Taxing Capital in a Globalized World: The Effects of Automatic Information Exchange*

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Abstract

In the second half of the 2010s more than 100 countries—including all large offshore financial centers—started to automatically exchange bank information with foreign tax authorities. This informational big-bang marks a break with the situation of offshore bank secrecy that prevailed before. We study its effects on tax compliance by analyzing the universe of information reports sent by foreign banks to Danish authorities, matched to population-wide micro-data on income, wealth, and cross-border bank transfers. In response to the automatic exchange of bank information, tax evaders may repatriate previously undeclared offshore wealth, they may start to self-report offshore income to the tax authorities, or the tax authorities may detect their evasion in audits that use the new information reports. Using a variety of research designs, we find large increases in tax compliance along all these margins, with the largest response coming from repatriation of wealth. Overall we estimate that the automatic exchange of bank information has caused a decline in the offshore tax gap of about 70% relative to a counterfactual with no policy change. These results highlight the power of international cooperation to improve tax compliance in a globalized world.
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1 Introduction

The 2010s have seen the advent of a major new form of international economic cooperation: the automatic exchange of bank information. In 2017–2018, more than 100 countries and territories—including many with historically strict bank secrecy rules—began to automatically share bank account data with foreign tax authorities. This informational big-bang marks a break with the bank secrecy that prevailed in offshore financial centers.

Yet despite the importance of this new policy, still relatively little is known about its effects. Tax authorities publish little information about the amounts of income and wealth disclosed by foreign banks. While a burgeoning literature (discussed in Section 2) explores some of the behavioral responses to this new reporting system, to date there is no comprehensive assessment of its impacts on tax compliance. Has the amount of wealth hidden in tax havens declined, and if so by how much? Do wealthy taxpayers—who own the bulk of offshore assets—report more income and pay more tax as a result? Answering these questions is crucial to evaluate the effectiveness of the new transparency regime and to draw inference for the design of tax systems. This is an issue of tremendous importance not only for the analysis of tax policy, but also more broadly for the social sustainability of globalization.

In this paper, we use population-wide administrative micro-data to provide a first quantification of how the automatic exchange of bank information affected tax compliance. Thanks to a collaboration with the Danish tax authority, we were able to analyze the universe of reports sent by foreign banks to Denmark, matched to individual income, wealth, and cross-border bank transfer data covering the full Danish population over a long period of time. To quantify changes in the enforcement capacities of tax authorities, we also designed and analyzed a random audit experiment. Taken together, these data allow us to capture all the potential improvements in tax compliance caused by the new policy: the repatriation of assets previously hidden abroad; increases in self-reporting of offshore income; and better tax collection through audits. Because the data we have access to (presented in Section 3) are granular, and because the automatic exchange of bank information represents a large shock, we are able to obtain well-identified evidence of the effects of this reform on each of these potential compliance margins.

The goal of the new information exchange regime was to reduce the offshore tax gap: the amount of unpaid taxes due to the concealment of financial assets abroad. Overall, we estimate that this policy has caused a decline in the offshore tax gap of about 70% relative to a counterfactual with no policy change. This does not mean that offshore tax evasion has disappeared or that there aren't loopholes in the new system (and indeed, we provide evidence of some

continuing non-compliance). More modestly, our results highlight the power of international coordination to improve tax compliance in a globalized world.

The positive compliance effects we estimate come from three channels. First, we find that about 40% of the financial wealth that would have remained hidden absent the automatic exchange of bank information was repatriated by Danish taxpayers. Second, an additional 20% is now self-reported by taxpayers. Last, about 10% of that wealth is still not duly reported but has become observable to the Danish tax authority and could be brought into compliance through increased auditing.

Section 4 studies the largest margin of response, the repatriation of offshore wealth. Our data environment allows us to quantify this important—but typically hard to capture—form of response, because we can observe cross-border money transfers made by Danish households before and after the announcement of the new transparency regime. A key feature of our data is that we can distinguish transfers that correspond to repatriations vs. transfers that correspond to payments from third parties, allowing us to implement a difference-in-differences design. We find that large amounts of funds previously held in tax havens were repatriated by Danish households in response to the automatic exchange of bank information. This wealth was previously hidden: repatriations are associated with a one-to-one jump in reported wealth, with most of the effect coming from households in the top 0.1% of the wealth distribution. These repatriations are also associated with a persistent increase in taxes paid.

Section 5 studies the change in self-reporting behavior. The number of Danish taxpayers who self-report offshore financial income triples after the implementation of the automatic exchange of bank information. The rise in self-reporting, however, appears concentrated among relatively small accounts. As a result, the increase in the amount of self-reported wealth is about half as large as the amount of repatriated wealth. A low-cost, targeted intervention by the tax authorities—sending letters to taxpayers known to own offshore assets—increases self-reporting.

Section 6 studies the third channel of improvement in tax compliance: how the new data received by the tax authorities allow them to better enforce taxes. Third-party reporting of information is not sufficient to ensure full compliance on offshore assets: some people whose accounts start being disclosed still fail to report the corresponding income. Using a random audit experiment, we find that auditing taxpayers with a significant discrepancy between self-reported and bank-reported foreign income would allow tax authorities to bring into compliance slightly more than 10% of the counterfactual untaxed wealth. However, realizing the potential revenue gain uncovered by our random audit experiment faces obstacles. Reports sent by foreign

banks to Denmark can have errors, income can be reported by taxpayers in a wrong field of the tax return, and the tax rate applicable to offshore income can vary from one country to another. These issues, that we quantify using our expriment, limit the ability of tax authorities to automate corrections.

The new reporting system has not erased all forms of financial wealth concealment abroad. Leveraging our money transfer data, in Section 7 we report evidence suggesting that some foreign banks fail to comply with the new regulations or that taxpayers are able to exploit loopholes. We consider taxpayers who make transfers to (or from) a bank account they own abroad. In principle, the foreign banks should report the accounts to Denmark. In close to 30% of the cases, however, no report is sent to the Danish tax authority. This result is particularly relevant from a global perspective, as banks that fail to send information to Denmark may be unlikely to send information to other countries, towards which they have the same reporting duties.

Taken together, these results yield new insights about the determinants of tax evasion and the role—but also limits—of third-party reporting of information. The large responses we estimate, summarized in Section 8, confirm the central importance of third-party reporting for tax compliance in modern tax systems. But non-trivial noncompliance on offshore income remains: about 30% of the counterfactual amount of hidden wealth still fails to be captured by the tax authorities. This remaining noncompliance is larger than noncompliance estimated on other forms of third-party reported income (e.g., Kleven et al., 2011). This suggests that third-party reporting has more limitations when applied across borders than domestically. Incentives to provide truthful information are weaker internationally than domestically, because domestic authorities cannot easily audit foreign financial institutions. Moreover, when information is too complex to be used automatically (as is the case for the reports sent by foreign banks), tax evasion may subsist in equilibrium because tax authorities cannot credibly commit to auditing all potentially noncompliant returns. In that context, third-party information reporting may need to be complemented by additional interventions by the tax authority—letters, targeted audits—to be fully effective.

Even though the data at our disposal are particularly rich, two limitations of our setting are worth noting. First, households can own offshore assets directly or indirectly through holding companies (e.g., Omartian, 2018). Due to the lack of granularity of holding company data, our analysis focuses on the behavioral responses of directly-held assets. Because directly-held assets account for about half of all household offshore wealth, and because both types of assets are

subject to the same reporting requirements under the automatic exchange of bank information, our analysis is likely to be informative about the response of the overall stock of household offshore wealth. Section 8 presents evidence supporting this notion. We analyze a small set of audits of holding companies that leverage the new bank-reported data, and find no evidence that widespread noncompliance remains on indirectly-held offshore assets. Noncompliance appears to be of the same order of magnitude as for directly-held assets. In future work, additional evidence on the response of indirectly-held assets would be valuable.

Second, the compliance effects we uncover may differ in other countries. There might be less response in countries where tax authorities are perceived to have fewer resources than in Denmark, or more response in countries perceived to have more leverage over offshore financial centers. We see our paper as a blueprint that could be used globally to conduct similar studies in as many countries as possible.

2 Related Literature

2.1 Offshore Wealth and Information Exchange Policies

A key form of tax evasion among the rich globally is offshore tax evasion. Available estimates suggest that about 8% of the world's financial household wealth was held in tax havens globally in the late 2000s and early 2010s, most of which unreported (Zucman, 2013, 2015; Alstadsæter, Johannesen and Zucman, 2018). Tax amnesties and leaks from offshore financial institutions show that this wealth is concentrated at the top of the distribution (Alstadsæter, Johannesen and Zucman, 2019; Londoño-Vélez and Ávila-Mahecha, 2021; Londoño-Vélez and Tortarolo, 2022; Leenders et al., 2023; Baselgia, 2023; Johannesen et al., 2024).

A number of policies have been implemented to try to curb this form of evasion since the turn of the 21^{st} century. At the time of the financial crisis of 2008-2009, G20 countries compelled tax havens to sign at least twelve bilateral agreements providing for the exchange of bank information on request (Johannesen, 2014; Johannesen and Zucman, 2014; Hanlon et al., 2015; Menkoff and Miethe, 2019). This approach seems to have had relatively limited effects, because tax authorities needed to have prior suspicion of noncompliance to request information (a difficult task in practice) and the network of treaties was incomplete.

A burgeoning literature studies the effects of the more recent automatic exchange of bank information—the Foreign Account Tax Compliance Act in the United States in force since 2015, and the Common Reporting Standard in force since 2017–2018 in more than 100 countries—

which is a much more ambitious approach. Banks must provide information to the relevant foreign tax authorities on an automatic basis, as opposed to on request. All large offshore financial centers have accepted to participate in this exchange, leaving no obvious hole for tax evaders to hide assets. However, there is limited evidence on the effectiveness of this policy. The OECD (2023) reports aggregated statistics on the amounts of wealth covered by the CRS, but no details on who owns it or where it is managed. A number of papers focus on macroeconomic statistics (Beer, Cole and Leduc, 2019; Case, Spengel and Stage, 2019; De Simone et al., 2020; O'Reilly, Parra Ramirez and Stemmer, 2021; Bénétrix et al., 2023). Baselgia (2023) and Alstadsæter et al. (2024) use micro-data to study certain behavioral responses to the CRS.

Our main contribution to this literature is to provide a first comprehensive assessment of the effect of the automatic exchange of bank information on tax compliance. Using a unique set of linked administrative micro-data, we quantify the effects of this policy on the key potential sources of increased compliance by taxpayers.

2.2 Tax Evasion and Third-Party Reporting

Our paper also adds to a body of work highlighting the crucial role of third-party information reporting for tax compliance. Income sources that are subject to third-party reporting have low rates of underreporting, and vice-versa (see, e.g., Kleven et al., 2011, for evidence in Denmark; Internal Revenue Service, 2023, for evidence in the United States; see also Pomeranz, 2015, for evidence on the deterrence effects of paper trails when they can be used for enforcement). Globally, the rise of third-party reporting appears to have played a major role in the expansion of the income tax over time (Jensen, 2022). This suggests that introducing third-party reporting can significantly curb noncompliance.

The literature, however, focuses on domestic third-party reporting. Reporting by third parties could have different effects when information is exchanged across borders. What makes third-party reporting work domestically is the threat of auditing and penalties for firms failing to properly report (Kleven, Kreiner and Saez, 2016). But monitoring and sanctions possibilities are more limited internationally: the tax authority of, say Denmark, cannot easily audit or fine banks in Singapore. In that context, incentives to comply are weaker and third-party reporting may break down.[1]

In the case of the Common Reporting Standard, domestic authorities are responsible for

[1]Third-party reporting can also fail domestically when employers and employees collude on evasion; for a striking illustration see Feinmann, Hsu Rocha, and Lauletta (2022).

collecting data on the accounts of non-residents managed by domestic banks, and then for sharing these data with foreign tax authorities. But because there are no tax revenues at stake for them, domestic authorities may have limited incentives to ensure compliance by domestic banks.[2] Whether cross-border third-party reporting of information is effective is thus an open question—and an increasingly important one with the rise of cross-border activity. Our paper provides some of the first answers to this question using a major natural experiment.

We also contribute to the literature on tax evasion by high-income individuals (e.g., Guyton et al. 2023). Our finding that the automatic exchange of bank information led to a sustained increase in tax payments by the rich echoes recent results by Boning et al. (2023) on the long-run positive effects of audits on tax compliance at the top in the United States.

3 The Automatic Exchange of Bank Information

3.1 Context and Data

Timeline. In September 2013, the G20 endorsed the automatic exchange of bank information as a new global standard. The OECD was tasked with operationalizing this decision. In 2014 it established the Common Reporting Standard (CRS), setting out the information to be exchanged, the institutions required to report, the different types of accounts and taxpayers covered, and common due diligence procedures. Financial institutions must identify the beneficial owners of all the accounts that they manage and that are owned by non-residents. All financial assets are covered, i.e., not only bank deposits, but also securities (equities, notes, bonds, mutual fund shares, etc.), and financial products such as insurance contracts and swaps. Financial institutions—including banks, insurance companies, and asset management firms—in participating jurisdictions are required to be compliant with the CRS. They must collect information on account balances, interest income, dividend income, gross proceeds from sales, and other income. This information is shared with tax authorities in the residence country of the account owner. Accounts owned by publicly listed companies are outside the scope of the CRS, but accounts of privately-held companies are in scope. Information about these accounts must be sent to the countries where the beneficial owners of the companies live.[3] The first batch of

[2]The OECD has established a Global Forum on Transparency and Exchange of Information for Tax Purposes to review the practice of international information exchange. In the most recent assessment, 36% of the 101 jurisdictions that committed to share information in 2017, 2018, or 2019 were found to be noncompliant or partially compliant (OECD, 2023, Figure 1.2). This is possibly a lower bound, since some noncompliance and collusion could go undetected in this peer-review framework.

[3]Specifically, reports are always sent to the residence country of the company. When the company is classified as "passive," reports are also sent to the residence country of its beneficial owners or directors. When it is

information was exchanged in 2017 for tax year 2016, but most countries (including key offshore wealth management centers such as Switzerland) only started sharing information in 2018 for tax year 2017. By 2023 more than 100 jurisdictions shared data (OECD, 2023).[4]

Separately, the United States decided to pursue its own automatic exchange of information, the Foreign Account Tax Compliance Act (FATCA). As detailed in Johannesen et al. (2024), this law, enacted in 2010, requires foreign financial institutions to report data about their U.S. account holders to the U.S. tax authority or be subject to withholding taxes. The negotiation with foreign partners took place in 2012-2014 and the first batch of information (concerning the tax years 2014) was received in 2015. The vast majority of financial institutions have agreed to share information with the United States.

Data available in Denmark and matching. For this paper, we have access to the universe of CRS and FATCA reports received by the Danish tax authority over the period 2016–2019.[5] These reports are linked to the rich set of administrative data available within the tax authority. For the full sample of taxpayers in Denmark, we have information from (i) individual income tax returns, (ii) administrative wealth data, (iii) cross-border bank transfers, (iv) reports from foreign banks under the CRS and FATCA. CRS and FATCA reports are matched to individuals by the tax authorities based on taxpayer identification numbers, names, birth dates, and addresses; see Appendix A for details of the matching procedure. In some cases information is missing or incomplete, making it impossible to match accounts to a specific individual with a high enough degree of certainty (defined as a matching score greater than 99%). We refer to Section 3.2 below for an analysis of these unmatched accounts.

Limitations of the automatic exchange of information. As noted in the literature, the Common Reporting Standard has some limitations, which carry over to our data environment.

First, some jurisdictions do not participate in it. Because the CRS is based on reciprocity—countries that receive information must also be able to send bank data to foreign authorities—a number of low-income countries, which lack the administrative capacity to send bank data automatically abroad, are de facto excluded from it. Importantly, however, all large financial

classified as "active," banks do not need to look for controlling persons.

[4]The OECD maintains a tracker of the state of CRS implementation for all jurisdictions committed to automatic exchange of financial account information, indicating, e.g., the first year that information exchange too place: `https://web-archive.oecd.org/tax/automatic-exchange/crs-implementation-and-assistance/crs-by-jurisdiction/index.htm`.

[5]In particular, our data include all reports sent by all foreign financial institutions covered by the CRS and FATCA (even if we sometimes write "bank" instead of "financial institution" for conciseness). Data for 2016 is limited as only a small number of countries automatically exchanged data in that year.

centers are part of it. Second, some banks in participating jurisdictions may fail to comply with their reporting requirements, and taxpayers may be able to avoid reporting due to legal loopholes in the CRS or the use of citizenship-by-investment programs (Langenmayr and Zyska, 2023). Our analysis in Section 7 speaks directly to these issues. Third, even though the automatic exchange of information is broad in scope, some asset classes are excluded from it, most importantly real estate, unlisted shares, and precious metals. Bomare and Le Guern Herry (2023) provide evidence of portfolio reallocation in response to the introduction of the CRS, with some taxpayers switching away from offshore financial assets and towards offshore real estate. Last, because the automatic exchange of information is still in its early years, tax authorities are only starting to develop methods to automatically use this new information (e.g., to pre-populate tax returns) and to systemize cross-checking and error-spotting.

3.2 The Size of Offshore Wealth

Table 1 reports summary statistics on the amount of offshore wealth reported by foreign financial institutions to Danish authorities in 2019.[6] Panel A focuses on the wealth owned by households, which is the one affected by the automatic exchange of bank information. For completeness Panel B reports on the assets owned by other categories of investors. A number of facts are worth noting.

CRS household wealth. First, the amount of household offshore wealth captured by the CRS is significant: the equivalent of 4.3% of Danish GDP. About two-thirds of that wealth (2.7% of Danish GDP) is held in tax havens, using the list of tax havens of Johannesen and Zucman (2014).[7] The CRS thus captures a significant amount of wealth that was likely to evade reporting in the past. For comparison (and as further discussed in Section 8), Alstadsæter et al. (2018, 2019) estimate that Danish households owned the equivalent of 2.4% of Denmark's

[6]Because foreign financial institutions do not have to report on account balances in FATCA (but only on income flows such as interest and dividends), the amounts in Table 1 only reflect the offshore wealth captured by the CRS. Appendix Table A1 provides supplementary information on the number of accounts and interest and dividends earned, as well as a breakdown of these income flows into CRS vs. FATCA.

[7]This list includes 52 countries and territories: Andorra, Anguilla, Antigua and Barbuda, Aruba, Austria, Bahamas, Bahrain, Barbados, Belgium, Belize, Bermuda, Cayman Islands, Chile, Cook Islands, Costa Rica, Curacao, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong, Isle of Man, Jersey, Liberia, Liechtenstein, Luxembourg, Macao, Malaysia, Malta, Marshall Islands, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Seychelles, Singapore, Sint Marten, Switzerland, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, Vanuatu, Virgin Islands, British Virgin Islands, US Virgin Islands. It is slightly broader than the list of 42 noncompliant tax havens established by the OECD in April 2009 (see Johannesen and Zucman, 2014, for complete details). Legal constraints prohibit us from disclosing the amount of wealth reported in individual jurisdictions.

GDP in non-compliant offshore wealth in 2007. In the aggregate Denmark—like Scandinavian countries more broadly—owns relatively little offshore wealth compared to other countries; yet because this wealth is highly concentrated, the implications for tax compliance at the top of the wealth distribution are significant.

Second, about 55% of the household offshore wealth captured by the CRS is owned by households directly; the rest is owned via personal wealth-holding companies.[8] This is consistent with Johannesen and Zucman (2014), who found that in the case of Switzerland—historically the largest offshore wealth center—about half of household offshore wealth was indirectly owned through holdings in the 2000s. Our analysis will mostly focus on directly-held household offshore wealth, due to the lack of granularity of firm data. In Section 8, we provide some evidence on noncompliance of holding companies, suggesting that the post-CRS evasion rate for indirectly-held offshore assets is of the same order of magnitude as for directly-owned assets.

Other CRS assets. Panel B of Table 1 shows that the CRS casts a wide net and captures a large amount of wealth controlled by investors than households: active firms (corporations that derive more than half of their income from sources other than investments), passive firms that have a large number of owners (such as mutual funds), and charities. For these categories of owners, it is unlikely that tax evasion was ever involved. Assets owned by firms other than holding companies often reflect the transnational nature of multinational firms' treasury and asset management activities and are typically excluded from standard measures of household offshore wealth (e.g., Zucman, 2013; Alstadsæter et al., 2018).[9]

Some CRS wealth also belongs to investors who cannot be matched to a specific owner with a high enough degree of certainty, defined as a matching score greater or equal to 99%. This wealth is predominantly held in non-haven countries. Given our focus on tax evasion, the exclusion of unmatched accounts from our analysis should not be a major source of concern. To better understand these unmatched accounts, Appendix Figure A1 reports statistics on the fraction of CRS returns that can be matched to an owner by type of bank and country. About a quarter of foreign banks send reports that can never be matched. These banks are almost all small banks (defined as banks that send less than 50 CRS reports a year). Match rates are somewhat heterogeneous across country groups: they are higher in OECD countries than in

[8] In the CRS terminology, these holdings correspond to closely-held "passive non-financial enterprises" that have a beneficial owner who is a Danish taxpayer. Accounts nominally owned by these holdings can be matched to their owners because offshore banks must identify their ultimate beneficial owners in the CRS.

[9] These firms are not even always in scope of the CRS. For instance listed firms are out of scope, yet in our data it appears that Danish authorities receive CRS reports for some listed companies. Some offshore financial institutions "over-report," perhaps because the CRS was still only in its infancy in 2019.

non-OECD countries.

3.3 The Distribution of Offshore Wealth

Who owns offshore assets? After linking CRS reports received by the Danish authorities to the corresponding households, we can study the distribution of CRS-reported wealth (Figures 1 and 2). To do so, we construct a household-level measure of wealth leveraging the population-wide micro-data maintained by the Danish authorities. These data have been successfully used in several contexts to study, e.g., the effect of wealth taxation on wealth accumulation (Jakobsen et al., 2020) and the distribution of tax evasion (Alstadsæter et al., 2019). Because Denmark collects comprehensive micro-data on wealth based on third-party reporting by domestic banks, pension institutions, real estate and business registries, and other sources, it is possible to construct a particularly reliable individual-level measure of wealth in this country. We use it to rank households by their total net wealth, defined as domestic wealth plus reported offshore wealth.[10] In 2019 the top 1% of the wealth distribution owns more than 10 million DKK ($1.5 million), the top 0.1% more than 26 million DKK, and the top 0.01% more than 108 million.[11]

Figure 1 shows that offshore wealth reported through the CRS in 2019 is highly concentrated towards the top of the distribution.[12] Panel (a) reports the probability to own an offshore account by wealth bin. Less than 5% of households in the bottom 99% of the wealth distribution have a CRS-reported offshore account. This fraction rises to about 30% for households in the top 0.01%, and to 40% when weighting by net wealth. Panel (b) shows that conditional on having offshore wealth captured by the CRS, households in the top 0.01% own a large fraction of their wealth offshore—close to 20% of their wealth. As a result, as shown by panel (c), the top 0.01% owns a significant fraction of its total wealth offshore: about 8% (40% times 20%).

Haven vs. non-haven offshore wealth. Figure 2 reports the same statistics as in Figure 1 but for haven accounts and non-haven accounts separately. Virtually all the (small amount

[10]Because our analysis of behavioral responses to the CRS focuses on directly-held offshore wealth, Figures 1 and 2 focus on the distribution of directly-held offshore wealth. Appendix Figure A2 reports the same statistics but including indirectly-held offshore wealth. Indirectly-held wealth, owned by more sophisticated taxpayers, is more concentrated than directly-owned wealth.

[11]Our wealth measure is based on the Danish registry data, to which we add directly-held CRS wealth and estimated pension wealth (based on income and age, as in Jakobsen et al., 2020). In contrast to Alstadsæter et al. (2019) we do not try to estimate the market-value of unlisted shares, explaining why wealth levels are lower at the top. Alstadsæter et al. (2019) found that including or excluding the market value of unlisted shares made negligible difference for the probability to own offshore assets by wealth bin.

[12]Appendix Figure A3 shows the same statistics but for 2017, 2018, and 2019 separately. Patterns are similar across years.

of) offshore wealth owned by the bottom 99% is in non-haven countries. Almost all the (large amount of) offshore wealth owned by the top 0.01% is in tax havens. As a result, and as illustrated by panel (d) of Figure 1, CRS-reported wealth held in tax havens is highly concentrated: the top 0.01% owns about 50% of it. This wealth is distributed like the offshore wealth disclosed by Scandinavian individuals in tax amnesties (dotted red line in Figure 1, taken from Alstadsæter et al., 2019). CRS-reported wealth held in non-havens is much less concentrated and distributed like domestic wealth: the top 0.01% owns about 5% of it.

4 Effects on Repatriation

We start the analysis by studying the effect of the automatic exchange of information on the repatriations of assets held in tax havens. The announcement of this policy creates incentives for evaders to repatriate funds before the onset of information exchange, to avoid scrutiny from tax authorities such as the risk of audits of past tax returns. This makes repatriation both a particularly important form of response to study, but also a particularly challenging one, since such repatriations leave no traces in the CRS or in foreign income fields on the tax return. To overcome these challenges, we use data on cross-border money transfers from personally-owned accounts in tax havens as a direct measure of repatriations.

4.1 Response of Bank Transfers to CRS Announcement

Bank transfer data. In the context of this project, we have access to transaction-level data on cross-border bank transfers for the period 2005-2019 matched to administrative income and wealth data. The bank transfer data is collected by the tax authorities from Danish banks for tax enforcement purposes. While the data was initially limited to the five largest banks in Denmark and to transfers involving tax havens, the coverage has expanded over time. Nearly all cross-border bank transfers have been covered since 2013. To avoid confounding composition effects, our analysis only uses data for the five largest banks (accounting for 87% of all transfers in 2013-2019) and transfers involving tax havens. We had to exclude one of the five banks from our sample (which accounts for 29% of top 5 bank transfers and 27% of the amounts) because information about the foreign sender turned out to be unusable. We also only include transfers from countries that appear during the full reporting period.

Research design. In our baseline research design, we compare the evolution of bank transfers received by Danish taxpayers from a foreign haven account they own ("own account") to the

evolution of transfers received from an unrelated haven account ("other account"). We think of transfers to Denmark from "own accounts" as treated by the CRS, while transfers from "other accounts" constitute our control group. These "other accounts" transfers include payments from third-parties (such as wages, fees, or reimbursement for travel expenses) which should not be affected by the new transparency policy. The identification assumption is that absent the announcement of the CRS in 2013, transfers from "own accounts" would have evolved like those received from "other accounts".[13] We estimate the following difference-in-differences model:

$$\frac{T_{i,x,y} - \bar{T}_{x,2012}}{\bar{T}_{x,2012}} = \alpha_y + \beta_y D_x + \epsilon_{i,x,y} \tag{1}$$

where $T_{i,x,y}$ are bank transfers received in Denmark by individual i from account type x (own versus other) in year y, $\bar{T}_{x,2012}$ is the average value of transfers from account type x received in 2012, α_y are year fixed effects, and D_x indicates whether the transfer is received from an own account. The equation is estimated on a balanced sample where $T_{i,x,y}$ is set to zero if the individual has no transfer of type x in year y. Standard errors are robust and clustered at the individual level. The coefficients β_y measure the percentage change (in year y relative to 2012) in amounts received from own accounts relative to the percentage change in amounts received from other accounts.

Baseline results. Figure 3 reports our baseline results. Panel (a) depicts the evolution of the aggregate amount of bank transfers received by Danish households from haven accounts they own vs. haven accounts they do not own. Both series are normalized to 100 in 2012, the year immediately preceding the announcement of the Common Reporting Standard. Own-account and other-account transfers evolved in parallel between 2005 and 2012, but start diverging in 2013. The growth rate of own-account transfers surges in 2013–2015, immediately after the announcement of the CRS but prior to its implementation. Own-account transfers remain higher than other-account transfers from 2015 onward through to 2019, suggesting continuing repatriation in the first years of CRS implementation. Panel (b) reports the corresponding difference-in-differences coefficients, estimated using equation 1. The announcement of the CRS led to a doubling of transfers from own accounts, relative to transfers from other accounts. Results are unchanged when adding individual fixed effects.

[13]The name of the foreign sender of the money transfer can be reported differently from year to year, even within accounts. When we categorize accounts into "own" or "other" accounts, the account may change categorization from year to year. To correct for that, we assume that a foreign account is an "own" account if it has been categorized as an "own" account at least once.

Heterogeneity analysis. Repatriation—a relatively sophisticated form of response to the CRS—appears to be concentrated among the rich. First, as shown by panel (c) of Figure 3, almost all the estimated treatment effect comes from taxpayers in the top 1% of the wealth distribution.[14] More than half of the effect comes from individuals in the top 0.1% of the wealth distribution, and about a quarter from individuals in the top 0.01%. Second, panel (d) of Figure 3 decomposes the average effect into small vs. large transfers. Large transfers are defined as yearly transfers above DKK 500,000 (roughly $80,000). People are classified in the "large transfer" group if they receive more than DKK 500,000 in at least one year. Around 5% of the treated receive transfers above DKK 500,000. These individuals account for the whole average treatment effect.

Robustness. A potential concern with our analysis of bank transfers is that it may be confounded by other policy measures happening at the same time as the announcement of the CRS. Importantly, after the financial crisis of 2008-09 many countries implemented amnesty programs encouraging taxpayers to declare previously hidden assets. This was the case also in Denmark that had an amnesty program active from July 1^{st}, 2012 to July 1^{st}, 2013. One might fear that the effects shown on Figure 3 partly reflect repatriations conducted by amnesty participants. To address this concern, panels (a) and (b) of Appendix Figure A5 replicate panels (a) and (b) of Figure 3 while excluding taxpayers who participate in an amnesty. The results are virtually unchanged, showing that our effects are not confounded by contemporaneous amnesties.

As another robustness test, Appendix Figure A6 considers an alternative specification of our baseline model in which we regress transfers in level (as opposed to transfers normalized by their 2012 value as in equation 1):

$$T_{i,x,y} = \gamma + \alpha_y + \beta_y D_x + \epsilon_{i,y,x} \tag{2}$$

where $T_{i,x,y}$ are bank transfers received by individual i from account type x in year y, α_y are year fixed-effects, D_x indicates whether a transfer is received from an own-account, and $\beta_{y=2012}$ is set to 0. The results are similar as in our baseline specification. There is a clear break right at the time of the announcement of the automatic exchange of bank information and a sharp

[14] In this decomposition analysis, we estimate the regression model: $\frac{T_{i,x,y}*\mu_z - \bar{T}_{x,2012}}{\bar{T}_{x,2012}} = \alpha_{y,z} + \beta_{y,z} D_x + \epsilon_{i,x,y,z}$ where $\mu_z = n_z/N$, n_z is the number of individuals in the decomposition group z (for example top 1% wealthiest versus the rest or people with large transfers versus small transfers), and N is the total number of individuals. This specification yields coefficients $\beta_{y,z}$ that add up to β_y from the baseline where each $\beta_{y,z}$ corresponds to the contribution of decomposition group z to the overall effect.

increase in transfers in the subsequent years. The average transfer made from own-accounts in tax havens (relative to other-accounts in havens) in 2015 is 25,000 DKK higher than in 2012.

Placebo test: transfers from non-havens. To further validate our research design, we apply it to transfers from non-haven countries. This can be seen as a placebo test, since non-haven accounts have little reason to respond to the announcement of the automatic exchange of bank information. As shown by panel (d) of Appendix Figure A5, and in sharp contrast to the results obtained for havens, transfers from non-havens evolved similarly for own-accounts vs. other-accounts over the 2010–2019 period.

One can also use the non-haven transfer data to implement a research design comparing the evolution of own-account transfers from havens (treated) to own-account transfers from non-havens (control). Own-account transfers from havens increase by 125% between 2012 and 2019 (blue line in panel (a) of Figure 3), while own-account transfers from non-havens increase by 45% only (blue line in panel (d) of Appendix Figure A5), leading to a DiD estimate close to the one obtained in our baseline design. However the non-haven transfer data only start in 2010 (as opposed to 2005 for the haven transfer data), leaving us with fewer pre-year reforms to ascertain parallel trends.

4.2 Effects of Repatriation on Assets, Income, and Taxes Paid

Effects on reported assets. To bolster the case that the funds repatriated from havens after the announcement of the CRS were previously unreported, Figure 4 investigates the impact of receiving transfers from tax havens on wealth, taxable income, and taxes paid.

Panel (a) considers the effect of repatriations on domestic wealth, as reported to the Danish authorities by Danish third parties.[15] For individuals i receiving a transfer from own accounts in tax havens in year y for the first time over the period 2005–2019, we estimate:

$$\text{Wealth}_{i,y+h} = f_{h,y}(\text{Wealth}_{i,y-1}) + \beta_h \text{Transfer}_{i,y} + \epsilon_{i,y+h} \tag{3}$$

where $f_{h,y}(\cdot)$ are flexible functions used to predict future and past reported wealth from wealth in $y-1$ (absent transfer), $\beta^{h\geq 0}$ measures the increase in reported wealth per dollar repatriated from tax havens in $h=0$, and $\beta^{h<0}$ captures the correlation between the size of money transfers and historical wealth accumulation (placebo). For the function f, we consider polynomials in

[15] Denmark used to have a wealth tax until 1997, under which domestic assets were reported to the tax authorities by Danish institutions (banks, insurance companies, other financial institutions, real estate registry, etc.). This third-party reporting of wealth continued after the abolition of the wealth tax.

event and calendar time:

$$f_{h,y}(\text{Wealth}_{i,y-1}) = \sum_{j=0}^{k} \alpha_{h,y,j}(\text{Wealth}_{i,y-1})^j \tag{4}$$

where k is the order of the polynomial. We consider first, second, third, and fourth-order polynomials.

Panel (a) shows that reported domestic wealth increases one-to-one with transfers from own accounts. Reported wealth jumps immediately in the year when the assets are repatriated from tax havens. This one-to-one jump is almost mechanical: when foreign money is transferred to a Danish bank account, domestic third-party reporting kicks in and domestic wealth increases accordingly (absent consumption or transfer to another country). The jump is nearly identical in all specifications. For the other outcomes, we thus focus on the baseline specification (first-order polynomial in event-time); results are robust to using any of the alternative specification for the $f^{h,y}$ function.

Panel (b) shows that in contrast to reported domestic wealth, reported *foreign* wealth does not change. Foreign wealth must be self-reported in Denmark, because financial assets matter for receiving certain benefits such as cash benefits for the elderly. Yet foreign wealth does not decline after repatriation, suggesting that the repatriated assets were noncompliant.[16] Overall, total (domestic plus foreign) reported wealth increases one-to-one in the year when individuals repatriate assets they owned in tax havens. The increase in reported assets is persistent: three years after repatriation, reported assets are still higher than pre-repatriation, by the amount of the repatriated assets. Taxpayers do not appear to conceal (or consume) the repatriated assets.

Effects on taxable income and taxes paid. Panel (c) investigates the effect of repatriating haven assets on domestic financial income. After three years, 100 DKK of repatriated wealth are associated with an increase of 4 DKK in reported domestic financial income. This increase is consistent with the notion that the repatriated foreign wealth is invested in domestic assets that on average have a rate of return of 4%. The increase is gradual: repatriated assets may initially be held in low-yield bank deposits, before being moved to higher-yielding financial investments. By contrast there is zero effect of repatriation on reported foreign capital income, as shown by panel (c) of Appendix Figure A5. Reported financial capital income (domestic plus foreign)

[16] Another possible interpretation of Panel (b) is that taxpayers may have been unaware of their duty to report foreign assets. However, as shown by Panel (c) below, foreign financial income does not change either after repatriation, consistent with the notion that the repatriated foreign assets (and corresponding financial income) were noncompliant. Foreign financial income is reportable and taxable in Denmark (even if some tax has already been paid abroad) and failing to report it is tax evasion.

thus increases in line with the amount of funds brought back to Denmark and with the increase in total reported wealth. This provides further evidence that the haven wealth repatriated in the context of the CRS used to evade taxation.

Last, panel (d) investigates the effect of the repatriation of offshore assets on tax liabilities. Tax liabilities gradually increase after repatriation and remain persistently higher thereafter. After three years, 100 DKK of repatriated wealth from havens are associated with an increase of about 2 DKK in individual income taxes paid. This increase is consistent with the fact that the marginal tax rate on interest income and dividends for wealthy Danish taxpayers is close to 50%. The persistent nature of the rise in tax payments echoes earlier studies showing that policies to fight high-end tax evasion appear to have long-run positive effects on tax revenues—and in particular that the affected taxpayers do not appear to substitute towards legal tax avoidance (Alstadsæter et al., 2022).

4.3 Size of Aggregate Repatriation

We use our estimates of the effect of CRS announcement to quantify the amount of wealth repatriated in the context of the CRS and the impact on Denmark's tax revenues.

To estimate the amount of wealth repatriated, we proceed as follows. For each year y between 2013 and 2019 we apply the DID estimate for year y to the 2012 baseline aggregate amount. Summing these treatment effects over time, the estimated amount of repatriated wealth adds up to 10.5 billion DKK in total over 2013–2019.[17] For comparison, Danish households directly owned 25.2 billion DKK in offshore wealth in tax havens in 2019, as captured by the CRS (Table 1). Without these repatriations and everything else equal, this haven wealth would have amounted to 35.6 billion DKK. Relative to that counterfactual, repatriations reduced the 2019 haven wealth of Danish households by close to 30%.[18]

To get a sense of the impact on tax payments, following the evidence presented in Figure 3 we assume that additional tax payments add up, in steady state, to 2% of the amount of wealth repatriated. This represents about 200 million DKK in additional annual tax payments, coming

[17] This computation includes estimated repatriation from smaller banks that are not included in our estimation of the DiD coefficient because transfers information is only available for these banks from 2013Q3 onwards. For these smaller banks we impute own-account transfers in the base year 2012 by assuming that these banks account for a fixed fraction of the total amount of own-account transfers. We also assume that the treatment effect is the same for small and big banks. Our estimation of repatriation excludes amnesty participants; including amnesty participants the estimated amount of repatriated wealth is 10.7 billion DKK.

[18] As we show in Section 7, there is evidence that not all the offshore wealth of Danish households is captured by the CRS. Thus repatriations reduced the 2019 true haven wealth of Danish households by a bit less than 30%, see Section 8 for a detailed discussion.

primarily from very rich taxpayers.

A number of remarks are worth noting. First, our estimates of the effect of the CRS on repatriation should be seen as conservative, because the control group (transfers from "other accounts") might itself be affected by the CRS. For instance an individual may repatriate assets that were nominally held by a shell company—in which case the transfers are classified as "other accounts." Some assets may have also been repatriated to a company account in Denmark (as opposed to an individual account) or repatriated in cash. With our data one cannot identify such repatriations. Second, repatriations—and the associated increase in reported income and taxes paid—are only one of the several ways in which the CRS may have improved tax compliance. We now turn to these other margins.

5 Effects on Self-Reporting

The second type of behavioral response to the automatic exchange of information we analyze is the increase in self-reporting of foreign assets. After the implementation of the new transparency regime, taxpayers may become compliant by leaving assets abroad while starting to properly declare them (and the associated capital income flows) on their tax returns. This will be the case if the foreign accounts provide some value other than the ability of hide assets, for instance because they provide access to certain investments at a lower cost, or if there are costs involved with repatriating.

5.1 The Rise in the Number of People Self-Reporting Offshore Wealth

The implementation of the Common Reporting Standard was highly publicized. Foreign banks informed their customers about their new reporting obligation, as did the Danish authorities in some cases. This suggests that the CRS could have had large and immediate effects on self-reporting. Figure 5 reports statistics on the evolution of the number of Danish taxpayers who self-report offshore accounts. Consistent with our expectations, the time series show a clear break at the time of the start of the CRS.

Number of taxpayers self-reporting foreign income. First, and as shown in Panel (a) of Figure 5, there was a sharp increase in the number of people who self-report foreign financial income in the years immediately following the implementation of the CRS.[19] In 2015, only

[19]Even though the Danish tax authority generally pre-populates tax returns (with information received from domestic employers, domestic banks, etc.), it does not pre-populate returns with any CRS/FATCA information: taxpayers must ensure they properly self-report any foreign income.

about 15,000 taxpayers self-reported foreign income (0.3% of the adult population). By 2020 that number had tripled to almost 50,000 (close to 1% of the adult population). The bulk of the increase took place in 2016 (when a small number of countries, primarily non-havens, started participating in the CRS) and especially in 2017 (when most countries including the key tax havens joined the CRS). Self-reporting continued to increase gradually after. The number of self-reporters was on a slightly rising trend over the 2006–2015, but the trend break in 2016–2017 is clear. If we assume that the number of people self-reporting foreign income would have kept growing at its 2006–2015 pace over the 2016–2020 period, then the CRS led about 30,000 taxpayers to self-report foreign income.

Link between self-reporting and CRS. To provide additional support for the notion that the trend break in 2016–2017 was caused by the CRS, panel (b) of Figure 5 reports the evolution of the number of taxpayers matched to a CRS return who self-report any foreign financial income. The blue line considers taxpayers matched in 2016 to a CRS report sent by a country that joined the CRS in 2016. The red line considers taxpayers who are not part of that first group but are matched in 2017 to a CRS report sent by a country that joined the CRS in 2017. For both groups, the number of self-reporters is normalized to 100 in 2015. We can see that the timing of the jump in self-reporting mirrors the timing of CRS implementation. For accounts held in countries where information is first exchanged for tax year 2016, self-reporting jumps in 2016. For accounts in countries where information is first exchanged for tax year 2017, self-reporting jumps in 2017.

Similarly, Panel (c) decomposes the number of people self-reporting foreign income shown in Panel (a) into three groups: people who are not matched to any CRS information return, people matched to CRS returns for at least one account held in a tax haven, and people matched to CRS returns for accounts in non-haven countries. There is a direct link between the magnitude of the rise in self-reporting and CRS implementation. In 2019, the number of self-reporters exceeds the 2015 number by about 30,000, a figure that corresponds to the number of self-reporters matched to a CRS return in 2019. Most people who start self-reporting income for tax years 2016–2017 report accounts in non-haven countries. Relatively few self-reporters are matched to a haven CRS return (which have much larger average balances and are concentrated at the top of the distribution). Last, at the end of the period about 20,000 taxpayers report foreign income even though they are not matched to *any* CRS return. This suggests that the coverage of offshore wealth by the CRS is imperfect, an issue we return to in Section 7.

Who starts self-reporting? Additional cuts of the data suggest that the upsurge in the number of people self-reporting foreign income is stronger among people who report relatively small amounts of foreign income. Panel (d) of Figure 5 groups the population of self-reporters by the amount of foreign income reported. The number of people who self-report strictly positive but less than 1,000 DKK in foreign income is multiplied by almost six between 2015 and 2020, with the bulk of the increase occurring in 2017. The growth rate attenuates as one moves up the distribution of self-reported foreign income.

The rise in the number of self-reporters is also more muted at the top of the wealth distribution than at the bottom. As shown in Appendix Figure A7, the fraction of people self-reporting foreign income is multiplied by about 3 in the entire population between 2015 and 2019 (panel a), but by about 2 for people in the top 1%, and by about 1.5 for people in the top 0.1% (panels b and c). In principle this lower growth rate at the top could simply reflect the fact that wealthier individuals had higher reporting rates pre-CRS. Indeed the fraction of taxpayers who self-report foreign income always rises with wealth (Appendix Figure A7 panel b). But self-reporting rates were low pre-CRS for all groups including the very top. In 2015, only about 12% of individuals in the top 0.1% self-reported any foreign income (a fraction that rose to close to 20% after the CRS).

The role of information provision. To bolster the case that the rise in self-reporting was caused by the CRS, we exploit the fact that starting in 2018, the Danish tax authorities sent a letter to some (but not all) taxpayers whom they had matched to a CRS return, to inform them that they knew about their ownership of offshore assets. Letters were sent only to taxpayers matched to a CRS report with a high-enough matching score. We compare the reporting behavior of taxpayers who did and did not receive letters, focusing on the first batch of letters sent by the tax authorities.[20] These letters, sent out in May-July 2018, inform taxpayers that the tax authority has received reports from foreign banks concerning tax year 2016. At the time they received this letter, the taxpayers involved were filing taxes for the year 2017.

Figure 6 shows that receiving a letter affects the probability to correct one's tax return significantly. The first panel reports the probability to correct the return filed for tax year $t-2$.[21] Such corrections are usually rare: in a given month, the probability to amend one's $t-2$ return is typically below 1%. But this probability surges in the months when letters were

[20]The control group includes all taxpayers matched to a CRS report with a matching score greater than 0.9 and who did not receive a letter. The 0.9 threshold purges the sample of people who do not own foreign accounts.

[21]For instance, if one looks at May 2017, the y-axis reports the share of taxpayers making changes to the tax return filed for the tax year 2015.

sent out, to reach up to 8% in June 2018 for taxpayers who received a letter (vs. still less than 1% for taxpayers who did not). Once informed that the tax authority knows they have offshore income, taxpayers are much more likely to amend their $t-2$ tax return. The second panel shows that the probability to correct the tax return for year $t-1$ (i.e., 2017) also rises in May–July 2018, to up to 15% in June 2018 (vs. 7% for control taxpayers). There is seasonality in the $t-1$ amendment behavior for both the letter and no-letter groups, because taxpayers typically file in April–May and make correction to the pre-populated return they receive for income earned in $t-1$ in those months. But taxpayers who received a letter were significantly more likely to make a correction, presumably because foreign account ownership is persistent so that most taxpayers receiving letters concerning $t-2$ still owned their account in $t-1$. Overall, this provides clear evidence that information provision increases self-reporting. Because the tax authority did not send out letters randomly, however, the effects cannot easily be scaled to population.

To summarize, there is a clear trend break in self-reporting patterns in 2016–2017, which can be directly linked to the implementation of the CRS. Because the results described so far concern people, and offshore wealth is highly concentrated among a few individuals, they are not directly informative about the size of offshore wealth that starts being self-reported, a question we now turn to.

5.2 Effects of the CRS on Self-Reported Amounts

To quantify the effect of the CRS on the amounts of self-reported income and wealth, and motivated by the evidence of a sharp break in self-reporting patterns in 2016-17, we use an interrupted time series design. Figure 7 compares the amounts of self-reported income before vs. after the implementation of the CRS. We focus first on taxpayers reporting less than 100,000 DKK, for whom there is a clear trend break at the time of CRS implementation (panels a and b). We then consider taxpayers reporting more than 100,000 in foreign income (panel c). The main finding is that the CRS led to a sizable increase in self-reported offshore income and wealth, but the gains appear smaller than those caused by repatriation.

Growth of self-reported income. First, and as shown in panel (a), for people who report less than 100,000 DKK in foreign dividends and interest, the amount of self-reported income increases from about 150 million DKK in 2015 to close to 240 million DKK in 2020, with the bulk of the jump occurring in 2017. Out of that increase, about 63 million DKK (with a standard error of 14.6 million) can be attributed to the CRS, assuming that absent this policy foreign

income would have kept growing like it did over the 2006–2015 period.[22] We can use these estimates to infer how much additional wealth is self-reported by taxpayers. To do so we use the observed yield (interest rate and dividend yield) for fixed-income claims and equities held offshore to capitalize self-reported foreign interest and dividends, following Saez and Zucman (2016).[23] Panel (b) indicates that the CRS led to an increase in self-reported offshore assets of about 6.0 billion DKK by 2020 (with a standard error of 1.1 billion). This represents an increase of about 80% relative to a no-CRS counterfactual.

Turning to taxpayers with more than 100,000 DKK in self-reported foreign income, there is no apparent break in 2016-17 (panel c). This is consistent with panel (d) of Figure 5 that showed no discontinuity in the number of people reporting more than 100,000 DKK in foreign income.[24] In that group, self-reported foreign income has been on a rising trend since 2006, and it is no higher in 2020 than what would be predicted based on the observed 2006–2015 growth of self-reported income.

There are two ways to interpret the pre-2015 growth of self-reported income above 100,000 DKK. First, it may reflect a trend in internationalization of asset management for the rich. Second, it could (at least partly) be caused by the automatic exchange of information. As panel (c) shows, self-reported foreign income picked up in 2014-15, i.e., after the announcement of the CRS but prior to its implementation, a pattern we do not observed for people with less than 100,000 DKK in foreign income.[25] The wealthiest Danish taxpayers may have started self-reporting in anticipation of the implementation of the CRS, similar to the pattern seen for repatriation. But the volatility of the series, and the lack of obvious counterfactual for people reporting more than 100,000 DKK in foreign income (who are very few in number), makes it difficult to make firm inference on this issue.

[22]Because we do not observe the source of self-reported income, it is not possible to directly estimate what fraction of the rise in self-reported income is due to haven income vs. non-haven income. We note that self-reporters matched to a CRS return for a haven account declare about 30 million DKK in offshore income in 2020, as reported in Appendix Figure A8, panel (a). Assuming that all this income was unreported before the CRS, up to half of the rise in the amount of self-reported income caused by the CRS would correspond to income earned in tax havens.

[23]To capitalize interest, we construct a global interest rate series using IMF balance of payments data, dividing global "portfolio interest" and "other interest" by the corresponding claims ("portfolio investment debt securities" and "other investment debt securities"). We estimate the dividend yield similarly.

[24]Appendix Figure A8 panel (b) reports the evolution of the amounts of foreign income (normalized to 100 in 2015) reported by taxpayers grouped by size of reported foreign income. The group with more than 100,000 DKK is the only group with no apparent break.

[25]Similarly, Appendix Figure A8 panel (c) shows that the concentration of self-reported foreign income (e.g., the share of such income earned by top 0.1% wealthiest Danish taxpayers) was on a rising trend in the years immediately preceding the implementation of the CRS, and Appendix Figure A8 panel (d) shows that in the aggregate the ratio of self-reported foreign financial income to domestic income rose in those years too.

Estimate of compliance effect. In our benchmark scenario, we assume that the CRS had no effect on self-reporting for people reporting more than 100,000 DKK. The increase in self-reported income caused by the CRS is 63 million DKK (panel a) and the increase in wealth is 6.0 billion DKK (panel b), with the standard errors reported in these panels. Recall that the CRS, according to our estimates, led to a repatriation of 10.5 billion DKK over the 2013–2019 period (Section 4.3). Repatriations are large and mechanically reduce the amount of foreign income that remains to be self-reported, which may explain the somewhat more muted response along the self-reporting margin. Because our estimates of the rise in self-reporting disregard any potential increase for people with more than 100,000 DKK in foreign income, they should be seen as conservative.

6 Effects on Tax Compliance Through Audits

In addition to its effects on behavior, the automatic exchange of information can have a direct effect on tax compliance by allowing tax authorities to detect underreported foreign income. This margin is particularly important if a large amount of underreporting remains in the era of automatic information exchange. To shed light on this question, we conducted a random audit experiment in partnership with the Danish tax authorities.

6.1 The Audit Experiment: Baseline Results

Potential underreporting by taxpayers. To assess the amount of potentially detectable income underreporting in the CRS era, we consider taxpayers for whom foreign dividends and interest reported by banks through the CRS and FATCA exceed self-reported dividends and interest. For these "underreporters," there is a gap of 152 million DKK between bank-reported and self-reported foreign income. Of course, this gap is only indicative of *potential* noncompliance: there are other possible explanations for it. Taxpayers, for example, may mistakenly have reported their foreign income elsewhere in the tax return, or there may be errors in the CRS/FATCA reports. A key goal of the random audit experiment is to learn more about the source of this gap, in particular whether potential noncompliance corresponds to actual noncompliance.

Panel (a) of Appendix Figure A9 shows that potential noncompliance is highly concentrated. The 100 taxpayers with the largest discrepancy between bank-reported and self-reported foreign income account for about 40% of the aggregate potential noncompliance. This motivates placing particular emphasis on taxpayers with a large discrepancy.

Description of the experiment. When selecting taxpayers for audits, we focus on foreign dividend and interest income. These are the two income types for which it is possible to detect potential non-compliance by directly comparing the amounts self-reported by taxpayers on their tax return to the amounts reported by foreign banks through the CRS and FATCA. We define the potential underreporting for each taxpayer as the excess of bank-reported over self-reported income.

We assign non-zero audit probabilities to the 3,655 taxpayers with non-negligible potential underreporting, defined as potential underreporting of at least DKK 5,000. Aggregate potential underreporting for this group of taxpayers adds up to DKK 122.4 million. For the purposes of the stratification, we rank these taxpayers by their potential underreporting and define three subsamples: the top 100 taxpayers with the highest potential non-compliance ("H"), the next 1,000 with intermediate potential non-compliance ("M"), and the remaining 2,555 with low potential noncompliance ("L").

The audit resources made available by the tax authority allowed for around 500 audits. We allocated audits across the three groups to minimize the variance of the estimated total tax gap. This led to auditing the 100 taxpayers in group H, 263 randomly selected taxpayers from group M, and 136 randomly selected taxpayers from group L. Completing an audit is not always possible, due for example to death or change in residency. To ensure 500 audits would be completed, 100 additional taxpayers were sampled from the "M" and "L" groups, proportionally to the variance-minimizing allocation. In total, 100 taxpayers from the top-100 group, 329 from the next-1,000, and 171 from the low potential noncompliance group were selected for audit.[26]

As a part of the experiment, the auditors were asked to fill out a survey about the usability of the CRS/FATCA reports. When an audit led to a smaller correction than the discrepancy between self-reported and bank-reported income, we use the survey to find out why. The survey includes questions about mistakes in the reports, mistakes in self-reporting by the taxpayer, and the complexity of the Danish tax system.

Results on actual underreporting. As expected there is a high share of noncompliant taxpayers in the examined sample. But, as detailed in Table 2, that share is higher in the "M" and "L" groups (about 80%) than in the high potential noncompliance group (about 45%). It turns out that when there is a very large gap between bank-reported and self-reported income, in about half of the cases the gap reflects issues with the bank reports or misclassification in

[26]By the end of the audit experiment, 543 taxpayers had been audited: 99 in the top 100 group, 290 in the next 1,000, and 154 in the low potential noncompliance group (top line of the top panel of Table 2).

the tax return. As a result, actual underreporting is lower than potential underreporting.

When the results are scaled to population (bottom panel of Table 2), actual underreporting is estimated to equal about half of the aggregate potential underreporting. Actual underreporting, moreover, is more dispersed than potential underreporting. Among the 3,655 taxpayers with a discrepancy between bank-reported and self-reported foreign income larger than 5,000 DKK, 78% are estimated to be noncompliant. The 100 taxpayers with the largest discrepancies account for about a quarter of total actual underreporting (as opposed to 40% of potential underreporting). Households in the top 1% of the wealth distribution account for about 30% of actual underreporting. In addition to taxes on unreported dividends and interest, the random audits indicate that taxpayers are liable for taxes on other forms of unreported income, such as capital gains made offshore.

Two main lessons can be drawn from these findings. First, the automatic exchange of information, even if it does not eliminate evasion on offshore income, makes some of that evasion detectable through audits. Capitalizing the underreported foreign income, our experiment indicates that the underreporters own about 3.6 billion DKK in noncompliant offshore wealth that could now be brought into compliance. This wealth would have typically gone undetected in the pre-CRS world even upon audit. As shown by Guyton et al. (2023) in the United States, IRS audits very rarely detected the ownership of offshore accounts before the advent of automatic information exchange.

Second, because the underreported income revealed by the CRS is somewhat dispersed, curbing this noncompliance through audits may come at a sizable cost to tax authorities. This task is complicated by the fact that about 20% of the taxpayers with potential underreporting are actually compliant, which limits the scope for automating corrections.

6.2 Forensic Analysis of Audits

To understand why potential underreporting does not always correspond to actual underreporting, Table 3 reports the results of the survey of auditors. A number of findings stand out.

First, the quantitatively key source of discrepancy between potential and actual underreporting is mistakes in CRS/FATCA reports. Scaling the random audit numbers to population, the experiment indicates there was about 43 million DKK in offshore income incorrectly reported by foreign banks in 2019. About 40% of this sum corresponds to cases when income is reported with incorrect amounts or currency; 22% to cases when the taxpayer actually does not earn offshore income; 14% to cases when the taxpayer is not resident in Denmark. These

results point to the need to improve CRS and FATCA reporting, a point we return to in the conclusion.

Second, some of the gap between potential and actual corrections also owes to mistakes made by taxpayers (about 15 million DKK). This corresponds to cases where foreign dividends and interest are reported in a wrong field of the tax return, or by another person (e.g., a spouse), or netted with some other incomes.

Third, even when income is correctly reported by foreign banks, it is often hard for the tax authority to use that information to pre-populate tax returns or automate corrections. A key practical difficulty is that dividends earned offshore can be subject to withholding taxes in complex ways. For instance, dividends earned in Luxembourg on the shares of a Dutch company may have been subject to a withholding tax in the Netherlands. For 81% of the dividends reported by foreign banks to Denmark, the transmitting country (Luxembourg in the above example) differs from the country of source (Netherlands). The same problem also exists for interest although it is a bit less severe.

6.3 Evasion Rate on Third-Party-Reported Offshore Income

A common finding in the literature on tax evasion is that evasion rates on third-party-reported income are very low. Analyzing a random audit experiment in Denmark, Kleven et al. (2011, p. 670) find that "For third-party reported income, the evasion rate is always extremely small: it is equal to 0.23% for total positive income, 0.35% for total negative income, and always below 1% across all the different categories." How large is the tax evasion that remains in the post-CRS world on income reported to the Danish authorities by foreign banks?

Strikingly, tax evasion on third-party-reported offshore income appears an order of magnitude larger than tax evasion on domestic third-party-reported income. In total there was 540 million DKK in offshore dividends and interest reported through the CRS and FATCA in 2019 (Appendix Table A1). The audit experiment indicates that at least 87 million DKK was not reported by taxpayers that year, implying an evasion rate of 16%.[27] This 16% evasion rate is a lower bound as the audit experiment only captures evasion among underreporters (those for whom bank-reported income is greater than self-reported income), while there might be evasion

[27] Among taxpayers with more than 5,000 DKK in potential noncompliance, actual noncompliance is estimated to be 62.6 million DKK (Table 2). Extrapolating the results for the "L" group to the taxpayers with less than 5,000 DKK in potential noncompliance adds an extra 25 million DKK. Panel (b) of Appendix Figure A9 shows that the ratio of actual to potential noncompliance is around 80% at the bottom of the potential noncompliance distribution with no trend, making this extrapolation reasonable.

among overreporters too.[28] The interesting point, however, is that even this lower bound is already much larger than evasion rates found on domestic third-party reported incomes. It is in between evasion rates found for self-employment income (around 40%) and domestic third-party reported income (nearly 0%).

There are two main hypotheses for why third-party reporting may not be enough to ensure full compliance on offshore income. First, the noncompliance we estimate may be temporary and may reflect the fact that the implementation CRS was still recent in 2019. A number of taxpayers may have been unaware of the availability of these new data within the tax authority, and compliance rates may increase over time.

Second, equilibrium evasion may be higher on third-party reported income when the information reported by third parties is complex to use. In the case of the CRS, the complexity stems from imperfect match rates, from mistakes in the CRS, and from the composite tax treatment of offshore income. These elements make it hard for tax authorities to automate the use of bank-reported data and credibly commit to auditing all potentially noncompliant tax returns, which in turn may lead some people to keep evading. This complexity may be hard to overcome and inherent to the cross-border nature of the information provided. In particular, the high non-match rates (with some banks sending only unusable reports, see Panel (a) of Figure A1) point to a fundamental difference between domestic and cross-border third-party reporting. A domestic financial institution that would send unusable information would likely be forced to fix its reporting by the domestic authorities.

7 Limits to CRS Coverage

A key question to assess the effectiveness of the CRS is whether foreign banks duly comply with their reporting duties. Because domestic authorities lack the ability to audit foreign banks, noncompliance by foreign banks could be possible in equilibrium. We attempt to detect and quantify such potential noncompliance by leveraging the micro-level bank transfer data of Denmark.

[28] In the sample of underreporters scaled to population, there is an evasion rate of 47% on the income correctly reported by foreign banks (Table 3, third panel). This can be seen as an upper bound for the evasion rate for the entire population of Danish individuals captured by the CRS, as evasion rates for overreporters are likely lower.

7.1 Methodology

Identifying unreported accounts. Consider the population of Danish resident individuals who make a transfer to (or from) a given foreign bank account they personally own in country j in both years t and $t+1$. We call these individuals the "repeat transfer sample." These individuals clearly own a foreign bank account at the end of year t, which should generate a CRS report issued by country j.[29] By matching the universe of cross-border bank transfer data to the universe of CRS reports received by Denmark, we can compute what fraction of individuals in the repeat transfer sample can actually be matched to a CRS report. Because cross-border transfers are reported by Danish banks to Danish authorities, domestic third-party reporting is high-quality in Denmark, and there is no incentive for Danish banks to misreport transfers, the transfer data are most likely accurate and can be used to assess the quality of CRS reporting.

Interpretation. There are several possible interpretations for the absence of a CRS report. First, the foreign bank may send a report but the Danish tax authorities may fail to match it with sufficient confidence to a specific taxpayer. About 30% of CRS reports received by Denmark cannot be matched with a 99% or more matching score (Appendix Figure A1). Second, some taxpayers may be able to avoid reporting due to legal loopholes in the CRS, such as the use of citizenship-by-investment programs (Langenmayr and Zyska, 2023). Last, there could be noncompliance by banks, which may be intentional or not. A bank may unintentionally fail to send a report because it does not have the correct information on file for the customer involved (e.g., that customer may have moved to Denmark without informing the bank). A bank may also intentionally choose not to send a report even if it knows the customer is a reportable person in Denmark, or omit critical information in the return, making it de facto unusable.

Correcting for match rates. From the perspective of the Danish tax authorities, whether the absence of a CRS report is due to matching issues, to legal loopholes, or to noncompliance by banks has similar practical implications: in all cases it is difficult to enforce taxes on offshore income. To understand what policies could be implemented to improve enforcement, however, it is useful to try to tease out matching issues from potential noncompliance and legal loophole.

We account for imperfect matching by assuming that the quality of the match process at the Danish tax authority is the same for individuals in the repeat transfer sample as for other Danish

[29] We restrict the sample to Danish taxpayers who make transfers with countries that participate in the CRS or with the United States, and are fully taxable in Denmark over the 2016–2020 period.

taxpayers on average. Define as M the match rate for all CRS reports received by Denmark, and as r_j the fraction of Danish taxpayers who make repeat transfers with a bank in j who are matched to a CRS return. Then under our assumptions there is a fraction $(M - r_j)/M$ of Danish customers of j's banks for whom the banks fail to send a report. For the entire sample of CRS reports, the match rate M is 68% (and 72% when weighting by wealth).

Wealth in unreported accounts. When individuals in the repeat transfer sample are not matched to a CRS report, we cannot observe how much they own in their foreign accounts. In that case we impute this wealth by using the estimated coefficients from a non-parametric regression of account values on quintiles of wealth × quintiles of cross-border bank transfer values in the population of Danish individuals matched to a CRS report.[30]

Inference. To estimate potential noncompliance by foreign financial institutions, one would ideally randomly make transfers with banks and observe which of them send a corresponding CRS return, in the spirit of the literature on correspondence experiments (e.g., Kline, Rose and Walters, 2022). In our context, however, the sample of customers who make repeat bank transfers is not randomly drawn. Selection into this sample could go either way. People may be more likely to make repeat transfers if they have reason to believe that the bank will not report them to Denmark. On the other hand because bank transfers are reported to Danish authorities, the more sophisticated tax evaders (most likely to use relatively uncooperative institutions) may be less represented in our sample. Under our assumptions about match rates, our estimates of the share of offshore accounts and wealth that escapes CRS reporting are valid within our sample. But caution is required when extrapolating these estimates to the full population of offshore accounts holders.

7.2 Results

Probability to go unreported. The first result from the analysis is that in a large number of cases, Danish customers of foreign banks appear to go unreported by these banks (Table 4). Specifically, in 2019 there was 20,383 individuals in our repeat transfer sample (panel a, cols. 1 + 2), that is, Danish resident individuals who made a transfer to/from a given foreign bank account

[30] In this regression, because wealth and income are at the individual level, account values are the sum of an individual's account values in all matched CRS reports. To neutralize the effect of outliers, account values are winsorized at the 1^{st} and 99^{th} percentile. The regressions are run separately for each year; results for 2019 are reported in Appendix Figure A10.

they personally own in a CRS country in both 2019 and 2020.[31] Among those individuals, only 48% can be matched to a CRS report sent by the country where the foreign account is located in 2019 (col. 3). In other words in a large sample of individuals known to have a foreign account, we can only observe a CRS return in a bit less than half of the cases.

Consider now the full set of CRS returns received by Denmark for accounts held by individuals (panel b). In 2019, Denmark received 312,074 such returns (cols. 4 + 5), of which 68% could be matched to a specific person with a matching score larger than 99%. The tax authority cannot always identify the taxpayer being reported on by foreign banks with a high enough degree of certainty, and this must be part of the reason why only half of the repeat-transfer sample can be matched to a CRS return.

Accounting for the imperfection of the match process, we can estimate that for (68% - 48%)/68% = 30% of the individuals in the repeat transfer sample, the foreign banks involved failed to send a report (col. 7). In sum, if we try to explain why about half of the individuals in the repeat-transfer sample cannot be matched to a CRS return, in 40% of the cases this failure can be explained by general limitations of the matching process within the Danish tax authority, and in about 60% by noncompliance by foreign banks or loopholes in the CRS. Estimated noncompliance was very large in 2016 (the very first year of the CRS), dropped in 2017 and continued to fall in 2018 (perhaps due to some learning by doing), but appears to have stabilized since then.

Size of unreported accounts. The second main result is that estimated noncompliance remains significant when considering account values. As reported in panel (b) of Table 4, we estimate that in 2019 the repeat-transfer sample owned 2.0 billion DKK in foreign wealth, of which only 1.2 billion DKK could be observed through the CRS. Factoring in the imperfection of the match process, we estimate that 17% of the foreign wealth of the individuals in our sample was not reported by the banks involved. This is lower than the 30% when counting individuals. Accounts that are not reported may on average be smaller in size than the accounts that are reported, although some caution is needed in interpreting this result since the account values of unmatched accounts are imputed.

Country heterogeneity. The third result is that there is some heterogeneity in potential noncompliance across groups of countries. We consider three groups of countries: OECD non-

[31] The number of individuals in the repeat-transfer sample is higher in earlier years because international bank transfers dropped in 2020 during Covid. As detailed below and shown in Table 4, our results are similar whether one focuses on 2018 or 2019.

havens, non-OECD non-havens, and tax havens. Panel (a) of Figure 8 shows r_j, the fraction of individuals who are known to be customers of banks in country-group j whom we can match to a CRS return. Panel (b) reports the same statistics for account values. The main finding is that match rates are broadly similar for tax havens and OECD non-havens, but appear particularly low for non-OECD non-havens.

8 Putting it All Together: What Fraction of Hidden Wealth Has Become Compliant?

The automatic exchange of bank information is a landmark policy that affected tax compliance along the different dimensions discussed above. In this Section we put together our estimates to attempt to quantify the extent to which it has reduced the offshore tax gap. The main findings are reported in Table 5. As with any attempt at measuring tax evasion, a word of caution is in order at the outset. The data we have access to allow us to establish clear and well-identified compliance responses, which we view as the main contribution of our paper. The offshore tax gap is known with less certainty. Putting the compliance responses in the context of this tax gap is, we believe, valuable to put these responses in perspective, but a margin of error is necessarily involved.

Benchmark estimates. Panel A constructs an estimate of the counterfactual amount of wealth that would be directly held offshore by Danish households absent the automatic exchange of bank information. To do so, we start with the amount of offshore wealth captured by the CRS (53 billion DKK). To this we add our estimate of the amount of offshore wealth missed by the CRS due to imperfect compliance by banks (11 billion DKK), and the amount that was repatriated because of the CRS (10.5 billion DKK). The total adds up to close to 75 billion DKK.

Panel B considers the counterfactual amount of offshore wealth that would be self-reported absent the automatic exchange of bank information. This amount is obtained by capitalizing the counterfactual amounts of self-reported income in 2019, reported in Panels (a) and (c) of Figure 7. It is equal to DKK 47 billion.

The difference between the total in Panel A and Panel B is the counterfactual amount of *noncompliant* directly-held offshore wealth absent the automatic exchange of bank information: 27 billion DKK. To assess the reliability of this number, we also estimate it using another, fully independent methodology. We take the estimates of Alstadsæter, Johannesen and Zucman

(2018, 2019) of the amount of noncompliant offshore wealth owned by Danish households in 2007, which is based on a systematic analysis of global investment data (but does not use CRS data, which were not available at the time), and age it to 2019. Remarkably, even though the estimates rely on completely different methodologies and data sources, the results are nearly identical.[32] This similarity of findings lends support to the view that 27 billion DKK is indeed the correct order of magnitude for noncompliant offshore wealth absent the CRS.

Panel D compares the compliance responses we estimate to this counterfactual amount of noncompliant wealth. The automatic exchange of bank information appears to have closed a large fraction of the offshore tax gap. According to our benchmark estimates, it has made 73% of this wealth compliant or at least observable to the tax authority. Specifically, repatriations over the 2013–2019 period have reduced the counterfactual stock of noncompliant wealth by 38%. Increased self-reporting has reduced this stock by an extra 22%. The new information available within the tax authority has made an additional 13% of this stock observable and hence taxable. In that last category, most of the assets are still noncompliant—the audit experiment we conducted allowed to correct about 30% of actual noncompliance—and significant resources may need to be mobilized to correct the remaining noncompliance. If one focuses on increases in actual enforcement, the automatic exchange of bank information has closed 64% of the offshore tax gap; an additional 9% could be closed by auditing returns for which bank-reported offshore financial income exceeds self-reported income.

As reported in Panel E the offshore tax gap, although much reduced by the CRS, remains non-trivial: 27% of the wealth that would be noncompliant absent the CRS has not yet become compliant or observable. This can be explained by noncompliance by banks, legal loopholes, and limited enforcement by the tax authority even with this new information in hand. As we have seen by studying people making repeat transfers, for about 17% of the wealth held offshore, no report is sent by the banks involved. In addition, some wealth that is being reported cannot be matched to specific taxpayers, restricting the ability to use that information for enforcement.

[32] Alstadsæter, Johannesen and Zucman (2018, Figure 5 p. 95; 2019, Table 2 p. 2090) estimate that Danish households held $8.4 billion (45.7 billion DKK) in offshore wealth in tax havens in 2007, of which 90% was noncompliant. This noncompliant offshore wealth amounted to 2.4% of Denmark's GDP. We take this fraction with no modification whatsoever and assume that it would have remained constant between 2007 and 2019 absent the CRS, consistent with findings from the literature that the first wave of measures to fight offshore tax evasion after the financial crisis of 2008-09 had little effect (see Section 2.1 above). This leads to a counterfactual amount of noncompliant offshore wealth of 54.4 billion DKK in 2019. This total includes both directly-held and indirectly-held offshore accounts. Following Johannesen and Zucman (2014) and consistent with the evidence from the CRS reported in Table 1, we consider that half of this wealth is directly held. The counterfactual 2019 amount of noncompliant directly-held offshore wealth based on the Alstadsæter, Johannesen and Zucman (2018, 2019) methodology is thus 27.2 billion DKK.

This absence of matching may enable some residual noncompliance to take place.

Sensitivity analysis. Our benchmark estimate that the automatic exchange of bank information has closed around 70% of the offshore tax gap comes with two main sources of uncertainties that we can quantify or sign. The first comes from the confidence intervals attached to the various compliance responses to the new transparency policy, reported in Table 5. We can use these confidence intervals to compute a low-end and a high-end scenario. In the low-end scenario, each of the response is equal to the lower bound of its confidence interval, and vice-versa for the high-end scenario. This bounds the reduction in the amount of noncompliant offshore wealth to a range of 54% to 93%. Another source of uncertainty has to do with limitations in our ability to fully capture all potential margins of responses. These limitations suggest that our benchmark estimate, although already large, is if anything conservative.[33]

Compliance of offshore wealth owned through holdings. Our analysis so far has focused on directly-held household offshore wealth. There are a number of a priori reasons to believe that the response of this wealth is informative about the response of total household offshore wealth. Directly-held offshore wealth is large—about half of the total amount of wealth hidden in tax havens, according to pre-CRS evidence (Johannesen and Zucman, 2014). It is highly concentrated—as much as the hidden wealth disclosed in leaks and tax amnesties (Figure 1). Moreover, indirectly-held wealth is subject to the same set of reporting rules as directly-held wealth, and a large amount of indirectly-held wealth is indeed captured by the CRS (Table 1), suggesting large potential improvements in enforcement on this type of wealth.

One possible concern, however, is that this potential may have not yet materialized. One could imagine that, despite third-party reporting, a lot of the indirectly-held haven wealth captured by the CRS may remain non compliant.

To shed light on this issue, we analyze the results of audits of holding companies conducted by the Danish authorities. In contrast to the audits of individuals analyzed in Section 6, these firm audits are not conducted at random but target firms likely to be non-compliant. The analysis thus requires more assumptions and the results are more uncertain. Appendix B presents the data and our estimation strategy. We consider various scenarios on the audit selection process. In an upper bound scenario, we assume that the firms are quasi-randomly selected

[33] As discussed in Section 4, our estimate of repatriation responses is conservative because some assets may have also been repatriated from or to a company account or repatriated in cash. As discussed in Section 5, our estimate of the self-reporting response is conservative because we assume that there is no response for taxpayers with more than 100,000 DKK in offshore income.

(i.e., the fraction of non-compliant assets is the same for audited and non-audited firms); in other scenarios we model the audit selection process based on observable firm characteristics.

As reported in Appendix Table A2, in all cases the total detectable non-compliance of holding companies appears similar in size to that of individuals: in both cases of the order of 3.5 billion DKK. Recall that indirectly-held household offshore wealth captured by the CRS is about as large as directly-held wealth: in both cases of the order of 50 billion DKK (Table 1). While this result does not mean that the compliance responses are equally strong for indirectly-held accounts as for directly-held ones, it is inconsistent with the hypothesis that massive non-compliance remains on indirectly-held assets.[34]

9 Conclusion

The automatic exchange of bank information is one of the most important advances in international economic cooperation of the last decades. This paper analyzes its effects on taxpayer behavior and compliance along its key dimensions: repatriation of assets previously held abroad; increases in self-reporting; improvements in the auditing capacity of tax authorities. We find transparent evidence of large effects along each of these margins, with particularly large effects on the repatriation of wealth. Overall, around 70% of the wealth that would have been hidden offshore by Danish individuals absent this policy has been brought into compliance or has become observable to the tax authority.

Our results have a number of implications for policy. Understanding the effectiveness of cross-border information exchange policies is critical to quantify the trade-offs involved with changing tax progressivity. Our results suggest that—at least in the context of a country with a well-funded tax authority—the automatic exchange of bank information has reduced possibilities for evasion, making the tax base less elastic and potentially reducing the distortionary effects of higher top tax rates (Johannesen, 2023).

However, realizing the full potential of this new policy may require additional investments. Third-party information reporting in itself is not enough to make tax evasion disappear. Interventions that supplement this reporting (such as sending letters or targeted audits) can boost compliance. To systematize these interventions, tax authorities may need to invest in improving their technology to match CRS returns to taxpayers.

[34]To overturn our result that more than half of the offshore tax gap has been closed, it would have to be that a very large amount of indirectly-held haven wealth is not captured by the CRS. While we cannot formally rule out this possibility with the data at our disposal, we note that this hypothesis would imply that there is substantially more haven wealth than estimated by Alstadsæter, Johannesen and Zucman (2018, 2019).

A number of issues deserve particular attention in future work. First, it would be informative to quantify compliance responses in other countries, where the tax authorities may have access to more or less resources than in Denmark. Second, our analysis points to the need to design and implement improved cross-border auditing procedures to ensure full compliance by offshore banks. It would be revealing to conduct a field experiment where one would test the compliance of different financial institutions, building on the correspondence experiment literature (e.g., Kline, Rose and Walters, 2022) and previous audit studies of criminality in the international financial system (Sharman, 2010). All of this raises exciting challenges for future research.

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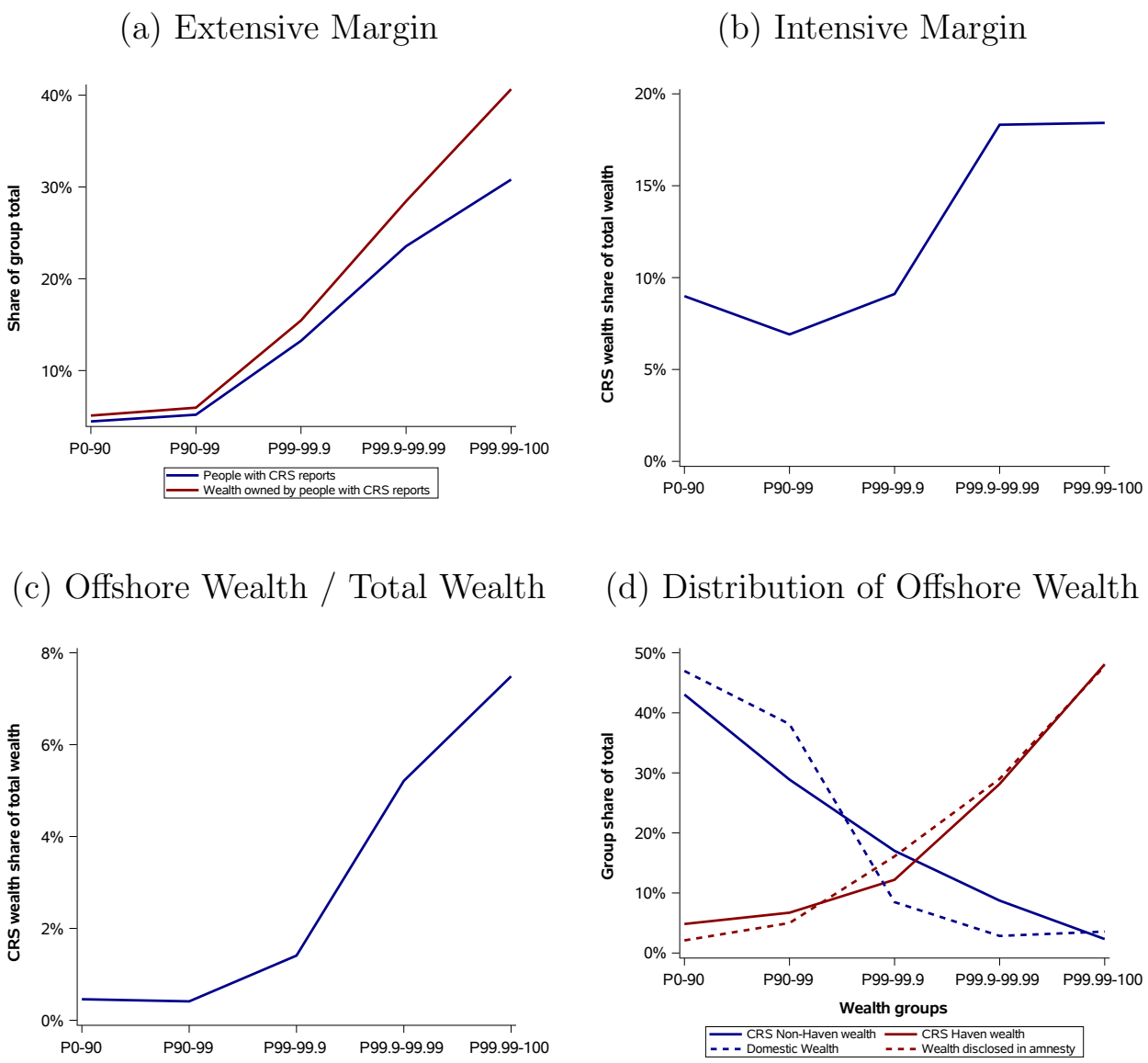
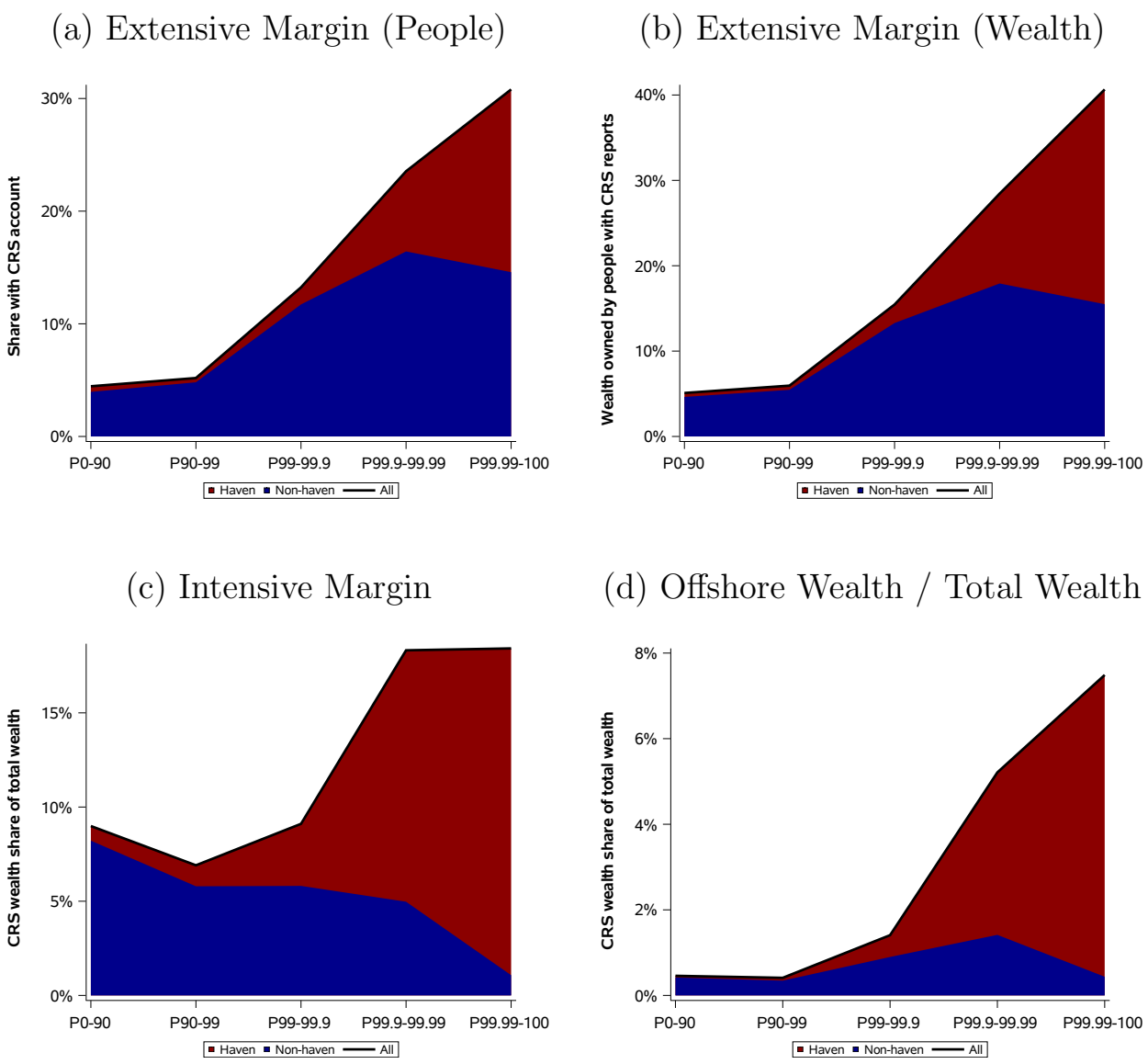
Figure 1: Offshore Wealth Reported to Denmark in 2019



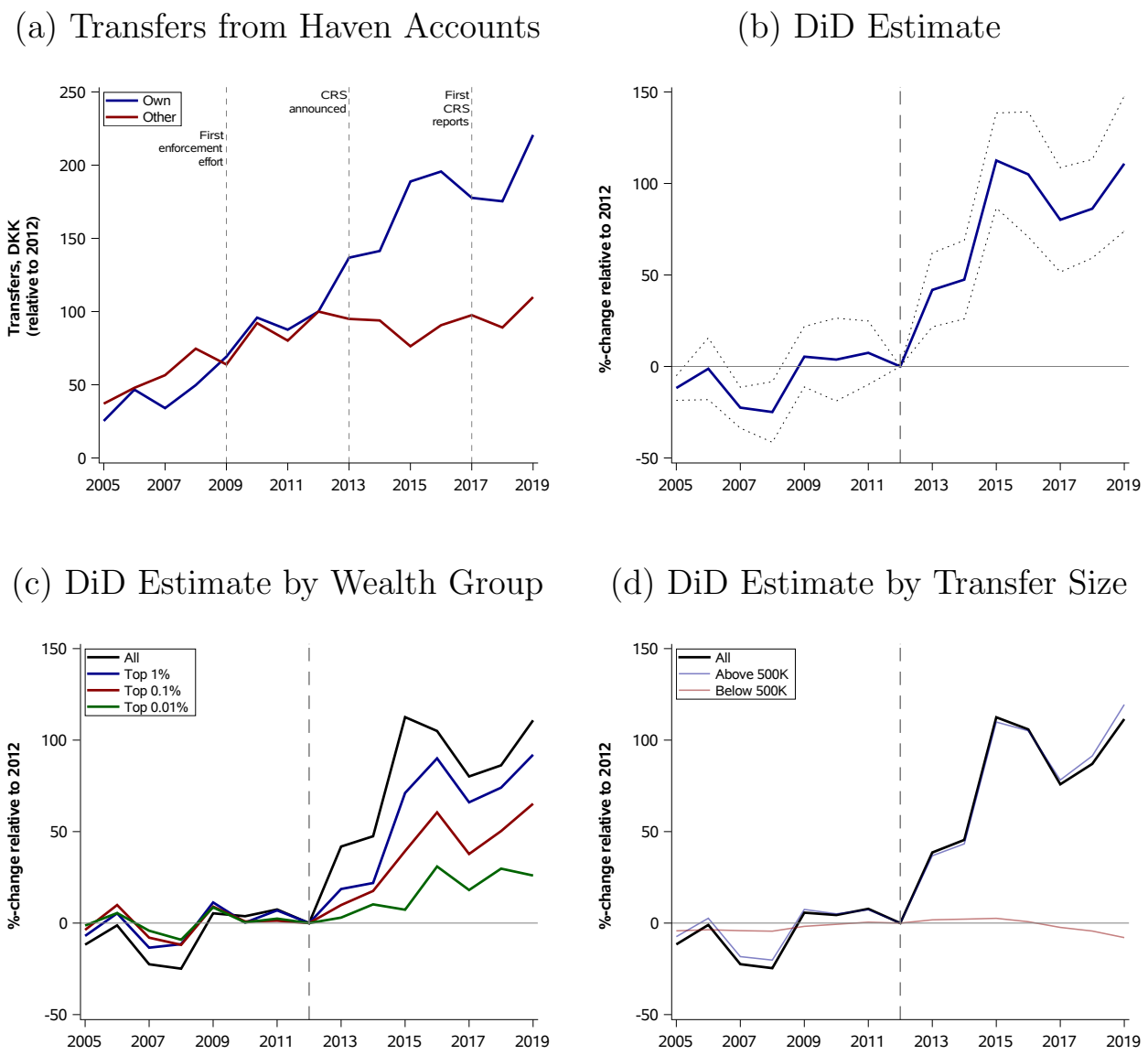
Notes: This figure shows the distribution of offshore wealth owned by Danish households as reported through the Common Reporting Standard in 2019. Offshore wealth includes only directly-held offshore assets owned by households; it excludes assets owned indirectly through holding companies (and assets owned by investors other than households). Households are ranked by their net wealth including reported offshore wealth. Panel (a) shows the probability to own a CRS-reported offshore account (blue line: unweighted, red line: weighted by net wealth). Panel (b) shows the fraction of net wealth held offshore conditional on having offshore wealth reported through the CRS. Panel (c) shows the fraction of net wealth held offshore (unconditional). Panel (d) reports the distribution of CRS-reported wealth in tax havens (red line) and in non-havens (blue line), and contrasts it to the distribution of offshore wealth voluntarily disclosed in tax amnesties in Norway and Sweden (taken from Figure 4, panel (a), of Alstadsæter et al., 2019) and the distribution of Danish domestic wealth (dashed lines). Tax havens are the jurisdictions identified as such in Johannesen and Zucman (2014). Source: authors' computations.

Figure 2: Offshore Wealth Reported to Denmark in 2019, in Havens vs. Non-Havens



Notes: This figure shows the distribution of offshore wealth owned by Danish households as reported through the Common Reporting Standard in 2019, with a breakdown into haven vs. non-haven wealth. Offshore wealth includes only directly-held offshore assets owned by households; it excludes assets owned indirectly through holding companies (and assets owned by investors other than households). Households are ranked by their net wealth including reported offshore wealth. Panel (a) shows the unweighted probability to own a CRS-reported offshore account. Panel (b) shows the probability to own a CRS-reported offshore account, weighted by net wealth. Panel (c) shows the fraction of net wealth held offshore conditional on having offshore wealth reported through the CRS. Panel (d) shows the fraction of net wealth held offshore (unconditional). Tax havens are the jurisdictions identified as such in Johannesen and Zucman (2014). Source: authors' computations.

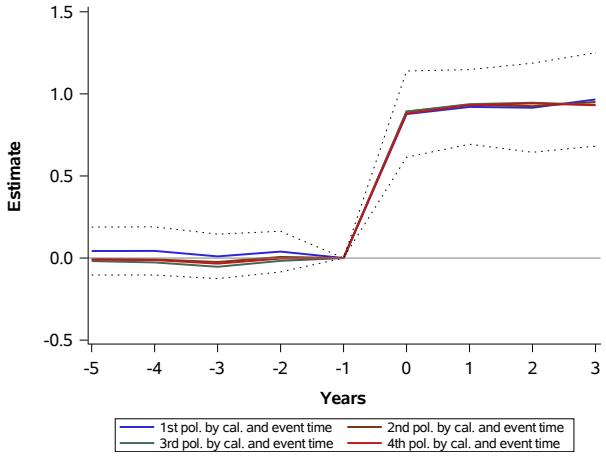
Figure 3: Effects of the CRS on the Repatriation of Offshore Wealth



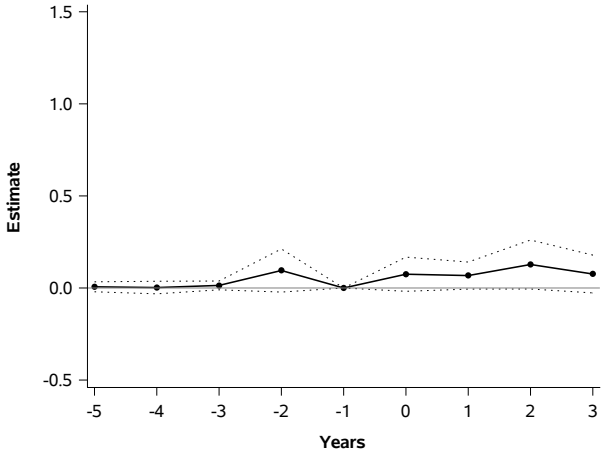
Notes: Panel (a) reports the evolution of transfers received by Danish households in Denmark from a foreign account they own in a tax haven vs. a foreign haven account they do not own; both series are normalized to 100 in 2012, the year preceding the announcement of the Common Reporting Standard (CRS). Panel (b) reports the implied difference-in-differences coefficient, with 95% confidence intervals based on robust standard errors clustered at the individual level in dashed line. In both cases transfers are winsorized at the 99.9^{th} percentile. Panel (c) decomposes the difference-in-differences estimate of panel (b) by wealth group. The colored lines show the fraction of the effect that is accounted for taxpayers in the top 1% (resp. top 0.1% and top 0.01%) of the wealth distribution. Wealth includes directly-owned offshore wealth from 2016-2019 and excludes indirectly-owned offshore wealth. Panel (d) shows what fraction of the total effect of panel (b) is accounted for by large vs. small transfers (defined as transfers greater or small than 500,000 DKK, roughly $80,000). Source: authors' computations.

Figure 4: Effects of Repatriation of Offshore Wealth

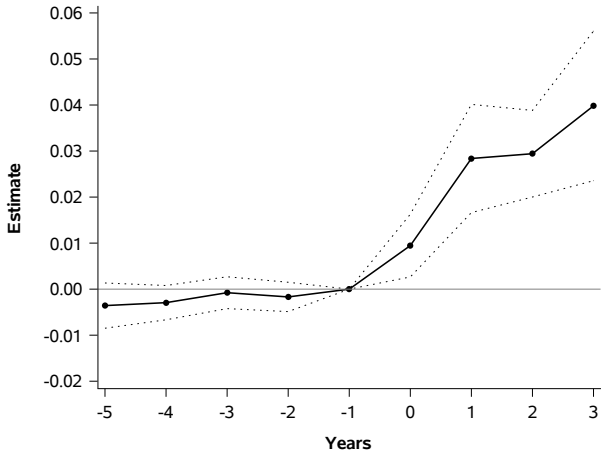
(a) On Reported Domestic Assets



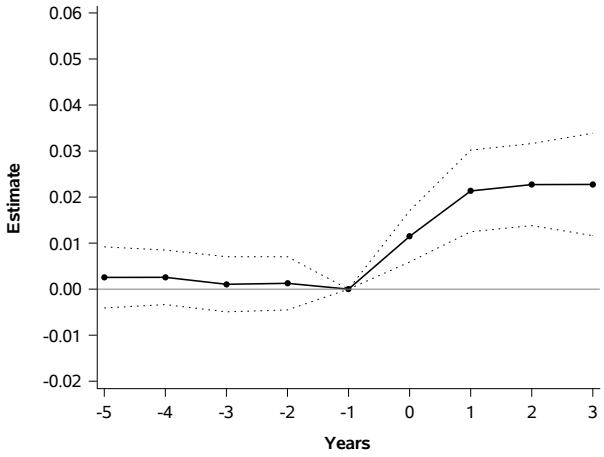
(b) On Reported Foreign Assets



(c) On Reported Domestic Financial Income



(d) On Income Tax Paid

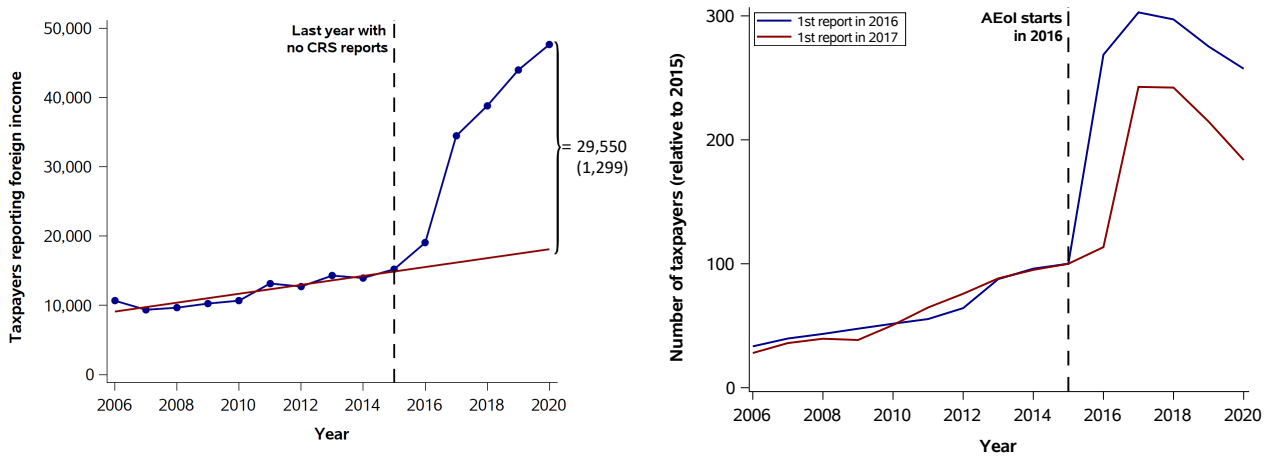


Notes: This figure reports the effects of the repatriation of offshore assets held in tax havens on reported domestic assets (panel a)), reported foreign assets (panel (b)), reported domestic financial income (panel (c)), and individual income taxes paid (panel (d)), following equation 3 in the text. Panel (a) shows results for the five specifications described in the text; the other panels focus on the benchmark specification (first-order polynomial in event time). In each case 95% confidence intervals based on robust standard errors clustered at the individual level are reported in dashed line. To neutralize the effect of outliers, in panels (a) and (b) individuals in the bottom 1% and top 0.1% of the wealth measure (the regressand) in a given year are removed, as well as those with money transfers in the top 1% of the distribution of money transfers (the regressor). In panels (c) and (d) individuals in the bottom 1% and top 1% of the domestic financial income distribution are removed. Source: authors' computations.

Figure 5: Taxpayers Self-Reporting Offshore Income

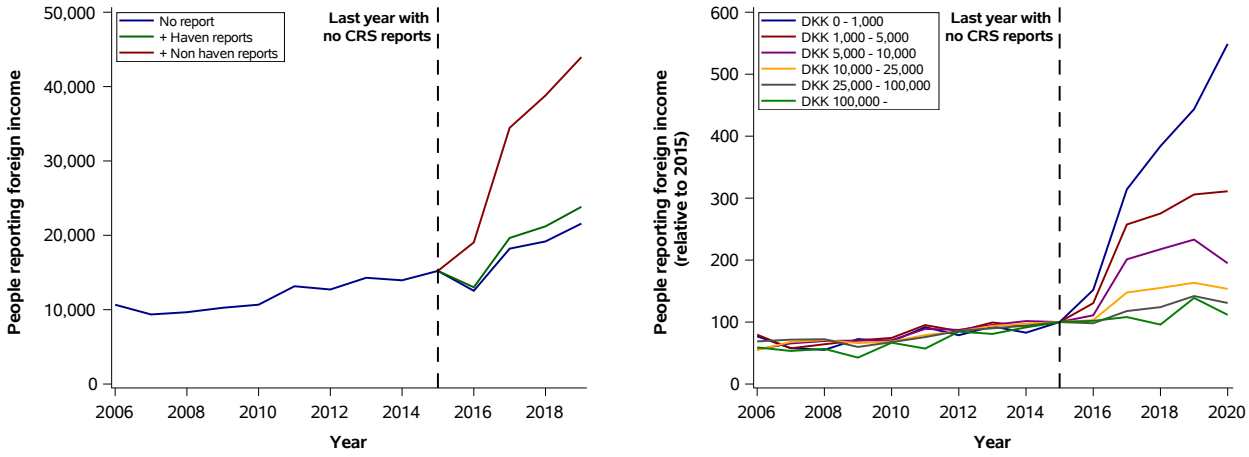
(a) Number of Taxpayers with Self-Reported Foreign Income

(b) By Wave of CRS Implementation



(c) By CRS Account Status

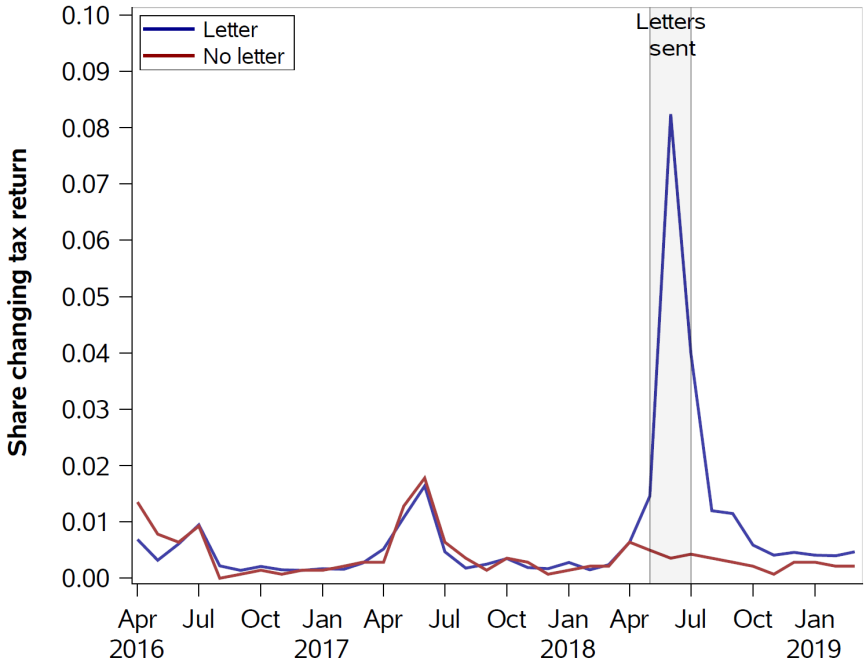
(d) By Size of Foreign Income



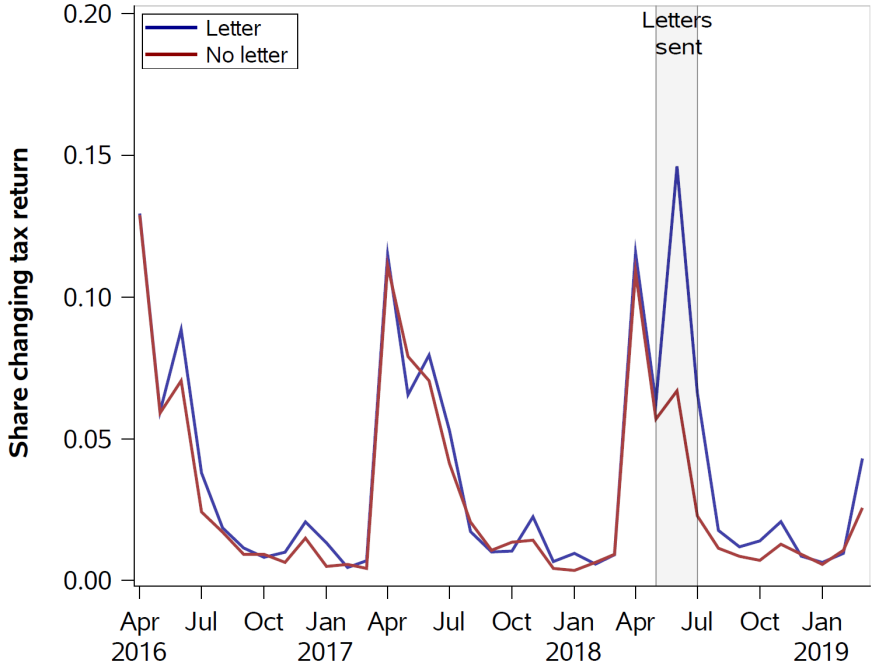
Notes: This figure reports the evolution of the number of Danish taxpayers who self-report foreign income (defined as dividends and interest earned in foreign banks). Panel (a) shows the absolute number of self-reporters and a simple counterfactual for the 2016–2020 period based on assuming that the rising trend observed over 2006–2015 would have continued absent the CRS. Panel (b) shows the evolution of the number of taxpayers matched to a CRS return who self-report foreign income. The blue line considers taxpayers matched in 2016 to a CRS report sent by a country that started reporting in 2016. The red line considers taxpayers who are not part of that first group but are matched in 2017 to a CRS report sent by a country that started reporting in 2017. For both groups, the number of self-reporters is normalized to 100 in 2015. Panel (c) shows the absolute number of self-reporters in three groups: (i) people who are not matched to a CRS return, (ii) people in group (i) plus people who are matched to a CRS return for at least one haven account, and (iii) people in group (ii) plus people matched to a CRS return for a non-haven account. Panel (d) shows the number of taxpayers self-reporting foreign income normalized to 100 in 2015, by size of foreign income reported. Source: authors' computations.

Figure 6: Effects of Tax Authority Sending Letters

(a) Probability of making a change to the tax return for year $t-2$



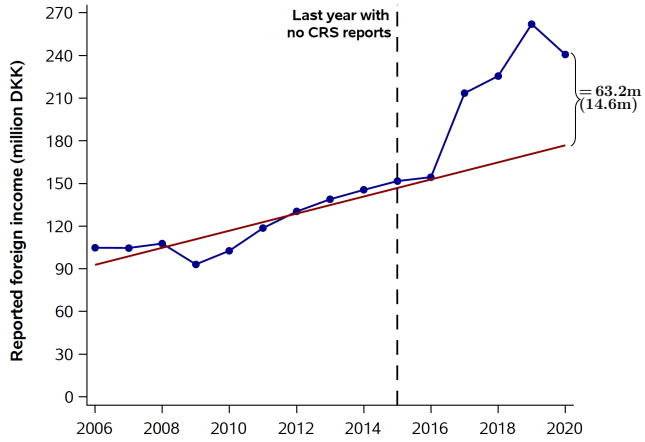
(b) Probability of making a change to the tax return for year $t-1$



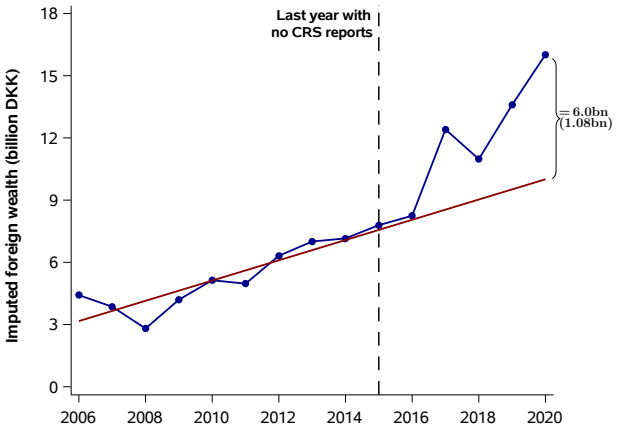
Notes: This figure reports the fraction of taxpayers who amend their individual income tax return for tax year $t-2$ (panel a) and tax year $t-1$ (panel b) each month. The sample includes all Danish taxpayers who are matched to a CRS or FATCA report. The "letter" group includes the taxpayers who received a letter from the tax authority in May–July 2018 informing them that the tax authority knew about their ownership of an offshore account. The probability to make a correction to one's tax return spikes in those months relative to the "no letter" control group. Sources: authors' computations.

Figure 7: Effects of the CRS on Self-Reporting of Offshore Income and Wealth

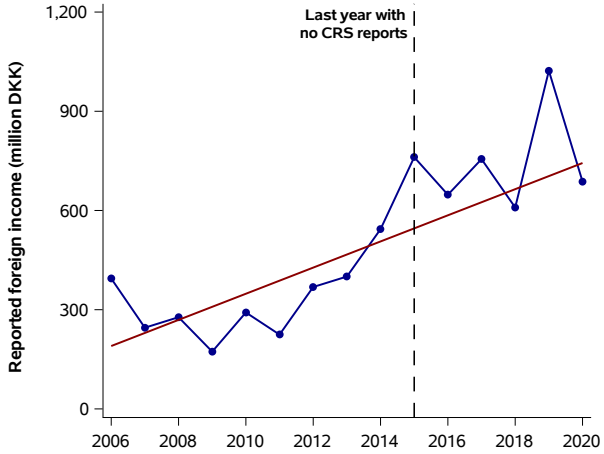
(a) Self-Reported Foreign Income (<100,000 DKK)



(b) Imputed Self-Reported Foreign Wealth



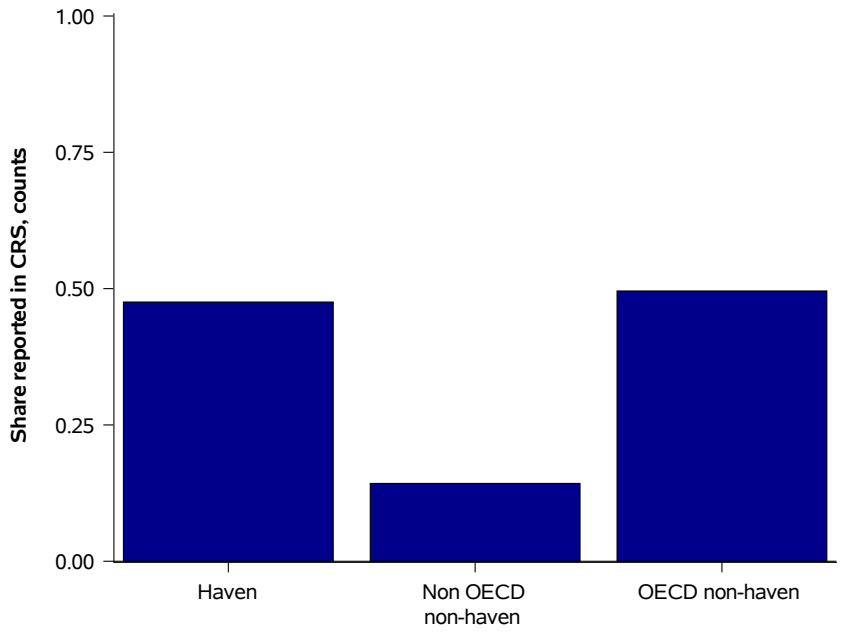
(c) Self-Reported Foreign Income (>100,000 DKK)



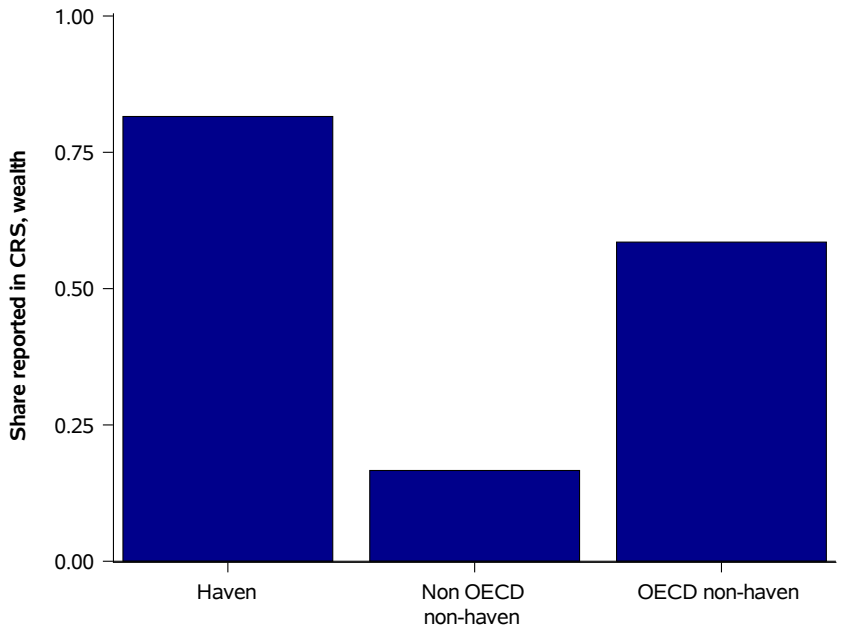
Notes: This figure reports the evolution of the amount of self-reported foreign income, defined as dividends and interest earned in foreign banks. Panels (a) shows the amount of foreign income self-reported by taxpayers who report less than 100,000 DKK in foreign income. Panel (b) shows the implied amount of foreign wealth owned by these taxpayers (i.e., taxpayers who report less than 100,000 DKK in foreign income), obtained by capitalizing their self-reported foreign dividends and interest. In both panels standard errors are computed using a time-series regressions (with one observation per year over 2006-2020) of foreign income or wealth on a continuous year variable (to estimate the pre-CRS trend) and dummies for years 2016-2020 (to estimate deviation from the trend); the reported treatment effects and standard errors are those of the 2020 dummy. Panel (c) shows the amount of foreign income self-reported by taxpayers who report more than 100,000 DKK in foreign income. Source: authors' computations.

Figure 8: Compliance Rates by Country in the Repeat-Transfer Sample

(a) Fraction of Individuals Matched to a CRS Report



(b) Share of Wealth Matched to a CRS Report



Notes: This figure reports the shares of accounts in our 2019 repeat-transfer sample that can be linked to a CRS report, by bank country group. Panel (a) considers the fraction of accounts that can be matched, while Panel (b) considers amounts. We consider three groups of countries: OECD non-havens, non-OECD non-havens, and tax havens. The list of tax havens is taken from Johannesen and Zucman (2014); see text. Source: authors' computations.

Table 1: Offshore Wealth Reported to Danish Authorities in 2019

	DKK billion			% of Denmark's GDP		
	All accounts	Accounts in havens	Accounts in non-havens	All accounts	Accounts in havens	Accounts in non-havens
Panel A: Offshore household wealth captured by the CRS						
Households, directly	53.1	25.2	28.0	2.3%	1.1%	1.2%
Households, through holdings	45.6	37.4	8.3	2.0%	1.6%	0.4%
Total, households	**98.8**	**62.5**	**36.2**	**4.3%**	**2.7%**	**1.6%**
Panel B: Other offshore assets captured by the CRS						
Firms, other than holdings	110.2	60.8	49.5	4.8%	2.6%	2.2%
Charities	12.4	10.9	1.6	0.5%	0.5%	0.1%
Non-residents	14.2	11.3	2.9	0.6%	0.5%	0.1%
Unknown (no ID)	104.7	8.4	96.3	4.6%	0.4%	4.2%
Total, other	**241.6**	**91.3**	**150.2**	**10.5%**	**4.0%**	**6.5%**
Total	**340.3**	**216.4**	**222.7**	**14.8%**	**9.4%**	**9.7%**

Notes: This table provides summary statistics on the amount of offshore wealth reported to Danish authorities through the CRS in 2019. Panel A focuses on household offshore wealth, either held directly or through personal wealth-holding companies (defined as passive non-financial entities with controlling persons who are Danish individual resident taxpayers). Panel B focuses on offshore wealth not owned by Danish households. Assets of "firms other than holdings" include the assets of companies other than personal wealth-holding companies; this category includes both actives and passive companies (such as investment funds, banks, insurance companies, etc.). The category "non-resident" includes (i) assets of passive non-financial entities with controlling persons who are Danish individuals, but that cannot be linked to a taxable individual in Denmark or can be linked to a personal who is not fully taxable in Denmark, (ii) assets of individuals that did not file a tax return in 2019. The category "Unknown (no ID)" includes assets reported as belonging to Danish active or passive companies, but for which there is no matching firm ID, and assets reported as belonging to Danish individuals, but for which there is no matching personal ID. Source: authors' computations.

Table 2: Effects of Audits

	Group H	Group M	Group L	All	Confidence interval
Sample:					
Taxpayers/cases completed (count)	99	290	154	543	
Non-compliers (count)	45	217	124	386	
Non-compliers (%)	45%	75%	81%		
Potential non-compliance (million DKK)	59.1	11.7	1.3	72.1	
Actual non-compliance (million DKK)	16.9	7.9	1.1	25.9	
Average non-compliance (% of potential)	35%	81%	89%		
Additional tax from dividends/interest (million DKK)	4.3	1.9	0.3	6.5	
Additional total tax (million DKK)	13.2	4.9	0.5	18.5	
Population:					
Taxpayers/cases in total (count)	100	1,000	2,555	3,655	
Non-compliers (count)	45	748	2,057	2,851	(2690 , 3012)
Non-compliers (%)	45%	75%	81%	78%	(73.6% , 82.4%)
Potential non-compliance (million DKK)	60.0	41.0	21.4	122.4	
Actual non-compliance (million DKK)	17.1	27.3	18.2	62.6	(61.4 , 63.7)
Average non-compliance (% of potential)	35%	81%	89%	60%	(58.6% , 60.6%)
Additional tax from dividends/interest (million DKK)	4.4	6.5	4.5	15.3	(14.3 , 16.4)
Additional total tax (million DKK)	13.3	16.9	7.6	37.8	(27.1 , 48.5)

Notes: This table reports the results of the random audit experiment described in the text. The "H" group includes the 100 taxpayers with the largest discrepancy between CRS- or FATCA-reported interest and dividends and self-reported interest and dividends in 2019. All taxpayers in that group were selected for audit, and in 99 cases the audits were completed. The "M" group includes the next 1,000 taxpayers ranked by size of the discrepancy, and the "L" groups all the remaining taxpayers with a discrepancy larger than 5,000 DKK in 2019. In the "M" and "L" groups taxpayers were randomly selected for audits. Potential noncompliance is the difference between CRS- or FATCA-reported and self-reported dividends and interest in 2019; actual noncompliance is the noncompliance found by the examiners; "average non-compliance (% of potential)" is person-weighted. Source: authors' computations.

Table 3: Why is Potential noncompliance not Always Actual noncompliance?

Usability of AEoI income	Population
AEoI income	174,814,576
Correctly reported by foreign bank	132,041,910
Incorrectly reported by foreign bank	43,146,347

Reasons for non-usable AEoI income	Population
Incorrectly reported by foreign bank	**43,146,347**
- AEoI income is reported with incorrect amount or currency	39%
- Taxpayer does not own AEoI account/income	22%
- AEoI income is not dividends/interests	20%
- AEoI income is not fully taxable in Denmark because of in/out-migration	14%
- Taxpayer is not fully taxable (deceased or moved)	4%
- Same AEoI income reported by several countries	1%
- The account has several owners and it is not accounted for correctly	1%
- AEoI income is too small and taxpayer not contacted	0%

Taxpayer behaviour	Population
Correct income	**132,041,910**
- Self-reported correctly	40%
- Self-reported (but not correctly; wrong field / by another person / net income)	12%
- Corrections	47%

How simple/complicated is the tax treatment	Population
Correct dividends	**78,384,225**
- Is transmitting country also country of source?	19%
- Foreign withholding taxes?	63%
- All dividends must be taxed as income from shares	80%
- All dividends must be taxed as capital income	3%
- Dividends must be taxed as a mix of income from shares and capital income	17%
- Is it correct to apply standard deduction of dividend tax of 15 %?	14%
Correct interests	**53,657,686**
- Is transmitting country also country of source?	45%
- Are the interests only taxable in Denmark?	63%
- Foreign withholding taxes according to double taxation agreement? *Answer only if YES in 2) and NO in 3)*	11%

Notes: This table reports the results of the survey of examiners who were tasked with the random audit experiment described in the text—auditing tax returns of taxpayers with a discrepancy between CRS or FATCA-reported interest and dividends and self-reported interest and dividends in 2019. AEoI income stands for "automatic exchange of information" income and includes dividends and interest reported by foreign banks through the CRS and FATCA.

Table 4: Potential Bank Noncompliance with the CRS

	Repeat transfer sample			All CRS reports			Implied non-compliance
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Panel A: counts						
	In CRS	Not in CRS	% in CRS	Matched	Not matched	% matched	%
2016	3,167	22,779	12%	44,783	23,301	66%	81%
2017	11,879	20,341	37%	134,497	88,405	60%	39%
2018	14,379	18,043	44%	164,920	109,061	60%	26%
2019	9,735	10,648	48%	211,627	100,447	68%	30%
	Panel B: amounts (million DKK)						
	In CRS	Not in CRS	% in CRS	Matched	Not matched	% matched	%
2016	423	1,973	18%	5,109	2,341	69%	74%
2017	1,289	1,392	48%	13,240	7,460	64%	25%
2018	1,446	1,236	54%	15,190	9,336	62%	13%
2019	1,187	819	59%	22,009	8,749	72%	17%

Notes: This table reports summary statistics on CRS match rates for individuals with foreign accounts. Panel A reports counts (number of individuals), Panel B reports amounts (in million of DKK). The left panel (cols. 1 to 3) considers individuals who make repeat transfers (i.e., in both year t and year $t+1$) to or from a foreign account they personally own. The middle panel (cols. 4 to 6) considers all CRS reports for individuals received by Denmark. Matched reports are those that can be matched to an individual with a matching score of 0.99 or more. Account balances are winsorized by year at the 99^{th} and 1^{st} percentiles. The last column computes the implied noncompliance by foreign banks for people in the repeat transfer sample, computed as (col. 6 - col. 3) / col. 3. Source: authors' computations.

Table 5: What Fraction of Hidden Financial Wealth has Become Compliant?

	Wealth, billion DKK	Confidence interval	% hidden wealth without CRS
A. Offshore wealth without CRS			
Offshore wealth in CRS	53.1		
Imperfect coverage of CRS	11.1	[9.3 ; 13.0]	
Repatriation due to CRS	10.5	[7.5 ; 13.6]	
Total	**74.8**		
B. Compliance without CRS (self-reporting)	**47.4**	[23.3 ; 71.5]	
C. Hidden wealth without CRS	**27.4**		**100%**
Memo: Alstadsæter et al. estimate, aged	27.2		
D. Increase in compliance due to CRS			
Repatriation from havens 2013-19	10.5	[7.5 ; 13.6]	38%
Self-reporting	6.0	[3.9 ; 8.1]	22%
Detectable noncompliance (audits)	3.6	[3.4 ; 3.8]	13%
Of which: actually detected	1.0		4%
Total	**20.1**		**73%**
E. Remaining noncompliance (residual)	**7.3**		**27%**

Notes: see text. Sources: authors' computations and Alstadsæter, Johannesen and Zucman (2018, 2019).

Appendix (for Online Publication)

A Matching Procedure

The CRS and FATCA reports include information about accountholder's name, birth date, and address. The Danish tax authorities compare that information with the population registry of all taxpayers. They apply fuzzy string matching on each CRS and FATCA report to calculate a matching score for all taxpayers in the population registry. The taxpayer with the highest matching score is then chosen as a match to the report.

The matching score is normalized to a value between 0 and 1. The closer to 1, the more similar are the report's name, birth date, and address to the taxpayer information in the population registry. A matching score of 1 reflects identical CRS/FATCA and registry information.

To ensure matches are correct, the tax authorities only consider matches with a matching score greater than 0.99. One exception is if the taxpayer identification number reported in CRS/FATCA is identical to the one of the matched taxpayer. Then the match is also considered correct independently of the matching score.

B Non-Compliance Through Holding Companies

This appendix documents how we use information from a small-scale risk-based audit effort conducted by the tax authorities to estimate the scale of non-compliance through holding companies with foreign financial assets.

The audit effort selected companies for audits based on foreign account information received under FATCA and CRS. While it aimed to select companies with foreign account characteristics indicative of high non-compliance risk, the tax authorities do not disclose the details of the selection process.

The audit effort covered 26 out of the 4,619 holding companies in our sample. For each audited company, we observe the number of fiscal years covered by the audit and the number of fiscal years with some detected non-compliance. However, we have no information about the specific years covered nor about the specific type of non-compliance detected. In all the audits, companies were consistently compliant or non-compliant through the audit period. Hence, the audits effectively yield a cross-sectional company-level indicator of compliance vs. non-compliance.

In a first step, we create a measure of non-compliant assets for each audited company. We start from the foreign assets observed in the CRS and FATCA reports, averaged over the period 2016–2019. Due to the lack of detailed information, we assume that all of a company's foreign assets are non-compliant when audits detect some non-compliance and that all of them are compliant when audits detect no non-compliance. Formally, denote the total foreign assets and the non-compliant foreign assets of an audited company by a_i and e_i respectively and the set of audited companies by $\mathbb{Z}$.

Next, we take two distinct approaches to obtaining estimates of aggregate non-compliant foreign assets in the population of holding companies, which we denote by E. In the first

approach, we assume that audit selection is uncorrelated with true non-compliance, i.e., quasi-random selection. To implement this approach, we multiply the aggregate non-compliant assets found in the audits by the ratio of aggregate foreign assets in the population of holding companies to aggregate foreign assets in the sample of audited companies:

$$\widehat{E'} = \frac{A}{\sum a_i} \sum e_i \tag{5}$$

where A denotes aggregate foreign assets in the population of holding companies. In the second approach, we estimate sampling probabilities—an analogue to the risk-based sampling probabilities used by the tax authorities—based on observable foreign account information x_i. We then multiply the non-compliant assets found for each audited company by the inverse of the company's estimated sampling probability p_i (while adjusting for size differences across audited and non-audited companies as before):

$$\widehat{E''} = \frac{A}{\sum a_i} \sum e_i \frac{n/N}{p_i} \tag{6}$$

where n is the number of audited companies, N is the number companies in the population and p_i is estimated with the following probit model:

$$\text{prob}(i \in \mathbb{Z}|x_i) = \Phi(\alpha + \beta x_i + \epsilon_i) \tag{7}$$

We note that E'' collapses to E' when audit selection is quasi-random, i.e., when $p_i{=}n/N$. We also note that E'' collapses to $\sum(e_i/p_i)$ when the average assets of audited companies ($\sum a_i/n$) equals the average assets in the population of companies (A/N).

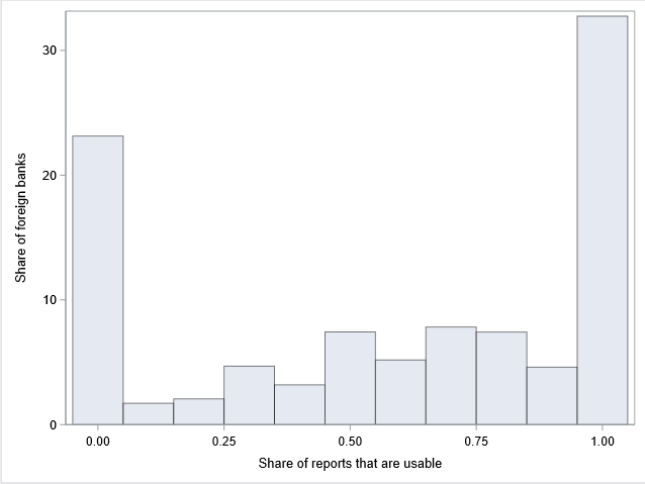
Table A2 reports the results. The first approach yields an estimate of aggregate non-compliant foreign assets in the population of holding companies of DKK 5.2 billion. The second approach yields estimates of DKK 2.3 billion and DKK 1.9 billion depending on the set of foreign account characteristics x_i used to estimate sampling probabilities p_i. In the former case, we only include the foreign account balance while the latter case includes four additional variables: dividend income, interest income, gross proceeds, and other income (we apply the inverse hyperbolic sine transformation to all the elements in x_i to accommodate extreme values and zeros).

There is uncertainty about these estimates due to the small sample and the limited information we have been able to obtain about sampling method, audit periods, and audit findings. However, we believe that even the second approach is likely to overestimate the aggregate non-compliance of holding companies for at least two reasons. First, we assume that any non-compliance found in an audit implies that all the company's foreign assets are non-compliant in the year of the audit. Second, while the probit model attempts to account for selection on risk into audits, we can only do so imperfectly. Any additional signal about non-compliance that the tax authorities relied on to select companies for audits imply that the audited companies had more non-compliance than non-audited companies conditional on x_i and, thus, that we overestimate aggregate non-compliance. Thus the results should be seen as upper-bounds for the total non compliance of holding companies.

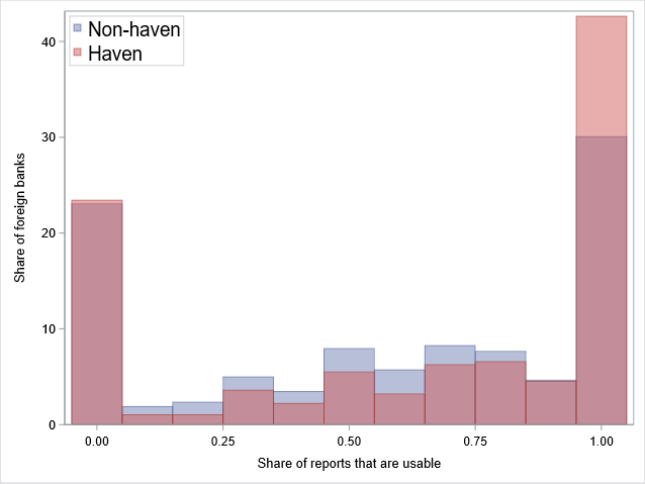
C Appendix Figures and Tables

Figure A1: Matched vs. Unmatched CRS Reports, 2019

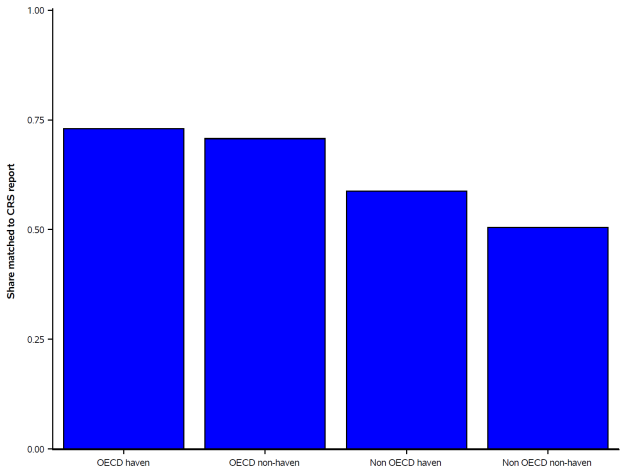
(a) Share of usable reports



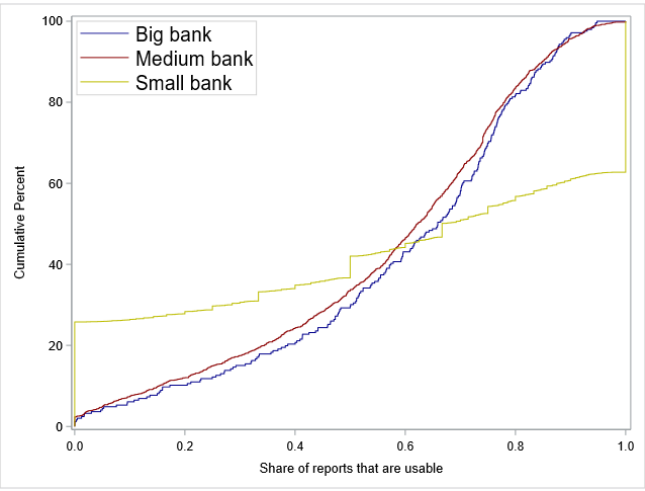
(b) By haven vs. non-haven bank



(c) By country group



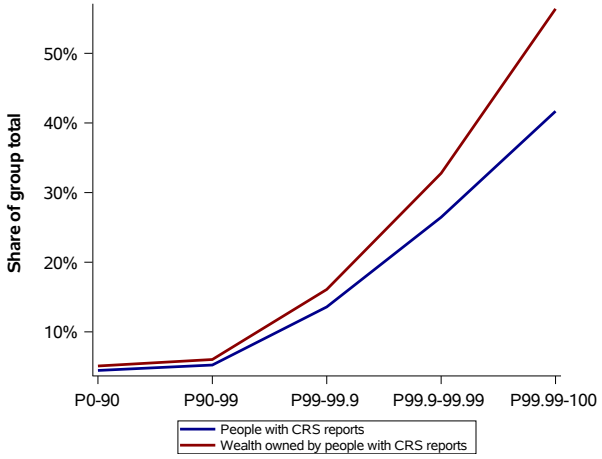
(d) By bank size



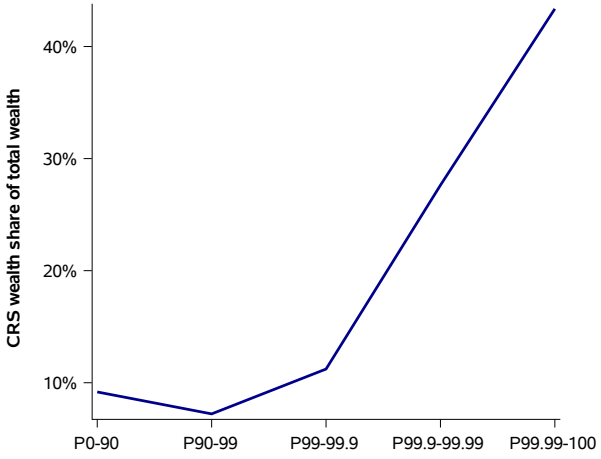
Notes: This figure reports statistics on CRS reports that are not usable reports, i.e., cannot be matched to a specific owner with a more than 99% matching score. Panel (a) reports the distribution of the share of usable reports. Panel (b) shows this distribution separately for banks located in tax havens and non-haven countries (using the list of tax havens of Johannesen and Zucman, 2014). Panel (c) reports the fraction of usable reports for individuals by bank country, aggregating countries into four groups (OECD havens, OECD non-havens, non-OECD havens, non-OECD non-havens). Panel (d) reports the cumulative distribution function of the share of usable reports, by bank size. Big banks are defined as financial institutions that send 1,000 or more CRS reports (246 financial institutions); medium-size banks as those that send in between 50 1,000 reports (1,361 financial institutions); and small banks as those that send under 50 reports (10,653 financial institutions). Source: authors' computations.

Figure A2: Reported Offshore Wealth (Directly Plus Indirectly Held), 2019

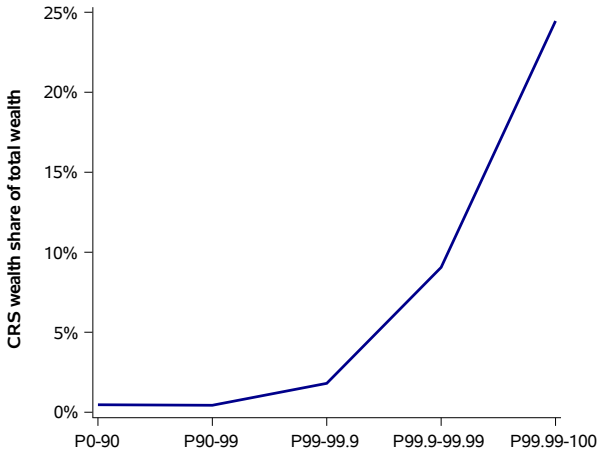
(a) Extensive Margin



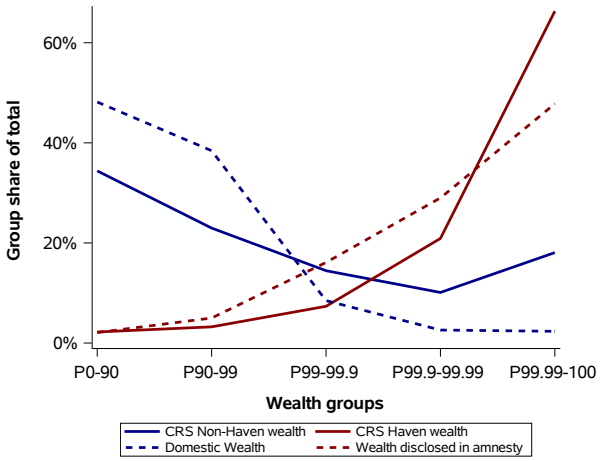
(b) Intensive Margin



(c) CRS Wealth Out of Total Wealth

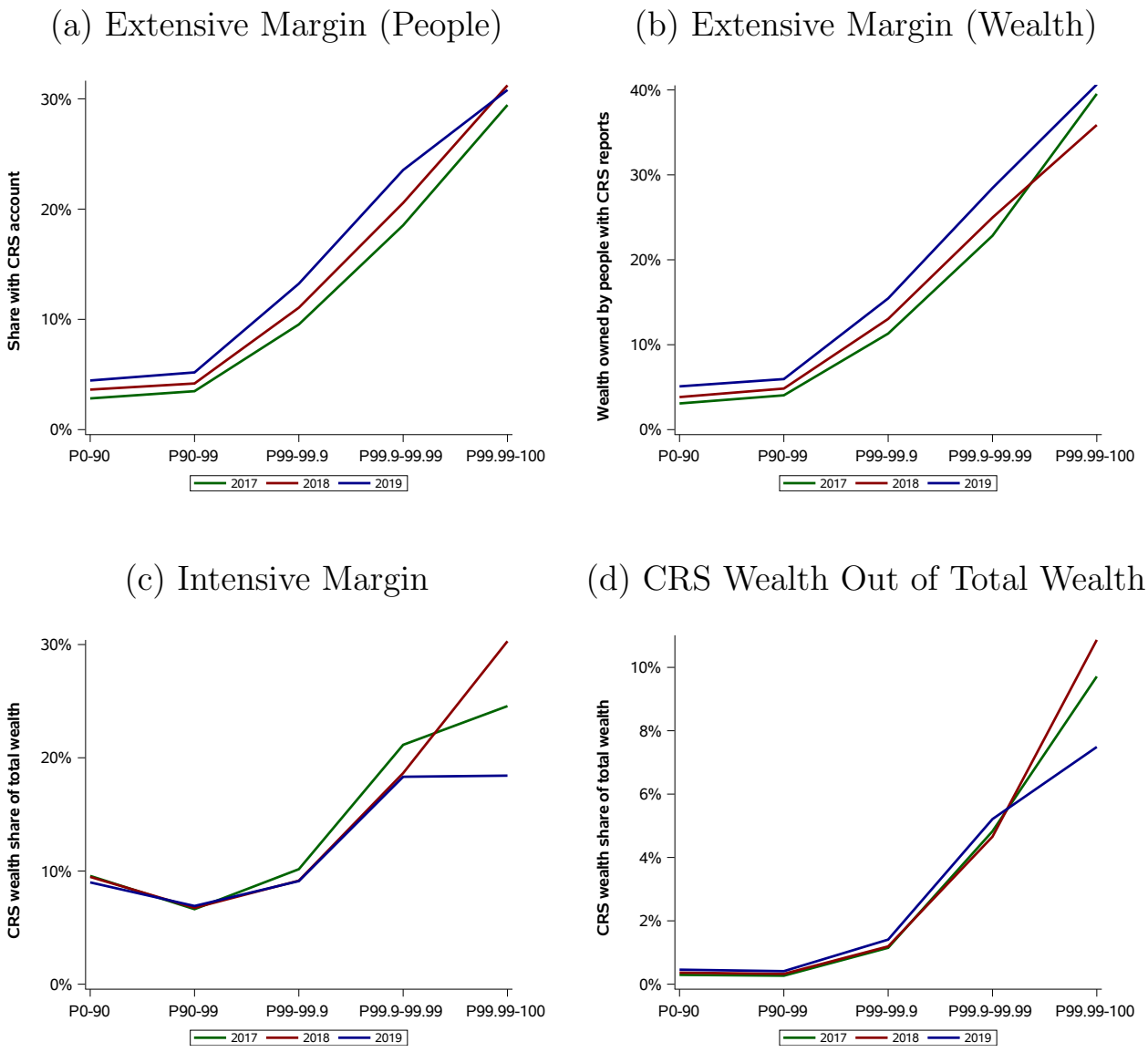


(d) Distribution of CRS Wealth



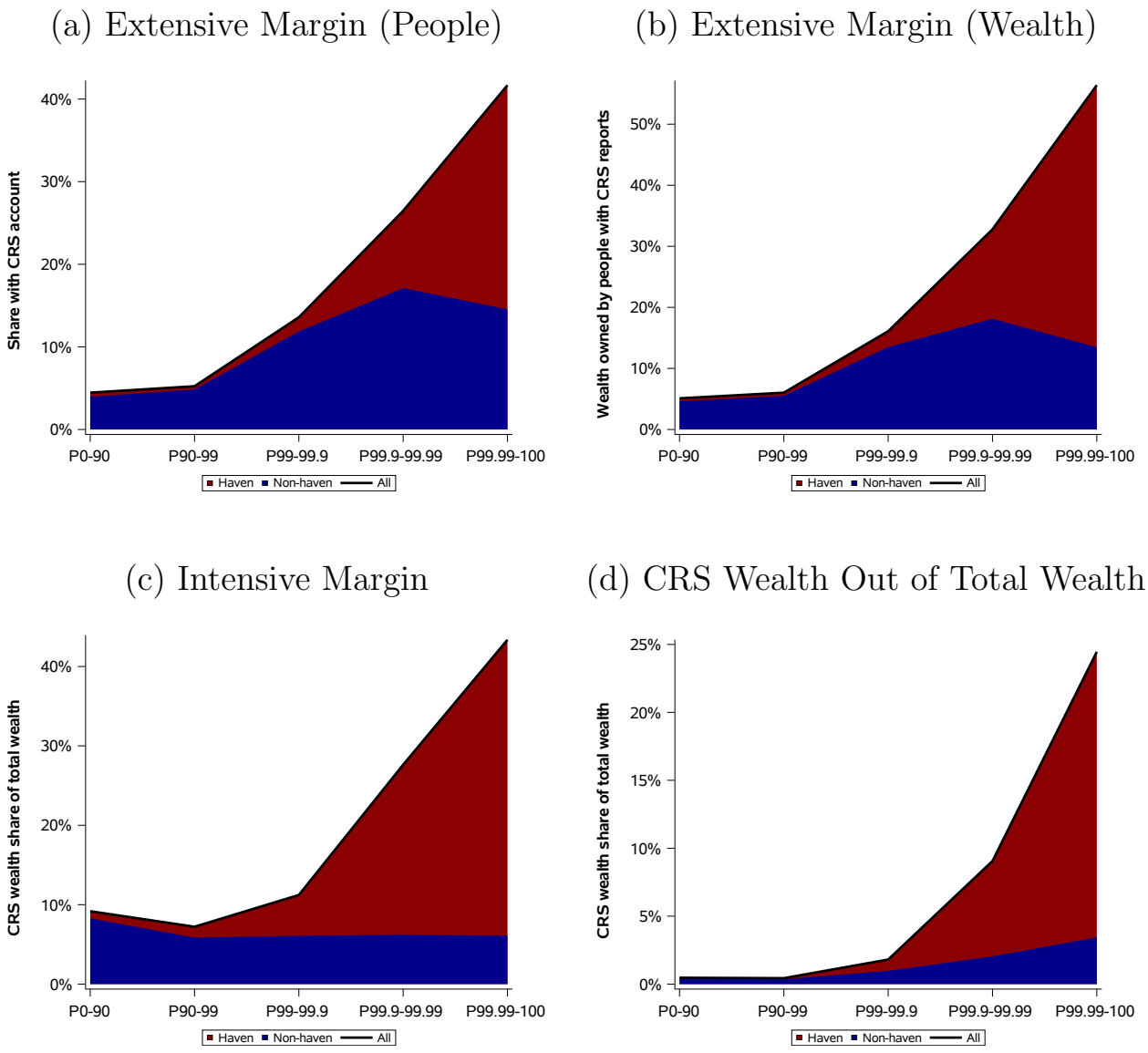
Notes: This figure shows the distribution of offshore wealth owned by Danish households as reported through the Common Reporting Standard in 2019. Offshore wealth includes both directly-held offshore wealth and indirectly-held wealth (i.e., offshore accounts owned by households through personal wealth-holding companies). Households are ranked by their net wealth including reported offshore (directly plus indirectly held) wealth. Panel (a) shows the probability to own a CRS-reported offshore account (blue line: unweighted, red line: weighted by net wealth). Panel (b) shows the fraction of net wealth held offshore conditional on having offshore wealth reported through the CRS. Panel (c) shows the fraction of net wealth held offshore (unconditional). Panel (d) reports the distribution of CRS-reported wealth in tax havens (red line) and in non-havens (blue line), and contrasts it to the distribution of offshore wealth voluntarily disclosed tax amnesties (dashed lines). Source: authors' computations.

Figure A3: Reported Offshore Wealth (Directly Held), 2017–2019



Notes: This figure shows the distribution of directly-held offshore wealth owned by Danish households as reported through the Common Reporting Standard in 2017, 2018, and 2019. Offshore wealth includes only directly-held offshore assets owned by households; it excludes assets owned indirectly through holding companies (and assets owned by investors other than households). Households are ranked by their net wealth included reported offshore wealth. Panel (a) shows the unweighted probability to own a CRS-reported offshore account. Panel (b) shows the probability to own a CRS-reported offshore account, weighted by net wealth. Panel (c) shows the fraction of net wealth held offshore conditional on having offshore wealth reported through the CRS. Panel (d) shows the fraction of net wealth held offshore (unconditional). Source: authors' computations.

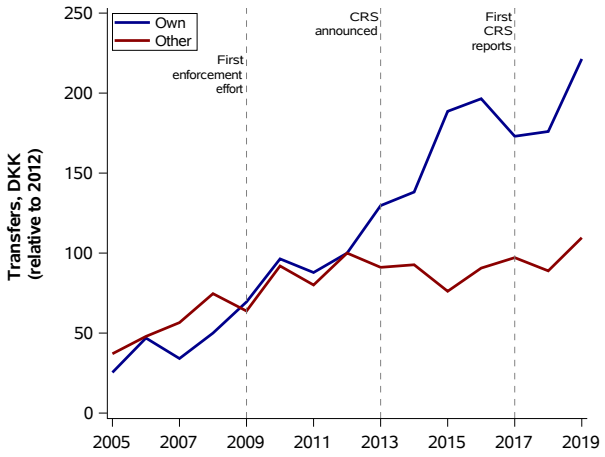
Figure A4: Reported Offshore Wealth (Directly Plus Indirectly Held), 2019: Havens vs. Non-Havens



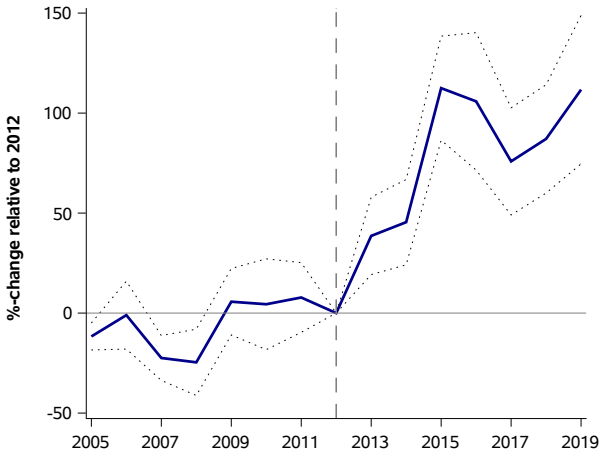
Notes: This figure shows the distribution of offshore wealth owned by Danish households as reported through the Common Reporting Standard in 2019, with a decomposition into haven wealth and non-haven wealth. Offshore wealth includes both directly-held offshore wealth and indirectly-held wealth (i.e., offshore accounts owned by households through personal wealth-holding companies). Households are ranked by their net wealth including reported offshore (directly plus indirectly held) wealth. Panel (a) shows unweighted the probability to own a CRS-reported offshore account. Panel (b) shows the probability to own a CRS-reported offshore account, weighted by net wealth. Panel (c) shows the fraction of net wealth held offshore conditional on having offshore wealth reported through the CRS. Panel (d) shows the fraction of net wealth held offshore (unconditional). Tax havens are the jurisdictions identified as such in Johannesen and Zucman (2014). Source: authors' computations.

Figure A5: Wealth Repatriation: Supplementary Results

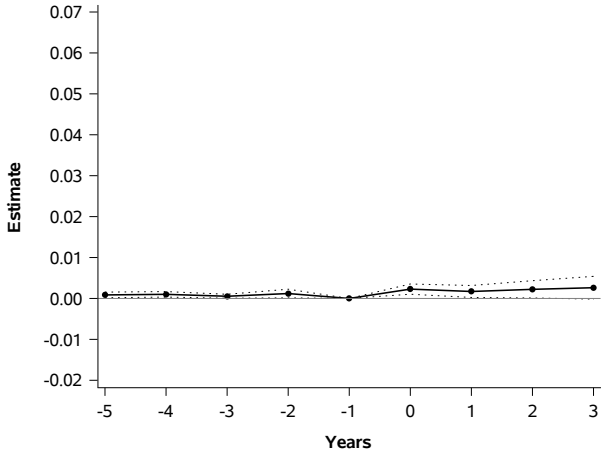
(a) Transfer from Haven Accounts (no Amnesty)



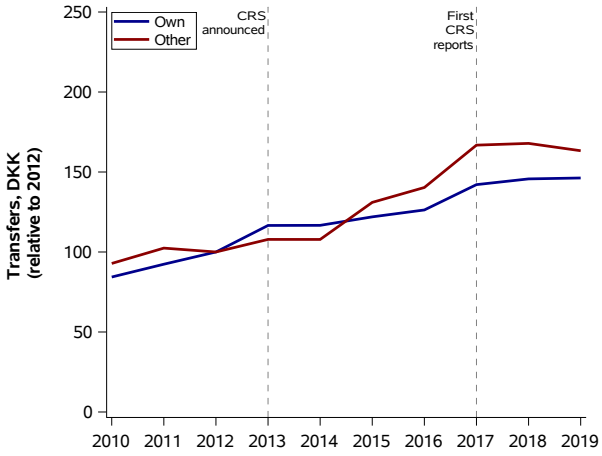
(b) DiD Estimates (no Amnesty)



(c) Effect of Transfers on Foreign Financial Income

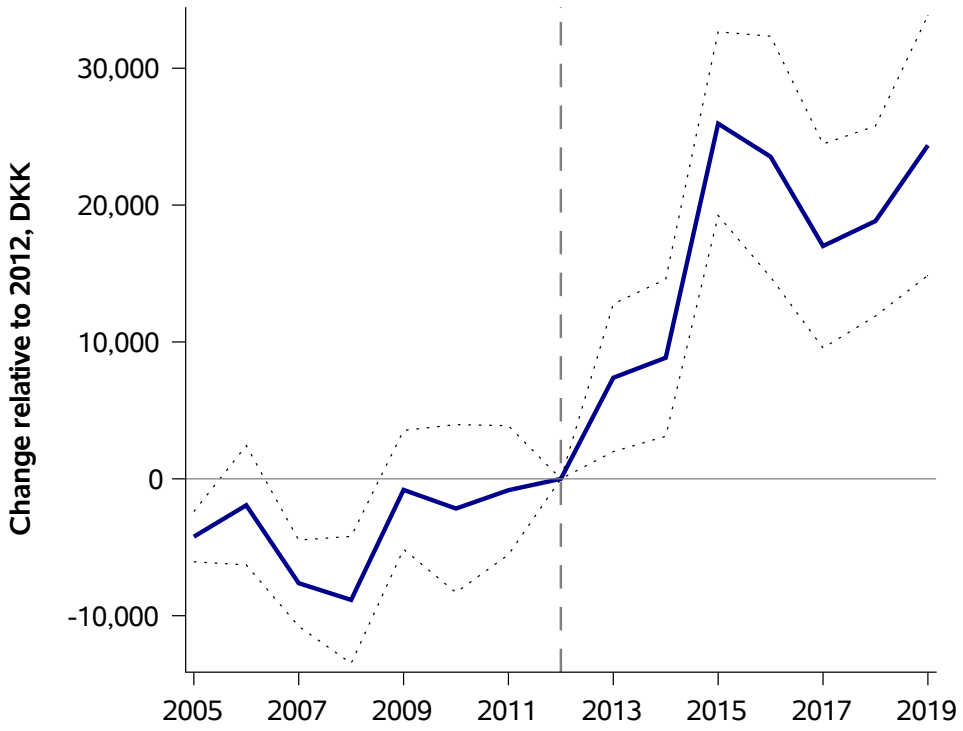


(d) Placebo Test: Transfers to Non-Havenss



Notes: Panels (a) and (b) replicate the corresponding panels in Figure 3 but excluding Danish individuals who participated in the amnesty in force in Denmark between July 1^{st}, 2012 and July 1^{st}, 2013. Panel (c) reports the effect of repatriation of offshore funds on reported foreign financial income, showing that these transfers have no effect on reported foreign financial income (and hence that the income generated by these offshore assets was likely unreported to the tax authority). Panel (d) reports a placebo test where we investigate the evolution of transfers from non-havens, before vs. after the automatic exchange of information, for own vs. other accounts. Non-havens include the non-haven countries that appear in the money transfer data over the full 2010-19 period: Brazil, Germany, Estonia, Egypt, Guatemala, Lithuania, Latvia, Mauritius, Russia, Saudi Arabia, Slovakia, Thailand, and UAE; the definition of havens vs. non-havens is from Johannesen and Zucman (2014).

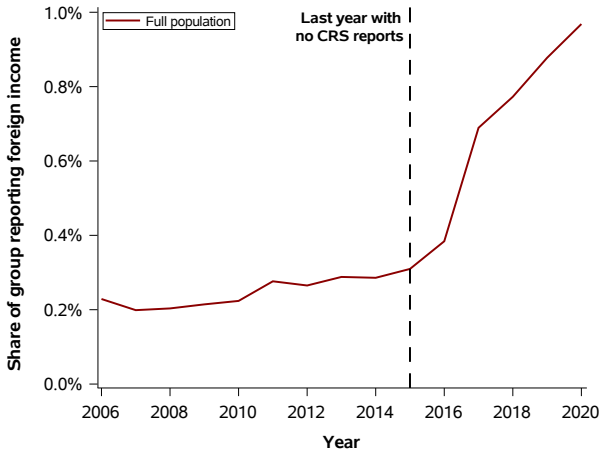
Figure A6: Wealth Repatriation: Regression in Level



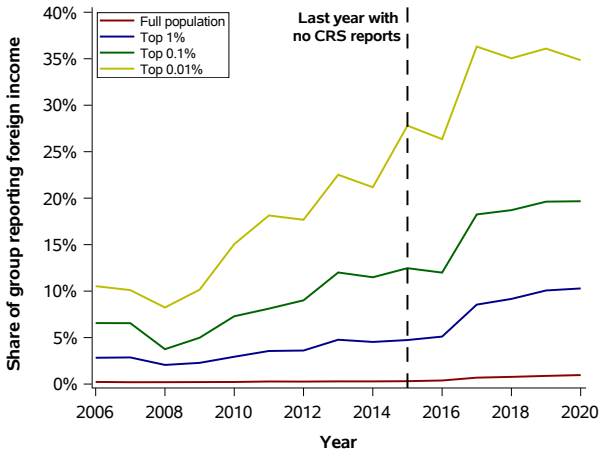
Notes: This figure plots the β_y coefficients from equation 2 in the main text. This shows the result of a difference-in-difference regression of transfers received from "own" haven accounts vs. "other" haven accounts, before vs. after the announcement of the automatic exchange of bank information, in levels. The dashed lines show 95% confidence intervals based on robust standard errors clustered at the individual level.

Figure A7: Number of Taxpayers Self-Reporting Offshore Income: Supplementary Results

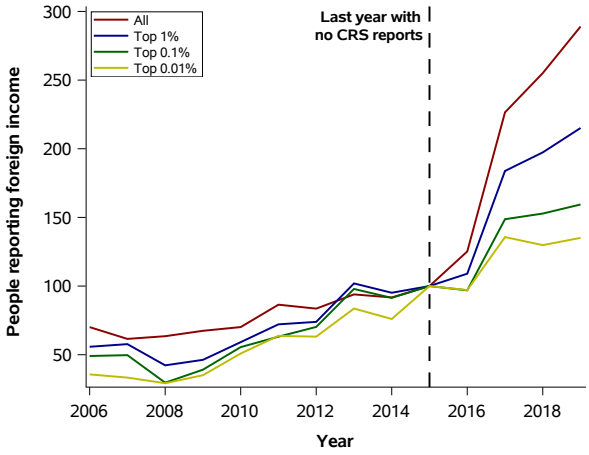
(a) Fraction Reporting (Full Population)



(b) Fraction Reporting by Wealth Group



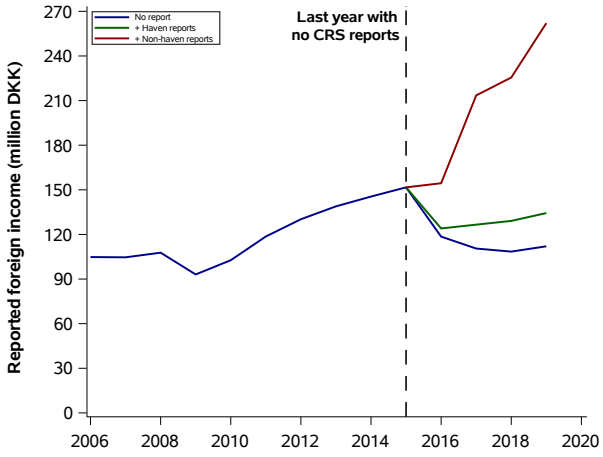
(c) Fraction Reporting by Wealth Group (2015 = 100)



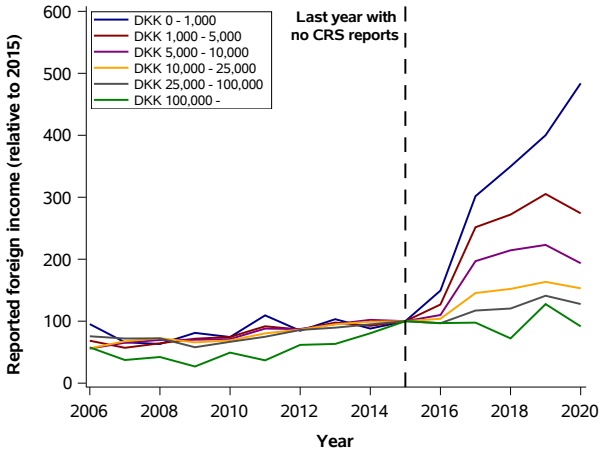
Notes: see text. Source: authors' computations.

Figure A8: Amounts of Self-Reported Offshore Income: Supplementary Results

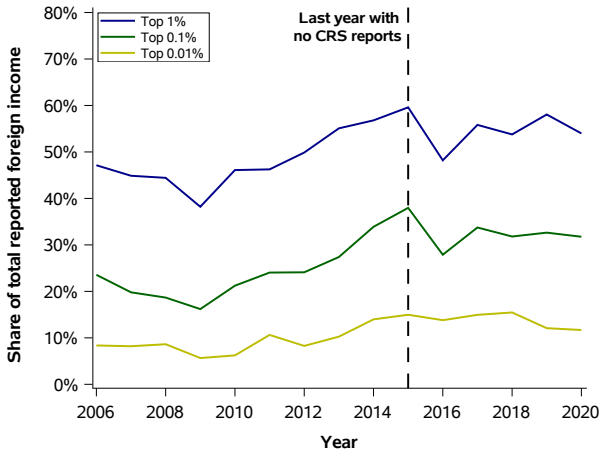
(a) By CRS Status



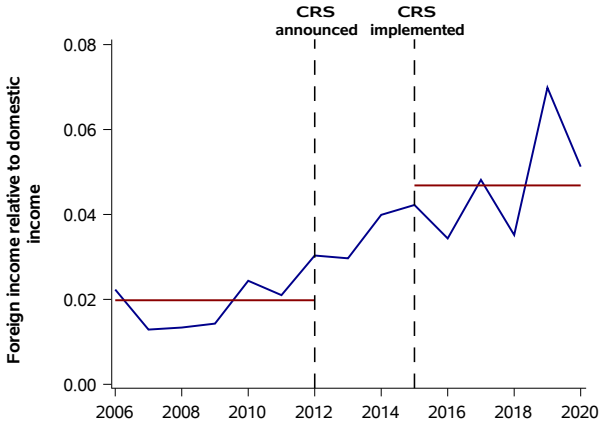
(b) By Size of Self-Reported Income



(c) Share of Self-Reported Foreign Income by Wealth Group



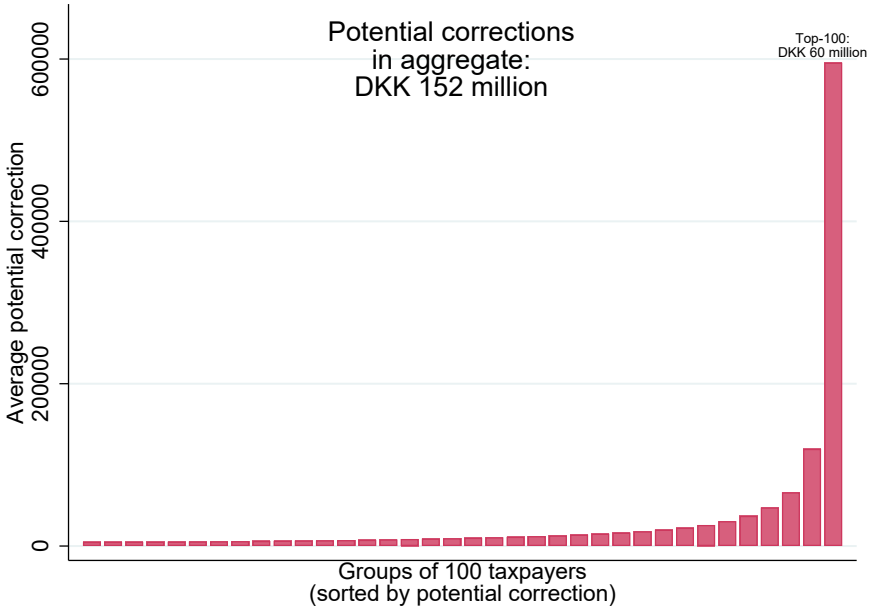
(d) Ratio of Self-Reported Foreign Income to Domestic Financial Income



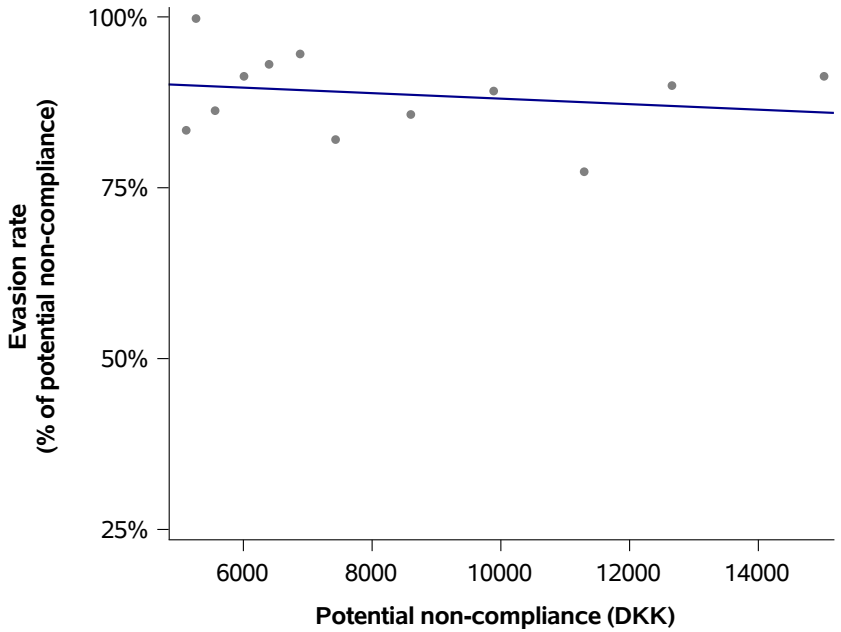
Notes: see text. Source: authors' computations.

Figure A9: Potential Underreporting: Supplementary Results

(a) Distribution of Potential Underreporting

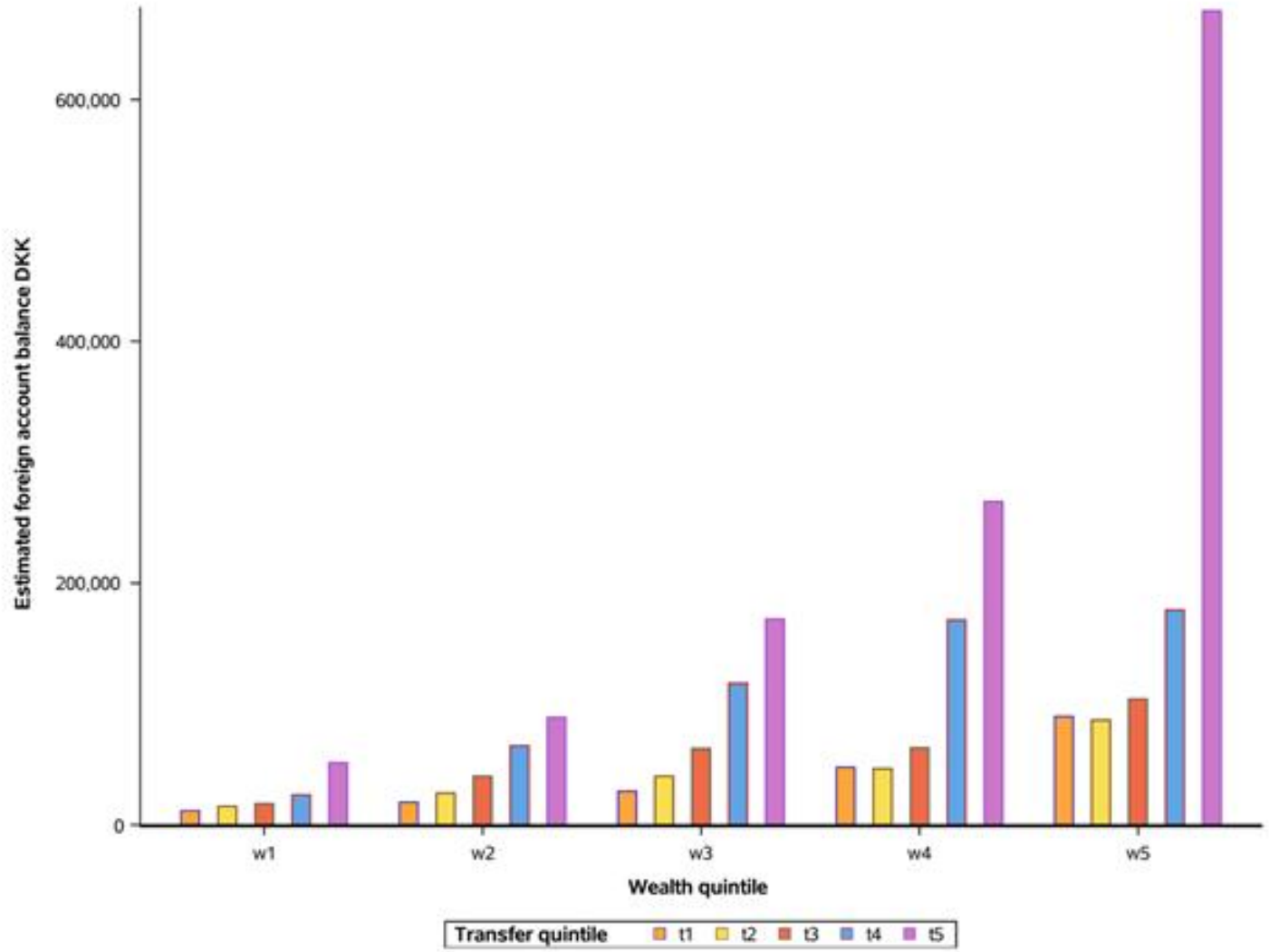


(b) Ratio of Actual to Potential Undereporting



Notes: Panel (a) shows the distribution of potential underreporting of offshore dividends and interest. Panel (b) shows the ratio of actual to potential underreporting of offshore dividends and interest found in the random audit. Source: authors' computations.

Figure A10: Average Account Balances by Wealth × Transfers Quintiles (2019)



Notes: This figure shows the estimates of average foreign account balances by wealth quintiles × transfer quintiles in the population of Danish individuals matched to a CRS return. We use these estimates to impute account values for the sample of "repeat-transfer" individuals who cannot matched to a CRS return. Source: authors' computations.

Table A1: Reports Received by Danish Authorities in 2019

		Million DKK		
	Holders of foreign accounts	Aggregate account balances	Aggregate dividend income	Aggregate interest income
All accountholders	**324,900**	**340,300**	**1,840**	**1,380**
- CRS	320,900	340,300	1,400	710
- FATCA	5,400	n.a.	430	670
Matched to individuals	**252,000**	**98,700**	**690**	**260**
- Accounts directly owned	250,600	53,100	360	180
- Accounts owned through holdings	1,400	45,600	330	80
Not matched to individuals	**72,900**	**241,600**	**1,140**	**1,120**
- Organizations other than holdings	7,100	214,600	1,060	1,040
- Individuals with no match	43,900	23,900	70	60
- Individuals with match but not taxpayer	21,900	3,100	10	20

Notes: This table reports summary statistics for the CRS and FATCA reports received by the Danish tax authority in 2019. Column 1 reports the number of account holders; the line "all accountholders" is greater than the sum of CRS and FATCA because some accountholders have accounts both in the United States and in CRS-reporting countries. Column 2 reports account balances; account balances are not reported in FATCA hence the figures only capture CRS-reported account. Column 3 and 4 report total dividend and interest income reported, respectively. Sources: authors' computations.

Table A2: Estimated Non-Compliance Through Holding Companies

	(1)	(2)	(3)
Estimated non-compliance (DKK million)	5,230	2,334	1,934
Any risk weighting?	N	Y	Y
Foreign account characteristics used to estimate sampling probabilities:			
- Foreign account balance	N	Y	Y
- Dividends	N	N	Y
- Interests	N	N	Y
- Gross proceeds	N	N	Y
- Other income	N	N	Y

Notes: This table reports the result of our estimation of the amount of non-compliant foreign assets owned by holding companies. The estimation is based on the results of risk-based audits of holding companies with foreign financial assets conducted by the Danish tax authority. The first column assumes that the audits are quasi-random, thus providing an upper bound for the amount of non-compliance. The second and third columns estimate audit probabilities based on the size of the foreign account balance (col. 2) and additional variables (col. 3). See Appendix B for complete details. Sources: authors' computations.