Hidden Treasures: The Impact of Automatic Exchange of Information on Cross-Border Tax Evasion

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Abstract

We analyze the impact of exchange of information in tax matters in reducing international tax evasion between 1995 and 2018. Based on bilateral deposit data for 39 reporting countries and more than 200 counterparty jurisdictions, we find that recent automatic exchange of information frameworks reduced foreign-owned deposits in what we label as offshore jurisdictions by an average of 25 percent. This effect is statistically significant and, as expected, much larger than the effect of information exchange upon request, which is not significant. Furthermore, to test the sensitivity of our findings, we employ a finite mixture model that classifies countries into offshore and non-offshore jurisdictions based on the observed reaction to the introduction of information exchange. We show that our findings are robust to the choice of offshore classification.

I. INTRODUCTION

International tax evasion raises several concerns from a public policy perspective as it reduces government revenues, impacts the fairness of the tax system, and ties in with other illegal activities such as money laundering, terrorist financing, bribery and corruption. One of the most important policy tools to fight international tax evasion and help countries enforce worldwide taxation of their residents is exchange of information (EOI) between national revenue authorities (Keen and Lighart, 2006). While each EOI framework varies in its scope and modalities, the underlying principle remains the same: EOI is meant to provide tax authorities access to information which they may not otherwise be able to obtain. In doing so, it supports tax authorities' ability to detect international tax evasion through targeted risk and personal income tax assessments and to deter its occurrence, including through taxpayer awareness campaigns (EC, 2018).

Drawing on Bank of International Settlements (BIS) restricted locational banking statistics, we test the impact of four different EOI frameworks in addressing international tax evasion. The dataset records foreign-owned deposits in 39 countries held by residents of over 200 counterparty jurisdictions on a quarterly basis since 1995.[1] Assuming EOI agreements pose a credible threat to tax evaders insofar as they increase the perceived risk of the domestic tax authority becoming aware of undeclared foreign income, one would expect to observe a behavioral response from tax evaders (Allingham and Sandmo,1972). For instance, some tax evaders may opt to bring undeclared foreign deposits onshore by unwinding round-tripping schemes or by taking advantage of voluntary disclosure initiatives to protect themselves against criminal prosecution. Others may decide to leave their undeclared deposits offshore but reallocate them to jurisdictions where the risk of being reported is perceived as being smaller. Based on a sample of over 230,000 observations, we find that deposits held in offshore jurisdictions[2] decrease by between 8 and 12 percent following the conclusion of a bilateral agreements related to EOI upon request (EOIR), although this relationship has weak statistical significance. In contrast, automatic EOI (AEOI) agreements are significantly more effective, reducing deposits in offshore jurisdictions by around 25 percent.

We complement this analysis by quantifying the effect of EOI agreements on deposits in non-offshore centers held by (or through) residents from offshore centers. As the locational banking statistics indicate immediate rather than ultimate ownership, money flowing through entities residing in offshore centers may not be beneficially owned by residents of that offshore country, but rather by residents of the non-offshore bank holding the deposits or even by third-country

[1] As discussed throughout the paper, we recognize that not all cross-border deposits are driven solely for tax evasion purposes, and that furthermore, deposits present only a partial view of the equation, since wealth can be stored under other financial and non-financial assets. Notwithstanding, we highlight such limitations whenever important for interpretation and choose to use this dataset in continuity with existing literature on the subject.

[2] We use the terminology "offshore" to designate countries whose legal frameworks and/or practices are conducive to facilitating financial secrecy, which can elicit practices such as tax evasion, asset underreporting, and money laundering. Others in the literature often refer to such countries as "tax havens," though that terminology may not fully capture the motivation of foreign investors to hold assets in those countries. We primarily rely on the list of offshore jurisdictions provided by Johannesen and Zucman (2014).

residents. Earlier evidence of a home bias in portfolio choices (e.g., see French and Poterba (1991), Cooper and Kaplanis (1994), and Tesar and Werner (1995)) indeed suggests that some of the wealth hidden in offshore centers is likely reinvested in the tax evader's country of residence, behavior which is also known as round-tripping. Testing the response in the deposits held by offshore center residents in non-offshore banks, our results also tend to confirm the effect of EOI in countering possible round-tripping schemes. However, we do not find evidence that the US automatic exchange initiative, the Foreign Account Tax Compliance Act (FATCA), has reduced round-tripping to the US. In contrast, we find that deposits from offshore centers into the US increased following the introduction of FATCA Intergovernmental Agreements (IGAs). This might be related to various factors, including the removal of a withholding tax threat, a lack of information exchange reciprocity by the US[3], and the non-imposition of tax on certain US sourced portfolio interest received by non-residents.

This paper contributes to the existing literature in three key areas. First, our work extends earlier evidence on the effects of EOI, in terms of both the scope of the agreements analyzed and the time-period covered. Prior work tends to focus on the effect of specific EOI agreements. For instance, Johannesen (2014) analyzes the effect of the EU's Savings Directive, Johannesen and Zucman (2014), henceforth JZ2014, examine the effect of the Savings Directive and EOIR, De Simone, Lester and Markle (2018) investigate the effect of FATCA on round-tripping and Casi, Spengel, and Stage (2018), henceforth CSS2018, analyze the effect of the Common Reporting Standard (CRS)[4]. These studies use data covering between 3 and 13 years, and consistently find that EOI exerts some influence on foreign-owned deposits. However, empirical results from studies failing to control for all agreements simultaneously likely suffer from an omitted variable bias, since EOI agreements can affect both the deposits between any given country-pair and the probability that those countries will enter into additional EOI agreements. To overcome this gap, we analyze the effects of all existing bilateral EOI agreements over the last 20 years – which includes over 3,000 EOIR agreements, 85 FATCA agreements, EOI under the European Union Savings Directive and its related arrangements, and the CRS – rather than only a subset of them.

Second, we improve identification of the causal impact of EOI agreements by employing a triple-differenced estimator. Previous work has typically used a simpler difference-in-differences (DD) based approach where the progression of deposits in offshore jurisdictions without an EOI agreement serves as the counterfactual outcome for *treated* offshore jurisdictions. In other words, this approach exploits a narrow subset of all cross-border deposits, by using offshore jurisdictions as both the treatment and control group. However, the treatment effect identified as such potentially captures various factors, some of which might be unrelated to tax evasion. For instance, if double tax treaties increase tax certainty for foreign investors, foreign-owned deposits would likely increase as a result. On the other hand, double tax treaties also provide for EOI. By focusing on offshore jurisdictions only, the DD based approach confounds the positive effect of double tax treaties with any negative effect of EOI on tax evasion and thus biases

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[3] Lack of reciprocity in this context refers to US financial institutions not having equivalent due diligence procedures and reporting obligations as those imposed on other jurisdictions.

[4] The international standard underpinning the global effort to develop an automatic exchange of information regime by the OECD and G20, described in further detail in section **Error! Reference source not found.**

results. The triple differenced estimator improves identification by estimating the effect on offshore and non-offshore jurisdictions separately and using the difference of these effects as an estimator of EOI's impact on tax evasion. [5] Our findings are economically more meaningful when using the triple-differenced approach, underscoring the importance of controlling for factors that are correlated with EOI but likely not related to tax evasion.

Third, recognizing the subjectivity involved in classifying countries as offshore jurisdictions, we test the sensitivity of our findings to the choice of offshore list. Various classifications have been proposed:[6] for instance, Hines and Rice (1994) develop a list of 41 jurisdictions based on the coexistence of low business tax rates and the identification of these countries by "multiple authoritative sources" (Dharmapala and Hines, 2009); the Organisation for Economic Co-operation and Development (OECD) published in 2000 a black-list (which was later complemented by a grey and white list) of 35 countries based on the level of taxation and a lack of either EOI, transparency or substance requirements (Avi-Yonah, 2009); JZ2014 used a list of 51 countries based on similar criteria. The overlap between these lists is less than perfect. However, the choice of which countries constitute offshore jurisdictions is an integral part of the identification approach and has a profound impact on the measured effect of EOI.

To address this challenge, we employ a finite mixture model that estimates the offshore-status of over 200 jurisdictions in a data-driven way. The approach builds on the assumption that foreign-owned deposits respond differently to the introduction of EOI, depending on whether the bank or the saver are located in an offshore jurisdiction. Starting with the JZ2014 classification, we re-estimate the baseline specifications but allow for the potential that some (or all) of the countries were wrongly classified. Intuitively, the algorithm identifies outliers under the current classification, based on a maximum likelihood criterion, and updates probabilities that any country belongs to one group or another. Notably, the approach neglects a country's tax and regulatory environment which ultimately determine the usefulness of a foreign jurisdiction in sheltering income. The findings from this analysis thus need to be interpreted with caution and may not replace a qualitative assessment of a country's legislation to pinpoint which jurisdiction constitutes an offshore center. However, the algorithm-based classification allows testing the sensitivity of our findings on a basis which is free from subjective assessment.[7]

The remainder of this paper is structured as follows. Section 2 provides background on the different EOI frameworks. Section 3 discusses potential identification strategies and classifies existing work on the impact of EOI. Section 4 presents empirical results and Section 5 concludes.

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[5] A related but distinct approach is chosen by CSS2018 who also use non-offshore jurisdictions as a control. However, due to the time structure included in their empirical model, the measured effect is not a triple differenced estimator. See section III.A for further details.

[6] See Schjelderup (2016) for an overview.

[7] See Zorome (2007) for another data-driven attempt to classify offshore jurisdictions.

II. Background on Exchange of Information in Tax Matters

A. Different Frameworks for EOI Over Time

Cross-border deposits can exist for a gamut of reasons, several of which can be orthogonal to tax evasion. Savers may want to invest elsewhere for passive diversification of foreign exchange, exploiting interest rate differentials, cross-border trade settlement, or migration linkages (such as remittance flows) (see for example Fornari and Levy, 2000; Masciandaro, 2004; Karpowicz, 2006; and Lane and Milesi-Ferretti, 2008). Notwithstanding, there is empirical evidence relating non-bank international deposits to tax rates on interest income and standards for domestic bank interest reporting, which is suggestive of tax evasion motives (Huizinga and Nicodeme, 2004). Income earned on offshore assets is particularly vulnerable to imperfect compliance due to the additional layer of informational asymmetry between a foreign tax authority and an individual's resident authorities. In this context, EOI arrangements can support the enforcement of residence based taxation, with positive effects on production efficiency (Keen and Lighart, 2006), by increasing the likelihood of detection of cross-border tax evasion or money laundering.

The traditional model consisted in undertaking EOIR, if and when domestic tax authorities needed information located in another jurisdiction to properly enforce worldwide taxation of its residents.[8] This model suffered from a range of limitations. First, there was no obligation for a jurisdiction to provide the information requested by another jurisdiction if the first-mentioned jurisdiction did not have an interest in the information requested for its own domestic tax purposes. In 2005, the OECD amended its Model Tax Convention by adding a new paragraph 4 to Article 26 to deal with this issue.[9] Second, EOIR required that the requesting jurisdiction present a sufficiently detailed request in which it needed to demonstrate that the information being requested is foreseeably relevant to the administration or enforcement of its domestic tax laws.[10] The need to meet this somewhat subjective threshold significantly limited the potential benefits from EOIR as tax evasion schemes are, by their very design, intended to ensure that information is concealed from domestic tax authorities. Third, EOIR has historically relied on bilateral relationships under a double tax treaty (DTT) or a tax information exchange agreement (TIEA) as the legal basis for undertaking the exchange. Access to information thus necessitated the successful conclusion of one of those instruments, which could take years in the making.[11] While the number of

[8] Our analysis of EOIR focuses on bilateral relationships, and thus omits relationships established under the 1988 multilateral Convention on Mutual Administrative Assistance in Tax Matters, as amended by Protocol in 2010. The authors recognize that future research would gain from incorporating such relationships into the analysis.

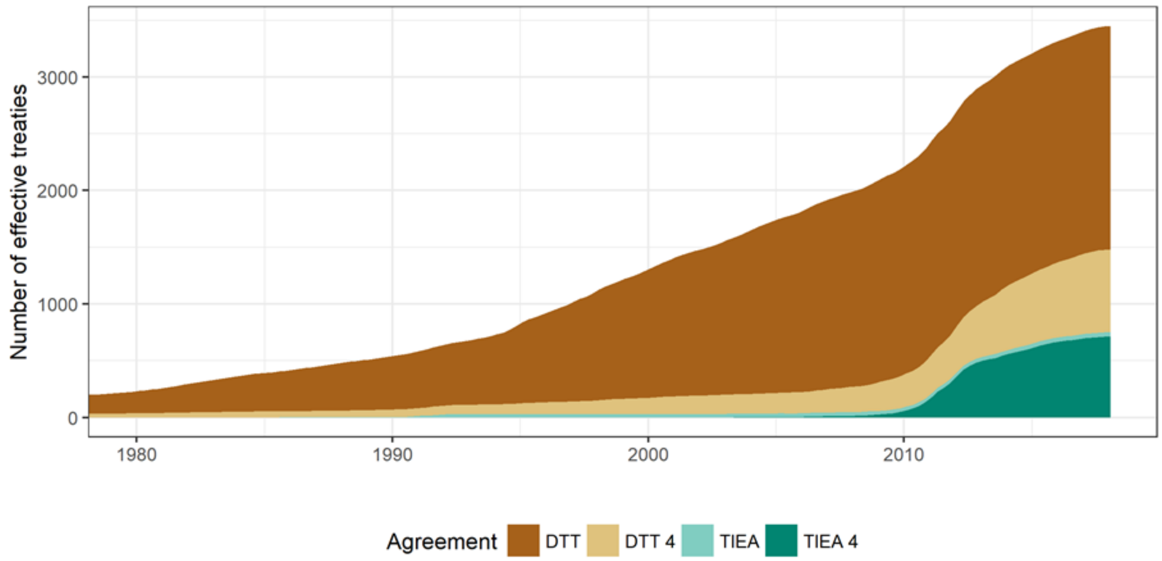
[9] At the same time, paragraph 5 was also added which does not permit the requested country to decline to supply information solely because the information is held by a bank, other financial institution, nominee or person acting in an agency or a fiduciary capacity or because it relates to ownership interests in a person.

[10] Under EOIR, a requesting competent authority needs to identify a specific taxpayer and strictly prohibited so-called "fishing expeditions" (such as requesting all bank account information held in a foreign country by its residents).

[11] And, in the case of a DTT, require tax concessions which may outweigh the expected benefits of obtaining access to the information being sought.

bilateral relationships providing for EOIR has been steadily growing over the last few years, it remained challenging to ensure that all possible offshore locations were effectively covered under a given jurisdiction's DTT/TIEA network (see Figure 1 which differentiates DTTs and TIEAS with and without paragraph 4).

Figure 1. EOIR under DTTs and TIEAs



Data source: Exchange of information portal, OECD.

In light of these challenges, new models for undertaking EOI in tax matters emerged.[12] These models focused on the automatic sharing of taxpayer information, which effectively amounts to an extraterritorial extension of the longstanding practice of using third-party reporting to support taxpayer compliance under self-assessment-based tax systems.

The first significant multilateral move towards a systematic framework for AEOI came from the European Union (EU). In June 2003, EU Member States reached an agreement to have banks and other financial institutions ("paying agents") disclose information on interest income earned by non-resident individuals to the domestic tax authority, who would then automatically exchange that information with the tax authorities of the accountholder's jurisdiction of residence.[13] This

[12] Though AEOI per se is not completely new. For example, Canada and the US have had AEOI since 1942.

[13] Three countries—namely Austria, Belgium, and Luxembourg—were permitted to apply a withholding tax in lieu of reporting. This means that the identity of the accountholder could be preserved, for a price. Withholding rates were set to gradually increase from 15 percent (2005-2007), to 20 percent (2008-2010), and then finally to 35 percent (2011 onwards), with a 75/25 revenue sharing scheme between the residence and withholding country respectively. Belgium applied withholding until 31 December 2009, Luxembourg until 31 December 2014, and Austria until 31 December 2016. The distinction between reporting and withholding is not taken to be a significant one for the purpose of our analysis, as both could be expected to disincentivize undeclared foreign bank accounts.

landmark agreement, colloquially referred to as the EU Savings Directive (EUSD),[14] came into effect on 1 July 2005. In order to help preserve a level playing field, similar arrangements providing for either reporting or withholding were concluded with select non-EU countries (Switzerland,[15] Andorra, Liechtenstein, Monaco and San Marino) as well as 10 dependent and associated territories (Aruba, Anguilla, British Virgin Islands, Cayman Islands, Guernsey, the Isle of Man, Jersey, Monserrat, Netherlands Antilles,[16] and the Turks and Caicos Islands).[17] The EUSD was eventually repealed and superseded by parts of Council Directive 2014/107/EU which provides for the implementation of broader AEOI consistent with the "Common Reporting Standard" (discussed below) as of 1 January 2016.[18]

Amidst several banking scandals involving international tax evasion schemes—including with LGT Bank in Liechtenstein and, most notably, the Union Bank of Switzerland (UBS) and Crédit Suisse—and growing concerns that the qualified intermediary program that had been implemented in 2001 was being exploited,[19] the US followed suit and made a much bolder move towards global application of AEOI. Enacted in 2010, the Hiring Incentives to Restore Employment (HIRE) Act included provisions—commonly referred to as FATCA—targeting non-compliance by US taxpayers (both US residents and citizens) using undeclared foreign accounts to conceal income. On the threat of a 30 percent withholding tax on US-source income, foreign financial institutions (FFIs) were either "encouraged" to directly enter into a FFI Agreement with the US Internal Revenue Service (IRS) to undertake certain due diligence, reporting and withholding requirements under FATCA or required to comply with the FATCA Intergovernmental Agreements (IGA) treated as in effect in their jurisdictions. FATCA requires FFIs to identify and report information about financial accounts held by US taxpayers, or by foreign entities in which US taxpayers hold a substantial ownership interest, such as the name, address, and taxpayer identification number of the account holder, the account number, account balance, and income (including interest and dividends), and sales proceeds. FATCA went into effect on July 1, 2014

[14] The official name is Council Directive 2003/48/EC on taxation of savings income in the form of interest payments.

[15] Switzerland opted to retain bank secrecy and apply withholding. It did so until 31 December 2016.

[16] Now Curaçao and Sint Maarten.

[17] Of these dependent/associated territories, four (Aruba, Anguilla, the Cayman Islands and Montserrat) opted for AEOI from the date of the start of application of the relevant agreements on 1 July 2005. Since that date, Guernsey (1 July 2011), the Isle of Man (1 July 2011), the British Virgin Islands (1 January 2012), the Turks and Caicos Islands (1 July 2012) and Jersey (1 January 2015) also moved to AEOI (see https://ec.europa.eu/taxation_customs/individuals/personal-taxation/taxation-savings-income/international-developments_en).

[18] It should also be noted that through Directive 2011/16/EU, EU cooperation in tax matters also extends to AEOI in respect of five non-financial sources of income: employment income, pensions, directors' fees, life insurance products, and immovable property ownership and income related thereto.

[19] By adhering to the qualified intermediary program, non-US financial institutions could escape the application of backup US withholding by agreeing to certain documentation and withholding responsibilities (Byrnes and Munro, 2017).

and to date 113 jurisdictions[20] have reached agreement with the US to undertake AEOI under one of three different types of FATCA IGAs.[21]

Recognizing the benefits of implementing an AEOI framework on a truly global (and multilateral) basis, and mindful of the need to standardize FATCA-style due diligence procedures so as to minimize implementation costs for the financial sector, other countries soon followed suit in moving towards a new AEOI regime. In September 2013 at the St. Petersburg Summit, G20 Leaders committed to AEOI as the "new global standard" and endorsed the OECD's work to develop the Common Reporting Standard (CRS) which provides for multilateral exchange of financial account information in tax matters. In July 2014, the OECD released the final version of the CRS, which contains the reporting and due diligence procedures that underpin AEOI under the new standard. Much like FATCA from which it largely draws, the CRS has broad scope and covers many financial institutions such as custodial institutions, depository institutions, investment entities and specified insurance companies. It also requires financial institutions to look through passive entities to identify the relevant controlling persons, the "beneficial owners". Aside from a few mostly technical details, the main difference between the CRS and FATCA resides in the fact that the CRS was designed for multilateral implementation with full reciprocity between participating jurisdictions.[22] It marks an unprecedented international effort to combat international tax evasion; as of November 2018, 101 jurisdictions committed to start AEOI under the CRS framework by 2017 or 2018, and an additional seven countries committed to doing so in 2019 or 2020.[23]

B. Skepticism Over the Impact of AEOI Frameworks

While AEOI under the EUSD, FATCA and the CRS were all meaningful steps in the fight against international tax evasion, questions have emerged as to whether these frameworks have or would truly be effective in achieving their underlying objectives of detecting and deterring tax evasion.

For example, from the EUSD's inception, there were persistent concerns that it would be far less successful at preventing tax evasion as first hoped as it could be circumvented in a number of

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[20] Out of these, 88 IGAs are in force, 13 are signed but not yet in force, and 12 are agreed in substance. https://www.treasury.gov/resource-center/tax-policy/treaties/pages/fatca.aspx

[21] Model 1 IGAs (both 1A and 1B) require the relevant competent authorities to collect information from their domestic FIs and submit this information to the IRS (a procedure aimed at circumventing domestic privacy legislation). The difference between Model 1A and Model 1B is that the former is partially reciprocal while the latter is not. Model 1A IGAs are not fully reciprocal as the US does not provide the balance or value of reportable accounts, gross proceeds, or beneficial ownership information, nor does the US require its FIs to look through entities, whereas FATCA partners are required to. A Model 2 type requires FFIs to register with the IRS and directly report to the IRS customer-specific information as required under the FFI Agreement with the US.

[22] In addition, FATCA's requirement to also identify and report on US citizens, not just US residents, is perhaps another notable difference.

[23] Global Forum on Transparency and Exchange of Information for Tax Purposes: "AEOI: Status of Commitments," November 2018.

ways. For instance, as the EUSD initially only focused on accountholders who are individuals, it could be avoided through the use of trusts, foundations, or other entities. Other sources of concerns pertained to the possible relocation of assets outside the EUSD-covered jurisdictions to avoid reporting or withholding, or their relocation to other investments not covered under the EUSD's relatively narrow scope.

There is broad skepticism that FATCA has generated anything close to the amount of revenue initially anticipated. FATCA was projected to generate $8.7 billion in revenue between fiscal years 2010-2020,[24] a yearly average of $792 million, in an effort to act on the unsubstantiated claim that "each year, the United States loses an estimated $100 billion in tax revenue due to offshore tax abuses" (Byrnes and Munro, 2018). The limited information that is publicly-available suggests that FATCA may not have lived up to its hype. For example, since the Offshore Voluntary Disclosure Program's initial launch in 2009,[25] more than 56,000 taxpayers used the program and paid a total of $11.1 billion in back taxes, interest and penalties.[26] However, the bulk of these proceeds are believed to come from anti-money laundering penalties applied against individuals' foreign assets for failure to file the Report of Foreign Bank and Financial Accounts (FBAR) form, instead of being based on non-compliance with tax obligations (Byrnes and Munro, 2017). Also, while the IRS has spent approximately $380 million to implement and administer the FATCA program, a recent report from the Treasury Inspector General for Tax Administration (TIGTA) concludes that the IRS is still not prepared to enforce compliance with FATCA.[27]

In the case of the CRS, participating jurisdictions may choose to allow its financial institutions to apply a threshold such that preexisting entity accounts below US$ 250,000 are not subject to review. Hence, tax evaders using sham entities in a jurisdiction availing themselves of this option may remain undetected by fragmenting their holdings into multiple entity accounts before the entry into force of the enabling domestic legislation. Another technique to conceal beneficial ownership (which rests on a 25 percent threshold, the international standard set by the Financial Action Task Force), would be to dilute interest in a given passive entity between related individuals (e.g., between spouses, children, grandchildren, etc.). For new individual accounts, due diligence procedures contemplate that FIs can rely on customers' self-certification (and the FI's confirmation of its reasonableness).[28] A concern arises with the increasing number of countries

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[24] Joint Committee on Tax. Estimated Revenue Effects Contained in Senate Amendment 3310, the "Hiring Incentives to Restore Employment Act", under consideration by the Senate.

[25] The OVDP is a partial amnesty program that allows persons not under audit to disclose unreported offshore activities and benefit from reduced civil and criminal penalties. Launched in 2009, it was extended and modified in 2011, 2012 and again most recently in 2014. The OVPD program ended on September 28, 2018.

[26] https://www.irs.gov/newsroom/irs-to-end-offshore-voluntary-disclosure-program-taxpayers-with-undisclosed-foreign-assets-urged-to-come-forward-now

[27] Treasury Inspector General for Tax Administration, July 5, 2018 Final Report (reference number 2018-30-040).

[28] Regarding non-resident holders of existing accounts, FIs need to conduct 'Permanent residence test' based already existing documentary evidence or residence-indicia search of electronically searchable data maintained in the FI.

offering "citizenship/residence by investments" schemes,[29] which would seemingly allow these individuals to avoid reporting in their true residence jurisdiction by documenting nexus in the countries where citizenship was purchased (e.g., by providing a passport and a utility bill).[30]

These claims all appear to raise legitimate concerns about the different challenges that these AEOI frameworks may face in being effective in combatting offshore tax evasion. However, they are largely based on anecdotal evidence and *a priori* analysis of the underlying due diligence and reporting obligations. To more systematically analyze the impact of the EUSD, FATCA and CRS on tax evasion in offshore jurisdictions, we turn to empirical analysis.

III. EMPIRICAL STRATEGY

A. Measuring the Impact of EOI

Previous empirical work sought to quantify the impact of EOI by estimating variants of the regression specification:

$$log\left(deposit_{ijt}\right) = \beta * T_{ijt} + \lambda_t + \mu_{ij} + \varepsilon_{ijt} \tag{1}$$

where, $deposit_{ijt}$ are foreign-owned deposits in country i held by residents of country j in time t, T_{ijt} is an indicator variable taking the value one if an EOI agreement between i and j is effective in year t, λ_t is a time-specific fixed effect, μ_{ij} is a pair-specific fixed effect and ε_{ijt} is an idiosyncratic error. By including a set of time-specific fixed effects, the coefficient β can be interpreted a DD-based estimate of the treatment effect: it captures the relative change in the deposits of countries where an EOI agreement became effective that exceeds the relative change in the control group where a similar agreement is not in effect.[31]

The BIS locational data provides information on the deposits held in 39 reporting countries (banks) owned by non-residents in over 200 counterparty jurisdictions (savers). By classifying banks and savers into offshore and non-offshore jurisdictions, the data can be seen to consist of four different subsets (Table 1). Previous studies have focused on different subsets to identify the treatment effect of EOI. For instance, JZ2014 use the subset of banks in offshore jurisdictions and

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[29] Including countries such as Saint Lucia, Antigua and Barbuda, Dominica, St. Kitts and Nevis, Grenada, Comoros, Vanuatu, Malta, Cyprus, Bulgaria, and Austria. See Finance & Development, International Monetary Fund, December 2015 issue featured "A passport of Convenience" (http://www.imf.org/external/pubs/ft/fandd/2015/12/gold.htm).

[30] The OECD is aware of the issue and initiated public consultation on abuse of residence by investment schemes to circumvent the CRS. See http://www.oecd.org/tax/oecd-releases-consultation-document-on-misuse-of-residence-by-investment-schemes-to-circumvent-the-common-reporting-standard.htm. More recently, the OECD has established criteria for schemes which are high risk for the CRS and published such a list. There is CRS guidance for additional expectations on a FI encountering an account holder claiming to be resident in such a country. See, e.g., http://www.oecd.org/tax/automatic-exchange/news/jurisdictions-take-action-to-address-the-potential-misuse-of-rbi-cbi-schemes-for-crs-circumvention-purposes.htm.

[31] Time-specific fixed effects allow for variation in control group deposits over time while the common trend assumption of DD-based identification provides the necessary restriction to interpret differences in trends between the two groups, as captured by the coefficient β, as an estimated treatment effect.

savers from non-offshore jurisdictions (subset C in Table 1) to estimate equation (1).[32] In this case, the implicit control is the progression of deposits held in offshore jurisdictions by non-offshore savers whose country has not concluded an EOI agreement. In contrast, given the focus on the treatment effect of EOI agreements on round-tripping, Menhoff and Miethe (2017) use the subset of non-offshore banks and offshore savers (subset B). The implicit control group in this case are the deposits held in non-offshore jurisdictions by savers in offshore countries where there are no EOI agreements in place. CSS2018 use a slightly different approach and combine subsets A and C to look at deposits held in all banks, including offshore and non-offshore, by non-offshore savers. To identify the treatment effect of the CRS, they include an interaction between T_{ijt} and an indicator which classifies banks into offshore and non-offshore jurisdictions as an additional regressor in equation (1).

Table 1. Subsets of Locational Data and Measured Effects

		Saver	
		Non-offshore	Offshore
Bank	Non-offshore	A	B
	Offshore	C	D

Combining subsets A and C allows to control for factors that are unrelated to tax evasion but potentially correlated with EOI agreements. For instance, increased legal certainty provided by DTTs might attract additional FDI and thus increase foreign-owned deposits. Treatment effects identified on basis of subset C alone would confound this positive effect from increased legal certainty, in this example, with the potentially negative effect from an increased risk for tax evaders. In contrast, the DD approach based on the wider sample captures the positive effect from legal certainty, which also impacts deposits in subset A, and allows differentiating this effect from the negative effect from an increased risk for tax evaders, which only affects deposits in subset C. Notably, if a given EOI framework leaves deposits in the non-offshore sample unaffected, then the DD approach using the wider sample identifies the same treatment effect which could be obtained by using subset C alone.

We employ a generalized version of the methodology used by CSS2018 by estimating

$$\log(deposit_{ijt}) = \beta_1 * T_{ijt} + \beta_2 * T_{ijt} * Off_i + \lambda_t^{Non-Off} + \lambda_t^{Off} + \mu_{ij} + \varepsilon_{ijt}, \tag{2}$$

on the sample of deposits held in all banks (offshore and non-offshore) by savers located in non-offshore jurisdictions (subsets A and C in Table 1). The indicator Off_i takes the value of one if the bank is classified as an offshore jurisdiction. In our baseline regressions, we rely on the classification proposed by JZ2014 in their online appendix. Section V.C then tests the sensitivity of our findings to the choice of offshore list. We use five indicators for the existence of an EOI agreement: EOI4 reflects the existence of an EOIR relationship which includes a clause similar to paragraph 4 of Article 26 of the OECD Model Tax Convention; *EUSD* relates to an effective agreement to exchange information or applying withholding in lieu of reporting under the EUSD;

[32] Likewise, Menkhoff and Miethe (2017) used this subset in the analysis of outbound investments.

FAT pertains to the existence of a FATCA relation being in effect; *CRS* relates to the CRS being in effect (i.e., whether countries i and j adhere to the CRS and have activated their AEOI relationship); and *AEOI* takes the value of one if any of the automatic exchange of information frameworks exists.

The key difference to CSS2018 is that we include two sets of time-specific fixed effects: one set for offshore banks λ_t^{Off} and one for non-offshore banks $\lambda_t^{Non-Off}$.[33] Effectively, we thus estimate two treatment effects, which could be obtained by estimating equation (1) separately for subsets A and C, in a single equation. By estimating them jointly and using dummy variable contrasts, the coefficient β_2 captures the difference between these two DD-based treatment effects. In other words, the coefficient is a triple differenced estimate of the treatment effect, capturing the *relative* effect of EOI agreements on offshore banks which exceeds the effect of EOI agreements on non-offshore banks. Notably, we do not use the entire sample of all banks and all savers in this first set of regressions, since neither subset B nor subset D could provide an adequate counterfactual to the effect of EOI agreements on foreign-owned deposits which are unrelated to tax evasion.

In a second set of estimations, we apply the logic of equation (2) to test the effect of EOI agreements on round-tripping. Specifically, using the subset of deposits held by all savers (offshore and non-offshore) in non-offshore banks (subsets A and B), we re-estimate equation (2) where now Off_j takes the value of one if saver j is an offshore jurisdiction. We use robust standard errors (Arellano, 1987) in all estimations that account for clustering at the bank-saver level and allow for arbitrary heteroscedasticity.

B. Identifying Offshore Banks

The classification of countries into offshore centers and non-offshore centers is central to measuring EOI's impact: leaving other factors aside, effective EOI agreements are only expected to reduce deposits in offshore centers where income is hidden, but not in other jurisdictions. Consequently, an excessively broad definition of tax havens will result in a downward bias of EOI's measured impact. In contrast, too narrow a definition may result in either a downward or upward bias.[34]

Lacking a universally accepted classification of countries, we instead reverse the problem: we take EOI's impact as a given and seek to identify offshore jurisdictions by analyzing the response of bank deposits following the conclusion of an EOI agreement. Intuitively, we would expect that foreign-owned deposits decrease in offshore jurisdictions but not (or much less so) in non-offshore jurisdictions. More generally, the response of cross-border deposits to an EOI agreement depends on whether the bank and the saver are offshore centers or not (see Table 1).

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[33] CSS2018 include residence (saver) country time-specific fixed effects. Since the treatment of interest is understood to be at the bank/deposit receiving country level, our variant of time fixed effects captures differences in pre-treatment trends between offshore and non-offshore jurisdictions in our sample.

[34] An upward bias would arise for instance where the deposits are relocated to another offshore jurisdiction in the control group that was mistakenly classified as not being offshore.

We operationalize this idea by drawing on a finite mixture model (see A.P. Dempster, N.M. Laird, and D.B. Rubin, 1977, and Quandt and J. Ramsey, 1978).[35] Specifically, let $\log(deposit_{ijt})$ denote the logarithmic stock of bilateral deposits in country i which are held by savers from country j at time t. Let $f(\log(deposit_{ijt})\,|\theta^{ci,cj}, x_{ijt})$ denote the density of these deposit stocks conditional on a vector of explanatory variables x_{ijt} and conditional on a vector of parameters $\theta^{ci,cj}$ that depends on whether the bank and the saver are classified as offshore centers or not. The vector x_{ijt} includes the explanatory variables used in our baseline regression specifications. While bilateral stocks follow the same distributional form (a normal distribution), differences in the underlying parameters $\theta^{ci,cj}$ imply four different distributions of cross-border deposits. To derive the joint density of these distributions, denote the probability of country i being an offshore center by p_i. The probability of observing cross-border deposits between two offshore centers is then given by $q_{O,O} = p_i p_j$ while the probability of observing a non-offshore center pair is given by $q_{NO,NO} = (1-p_i)(1-p_j)$. We define the other joint probabilities $q_{NO,O}$ and $q_{O,NO}$ analogously. The overall density of bilateral deposit stocks is then given by:

$$f(\log(deposit_{ijt})\,|\theta, x_{ijt}) = \sum_{cj}\sum_{ci} q_{ci,cj} f(\log(deposit_{ijt})\,|\theta^{ci,cj}, x_{ijt}) \qquad (3)$$

where $cj \text{ and } c_i \in \{O, NO\}$.

We estimate the vector of probabilities $p = (p_1, \dots p_N)$ and the parameters of the four density distributions, $\theta = (\theta^{O,O}, \theta^{O,NO}, \theta^{NO,NO}, \theta^{NO,O})$ in an iterative procedure, using an EM algorithm that maximizes the likelihood of observing the sample at hand.

Intuitively, the iterative process consists of two steps. First, equation (1) is estimated with weighted least squares for each of the four subsets depicted in Table 1 separately, where the weights reflect the prior probability of an observation belonging to any one of the four groups. In this way, we estimate prototypical reactions, or expected values conditional on the variables included in equation (1), for the four possible combinations among banks and savers. In a second step, outliers of the current classification are identified by contrasting observed reactions with prototypical reactions. Probabilities of each country belonging to one of the two groups are updated to maximize the joint likelihood of the sample.

While the probability of being an offshore center likely varies over time and across counterparties, we restrict this probability to be constant across both dimensions for simplicity. Annex 2 provides further details.

IV. Data

Our primary source of data is the BIS' restricted locational banking statistics, where we analyze bilateral deposit stocks held by non-resident non-banks. Our sample includes quarterly data for

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[35] For as similar approach, see Egger, Merlo and Wamser (2014) who distinguish multinational firms that avoid taxes from non-avoiders when evaluating their investment decisions' responsiveness to taxes.

39 reporting countries[36], 19 of which have data as far back as Q1 1995, and 17 of which are classified as offshore jurisdictions according to JZ2014.[37] The latest quarter of available data at the time of writing is Q2 2018.

Figure 2 illustrates the evolution of cross-border deposits as a share of the reporting countries' aggregate GDP, both in aggregate and differentiating between offshore and non-offshore deposits (based on the JZ2014 classification). On average, aggregate cross-border deposits represent around 10 percent of GDP in any given quarter. Starting in 2003, aggregate foreign-owned deposits increased and reached 15 percent of GDP in 2008.[38] However, they have moderately declined since, resembling the levels observed in the early 2000s. Figure 2 shows that the aggregate trend depicts two very distinct patterns for offshore and non-offshore jurisdictions. As could be expected, the cross-border deposits-to-GDP ratio of offshore centers has historically been at much higher levels; it has, however, shown considerable volatility and has embarked onto a pronounced downward trend since reaching a peak at around 60 percent in 2008. In comparison, the foreign deposits-to-GDP ratio in non-offshore jurisdictions has been much more stable and has even slightly increased in recent years. While the cross-border deposits database recorded by the BIS also captures financial flows which are unrelated to tax evasion[39] and does not allow to differentiate between entity and individual accountholders, it arguably remains the richest source of information available to investigate how recent AEOI initiatives may have been effective in curtailing international tax evasion in offshore jurisdictions.[40]

Figure 2. Evolution of Cross-Border Bank Deposits (in % of group-specific GDP)

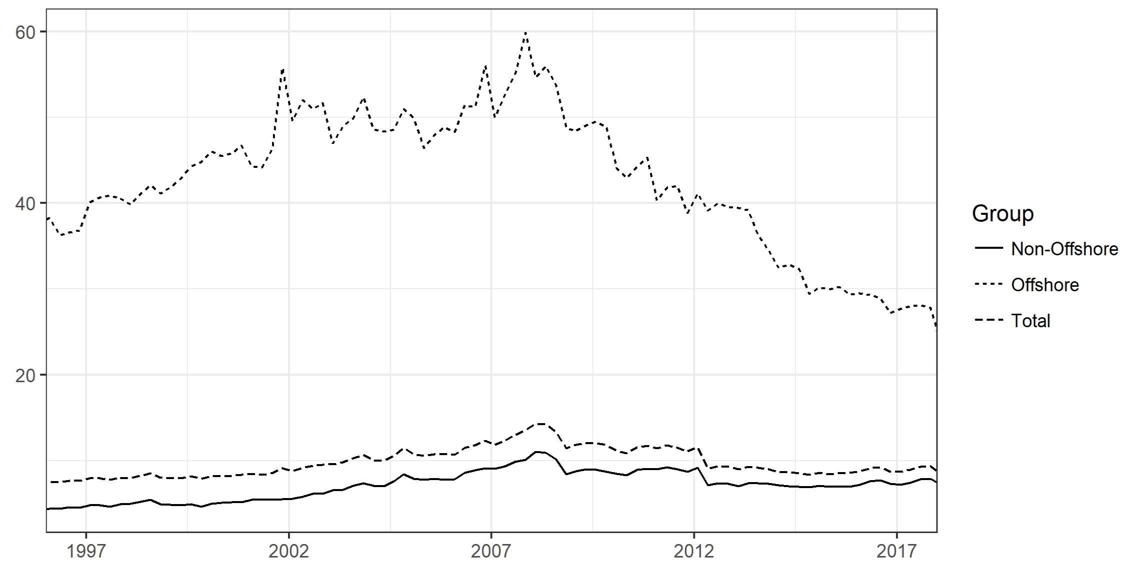
[36] These include Austria, Australia, Bahrain, Bahamas, Belgium, Bermuda, Brazil, Canada, Curacao, Cyprus, Chile, , Denmark, Finland, France, Greece, Guernsey, Hong Kong, India, Indonesia, Ireland, Isle of Man, Italy, Jersey, Luxembourg, Macau, Mexico, Netherlands, Panama, Philippines, Portugal, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States.

[37] These include Austria, Bahamas, Bahrain, Belgium, Bermuda, Chile, Curacao, Cyprus, Guernsey, Hong Kong, Isle of Man, Jersey, Luxembourg, Macau, Panama, Singapore and Switzerland.

[38] Part of this trend could be due to an increase in the number of countries reporting to the BIS. In 2001-02, seven additional countries started reporting to the BIS (in a sensitivity check, we restrict our sample to post-2001 observations).

[39] On the other hand, the data also offers a narrow look at tax evasion insofar as it is limited to cross-border bank deposits and does not include, for example, information on tax evasion through other financial or real assets such as bonds, financial securities, and real estate.

[40] See JZ2014 for further discussion of this data source.



Source: BIS locational statistics, Offshore classification according to JZ2014

In addition, four key sets of indicator variables on the timing and nature of bilateral EOI relationships are used: first, we extend the dataset compiled by JZ2014 on EOIR using data from the OECD's Exchange of Tax Information Portal. This dataset covers the universe of DTTs and Tax Information Exchange Agreements (TIEAs). It describes for over 6,500 bilateral relationships information such as the date when EOI upon request became effective, whether the legal basis is a DTT or a TIEA, and whether this basis includes a provision akin to paragraph 4 of Article 26 of the OEDC Model Tax Convention. Second, information on the Savings Directive is collected directly from the European Commission's website. The EUSD covers over 1,300 bilateral relationships, including the agreements between the EU and third countries and overseas territories. Third, information on FATCA agreements is downloaded from the US Treasury's website. At the time of writing, 88 FATCA relationships are in effect. Fourth, activated relationships under the CRS are retrieved from the OECD's Automatic Exchange Portal.[41] Based on the CRS, more than 4,600 country pairs exchange information currently.

Table 2 provides descriptive statistics for our baseline sample. Non-bank deposits held by non-residents range between 1 USD and 750 billion USD. The EOI4 indicator takes the value of one among 11 percent of the baseline sample's observations. The respective shares for the EUSD, FATCA and CRS are 8 percent, 0.1 percent, and 4 percent. When combining indicators (i.e. when letting the treatment indicator equal 1 whenever at least one type of AEOI arrangement is in place between the country-pair), 11 percent of the sample is governed by an AEOI relationship. As control variables, we use the logs of both GDP and foreign exchange rates, as provided by the IMF's World Economic Outlook database, as well as the World Bank's Governance indicator "*Voice*", which captures perceptions of the extent of citizen participation in government selection,

[41] A country adhering to the CRS is not bound to exchange automatically with all other CRS-participating jurisdictions. Bilateral CRS relationships still require some form of administrative "activation" in order the make them effective.

as well as freedom of expression.[42] We impute missing observations with a matrix completion method.

Table 2. Descriptive Statistics

Variable	Observations	Min	Mean	Max
Non-bank (nb) deposits	311,778	0.001	1,066.31	749,655
Log of nb deposits	311,778	-6.908	2.970	13.52737
EOI4	311,778	0	0.114	1
EUSD	311,778	0	0.087	1
FAT	311,778	0	0.001	1
CRS	311,778	0	0.0374	1
AEOI	311,778	0	0.109	1
Log of Bank GDP	311,778	0.574	24.315	30.661
Log of Saver GDP	311,778	1.009	24.539	30.601
Bank Voice	309,782	-1.387	1.110	1.801
Saver Voice	309,782	-2.313	0.124	1.801
Bank FX	311,778	0.376	240093.5	6973905

V. Empirical Findings

A. Effect on Deposits in Offshore Jurisdictions

Table 3 summarizes our baseline results. The first four specifications examine the effect of EOI4 agreements, while columns 5 and 6 estimate the effect of all EOI agreements. All estimations include a set of pair-specific fixed effects and time-specific fixed effects. A more flexible time-fixed effects structure that allows for different trends among offshore banks and non-offshore banks which did not conclude an EOI agreement is used from specification 3 onward.

Overall, the results confirm a strong and statistically significant effect of automatic exchange of information agreements in reducing cross-border deposits into offshore jurisdictions. The measured effect implies that such deposits decreased by between 35 percent (for the CRS) to 50 percent (for the EUSD) following the introduction of agreements to undertake AEOI. In contrast, EOIR reduced deposits in offshore jurisdictions by around 12 percent, although this effect is not statistically significant in most specifications.

Table 3. Baseline Results

Dependent variable: log deposits, Sample: all banks, non-offshore savers (except Model 1)

Explanatory	Model 1	Model 2	Model 3	Model 4	Model 5
EOI4	0.08	0.329***	0.207***	0.205***	0.195***
	[0.069]	[0.071]	[0.073]	[0.071]	[0.072]
EOI4*Offshore		-0.431***	-0.127	-0.129	-0.114
		[0.095]	[0.100]	[0.099]	[0.099]

[42] In unreported estimations we check the robustness of our findings to the choice of governance indicator. The results remain unaffected.

EUSD				0.660***	
				[0.070]	
FAT				0.067	
				[0.228]	
CRS				0.258***	
				[0.045]	
EUSD*Offshore				-0.514***	
				[0.101]	
FAT*Offshore				-0.457	
				[0.280]	
CRS*Offshore				-0.351***	
				[0.071]	
AEOI					0.525***
					[0.049]
AEOI*Offshore					-0.535***
					[0.075]
One set time FE	Yes	Yes	No	No	No
Two sets time FE	No	No	Yes	Yes	Yes
AdjR	0.052	0.067	0.076	0.086	0.084
Obs	98374	237313	237313	237313	237313

*, **, and *** indicate significance at the 10, 5, and 1 percent level. Fully robust standard errors in brackets.

The importance of controlling for factors that are unrelated to tax evasion is evidenced by the results in Columns 1 and 2. Following JZ2014, column 1 estimates the effect of EOI4 relationships using only the subset of offshore banks and non-offshore savers (subset C). This specification suggests that deposits in offshore jurisdictions increased by 8 percent following the introduction of an EOIR relationship. This finding is inconsistent with earlier evidence on a negative impact of EOIR (for instance, in the order of 12 percent in JZ2014). Column 2 adds the sample of non-offshore banks and identifies the effect on tax evasion by interacting the treatment variable with the offshore indicator. Using this broader sample, we find that EOIR increased deposits in *non-offshore* jurisdictions by around 33 percent. Relative to this benchmark, the effect in *offshore* jurisdictions is much lower (-44 percent) and statistically significant, suggesting that EOIR reduces income concealed in offshore jurisdictions that signed such an agreement. However, this second specification presumes that non-treated banks followed the same time trajectory.

The specification presented in Column 3 allows for more flexibility by introducing a separate set of time fixed effects for offshore and non-offshore banks. Using this specification, the estimated effect of EOIR in addressing tax evasion in offshore jurisdictions remains negative (-12 percent) but loses statistical significance.

Columns 4 and 5 estimate the effect of both EOIR and AEOI. As before, we use a triple differenced estimator to identify the treatment effect of EOI agreements on tax evasion. By expanding the set of explanatory variables, the measured effect of EOI4 remains relatively stable at around -12 percent but is also consistently not statistically significant. In contrast, the effects of AEOI range from -35 percent for the CRS percent to -51 percent for the EUSD, with both results being highly statistically significant. At -45 percent, the measured effect of FATCA is sizeable but not statistically significant. Based on a Wald test, we cannot rule out that the effects of FATCA, CRS, and the EUSD are identical and thus increase estimation precision in column 6 by estimating the effects of these agreements jointly. Using the combined *AEOI* indicator, the measured effect is also very large (-53 percent) and significant at the 1 percent level.

B. Robustness

Table 4 reports a series of robustness checks, using bank deposits between 2002 and 2018. By restricting the number of years, we lose around 18 percent of the baseline sample observations but potentially increase the accuracy of our estimated effects by reducing the total number of estimated coefficients. All specifications include two sets of time fixed effects as well as pair-specific (bank-saver) fixed effects. Throughout the specifications, we include additional explanatory variables to test the sensitivity of our findings. To improve readability, we do not show the first order terms (non-interacted EOI agreements) in the table even though these are included in the estimations.

Columns 1 and 2 repeat the baseline regressions used in columns 5 and 6 in Table 1 (omitting coefficients on the non-interacted EOI agreements). The estimated effects remain largely unchanged using the restricted sample: EOIR exerts a small and statistically non-significant impact on offshore deposits while all AEOI frameworks exert a strong negative impact (still statistically insignificant for FATCA only). The second column again restricts the effects of AEOI agreements to be uniform, with the measured effect being only slightly smaller than in the baseline estimations (-46 percent).

Columns 3 to 5 allow for bank-specific time trends in addition to the two sets of time-specific fixed effects (our preferred specification). By allowing for more flexibility, the measured effect of AEOI agreements is substantially reduced to 25 percent. The associated standard error implies that, in 95 percent of the observed cases, the bank deposits held in offshore jurisdictions by non-offshore residents declined by between 13 and 37 percent. This measured effect remains unaffected by including GDP in the bank and saver locations, as well as the foreign exchange rate between the bank location and the US dollar, as explanatory variables in column 4, and by adding a governance indicator in column 5.

Table 4. Robustness Checks

Dependent variable: log deposits; Sample: all banks, non-offshore savers					
	Model 1	Model 2	Model 3	Model 4	Model 5
EOI4*Offshore	-0.094	-0.082	-0.097	-0.1	-0.097
	[0.101]	[0.101]	[0.094]	[0.094]	[0.094]
EUSD*Offshore	-0.452***				
	[0.097]				
FAT*Offshore	-0.291				
	[0.277]				
CRS*Offshore	-0.320***				

	[0.069]				
AEOI*Offshore		-0.461***	-0.254***	-0.254***	-0.252***
		[0.066]	[0.061]	[0.061]	[0.061]
Log(Saver Gdp)				-0.001	0.001
				[0.007]	[0.007]
Log(Bank Gdp)				0.274***	0.273***
				[0.090]	[0.090]
Log(FX rate)				-0.057 *	-0.057 *
				[0.034]	[0.034]
Saver Estimate Voice					-0.237***
					[0.046]
Bank Estimate Voice					0.01
					[0.076]
Bank-specific time trends	No	No	Yes	Yes	Yes
AdjR	0.031	0.03	0.086	0.087	0.088
Obs	194673	194673	194673	194673	194673

*, **, and *** indicate significance at the 10, 5, and 1 percent level. Fully robust standard errors in brackets. All specifications include separate time-fixed effects for offshore locations and non-offshore locations. The non-interacted EOI agreements are included in the estimations but not presented in this table for simplicity.

Overall, our results substantiate earlier evidence on the impact of AEOI but offers a nuanced view on the impact of EOIR. JZ2014 report that EOIR agreements reduce deposits in offshore jurisdictions by an average of 12 percent. While our analysis confirms the magnitude of these effects, the variability of the measured effect increases when using a broader timespan such that we cannot reject the assumption that the effect of EOIR in reducing deposits in offshore jurisdictions may be null. This finding supports the conclusion of Menkhoff and Miethe (2017) that the effects of EOIR may have weakened over time. As for AEOI, Johannesen (2014) shows reactions of Swiss deposits in the order of 30-40 percent in response to the introduction of the EUSD and, most recently, CSS2018 also find a statistically significant impact of the CRS on cross-border bank deposits in offshore jurisdictions (14 percent).[43]

C. Effect on Countering Round-Tripping

To investigate the effect of EOI relationships in countering round-tripping schemes,[44] we next analyze the sample of deposits held in non-offshore jurisdictions by savers from offshore jurisdictions (subset B).[45] This analysis provides an indirect test of EOI's overall impact, insofar as

[43] However, only five countries—namely Hong Kong, the Isle of Man, Jersey, Guernsey, and Macau—are considered as tax havens, which appear to influence their result. For example, Casi, Spengel and Stage (2018) find no statistically significant effect of the CRS on deposits when the more comprehensive tax haven list used in JZ2014. Futher, Casi, Spengel and Stage (2018) only rely on four years of data (2014-2017).

[44] Round-tripping refers to indirect investments made by a resident in his home country through an offshore center.

[45] For similar empirical strategies see Menkhoff and Miethe (2017) and De Simone, Lester and Markle (2018).

it builds on the assumption that concealed income from residents in non-offshore jurisdictions in routed through offshore jurisdictions and reinvested in the investor's residence country.[46]

Table 5 presents the results. Overall, we find that the presence of an EOI relationship reduces deposits held in non-offshore locations by residents of offshore centers. This finding, which appears most statistically significant for EOIR, would suggest a reduction in round-tripping behavior. However, we find a reverse effect of FATCA agreements on the cross-border deposits from offshore centers into the US: following the conclusion of FATCA agreements with offshore jurisdictions, deposits in the US increased by roughly the same amount by which other non-offshore jurisdictions witnessed a decline; by 20 percent, possibly due to the non-reciprocal nature of FATCA compared to other types of AEOI arrangements, as explained further below.

Column 1 estimates the treatment effect for each EOI framework separately. In contrast to the direct test of EOI's effectiveness shown in subsection A, the indirect test does not suggest that AEOI is more effective in reducing tax evasion than EOIR. The coefficients on EOI4, EUSD and CRS indicate that deposits decreased by between -14 and -20 percent. While a Wald test confirms that these point estimates do not differ statistically from each other, only EOIR is significantly different from zero at the 10 percent level. Nonetheless, we note that the reduction in deposits from offshore savers in non-offshore banks under EOIR is consistent with an attempt to mitigate triggering an EOI request by the non-offshore jurisdiction (an incentive that would not be present under AEOI). Surprisingly, however, the effect of FATCA is positive, implying that cross-border deposits in the US increased by 23 percent following the conclusion of FATCA agreements with offshore jurisdictions.

Column 2 estimates effects of the EUSD and CRS jointly by including a combined indicator variable *NON_FATCA*. The measured effect is now statistically significant at the 10 percent level and suggests a reduction in the order of 19 percent. Columns 3 to 5 add control variables, with little impact on the measured treatment effects: EOIR continues to exert a statistically significant negative impact on the deposits in non-offshore jurisdictions; the effect of the EUSD and CRS (again measured jointly) become slightly lower in magnitude and measured with less precision, which is likely due to less time variation compared to EOI4.

Table 5. Round-Tripping Results

Dependent variable: log deposits; Sample: non-offshore banks, all savers

	Model 1	Model 2	Model 3	Model 4	Model 5
EOI4*Offshore	-0.206 *	-0.202 *	-0.261***	-0.265***	-0.277***
	[0.121]	[0.121]	[0.117]	[0.117]	[0.115]
EUSD*Offshore	-0.204				
	[0.150]				

[46] The present analysis shies away from an analysis of round-tripping investment via portfolio assets or direct investment in the resident country via shell structures in offshore jurisdictions, since our dataset only covers cash deposits. For an analysis of the same phenomenon conceptually using non-deposit investment vehicles, see Hanlon et al (2015) and Hemmerich and Heckemeyer (2018).

FATCA*Offshore	0.22	0.234	0.242	0.247 *	0.241 *
	[0.161]	[0.156]	[0.147]	[0.147]	[0.144]
CRS*Offshore	-0.144				
	[0.123]				
Non_FATCA*Offshore		-0.190 *	-0.174	-0.173	-0.16
		[0.115]	[0.113]	[0.114]	[0.112]
Save Gdp				-0.007	-0.006
				[0.005]	[0.005]
Bank Gdp				0.654***	0.607***
				[0.168]	[0.167]
Log(Bank FX)				0.845***	0.974***
				[0.192]	[0.195]
Saver Voice					-0.277***
					[0.052]
Bank Voice					0.702***
					[0.100]
AdjR	0.105	0.103	0.133	0.133	0.135
Obs	177621	177621	177621	177621	176440

*, **, and *** indicate significance at the 10, 5, and 1 percent level. Fully robust standard errors in brackets. All specifications include separate time-fixed effects for offshore locations and non-offshore locations.

Our measured effect of EOIR agreements on deposits in non-offshore jurisdictions is smaller than the effect of -36 percent reported by Menkhoff and Miethe (2017), which is likely driven by differences in the classification of offshore jurisdictions as we further discuss below. CSS2018 find that the introduction of the CRS induced a reduction in cross-border deposits held in traditional offshore locations. However, the authors show that such wealth has not been repatriated but instead relocated mostly to the US, which they argue has emerged as a potentially attractive location for cross-border evasion. Our results are not inconsistent with this finding, as they point to the US FATCA being the only AEOI agreement which has not led to a reduction in deposits from offshore centers to a non-offshore country (here, the US) following the introduction of such agreements. One rationale for the observed response is that FATCA IGAs concluded by offshore centers provide certainty to evaders located in third countries that investing in the US through these centers avoids the application of FATCA withholding. At the same time, the existence of a FATCA IGA de facto preserves anonymity for the offshore saver, since the US does not reciprocate in terms of identification and reporting of beneficial owners. Finally, the US may also be an attractive jurisdiction in which to hold bank deposits in light of its offering of a zero percent withholding tax rate on related interest payments to nonresident aliens.[47]

[47] US nonresident aliens who receive interest income from deposits with a US bank, savings & loan institution, credit union, or insurance company, or who receive portfolio interest are exempt from taxation on such interest income as long as such interest income is not effectively connected with a United States trade or business. See: https://www.irs.gov/individuals/international-taxpayers/aliens-which-income-to-report.

D. Offshore Jurisdiction Lists

[not completed]

VI. Conclusion

Considerable effort has been deployed since the early-2000s to rethink how exchange of information for tax purposes could be made more effective. While initial steps focused on tweaking the initial EOIR model based on bilateral relationships, new models emerged to provide for the systematic transmission of taxpayer information across national boundaries. After a regional multilateral approach under the EUSD, the US attempted a more global reach by concluding bilateral FATCA agreements with over 80 countries. Most recently, the leadership of the G20 and OECD led to the adoption of a new global and multilateral approach to AEOI, the CRS which will be implemented in over 100 jurisdictions worldwide. Though these were notable milestones in international cooperation in tax matters, many have expressed doubts over their ability to successfully detect and deter international tax evasion.

We empirically test the effect of these EOI frameworks in reducing cross-border deposits in offshore jurisdictions, which can be interpreted as assessing their impact in curtailing tax evasion in these jurisdictions. We don't observe a consistent reduction in offshore jurisdiction deposits following the introduction of EOIR. This result is consistent with our *a priori* expectation and potentially explains why policymakers worldwide devoted considerable efforts into adopting new standards for information exchange. In contrast, we find strong evidence suggesting that AEOI has been effective in limiting the use of offshore jurisdictions to evade taxes, with deposits therein dropping by an average of 25 percent after the entering into force of any AEOI agreement. However, as reiterated at various points in this paper, the precise implications of this observation for global tax evasion are ambiguous, since a reduction in presumably tax evading deposits in one offshore jurisdiction could imply an increase in tax evading deposits elsewhere. Furthermore, not all cross-border deposits in offshore jurisdictions need to have been there for tax evasion purposes, and therefore should not be expected to decline.

Among the three AEOI agreements studied, the EUSD and the CRS appear to have been most effective with a strong statistical relationship, while FATCA's impact is most often not statistically significant. Interestingly, while the EUSD and CRS are also found to reduce deposits held by residents of offshore centers in non-offshore banks—and effective in addressing round-tripping schemes—FATCA is not. What is more, the conclusion of a FATCA agreement with an offshore center seems to have increased deposits into the US, a result consistent with prior findings (such as CSS2018) that the US may have become a more attractive location in which to hold—and perhaps conceal—income.

Annex 2. Finite Mixture Model Estimations

We estimate the finite mixture model depicted in equation (3) in an iterative process, the so-called expectation maximization (EM) algorithm.

Initiation: In the first round of estimations, we assign countries that are classified as an offshore jurisdiction a posterior probability of $p_i = 0.75$ to be an offshore jurisdiction and a posterior probability of $p_i = 0.25$ not to be an offshore jurisdiction.

Step 1: We then use these posteriors to calculate four sets of weights: one for the joint probability that both the bank and the saver are offshore centers, one for the joint probability that the bank is an offshore center while the saver is not, one for the joint probability that the bank is not an offshore center while the saver is and one for the remaining case. Conditional on these four sets of weights, the four parameter vectors $\theta^{ci,cj}$ are obtained by estimating equation (1) with weighted least squares.

Step 2: Conditional on the new parameter estimates and last round's prior, the likelihood of country i being an offshore center is proportional to the product of observed densities over time and over counterparty jurisdictions multiplied by the prior probability. More specifically, using the notation from the main text, this proportional likelihood is given by:

$$\omega_i^O = p_i \prod_j \prod_t \left[f\left(y_{ijt} \middle| \theta^{O,NO}, x_{ijt}\right) + f\left(y_{ijt} \middle| \theta^{O,O}, x_{ijt}\right) \right]$$

Conversely, the likelihood of country i not being an offshore center is given by

$$\omega_i^{NO} = (1 - p_i) \prod_j \prod_t \left[f\left(y_{ijt} \middle| \theta^{NO,NO}, x_{ijt}\right) + f\left(y_{ijt} \middle| \theta^{NO,O}, x_{ijt}\right) \right]$$

It follows that the posterior probability of country i being an offshore center is given by

$$p_i^{t+1} = \frac{\omega_i^O}{\omega_i^O + \omega_i^{NO}}$$

The iterative procedure is stopped when the posterior probabilities do not change from one round to the next. If they do change, the new posterior is used in Step 1.

In some of the estimations, we restrict the reaction of offshore banks and non-offshore banks to be the same. In these equations, we estimate the first step WLS in a SUR framework (Zellner 1962) to incorporate these restrictions.

All estimations control for pair-specific fixed effects and take the JZ list to assign prior probabilities of country classification.[48] To increase the accuracy of classification, we drop savers

[48] In the initial estimation round, countries which are included in the JZ list are given a posterior probability of 75 percent of being an offshore jurisdiction.

from the restricted dataset with fewer than 1400 observations, which results in a sample of 85 countries which are classified with the EM algorithm.

Table A1 presents the coefficient estimates after convergence of the algorithm. Following the logic of our baseline estimations, and to simplify presentation, we only report the subset of results which describes reactions by all banks and non-offshore savers. The first specification in Table A1 explains cross-border deposits with our two main explanatory variables (EOI4 and AEOI), as well as a set of time-specific fixed effects. We do not include any cross-equation restrictions in this specification, implying that the classification of countries into offshore jurisdictions is based on four independent sets of coefficient estimates, one for each of the subsample presented in Table 1. The second specification builds on the assumptions of the triple differenced identification approach and restricts time-specific fixed effects to be constant depending on whether the bank is an offshore jurisdiction or not. Finally, the third specification resembles our most flexible specification of the baseline results by adding a set of bank specific time trends and foreign-exchange rates which are restricted to be constant across all four subsets of the data. Generally, we find no significant effect of EOI4 but a large and negative effect of AEOI. While the results presented in the main text Table 5 are qualitatively similar, the precise magnitude differs as these estimations are based on a broader sample.

Annex Table 1. EM Results

Dependent: log non-financial deposits			
	Model 1	Model 2	Model 3
EOI4	-0.066	-0.07	0.014
	[0.057]	[0.056]	[0.052]
AEOI1	0.032	0.021	0.077***
	[0.037]	[0.036]	[0.034]
EOI4: Offshore	0.106	0.172	-0.008
	[0.123]	[0.132]	[0.111]
AEOI:Offshore	-0.198***	-0.202**	-0.170**
	[0.089]	[0.101]	[0.084]
AdjR	0.096	0.097	0.16
Obs	112465	114800	110895

*, **, and *** indicate significance at the 10, 5, and 1 percent level. Fully robust standard errors in brackets. All specifications include separate time-fixed effects for offshore locations and non-offshore locations.

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