



Exchange of Information and Bank Deposits in International Financial Centres*

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Abstract

This paper assesses the impact of exchange of information on foreign-owned bank deposits in international financial centres (IFCs). IFC deposits declined globally by 24% or USD 410 billion during 2008 to 2019. The commencement of automatic exchange of information is associated on average with a 22% reduction in IFC bank deposits held by non-IFC jurisdictions. Increasing multilateral expansion of exchange of information on request seems to diminish marginal gains of new bilateral treaties. IFC jurisdictions specialising in banking activities have been mostly affected by increasing tax transparen-

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cy. A comprehensive multilateral approach is thus fundamental for successfully increasing international tax transparency.

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1. Introduction

In 2009, in response to widespread international concern about tax evasion, the G20 declared that ‘the era of bank secrecy is over’.¹ Since then there has been a dramatic expansion in tax transparency worldwide. By the end of 2019, over 150 jurisdictions had committed to implement the standard of exchange of information on request (EOIR) and 130 jurisdictions now participate in the Convention on Mutual Administrative Assistance in Tax Matters (the MAC), which provides an international and multilateral legal basis for all types of exchange, with more countries joining each year. More than 100 jurisdictions have committed to exchanging information related to offshore accounts automatically (the AEOI) under the Common Reporting Standard (CRS), and over 95 have already commenced information exchange (OECD, 2019). In 2019, this exchange of information concerned more than 84 million bank accounts, totalling almost €10 trillion (OECD, 2020). These new initiatives have marked a step change in the global commitment to tax transparency.

The changes have brought with them significant interest from stakeholders in understanding the impact of exchange of information (EOI) to assess its effectiveness, warrant the various costs involved and identify strategies that could improve its function. These stakeholders include member jurisdictions of the Global Forum on Transparency and Exchange of Information for Tax Purposes (the Global Forum), the private sector, non-governmental organisations and the public.

Increases in tax transparency through an expansion in EOI may have far-reaching implications for government tax returns –even more so in times of increasingly squeezed government coffers due to the COVID-19 pandemic. The heightened risk of wealth hidden in international financial centres (IFCs) being detected may have a significant effect on tax compliance resulting in higher tax revenues for governments, as has been suggested by the existing literature (Johannesen *et al.*, 2020; Londoño-Vélez and Ávila-Mahecha, 2021).

Moreover, recent evidence has shown that foreign or hidden wealth is likely to be concentrated amongst those with high incomes, therefore not accounting for such foreign wealth biases downwards the existing estimates of inequality (Alstadsaeter *et al.*, 2019). Expanding tax transparency thus ensures, if combined with strengthened enforcement, that tax systems may become more progressive. Expanded tax transparency may also provide a more accurate picture of wealth inequality within society.

Our study highlights the overall decrease in deposits in IFCs as evidence that EOI has improved tax compliance. Banks in IFCs lost over US\$400 billion in deposits owned by

non-IFC residents during a period of increasing tax transparency, even when accounting for major global regulatory changes in the aftermath of the financial crisis. A substantial share of this amount has been turned into additional tax revenues for governments.² The stylised facts demonstrate a strong decline in foreign-owned deposits in IFCs during a period of increasing tax transparency.

The results show that the various EOI mechanisms are associated with a significant but differentiated impact over time and across agreements. Our estimates show a strong and significant impact of commencement of exchange under AEOI on foreign-owned offshore wealth. Specifically, AEOI commencement is associated with a quantitatively and statistically significant 22% reduction in IFC deposits while accounting at the same time for the earlier AEOI announcement and the multilateral enlargement of EOIR through the MAC. As shown in the literature review, our estimates range in the middle of results obtained by *Casi et al. (2020)* and *Menkhoff and Miethe (2019)*. Both studies build with respectively -13% and -35% the lower and upper bounds of the impact distribution across the related literature.

Our results also suggest that the impact of EOIR has changed over time. Initial EOIR agreements signed in the aftermath of the commencement of peer reviews in 2009 were found to exert a statistically significant impact of a 10% reduction in IFC deposits. However, the impact of each additional agreement over time has been more muted, potentially due to the increasingly multilateral nature of the EOIR network through MAC signatures.³

We also consider the impact of AEOI over time, by differentiating between the impact of the announcement of the joint commitment to multilateral AEOI and its implementation. The results show that the joint announcement in 2014 of a number of jurisdictions to commit early to AEOI had heterogeneous effects on IFC deposits. IFC jurisdictions that specialise in traditional banking services such as Guernsey or Jersey (*Hampton, 1996*) experienced a stronger decline in foreign-owned deposits upon early commitment than several jurisdictions in the Caribbean, many of which are predominantly active in asset management for institutional investors (*Fichtner, 2016*). Being able to distinguish effects by the underlying ‘business model’ of different jurisdictions provides further evidence for financial sector specialisation of IFCs and corroborates earlier results on IFC activity by, for instance, *Bouvatier et al. (2018)*.

Using recently updated statistics on cross-border bank deposits, this paper contributes to the debate on the effectiveness of increasing tax transparency by providing a comprehensive assessment of the impact of EOI on hidden wealth in IFCs.

The remainder of this paper proceeds as follows. Section 2 provides a short literature review. Section 3 focuses on Locational Banking Statistics (LBS) available from the Bank for International Settlements (BIS), our data source of cross-border financial activity. It provides some stylised facts about the data and notes the overall decline in bank deposits in IFCs held by non-bank counterparties over the last ten years. It also describes the expansion of EOI over this period. Section 4 provides the results of a panel regression analysis on the impact of EOI agreements between two jurisdictions on cross-border bank deposits.⁴ Section 5 offers a series of robustness checks that examine the main results in more detail. Section 6 concludes the paper with suggestions for possible future research in this area.

2. Literature review

The literature on the impact of EOI is small but growing. Using data on cross-border financial liabilities in international financial centres (IFCs) has been a key means of assessing the impact of EOI. In an early paper, Johannesen and Zucman (2014) showed that bank liabilities in IFCs had not declined significantly since the expansion of EOI in 2008, following the G20 declaration about bank secrecy. While they did find evidence that some low-tax jurisdictions did experience a fall in bank deposits in the aftermath of the signature of new EOIR agreements, the authors argued that the lack of a broad decline in deposits in IFCs suggested that taxpayers responded to EOIR by transferring deposits to other non-exchanging IFCs:

“[... so far] treaties have led to a relocation of bank deposits between tax havens but have not triggered significant repatriations of funds... A comprehensive network of treaties providing for automatic exchange of information would put an end to bank secrecy and could make tax evasion impossible” (Johannesen and Zucman, 2014, p. 89).

Since its publication, the tax transparency environment has significantly expanded and several papers have used more up to date data to assess the impact of continuing developments. Each of these studies has found that EOIR or AEOI are, to varying degrees, associated with reductions in bank deposits in IFC jurisdictions.

Menkhoff and Mieth (2019) repeat and extend the analysis of Johannesen and Zucman (2014) by analysing both inflow and outflow deposits held in non-IFC and IFC jurisdictions. They find that EOIR is associated with a significant, though declining, impact in the bank deposits held in IFC jurisdictions from non-IFCs after the signature of an EOIR agreement. They also note mirroring but lagged reactions to deposits in non-IFC jurisdictions from IFCs. Finally, they find a significant impact on IFC deposits from the activation of AEOI agreements under the CRS. Casi *et al.* (2020) carry out a difference-in-differences analysis, with a sole focus on AEOI and a sample limited to 2014 to 2017. They argue that this reduced sample allows them to better focus on the impact of AEOI, and find that AEOI is associated with a statistically significant reduction in bank deposits in IFCs. Beer *et al.* (2019) extend this analysis by assessing EOIR, AEOI and the Foreign Account Tax Compliance Act (FATCA) covering a longer time period and an increased IFC sample, similar to Johannesen and Zucman (2014). Finally, Ahrends and Bothner (2019) employ a difference-in-differences model to successfully estimate the impact of AEOI on non-IFC deposits. Table 1 compares the above studies in terms of their varying sample sizes, time periods covered, and different jurisdictions defined as IFCs. Figure 1 shows the estimated impact of EOIR and AEOI on IFC deposits.

In addition to the papers focusing on the impact of EOI on bank deposits, several other papers in the literature analyse the effects of EOI on other forms of financial asset. Hanlon *et al.* (2015) and De Simone *et al.* (2019) focus on the response of portfolio holdings of IFCs in the United States in the aftermath of the implementation of FATCA, and find that the implementation of FATCA agreements between the United States and IFCs is associated with reduced portfolio investment from those IFCs in the United States. Heckemeyer and Hemmerich (2020) assess the response of portfolio holdings of IFCs in securities markets in OECD coun-

tries. They find that EOIR is associated with reduced portfolio investment in securities markets in OECD countries by IFC jurisdictions participating in EOI. Kemme *et al.* (2017) find similar results, albeit with more modest effects of the expansion of EOI on portfolio activity.

Table 1
SAMPLE LENGTHS AND IFC LISTS UTILISED IN THE LITERATURE

Articles	Sample length	IFC sample
Johannesen and Zucman (2014)	Q4 2003 - Q2 2011	Austria; Belgium; Cayman Islands; Chile; Cyprus; Guernsey; Isle of Man; Jersey; Luxembourg; Macau, China; Malaysia; Panama; Switzerland.
Ahrends and Bothner (2019)	Q1 2009 - Q4 2017	Austria; Belgium; Chile; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macau, China; Switzerland.
Beer, Coelho and Leduc (2019)	Q1 1995 - Q2 2018	Austria; Bahamas; Bahrain; Belgium; Bermuda; Chile; Netherlands Antilles/Curaçao ^(a) ; Cyprus; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macau, China; Panama; Singapore; Switzerland.
Menkhoff and Miethe (2019)	Q1 2003 - Q4 2017	Belgium; Chile; Guernsey; Ireland; Isle of Man; Jersey; Luxembourg; Switzerland.
Casi, Spengel and Stage (2020)	Q4 2014 - Q3 2017	Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Switzerland.
This paper	Q1 2006 - Q4 2018	Bahamas; Bahrain; Bermuda; Cayman Islands; Netherlands Antilles/Curacao; Cyprus; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macao, China; Malaysia; Panama; Singapore; Switzerland.

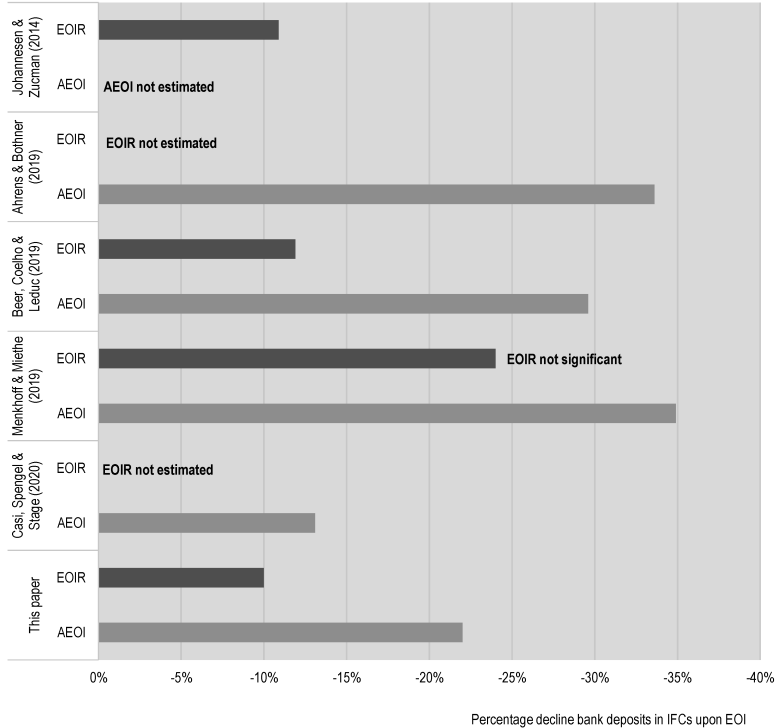
^(a) In the BIS LBS, data for Netherlands Antilles are succeeded by data for Curaçao. See Bank for International Settlements (2017) for an explanation of the data structure definitions.

Source: Based on the literature cited.

Other papers have analysed the impact of EOI using other data. Omartian (2016) employs data from international data leaks to argue that EOI is associated with declines in company incorporations in IFCs. Johannesen *et al.* (2020) use Internal Revenue Service (IRS) tax administration data and find that expanded enforcement initiatives in the United States have resulted in approximately 60,000 individuals disclosing offshore accounts with a combined value of around US\$120 billion, corresponding to around US\$0.7 - 1.0 billion in additional tax revenue.

Against this background, while closely related to those by Johannesen and Zucman (2014), Beer *et al.* (2019) and Menkhoff and Miethe (2019), this paper makes several important contributions to the literature. First, it expands on the work of Johannesen and Zucman (2014) by employing in the panel data analysis a larger sample in terms of time and country coverage than has been available to other researchers. Compared to Beer *et al.* (2019), Menkhoff and Miethe (2019) and Casi *et al.* (2020) for instance, this study gains up to four additional quarters in time coverage in 2018 and uses data on all major IFCs, most notably including the Cayman Islands. More recent data allows for a deeper analysis of the EOI impact on deposits across a broader range of IFCs.

Figure 1
ESTIMATES OF THE DECREASE IN IFC DEPOSITS ASSOCIATED WITH
EOI IN THE LITERATURE



Note: EOI effects on deposits have been recalculated where necessary based on the formula $100 * \exp(\text{estimated coefficient}) - 1$.

Source: Authors' calculations based on the relevant literature cited.

A large IFC sample also allows for a deeper consideration of the argument that lack of comprehensive coverage of EOI agreements leaves places for money to hide or reallocate, a key concern for previous studies. By expanding the set of jurisdictions in the analysis and demonstrating a widespread decrease in aggregate bank deposits across the sample, we demonstrate that shifting bank deposits from jurisdiction to jurisdiction is unlikely to be a successful response to the expansion of EOI for taxpayers. This not only provides further confidence in the effects of increasing tax transparency measured below, but also helps to improve on prior studies that do not find evidence for reduced tax evasion (Hanlon *et al.*, 2015). The differences in available sample length and IFC jurisdiction coverage across the related EOI literature are presented in Table 1.

Second, this study accounts for the impact of the rapid multilateral expansion in EOI networks that has occurred through signature of the MAC since 2010. To our knowledge, this study is the first to account explicitly for EOIR agreements induced by MAC signatures

—similar studies such as Beer *et al.* (2019) have left these for future research. This provides for a more detailed assessment of EOI impact on IFC deposits by jointly testing for EOIR signatures including the MAC, the announcement by jurisdictions of their commitment to implement AEOI and the commencement of exchanges under AEOI. Our study thus recognises a change in the nature of tax transparency: from what was previously largely an expansion driven by new bilateral agreements to one driven increasingly by multilateral actions.

Third, our comprehensive assessment of EOI evolution over time offers a differentiated analysis of the earliest stage of AEOI, namely the joint announcement by jurisdictions to implement AEOI early in 2014. Unlike other literature, we provide evidence of a heterogeneous impact of AEOI commitments across IFCs by means of a difference-in-differences framework following Johannesen (2014). This allows for the identification of taxpayer response in key jurisdictions after the original announcement by the G20 and by jurisdictions that were early AEOI adopters.

3. Assessing changes in IFCs using cross-border banking statistics

A major issue in examining the impact of EOI on financial activity in IFCs is choosing the most appropriate outcome variable for the analysis. In assessing the impact of EOI on asset holdings in or through IFCs, a goal should be to analyse those financial assets that would be impacted by EOI, i. e. those likely to be held by potential tax evaders. Bank deposits held by individuals are one example of an asset class that may be impacted by EOI.

There is early evidence of the importance of bank deposits in the academic literature on tax evasion. Using data on Swiss bank liabilities, Zucman (2013) estimates that bank deposits form approximately 25% of global hidden wealth. Using data from the Italian voluntary disclosure programme for hidden assets, Pellegrini *et al.* (2016) find that while bank deposits are the most commonly repatriated asset class, they comprise 13.5% of total disclosed wealth. Londoño-Vélez and Ávila-Mahecha (2021) also find that bank deposits are a key asset class for high income taxpayers. A recent study by Alstadsaeter *et al.* (2018) allocates a wealth equivalent held in bank deposits of about 10% of global gross domestic product (GDP) to IFCs.

Bank deposits are a key component of cross-border investment activity. The BIS publishes quarterly data on bank liabilities in the LBS, including both deposits and banks' other holdings of securities aggregated at jurisdiction level. For example, in the case of France, it publishes total deposits held by French residents in foreign banks and total deposits held by foreign residents in French banks.

As discussed in Section 2, data on banking activity have been used repeatedly to study the impact of EOI (Johannesen and Zucman, 2014; Huizinga and Nicodème, 2004; Menkhoff and Miethe, 2019). There are several reasons for this. Access to banking information that is 'foreseeably relevant' for tax purposes is specifically provided for under EOIR agreements. Furthermore, information on bank deposits held abroad is one of the information catego-

ries covered by the AEOI Standard. This means that, to the extent that there are changes in cross-border investment activity because of EOI, bank deposits should be one of the assets most directly affected.

Moreover, banking data is among the best-quality data available on international financial activity. In recent years, the BIS has made substantial amounts of data publicly available to researchers. These include bilateral information for reporting jurisdictions, which are data on assets held in the reporting jurisdiction by a resident of a counterparty jurisdiction.⁵

This paper, like others in the literature, focuses on bank deposits of non-bank actors and, in particular, on bank deposits in IFCs held by non-bank residents of non-IFCs.⁶ Focusing on non-bank deposits involves excluding bank deposits with respect to other banks and their own affiliates abroad, as bank lending to one another on the inter-bank market is unlikely to be impacted substantially by EOI expansion.

The non-bank category includes households, corporates, general government, non-corporate enterprises such as trusts, and other non-financial institutions (e. g., charities and foundations). Despite being a narrower category than all bank liabilities, even this category is broad and presents a number of challenges from the perspective of accurately assessing the impact of EOI. While some entities may be used by individuals to evade taxes, others may be engaged in legitimate business purposes. An important caveat to the analysis is that various types of non-bank actors may respond to EOI differently, which influences the results presented in the analysis below.

A few additional limitations of the BIS LBS are noteworthy. The data are recorded as end-of-quarter observations and as such constitute stocks. These data thus only provide a snapshot of deposits at a given point in time and cannot provide details of flows over periods compared to flow variables. Moreover, the deposit data are collected on the basis of immediate rather than ultimate ownership.

3.1. Stylised facts of deposits in BIS reporting countries

Zucman and Johannsen (2014) highlighted the lack of decline in IFC deposits relative to non-IFC deposits in the aftermath of the financial crisis as evidence of the limited impact of EOI. However, as the sample period used in their paper concludes in 2011, it does not take into account the significant further development of the network of exchange relationships after 2011, nor the widespread adoption of the AEOI standard. Since 2011, there has been a change in the overall trend of IFC deposits as compared to non-IFC deposits. In particular, while both IFC and non-IFC deposits declined in the years after the financial crisis, non-IFC deposits have since surpassed pre-crisis levels, while IFC deposits have continued to decline.⁷ This could suggest that the immediate post-crisis contraction in bank deposits, which affected both IFCs and non-IFCs, was a result of the crisis itself. However, the contraction in IFC deposits (especially those in European and Caribbean IFCs) in more recent years while there has been an expansion in non-IFC deposits points to the potential impact of EOI.

Figure 2 shows bank deposits aggregated across IFCs and non-IFCs (in US\$ millions). Whereas the upper panel displays foreign-owned deposits in all IFCs, the lower panel presents IFC cross-border deposits excluding the Cayman Islands; Hong Kong, China; and Macau, China, as discussed below.

The broad trends in the data are similar in both charts. Following a peak in 2008, the level of bank deposits declined in both IFCs and non-IFCs. Bank deposits in non-IFCs began a return to pre-crisis levels from 2010 onwards and have recently even surpassed the 2008 peak. However, they continued to decline steadily in IFCs, albeit more gradually when excluding the Cayman Islands.

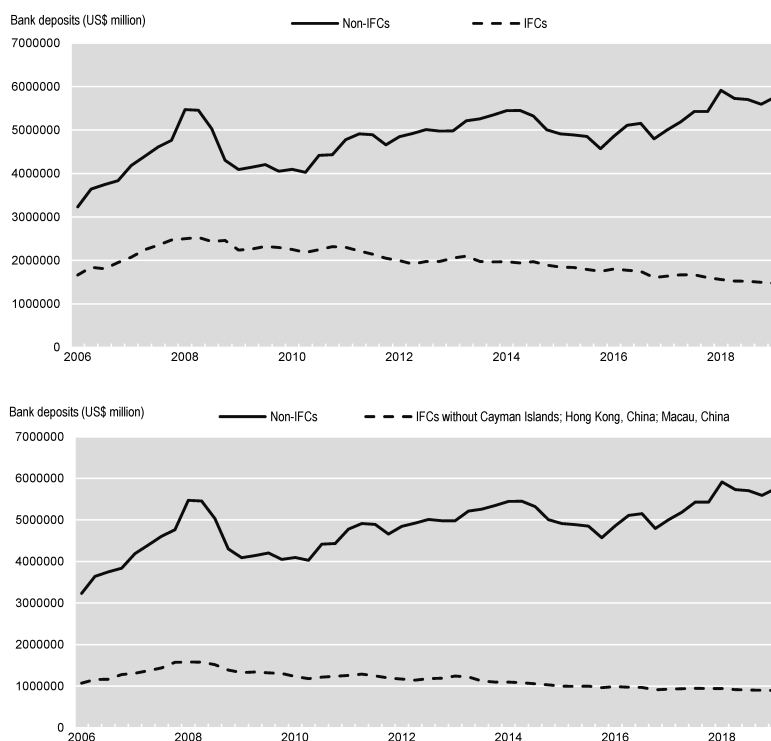
Deposits including all reporting IFC jurisdictions rose substantially in the period since the early 2000s and increased even faster in the period immediately before the global financial crisis, reaching a peak in Q2 2008 (US\$2.5 trillion). Since then, deposits of banks in IFCs in respect of non-banks have fallen substantially, by US\$ 1.055 billion or 42%. Amid an overall declining trend periods of stronger decreases appear. A large part of the total reduction occurred during and in the immediate aftermath of the global financial crisis, where deposits fell by 14% between the second quarter of 2008 and the second quarter of 2010. During the subsequent two years, IFC deposits experienced an even steeper decline of about 12% (from Q2 2010 to Q2 2012) and suffered from another decrease of around 17% during Q2 2013 and Q4 2015. The decrease has continued in recent years by a further 18% since Q1 2016.

Figure 2 also presents results with the Cayman Islands; Hong Kong, China; and Macau, China omitted from the set of IFCs. This is because there is a particularly strong reduction in bank deposits in the Cayman Islands. Bank deposits there have historically been driven by a strong share of deposits from financial institutions in the United States (Kreicher *et al.*, 2014; Fichtner, 2016).⁸ It is likely that domestic regulatory changes in the United States (e.g. the Dodd-Frank Act), have led US financial institutions to significantly reduce bank account activity in the Cayman Islands. Given that this reduction may be driven, at least in a significant part, by factors other than changes in the tax transparency environment, separate results are also presented for the rest of the sample. When excluding the Cayman Islands, the overall downward trend of IFC deposits is more modest. After the peak in Q1 2008 (US\$ 1.7 billion), deposits fell by US\$ 410 billion, an equivalent of 24%. However, the overall decline also disguises periods of stronger and weaker declines. During and directly after the financial crisis, IFC deposits decreased strongly by 23% between Q1 2008 and Q2 2010. The period between Q2 2011 and Q2 2012 was marked by another decrease of around 8%. Since 2013, deposits have dwindled rather slowly but steadily by around 11%. A similar decline in IFC deposits, though expressed in GDP terms, is also documented in Beer *et al.* (2019). In contrast and by relying on a smaller sample, Casi *et al.* (2020) find both a steeper decline in IFC deposits and a less pronounced increase in non-IFC deposits since 2013.

This discrepancy may be explained by jurisdiction-specific developments. While cross-border deposits have been stable over time in some IFC jurisdictions, others experienced an increase around the time of the global financial crisis and a subsequent decrease that has continued through to the present. Since Q1 2008, declines have been evident in Guernsey,

the Isle of Man, and Jersey as well as the Bahamas and the Cayman Islands. By contrast, Bahrain; Hong Kong, China; Macau, China; Panama and Singapore have experienced an increase in cross-border deposits over time, although in the case of Macau, China and Panama this increase has levelled off in recent years. In Switzerland, a sharp decline in deposits (of just over US\$100 billion) can be noted between June and September of 2013 (the G20 endorsed the AEOI standard in September 2013 and Switzerland announced the US-Swiss Bank Program in August 2013).^{9,10}

Figure 2
CHANGES IN CROSS-BORDER BANK DEPOSITS (2006-2019)



Note: The upper panel shows cross-border deposits in non-IFCs and IFCs, the lower panel cross-border deposits in non-IFCs and IFCs excluding the Cayman Islands; Hong Kong, China; and Macau, China. Data are provided for non-bank counterparties only. Data are aggregated across currencies, sectors, reporting institutions, and instrument type.

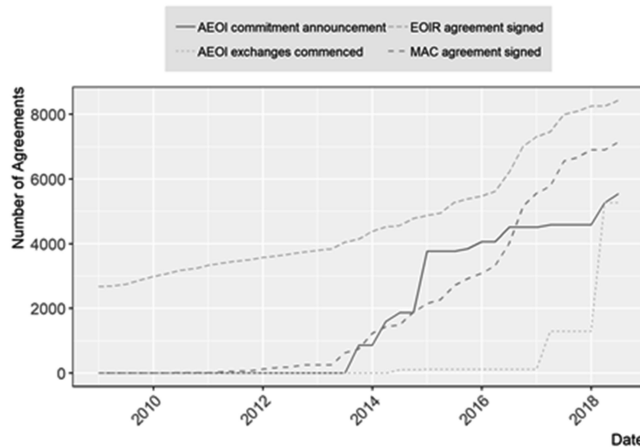
Source: Authors' calculations based on BIS LBS.

3.2. Stylised facts on the expansion of the EOI network

Figure 3 shows the expansion of EOI of various forms over the course of the last ten years.¹¹ There is a steady increase in the global number of bilateral EOIR relationships from 2009 to 2018 (the blue dashed line). However, more striking than the increase in total EOIR

relationships is the extent to which this increase is driven by MAC signatures. The number of global MAC-based EOIR relationships expands dramatically post-2012. The chart also shows the dramatic expansion in AEIOI –first following the commitment of G20 countries to exchange information automatically in September of 2014, with increasing commitments over the course of that year.

Figure 3
NUMBER OF BILATERAL EOIR RELATIONSHIPS



Note: Data on bilateral EOIR agreements post-2017 are preliminary and subject to revision. ‘EOIR agreement signed’ refers to the signature of any agreement that establishes an EOIR relationship, including TIEAs, DTCs, and the MAC itself. To avoid double-counting, agreements that establish an EOIR relationship where one was already in place are not included (e.g. instances where two countries sign a DTC that provides for EOIR where a TIEA already provided for EOIR between the two countries).

Source: Data on information exchange agreements provided by the Global Forum.

Accounting for the impact of the MAC is particularly important due to its multilateral approach to tax transparency. Established in 1988 and amended by Protocol in 2010 to allow for broader country participation, the MAC not only provides for bilateral and multilateral EOIR (including exchange on request, spontaneous exchange, and automatic exchange), it also includes assistance in recovery, the service of documents and can facilitate joint audits among its signatories. Apart from increasing individual tax transparency, businesses may also profit from a reduction in compliance costs and the creation of a level playing field. Moreover, the MAC is not only a valuable tool for fighting tax evasion; it may also encourage other law enforcement purposes such as fighting corruption and money laundering (OECD/Council of Europe, 2011). Importantly, the MAC allows jurisdictions seeking to engage in tax transparency to exchange information with a large number of other jurisdictions without signing many bilateral TIEAs. Johannesen and Zucman (2014, p. 89) write that a “comprehensive multilateral agreement would prevent tax evaders from transferring their funds from haven to

haven". The MAC performs exactly this function. Our study is, to our knowledge and despite its importance, the first to account for the relationships generated by the MAC signatures in an analysis on the impact of EOIR.¹²

Figure 4 presents the expansion of EOIR in IFCs over the period from 2008 to 2018. The figure shows, for each jurisdiction, the number of EOI relationships of all kinds (under tax information exchange agreements (TIEAs), double tax conventions (DTCs), European Union Directives, the MAC, or any other relevant transparency agreements). The blue line shows the number of EOI relationships that existed for each jurisdiction under the MAC. The flat blue lines in many jurisdictions, followed by sharp rises, serve to highlight the MAC signature date. It is important to highlight that in some countries signature of the MAC comprises a larger share of the total EOIR relationships than in others. It is clear, for example, that Switzerland had a large EOIR network prior to MAC signature, meaning that many of the EOIR relationships established by Switzerland under the MAC already existed under other agreements. However, for other jurisdictions such as Montserrat for example, it can be noted that agreements under the MAC constitute the vast majority of the EOIR relationships in which the jurisdiction participates.

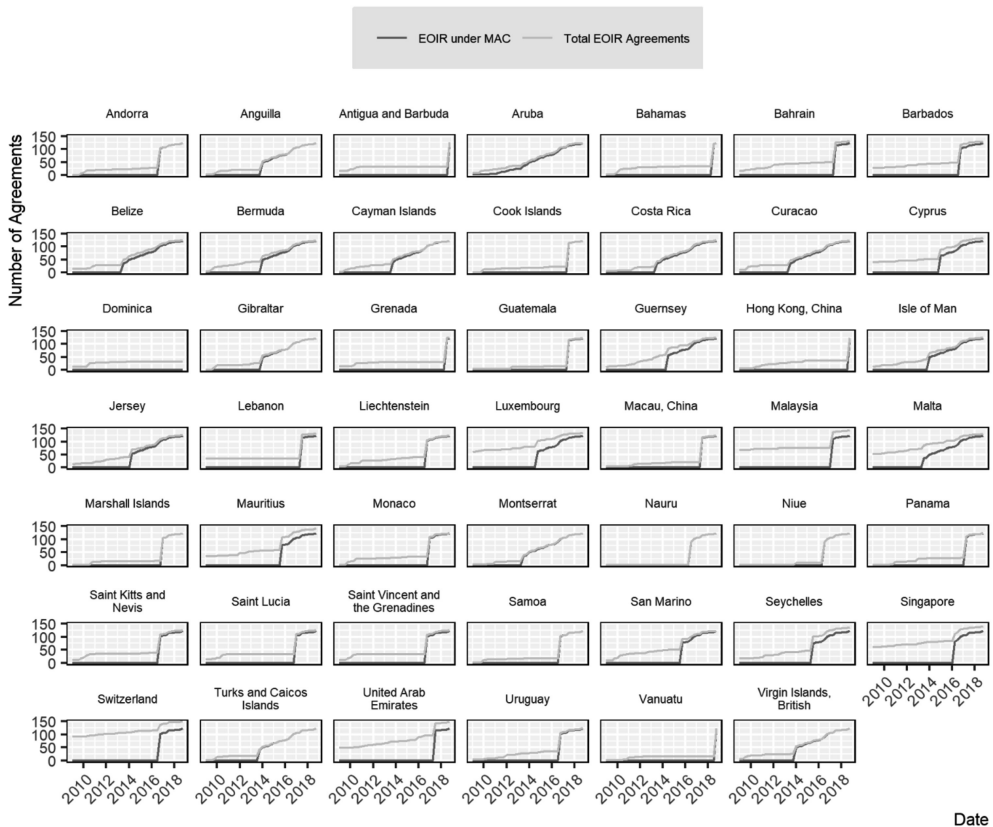
Before embarking on a more quantitative analysis of the impact of an enlarging EOI network on bank deposits in IFCs, a few words of caution on interpreting the results presented above and in the future are necessary. The previous section highlighted that there have been substantial reductions in the size of bank deposits in certain IFCs reported to the BIS. However, a challenge in assessing the impact of EOI is attempting to identify the extent to which these movements are a result of EOI or other factors. First, changes in bank deposits are impacted by non-tax factors such as the attractiveness of the jurisdiction's investment and legal environments, its overall economic performance and recent or impending regulatory changes. For instance, the impact of policy measures to increase financial stability in the post-financial crisis period under the Dodd-Frank Act on US –Cayman Island banking relations are a case in point (Kreicher *et al.*, 2014). Moreover, deposit declines in IFCs do not automatically imply less tax evasion, though tax authorities have anecdotally reported substantial revenue gains in the aftermath of the introduction of AEOI (OECD, 2020). Recent evidence by De Simone *et al.* (2019) shows, for example, that evaded funds have partly been relocated into other asset classes such as artwork or real estate, which have not yet been covered by AEOI.

As it becomes apparent, the extent to which offshore bank deposits represent hidden wealth is by no means clear. From a tax perspective, assets held offshore may be fully compliant with tax rules. Where this is the case, these deposits would be expected to be unresponsive to EOI.

Complementary evidence suggests that there has been significant disclosure of previously undisclosed assets. Since the widespread adoption of EOI, an estimated 500,000 individuals have disclosed offshore assets through voluntary disclosure programmes and around €107 billion in additional tax revenue has been identified as a result of voluntary compliance mechanisms and offshore investigations (OECD, 2020). The fact that these sums were in large part disclosed through voluntary disclosure programmes set up in advance of the com-

mencement of AEOI in 2017 points to a relationship between taxpayer behaviour and EOI. However, disentangling these various effects constitutes a significant challenge, which we attempt to take on in the following analysis.

Figure 4
EOIR AGREEMENTS AND MAC AGREEMENTS OVER TIME



Note: The figure shows the total number of EOIR agreements signed by each jurisdiction. The list of IFCs is based on IMF (2000).

Source: Data on information exchange agreements provided by the Global Forum.

4. Investigating the impact of EOI on cross-border bank deposit holdings

4.1. Key hypotheses and methodological approach

While the decline in overall bank deposits in IFCs provides some suggestive evidence of the impact of EOI, it does not fully analyse its impact at bilateral level. It is useful to turn to

regression analysis to investigate further whether the advent of EOI can be associated with changes in bank deposits. The key expectation is that, to the extent that some fraction of bank deposits in IFCs have historically existed for the purposes of tax evasion, the expansion of EOIR and the introduction of AEOI should have made riskier the holding of assets in EOI jurisdictions. The subsequent analytical approach follows closely that of Johannesen and Zucman (2014) and is adapted to our needs where necessary.¹³

The expected response is that taxpayers would remove their assets from IFCs that commit to, sign or implement EOI agreements with non-IFCs.¹⁴ This leads to the following hypothesis:

H1: An EOI agreement between a given IFC and a given non-IFC triggers a reduction in bank deposits held in the IFC by residents of the non-IFC.

This hypothesis is tested using the following general regression equation:

$$\log(\text{Deposits}_{ijq}) = \alpha + \beta \text{EOI}_{ijq} + \epsilon_{ijq} \quad (1)$$

where Deposits_{ijq} denotes the bank deposits held in jurisdiction i by residents of jurisdiction j in quarter q . This paper focuses on deposits in countries that are IFCs.^{15,16} It relies on an unbalanced panel of 16 IFCs with sufficient bilateral deposit relations available.¹⁷ The IFCs included are Bahrain; Bahamas; Bermuda; Netherlands Antilles/Curaçao; Cayman Islands; Cyprus; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macau, China; Malaysia; Panama; Singapore; and Switzerland. EOI_{ijq} is a dummy variable that denotes whether any kind of EOI relationship exists in quarter q between jurisdictions i and j .

According to hypothesis H1 above, it is expected that the sign of the coefficient β estimating the impact of EOI will be negative for deposits of IFCs with respect to non-IFCs. This paper examines the two main forms of EOI that have expanded in recent years: EOIR and AEOI. The independent variable for EOIR is the signature of a bilateral or multilateral agreement providing for EOIR. Such an agreement could be bilateral such as a DTC, a TIEA, or any other relevant multilateral transparency agreement, namely when two jurisdictions sign the MAC. As stated above, signatures of the MAC have particularly expanded during the post-2012 period and have accounted for the majority of EOIR relationships since then.

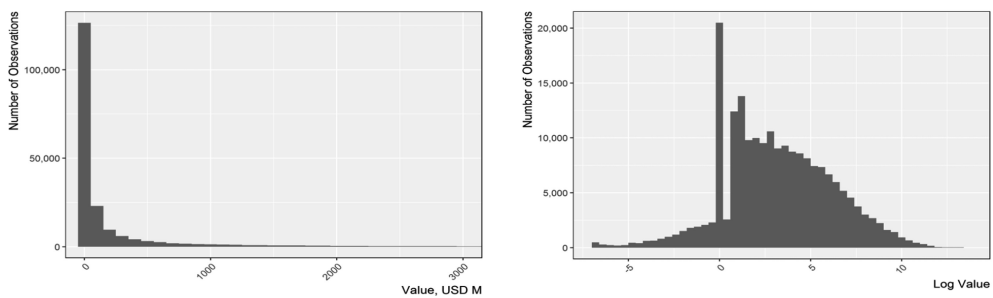
The independent variable for AEOI is either a public commitment to exchange information automatically or the commencement of AEOI under the CRS. It also includes the signature of a FATCA Intergovernmental Agreement (IGA).¹⁸ For robustness, the analysis is carried out with and without FATCA, which is a US-based system of information exchange, noting that it is similar to but not the same as the CRS.¹⁹ All three different approaches to assessing the impact of AEOI, the public commitment to AEOI, the commencement of AEOI and the FATCA IGA signatures are tested below.

Taxpayers may have responded to such agreements with varying speeds. Some taxpayers may have responded at the earliest possible date, declaring deposits to tax authorities or shifting them out of IFC jurisdictions with the advent of expanded EOI, or they may have

waited until the last possible moment before EOI came about. This means that it is useful to separately examine both the announcement of commitment to AEOI as well as the commencement of exchange under AEOI agreements to best capture the behavioural responses of taxpayers, whose behaviour may change either upon announcement of the upcoming changes in the EOI environment or at the time of the actual commencement of AEOI exchanges.

The regression approach uses log deposits as a dependent variable to account for the substantial skewness of bank deposits in the BIS dataset. Figure 5 shows the distribution of the BIS values (left panel), and the distribution of the logged BIS values (right panel). The distribution of the logged values more closely approximates the normality assumption. This means that the regression results should be interpreted as percentage changes in bank deposits.²⁰ Moreover, ϵ_{ijq} in equation (1) denotes a jurisdiction-pair-year-quarter specific error term that is modelled in various ways, as discussed below.

Figure 5
DISTRIBUTION OF BIS DATA



Note: Data are provided for non-bank counterparties only. Data are aggregated across currencies, sectors, reporting institutions, and instrument type.

Source: Authors' calculations based on BIS LBS.

4.2. Main results for liabilities of IFCs with respect to non-IFCs

The results of the analysis are presented first with jurisdiction-pair fixed effects, and then with both jurisdiction-pair fixed effects and time fixed effects. Time fixed effects work to account for many non-tax factors (e.g. declines in interest rates) that could have also impacted bank deposits over this period. As will be discussed below, the presence of time fixed effects complicates the interpretation of the results, because many significant changes in the EOI environment have proceeded quickly across all IFCs. It is thus challenging to separate the impact of EOI from the broader time trends of IFC deposits that can be discerned in the data.

4.2.1. Omitting time fixed effects

The first set of key regression results from the above equation are presented in Table 3. The dependent variable in this analysis is bank deposits in IFCs held by counterparties in

non-IFCs. As discussed above, these models have jurisdiction-pair fixed effects, but omit year-quarter fixed effects, in contrast to much of the literature. In each instance, the results are presented with clustered standard errors (in parentheses) at the jurisdiction-pair level. The regression equation is as follows:

$$\log(\text{Deposits}_{ijq}) = \alpha + \beta_1 \text{EOIR Signature}_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (2)$$

where μ_{ij} represents the dummy variable for the jurisdiction-pair ij . This means that the estimation of the impact of EOIR is averaging out the impact of a specific jurisdiction-pair relationship on cross-border bank deposits. This takes account of, for example, the fact that France and Switzerland may have higher expected cross-border bank deposits owing to their geographical proximity compared to, for example, Switzerland and Australia.²¹

The first column presents the specification with EOIR signature as the only independent variable. The coefficient on EOIR signature (β_1) is negative and statistically significant at the 1% level, suggesting that without controlling for either AEOI or time characteristics, the EOIR signature is associated with a reduction in bank deposits held in IFCs of about 20%. In the following specifications, the other EOI variables are gradually added to control simultaneously for the different forms of EOI, to avoid omitted variable bias and account for potential endogeneity in treaty adoption among jurisdictions.

The second set of results adds a dummy variable for the announcement of a commitment to AEOI commencement. This regression specification is as follows:

$$\begin{aligned} \log(\text{Deposits}_{ijq}) = \\ \alpha + \beta_1 \text{EOIR Signature}_{ijq} + \beta_2 \text{AEOI Announcement}_{ijq} + \mu_{ij} + \epsilon_{ijq} \end{aligned} \quad (3)$$

In this specification, the coefficients on both β_1 and β_2 are negative and statistically significant. The AEOI announcement is associated with an 18.6% reduction in bank deposits over and above EOIR signature, the coefficient for which falls from 20% to 12%.

The third set of results does not consider the impact of the AEOI announcement but rather the impact of the commencement of automatic information exchange mechanisms, i.e. with AEOI operational and FATCA in place. As discussed above, this helps to assess whether taxpayers respond to the announcement of AEOI or its commencement. The regression specification is as follows:

$$\begin{aligned} \log(\text{Deposits}_{ijq}) = \\ \alpha + \beta_1 \text{EOIR Signature}_{ijq} + \beta_2 \text{AEOI Commencement}_{ijq} + \mu_{ij} + \epsilon_{ijq} \end{aligned} \quad (4)$$

The regression results show a negative association between EOIR (associated with a 14.7% decrease in bank deposits) as well as a larger negative association between AEOI commencement and bank deposits. The coefficient suggests a reduction of 31% in expected bank deposits in the aftermath of AEOI commencement.

The subsequent set of results incorporates both the AEOI announcement and commencement. The regression equation is as follows:

$$\log(\text{Deposits}_{ijq}) = \alpha + \beta_1 \text{EOIR Signature}_{ijq} + \beta_2 \text{AEOI Announcement}_{ijq} + \beta_3 \text{AEOI Commencement}_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (5)$$

The results in this instance are broadly consistent with the effect found in the previous two models, with EOIR signature being associated with a roughly 11% reduction in bank deposits in IFCs, the AEOI announcement also being associated with an approximately 11% reduction, and AEOI commencement being associated with a -28% impact.

The last specification in Column 5 is similar to equation 5 as it includes again EOIR signature and AEOI announcement. In addition, it adds a variable on AEOI commencement without accounting for established FATCA IGA relationships to test both impacts separately. Both EOIR and AEOI announcements exert the same negative 10.6% effect on IFC deposits. The coefficient from the AEOI commencement variable excluding FATCA is, with an estimated impact of -30%, significantly higher. It has a slightly larger impact than the previous combined AEOI commencement variable. It is important to note that the sample size in this specification is relatively small, as there are only five quarters after September 2017 (when AEOI was widely implemented) in the dataset. This suggests that a longer time series may give further support to this result.

Table 3
THE EFFECT OF EOIR ON FOREIGN-OWNED DEPOSITS IN IFCs, WITH JURISDICTION-PAIR FIXED EFFECTS

	EOIR Only	EOIR and AEOI Announcement	EOIR and AEOI (incl. FATCA) Commencement	EOIR and AEOI (incl. FATCA) Announcement and Commencement	EOIR and AEOI Announcement and Commencement
EOIR Signature	-0.219*** (0.046)	-0.128*** (0.042)	-0.159*** (0.044)	-0.116*** (0.042)	-0.112*** (0.042)
AEOI Announcement		-0.206*** (0.053)		-0.115** (0.052)	-0.112** (0.051)
AEOI Commencement					-0.354*** (0.044)
AEOI (incl. FATCA) Commencement			-0.374*** (0.050)	-0.322*** (0.045)	
R2	0.011	0.017	0.023	0.025	0.026
Num. obs.	29 461	29 461	29 461	29 461	29 461
Jurisdiction-pair FEs	Yes	Yes	Yes	Yes	Yes
Year-Quarter FEs	No	No	No	No	No

Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of IFC j at the end of quarter q . The unit of observation is the jurisdiction-pair (i, j) and the sample period runs from Q1 2006 to Q4 2018. Data are provided for non-bank counterparties only. ***, ** and * represent statistical significance levels of 1%, 5% and 10% respectively. The countries used as reporting IFCs in this regression are: Bahrain, Bermuda, Bahamas, Cayman Islands, Cyprus, Netherlands Antilles/Curaçao, Guernsey, Hong-Kong, Isle of Man, Jersey, Luxembourg, Macau (China), Malaysia, Panama, Singapore, and Switzerland. The Cayman-US series has been removed from the regression as outlined in Section 3.1.

Source: Authors' calculations based on BIS LBS, and data on information exchange agreements provided by the Global Forum.

4.2.2. Including time fixed effects

In Table 4, the regression includes year-quarter fixed effects. Time fixed effects factor out events at specific times that may have affected all IFCs in a similar way, such as the financial crisis or global regulatory changes. The regression equation becomes as follows:

$$\log(\text{Deposits}_{ijq}) = \alpha + \beta_1 \text{EOIR Signature}_{ijq} + \mu_{ij} + \theta_q + \epsilon_{ijq} \quad (6)$$

where the term θ_q represents the specific time effect of each year-quarter q on log-bank deposits.

When year-quarter fixed effects are accounted for, the size of many coefficients in the regressions shrinks substantially or becomes insignificant. Signature to EOIR is now associated with a small and not-statistically significant decrease in IFC bank deposits of between 2% and 4%. AEOI announcement is also no longer significant despite the expected sign on the coefficient. Both AEOI commencement variables, however, continue to be associated with a strong decrease in deposits. While the AEOI and FATCA combined variable exerts an impact of between -17% and -18%, the AEOI-only dummy indicates again an even higher negative effect of around 22%. All AEOI commencement variables are significant at 1% level.

Table 4
THE EFFECT OF EOIR ON FOREIGN-OWNED DEPOSITS IN IFCS, WITH JURISDICTION-PAIR AND YEAR-QUARTER FIXED EFFECTS

	EOIR Only	EOIR and AEOI Announcement	EOIR and AEOI (incl. FATCA) Commencement	EOIR and AEOI (incl. FATCA) Announcement and Commencement	EOIR and AEOI Announcement and Commencement
EOIR	-0.024	-0.028	-0.041	-0.042	-0.043
Signature	(0.044)	(0.044)	(0.045)	(0.045)	(0.044)
AEOI		-0.074		-0.041	-0.033
Announcement		(0.066)		(0.064)	(0.064)
AEOI Commencement					-0.249***
AEOI (incl. FATCA) Commencement			-0.199***	-0.185***	(0.062)
R2	0.0001	0.0005	0.002	0.002	0.003
Num. obs.	29 461	29 461	29 461	29 461	29 461
Jurisdiction-pair FEs	Yes	Yes	Yes	Yes	Yes
Year-Quarter FEs	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of IFC j at the end of quarter q . The unit of observation is the jurisdiction-pair (i, j) and the sample period runs from Q1 2006 to Q4 2018. Data are provided for non-bank counterparties only. ***, ** and * represent statistical significance levels of 1%, 5% and 10% respectively. The countries used as reporting IFCs in this regression are: Bahrain, Bermuda, Bahamas, Cayman Islands, Cyprus, Netherlands Antilles/Curaçao, Guernsey, Hong-Kong, Isle of Man, Jersey, Luxembourg, Macau (China), Malaysia, Panama, Singapore, and Switzerland. The Cayman-US series has been removed from the regression as outlined in Section 3.1

Source: Authors' calculations based on BIS LBS, and data on information exchange agreements provided by the Global Forum.

Consistent with the literature on this topic, these results continue to show the robust negative association of AEOI implementation on bank deposits in IFCs. Compared to other relevant studies in the field, estimates in this paper land in the middle of an AEOI impact range of between -13.1% and -34.9% (see Figure 1). The findings come closest to Beer *et al.* (2019) who use an unbalanced sample with a different coverage of IFCs and sample length. They report an average effect of about -25% exerted by AEOI commencement on IFC deposits. The slightly reduced effect of FATCA on AEOI efficiency may be, for instance, due to the limited reciprocity in information exchange by the US as suggested by Beer *et al.* (2019) and Casi *et al.* (2020).

The null results with respect to EOIR in Table 4 stand in contrast to work by Johannesen and Zucman (2014) and Menkhoff and Miethe (2019), which demonstrates statistically significant negative results of -11% and -24% respectively. However, they corroborate the findings of Beer *et al.* (2019) who note an insignificant reduction in IFC deposits of around 12%. To examine this discrepancy further, Table 5 re-estimates the model specification of Table 4 for EOIR only over varying sample lengths, assessing whether the impact of EOIR signatures has varied over time. As in Johannesen and Zucman (2014), the beginning of the sample period considered in the analysis is Q4 2003 and the end of the sample period varies from Q4 2011 up to Q4 2014.

Table 5
THE IMPACT OF EOIR OVER TIME

	EOIR only Sample length: Q1 2006 - Q4 2018	EOIR only Sample length: Q4 2003 - Q4 2011	EOIR only Sample length: Q4 2003 - Q4 2012	EOIR only Sample length: Q4 2003 - Q4 2013	EOIR only Sample length: Q4 2003 - Q4 2014
EOIR	-0.024	-0.066	-0.106*	-0.095*	-0.093*
Signature	(0.044)	(0.056)	(0.055)	(0.051)	(0.049)
R2	0.0001	0.001	0.002	0.001	0.001
Num. obs.	29 461	16 169	18 585	21 065	23 834
Jurisdiction- Pair FEs	Yes	Yes	Yes	Yes	Yes
Year-Quarter FEs	Yes	Yes	Yes	Yes	Yes

Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of IFC j at the end of quarter q . The unit of observation is the jurisdiction-pair (i, j) and the maximum sample period runs from Q1 2003 to Q4 2014. Data are provided for non-bank counterparties only. Data are aggregated across currencies, sectors, reporting institutions, and instrument type. ***, ** and * represent statistical significance levels of 1%, 5% and 10% respectively.

Source: Authors' calculations based on LBS, BIS, and data on information exchange agreements provided by the Global Forum.

Table 5 demonstrates the impact of expanded EOIR agreements during the early years of the EOIR standard and confirms previous results in the literature. Whereas in Column 1 the original sample does not yield significant results with respect to EOIR impact, subsequent estimates show some significant results at the 10% levels that are decreasing in size with the lengthening time series. Column 3 reports an effect on IFC deposits of about -10% during

the period from Q4 2003 to Q4 2012, which is close to the estimate reported by Zucman and Johannesen (2014) despite of the different cross-country sample. Including additional years up to Q4 2014, however, decreases the impact to about 8.5%. Menkhoff and Miethe (2019) document a similar weakening effect of EOIR over time.

This difference in impact could be explained by the nature of the country pairs experiencing changes in EOI relationships over this period. As more and more countries signed the MAC, more and more EOI relationships were coming into place (see Figure 3 above). As MAC coverage became close to comprehensive, the multilateral nature of the MAC meant many of these relationships were among countries that had little or no bilateral cross-border financial activity that might be impacted by the MAC.²² Countries signing the MAC established potential EOIR relationships with every other signatory, whether or not there were substantial volumes of cross-border banking activity. This may account for the relative decline in the size of the EOIR's impact over time.

4.3. Accounting for multicollinearity

The reduction in coefficient size and significance suggests that time fixed effects explain some of the effects previously attributed to EOI.²³ This is complicated by the fact that changes to several of the independent variables are concentrated in certain periods. This suggests that there is some multicollinearity between specific events factored out by time fixed effects and the EOI variables. This may imply that the time fixed effects capture some of the impact of the changes in the EOI environment found in Table 4. To observe this, it is useful to examine the fixed effects and time trends in the independent variables themselves.

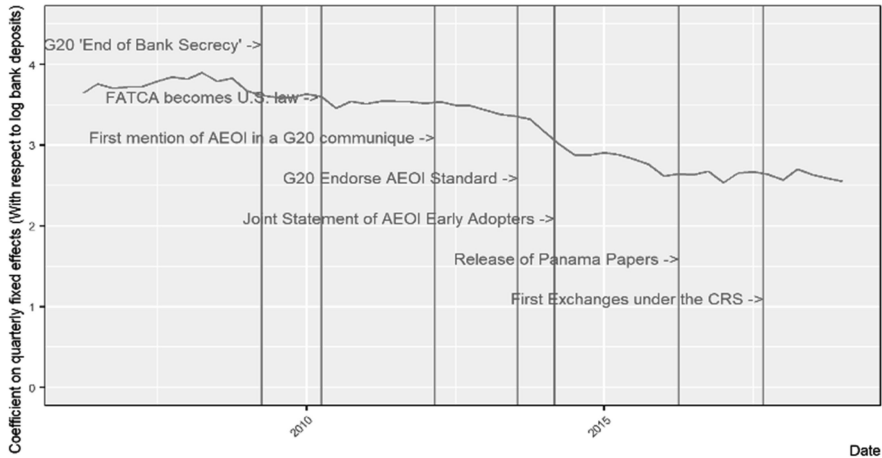
Figure 6 shows these fixed effects over time. There is an overall decline in bank deposits in IFCs being captured by the quarterly fixed effects. Several of these periods of substantial decline coincide with changes in the EOI environment, either through substantial increases in the expansion of EOIR (i.e. through the expansion of the MAC) or public commitment to AEOI, most notably in the period from the end of 2013 to end 2014. Figure 7 depicts that most IFC jurisdictions declared commitments to AEOI over this period. The periods of highest new signature levels are also the periods of the sharpest declines in the fixed effects.

Around the same time, other countries such as Switzerland entered into economically important bilateral treaties (such as the US-Swiss Bank Program in August 2013) and then experienced significant declines of foreign-owned deposits (see Figure 8). Over the course of the quarters covered, the trend effect shows several reductions (albeit of varying sizes) that coincide with key events in the tax transparency timeline. This includes the period following FATCA becoming law in the United States, as well as in the aftermath of early signals that AEOI would expand beyond the United States' FATCA legislation (e.g. the first time AEOI is mentioned in a G20 Communiqué).

This, in turn, suggests that certain events in the timeline of the expansion of tax transparency are associated with decreases in bank deposits in IFCs. However, the fact that these

events are collinear with AEOI announcement dates makes this effect difficult to conclusively associate with AEOI in the regression specification.²⁴

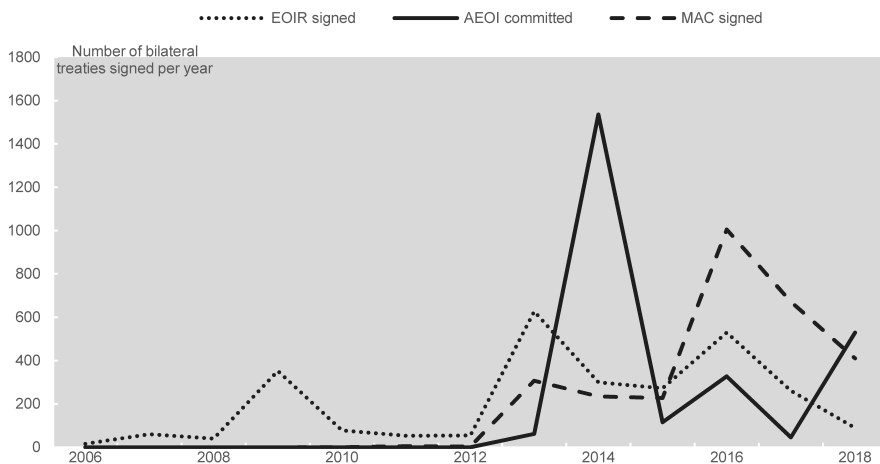
Figure 6
YEAR-QUARTER FIXED EFFECTS OVER TIME



Note: The figure is based on the regression of EOIR and AEOI commencement with jurisdiction-pair and year-quarter fixed effects. The dependent variable is the stock of deposits held by savers of jurisdiction *i* in banks of IFC *j* at the end of quarter *q*.

Source: Authors' calculations based on BIS LBS.

Figure 7
CHANGES TO THE EOI ENVIRONMENT OVER TIME



Note: The figure shows the number of bilateral treaties signed in each year.

Source: Data on information exchange agreements provided by the Global Forum.

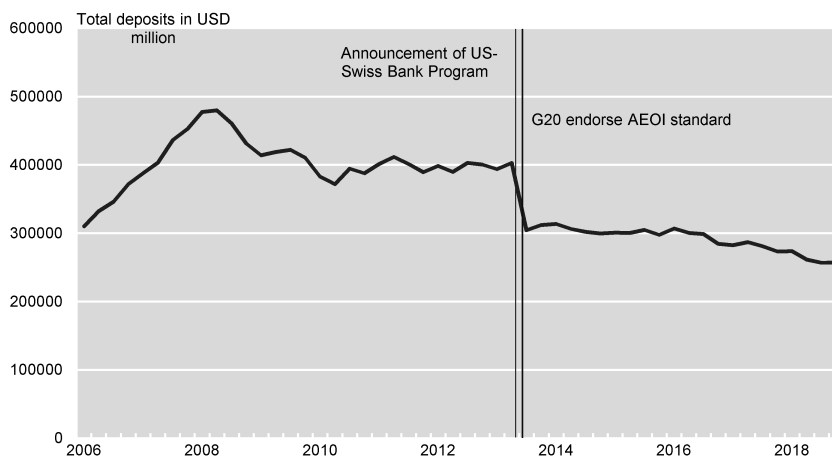
4.3.1. Quantifying the impact of the AEOI Joint Announcement

In March 2014, forty-four jurisdictions jointly announced their commitment to AEOI at the same time (referred to hereinafter as the Joint Announcement).²⁵ This substantial number of jurisdictions participating in the Joint Announcement provides the opportunity to analyse the potential impact of EOI on a sub-sample of IFCs in more detail, to check for a diluting effect of multicollinearity and establish further the robustness of the results presented in Section 4.2.

Among those jurisdictions that were part of the Joint Announcement, six IFCs provide bilateral data in the sample available from the BIS.²⁶ Combining the data for these IFCs with other early-adopting non-IFC jurisdictions enables the examination of their bank deposits relative to those of other jurisdictions that did not participate in the Joint Announcement.²⁷

The analysis relies on a sub-sample of the bilateral deposit database composed of two different jurisdiction pairs, namely those that announced early and others that did not (illustrated in Figure 9), whereby the IFC-non-IFC pairs that both participated in the Joint Announcement can be compared to those IFC-non-IFC country pairs that did not. This allows for an examination of the impact of many jurisdictions publicly committing to implementing AEOI at the same time, and addresses the issue of multicollinearity that makes it difficult to assess this through the regression specification above. This is because for a short period, a set of IFCs and non-IFCs had publicly committed to AEOI while another set had not. By comparing these two groups, it is possible to assess the impact of public commitment on bank deposits.

Figure 8
FOREIGN-OWNED DEPOSITS IN SWITZERLAND



Note: The variable is the stock of deposits held by foreign savers in Swiss banks at the end of each quarter. The vertical lines indicate respectively the joint announcement of the US-Swiss Bank Program by US and Swiss authorities on August 29, 2013 and the G20 endorsement of the AEOI standard on September 5-6, 2013 in St. Petersburg.

Source: Authors' calculations based on BIS LBS, and data on information exchange agreements provided by the Global Forum.

Figure 9
COMPOSITION OF DIFFERENT SUB-SAMPLES FOR THE
DIFFERENCE-IN-DIFFERENCES ESTIMATION

		IFCs	
		Early Adopters	Latecomers
Non-IFCs	Early Adopters		
	Latecomers		

Note: Both panels in grey can be compared to each other.

It is assumed that responses to the AEOI Joint Announcement in the form of reductions in bank deposits in IFCs should occur between early-adopting jurisdiction pairs and leave the jurisdictions that commit at a later stage relatively unaffected. An approach similar to Johannesen (2014) is used to test this assumption by estimating through OLS an extended version of a regular two-period difference-in-differences model such as the following:

$$\log(\text{deposits})_{ijt} = \alpha + \mu_{ij} + \gamma_t \theta_t + \delta_t \theta_t * EA_{ij} + \varepsilon_{ijt} \quad (7)$$

where μ_{ij} is a set of jurisdiction-pair dummies, θ_t is a set of year-quarter fixed effects and EA_{ij} is an indicator variable coded as one whenever a jurisdiction pair belongs to the group of early adopters and zero otherwise. As the joint announcement of jurisdictions to adopt AEOI occurred in March 2014, the first quarter of 2014 becomes our reference quarter in the regression and consequently remains omitted.

The model estimates time trends in foreign-owned deposits among early-announcing jurisdiction pairs (the treatment group), and those that commit at a later stage, referred to as the control group. Any significant divergence in trends around the time of the Joint Announcement, in the first quarter of 2014, is interpreted as a causal effect of early AEOI commitment on bank deposits. Due to the inclusion of various fixed effects, the results are reported conditional on time-invariant jurisdiction-pair effects, accounting for gravity factors such as common language or geographical distance, and common time-varying year-quarter effects accounting, for instance, for global regulatory changes or financial crises (this approach is similar to that in Section 4.2 above). Estimated standard errors are robust and clustered at the jurisdiction-pair level, as suggested in Bertrand *et al.* (2004).

The estimated treatment effect for a given post-announcement quarter t is captured by $\hat{\delta}_t$. This parameter represents the difference in growth of deposits in early-adopting IFCs held by other early-adopting non-IFCs over deposit growth in the control group (the later-committing jurisdiction pairs) in every year-quarter as of 2014 Q1. The causal interpretation of the treatment effect relies on the strict assumption that only the IFCs within the treatment group encounter withdrawals of deposits upon early announcement.²⁸ The deposit time trend of

early-announcing IFCs should thus follow a significantly different trajectory after 2014 Q1. In the absence of the Joint Announcement, both trends would follow roughly identical paths prior to and post Joint Announcement. This implies that pre-treatment trend differentials should be relatively negligible, with the coefficients of $\hat{\delta}_t$ being relatively small and statistically insignificant. Failure to do so, for instance through different economic or regulatory shocks driving trends in the treatment and control groups, would yield biased results.

Figure 10 presents the main results of the regression analysis: the estimated aggregated time trends for early-adopting jurisdiction pairs relative to non-early-adopting jurisdiction pairs.²⁹

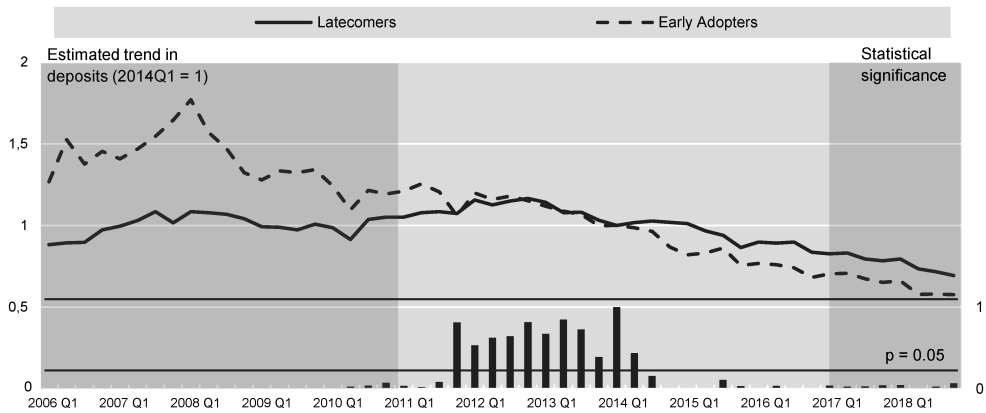
The two lines represent respectively the treatment and control group in the difference-in-differences estimation. The dotted line is the estimated time trends of foreign deposits in early-adopting IFCs held by early-adopting non-IFC counterparties. The solid line is the estimated time trend of foreign deposits held between jurisdiction pairs that committed later. The columns indicate the statistical significance of the interaction terms $\theta_\tau * EA_{ij}$, the combined impact of being an early adopting IFC jurisdiction compared to non-early-adopting IFCs.

The results point to a notable common trend in both series of about ten quarters preceding the Joint Announcement, which is followed by an increasing divergence of both trends after the first quarter of 2014.³⁰ The estimated trend line of the treatment group declines considerably more than the control group trend amid an overall fall in IFC deposits. This is particularly the case in the first four post-announcement quarters.

The statistical significance of this diverging trend trajectory is confirmed by the bars on the bottom of the figure, which indicate rising significance directly following the Joint Announcement, surpassing the 5% level around the third quarter of 2014. The bars represent the p-values in the regression, so lower bars point to evidence of a statistically significant difference between early-adopters and non-early-adopters. The very low bars after the Joint Announcement point to a statistically significant difference between jurisdictions that announced and those that did not. Moreover, both trend lines fail to converge and continue their constant earlier decline after the Joint Announcement. This suggests that early AEOI announcement seems to trigger a permanent shift in the level of bank deposits of the six IFC treatment groups.

A comparison of average growth rates in deposits between late 2012 until the Joint Announcement and the third and fourth quarter of 2014 (i.e. deposits measured on 30 September and 31 December) provide further evidence for this divergence. While prior to the Joint Announcement growth rates move synchronically at around -1%, they drop by about 5% and 10% for the control and treatment groups respectively. These developments are mirrored by the similarity in the calculated treatment effect on the trend of the treatment group, which amounts to about -15% during the same period.³¹ Averaged over the four post-announcement quarters (i.e. until 31 March 2015), the analysis suggests that the impact of AEOI joint announcement has a treatment effect on the early-announcing IFC jurisdictions of about -11%.³²

Figure 10
THE IMPACT OF AEOI JOINT ANNOUNCEMENT ON TIME TRENDS IN IFC DEPOSITS



Note: The lines indicate trends in deposits as captured by coefficients on time dummies θ_t and the interaction terms $\theta_t * EA_{ij}$, that is $\exp(\gamma_t)$ for non-Early Adopters and $\exp(\gamma_t + \delta_t)$ for Early Adopters. The columns indicate statistical significance levels of interaction terms $\theta_t * EA_{ij}$. Areas shaded on both ends of the sample range direct the reader to a time window of analysis relevant for inspection due to it being less likely influenced by other events than the Joint Announcement.

Source: Authors' calculations based on BIS LBS data.

4.3.2. The impact on individual IFCs

To further analyse the impact of EOI on individual jurisdictions, it is useful to disaggregate the impacts of the Joint Announcement by country. Aggregating six different IFCs from across regions risks grouping underlying heterogeneity in the impact of AEOI on different jurisdictions. To examine further, the same difference-in-differences specification in Equation 7 is estimated one-by-one for each early-adopting IFC for which data are available from the BIS. The counterparty non-IFCs are split up again into early adopters (the treatment group) and those that announced later on (the control group). The respective figures are contained in the Appendix.

As shown by the estimations in Figures A1, A2 and A3 in the Appendix, there is substantial heterogeneity in the impact of the AEOI Joint Announcement on deposits in each country. The results suggest some signs of trend divergence for Guernsey and the Cayman Islands. As depicted by the bars in the individual figures, the interaction terms become significant after the reference period 2014 Q1, with partial effects only during the four post-announcement quarters. The estimated effects over the four post-announcement quarters of the same period are around -53% for Guernsey and -27% for the Cayman Islands. The results suggest that Jersey was affected to a much lesser extent, as demonstrated by a very slight trend divergence and the barely significant interaction terms. Cyprus shows a parallel decrease in both trends after the reference quarter with no significant drop for the early-adopting jurisdictions, suggesting a very modest impact by the announcement in that jurisdiction.

The trend results for Bermuda and the Isle of Man point to further heterogeneity and suggest that the AEOI Joint Announcement has increased deposits from early-adopting non-IFCs during some periods (Figure A3). This finding is counter-intuitive. However, most of the interaction terms in the four post-announcement quarters for Bermuda and the Isle of Man are not statistically significant, suggesting that the estimated effects are weak.

Overall, the difference-in-differences estimations indicate that the AEOI Joint Announcement in March 2014 had a small and relatively mild significant one-off impact on deposits across the six IFCs covered that were early adopters and for which detailed data is available. The effect on the individual IFCs varies considerably in size and statistical significance, pointing to a heterogeneous impact of EOI on different IFCs. These results contrast the regression results obtained earlier, which do not show a statistically significant impact for the AEOI announcement.

Explanations for this observed divergence in IFC reactions to the Joint Announcement partly lie in structural differences of their underlying business models, which may have been unevenly affected (Bouvatier *et al.*, 2018). For instance, Guernsey and Jersey have a history of specialising in private banking and deposit services (Hampton, 1996) and may thus have been more impacted by the announcement. Other jurisdictions specialising more in mutual fund or hedge fund activity may have been less impacted. Another explanation may be the major regulatory changes prior to the announcement such as the above-mentioned 'base widening' of US banks required by the Dodd-Frank Act in 2011 (Kreicher *et al.*, 2014; Fichtner, 2016).

These results strengthen the findings in two ways. The statistically significant difference between early adopters and non-earlier adopters points to some degree of multicollinearity driving the statistical insignificance in Table 4. The underlying heterogeneous country effects are masked by estimated average responses, which are picked up by the previous regressions with the larger sample. This raises an important qualifier to the headline result in this paper –the average effects of AEOI reported conceal important variation, with larger impacts in some countries and smaller impacts elsewhere.

5. Robustness checks

This section presents the analysis and results for establishing robustness of the main findings from the regression analysis above. These robustness checks are organised along three topics. First, the analysis considers whether the impacts of EOI changes are confined to IFC-non-IFC country pairs and examines the impact of EOI on deposits between non-IFCs and between IFCs. Second, the analysis incorporates into the main model a variable on voluntary disclosure and amnesty programmes to check whether these programmes, often implemented in jurisdictions around the same time as EOI initiatives, alter the main results. Third, the headline regression analysis is re-run on different samples of IFCs to ensure that the results are not driven by the specific list of IFCs used in the paper.³³

5.1. The effect of EOI across jurisdiction pairs

The results in Section 4 have shown a strong negative impact of AEOI commencement on bank deposits in IFCs owned by non-IFC jurisdictions. This is in line with expectations that the impact of EOI through potential non-compliant taxpayers would be concentrated in IFCs. However, the impact of EOI outcomes is strengthened if it is possible to highlight that this impact is confined to IFCs, and that non-IFC jurisdictions did not experience the same impacts as IFCs. For example, AEOI commencement should not trigger any significant reduction effect among deposits between non-IFCs and deposits with IFC counterparties only.

Table 6 shows the main regressions for deposits between non-IFC-IFC jurisdiction pairs from Section 4 estimated again, this time for non-IFC-non-IFC pairs (Columns 1 and 2) and for IFC-IFC jurisdiction pairs (Columns 3 and 4). The reported coefficients across all four columns on the AEOI commencements confirm the intuition. They do not exhibit significant negative effects on deposits held in the respective jurisdictions. The negative impact of EOI changes on cross-border bank deposits appears confined to deposits from non-IFCs into IFCs. Deposits between IFCs themselves are not affected in a statistically significant way, nor are those from non-IFCs in other non-IFCs.

Table 6
THE EFFECT OF EOI ON FOREIGN-OWNED DEPOSITS IN DIFFERENT JURISDICTION PAIRS

	EOIR and AEOI (incl. FATCA) Announcement and Commencement	EOIR and AEOI Announcement and Commencement	EOIR and AEOI (incl. FATCA) Announcement and Commencement	EOIR and AEOI Announcement and Commencement
	Non-IFC from Non-IFC	Non-IFC from Non-IFC	IFC from IFC	IFC from IFC
EOIR	-0.033	-0.034	-0.065	-0.065
Signature	(0.059)	(0.059)	(0.069)	(0.069)
AEOI	0.272**	0.275**	-0.14	-0.14
Announcement	(0.111)	(0.111)	(0.121)	(0.064)
AEOI	-0.03		-0.133	
Commencement		(0.073)		(0.106)
AEOI (incl. FATCA)	-0.014		-0.133	
Commencement	(0.07)		(0.106)	
R2	0.004	0.004	0.002	0.002
Num. obs.	23 860	23 860	15 645	15 645
Jurisdiction-pair FEs	Yes	Yes	Yes	Yes
Year-Quarter FEs	Yes	Yes	Yes	Yes

Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of either non-IFCs or IFC j at the end of quarter q . The unit of observation is the jurisdiction-pair (i, j) and the sample period runs from Q1 2006 to Q4 2018. Data are provided for non-bank counterparties only. Data are aggregated across currencies, sectors, reporting institutions, and instrument type. ***, ** and * represent statistical significance levels of 1%, 5% and 10% respectively.

Source: Authors' calculations based on LBS, BIS, and data on information exchange agreements provided by the Global Forum.

In contrast, the results suggest that AEOI commitments actually had a positive impact on non-IFC deposits between one another. This can be interpreted as additional evidence of the impact of AEOI, suggesting that AEOI commitments appear to have spurred banking activity between non-IFC jurisdictions and point to an increasing shift in cross-border banking activity away from IFCs.

5.2. The potential impact of voluntary disclosure and amnesty programmes

The signature of EOIR treaties or AEOI commencement has in the past often coincided with the domestic implementation of voluntary disclosure and amnesty programmes (VDPs). Because these VDPs may have incentivised taxpayers with offshore deposits to declare or repatriate hidden assets, the presence of these VDPs may act as a confounding variable in the analysis above. That is, it is possible that the impacts found in the analysis of EOI are not actually results of EOI but rather of the VDPs that coincided with the expansion in EOI. This section assesses whether this is the case.

Table 7 assesses the impact of VDPs and shows results from the previous regression specification from Table 4, accounting for these programmes. To do this, a list of 92 VDPs in 27 countries is compiled. Some of these have been implemented since 2009 and some are still ongoing, and are added as dummy variables to the regression specification.³⁴ An important caveat to these dummy variables is that the specifics of VDPs can differ significantly by jurisdiction in terms of length and the legal consequences of disclosure. These different characteristics may result in the varying impacts of the programmes and could influence the findings below.

The estimated models confirm the findings in Table 4 of a statistically significant negative impact of both AEOI commencement variables on IFC deposits, albeit with the size of the coefficients slightly reduced. The coefficients on the VDP variable exhibit positive signs and are significant at the 1% level. These results contrast, for instance, with Menkhoff and Miethé (2019), who find no significant impact of VDPs on IFC deposits, based on a considerably smaller list of VDPs.

Several reasons may explain the estimated size and direction of the coefficients on the VDP variables. One possibility is that the existence of VDPs is endogenous to the size of bank deposits in IFCs; that is, jurisdictions that felt they had a large tax compliance challenge with respect to bank deposits implemented a VDP for this purpose.

Other explanations are possible, including the possibility that VDPs may reduce tax compliance by inducing some taxpayers to increase non-compliance afterwards or disclose outside of VDPs.³⁵ Finally, the fact that several of the VDPs in the list are still active may bias the results. Self-declarations may peak towards the end of VDP eligibility periods. Although conclusive evidence on the effect of VDPs is still subject to further research, the evidence presented shows that accounting for disclosure programmes does not seem to invalidate the expected negative impact of AEOI on foreign bank deposits.

Table 7
TESTING FOR THE IMPACT OF VOLUNTARY DISCLOSURE PROGRAMMES ON IFC DEPOSITS

	EOIR and AEOI (incl. FATCA)	EOIR and AEOI
	Announcement and Commencement	Announcement and Commencement
	IFC from Non-IFC	IFC from Non-IFC
EOIR Signature	-0.043 (0.044)	-0.044 (0.044)
AEOI Announcement	-0.51 (0.064)	-0.044 (0.064)
AEOI Commencement		-0.230*** (0.062)
AEOI (including FATCA) Commencement	-0.172*** (0.061)	
Voluntary Disclosure/Amnesty	0.227*** (0.064)	0.219*** (0.064)
R2	0.004	0.005
Num. obs.	29 461	29 461
Jurisdiction-pair FEs	Yes	Yes
Year-Quarter FEs	Yes	Yes

Note: The dependent variable is the stock of deposits held by savers of non-IFC jurisdiction i in banks of IFC j at the end of quarter q . The unit of observation is the jurisdiction-pair (i, j) and the sample period runs from Q1 2006 to Q4 2018. Data are provided for non-bank counterparties only. Data are aggregated across currencies, sectors, reporting institutions, and instrument type. ***, ** and * represent statistical significance levels of 1%, 5% and 10% respectively.

Source: Authors' calculations based on LBS, BIS, and data on information exchange agreements provided by the Global Forum.

5.3. Differing definitions of international financial centres

The regressions in this paper use a list of IFCs based on that outlined by the IMF (2000) (see the Appendix). However, there are many definitions of what constitutes an IFC, with differing lists having been developed by many different authors (see, for example, Johannesen and Zucman, 2014; Gravelle, 2015). To ensure that the results in the regression analysis are not being driven by the selective use of different jurisdictions, this section examines the results with different IFCs omitted from the analysis.

Changing the IFC list also changes the sample of counterparty countries. Following the literature, the analysis in Section 4 focuses on deposits in IFCs held by non-IFC residents. This means that for each of the IFC jurisdictions in the sample, those countries not on a given IFC list are added to the list of potential counterparties.

Table 8 reproduces the tests carried out in Table 4, but removes each IFC one by one from the analysis. This shows the impact had by each IFC on the main result. The focus here is on the specification with only EOIR and AEOI commencement as the independent variables of

interest. Both models are shown: with jurisdiction-pair fixed effects (left panel) and both jurisdiction-pair and year-quarter fixed effects (right panel). Table 8 mirrors the results from the regression analysis above, where most results remain significant at the 1% level. The impact of the changes in the sample and the composition of the data used is clear.

For those IFCs that are BIS reporters in the analysis, the exclusion from the list of IFCs affects the results only marginally and the coefficient size of the highly significant AEOI commencement variable varies only slightly across the IFC jurisdictions. This result points to a rather homogeneous impact of AEOI commencement on cross-border deposits in IFCs.

Table 8
ROBUSTNESS CHECKS OF IFC LIST

Jurisdiction excluded	Coefficient for EOIR signature	Coefficient for AEOI commencement
Bahrain	-0.039	-0.254***
Bahamas	-0.029	-0.277***
Bermuda	-0.054	-0.240***
Cayman Islands	-0.034	-0.197***
Netherlands Antilles/Curaçao	-0.029	-0.256***
Cyprus	-0.035	-0.240***
Guernsey	-0.024	-0.267***
Hong Kong, China	-0.052	-0.256***
Isle of Man	-0.058	-0.281***
Jersey	-0.055	-0.292***
Luxembourg	-0.043	-0.276***
Macau, China	-0.047	-0.243***
Malaysia	-0.043	-0.266***
Panama	-0.047	-0.267***
Singapore	-0.043	-0.262***
Switzerland	-0.049	-0.277***

Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of IFC j at the end of quarter q .

Source: Authors' calculations based on BIS LBS, and data on information exchange agreements provided by the Global Forum.

6. Conclusion

This paper examines the overall impact of EOI on foreign-owned bank deposits in IFCs. The key contributions of the paper include an updated dataset on bank deposits compared to what has been used elsewhere in the literature, a more accurate dataset of information agreements including the MAC, and a more granular examination of key events in the EOI timeline. The results suggest that the expansion of EOI in many jurisdictions around the world is having a positive impact on tax compliance and is reducing offshore bank deposits that,

at least to some extent, represent hidden wealth. These findings accord with a fast-growing literature in this area.

The headline results in Figure 2 show a strong decline of over US\$400 billion in bank deposits in IFCs during a period of expanded tax transparency. The findings point to a strong reduction in the scale of offshore banking in IFCs and recent reports suggest that the disclosure of previously hidden wealth has resulted in substantial tax revenues for governments worldwide (OECD, 2020). Moreover, using a panel regression model following the approach of Johannesen and Zucman (2014), the results show that AEOI commencement is associated with a significant (22%) decrease in foreign-owned IFC deposits. This effect has been found to range in the middle of the referenced literature. While Casi *et al.* (2020) find in their analysis the lowest impact of about 13%, Menkhoff and Miethe (2019) report a strong effect of roughly 35%.

Estimations on the impact of EOIR, based on a shorter sample, suggest that its impact has changed over time. Initial EOIR agreements signed in the aftermath of the commencement of peer reviews in 2009 had a strong impact; however, the impact of each additional agreement has been more muted, potentially due to the increasingly multilateral nature of the EOIR network induced by MAC signatures. This partially reconciled the results of Zucman and Johannesen (2014) who find an impact of EOIR signature, and other papers in the literature that do not. The findings suggest that while the initial impact of new EOIR relationships prior to the introduction of AEOI may have had a significant impact, in more recent years the impacts have been driven by AEOI itself.

Moreover, the muted aggregated reactions of deposits on early AEOI adoption announcements by jurisdictions have been masked by considerable heterogeneity among IFCs. Jurisdictions that specialise in rather conventional banking activity seem to have had larger reactions to increasing tax transparency. In contrast, those that predominantly offer institutional and corporate financial services appear to have experienced less a decline in deposits.

There are important future areas of research to better understand the impact of EOI and hidden wealth. For instance, the impact of EOI on other asset classes (e. g. portfolio holdings) is not considered in this paper. The use of other assets not covered under EOI agreements to hide wealth (such as art or real property), is also an important area of study for detailed analysis (see e. g. De Simone *et al.*, 2019). Moreover, a departure from the predominantly macroeconomic, cross-country perspective of analysis can provide important insights into country-specific dynamics of tax and hidden wealth (see e. g. Cassetta *et al.*, 2014).

Appendix

Definitions of international financial centres

The definition of what constitutes an international financial centre is a controversial and challenging subject. In the academic literature, a wide variety of lists have been used, based on a wide variety of criteria. These criteria are often subjective. From the perspective of the assessment of EOI on bank deposits, the ideal focus would be on those jurisdictions that specialise in international banking. This presents an important caveat, as different IFCs may have different specialisations. For example, some IFCs may specialise in insurance activity, some as a centre for hedge fund and mutual fund activity, some in banking activity, some in trust activity, and so on. Assessing the impact of EOI requires a nuanced understanding of the differences across IFC profiles, and therefore of the varying ways the expansion of EOI will affect different IFCs.

The list of IFCs used in this study is based on a list of 46 jurisdictions defined by the IMF (2000). This IMF report defines an offshore financial centre (OFC) as follows:

“[A] centre where the bulk of financial sector activity is offshore on both sides of the balance sheet (i.e., the counterparties of the majority of financial institutions’ liabilities and assets are non-residents), where the transactions are initiated elsewhere, and where the majority of the institutions involved are controlled by non-residents. OFCs are usually referred to as:

Jurisdictions that have relatively large numbers of financial institutions engaged primarily in business with non-residents; financial systems with external assets and liabilities out of proportion to domestic financial intermediation designed to finance domestic economies; [...] centres which provide some or all of the following services: low or zero taxation; moderate or light financial regulation; banking secrecy and anonymity” (IMF, 2000).

Of the jurisdictions on this IMF list, many smaller centres do not report bank liability data to the BIS. Those that do are the Bahamas, Bahrain, Bermuda, the Cayman Islands; Netherlands Antilles/Curaçao; Cyprus; Guernsey; Hong Kong, China; Ireland; the Isle of Man; Jersey; Luxembourg; Macau, China; Malaysia; Panama; Singapore; and Switzerland. Reporting of bilateral liability and deposit information is even patchier and has been discussed in Section 3.1.

In this paper, the analysis relies on an amended list of IFCs (in bold) based on the IMF OFC definition. The full list is as follows: Andorra; Anguilla; Antigua and Barbuda; Aruba; Bahamas; Bahrain; Barbados; Belize; Bermuda; British Virgin Islands; Cayman Islands; Cook Islands; Costa Rica; Netherlands Antilles/Curaçao; Cyprus; Dominica; Gibraltar; Grenada; Guatemala; Guernsey; Hong Kong, China; Isle of Man; Jersey; Lebanon; Liechtenstein; Luxembourg; Macau, China; Malaysia; Malta; Marshall Islands; Mauritius; Monaco; Montserrat; Nauru; Niue; Palau; Panama; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; American Samoa; San Marino; Seychelles; Singapore; Switzerland; Turks and Caicos Islands; United Arab Emirates; Uruguay; and Vanuatu.³⁶ Countries in bold are those that report to the BIS.

In the stylised facts in Section 3.1, the analysis focuses on a decline in deposits in those IFCs from the list above that report to the BIS since 2006, in order to work with a balanced panel and to avoid the effect of new reporting countries. The headline results are reported as declines in IFC deposits from non-bank counterparties in all countries, including all IFCs. In the headline results, the sample excludes the Cayman Islands, based on the particular nature of the US-Cayman Islands relationship outlined in Section 3.1. For confidentiality reasons, it is not possible to report the overall aggregated decline in deposits with just the Cayman Islands-US series removed, so the entire Cayman Islands series is removed together with Hong Kong, China and Macau, China in Figure 2.

In the regression analysis in Section 4, the sample is different, as not all jurisdictions that provide aggregated data provide bilateral data that can be used in the regression analysis. The panel used in the regression analysis is unbalanced. The analysis relies on a regression for all available country-pairs where there are sufficient quarters with and without EOI to estimate the effects. One exception is that in this sample, the US-Cayman Islands series is removed, but the series between the Cayman Islands and other jurisdictions are kept in the sample. This means that the sample underlying the headline decline of US\$ 410 billion reported in Section 3.1 and that underlying the association with EOIR and AEOI are slightly different.

Section 5 contains a robustness analysis of the main results in the paper to the inclusion of different IFCs subject to data availability.

Table A.1
TIME TRENDS IN AGGREGATE DEPOSITS - REGRESSION OUTPUT

Date	Coefficient	p-value	Coefficient	p-value
2006 Q1	-0.12433	0.0182	0.362015	0.0003
2006 Q2	-0.11301	0.0277	0.535287	0.0000
2006 Q3	-0.10886	0.0306	0.427783	0.0000
2006 Q4	-0.0267	0.5911	0.400553	0.0001
2007 Q1	-0.00448	0.9253	0.347009	0.0002
2007 Q2	0.030148	0.5351	0.354037	0.0001
2007 Q3	0.080887	0.0950	0.354893	0.0002
2007 Q4	0.016419	0.7252	0.480816	0.0000
2008 Q1	0.081001	0.0754	0.489724	0.0000
2008 Q2	0.075437	0.0984	0.376012	0.0000
2008 Q3	0.066255	0.1484	0.31984	0.0005
2008 Q4	0.0414	0.3364	0.239093	0.0031
2009 Q1	-0.00742	0.8635	0.252757	0.0065
2009 Q2	-0.01077	0.7991	0.299142	0.0007
2009 Q3	-0.02637	0.5323	0.306506	0.0004
2009 Q4	0.007886	0.8597	0.286426	0.0013
2010 Q1	-0.01396	0.7366	0.231215	0.0063

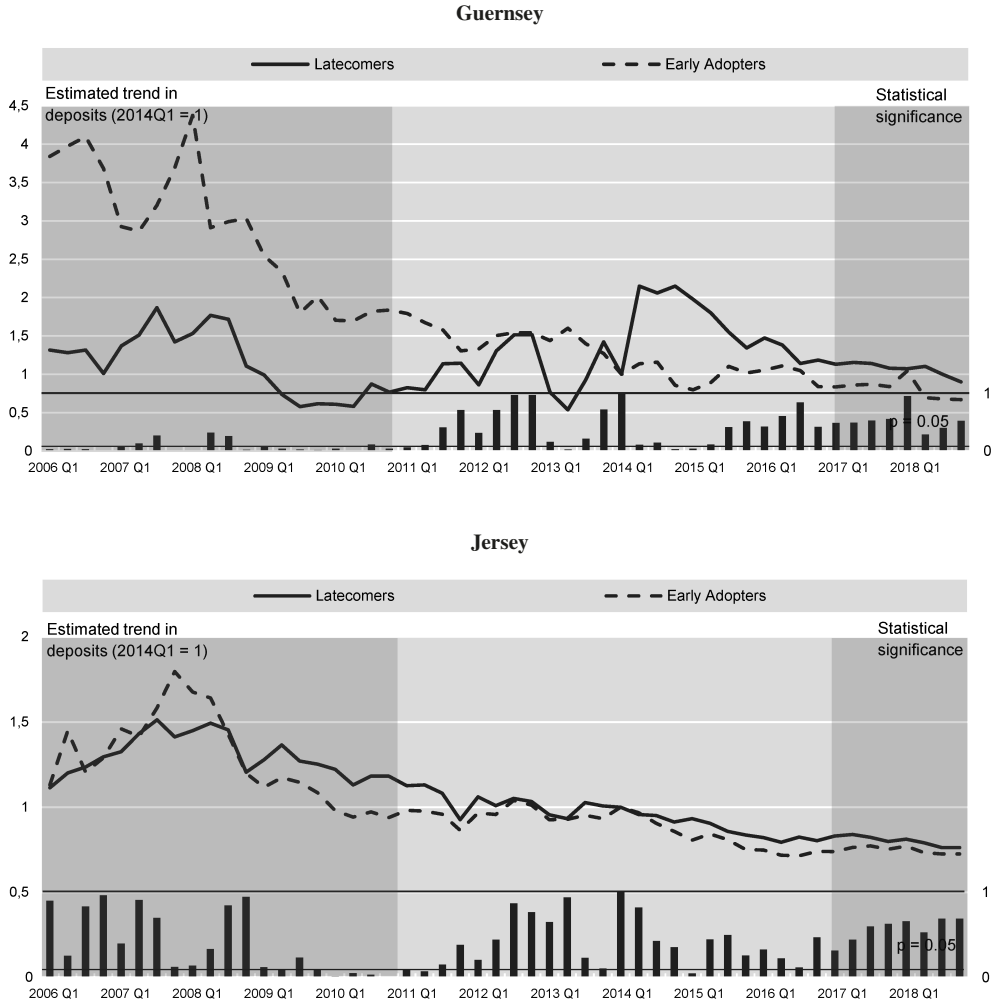
(Continued)

Date	Coefficient	p-value	Coefficient	p-value
2010 Q2	-0.08981	0.0239	0.181012	0.0275
2010 Q3	0.035601	0.3589	0.159014	0.0400
2010 Q4	0.049534	0.1983	0.126969	0.0750
2011 Q1	0.050493	0.1722	0.14098	0.0364
2011 Q2	0.076075	0.0323	0.150518	0.0198
2011 Q3	0.081971	0.0157	0.104929	0.0841
2011 Q4	0.070524	0.0352	-0.0137	0.8134
2012 Q1	0.144544	0.0000	0.036573	0.5323
2012 Q2	0.119218	0.0003	0.028633	0.6252
2012 Q3	0.139722	0.0000	0.025898	0.6447
2012 Q4	0.153191	0.0000	-0.01209	0.8154
2013 Q1	0.13317	0.0000	-0.02125	0.6737
2013 Q2	0.07476	0.0065	0.009525	0.8470
2013 Q3	0.079057	0.0018	-0.01438	0.7287
2013 Q4	0.03195	0.1044	-0.03276	0.3913
2014 Q2	0.017719	0.3486	-0.03253	0.4382
2014 Q3	0.027235	0.2527	-0.06489	0.1570
2014 Q4	0.018946	0.4883	-0.16016	0.0027
2015 Q1	0.010913	0.6984	-0.20804	0.0005
2015 Q2	-0.03328	0.2525	-0.15173	0.0109
2015 Q3	-0.06218	0.0343	-0.08604	0.1105
2015 Q4	-0.14513	0.0000	-0.13482	0.0341
2016 Q1	-0.10652	0.0016	-0.15668	0.0116
2016 Q2	-0.11455	0.0010	-0.16086	0.0364
2016 Q3	-0.10691	0.0022	-0.19385	0.0065
2016 Q4	-0.1781	0.0000	-0.20386	0.0047
2017 Q1	-0.1903	0.0000	-0.16094	0.0390
2017 Q2	-0.18372	0.0000	-0.16164	0.0282
2017 Q3	-0.22967	0.0000	-0.16448	0.0318
2017 Q4	-0.24305	0.0000	-0.18539	0.0433
2018 Q1	-0.22998	0.0000	-0.18413	0.0475
2018 Q2	-0.30778	0.0000	-0.23805	0.0115
2018 Q3	-0.33257	0.0000	-0.21167	0.0276
2018 Q4	-0.36552	0.0000	-0.18493	0.0678

Note: Columns 2 and 3 report point estimates and p-values for the time dummies. Columns 4 and 5 report point estimates and p-values for the interaction terms.

Source: Authors' calculations based on BIS LBS data.

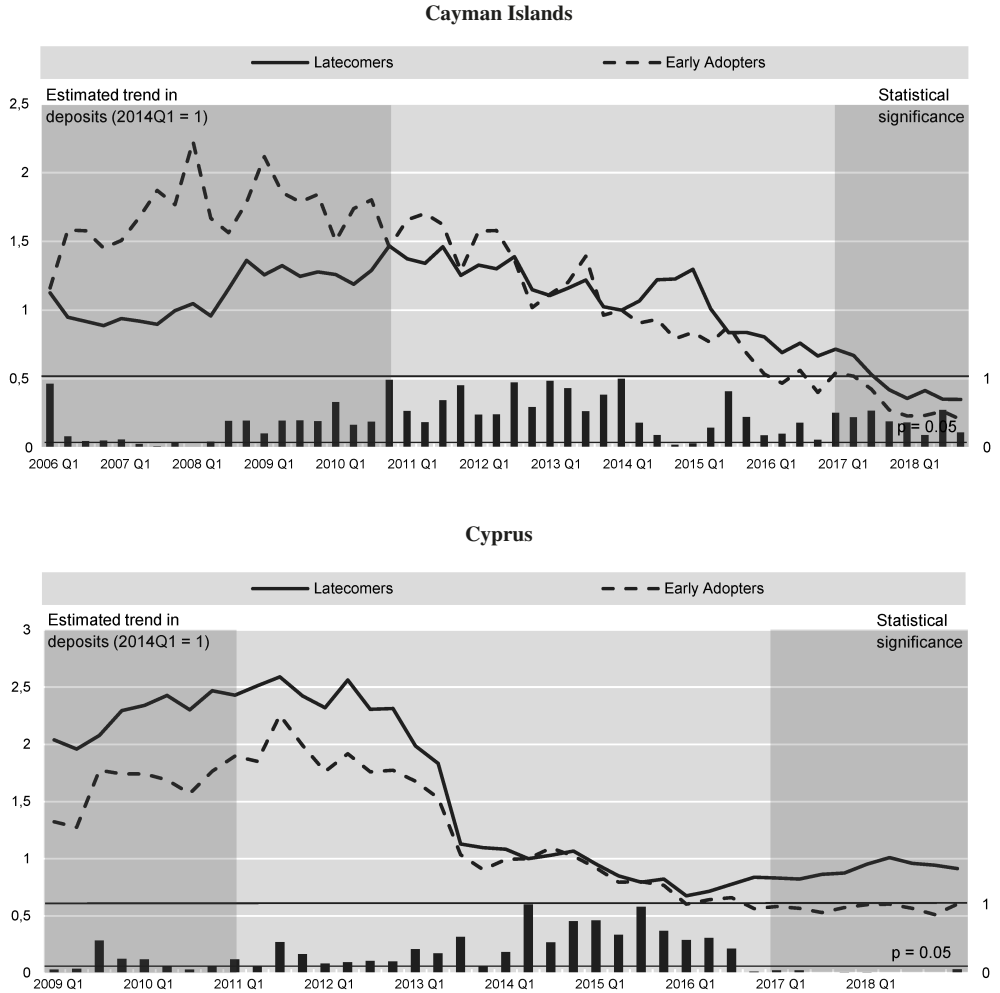
Figure A.1
DIFFERENCE-IN-DIFFERENCES ANALYSIS OF AEOI COMMITMENT BY
GUERNSEY AND JERSEY



Note: The lines indicate trends in deposits as captured by coefficients on time dummies θ_t and the interaction terms $\theta_t * EA_{ij}$, that is $\exp(\gamma_t)$ for non-Early Adopters and $\exp(\gamma_t + \delta_t)$ for Early Adopters. The columns indicate statistical significance levels of interaction terms $\theta_t * EA_{ij}$. Areas shaded on both ends of the sample range direct the reader to a time window of analysis relevant for inspection due to being less likely influenced by other events than the joint announcement.

Source: Authors' calculations based on BIS LBS data.

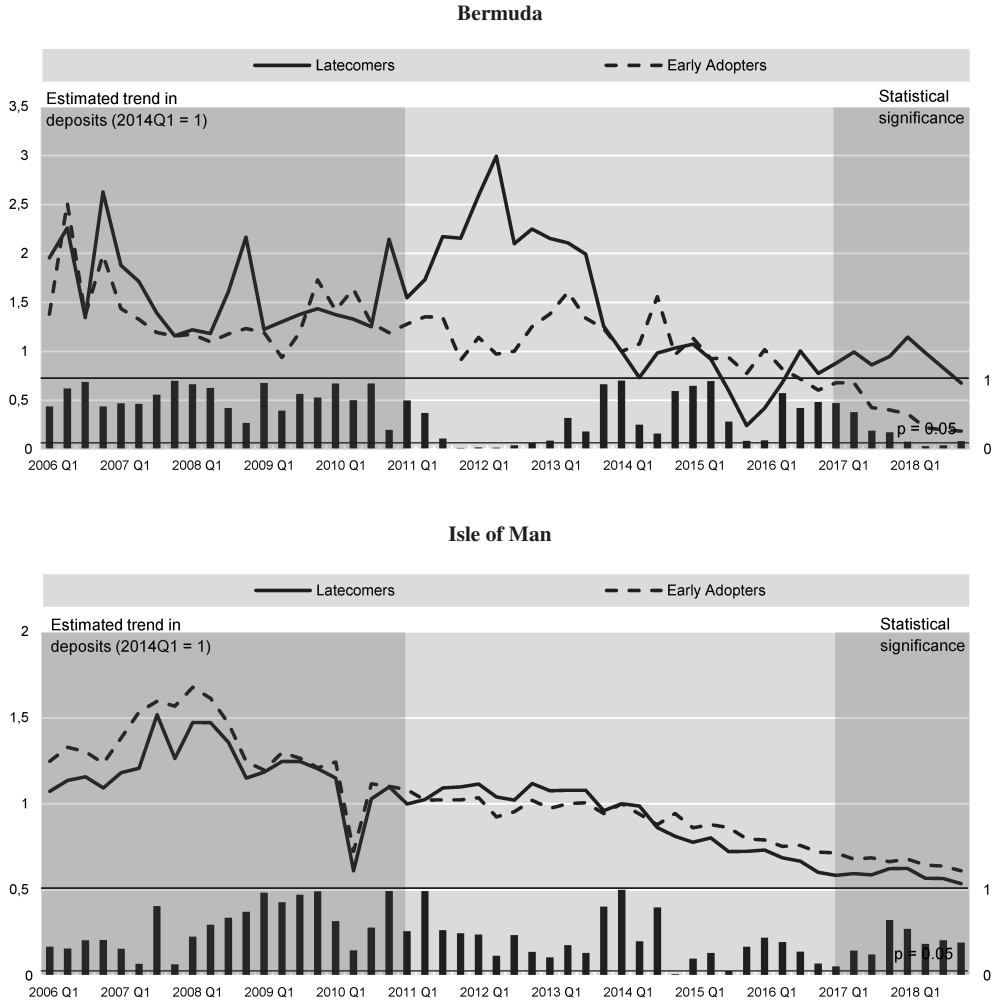
Figure A.2
DIFFERENCE-IN-DIFFERENCES ANALYSIS OF AEOI COMMITMENT BY
CAYMAN ISLANDS AND CYPRUS



Note: The lines indicate trends in deposits as captured by coefficients on time dummies θ_t and the interaction terms $\theta_t * EA_{ij}$, that is $\exp(\gamma_t)$ for non-Early Adopters and $\exp(\gamma_t + \delta_t)$ for Early Adopters. The columns indicate statistical significance levels of interaction terms $\theta_t * EA_{ij}$. Areas shaded on both ends of the sample range direct the reader to a time window of analysis relevant for inspection due to being less likely influenced by other events than the joint announcement.

Source: Authors' calculations based on BIS LBS data.

Figure A.3
DIFFERENCE-IN-DIFFERENCES ANALYSIS OF AEOI COMMITMENT BY
BERMUDA AND ISLE OF MAN



Note: The lines indicate trends in deposits as captured by coefficients on time dummies θ_t and the interaction terms $\theta_t * EA_{ij}$, that is $\exp(\gamma_t)$ for non-Early Adopters and $\exp(\gamma_t + \delta_t)$ for Early Adopters. The columns indicate statistical significance levels of interaction terms $\theta_t * EA_{ij}$. Areas shaded on both ends of the sample range direct the reader to a time window of analysis relevant for inspection due to being less likely influenced by other events than the joint announcement.

Source: Authors' calculations based on BIS LBS data.

Notes

1. G20 Leaders Statement, London, UK. <http://www.oecd.org/newsroom/44431965.pdf>.
2. Voluntary disclosure programmes, offshore tax investigations and related measures before and since the start of automatic exchange in 2017 have so far led to the identification of €107 billion of additional tax revenues worldwide (OECD, 2020).
3. A limited time series prevents us from carrying out a similar exercise to examine how AEOI implementation changes over time. This could be carried out as part of future research as AEOI continues for a longer period of time.
4. For the purposes of this paper, an EOI agreement includes all types of agreements enabling EOI, such as the MAC, bilateral tax treaties containing an article for exchange of information or bilateral tax information exchange agreements (TIEAs).
5. The BIS public locational banking statistics file currently contains 47 reporting jurisdictions. Of these, 29 jurisdictions have bilateral counterparty data in the public file, including: Australia; Austria; Belgium; Brazil; Canada; Chile; Chinese Taipei; Denmark; Finland; France; Greece; Guernsey; Hong Kong, China; Ireland; Isle of Man; Italy; Jersey; Korea; Luxembourg; Macau, China; Mexico; Netherlands; Philippines; South Africa; Spain; Sweden; Switzerland; the United Kingdom and the United States. Further restricted data has been provided to the Banque de France. Of the 29 jurisdictions reporting in the public file, seven provide time series extensions in the restricted sample of the BIS. 14 further jurisdictions have provided restricted but close to full bilateral data to the BIS for various time periods. However, the data supplied pertain to varying dates. The confidential bilateral data reported to the BIS are not accessible and hence not used in the paper.
6. The link between bank liabilities and bank deposits is discussed in more detail in Box 2 in O'Reilly *et al.* (2019).
7. The definition of IFCs and the different subsamples of IFCs used in the analysis are discussed in the Appendix.
8. "Historically, overnight sweep accounts in OFCs such as the Cayman Islands developed because Regulation Q prohibited US banks from paying interest on demand deposit accounts. Regulation Q was repealed in 2011 and this may partly explain the drop in Cayman LBS from US\$1800 billion in 2011 to about US\$1400 billion" (Fichtner, 2016, p. 1042).
9. The US-Swiss Bank Program was announced jointly by US and Swiss authorities on August 29, 2013 to resolve potential criminal liabilities of Swiss banks in the United States. Eligible Swiss banks had to advise US authorities of suspected tax-related criminal offenses linked to undeclared US-related accounts. To date 82 Swiss banks benefit from non-prosecution agreements (<https://www.justice.gov/tax/swiss-bank-program>).
10. This shift may also have been driven by changes in the reporting of trustee deposits.
11. For further information on the timeline of the expansion of tax transparency related to EOIR and AEOI please refer to Box 4 in the accompanying working paper (O'Reilly *et al.*, 2019).
12. This is perhaps because MAC relationships are not listed bilaterally on the Global Forum website.
13. Panel analysis is not the only available method to analyse policy interventions such as the expansion of EOI. Several other studies employ a difference-in-differences (DID) approach instead (e.g. Beer *et al.*, 2019; Cusi *et al.*, 2020; Menkhoff and Miethe, 2019). However, the main reference for comparison in this paper is Johannesen and Zucman (2014). Moreover, given that Menkhoff and Miethe (2019) employ a DID only to validate their panel results –which are similar to ours– we have confidence in the robustness of our findings.
14. This may occur at the time of announcement, signature, ratification or entry into force.
15. This excludes confidential bilateral data that is not available.
16. This is not to discount the fact that deposits in non-IFC jurisdictions could respond to EOI as well. Section 4 examines potential deposit reactions between non-IFCs and non-IFCs as well as between IFCs and other IFCs. The issue of 'inward' deposit flows is explored further in Menkhoff and Miethe (2019).

17. The composition of this list is discussed in the Appendix. Each IFC has on average 74 different bilateral deposit relations per year-quarter. To profit most from the data available, an IFC-non-IFC pair has been included when at least four quarters of data were available either side of the relevant EOI independent variable. While earlier studies such as Johannesen and Zucman (2014), Casi *et al.* (2020) or Beer *et al.* (2019) also used unbalanced panels, others like Ahrends and Bothner (2019) or Menkhoff and Miethe (2019) employed balanced panels largely at the expense of IFC coverage.
18. Dates for the commencement of AEOI are taken from the *Automatic Exchange of Information Implementation Report 2018* (Global Forum on Transparency and Exchange of Information for Tax Purposes, 2018, p. 3). AEOI agreements are activated on a bilateral basis and exchanges are also bilateral, which is not taken into account in this analysis. Jurisdiction-pairs are coded 1 if both jurisdictions have the legal framework in place for exchanging information under the CRS or under FATCA, and zero otherwise. However, the details of which jurisdictions have actually exchanged with one another are not public at this stage. Incorporating actual activated bilateral agreements could be an avenue for future enhancement of this work.
19. Further information on the differences between the two mechanisms are, for instance, provided in Casi *et al.* (2020) as well as in OECD (2018).
20. To obtain estimates of the percentage impacts of EOI, the following transformation is applied to the estimated coefficients: $100 * (\exp(\beta) - 1)$.
21. A jurisdiction-pair dummy facilitates controlling for all such invariant jurisdiction-pair specific effects without the loss of degrees of freedom that would come with separately controlling for distance, common language, common legal system, contiguous borders and other jurisdiction-pair effects typically used in some cross-jurisdiction data analysis.
22. Bilicka and Fuest (2014) also find that jurisdictions are more likely to initially sign EOI agreements with jurisdictions with which they have stronger economic ties. This may be a partial explanation as to why previously signed EOIR agreements may exert a stronger impact on deposit flows between jurisdictions.
23. This is also evidenced by the notable decline in the R^2 statistics between Tables 3 and 4 due to time fixed effects absorbing some of the variation in the data.
24. Some mild multicollinearity between the time dummies and the AEOI announcement variables has also been detected based on a slightly elevated variance inflation factor (VIF) and the Farrar-Glauber test.
25. The joint announcement jurisdictions are Anguilla, Argentina, Belgium, Bermuda, British Virgin Islands, Bulgaria, Cayman Islands, Colombia, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Guernsey, Hungary, Iceland, Isle of Man, India, Ireland, Italy, Jersey, Latvia, Liechtenstein, Lithuania, Malta, Mexico, Montserrat, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, South Africa, Spain, Sweden, Turks & Caicos Islands and the United Kingdom.
26. These are Bermuda, Cayman Islands, Cyprus, Guernsey, Isle of Man, and Jersey.
27. There are twelve other jurisdictions in the sample for which there is bilateral data available. These twelve other jurisdictions committed later: Bahamas; Netherlands Antilles/Curaçao; Hong Kong, China; Luxembourg; Macau, China; Malaysia; Singapore and Switzerland in October 2014; Bahrain and Panama in May 2016.
28. It is important to note that a potential confounding weakness of this approach is whether jurisdictions that did not participate in the Joint Announcement were interpreted as committing to the AEOI (e.g. if taxpayers suspected that even if they had not committed via the joint announcement, they would commit eventually).
29. Detailed regression results are contained in Table A1 in the Appendix.
30. This lack of fundamentally different trend trajectories in deposit levels, as well as the strong geographical dispersion of IFCs in both groups, also lend confidence to a certain randomness in assigned treatment. As Wing *et al.* (2018) argue, researchers can seldom fully rely on the random assignment assumption in a DID analysis to avoid bias from unmeasured confounding factors (e.g. seasonality in business activity or different economic shocks affecting treatment and control groups). Instead, DID analysis assumes that confounding factors varying

across groups are time invariant and time-varying confounding factors are group invariant. These assumptions hold through a common pre-treatment trend and are controlled for by the set of employed fixed effects.

31. The treatment effect for a period t is calculated as $\exp(0) - \exp(\widehat{\delta}_t)$ for post-treatment values of t , where 0 under the identifying assumption is the expected, counterfactual value of $\widehat{\delta}_t$ without the treatment.
32. The average over four quarters provides a more robust estimate as it smoothes the impact over the different quarters and accounts for seasonality and random variation in deposit series. The analysis of trend reactions beyond the four-quarter window does not seem to be reasonable due to the fact that after this period more countries had committed to AEOI. This means that the difference between the treatment and control group declined over the course of 2014 and 2015.
33. The list of robustness checks is not exhaustive. For instance, declines in IFC deposits may have been the result of downgrades in sovereign credit ratings associated with the implementation of EOI. Changing differentials in interest rate taxes could have been another trigger for deposit movements, which was tested in a previous version of Casi *et al.* (2020) but dropped in the final publication. Apart from often exhibiting too little variation over time for significant effects in a longer panel setting, some of these controls have already been included in recent studies and led to inconclusive results. We thus leave testing these again for future research.
34. This list of 92 VDPs has been compiled based on sources from the OECD (2015), public notes from global audit firms such as PwC, Deloitte or KPMG as well as information gathered from national tax authority or finance ministry websites.
35. Langenmayr (2017), conducting a study on the 2009 VDP in the US, finds that the programme increased the number of individuals who evade tax. She argued that voluntary disclosure allows individuals to better differentiate their actions according to the probability of detection, potentially resulting in more taxes evaded by low risk-averse taxpayers. Analysing the 2009, 2011 and 2012 VDPs in the US, Johannesen *et al.* (2020) find that VDPs are not necessarily conducive to disclosures. Their results suggest that most disclosures happened outside of VDPs by individuals who did not admit prior noncompliance.
36. In the BIS LBS, the following jurisdictions report on an aggregated basis or as part of other reporting jurisdictions. Anguilla, Antigua and Barbuda, British Virgin Islands, Cook Islands, Monaco, Montserrat, Niue, Saint Kitts and Nevis, and American Samoa. Given this aggregation, these IFC jurisdictions cannot be analysed separately. For further information, see Bank for International Settlements (2017).

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Resumen

Este trabajo evalúa el impacto del intercambio de información sobre los depósitos bancarios de propiedad extranjera en los centros financieros internacionales (CFI). Los depósitos de los CFI se redujeron en todo el mundo en un 24%, es decir, 410.000 millones de dólares, entre 2008 y 2019. El inicio del intercambio automático de información se asocia, por término medio, a una reducción del 22% de los depósitos bancarios de los CFI en manos de jurisdicciones que no son CFI. La creciente expansión multilateral del intercambio de información a petición parece disminuir las ganancias marginales de los nuevos tratados bilaterales. Las jurisdicciones de la CFI especializadas en actividades bancarias han sido las más afectadas por el aumento de la transparencia impositiva. Por tanto, un enfoque multilateral global es fundamental para aumentar con éxito la transparencia fiscal internacional.

Palabras clave: depósitos bancarios transfronterizos, intercambio de información, finanzas extraterritoriales, evasión fiscal.

Clasificación JEL: H26, F38, G21.

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