scheme for repentant tax evaders was put in place. While no follow-up program was originally announced, the IRS' formal acknowledgement that it treats tax evaders who come forward voluntarily in a more lenient way constitutes a significant shift in the perceived treatment of tax evaders.[21] At the very least, it made future voluntary disclosure programs far more likely. It is therefore suited to test Proposition 1 despite formally being a temporary program.

4.2. Data and descriptives

By its nature, data on tax evasion is scarce. I therefore proxy for tax evasion using the deposits of U.S. residents in an aggregate of offshore banking centers. The Bank for International Settlements (BIS) provides this data on a quarterly basis. It collects the information necessary to compile this dataset from local banks in cooperation with the respective countries' central banks. The offshore banking centers in this aggregate are the Bahamas, Bahrain, Bermuda, Cayman Islands, Curaçao (from Q4 2010), Guernsey, Hong Kong, Isle of Man, Jersey, Macao, Netherlands Antilles (to Q3 2010), Panama, and Singapore.[22]

The BIS designates these countries as offshore financial centers. At the same time, the economic literature identifies all of these countries as tax havens (Hines and Rice, 1994). In the following analysis, I make the assumption that the combination of bank secrecy and low tax rates makes these offshore financial centers a potentially attractive

[17] The only other country that recently introduced voluntary disclosure was Switzerland in 2010. Unfortunately, it is not possible to analyze the consequences of the introduction of voluntary disclosure there with the current data set, as the deposits in offshore banking centers do not seem to be a good measure for tax evasion in Switzerland. With its strong protection of bank secrecy, it is likely less necessary for Swiss citizens to use these offshore banking centers for tax evasion. Moreover, Switzerland is clearly an outlier in the deposit data used in this study, as its deposits in offshore banking centers are about eight times higher than the average in the sample. Likely, this is because funds and trusts route their deposits through Switzerland to profit from the bank secrecy there. In addition, a general shift in the policy towards tax evasion took place in Switzerland around that time, which also makes identifying the effects of voluntary disclosure difficult.

[18] An exception was a three-month program in 2003 (the 2003 offshore voluntary compliance initiative), which was aimed mostly at taxpayers who used offshore payment cards. As only 1321 taxpayers used the 2003 initiative, I will in the following focus on the program started in 2009. For more information on the history of voluntary disclosure in the U.S. see Madison (2001) and U.S. Government Accountability Office (2013).

[19] For details, see the IRS homepage at www.irs.gov/uac/2009-Offshore-Voluntary-Disclosure-Program, www.irs.gov/uac/2011-Offshore-Voluntary-Disclosure-Initiative and www.irs.gov/uac/2012-Offshore-Voluntary-Disclosure-Program.

[20] Without a voluntary disclosures, civil penalties for tax evasion are the greater of $ 100,000 or 50% of the total balance of the foreign account. In addition, criminal penalties of up to $ 500,000 or up to 10 years of imprisonment are possible for the failure to file a report of foreign bank and financial accounts (OECD, 2010).

[21] In Question & Answer section for the 2009 voluntary disclosure program, the IRS states that "taxpayers run a substantial risk that the uniform penalty structure described in the internal guidance will not be available past the 6-month deadline or that the terms will be less beneficial to taxpayers" in the future (IRS, 2009). By noting that terms will be "less beneficial", the IRS implicitly indicated the possibility that there would still be a somewhat beneficial treatment of voluntary disclosures after the formal program ended. At the very least, by officially offering more lenient penalties for offshore tax evaders for the first time in many decades, persons that were close to indifference whether to evade taxes likely concluded that other such possibilities might arise in the future.

[22] Unfortunately, data is only available for the aggregate of all offshore banking centers, not for individual offshore countries.

Table 3
Accounts, tax payments and penalties from 2009 OVDP.

	Mean	10th Pctl.	Median	90th Pctl.	Total
Offshore account balance	1,923,310	78,315	568,735	4,054,505	28.9 bn
Tax and interest	127,326	155	16,234	247,528	1.9 bn
OVDP penalty	375,879	13,320	107,949	793,166	5.6 bn

Account balances, tax and penalty payments within 2009 OVDP for 2003–2008 in U.S.-$. The account balance is an estimate for the highest balance between 2003 and 2008. Data from U.S. Government Accountability Office (2014), totals are own extrapolations.

location for tax evaders. Table 4 gives an overview of the amount of assets held in these offshore banking centers, and shows that these assets make up a significant fraction of the overall assets U.S. residents hold abroad.

Most deposits in offshore banking centers are not in the local currency. For each offshore banking center, the BIS also provides data on the amount of deposits belonging to foreigners in either "all currencies" or "foreign currencies".[23] Comparing these numbers shows that during the sample period, on average 94% of deposits belonging to foreigners in offshore banking centers were also in foreign currencies.[24]

There are some potential issues with measuring tax evasion indirectly by foreign assets: First, it is not clear if these deposits really belong to individuals. Johannesen and Zucman (2014) show that households hold at least 50% of the tax haven deposits. Second, it is possible that individuals do pay tax on this income. There is, however, little reasons except tax evasion for individuals to hold assets in the very small countries in the offshore banking aggregate.[25]

A further potential problem when studying the introduction of voluntary disclosure in the U.S. is the Foreign Account Tax Compliance Act (FATCA), which went into effect on March 18, 2010, about a year after the introduction of voluntary disclosure (though it was introduced in the House and Senate already on on October 27, 2009). It requires foreign financial institutions to report relevant information on their U.S. clients to the IRS. However, the IRS released the first draft of the actual FATCA regulations only in February 2012; and its implementation was postponed to January 1, 2014.

U.S. residents likely adjusted their portfolios at some time during this period. As individuals profit from tax evasion, it would be rational to adjust portfolios at the latest possible moment. Nevertheless, to minimize the impact of FATCA, I focus on the two years after the introduction of voluntary disclosure, ending the observation period in the first quarter of 2011, well before FATCA went into effect.[26] Nevertheless, the best inference about the effectiveness of voluntary disclosure is likely possible during 2009.

4.3. Research design

I use the synthetic control method, which Abadie and Gardeazabal (2003) developed specifically to analyze the effectiveness of policy interventions at an aggregate level. This method extends the difference-in-differences framework. It creates a control region (the "synthetic U.S.") from a weighted average of J other countries without policy changes (the "donor pool"). The effect of voluntary disclosure can then be inferred by comparing the evolution of tax evasion in the U.S. with that of its synthetic counterpart.[27]

The most important part of this process is to choose the countries for the control group, that is, to choose the weights w_j ($j = 1, \ldots, J$) that each country from the donor pool will have in the synthetic control. These weights constitute a vector $\mathbf{W} = (w_1, \ldots, w_J)'$ of nonnegative weights that sum to one. They are chosen so that the synthetic U.S. resembles most closely the actual U.S. before the introduction of voluntary disclosure. Denoting the vector of preintervention variables for the U.S. by $\mathbf{X}_1$, and the matrix with characteristics of the potential control countries by $\mathbf{X}_0$, one can express the difference between the characteristics of the U.S. and its synthetic counterpart before the introduction of voluntary disclosure by $(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})$. The synthetic control method aims to minimize this difference. To do so, I choose the weights $\mathbf{W}$ used in forming the synthetic control to minimize $\sqrt{(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})'\mathbf{V}(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})}$, where $\mathbf{V}$ is a matrix that reflects the relative importance of the various predictors of offshore deposits. It gives high weights to variables with a large predictive power over offshore deposits and is chosen to minimize the mean square prediction error over the period before the introduction of voluntary disclosure.[28]

The BIS has made available data on the deposits in offshore banking centers of residents in most OECD countries. Specifically, I have data on the offshore deposits of residents from Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Israel, Luxembourg, Mexico, Netherlands, Norway, Poland, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the U.S. I discard from the donor pool the countries that also significantly changed their voluntary disclosure program in the time period (France, Israel, Mexico, Netherlands, Switzerland, Turkey and the United Kingdom). I also drop Germany due to the large-scale acquisition of whistle-blower data (see Appendix 2), and Norway due to a large field experiment that was carried out on the full population of offshore tax evaders (Bott et al., 2014). As almost all counterparty countries signed tax treaties with one or some of the countries in the offshore banking aggregate, I cannot drop these counterparties. No country, however, has signed tax treaties with all offshore banking centers in the sample period. The data set is on a quarterly basis, starting in the first quarter of 2006, so that data on twelve pre-intervention quarters is available.

The outcome variable of interest, *Liab*, are the deposits in offshore banking centers held by residents of various countries ("counterparty countries"). I use the BIS variable "All instruments", which includes deposits, holdings of securities, and other liabilities of the offshore banks towards residents in the counterparty countries. I scale the deposits by the GDP of the counterparty country.

I then construct the synthetic U.S. to match the real U.S. as closely as possible. The synthetic control is based on prior values of *Liab*, using the lag of the last quarter before the introduction of voluntary disclosure (Q4 2008), and then every other quarter going back to Q2 2006. In addition, I match on three additional variables: per capita GDP to control for

Table 4
Foreign asset holdings of U.S. residents.

	2006	2009	2012
Assets held abroad (total)	$ 3,205 bn	$ 4,193 bn	$ 4,132 bn
Assets in offshore centers	$ 1,298 bn	$ 1,634 bn	$ 1,263 bn

All variables are for U.S. residents. Source: BIS.

[23] As this data is not specific to a counterparty location, it is available for each offshore banking center individually.

[24] There is, however, substantial variation across the offshore banking centers. In the Caribbean countries and Bahrain, almost all deposits are in foreign currencies. The British Crown dependencies Guernsey, Jersey and Isle of Man have substantially lower shares of foreign deposits in foreign currencies of 79% (Guernsey), 70% (Jersey) and 36% (Isle of Man). Via these countries, exchange rate movements could affect the overall measure of offshore deposits. To ensure that this is not the case, I use the exchange rate as an additional matching criterion in one of the robustness test described in Section 4.5.

[25] Johannesen and Zucman (2014) also show that tax treaties signed by a tax haven significantly decrease deposits held in this haven, confirming that tax haven deposits are a reasonable proxy for evaded taxes. I will discuss later how the signing of tax treaties may impact the results.

[26] According to Google trends, online queries for "FATCA" started in December 2009, but at a relatively low volume. The number of searches rose significantly only in the second quarter of 2011. Therefore, I end the observation period with the first quarter of 2011.

[27] Given its proximity to the U.S., Canada might seem the most natural control group. However, the offshore deposits of Canadian residents are far smaller than those of U.S. residents, even relative to GDP. Nevertheless, when I use only Canada as the control, the results are similar to the analysis below, albeit noisier.

[28] For more details, see Abadie and Gardeazabal (2003), Abadie et al. (2010).

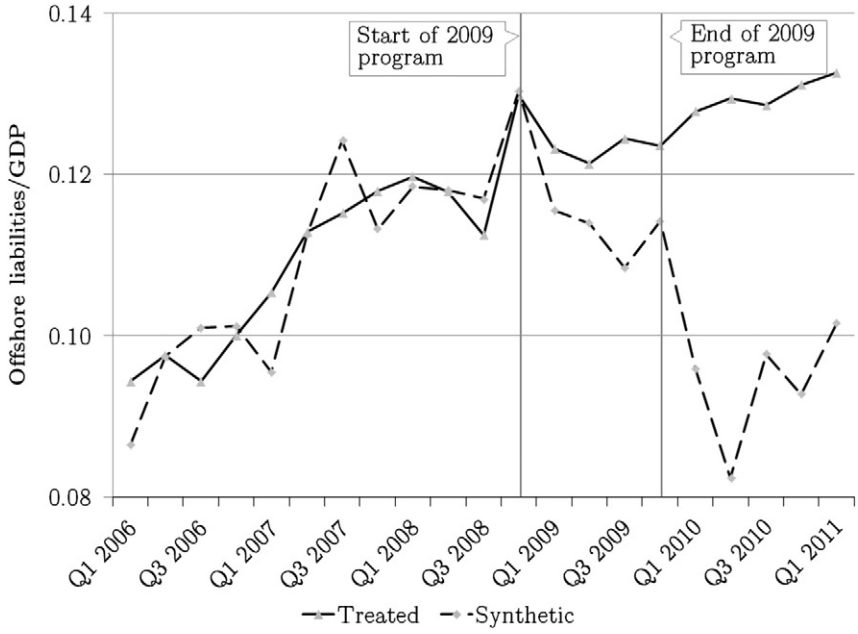

Fig. 4. Trends in *Liab*: United States vs. synthetic United States.

differences in available income, GDP growth to guarantee similar economic experiences over time, and the capital tax rate as provided in the OECD tax database to measure different incentives for evading taxes on capital income. Section 4.5 discusses results when using other matching criteria.

4.4. Results

Using the approach described above and matching on per capita GDP, GDP growth, the capital tax rate and prior values of *Liab*, I find that a combination of Canada (77.2%), Austria (10.2%), Luxembourg (6.8%) and Sweden (5.8%) matches the U.S. best. All other countries obtain a zero weight in the construction of the synthetic U.S.

Fig. 4 shows how the offshore deposits of residents of the U.S. (solid line) and its synthetic counterpart (dashed line) evolved during the period Q1 2006 to Q1 2011. Before the voluntary disclosure initiative in 2009, the deposits of the synthetic U.S. follow those of the real U.S. reasonably closely. Thus, the synthetic control should be a sensible approximation of how the U.S. would have behaved if they had not introduced voluntary disclosure.

After the introduction of voluntary disclosure in the first quarter of 2009, the offshore deposits of the U.S. clearly diverge from their synthetic counterpart. The deposits of U.S. residents rise significantly relative to the synthetic control.[29] This development is in line with the prediction from the model that the existence of a voluntary disclosure program, and thus the ability to come clean at a relatively low cost when circumstances warrant it, increases tax evasion.

After the end of the 2009 voluntary disclosure program, the U.S. diverge even more from the synthetic control. This clarifies that the introduction of the voluntary disclosure program in early 2009 affected offshore deposits in two ways: First, as the model predicts, tax evasion became more attractive due to the expectation of lenient treatment after a possible voluntary disclosure in the future. Second, there were likely some individuals who wanted to come clean even at the current detection probability. In the terms of the model, these individuals could correspond to those with moral costs in $[\alpha_L^{yd}, A]$, who choose to disclose also when the detection probability is low if they have evaded taxes. While they would not have chosen to evade taxes, they may be on the off-equilibrium "evade" path e.g., because they inherited an offshore account. This counteracting effect ends with the end of the voluntary disclosure program at the end of 2009. After the end of the program, only the positive effect described in the model remains; and correspondingly the gap between the U.S. and its synthetic counterpart widens in Fig. 4.

The sharp fall of the synthetic control in early 2010 may also partially be due to the Euro crisis, as there are three European countries in the synthetic control.[30] It is possible that the increased uncertainty induced people to hold their assets closer to home so that they could access them more easily. It is thus not clear how well the synthetic control replicates the U.S. in 2010. Moreover, FATCA legislation is passed in early 2010, however there does not seem to be a noticeable effect on U.S. offshore deposits at that time.

Could something other than the voluntary disclosure program be driving these results? One possible alternative explanation is the election of Barack Obama as president of the U.S. at the end of 2008. The election of a Democrat may have raised fears of higher capital taxes, in particular that preferential tax rates on capital gains would be allowed to expire. This may in turn have increased the incentive to hide money offshore. However, these preferential tax rates (from the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003) were only set to expire at the end of 2010, so that it is unlikely that taxpayers adjusted their tax evasion behavior right at the time of the election. Moreover, recent literature shows that a higher marginal tax rate has at most a very small effect on tax evasion (Kleven et al., 2011). Moreover, at the time of the election, in Q4 2008, the U.S. are very well matched by the synthetic control. Therefore, it is reasonable to believe that the results are not driven by the election.

Another possible concern is the role of the financial crisis. To guarantee that the countries in the synthetic control match the U.S. experience over the crisis, I use GDP growth as a matching criterion. All countries in

[29] In absolute values, the offshore deposits of the U.S. fall, and those of the synthetic control fall even more. This decrease is likely due to the financial crisis and the growing public and political pressure against tax havens in early 2009, which culminated in the announcement of the G20 at its London summit in April 2009 that it would crack down on tax havens (for details see Johannesen and Zucman, 2014).

[30] Indeed, the sharp fall in early 2010 is only visible in the European countries in the synthetic control, but not in Canada.

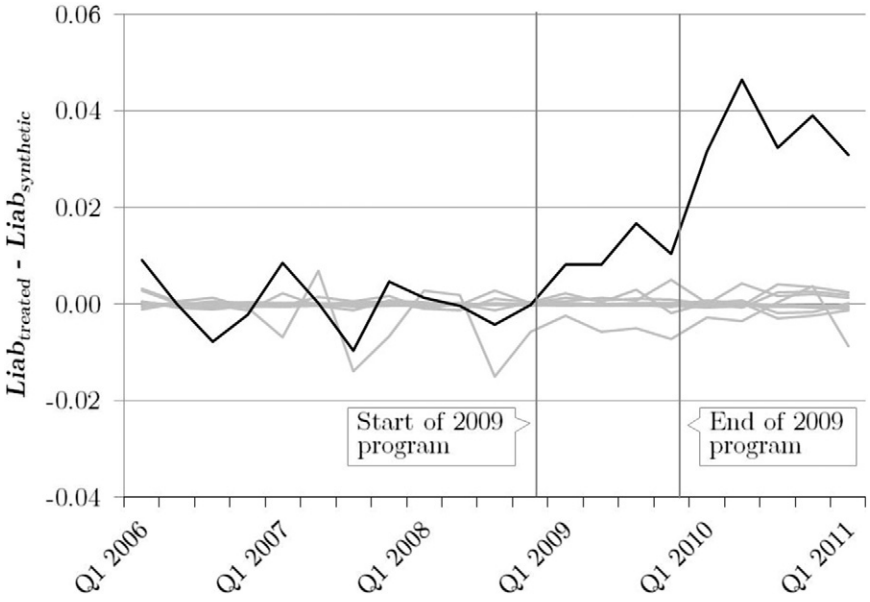

Fig. 5. Placebo test.

the synthetic control show a GDP growth pattern relatively similar to the U.S. over this period.

During the period studied, there were only a few tax treaties between these countries and offshore banking centers: between Canada and the Netherlands Antilles, signed on August 29, 2009, between Sweden and Guernsey and Jersey, signed on October 28, 2008, and Sweden and Bermuda and the Cayman Islands, signed in April 2009.[31] These tax treaties affect only a few of the countries included in the offshore banking aggregate. Moreover, if tax evaders shifted their deposits from one of these countries to other tax havens in response to the treaties (as suggested by Johannesen and Zucman, 2014), they likely shifted them to another offshore banking center.

To assess the significance of the visual result from Fig. 4, one has to consider if chance alone could be driving it. To evaluate this, I carry out placebo tests where I randomly select another country instead of the U.S. as the treated country. If the placebo studies show that the gap estimated for the U.S. is unusually large relative to the gaps of the countries that did not introduce voluntary disclosure, the present analysis provides significant evidence for an effect of voluntary disclosure.

Fig. 5 shows the results of this placebo test. It applies the synthetic control method to every country in the donor pool. Each line in Fig. 5 represents the gap between *Liab* of the treated and the synthetic control for one country. The gray lines show the gap for countries in the donor pool, and the black line denotes the gap estimated for the U.S.[32] The placebo test shows that the higher values of *Liab* in 2009 to 2011 are unlikely to arise by chance, confirming the theoretical result that the introduction of voluntary disclosure leads to more tax evasion.

4.5. Robustness

To test the robustness of these results, I repeat the analysis matching only on prior values of *Liab*, as Abadie et al. (2010) originally suggested. In this case, the synthetic U.S. are a combination of Denmark (79.5%), Sweden (8.2%), Luxembourg (7.2%) and Austria (5.1%). Despite this different control group, the results (reported in Appendix 3 in more detail) are very similar to the analysis with controls presented above.

In a further robustness test, I add the exchange rate of each country relative to a weighted average of the offshore banking centers as a matching criterium. The composition of the synthetic control is very similar to the main analysis (Canada 76.1%, Austria 13.2%, Luxembourg 6.8% and Sweden 4.0%), and correspondingly, the results are also very similar (see Appendix 3, Fig. A.4). In all, the result of increased tax evasion is thus robust to different choices of matching variables.

A general worry with the synthetic control method is that the synthetic control is a good match only during the pre-treatment period (on which basis it is formed), and not for other time periods. The comparison of trends before the intervention (as is usually done with difference-in-difference approaches) is not possible as the synthetic control is formed precisely to make these prior trends parallel. To check whether matched countries consistently develop in similar ways, I have rerun the analysis matching only on the first half of the pre-treatment period. The synthetic control then consists of Canada (93%) and Luxembourg (7%) and continues to match the U.S. very well until the introduction of voluntary disclosure in Q1 2009. The synthetic control and the U.S. then diverge in a way very similar to the main test (see Appendix 3, Fig. A.5).

5. Conclusion

This paper provides some first results on the effects of voluntary disclosure of tax evasion, a topic that has so far not been studied in the economics literature. The theoretical model has pointed out that the existence of a voluntary disclosure mechanism increases tax evasion. An empirical analysis considering the introduction of voluntary disclosure in the U.S. has confirmed this effect. Nevertheless, for a revenue-maximizing government, a voluntary disclosure program can be sensible as it provides a way to collect revenues without incurring high

[31] Based on tax treaty information from Johannesen and Zucman (2014). As Canada is by far the largest country in the synthetic control, one likely worries most about its treaty with the Netherlands Antilles. The Netherlands Antilles are, however, a very small tax haven, holding less than one percent of all foreign deposits in the offshore banking centers. To ensure that the Swedish tax treaties do not affect the results, I rerun the analysis without Sweden and get very similar results.

[32] As in Abadie et al. (2010), I drop countries that have a preintervention mean squared prediction error at least double that of the U.S. This step is necessary as convex combinations of other countries cannot reproduce all countries sufficiently well, leading to some mean squared prediction errors that are many times larger than that of the U.S.

administrative costs for prosecuting tax evaders. Evidence from Germany has shown that these administrative costs are significant.

The topic of voluntary disclosures is especially relevant today, as the detection probabilities for tax evaders have gone up in many countries (e.g., due to whistle-blowers or to better information exchange with tax havens). Therefore, voluntary disclosures have recently played a larger role. In this environment, a voluntary disclosure program is attractive for the government, as it can increase its revenues without overburdening its tax administration. When governments expect further increases in the detection probability, the model predicts they should increase the fine that applies after a voluntary disclosure.

As this paper is the first to study voluntary disclosures, it has been able to shed light on only some of its aspects. A possible extension might consider a situation in which the tax authority has a fixed budget (at least in the short term) and has to allocate its money between catching evaders and prosecuting caught evaders; i.e., it has to trade off a higher detection probability versus the administrative costs of assessing the tax returns of former evaders. A voluntary disclosure program clearly alleviates this tradeoff.

Further arguments concerning voluntary disclosure programs lie outside the revenue-maximization framework provided in this paper. On moral grounds, voluntary disclosure may be desirable as it offers a good way to come clean for taxpayers who have made unintentional errors when filing their tax returns, or inherited offshore accounts. In contrast, opponents of voluntary disclosure question the fairness of allowing tax evaders to come clean with a very low or even no punishment. In any case, the topic of voluntary disclosures of tax evasion clearly provides interesting further research questions and scope for discussion.

Appendix 1. Model with risk averse individuals

This appendix considers the implications of risk averse individuals for the model described in Section 2. Assume that individuals are homogeneous (i.e., that $\alpha_i = 0$ for all individuals) and maximize a well-behaved utility function $U(\cdot)$, with $U' > 0$ and $U'' < 0$. For simplicity, assume that there are no compliance costs when preparing the voluntary disclosure. As the focus of this extension is on the risk averse individuals' decisions, I do not analyze the behavior of the government here, and instead assume that the fine after a voluntary disclosure is zero ($f = 1$), as is the case in several countries (see Table 1).

Each individual receives an exogenous income y, but can choose to declare $x \le y$ on the tax return. The utility if evasion is detected is $U^F = U[y - tx - Ft(y - x)]$, and the corresponding utility if evasion is not detected is $U^0 = U[y - tx]$. If evasion is voluntarily disclosed, the utility is $U^{vd} = U[y - ty]$. Following Allingham and Sandmo (1972), I assume that parameters are such that tax evasion is worthwhile ex-ante, i.e., that $\overline{p}F = [(1-q)p_L + qp_H]F<1$; and that $p_HF > 1$, which implies that tax evasion is no longer worthwhile when the high detection probability occurs.

First, consider again the benchmark case without voluntary disclosure. In this benchmark model, which I denote by a hat on all decision variables, the individuals' expected utility is given by

$$\widehat{EU} = q\left[p_H\,\widehat{U^F} + (1-p_H)\,\widehat{U^0}\right] + (1-q)\left[p_L\,\widehat{U^F} + (1-p_L)\,\widehat{U^0}\right]. \tag{A.1}$$

The first order condition that implicitly determines the individual's choice of $\hat{x}^*$ is

$$\overline{p}\,\widehat{U^F}'(F-1) - (1-\overline{p})\,\widehat{U^0}' = 0. \tag{A.2}$$

The optimal choice of the declared income, $\hat{x}^*$, trades off the probability of being caught and fined against the expected tax saving.

Expected tax revenue net of administrative costs in this benchmark case without voluntary disclosure, expressed per individual, is

$$\hat{T} = t\hat{x} + \overline{p}Ft(y-\hat{x}) - \overline{p}c^a. \tag{A.3}$$

Next, consider how these outcomes change when voluntary disclosure is possible. As in the main model, individuals will in equilibrium only exercise the option to voluntarily disclose the tax evasion they rationally decided to commit earlier if nature draws p_H.

Expected utility if voluntary disclosure is possible is

$$EU = qU^{vd} + (1-q)\left[p_LU^F + (1-p_L)U^0\right]. \tag{A.4}$$

The first term describes utility when the individual chooses to voluntarily disclose, and the second and third term depict the outcome when the low detection probability occurs and the individual either pays the fine (2nd summand) or successfully evades taxes (3rd summand).

Taxpayers declare the income x^* that maximizes Eq. (A.4). The corresponding first order condition is (after simplifying)

$$p_LU^{F\prime}(F-1) - (1-p_L)U^{0\prime} = 0. \tag{A.5}$$

Due to the voluntary disclosure possibility, only the outcomes in the state of the world with the low detection probability matter for the tax evasion decision. If the high detection probability occurs, the individuals voluntarily report themselves and pay the full tax liability.

Expected tax revenues per individual when voluntary disclosure is possible are

$$T = qty + (1-q)[tx + p_LFt(y-x) - p_Lc^a]. \tag{A.6}$$

If nature draws the high detection probability (which occurs with probability q), tax revenue is ty, as all individuals voluntarily disclose. Taxes are only evaded when the detection probability is low. Then, tax revenues are an average of successful evasion and full taxation plus fines, minus administrative costs.

Now consider how the option of voluntary disclosure affects tax evasion, i.e., x^*. Comparing the first oder conditions (A.2) and (A.5) gives

$$\overline{p}\,\widehat{U^F}'(F-1) - (1-\overline{p})\,\widehat{U^0}' = p_L(F-1)U^{F\prime} - (1-p_L)U^{0\prime}, \tag{A.7}$$

Note that $\overline{p}>p_L$ and correspondingly $1-\overline{p}<1-p_L$. Thus, for the equality in Eq. (A.7) to be fulfilled, it has to hold that $\widehat{U^F}'<U^{F\prime}$ and $\widehat{U^0}'>U^{0\prime}$, as U^0 and U^F move into opposite directions when x changes. Due to the concavity of the utility function, this implies that $\hat{x}^*>x^*$, i.e., that more tax is evaded (lower x) when voluntary disclosure is possible. This result is analogous to Proposition 1 from the main model.

More tax evasion could imply that a voluntary disclosure mechanism decreases tax revenues. However, voluntary disclosure could also increase expected tax revenues, as some individuals voluntarily disclose whose tax evasion would not have been detected otherwise. These effects can be seen by comparing Eqs. (A.3) and (A.6):

$$T - \hat{T} = -(1-q)(1-p_LF)t(\hat{x}-x) - qt(p_HF-1)(y-\hat{x}) + qp_Hc^a. \tag{A.8}$$

The first summand shows that if voluntary disclosure is possible, individuals evade more taxes, which lowers tax revenues in the state of the world with the low detection probability. The second summand reflects the effects in the state of the world with the high detection probability. If there are no administrative costs associated with assessing taxes of evaders who have not disclosed (i.e., $c^a = 0$), then Eq. (A.8) is clearly negative; again showing that without administrative cost savings, there is no rationale for a voluntary disclosure program for a revenue-maximizing governments even when individuals are risk averse.

Appendix 2. Voluntary disclosure in Germany

Germany has a long-established voluntary disclosure program in its general tax law. It does not punish tax evasion if the taxpayer voluntarily discloses the tax evasion before the tax authorities start an investigation. For a successful voluntary disclosure, tax evaders have to report all taxes evaded in the last ten years. They then have to repay the taxes evaded in this ten-year period, plus a 6% interest payment per year. There is no fine (beyond the heightened interest rate) after a voluntary disclosure.

German federal states have recently bought data on bank accounts in tax havens from informants. The German state of North Rhine-Westphalia bought the first large dataset on February 26th, 2010.[33] It contained information on the names and credit balances of German-owned accounts in Switzerland. The state of North Rhine-Westphalia, co-financed by the federal government of Germany, paid €2.5 million to an unknown informant. Since then, Germany has bought several other additional CDs with data on accounts in Switzerland and Luxembourg. The data have been shared freely among the German federal states, which are the jurisdictions in charge of all tax collections, including federal income taxes. From the taxpayers' point of view, the acquisition of whistle-blower data constitutes an exogenous increase in the detection probability, which leads to an increase in voluntary disclosures (see Fig. 1).

In this appendix, I use these data acquisitions to quantify the tax revenue raised by voluntary disclosures. The GENESIS data base of the German Federal Statistical Office separates income tax revenues into different categories. One such category is the *veranlagte Einkommensteuer*, self-reported income tax, which summarizes all revenue collected from self-reported income, such as entrepreneurial income, interest income received on foreign bank accounts, and revenue raised after a voluntary disclosure. A different category is income tax collected as payroll tax (*Lohnsteuer*), which is withheld by firms for their employees. I use a difference-in-difference (DiD) design to analyze how the increase in the detection probability after the acquisition of the first whistle-blower data set in February 2010 changed the self-reported income tax revenue relative to the payroll tax revenue.

Fig. A.1 shows yearly tax revenues in both tax categories to provide some evidence of common trends before the intervention. Revenues from self-reported income tax and from payroll tax both increase from 2005–2008, then fall in 2009 as a result of the financial crisis and its aftermath. In 2010, after the acquisition of the whistle-blower data, the revenues for the two tax collection methods diverge: while payroll tax revenues continue to decline (in line with the overall economic development), revenues from self-reported income tax revenues increase, implying that the additional revenues from voluntary disclosures overcompensate the negative trend in tax revenues. In 2011 and 2012, the two tax revenues again move broadly in parallel.

The DiD analysis yields a coefficient on the *Post* Treated* indicator of 688,970, with a p-value of 0.006 (based on a wild cluster bootstrap following Cameron et al., 2008). The coefficient of *Post* is −453,809 (p-value 0.005), the coefficient of *Treated* is −6,734,296 (p-value 0.006), and the R^2 is 0.173. All variables are in thousand Euro and use observations from the 16 German states for the years 2009 and 2010. These results indicate that voluntary disclosures brought in tax revenues of about € 690 million.

In 2010, there were a total of 28,329 voluntary disclosures (see Fig. 1). Comparing this number to the average for the years 2006 to 2009, the increased detection probability in Germany in 2010 is associated with about 18,100 additional voluntary disclosures. Based on these numbers and the results described above, the average additional revenue per voluntary disclosure is about €38,000. Considering that taxes for the last ten years have to be paid after a voluntary disclosure, this number is relatively modest: At the standard tax rate of 25%, this implies undeclared capital income around €150,000 over this ten year period.

Fig. A.1. Revenues of *veranlagte Einkommensteuer*, self-reported income tax, and *Lohnsteuer*, payroll tax, yearly observations from 2005–2012.

An alternative way to estimate the revenue per voluntary disclosure is to use the numbers that the German states themselves report. 13 of the 16 states give some information on the revenue raised from voluntary disclosures since 2010, but they refer only to the actual payments received by the tax authorities, not to the legal obligation. An estimated tax liability is sometimes partially paid before a final ruling has been reached to avoid having to pay additional interest. Thus, there may also be payouts from the tax authorities, as is reflected by decreases in the aggregate revenues from voluntary disclosures in some states. Therefore, these revenues do not reflect the true, legally binding tax liabilities after voluntary disclosures. Nevertheless, they provide a second way to gauge the the average revenue of voluntary disclosures. Dividing the reported aggregate additional revenues by the numbers of voluntary disclosures reported yields average additional revenues of €51,000, and thus of a similar magnitude as the numbers obtained in the DiD analysis.

Appendix 3. Alternative matching for U.S. Empirical Test

This appendix provides robustness tests for the analysis in Section 4. First, I match only on lagged values of *Liab* to create the synthetic control. In this case, a combination of Denmark (79.5%), Sweden (8.2%), Luxembourg (7.2%) and Austria (5.1%) matches the U.S. best.

Fig. A.2 shows how the offshore deposits of residents of the U.S. (solid line) and its synthetic counterpart (dashed line) evolved during the period Q1 2006 to Q1 2010. Again, offshore deposits of U.S. residents increase strongly after the voluntary disclosure program is introduced in 2009.

The placebo test that assigns the intervention to all donor countries in the sample confirms that this increase is unlikely to arise by change (Fig. A.3). Again, the gray lines show the gap for countries in the donor pool, and the the black line denotes the gap estimated for the U.S.

In an additional robustness check, I add a weighted average of exchange rates to the matching criteria used in the main analysis. Fig. A.4 shows these results.

Lastly, Fig. A.5 shows the development of offshore deposits in the U.S. (solid line) and its synthetic counterpart (dashed line) when the synthetic control is defined using only information from the first half of the preintervention period, i.e., from Q1 2006 to Q3 2007. The synthetic control continues to match the U.S. well in the preintervention period.

[33] Already in 2006, Germany acquired a dataset containing information on around 800 Luxembourgian bank accounts. This dataset was smaller than those bought after 2010, which sometimes contained several ten thousand accounts. For details, see FAZ (2011).

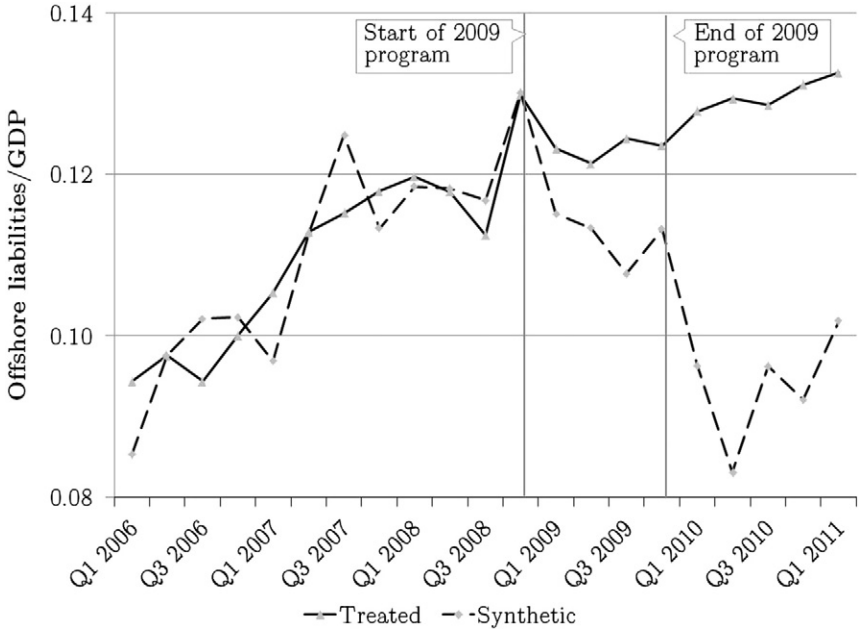

Fig. A.2. Trends in *Liab*: United States vs. synthetic United States, matching only on *Liab*.

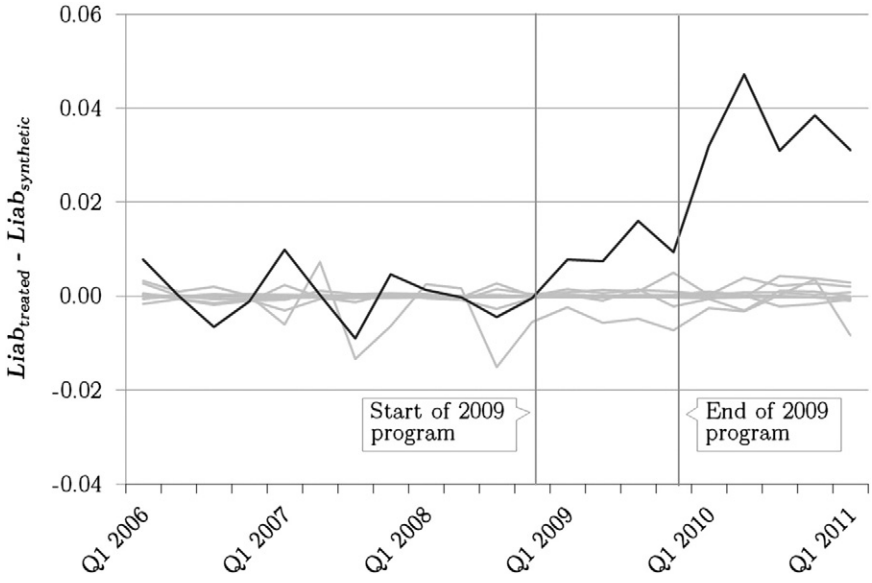

Fig. A.3. Placebo test.

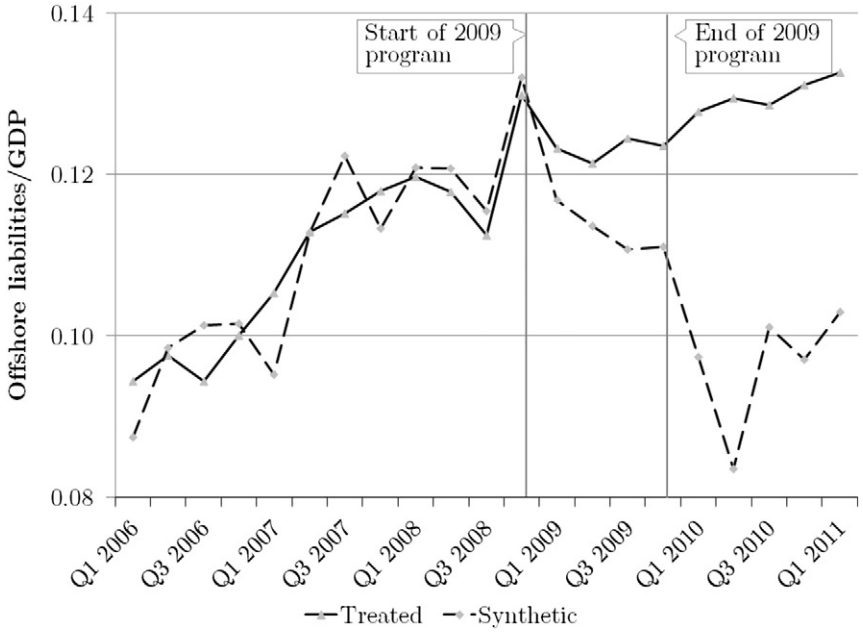

Fig. A.4. Trends in *Liab*: United States vs. synthetic United States, matching also on exchange rates.

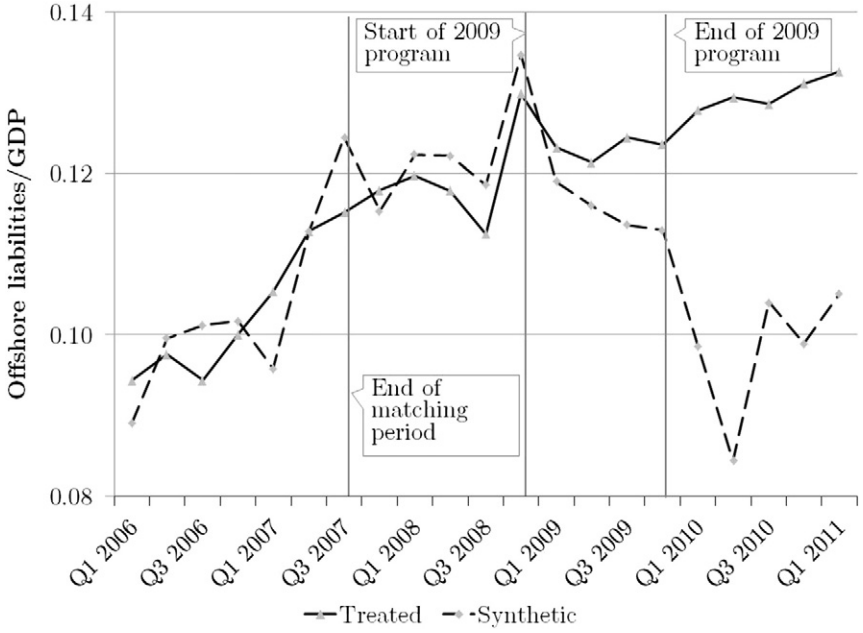

Fig. A.5. Trends in *Liab*: United States vs. synthetic United States, matching only before Q3 2007.

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