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Exchange of information and bank deposits in international financial centres

Pierce O'Reilly,

Kevin Parra Ramirez,

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Summary

This paper presents the results from new work to assess the impact of increasing tax transparency and exchange of information (EOI) on cross-border financial activity using bank deposit data. Since 2009, there has been a dramatic increase in tax transparency around the world, stemming from the implementation of new standards of exchange of information on request (EOIR) and automatic exchange of information (AEOI). Examining cross-border financial activity in light of these initiatives can help assess whether these standards have strengthened tax compliance.

The paper focuses on one aspect of international financial activity: cross-border bank deposits[1], using a dataset from the Bank for International Settlements (BIS), which provides bilateral data on bank deposits for up to 47 jurisdictions from 2000 to 2019. It evaluates the changes in these deposits in response to increasing tax transparency and EOI. The analysis focuses on bank deposits of non-banks (which include non-bank financial institutions, general government, households, and corporations).[2]

In particular, this paper presents the following results:

- Bank deposits in International Financial Centres (IFCs) from non-bank counterparties increased substantially over the period from the early 2000s to 2008, reaching a peak of USD 1.7 trillion in the second quarter of 2008.[3]
- Since then, these deposits have fallen substantially, by USD 410 billion or 24% by the first quarter of 2019. A large part of this reduction came in the immediate aftermath of the financial crisis – deposits fell by 13% following the start of the crisis, from the second quarter of 2008 to the second quarter of 2011. The decrease has continued since then by a further 11%.
- The extent to which this decline can be attributed to decreased tax evasion in response to tax transparency and EOI, reduction in base erosion and profit shifting (BEPS) activity, or other (potentially also non-tax) factors, cannot be established with precision. However, the analysis of the changing financial holdings against the signature of the EOI agreements suggests that tax transparency and EOI play a material role in these changes.
- The reduction has varied across jurisdictions: while some have seen substantial reductions, others have experienced an increase in cross-border bank deposits.
- The paper presents a regression analysis of the impact of EOI on bank deposits, following the approach of Johannesen and Zucman (2014[1]), but with a longer time series and an expanded number of reporting jurisdictions. A contribution of this paper is that it accounts for EOIR relationships established through the Multilateral Convention on Mutual Administrative Assistance on Tax Matters (the MAC), and for the widespread adoption of the Standard for Automatic Exchange of Financial Account Information (AEOI). These represent material changes in the global tax transparency and EOI landscape since the Johannesen and Zucman (2014[1]) study was carried out.

[1] Details of the definition of bank deposit used in the study are discussed below in footnote 10.

[2] Details of the definition of non-banks used in the study are discussed below in footnote 11.

[3] The definition of IFCs is based on that of IMF (2000[18]), as discussed below in Box 3.

- Signature of an agreement that enables EOIR between an IFC and a non-IFC is associated with an average reduction in bank deposits in the IFC with respect to the non-IFC counterparty of between 9% and 10% from the first signatures in 2009 until 2014, depending on the specific model used in the regression analysis. This is consistent with earlier findings in the literature, including Johannesen and Zucman (2014[1]) and Menkhoff and Miethe (2019[2]).
- Commencement of AEOI in 2017 and 2018 is associated with a further reduction in bank deposits of 22%. When also accounting for the Foreign Account Tax Compliance Act (FATCA), the association declines to about 17%.

The paper concludes with an assessment of potential future uses of international investment data for exploring the impact of tax transparency and EOI. This includes further analysis of foreign portfolio investment data or other assets hitherto not covered under EOI to hide wealth such as art or real property.

1 Introduction

1. In 2009, in response to widespread international concern about tax evasion, the G20 declared that 'the era of bank secrecy is over'.[4] Since then there has been a dramatic expansion in tax transparency worldwide. At present, over 150 jurisdictions have 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 legal basis for all types of exchanges, with more countries joining each year. More than 100 jurisdictions have committed to exchanging information related to offshore accounts automatically and over 90 have already commenced exchanges. These new initiatives have marked a step change in the global commitment to tax transparency.

2. These changes have brought with them significant interest among stakeholders in understanding the impact of exchange of information (EOI), to both assess its effectiveness and identify strategies that could improve its functioning. 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. This paper provides results using cross-border banking statistics to provide an assessment of the impact of EOI.

3. There is a growing literature using international financial statistics to assess offshore activity and tax evasion, as well as stocks of potentially hidden wealth. There is also a literature using international investment data to assess the impact of EOI. In many instances, however, studies have suffered from a lack of available data in both investments and treaties signed, as well as from challenges in accurately assessing whether changes, discrepancies, or asymmetries in these data reflect offshore activity and changes in this activity, or whether they represent measurement error or other factors. Using unique data, this paper provides a comprehensive assessment of the impact of EOI on cross-border bank deposits.

1.1 The literature on exchange of information and international financial centres

4. The literature on the impact of EOI is small but growing.[5] 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[1]) showed that bank liabilities in IFCs had not declined significantly since the expansion of EOI in 2008, following the G20 declaration that the era of bank secrecy was over. 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, these 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*

[4] G20 Leaders Statement, London, UK. http://www.oecd.org/newsroom/44431965.pdf

[5] This literature is more extensively summarised in Menkhoff and Miethe (2019[2]) and well as in OECD (2018[30]).

> *information would put an end to bank secrecy and could make tax evasion impossible (Johannesen and Zucman, 2014[1]).*

At the time this paper was published, the network of EOIR relationships was far from comprehensive (see Section 2 below).

5. Since the publication of the Johannesen and Zucman (2014[1]) paper, the tax transparency environment has continued to evolve, 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 and AEOI are, to varying degrees, associated with reductions in bank deposits in IFC jurisdictions. Figure 1 compares the studies cited above and shows the different estimates of the extent to which EOIR and AEOI have led to a decline in IFC deposits. Table 1 compares the above studies in terms of their varying sample sizes, time periods covered, and different jurisdictions defined as IFCs.

6. Menkhoff and Miethe (2019[2]) repeat and extend the analysis of Johannesen and Zucman (2014[1]) by analysing both inflow and outflow deposits held in the non-IFC and IFC jurisdictions. They find that EOIR is associated with a significant, but declining impact in the bank deposits held in IFC jurisdictions from non-IFCs after the signature of an EOIR agreement. They also find mirroring but lagged reactions to deposits in non-IFC jurisdictions from IFCs. Finally, they find a significant impact on IFC deposits from activation of AEOI agreements under the Common Reporting Standard (CRS). Casi, Spengel and Stage (2018[3]) carry out a difference-in-differences analysis, with a sole focus on AEOI and a sample limited to the years from 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, Coelho and Leduc (forthcoming[4]) extend this analysis by assessing EOIR, AEOI and Foreign Account Tax Compliance Act (FATCA) with a longer time period covered and an increased IFC sample similar to Johannesen and Zucman (2014[1]). Finally, Ahrends and Bothner (2019[5]) employ a difference-in-differences model to estimate successfully the impact of AEOI on non-IFC deposits.

7. 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 assets. Hanlon, Maydew and Thornock (2015[6]) and De Simone, Lester and Markle (2019[7]) 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 (2018[8]) assess the response of portfolio holdings of IFCs in securities markets in OECD countries. They find that EOIR is associated with reduced portfolio investment in securities markets in OECD countries by IFC jurisdictions participating in EOI. Kemme, Parikh and Steigner (2017[9]) find similar results, albeit with more modest effects of the expansion of EOI on portfolio activity.

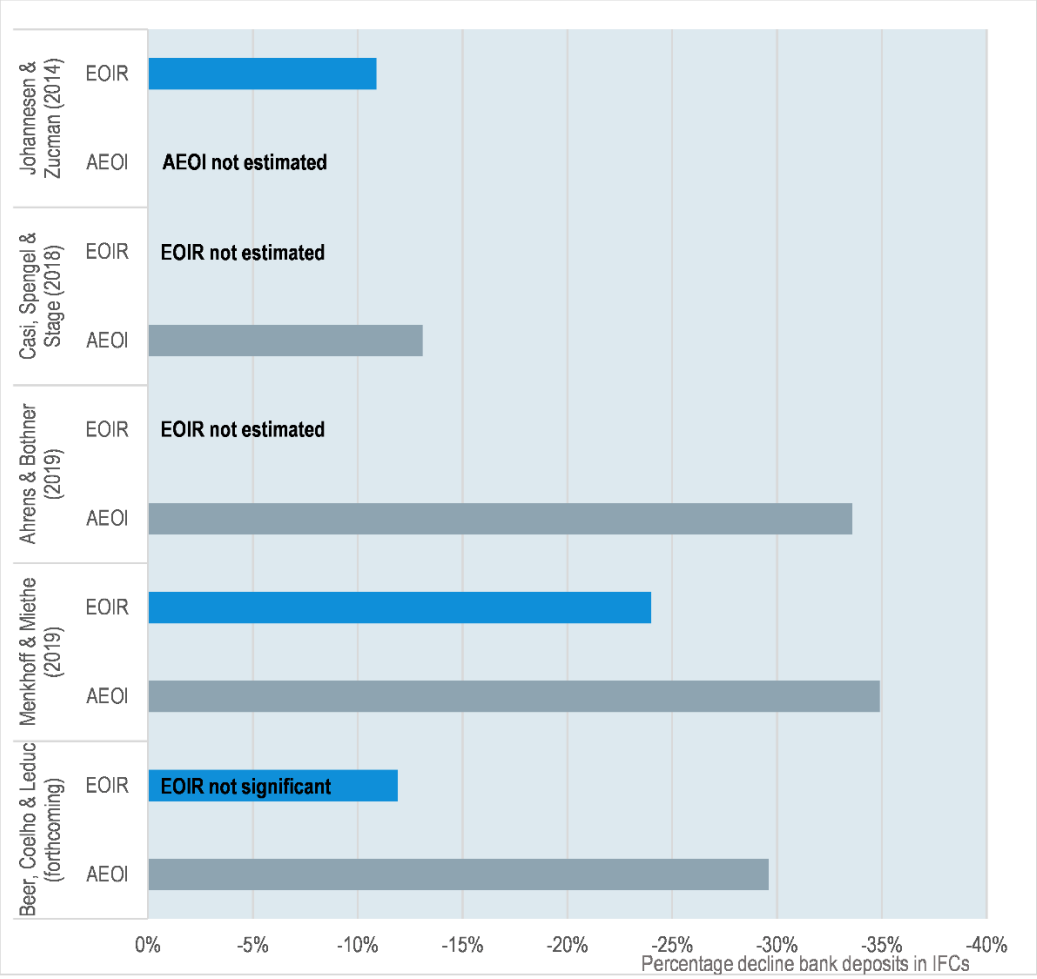
8. Other papers have analysed the impact of EOI in using other data. Omartian (2016[10]) employs data from international data leaks to argue that EOI is associated with declines in company incorporations in IFCs. Johannesen et. al. (2018[11]) use Internal Revenue Service (IRS) tax administration data 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 USD 120 billion, corresponding to around USD 0.7- 1.0 billion in additional tax revenue.

9. Against this background, this paper makes several contributions to the literature. First, it expands on the work of Johannesen and Zucman (2014[1]) by employing a larger sample in terms of time and country coverage than is available to other researchers. Second, unlike other papers in the literature, this paper accounts for the impact of the rapid expansion in EOI networks that has occurred through the signature of the MAC since 2010. By jointly testing for EOIR signatures, the impact of the announcement by jurisdictions of their commitment to implement AEOI and the commencement of exchanges under AEOI, it provides a comprehensive assessment of EOI impact and shows that the size of the banking sector in IFCs has been

substantially limited by the expansion of the EOI network. Finally, it highlights the overall decrease in deposits in IFCs as evidence that EOI has improved tax compliance.

Figure 1. Estimates of the decrease in IFC deposits associated with EOI in the literature

EOI impact expressed in percentage decline of deposits in IFCs based on baseline estimations in the respective articles



Note: The EOI effects on deposits expressed in percentages have been recalculated where necessary based on the formula 100 * exp(estimated coefficient) - 1. This transformation accounts for log-linear specifications in the estimated models of the respective articles.
Source: Authors' calculations based on the relevant literature cited.

Table 1. The existing literature employs different sample lengths and IFC lists

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
Casi, Spengel and Stage (2018)	Q4 2014 – Q3 2017	Guernsey; Hong Kong, China; Isle of Man; Jersey; Macau, China
Ahrends and Bothner (2019)	Q1 2009 – Q4 2017	Austria; Belgium; Chile; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macau, China; Switzerland
Menkhoff and Miethe (2019)	Q1 2003 – Q4 2017	Belgium; Chile; Guernsey; Ireland; Isle of Man; Jersey; Luxembourg; Switzerland
Beer, Coelho and Leduc (forthcoming)	Q1 1995 – Q2 2018	Austria; Bahamas; Bahrain; Belgium; Bermuda; Chile; Netherlands Antilles/Curaçao[6]; Cyprus; Guernsey; Hong Kong, China; Isle of Man; Jersey; Luxembourg; Macau, China; Panama; Singapore; Switzerland

Source: Based on the relevant literature cited.

1.2 Paper outline

10. The remainder of this paper proceeds as follows. Section 2 focuses on a specific data source of cross-border financial activity: Locational Banking Statistics (LBS) available from the Bank for International Settlements (BIS). It provides some stylised facts about the data and notes the overall decline in deposits of banks in IFCs held by non-bank counterparties over the last ten years. It also describes the expansion of EOI over this period.

11. Section 3 provides results of a regression analysis on the impact of EOI agreements between two jurisdictions on cross-border bank deposits.[7] The results suggest that when an IFC jurisdiction signs or commits to an EOI agreement with a non-IFC jurisdiction, the stock of bank deposits in that IFC with respect to counterparties in non-IFC jurisdictions decreases. Statistically significant results are found for the commencement of AEOI exchanges. The results also suggest that the impact of EOIR changes over time. Initial EOIR agreements signed in the aftermath of the commencement of peer review 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.

12. These results show the impact of tax transparency on bank deposits in IFCs, which suggests that secrecy is one of the features attracting wealth to these jurisdictions. Following an EOI agreement, tax authorities can obtain access to banking information. This means that the risks of engaging in tax evasion increase for holders of undisclosed bank deposits. The drop in offshore holdings in the aftermath of the EOI agreements suggests that EOI is successful in reducing bank deposits that were concealed from tax authorities in IFCs.

13. Section 4 concludes with a series of robustness checks that examine the results in Section 3 in more detail. It provides further evidence that the decline in bank deposits in IFCs associated with expanded EOI is linked to tax evasion by demonstrating that the decline is not present in non-IFCs. It assesses whether the results in Section 3 vary depending on the definition of IFCs and compares the

[6] In the BIS LBS, data for Netherlands Antilles are succeeded by data for Curaçao. See BIS (2017), BIS locational banking statistics: explanation of the data structure definitions https://www.bis.org/statistics/dsd_lbs.pdf.

[7] 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).

impact of EOI with the impact of voluntary disclosure programmes implemented domestically in various jurisdictions. Section 5 concludes the paper with suggestions for possible future research in this area.

2 Assessing changes in IFCs using cross-border banking statistics

14. 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 the 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.

15. As discussed in Section 1.1, data on banking activity have been used repeatedly to study the impact of EOI (Johannesen and Zucman, 2014[1]; Huizinga and Nicodème, 2004[12]; Menkhoff and Miethe, 2019[2]). 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 categories 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.

16. 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 data include bilateral information for reporting jurisdictions, which are data on assets held in the reporting jurisdiction by a resident of a counterparty jurisdiction. The coverage of the BIS data is further described in Box 1.

17. 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 (i.e., the category of 'loans and deposits' in Table 2). This is discussed further in Box 2. Focusing on non-bank deposits involves excluding banks' deposits with respect to other banks and their own affiliates abroad, as banks' lending to each other on the inter-bank market is unlikely to be impacted substantially by EOI expansion.

18. 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). Even though this is 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.

19. 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.

Box 1. Coverage of the BIS data

The BIS public locational banking statistics

There are 47 reporting jurisdictions in the public BIS file. 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.

Restricted BIS data 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.

Table 2. Variables available in locational banking statistics

Measure	Balance sheet position	Type of instrument	Currency denomination	Currency type of reporting country	Type of reporting institution	Counterparty sector	Position type
Stocks	**Total liabilities**	All instruments	**All currencies**	**All currencies**	**All reporting banks**	All sectors	**Cross-border**
Break adjusted changes	Total claims	Debt securities[8]	Swiss Franc	Foreign currency	Foreign branches	Banks, total[9]	All
		Debt securities, short-term	Euro	Domestic currency	Foreign subsidiaries	Banks, related offices	Local
		Loans and deposits[10]	Pound Sterling	Unclassified currency	Domestic banks	Banks, central banks	Unallocated
		Other instruments	Japanese Yen			**Non-banks, total[11]**	
		Unallocated by instrument	US Dollar			Non-bank financial institutions	
			All other currencies			Non-financial sectors	
			Unallocated currencies			Unallocated by sector	

Note: Data series highlighted in bold are the focus of the analysis in this paper.
Source: Authors' calculations based on BIS LBS.

Box 2. Bank deposits and bank liabilities

One 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 financial assets that are likely to be held by potential tax evaders. Bank deposits held by individuals are one clear example of an asset class that may be impacted by EOI. This can be the case whether they are held directly or as part of structures designed to conceal beneficial ownership.

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[13]) estimates that bank deposits form approximately 25% of global hidden wealth. Using data from the Italian voluntary disclosure programme for hidden assets, Pellegrini, Sanelli, and Tosti (2016[14]) find that while bank deposits are the most commonly

[8] Banks' holdings of debt securities are defined as comprising assets in all negotiable short and long-term debt instruments (see Box 2).

[9] Generally defined as institutions whose business it is to receive deposits and/or close substitutes for deposits, and to grant credits or invest in securities on their own account. Within the scope of the BIS locational banking statistics only, official monetary authorities including the BIS and the ECB are also regarded as banks. Can refer to banks' head offices or affiliates. Money market funds, investment funds and pension funds are excluded from this category (Bank for International Settlements, 2013[16]).

[10] Deposits comprise all claims reflecting evidence of deposit, including non-negotiable certificates of deposit (CDs), which are not represented by negotiable securities (see Box 2).

[11] All entities (including individuals but excluding official monetary authorities) other than those defined as "banks". A BIS definition of a bank is provided in footnote 9. General government and public corporations are part of the non-bank sector (Bank for International Settlements, 2013[16]).

repatriated asset class, they comprise 13.5% of total disclosed wealth. A more recent study by Alstadsaeter, Johannesen and Zucman (2018[15]) allocates a wealth equivalent of about 10% of global gross domestic product (GDP) to IFCs.

The definition of bank deposits versus bank liabilities

While bank deposits are often an asset class discussed in the literature and media on tax evasion, it is important to understand how they are defined in the data used in this study. In the BIS LBS Reporting Guidelines, bank deposits are defined as "all claims reflecting evidence of deposit – including non-negotiable certificates of deposit (CDs) – which are not represented by negotiable securities." This includes "[f]unds received by banks from non-residents in any currency or from residents in foreign currency on a trust basis. The BIS reporting guidelines also note that "[f]unds lent or deposited on a trust basis in banks' own name, but on behalf of third parties, with non-residents in any currency or with residents in foreign currency, represent international assets which also fall into the category of loans and deposits". Bank deposits also include working capital between related banks (Bank for International Settlements, 2013[16]).

The other major component of banks' overall liabilities in the BIS LBS is banks' holdings of securities. Banks' holdings of securities are defined as "comprising assets in all negotiable short and long-term debt instruments (including negotiable CDs, but excluding equity shares, investment fund units and warrants) in domestic and foreign currency issued by non-residents and all such instruments in foreign currency issued by residents. Banks' holdings of debt securities should include those held in their own name and those held on behalf of third parties as part of trustee business" (Bank for International Settlements, 2013[16]).

Bank deposits and bank liabilities in international financial centres

Data is available in the BIS LBS for both bank liabilities and bank deposits, with differing degrees of detail. This study focuses on bank deposits alone, omitting securities from consideration. There are several reasons for this. First, the reporting quality of information for securities is uneven. Some countries do not collect or report high-quality data on securities as a part of bank liabilities in the BIS data, which means that it is difficult to compare those countries that do include securities in their overall figures of bank liabilities with those countries that do not. A key reason for this is that it is challenging for banks to know the counterparty country and sector of the holders for tradable securities.

Second, bank deposits (as opposed to broader bank liabilities) may offer a better proxy of the taxpayer activity that EOI tries to address. This is because securities held in banks in IFCs may be held there not on behalf of individual households who may be hiding wealth, but on behalf of mutual funds or other asset management companies who locate in IFCs due to regulatory or other considerations. Several of the IFCs with large bank liabilities in the BIS data, such as Bermuda, Luxembourg or the Cayman Islands, are well-known centres for asset management activity.[12] Where mutual funds or hedge funds buy and sell assets, they may hold these assets on deposit with banks, who act as custodians of behalf of the funds. It is likely that these kinds of bank liabilities will be less responsive to the expansion of EOI when compared to bank deposits held by individual taxpayers, or held by these taxpayers through companies. This means that a broader definition of bank liabilities inclusive of securities may function less well as a proxy for overall assets being hidden in IFCs relative to focusing on bank deposits alone.

[12] These stylised facts are discussed further in Section 2.1.

2.1 Stylised facts of deposits in BIS reporting countries

20. Zucman and Johannsen (2014[1]) 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.[13] 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.

21. Figure 2 shows bank deposits aggregated across IFCs and non-IFCs (in USD 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.

22. 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.

23. Deposits including all reporting IFC jurisdictions rose substantially in the period since the early 2000s and rose even faster in the period immediately before the global financial crisis, reaching a peak in Q2 2008 (USD 2.5 trillion).[14] Since then, deposits of banks in IFCs in respect of non-banks have fallen substantially, by USD 1.055 billion or 42%. Amid an overall declining trend, however, 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.

24. 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 in the Cayman Islands have historically been driven by a strong share of bank deposits from financial institutions in the United States (Fichtner, 2016[17]).[15] 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 significant part, by factors other than changes in the tax transparency environment, separate results are presented for the rest of the sample as well. When excluding the Cayman Islands, the overall downward trend of IFC deposits is more modest. After the peak in Q1 2008 (USD 1.7 billion), deposits fell by USD 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%

[13] The definition of IFCs is discussed further in Box 3.

[14] Reporting IFC jurisdictions are discussed in Box 3 and are highlighted in bold.

[15] "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[17]).

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%.

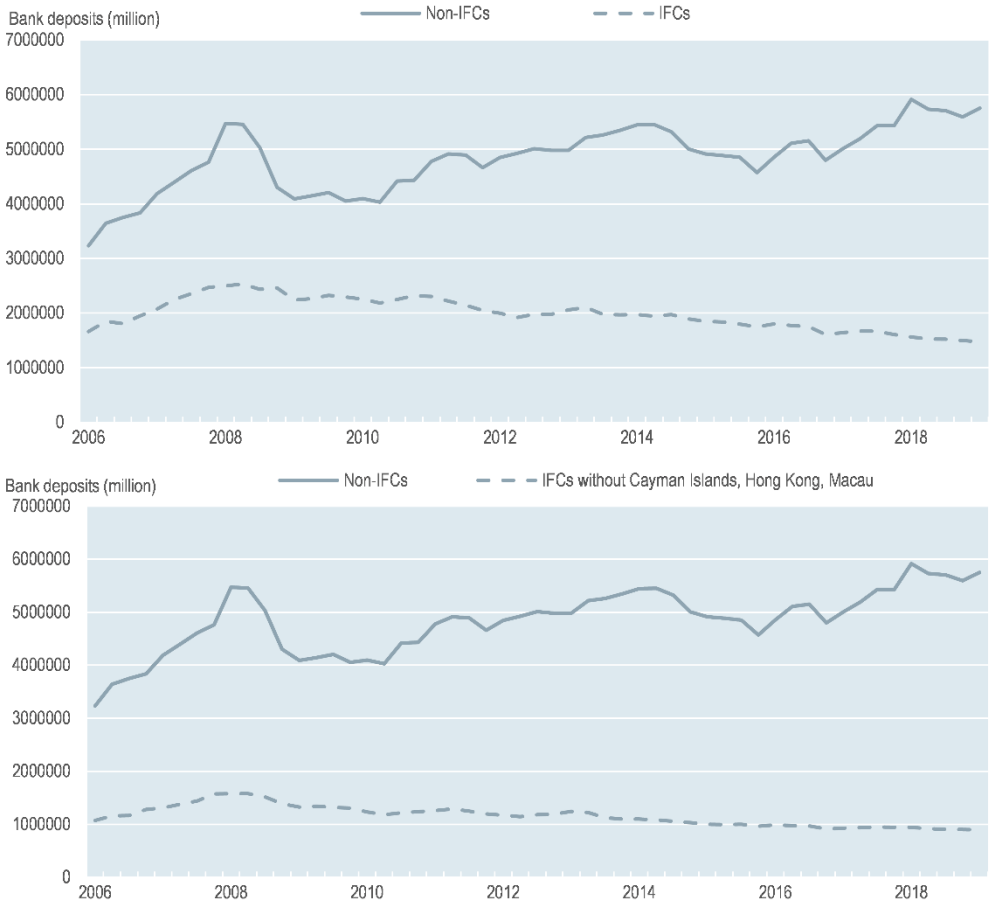
25. While cross-border deposits have been stable over time in some IFC jurisdictions, others have experienced an increase around the time of the global financial crisis and a subsequent decrease, which has continued through to the present. Since Q1 2008, declines have been evident in Guernsey, the Isle of Man, and Jersey as well as in 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, though 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 USD 100 billion) can be noted between June and September of 2013 (the G20 endorsed the AEOI standard in September 2013 and Switzerland announces the US-Swiss Bank Program in August 2013).[16] [17]

[16] 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).

[17] This shift may also have been driven by changes in the reporting of trustee deposits.

Figure 2. Changes in cross-border bank deposits (2006-2019)

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.



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.

Box 3. 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[18]). 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; and
- More popularly, centres which provide some or all of the following services: low or zero taxation; moderate or light financial regulation; banking secrecy and anonymity."

Of the jurisdictions on this IMF list, many smaller centres do not report bank liability data to the BIS. Those who do report to the BIS 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 more patchy and has been discussed in Section 2.1.

In this paper, the analysis relies on an amended list of IFCs 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.[18] Countries in bold are those that report to the BIS.

In the headline results in Section 2.1, 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 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 2.1. 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 3, 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 Cayman Islands and other jurisdictions are kept in the sample. This means that the sample underlying the headline decline

[18] 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 BIS (2017), BIS locational banking statistics: explanation of the data structure definitions https://www.bis.org/statistics/dsd_lbs.pdf.

of 410 billion reported in Section 2.1 and the sample underlying the association with EOIR and AEOI are slightly different.

Section 4.3 contains a robustness analysis of the main results in the paper to the inclusion of different IFCs subject to data availability.

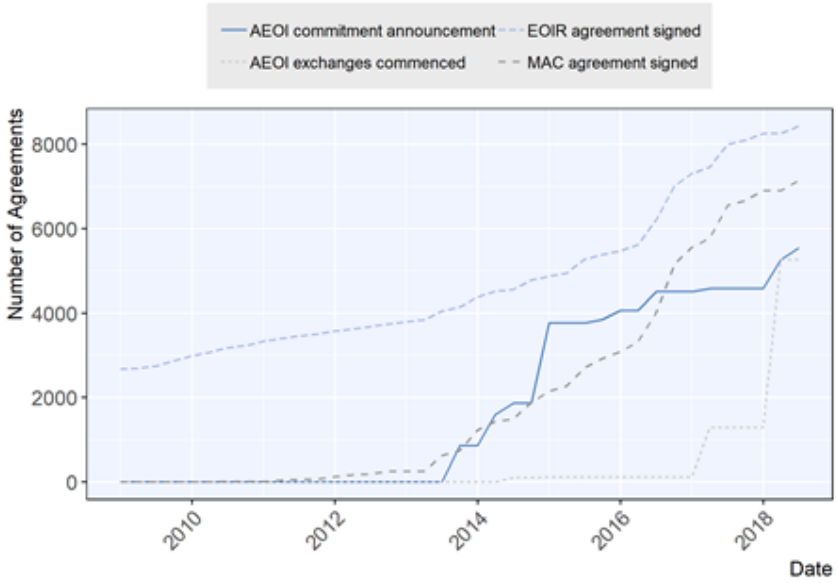
2.2 Stylised facts on the expansion of the EOI network

26. Figure 3 shows the expansion of EOI of various forms over the course of the last ten years (see Box 4 for further discussion). 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 AEOI – first following the commitment of G20 countries to exchange information automatically in September of 2014, with increasing commitments over the course of 2014.

27. Figure 4 shows 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 date of MAC signature. It is important to highlight that in some countries MAC signature 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. This means 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.

28. Consideration of the impact of the MAC is particularly important, as this has not been taken into account by previous studies. To our knowledge, none of the major studies in the literature on the impact of EOI have accounted for the relationships generated by the MAC signature in the analysis. Johannesen and Zucman (2014[1]) write that a 'comprehensive multilateral agreement would prevent tax evaders from transferring their funds from haven to haven.' The MAC performs exactly this function.

Figure 3. Number of bilateral EOI relationships



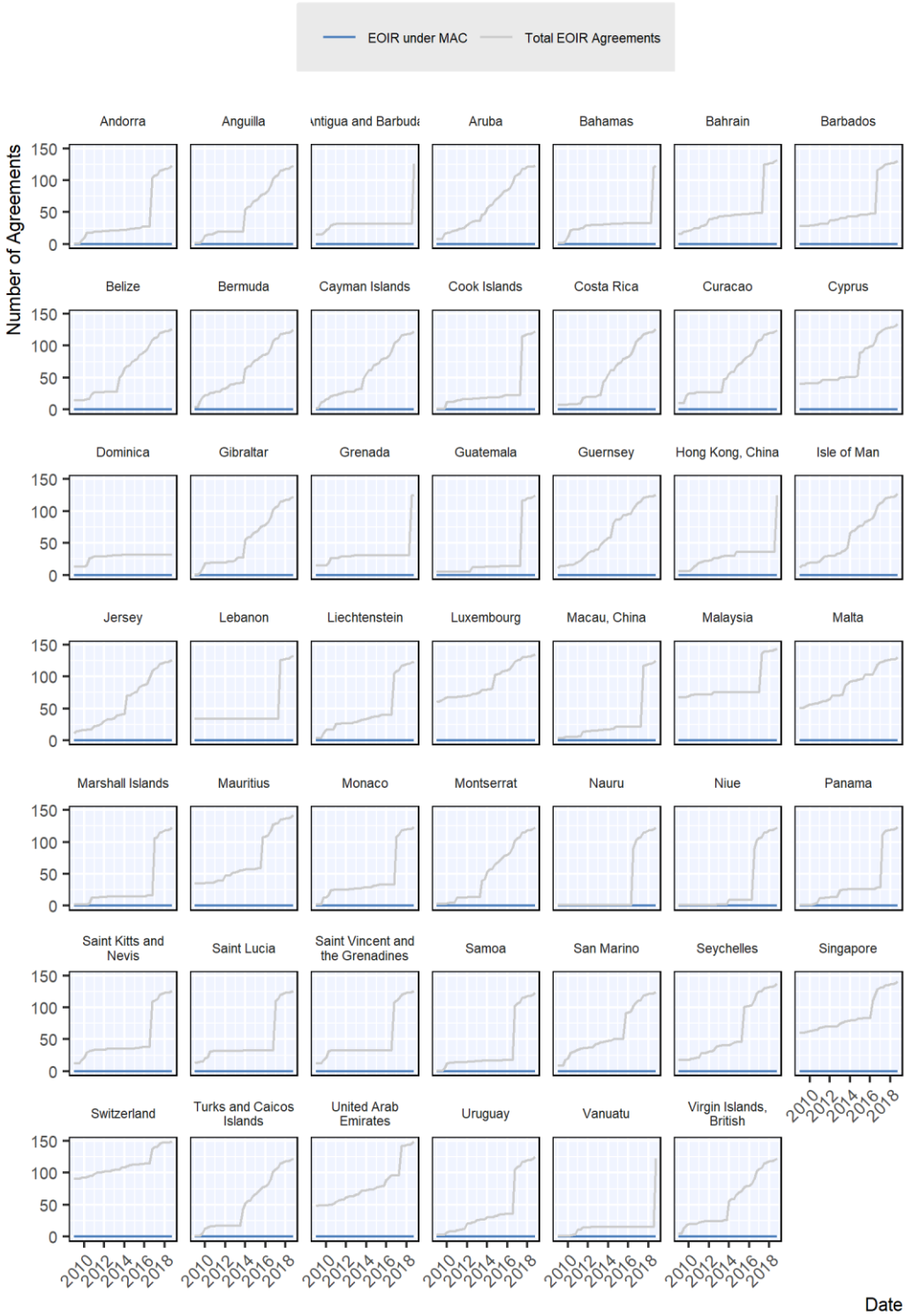
Note: Data on bilateral EOIR agreements post-2017 are preliminary and subject to revision. "EOIR agreement signed" refers to the signature of any agreement that establishes an EOIR relationship, including TIEAs, DTCs, and the MAC itself. To avoid double-counting, agreements that establish an EOIR relationship 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.

Box 4. A timeline of the expansion of tax transparency

- April 2009: The London G20 summit Communique states that the G20 agree, "to take action against "non-cooperative jurisdictions, including tax havens. We stand ready to deploy sanctions to protect our public finances and financial systems. The era of banking secrecy is over".
- September 2009: Global Forum on Transparency and Exchange of Information for Tax Purposes, which earlier comprised OECD countries working with Financial Centres, restructured and membership opened up to all those who commit to the standard of exchange of information on request (EOIR) and agree to undergo a peer review to assess its implementation.
- 2010-2011: The Convention on Mutual Administrative Assistance in Tax Matters developed jointly by the OECD and the Council of Europe in 1988 and amended by Protocol in 2010. Opened for signature to non-OECD and non-Council of Europe countries in 2011.
- 2010: The US Foreign Account Tax Compliance Act enters into law.
- September 2013: The G20 Leaders endorse the OECD proposal for a global model of AEOI and invite the OECD, working with G20 countries, to present such a new single standard for AEOI.
- August 2014: The Global Forum puts in place a commitment process to enable its members to publicly commit to a timetable to implement the new AEOI Standard. All Global Forum members, other than developing countries that do not house a financial centre, asked to commit to begin automatically exchanging information in accordance with the Standard, reciprocally and with appropriate partners, by 2017 or 2018.
- September 2014: The full AEOI Standard endorsed by the G20 Finance Ministers at their meeting in Cairns.
- October 2014: The Global Forum announces commitments to implementation of AEOI, with exchanges to commence by September 2017 or September 2018.
- October 2014: The first jurisdictions sign the CRS MCAA at the sidelines of the Global Forum Plenary Meeting in Berlin.
- 2015: Commitments to the new AEOI Standard announced by Bahrain, Panama, Cook Islands, Nauru and Vanuatu subsequent to the Panama Papers Data Leaks.
- September 2017: The first exchanges take place under the new AEOI standard.
- End of 2018: Exchanges taking place under the AEOI Standard now cover 90 jurisdictions.

Figure 4. EOIR agreements and MAC agreements over time

Total number of EOIR agreements signed by each jurisdiction



Note: The list of IFCs is based on IMF (2000[18]).
Source: Data on information exchange agreements provided by the Global Forum.

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

29. The previous section highlighted that there have been substantial reductions in the size of bank deposits in certain IFCs reported to the BIS. A challenge in assessing the impact of EOI is attempting to identify the extent to which these reductions are a result of EOI or of other factors. There are several aspects to consider. First, changes in bank deposits will be impacted by non-tax factors such as the attractiveness of a jurisdiction's investment and legal environments, its overall economic growth and recent or impending regulatory changes. Second, even if changes in bank deposits are tax-driven, they may not be due to changes in EOI. For example, in as much as deposits in IFCs potentially represent hidden wealth, it is possible that these deposits have been reduced as a result of other forms of tax enforcement such as targeted audits. In addition, the major data leaks in recent years may have provided information to tax authorities to address tax evasion.

30. In addition, 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. Changes in IFC bank deposits may also respond to other contemporaneous tax factors including changes in the tax environment of the IFC and the home jurisdiction of the capital owner. These could include changes in statutory rates or changes in tax rules, such as those that might result from implementing the OECD/G20 BEPS package, or temporary voluntary disclosure programmes to incentivise disclosure of funds hidden abroad. Disentangling these various effects constitutes a significant challenge.

31. There is complementary evidence that there has been significant disclosure of previously undisclosed assets, discussed further in Section 4.2. Since the widespread adoption of EOI, an estimated 500,000 individuals have disclosed offshore assets through voluntary disclosure programmes and around EUR 95 billion in additional tax revenue has been identified as a result of voluntary compliance mechanisms and offshore investigations.[19] The fact that these sums were in large part disclosed through voluntary disclosure programs (see Section 4.2) set up in advance of the commencement of AEOI in 2017 points to a relationship between taxpayer behaviour and EOI. However, it is important to recognise that the assets held in foreign jurisdictions that were disclosed may not have been repatriated. These assets could have stayed in foreign jurisdictions. This means that, while quantitative evidence of the link between EOI and reductions in cross-border bank deposits in IFCs is important, it is only one part of the overall picture.

3.1 Key hypotheses and methodological approach

32. While the decline in overall bank deposits in IFCs provides some suggestive evidence of the impact of EOI, it does not fully analyse the impact of EOI at a 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.

[19] http://www.oecd.org/tax/oecd-secretary-general-tax-report-g20-leaders-june-2019.pdf

The key expectation is that, to the extent that some fraction of deposits of banks in IFCs have historically existed for the purposes of tax evasion, the expansion of EOIR and the introduction of AEOI should have made holding assets in EOI jurisdictions riskier.[20] The expected response is that taxpayers would remove their assets from IFCs that commit to, sign or implement EOI agreements with non-IFCs.[21] This leads to the following hypothesis:

> *H1: An EOIR 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.*

33. This hypothesis is tested using the following general regression equation:

$$log(Deposits_{ijq}) = \alpha + \beta\, EOI_{ijq} + \epsilon_{ijq} \quad (1),$$

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.[22][23] It relies on an unbalanced panel of 16 IFCs based on the earlier list with sufficient bilateral deposit relations available.[24] 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.

34. 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 a bilateral agreement such as a DTC, a TIEA, or any other relevant multilateral transparency agreement, such as 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.

35. The independent variable for AEOI is either a public commitment to exchange information automatically or the commencement of AEOI under the CRS, or signature of a FATCA Intergovernmental Agreement (IGA).[25] All three different approaches to assessing the impact of AEOI are tested below.

---

[20] The approach here follows closely that of Johannesen and Zucman (2014[1]), as well as subsequent examinations of this issue by Casi, Spengel and Stage (2018[3]) and Menkhoff and Miethe (2019[2]). These papers, in turn, build on Huizinga and Nicodème (2004[12]), who used only one year of data as opposed to a panel approach.

[21] This may occur at the time of announcement, signature, ratification or entry into force.

[22] This excludes confidential bilateral data that is not available.

[23] 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[2]).

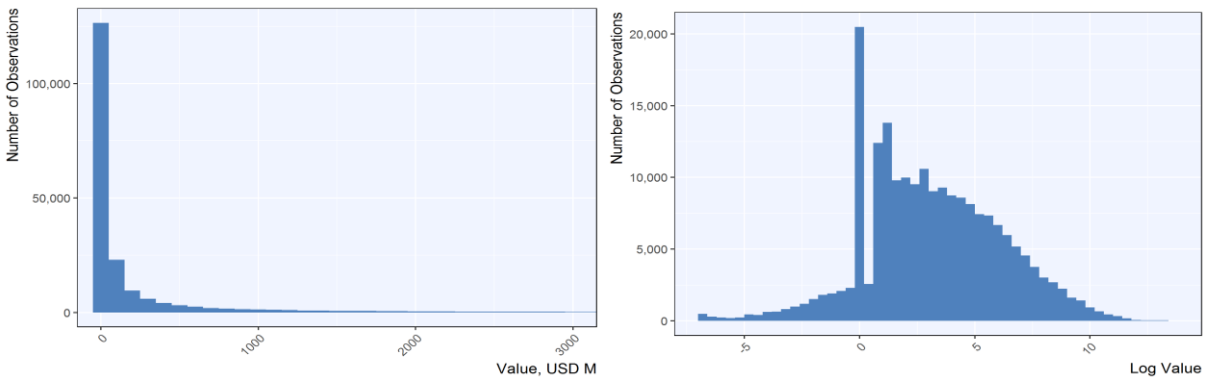
[24] Each IFC has on average 74 different bilateral deposit relations per year-quarter. To profit most from the data available, an IFC-non-IFC pair has been included when at least four quarters of data were available either side of the relevant EOI independent variable. While earlier studies such as Johannesen and Zucman (2014[1]), Casi, Spengel and Stage (2018[3]) or Beer, Coelho and Leduc (forthcoming[4]) also used unbalanced panels, others like Ahrends and Bothner (2019[5]) or Menkhoff and Miethe (2019[2]) employed balanced panels largely at the expense of IFC coverage.

[25] Dates for the commencement of AEOI are taken from *Automatic Exchange of Information Implementation Report 2018* (Global Forum on Transparency and Exchange of Information for Tax Purposes, 2018[27]), page 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 begun exchanging information under the CRS or under FATCA, and zero otherwise. However, this does not necessarily mean that they are exchanging with each other.

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 would come 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 behavioural responses of taxpayers, who may change behaviour either upon announcement of the upcoming changes in the EOI environment, or at the time of the actual commencement of AEOI exchanges.

36. According to hypothesis H1 above, it is expected that the sign of the coefficient β will be negative for deposits of IFCs with respect to non-IFCs. 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.[26] 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 the BIS LBS.

3.2 Main results for liabilities of IFCs with respect to non-IFCs

37. 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.

The details of which jurisdictions have actually exchanged with each other are not public at this stage. Incorporating actual activated bilateral agreements could be an avenue for future enhancement of this work.

[26] To obtain estimates of the percentage impacts of EOI, the following transformation is applied to the estimated coefficients: 100 * (exp(β) – 1).

Omitting time fixed effects

38. 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 at the jurisdiction-pair level. The regression equation is as follows:

$$log(Deposits_{ijq}) = \alpha + \beta_1 \, EOIR \, Signature_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (2)$$

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.[27]

39. 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, 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 to account for potential endogeneity in treaty adoption among jurisdictions.

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

41. This regression specification is as follows:

$$log(Deposits_{ijq}) = \alpha + \beta_1 \, EOIR \, Signature_{ijq} + \beta_2 \, AEOI \, Announcement_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (3)$$

In this specification, the coefficients on both β_1 and β_2 are negative and statistically significant. 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%.

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

$$log(Deposits_{ijq}) = \alpha + \beta_1 \, EOIR \, Signature_{ijq} + \beta_2 \, AEOI \, Commencement_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (4)$$

43. 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.

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

$$log(Deposits_{ijq}) = \alpha + \beta_1 \, EOIR \, Signature_{ijq} + \beta_2 \, AEOI \, Announcement_{ijq} + \beta_3 \, AEOI \, Commencement_{ijq} + \mu_{ij} + \epsilon_{ijq} \quad (5)$$

[27] 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.

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, AEOI announcement also being associated with an approximately 11% reduction and AEOI commencement being associated with a -28% impact.

45. 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 EOI on foreign-owned deposits in IFCs, with jurisdiction-pair fixed effects

Regression of foreign-owned bank deposits in IFCs on EOI dummy variables

	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***	-0.128***	-0.159***	-0.116***	-0.112***
	0.046	0.042	0.044	0.042	0.042
AEOI Announcement		-0.206***		-0.115**	-0.112**
		0.053		0.052	0.051
AEOI Commencement					-0.354***
					0.044
AEOI (incl. FATCA) Commencement			-0.374***	-0.322***	
			0.050	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 goes 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 2.1

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

Including time fixed effects

46. In Table 4, the approach follows the literature and includes year-quarter fixed effects.[28] 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.

47. The regression equation becomes as follows:

$$log(Deposits_{ijq}) = \alpha + \beta_1 EOIR\ Signature_{ijq} + \mu_{ij} + \theta_q + \epsilon_{ijq} \quad (6)$$

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

48. When year-quarter fixed effects are accounted for, the size of many coefficients in the regressions shrinks substantially or becomes non-significant. EOIR signature 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 the 1% level.

Table 4. The effect of EOI on foreign-owned deposits in IFCs, with jurisdiction-pair and year-quarter fixed effects

Regression of foreign-owned bank deposits in IFCs on EOI dummy variables

	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	-0.024	-0.028	-0.041	-0.042	-0.043
	0.044	0.044	0.045	0.045	0.044
AEOI Announcement		-0.074		-0.041	-0.033
		0.066		0.064	0.064
AEOI Commencement					-0.249***
					0.062
AEOI (incl. FATCA) Commencement			-0.199***	-0.185***	
			0.068	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 goes 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 2.1

[28] Huizinga and Nicodème (2004[12]) do not use time fixed effects as they have only one year of data. However, all other papers looking at this issue follow this approach.

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

49. 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 end up in the middle of an AEOI impact range of between -13.1% and -34.9% (see Figure 1). The findings come closest to Beer, Coelho and Leduc (forthcoming[4]), who use an unbalanced sample with a slightly reduced coverage of IFCs and sample length. They report an average effect of about -25% exerted by AEOI commencement on IFC deposits.

50. The null results with respect to EOIR in Table 4 stand in contrast to work by Johannesen and Zucman (2014[1]) and Menkhoff and Miethe (2019[2]), who demonstrate statistically significant negative results of -11% and -24% respectively. To examine this further, Table 5 re-estimates the model specification of Table 4 for EOIR only. As in Johannesen and Zucman (2014[1]), 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. This facilitates the examination of whether the impact of EOIR signature has varied over time.

Table 5. The impact of EOIR over time

Regression of foreign-owned bank deposits in IFCs on EOIR signature for varying sample lengths

	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 Signature	-0.024	-0.066	-0.106*	-0.095*	-0.093*
	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 goes 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.

51. 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[1]), in spite of the different cross-country sample. Adding additional years up to Q4 2014, however, decreases the impact to about 8.5%. Menkhoff and Miethe (2019[2]) document a similar weakening effect of EOIR over time.

52. This change 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.[29] Countries signing the MAC established potential EOIR relationships with every other signatory, whether there was substantial volumes of cross-border banking activity or not. This may account for the relative decline in the size of the impact of EOIR over time.

3.3 Accounting for multicollinearity

53. The reduction in the size and significance of the coefficients suggests that time fixed effects explain some of the effects previously attributed to EOI.[30] This is complicated by the fact that changes in 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 see this, it is useful to examine the fixed effects as well as the time trends in the independent variables themselves.

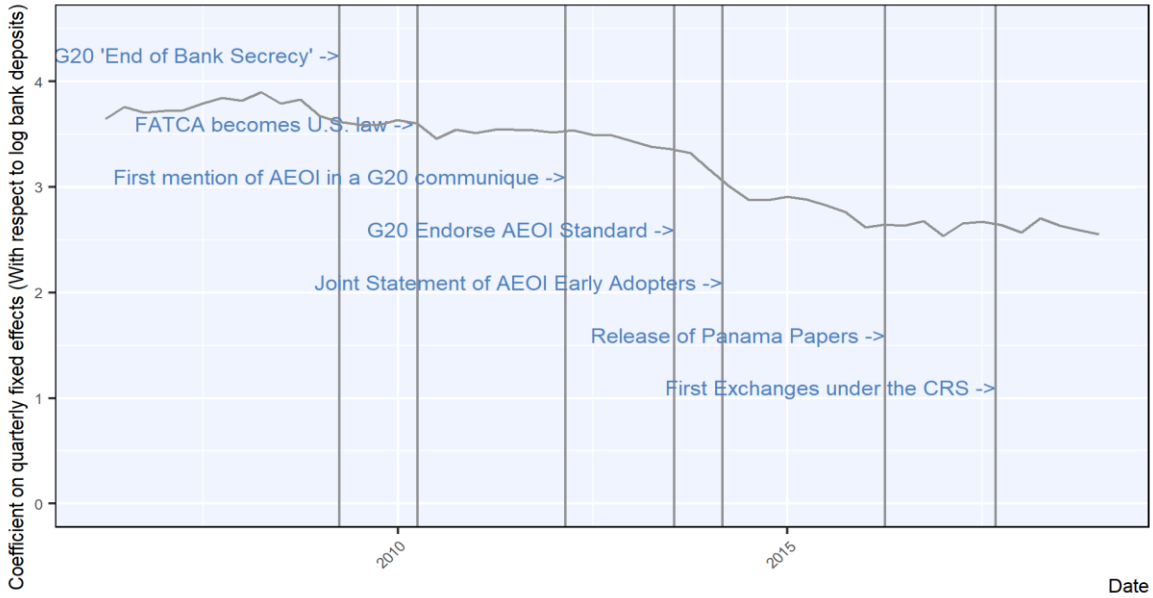
54. Figure 6 shows these fixed effects over time. There is an overall decline in bank deposits in IFCs being captured by the quarterly fixed effects. Several of these periods of substantial declines coincide with changes in the EOI environment, either through substantial increases in the expansion of both EOIR (i.e. through the expansion of the MAC) and through public commitments to AEOI, most notably in the period from the end of 2013 to end 2014. Figure 7 shows 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.

[29] Bilicka and Fuest (2014[29]) 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 EOIR agreements signed earlier may exert a stronger impact on deposit flows between jurisdictions.

[30] This is also evidenced by the notable decline in the R^2 statistics between Table 3 and 4 due to time fixed effects absorbing some of the variation in the data.

Figure 6. Year-quarter fixed effects over time

Based on the regression of EOIR and AEOI commencement with jurisdiction-pair and year-quarter fixed effects



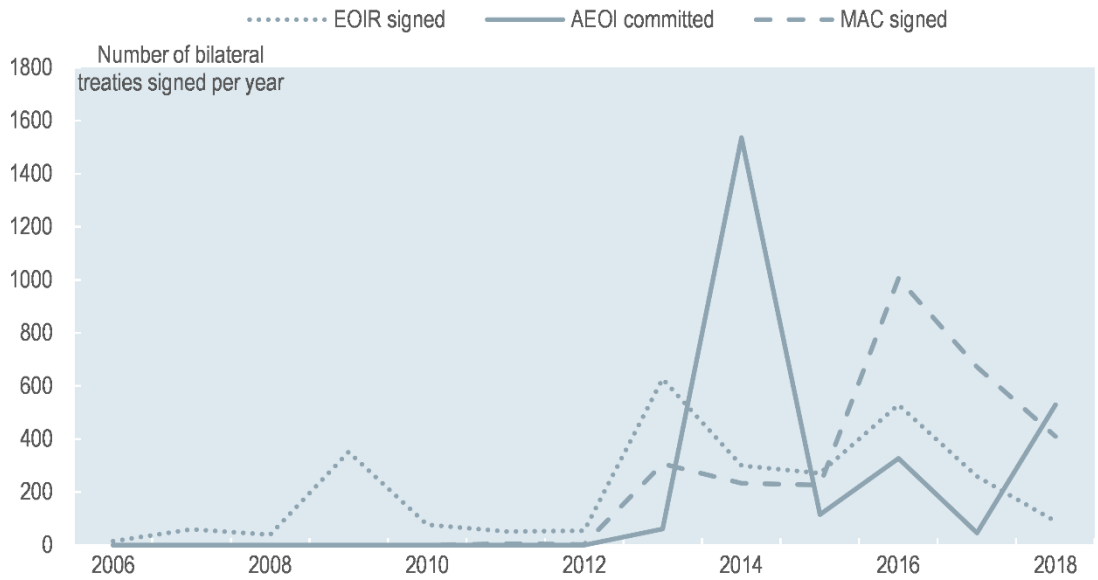
Note: The dependent variable is the stock of deposits held by savers of jurisdiction i in banks of IFC j at the end of quarter q.
Source: Authors' calculations based on BIS LBS.

55. Around the same time, other countries such as, for instance, 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 (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 after FATCA became 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 Communique).

56. 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.[31]

[31] Some mild multicollinearity between the time dummies and the AEOI announcement variables has also been detected based on a somewhat elevated variance inflation factor (VIF) and the Farrar-Glauber test.

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.

Quantifying the impact of the AEOI Joint Announcement

57. In March 2014, forty-four jurisdictions jointly announced their commitment to AEOI at the same time (referred to hereinafter as the Joint Announcement).[32] 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 to establish further the robustness of the results presented in Section 3.2.

58. Among those jurisdictions that were part of the Joint Announcement, six IFCs provide bilateral data in the sample available from the BIS.[33] Combining the data for these IFCs with other early-adopting non-IFC jurisdictions allows the examination of their bank deposits relative to those of other jurisdictions that did not participate in the Joint Announcement.[34] The analysis relies on a sub-sample of the bilateral deposit database, which is composed of two different jurisdiction pairs, namely those that announced early and others that did not. Figure 9 illustrates this, 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 the 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

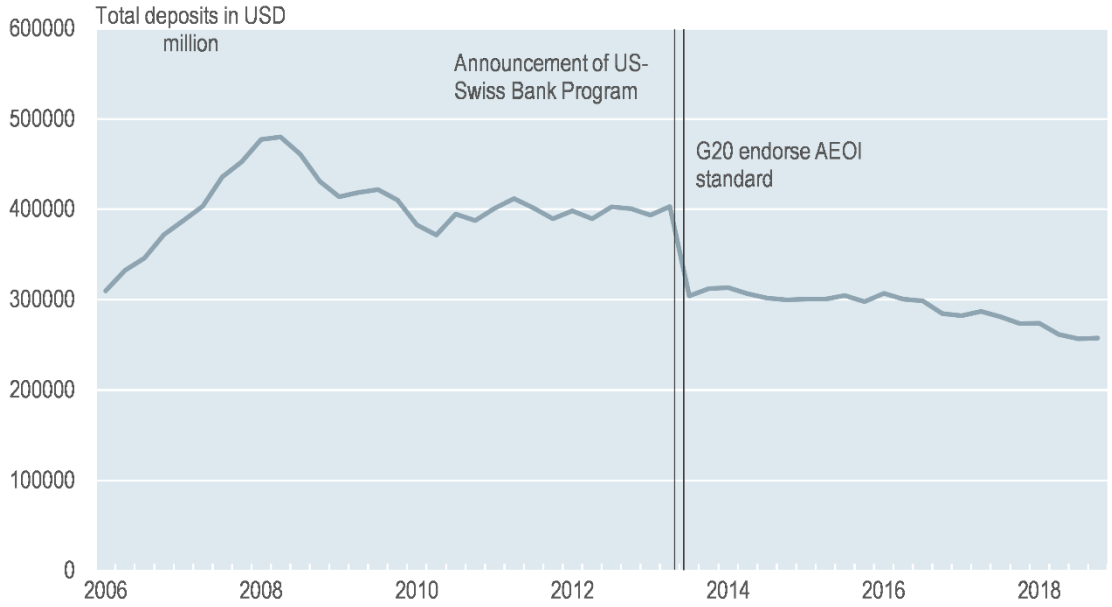
[32] The joint announcement jurisdictions are Anguilla, Argentina, Belgium, Bermuda, British Virgin Islands, Bulgaria, Cayman Islands, Colombia, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Guernsey, Hungary, Iceland, Isle of Man, India, Ireland, 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.

[33] These are Bermuda, Cayman Islands, Cyprus, Guernsey, Isle of Man, and Jersey.

[34] 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.

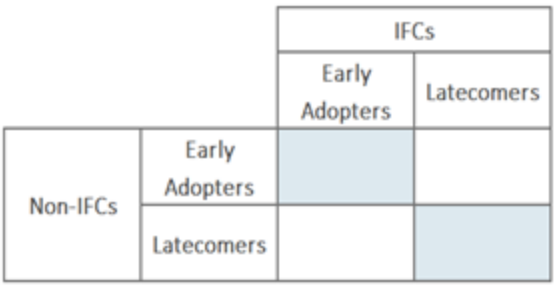
to AEOI while another set had not. By comparing these two groups, it is possible to assess the impact of public commitment on bank deposits.

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



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

59. 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[19]) is used to test this assumption, estimating using OLS an extended version of a regular two-period difference-in-differences model such as below:

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

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 happened in March 2014, the first quarter of 2014 becomes our reference quarter in the regression and consequently remains omitted.

60. 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, the control group. Any significant divergence in trends around the time of the Joint Announcement, the first quarter in 2014, is interpreted as a causal effect of early AEOI commitment on bank deposits. Due to the inclusion of various fixed effects, 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 3.2 above). Estimated standard errors are robust and clustered at the jurisdiction-pair level, following the recommendation of Bertrand, Duflo and Mullainathan (2004[20]).

61. The estimated treatment effect for a given post-announcement quarter t is captured by $\widehat{\delta_t}$. 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.[35] 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 and post Joint Announcement. This implies that pre-treatment trend differentials should be relatively negligible, with the coefficients of $\widehat{\delta_t}$ being relatively small and statistically insignificant.

62. Figure 10 shows the main results of this analysis: the estimated aggregated time trends for early-adopting jurisdiction pairs relative to non-early-adopting jurisdiction pairs.[36]

63. 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.

64. 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. 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.

65. 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 the early-adopters and non-early-adopters. The very low bars after the Joint Announcement point to a statistically significant difference between those jurisdictions that announced and those that did not. Moreover, both trend lines fail to converge and continue

[35] 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 the AEOI (e.g. if taxpayers suspected that even if they had not committed via the joint announcement, they would commit eventually).

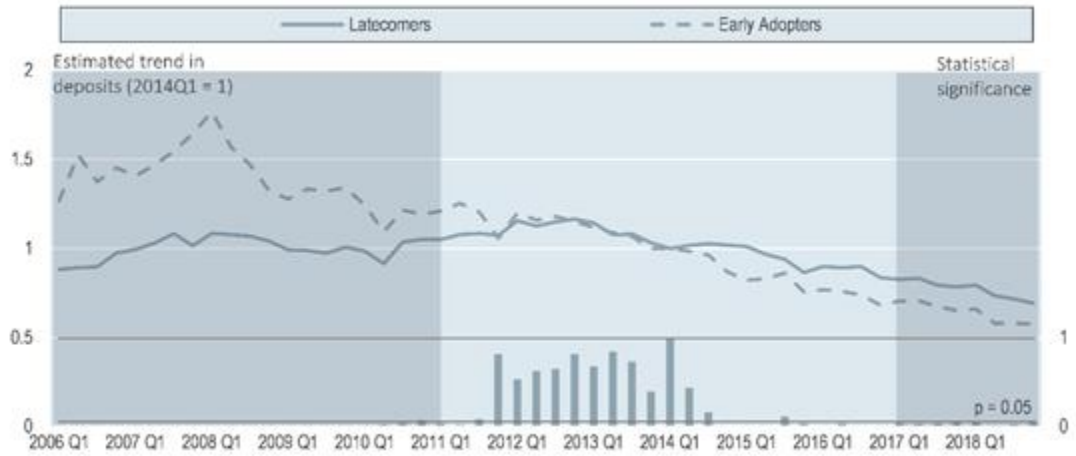
[36] Detailed regression results are contained in Table A1 in the Annex.

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 group.

66. 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 the treatment group 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.[37] 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%.[38]

Figure 10. The impact of AEOI Joint Announcement on time trends in IFC deposits

Deposit trends based on difference-in-differences estimation



Note: Lines indicate trends in deposits as captured by coefficients on time dummies θ_τ and the interaction terms $\theta_\tau * EA_{ij}$, that is exp(γ_t) for non-Early Adopters and exp(γ_t+δ_t) for Early Adopters. Columns indicate statistical significance levels of interaction terms $\theta_\tau * EA_{ij}$. 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.

The impact on individual IFCs

67. 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

[37] The treatment effect for a period t is calculated as exp(0) – exp($\hat{\delta}_t$) for post-treatment values of t, where 0 under the identifying assumption is the expected, counterfactual value of $\hat{\delta}_t$ without the treatment.

[38] 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.

adopters (the treatment group) and those that announced later on (the control group). The respective figures are contained in Annex A.

68. As the estimations in Figures A1, A2 and A3 in the Annex show, 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 turn significant after the reference period 2014 Q1, with partial effects only during the four post-announcement quarters. Estimated effects over the four post-announcement quarters of the same period are estimated at around -53% for Guernsey and -27% for the Cayman Islands. The results suggest that Jersey was affected to a much lesser extent, as a very slight trend divergence and the barely significant interaction terms demonstrate. 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 of the announcement in that jurisdiction.

69. 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.

70. 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 of AEOI announcement. These results strengthen the findings in two ways. The statistically significant difference between early adopters and non-earlier adopters points to some degree to multicollinearity that is 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.

4 Robustness checks

71. 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.

4.1 The effect of EOI across jurisdiction pairs

72. The results in Section 3 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.

73. Table 6 shows the main regressions for deposits between non-IFC-IFC jurisdiction pairs from Section 3 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 significant way. Deposits from non-IFCs in other non-IFCs are also not affected in a statistically significant way.

74. In contrast, the results suggest that AEOI commitments actually had a positive impact on non-IFC deposits between each other. 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.

4.2 The potential impact of voluntary disclosure and amnesty programmes

75. 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.

76. 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 38 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.[39] An important caveat to these dummy variables is that the specifics of VDPs can differ significantly by jurisdiction in terms of length and legal consequences of disclosure. These different characteristics may result in varying impacts of the programmes and may influence the findings below.

Table 6. The effect of EOI on foreign-owned deposits in different jurisdiction pairs

Regression of foreign-owned bank deposits in different jurisdiction pairs on EOI implementation

	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 Signature	-0.033	-0.034	-0.065	-0.065
	0.059	0.059	0.069	0.069
AEOI Announcement	0.272**	0.275**	-0.14	-0.14
	0.111	0.111	0.121	0.064
AEOI Commencement		-0.03		-0.133
		0.073		0.106
AEOI (incl. FATCA) Commencement	-0.014		-0.133	
	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 goes 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

77. 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 Miethe (2019[2]), who find no significant impact of VDPs on IFC deposits, based on a considerably smaller list of VDPs.

78. 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;

[39] This list has been compiled based on sources from the OECD (2015[28]), public notes from global audit firms such as PwC, Deloitte or KPMG as well as information scraped from national tax authority or finance ministry websites.

that jurisdictions that felt they had a large tax compliance challenge with respect to bank deposits implemented a VDP for this purpose.

79. 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.[40] 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

Regression of foreign-owned bank deposits in IFCs on EOI and VDP dummy variables

	EOIR and AEOI (incl. FATCA) Announcement and Commencement	EOIR and AEOI 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	-0.044
	0.064	0.064
AEOI Commencement		-0.230***
		0.062
AEOI (including FATCA) Commencement	-0.172***	
	0.061	
Voluntary Disclosure/ Amnesty	0.227***	0.219***
	0.064	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 goes 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

4.3 Differing definitions of international financial centres

80. The regressions in this paper use a list of IFCs based on that outlined in IMF (2000[18]) (see Box 3). 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[1]) or Gravelle, (2015[21])). To

[40] Langenmayr (2017[24]), conducting a study on the 2009 VDP in the US, finds that the programme increased the number of individuals who evade taxes. 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. (2019[31]) find that VDPs are not necessarily conducive to disclosures. Their results suggest that most disclosures happened outside of VDPs by individuals who never admitted prior noncompliance.

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.

81. Changing the IFC list also changes the sample of counterparty countries. Following the literature, the analysis in Section 3 focuses on deposits in IFCs held by non-IFC residents. This means that for each of the IFC jurisdictions in the sample, those countries that are not on a given IFC list are added to the list of potential counterparties.

82. Table 8 reproduces the tests carried out in Table 4, but removes each IFC one by one from the analysis. This shows the impact that each IFC has had 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).

83. 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.

84. 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

Coefficient on EOIR signature and AEOI commencement including jurisdiction-pair and year-quarter fixed effects

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.

5 Conclusion and future research

85. This paper examines the overall impact of EOI on foreign-owned bank deposits in IFCs. The key contributions of the paper include a more detailed dataset on bank deposits than has been used elsewhere in the literature, a more accurate dataset of information agreements, 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.

86. The BIS data show a strong decline in bank deposits in IFCs in a period of expanded tax transparency. The results point to a decline of over USD 400bn in these deposits, a significant reduction in the scale of offshore banking in IFCs. Using a panel regression model following the approach of Johannesen and Zucman (2014[1]), the results show that AEOI commencement is associated with a significant (22%) decrease in foreign-owned IFC deposits. The results on EOIR, based on a shorter sample, suggest that the impact of EOIR has changed over time. Initial EOIR agreements signed in the aftermath of the commencement of peer review in 2009 had a strong impact; however, the impact of each additional agreement has been more muted, potentially due the increasingly multilateral nature of the EOIR network.

87. 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, Lester and Markle (2019[7])). 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[22])).

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Annex A. Further tables

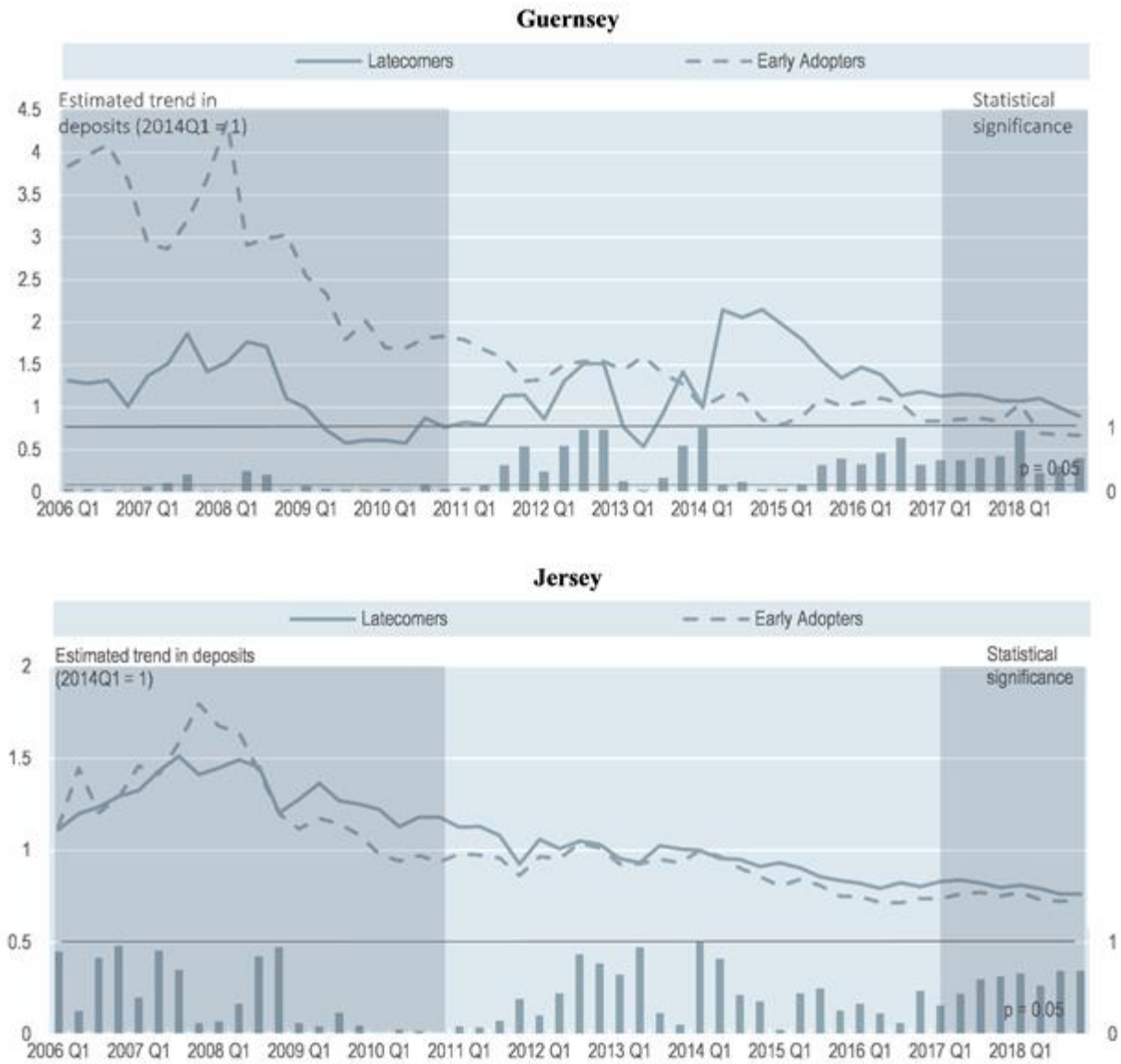
Table A 1. Time trends in aggregate deposits – regression output

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
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

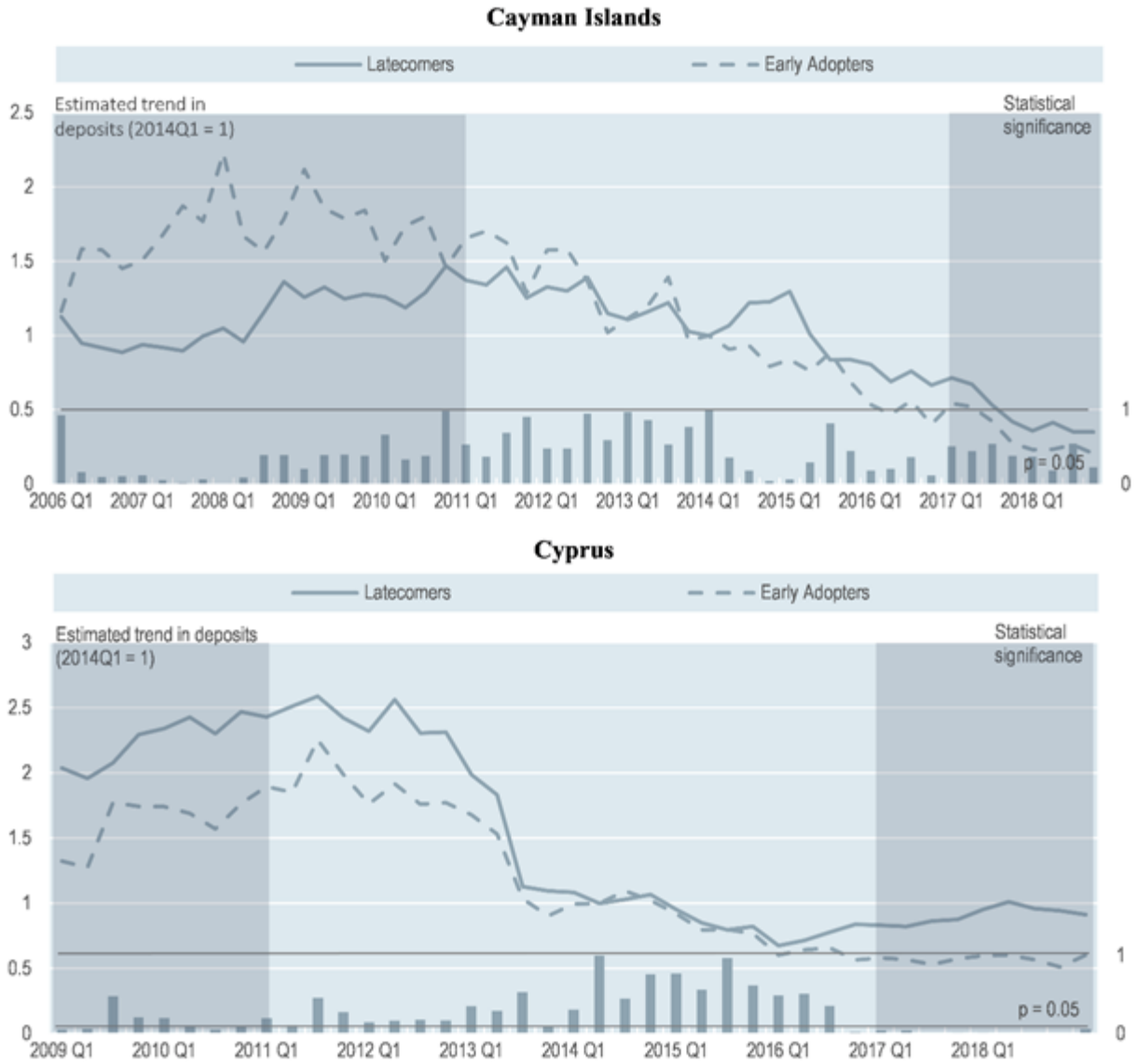
Deposit trends based on difference-in-differences estimation



Note: Lines indicate trends in deposits as captured by coefficients on time dummies θ_τ and the interaction terms $\theta_\tau * EA_{ij}$, that is exp(γ_t) for non-Early Adopters and exp(γ_t+δ_t) for Early Adopters. Columns indicate statistical significance levels of interaction terms $\theta_\tau * EA_{ij}$. 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

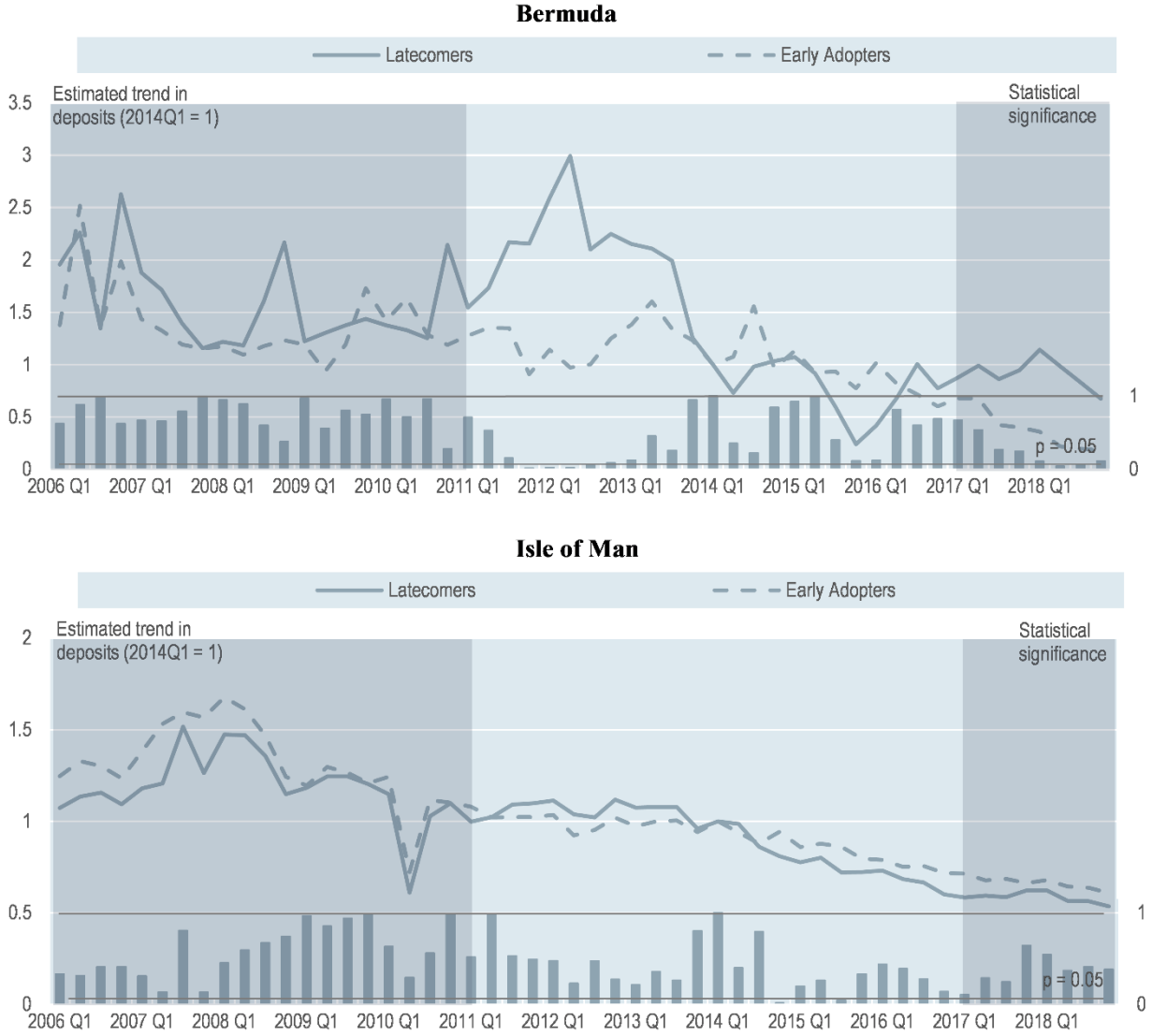
Deposit trends based on difference-in-differences estimation



Note: Lines indicate trends in deposits as captured by coefficients on time dummies θ_τ and the interaction terms $\theta_\tau * EA_{ij}$, that is exp(γ_t) for non-Early Adopters and exp(γ_t+δ_t) for Early Adopters. Columns indicate statistical significance levels of interaction terms $\theta_\tau * EA_{ij}$. 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

Deposit trends based on difference-in-differences estimation



Note: Lines indicate trends in deposits as captured by coefficients on time dummies θ_τ and the interaction terms $\theta_\tau * EA_{ij}$, that is exp(γ_t) for non-Early Adopters and exp(γ_t+δ_t) for Early Adopters. Columns indicate statistical significance levels of interaction terms $\theta_\tau * EA_{ij}$. 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.