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Enforcing Taxes on Cryptocurrencies

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Enforcing Taxes on Cryptocurrencies:

Limits to Taxation in the Digitalized Economy*

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Abstract

Digitalization challenges tax collection by allowing economic activity to move beyond the reach of domestic enforcement. We study this challenge in the cryptocurrency market by exploiting the introduction of domestic third-party reporting, a cornerstone of modern tax enforcement. Combining micro data on crypto transactions, tax returns, and cross-border bank transfers from Denmark, we document pervasive crypto tax noncompliance. Third-party reporting modestly increases self-reported income while simultaneously inducing a shift in activity beyond the regulatory reach of domestic tax authorities. This flight to opacity limits the effectiveness of unilateral tax enforcement and highlights the need for international coordination.

Keywords: Digitalization, Cryptocurrencies, Tax compliance, Tax enforcement

JEL codes: D31, H24, H26, H31, K34

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As economic activity becomes increasingly digital, a growing share of income is generated in markets that transcend national borders. This creates new challenges for tax enforcement, since it becomes easier to shift activity beyond the reach of domestic tax authorities. We study these challenges in the context of cryptocurrencies (hereafter crypto), an emerging digital capital market. Since Bitcoin's introduction in 2009, cryptos have grown from a niche technology to a multi-trillion-dollar asset class, with transactions often mediated by digital exchanges operating across jurisdictions.

Modern tax enforcement relies heavily on third-party information reporting by domestic employers and financial institutions to verify self-reported income and ensure large-scale tax compliance (see, e.g., Kleven et al. 2011, Pomeranz 2015, Naritomi 2019, Jensen 2022). However, when economic activity moves seamlessly across borders, taxpayers can endogenously choose whether their activity is subject to domestic reporting regimes. Understanding the extent of tax noncompliance that emerges in such environments, and whether third-party reporting remains effective when exposure to reporting is endogenous, is therefore critical for designing tax policy in an increasingly digitalized economy.

We study these questions by exploiting the introduction of third-party reporting for crypto transactions in Denmark. In 2019, the Danish tax authorities mandated domestic crypto exchanges to share all customers' crypto transactions, generating a sharp and unanticipated increase in customers' detection probability. We combine micro data on crypto transactions, tax returns, and cross-border bank transfers to study how crypto investors respond to third-party reporting along two margins: a compliance margin – consistent with causal evidence from other settings with third-party reporting (Slemrod et al. (2017) and Johannesen et al. (2020)) – and an evasion margin, enabled by the endogenous exposure to third-party reporting.

In the first part of the paper, we document pervasive noncompliance in the crypto market. Linking third-party reported information on crypto transactions to tax returns, we show that more than 90% of crypto investors fail to report taxable income. Although noncompliance remains persistently high, compliance increases over time among a small group of high-volume investors. The resulting tax gap amounts to 1.4% of the total tax revenue from financial assets. Noncompliance is widespread across the wealth distribution, in contrast to traditional financial assets where evasion is concentrated among the wealthiest individuals and facilitated by offshore intermediaries in tax havens (Alstadsæter et al. 2019).

In the second part of the paper, we examine how crypto investors respond to the higher detection probability induced by third-party reporting. We begin by studying compliance responses using a difference-in-differences design that compares investors on domestic exchanges (treated), who are affected by the reform, to investors on foreign exchanges (control), who remain outside the reporting regime. We find that three years after the reform, treated investors increase their self-reported crypto gains by an amount corresponding to roughly one-fourth of total realized gains. Hence, domestic third-party reporting induces a meaningful compliance response, yet a substantial share of crypto income remains unreported.

To understand why noncompliance remains pervasive despite increased tax transparency, we turn to evasion responses. We find that investors on domestic exchanges – now subject to third-party reporting – shift trading activity toward foreign exchanges outside regulatory reach. Using cross-border bank transfers as a proxy for foreign exchange activity, we find a persistent reform-induced increase in foreign exchange activity among treated investors, corresponding to up to one-third of pre-reform domestic exchange activity. This pattern is consistent with a flight to opacity, whereby investors shift activity toward less transparent exchanges in response to strengthened (domestic) enforcement.

Our results highlight the limitations of unilateral tax enforcement for highly mobile digital assets and underscore the need for international coordination. In response to these challenges, the OECD has introduced a Crypto-Asset Reporting Framework (CARF), under which more than 75 countries have committed to exchanging information on crypto holdings and transactions starting in 2027 (OECD 2025). Our findings strongly support such multilateral initiatives, suggesting that domestic third-party reporting alone is insufficient to address compliance challenges in the digital economy.

This paper contributes to the extensive literature on third-party reporting (e.g., Kleven et al. 2011, Pomeranz 2015, Carrillo et al. 2017, Slemrod et al. 2017, Naritomi 2019, Johannesen et al. 2020, Jensen 2022, Boas et al. 2024) by studying its effectiveness in a setting with highly mobile digital assets. We show that the global nature of crypto markets makes exposure to third-party reporting regimes endogenous, limiting the effectiveness of unilateral enforcement.

More broadly, our findings speak to the large literature on digital economics by highlighting how digital innovations affect tax enforcement (see Goldfarb and Tucker (2019) and Chen and Volpe Martincus (2022) for reviews of the digital economics literature). Digitalization expands

investment through blockchain-based venture capital markets, popularizes activity in cross-border prediction markets such as Polymarket and Kalshi, and shifts economic activity toward online platforms that mediate retail sales and self-employment in the gig economy.[1] While these developments weaken unilateral tax enforcement, they also generate detailed data trails that can be used to improve tax transparency. Realizing these potential enforcement gains, however, requires cross-border coordination. Our paper takes a first step toward understanding tax enforcement in this increasingly digitalized world.

The paper also contributes to the emerging literature on tax compliance in crypto (Cong et al. 2023, Barake et al. 2024, Meling et al. 2026, Hoopes et al. 2026). Evidence on the extent of crypto tax noncompliance and its fiscal implications is scarce because crypto investors are difficult to identify (Baer et al. 2023). One notable exception is Meling et al. (2026), who document persistently high noncompliance rates among Norwegian crypto investors throughout 2018-2024, similar to the levels we find. Taken together, the evidence points to pervasive noncompliance in crypto markets despite increasing tax enforcement efforts. Our findings suggest that crypto tax noncompliance is not confined to a small group of sophisticated investors, but instead reflects a broader compliance challenge with meaningful fiscal consequences.

I. Context

Market adoption. The crypto market emerged with the first Bitcoin transaction in 2009 and has since expanded rapidly, giving rise to thousands of cryptos. The market capitalization of cryptos has grown from approximately $5 billion in 2014 to more than $4 trillion at its peak in 2025 (Forbes 2026). Adoption is widespread across both advanced and emerging economies: around 10% of households have held or currently hold crypto in the US, the UK, and Denmark, while participation reaches 20-30% in emerging economies such as the UAE and Vietnam (Skattestyrelsen 2021, Fearn and Saunders 2022, Baer et al. 2023, Weber et al. 2023).[2]

[1] See, e.g., Couture et al. (2021) and United Nations (2024) for studies of developments in digital platform markets, Aquilina et al. (2025) for a description of decentralized capital markets, Stanton and Thomas (2025) for a characterization of the gig economy, and Goodell Ugalde (2026) for an analysis of prediction market regulation.

[2] By comparison, 21% of American households directly own stocks (Federal Reserve 2023).

Transacting cryptocurrencies. Cryptos enable pseudonymous and decentralized financial transactions through blockchain technology, where transactions are validated by a distributed network without a central intermediary. In practice, however, most crypto trading takes place on centralized exchanges rather than through fully decentralized transactions. Centralized exchanges allow users to buy and sell crypto using fiat currency, providing easy access to the market. In Denmark, these exchanges are regulated by financial authorities and, since 2019, subject to know-your-customer requirements mandating customer identification. A survey conducted by the Danish tax authorities in 2021 shows that approximately 80% of crypto transactions take place on centralized exchanges (Skattestyrelsen 2021). The remaining 20% of transactions occur through decentralized methods, where buyers and sellers interact directly on the blockchain, either via decentralized exchanges that facilitate matching without handling funds or through informal networks.[3]

On 14 January 2019, the Danish tax authorities issued subpoenas to all domestic centralized exchanges, requiring them to provide detailed information on customer transactions for the period from 1 January 2016 to 31 December 2018. A second request was issued in May 2022 covering transactions from 1 January 2019 to 31 December 2021. While centralized exchanges facilitate crypto use both for payments and speculative investments, this paper focuses on the taxation of income from the latter.

Shifting between exchanges. Cryptos can easily be transferred between exchanges due to their global and digital nature. Exchanges operate online, allowing users to open accounts and move funds with minimal friction. Moreover, many foreign exchanges offer services in multiple languages and support a wide range of payment methods, facilitating shifting between exchanges. Investors can transfer funds between exchanges in two main ways. First, they can liquidate their crypto holdings, transfer the proceeds in fiat currency to their primary bank account, and subsequently fund a new exchange account via bank transfer or card payment. Second, they can transfer cryptos directly between exchanges using blockchain transactions, by moving funds from a wallet associated with one exchange to a wallet on another exchange. Regardless of the transfer method, converting crypto holdings into fiat currency for consumption typically involves transferring funds back to a bank account or the use of exchange-linked

[3]This is broadly consistent with global estimates, suggesting that approximately 86% of transactions occur on centralized exchanges and 14% through decentralized channels in 2025 (Coingecko 2026).

cards. As a result, transactions between the conventional banking sector and crypto exchanges often generate bank transfers that are observable to the Danish tax authorities.

II. Data

We use microdata from the following three sources:

(i) All crypto transactions from the only three Danish crypto exchanges from 2016 to 2021, retrieved by the Danish tax authorities in 2019 and again in 2022. The dataset covers all 28,334 customers on these exchanges and contains detailed transaction-level information (wallet address, sales, purchases, prices, crypto type, transaction date, and fees) along with customer information (name, birth date, home address, and taxpayer identification number (TIN) when available). The Danish tax authorities use this information to target audits towards likely noncompliant taxpayers. We construct measures of crypto income and wealth applying the First-In-First-Out (FIFO) principle to individual transaction histories, following Meling et al. (2026). Because transactions are observed only on Danish exchanges between 2016 and 2021, these measures should be interpreted as approximations of true crypto income and wealth. Appendix A provides further details.

(ii) Individual tax returns for all taxpayers in Denmark from 2013 to 2021, including information on 1) demographics, 2) taxable income covering all fields on the tax return, and 3) wealth records from third parties decomposed into types of wealth. Crypto income must be declared in residual tax return fields that also contain other types of income.[4] We discuss the implications of this in Appendix B. Danish wealth data have previously been used to study the distribution of offshore wealth and tax evasion (Alstadsæter et al. 2019, Boas et al. 2024). We follow Boas et al. (2024) to construct a household-level wealth measure and rank households by their total net wealth.

(iii) All transaction-level cross-border bank transfers processed by the five largest banks in Denmark from 2005 to 2022, including information on transfer amounts, dates, foreign banks, foreign account numbers, foreign account holders, and sender-provided transfer

[4]For example, crypto gains are reported in the same field as income from rental services, taxable scholarships, and taxable employee benefits, while crypto losses are reported alongside deductible expenses for work-related courses, IT equipment, and professional literature.

messages. Since November 2020, the Danish tax authorities have screened these transfers using a predefined list of keywords and account numbers known to be associated with crypto and foreign crypto exchanges.[5] The resulting sample of crypto-related bank transfers is used to target audits of taxpayers likely to invest in crypto through foreign exchanges.[6] Cross-border bank transfer data from Denmark and Norway have been used in previous studies to study compliance responses to enforcement initiatives on offshore wealth (Alstadsæter et al. 2022, Alstadsæter et al. 2023, and Boas et al. 2024).

We link the three main datasets using matched TINs and retain investors with a matching score above 0.5.[7] This leaves us with a sample of crypto investors using either Danish or foreign exchanges, along with detailed information on income and wealth. Table 1 presents summary statistics for the population of Danish taxpayers as well as for crypto investors on Danish and foreign exchanges. Crypto investors are on average younger and primarily male compared to the full population. They are also more likely to hold stocks and have higher income, but lower net wealth, primarily driven by lower pension wealth and higher levels of debt. Their crypto wealth amounts to roughly 10% of total financial assets. These patterns align with other studies investigating characteristics of crypto investors (e.g., Hasso et al. 2019, Hackethal et al. 2021, Weber et al. 2023, and Kogan et al. 2024).

Crypto investors on Danish and foreign exchanges are generally comparable, with very similar income and wealth compositions, although investors on foreign exchanges are slightly younger and hold somewhat more net wealth, largely coming from higher stock ownership.

III. Crypto Tax Noncompliance

In this section, we quantify crypto tax noncompliance by linking transaction data on Danish crypto exchanges to individual tax returns. We show how noncompliance varies across the wealth distribution and by investment volume. Lastly, we estimate the tax gap for the population of Danish crypto investors to assess the fiscal importance of tax noncompliance.

[5] The list cannot be disclosed for confidentiality reasons.

[6] Appendix Figure A.2 shows that variation in the number of individuals making crypto-related bank transfers tracks movements in the Bitcoin price, suggesting that such transfers provide a valid proxy for activity on foreign exchanges.

[7] Appendix C provides details on TIN matching and the linkage between exchange data and tax returns.

Table 1: Summary statistics for the full population of taxpayers and crypto investors on Danish and foreign exchanges

		Crypto investors	
	Full Population	Danish Exchanges	Foreign Exchanges
	(1)	(2)	(3)
Panel A: Demographics			
Age (years)	47	37	33
Male	50%	88%	88%
Panel B: Wealth			
Net wealth ($)	133,046	74,162	83,498
Financial assets ($)	23,920	19,223	25,675
Pension wealth ($)	96,265	65,438	65,854
Housing ($)	71,359	73,366	75,860
Debt ($)	59,968	84,578	82,403
Crypto ($)	-	2,107	-
Stock ownership	24%	29%	35%
Panel C: Income			
Net total income ($ per year)	32,931	40,936	41,385
Labor income ($ per year)	27,012	40,997	41,747
Crypto gains ($ per year)	-	1,528	-
Crypto losses ($ per year)	-	675	-
Number of individuals	5,392,498	13,873	19,716
Number of individual-year observations	15,365,912	41,298	57,940

Notes: Crypto investors on Danish exchanges are identified using the transaction data from Danish exchanges. Crypto investors on foreign exchanges are identified using the sample of crypto-related cross-border bank transfers. Net wealth is defined as the sum of financial assets (securities and bank deposits), pension wealth, and housing wealth, net of total debt, and excludes crypto wealth. Pension wealth is estimated based on income and age following Jakobsen et al. (2020). Housing wealth includes all privately held real estate. Debt comprises bank, mortgage, and public debt. Stock ownership is defined as directly holding listed shares. Net total income includes labor income, pensions, and capital income, net of interest expenses, and excludes crypto gains and losses. Crypto wealth as well as gains and losses on Danish exchanges are calculated using the approach described in Appendix A and reported as averages conditional on observing crypto wealth or income. All monetary variables are winsorized at the 95th percentile by year. The statistics are based on pooled data from pre-reform years 2016 to 2018. Monetary values are converted from DKK to USD using the average exchange rate over 2016 to 2018 (1 DKK = 0.153 USD).

A. Noncompliance rates

Research design. Ideally, we would estimate tax noncompliance by comparing realized and self-reported crypto income. However, we only observe an approximation of realized income as our transaction data are incomplete. To construct a measure of noncompliance that is robust to this limitation, we take a conservative approach and exploit that we observe all crypto sales on Danish exchanges and that each sale generates either a gain or a loss.[8] Since all gains and losses must be reported, we define a taxpayer as noncompliant if and only if they have

[8]Given the volatility of crypto markets, it is unlikely that sales occur exactly at purchase prices.

crypto sales but report neither a gain nor a loss. For such taxpayers, all observed crypto sales are classified as noncompliant. This allows us to construct measures of both the share of noncompliant investors and the share of noncompliant sales.

These measures should be interpreted as lower bounds on noncompliance for two reasons. First, taxpayers are classified as compliant as long as they report non-zero gains or losses, even if reported amounts understate true realized income. Second, we treat all income reported in the residual fields as crypto income; to the extent that these fields include other income sources, some noncompliant taxpayers will be misclassified as compliant. To assess the robustness of this conservative approach, we estimate noncompliance based on estimated realized gains and losses instead and present the results in Appendix Figure A.5. The results are similar to those obtained using our baseline measure.

Results. Panel (a) of figure 1 shows that the share of noncompliant crypto investors exceeds 90% throughout 2017–2021.[9] This high noncompliance rate masks heterogeneity across investors, as illustrated in panel (b). The overall share of noncompliant sales (black line) remains between 80 and 90% until 2019, before declining to 69% by 2021. This decline is driven by investors with the top 10% largest annual sales (red dotted line). For these high-volume investors, the noncompliance rate falls to 55% in 2021, whereas the bottom 90% (blue dashed line) exhibit persistently high noncompliance rates of around 90% throughout the period. This pattern is consistent with the canonical Allingham and Sandmo (1972) framework in which tax evasion decisions depend on the perceived detection probability, the associated penalty, and tax incentives. To the extent that audit probability increases with transaction volume, high-volume investors face higher detection probabilities and larger expected penalties, and therefore exhibit higher compliance.

Crypto investment and noncompliance are widely distributed across the wealth distribution, as shown in panel (c). Conditional on investing, trading activity is substantial even among the bottom half of investors, with average annual sales of about DKK 20,000 (∼USD 3,000), compared to around DKK 50,000 (∼USD 7,600) for the wealthiest half of investors. The share of noncompliant investors remains close to 90% across all wealth groups. This contrasts sharply with traditional financial assets, which are highly concentrated among the wealthiest house-

[9] Appendix Figure A.5 shows similar patterns when realized gains and losses are analyzed separately.

holds and where access to tax evasion is often mediated by specialized intermediaries, such as private wealth managers facilitating offshore evasion (Alstadsæter et al. 2019). By comparison, the crypto market appears to combine widespread participation with broadly accessible evasion opportunities, suggesting both high demand for evasion and that the technology underlying crypto markets substantially lowers barriers to supplying it.

B. Tax gap

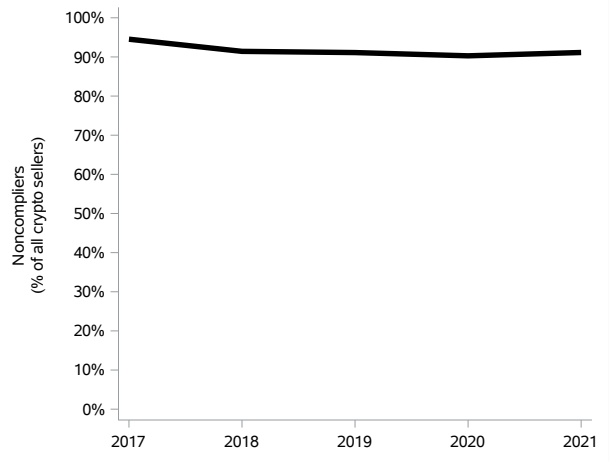
While the previous section documents widespread crypto noncompliance, its fiscal implications remain unclear. We address this by estimating the tax gap from unreported crypto income.

Research design. We focus on 2021, for which a survey of a representative sample of the Danish population provides an estimate of the number of active crypto investors in 2021 (Skattestyrelsen 2021). An estimated 9.3% of individuals either purchased or sold crypto in 2021, corresponding to 390,181 individuals. Appendix D provides further details. With this survey estimate in hand, we restrict attention to investors who purchased or sold crypto on Danish crypto exchanges in 2021, abstracting from earlier years (2016–2020). To estimate the tax gap, we rely on realized gains and losses constructed from transaction histories. Our sample consists of 2,401 crypto investors with purchases or sales on Danish exchanges in 2021 (86% with purchases and 14% with sales), generating DKK 7.6 million in realized gains and DKK 0.2 million in realized losses.

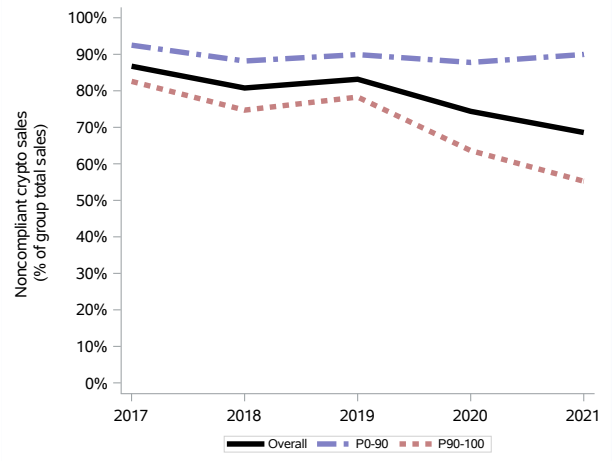
We define unreported crypto gains as realized gains on Danish exchanges that exceed self-reported crypto gains. Symmetrically, unreported losses are defined as realized losses on Danish exchanges that exceed self-reported losses. To translate unreported income into foregone tax revenue, we apply individual-specific marginal tax rates computed using a tax simulator that accounts for changes in progressivity and tax deductions when taxable crypto income changes. This yields a sample tax gap of DKK 2.6 million. We scale this estimate to the population of crypto investors using a factor of 162.5 (= 390,181/2,401).

Figure 1: Crypto Tax Noncompliance

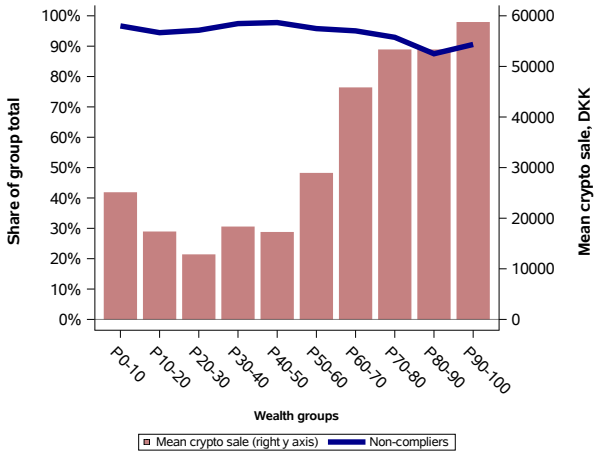
(a) Noncompliers



(b) Noncompliant Sales



(c) Noncompliers by wealth groups, 2017



Notes: Panel (a) shows the share of noncompliant crypto investors over time. Noncompliers are defined as investors who sold crypto on Danish exchanges but reported neither gains nor losses on their tax returns. Panel (b) shows noncompliant crypto investors' share of total crypto sales. The black line represents the overall noncompliant share of total crypto sales, and the blue and red lines show the shares for the bottom 90% and top 10% in the sales distribution, respectively. In 2017, investors in the bottom 90% sold on average DKK 15,533 of crypto, compared to DKK 193,210 among those in the top 10%. Panel (c) shows the share of noncompliant crypto investors by wealth deciles in the pre-reform year 2017 along with their average annual crypto sales. The wealth measure includes financial assets (securities and bank deposits), pension wealth, and housing wealth, net of total debt, and excludes crypto wealth. Crypto sales are winsorized at the 99th percentile. Appendix Figure A.3 presents results for panel (b) under alternative TIN matching thresholds. Appendix Figure A.4 compares noncompliance in 2017 with the post-reform period (2018–2021) across the wealth distribution.

Results. This approach yields an estimated population crypto tax gap of DKK 419 million in 2021.[10] It corresponds to 1.4% of total tax revenue from financial assets in Denmark. The

[10]The 95% confidence interval ranges from DKK 293 to 546 million.

tax gap is concentrated among high-volume investors: 55% of the tax gap is attributable to the top 10% of investors ranked by sales. This illustrates the challenge that tax authorities face: while a large share of the tax gap is driven by a relatively small group of investors – which can be targeted in audits – noncompliance remains widespread across the broader population. As a result, recovering a substantial share of the tax gap is likely to require expanding enforcement beyond a narrow set of high-volume investors.

The tax gap estimate should be interpreted with considerable caution. First, Danish exchanges account for only a limited share of total crypto investments, implying that the aggregate tax gap is extrapolated from a relatively small sample. It requires the assumption that investors on Danish exchanges in 2021 are representative of noncompliance and investment behavior in the broader population of crypto investors. This is a strong assumption, given that tax transparency is higher on Danish exchanges in 2021 and investors have self-selected into these exchanges despite third-party reporting. To the extent that investors on foreign exchanges are more noncompliant due to lower transparency after the reform, our estimate will understate the true tax gap. Second, our transaction data are incomplete, which may lead to both under- and overestimation of realized income.[11] Third, the tax return fields used to measure self-reported crypto income also include other income sources, implying that our estimate likely understates the true tax gap.

Despite these limitations, the estimate provides a helpful benchmark for assessing the fiscal importance of crypto tax noncompliance in an area where evidence remains extremely scarce (Baer et al. 2023). While the current revenue loss remains modest given the still limited size of the crypto market, persistently high noncompliance combined with rapid market growth highlights the importance of developing effective enforcement mechanisms before the challenge becomes more substantial.

IV. Behavioral responses to third-party reporting

In this section, we study behavioral responses to domestic third-party reporting. On the one hand, increased detection probability may induce investors to self-report more crypto income. On the other hand, investors may seek to avoid the reporting regime altogether by shifting

[11] See Appendix A for a detailed explanation.

activity to foreign exchanges that remain outside regulatory reach. We study both margins to assess whether third-party reporting increases compliance and whether such gains are partly offset by evasion through shifting activity abroad.

Identifying response margins with cross-border bank transfer data. To study these two margins, we compare behavior of investors on domestic exchanges to behavior of a comparable group that is not affected by the policy, namely investors trading on foreign exchanges. A key challenge is that activity on foreign exchanges is not directly observable – precisely the feature that makes them attractive for evasion. To overcome this, we exploit cross-border bank transfers to and from accounts associated with foreign crypto exchanges. While we do not observe crypto transactions themselves, these transfers provide a proxy for activity on foreign exchanges. This allows us to both identify investors with foreign exchange activity and track changes in their activity over time.

The bank transfer data identify 20,741 crypto investors making 73,368 crypto-related bank transfers to or from foreign exchanges between 2016Q2 and 2022Q4.[12]. Among these, 9,568 investors engage with foreign exchanges before the policy announcement in 2019Q1, including 8,733 investors trading exclusively on foreign exchanges and 835 investors trading on both foreign and Danish exchanges. Investors who trade exclusively on foreign exchanges before the reform serve as the control group in both the self-reporting and shifting analyses, as their activity remains beyond the reach of domestic third-party reporting.

A. Self-reporting

The results so far document pervasive crypto noncompliance along with increasing compliance among high-volume investors. In this section, we examine whether the introduction of third-party reporting contributed to this shift by studying self-reporting behavior.

Research design. We start from crypto investors trading on domestic exchanges before the introduction of third-party reporting in 2019. For these investors, the reform represents a discrete increase in transparency and, hence, in the detection probability. To identify the

[12]To avoid conflict with non-disclosure rules, we exclude all quarters with less than five transfers. As a result, all quarters before 2016Q2 are excluded.

effect of this transparency shock, we compare their self-reporting behavior to that of crypto investors trading on foreign exchanges who are not affected by the reform.

Our balanced sample consists of 9,903 investors trading on domestic exchanges (treated group) and 8,088 investors only trading on foreign exchanges (control group) in the pre-reform period (2013-2018).[13] We follow self-reported gains for these investors over the period 2013–2020.[14] We treat 2017 as the last pre-reform tax year. The reform was announced in January 2019 before the filing deadline for the 2018 tax year, and, therefore, investors may have adjusted reporting behavior already in their 2018 tax returns. We restrict the sample period to end in 2020, as the Danish tax authorities began using cross-border bank transfer data to audit investors trading on foreign exchanges in November 2020. From that point onward, the control group is also subject to increased enforcement, which would attenuate the estimated effects of domestic third-party reporting. While the 2020 estimates may also be affected by this change, we retain this year in the sample, as the control group had limited time to adjust their self-reporting behavior.

We compare changes in self-reported crypto income using the following event study difference-in-differences specification:

$$\frac{y_{i,t} - \bar{y}_{x,2017}}{\bar{y}_{x,2017}} = \alpha_i + \gamma_t + \beta_t D_i + \epsilon_{i,t,x}, \tag{1}$$

where $y_{i,t}$ denotes self-reported crypto income for individual i in year t, α_i and γ_t capture individual and year fixed effects, and D_i is 1 if the crypto investor has traded on a domestic exchange before the reform and 0 otherwise. The outcome is expressed as a percentage deviation from group-specific ($x \in \{\text{treated,control}\}$) baseline self-reported crypto income in 2017.[15] The coefficients β_t measure the difference in percentage changes in self-reported income between treated and control investors in year t, relative to their pre-reform baseline levels.

Under the identifying assumption of parallel trends, β_t capture the causal effect of third-party reporting on self-reported crypto income. Treatment is defined based on pre-reform

[13]The difference between the sample sizes of 8,088 and 8,733 arises from restricting the sample to investors who are fully taxable throughout the whole period. Appendix Table A.2 reports more details on the treatment sample.

[14]To avoid conflict with non-disclosure rules, we start the estimation period in 2013 because fewer than five individuals self-report crypto income before that.

[15]We apply this normalization to capture proportional changes and accommodate zeros in the dependent variable following Boas et al. 2024.

exchange use rather than contemporaneous investment activity. As investors may not realize crypto income in every period, the estimates should be interpreted as intention-to-treat effects, capturing average changes in self-reporting among all investors exposed to the transparency shock.

Results. Figure 2 provides evidence on changes in self-reporting behavior. Panel (a) shows the evolution of self-reported crypto gains for investors on domestic and foreign exchanges, normalized to 100 in 2017. Before 2017, self-reported crypto gains were negligible, but reporting increased markedly during the 2017 crypto boom. Following the introduction of third-party reporting in 2019, reporting behavior diverges: investors trading on domestic exchanges exhibit a relative increase in self-reported gains compared to investors trading on foreign exchanges.

Panel (b) presents the corresponding difference-in-differences estimates. The estimates are close to zero and statistically insignificant before the reform, supporting the parallel trends assumption. Starting in 2018, the estimates increase gradually and become statistically significant by 2020, where investors on domestic exchanges report 104% more crypto gains than investors on foreign exchanges relative to 2017. The gradual increase suggests a delayed response to the introduction of third-party reporting. One interpretation is that compliance effects materialize over time as awareness of the reform and its enforcement implications spreads among investors. Turning to losses, Appendix Figure A.6 shows that investors on domestic exchanges report fewer losses relative to those on foreign exchanges after the reform, consistent with reduced noncompliance in deduction claims under greater tax transparency. Appendix Tables A.3 and A.4 present robustness checks based on alternative matching thresholds for linking investors to TINs, and including non-fully taxable individuals. The results remain qualitatively unchanged across these specifications.

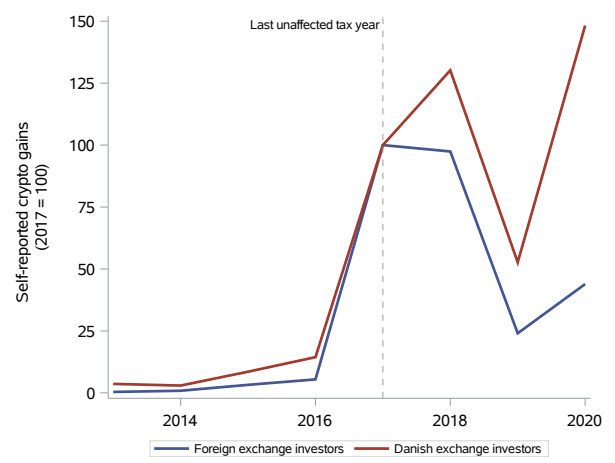
Despite the large relative effect of 104%, the increase masks a low baseline level of reporting. In 2017, investors on Danish exchanges reported crypto gains of DKK 10.2 million (∼USD 1.44 million), implying that third-party reporting increased annual reported gains by DKK 10.6 million ($= 10.2 \times 1.04$) three years after the reform.

To gauge the economic significance of this response, we compare it to a benchmark of total realized gains among the treated investors. Because investors may shift activity to opaque foreign exchanges following the reform, total realized gains are not directly observable. In-

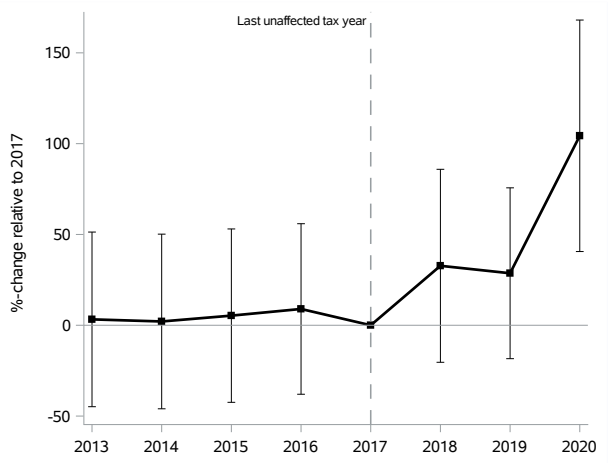
stead, we construct a counterfactual based on the reporting behavior of the control group. As shown in Appendix Table A.3, self-reported gains among control investors declined by 56.1% between 2017 and 2020. Applying this decline to the treated group's 2017 reporting level yields counterfactual reported gains of DKK 4.48 million ($= 10.2 \times (1 - 0.561)$) in the absence of the reform. Assuming that the compliance rate would have remained at its 2017 level of 11.2%, as shown in Appendix Figure A.5, these counterfactual reported gains correspond to total realized crypto gains of DKK 40 million ($= 4.48/0.112$) among treated investors in 2020. Under this assumption, the reform-induced increase in reporting of DKK 10.6 million corresponds to 26.5% ($= 10.6/40$) of total realized gains. While economically meaningful, the estimate also suggests that a substantial share of crypto income continues to go unreported.

Figure 2: Self-reporting response to domestic third-party reporting

(a) Self-reported crypto gains



(b) Self-reported crypto gains, DiD estimates



Notes: Panel (a) reports self-reported crypto gains for investors on domestic exchanges (red line) and foreign exchanges (blue line), normalized to 100 in 2017, the last tax year unaffected by the policy. In 2017, investors on domestic exchanges reported a total of DKK 10.2 million in crypto gains, compared to DKK 30.0 million for investors on foreign exchanges. Panel (b) reports the corresponding difference-in-differences estimates from regression (1). 95% confidence intervals (vertical error bars) are based on robust standard errors clustered at the individual level. Self-reported gains and losses are measured before any enforcement interventions (audits or compliance letters) and are winsorized at the 99.9th percentile.

B. Shifting investment activity to foreign crypto exchanges

A key feature of the crypto market is that investors can choose among exchanges with different exposures to tax transparency. Increased transparency on domestic exchanges may therefore induce investors to shift activity toward foreign exchanges that remain outside the

reporting regime to sustain noncompliance. In this section, we study this evasion response to domestic third-party reporting.

Research design. To identify the shifting effect, we restrict the estimation sample to investors who have activity on foreign exchanges before the policy announcement in 2019Q1, defined as having at least one crypto-related cross-border bank transfer. This restriction allows us to test for parallel trends before the policy announcement. Within this sample, we compare investors who also traded on domestic exchanges before the reform (treated group) to those who exclusively traded on foreign exchanges (control group). We aggregate on the quarterly level, and the resulting balanced sample consists of 835 treated investors and 8,733 control investors.

We estimate changes in foreign exchange activity using the following event study difference-in-differences specification:

$$\frac{y_{i,q} - \bar{y}_{x,2018Q4}}{\bar{y}_{x,2018Q4}} = \alpha_i + \gamma_q + \beta_q D_i + \epsilon_{i,q,x}, \tag{2}$$

where $y_{i,q}$ is an indicator of activity on foreign exchanges for individual i in quarter q, α_i and γ_q are individual and quarter fixed effects, and D_i indicates pre-reform investing on domestic exchanges. The outcome is expressed as a percentage deviation from group-specific ($x \in$ {treated,control}) baseline propensities to make crypto-related bank transfers in 2018Q4.[16] The coefficients β_q measure the difference in percentage changes in propensities to make crypto-related bank transfers between treated and control investors in quarter q, relative to their pre-reform baseline levels.

We focus on the extensive margin of foreign exchange activity, as cross-border bank transfers provide only a proxy for trading on foreign exchanges. In particular, the size of transfers need not reflect the underlying investment activity, making the intensive margin difficult to interpret. In addition, the decision to shift activity from Danish to foreign exchanges in response to a transparency shock is inherently discrete, making the extensive margin the relevant dimension to study.

To summarize the average post-reform effect, we also estimate a collapsed difference-in-

[16]We apply this normalization to capture proportional changes and accommodate zeros in the dependent variable following Boas et al. 2024.

differences specification that replaces the full set of quarter indicators with a single post-reform indicator:

$$\frac{y_{i,q} - \bar{y}_{x,2018Q4}}{\bar{y}_{x,2018Q4}} = \alpha_i + \lambda \text{Post}_q + \delta(D_i \times \text{Post}_q) + \epsilon_{i,q,x}, \tag{3}$$

where Post_q is an indicator for the post-reform period. The coefficient δ captures the average change in quarterly foreign exchange activity for treated investors relative to control investors after the reform.

Results. Figure 3 presents our results on shifting into opaque foreign exchanges following domestic third-party reporting. Panel (a) shows the evolution of the propensity to make a crypto-related bank transfer each quarter for treated versus control investors relative to the quarter before the policy announcement, 2018Q4. The large jump in activity at the end of 2017 and the beginning of 2018 reflects the surge in global interest in crypto during this period. Despite the volatile pre-reform period, the treatment and control groups evolve in parallel until the announcement, whereafter they immediately start diverging.

Panel (b) plots the corresponding difference-in-differences estimates from equation 2. The estimates are close to zero and statistically insignificant before the reform, supporting the parallel trends assumption. The estimates become positive and statistically significant two quarters after the policy announcement and stay significantly higher during the post-reform period, indicating a permanent shift in activity towards foreign exchanges.[17] The immediate reaction to domestic third-party reporting contrasts with the gradual response we find for self-reporting. This suggests that taxpayers seeking to maintain secrecy react faster to changes in the enforcement environment.

Panel (c) column (1) summarizes the post-reform effects from specification (3). Treated investors are 45.8% more likely than the control group to engage in quarterly foreign exchange activity after the reform relative to the pre-reform baseline. Given a baseline probability of foreign exchange activity of 11.1%, this corresponds to an increase of 5.0 percentage points ($= 0.111 \times 0.458$). For comparison, Appendix Table A.2 shows that 15.3% of treated investors

[17] The spike in the estimates around 2021 reflects a post-reform decline in foreign exchange activity among the control group relative to its baseline level. Because the outcome is normalized by the baseline, this mechanically amplifies the estimated treatment effects even when the relative difference between treated and control groups remains unchanged. To illustrate this, Appendix Figure A.7 plots the ratio of the number of investors with crypto-related bank transfers in the treatment and control groups. The ratio is flat before the announcement, increases in the quarters immediately following the policy change, and then remains stable after the initial adaptation period.

were active on domestic exchanges in an average pre-reform quarter. Thus, the reform-induced increase in foreign exchange activity corresponds to 32.7% (= 0.050/0.153) of the share of investors who were active on domestic exchanges in an average quarter before the reform, indicating a substantial shift toward foreign exchanges. The results are robust to varying the TIN matching threshold and restricting the sample to fully taxable individuals, as shown in columns (2)–(4).

Because the treatment group is restricted to investors with pre-reform activity on both domestic and foreign exchanges, the estimates capture responses among investors with demonstrated access to foreign exchanges. For these investors, shifting activity across exchanges is likely less costly, implying that the estimated increase in foreign exchange activity may represent an upper bound on shifting behavior in the broader population.

To provide a lower bound, consider the extreme case in which only investors in the treatment group shift activity toward foreign exchanges following the reform. Appendix Table A.2 shows that the treatment group accounts for 11.3% (=(15.8+6.1 mill.)/(138.4+55.2 mill.)) of total pre-reform purchases and sales on domestic exchanges. In this extreme case, the reform-induced increase in foreign-exchange activity corresponds to 3.7% (= 0.113×0.327) of pre-reform domestic exchange activity. Taken together, these estimates suggest that the increase in foreign-exchange activity amounts to between 3.7% and 32.7% of pre-reform domestic exchange activity. Overall, the findings provide evidence of a flight to opacity, whereby increased domestic transparency induces investors to shift activity toward foreign exchanges that remain outside regulatory reach.

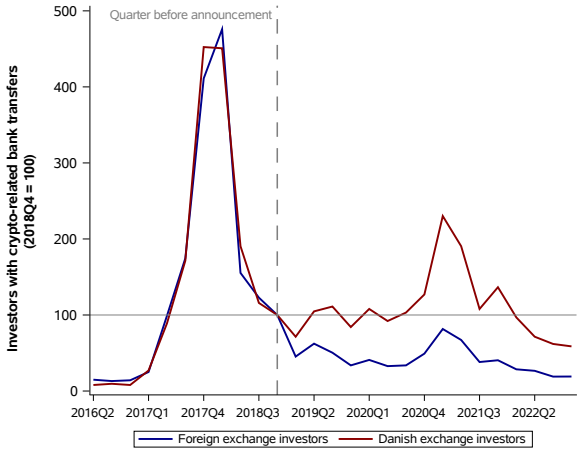
V. Discussion on policy design

As economic activity becomes increasingly digital and mobile, tax enforcement faces both new challenges and new opportunities. On the one hand, our findings highlight a key limitation of domestic third-party reporting in global digital asset markets: increased domestic transparency may shift, rather than eliminate, tax evasion. On the other hand, digital economic activity generates detailed data trails that can potentially expand the scope of third-party reporting and thereby improve tax evasion detection.

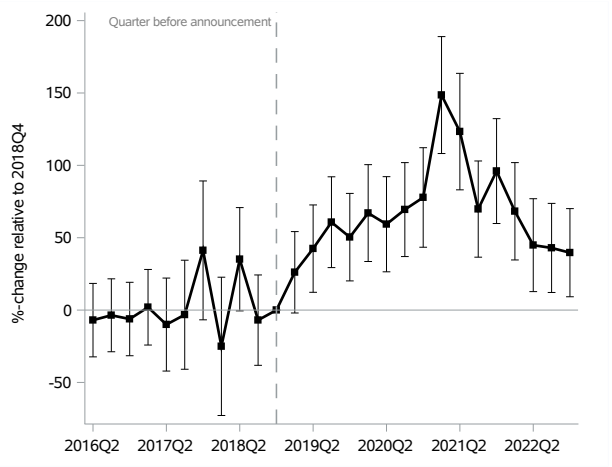
In response to these challenges and opportunities, the OECD has developed the Crypto-

Figure 3: Shifting response to domestic third-party reporting

(a) Activity on foreign exchanges



(b) Activity on foreign exchanges, DiD estimates



(c) Activity on foreign exchanges

	1(Activity on Foreign Exchanges)			
	(1)	(2)	(3)	(4)
δ	0.458	0.512	0.486	0.464
	(0.054)	(0.082)	(0.117)	(0.057)
λ	-0.714	-0.711	-0.709	-0.712
	(0.008)	(0.008)	(0.008)	(0.008)
Pre-reform treatment mean	0.111	0.113	0.109	0.109
Pre-reform control mean	0.152	0.152	0.152	0.151
Individuals	9,568	9,427	9,365	8,743
Observations	258,336	254,529	252,855	236,061
R^2	0.03	0.04	0.04	0.03
Robustness checks				
Match score ≥ 0.5	Yes	No	No	Yes
Match score ≥ 0.8	No	Yes	No	No
Match score $= 1$	No	No	Yes	No
Fully taxable	No	No	No	Yes

Notes: Activity on foreign exchanges is defined as a crypto investor making at least one bank transfer to or from foreign crypto exchanges in a given quarter. Panel (a) reports activity on foreign exchanges for investors on domestic exchanges (red line) and foreign exchanges (blue line), normalized to 100 in 2018Q4, the quarter before the policy announcement. Panel (b) reports the corresponding difference-in-differences estimates from regression (2). 95% confidence intervals (vertical error bars) are based on robust standard errors clustered at the individual level. Panel (c) summarizes the aggregate effect of domestic third-party reporting on foreign exchange activity. The outcome, **1**(Activity on Foreign Exchanges), is normalized by group-specific baseline propensities in 2018Q4. δ represents the difference-in-difference coefficient from specification (3). λ presents the post-reform change in quarterly activity for the control group. Column (1) shows the baseline results. Column (2) changes the TIN matching threshold to 0.8 instead of 0.5, column (3) changes it to 1, and column (4) excludes all individuals who are not fully taxable in all years.

Asset Reporting Framework (CARF), under which more than 75 countries have committed to require centralized crypto exchanges to identify foreign customers and automatically exchange transaction information with their home countries starting in 2027 (OECD 2025).[18] Our find-

[18]The eighth amendment of the EU Directive of Administrative Cooperation in Direct Taxation (DAC8) establishes a crypto reporting regime within the EU in accordance with CARF (European Commission 2026).

ings suggest that such multilateral reporting regimes have the potential to reduce the flight to opacity by harmonizing tax transparency across jurisdictions.

At the same time, important enforcement challenges are likely to remain. In particular, decentralized crypto transactions do not rely on intermediaries that can serve as third-party reporters. As a result, even a global reporting regime may leave parts of the crypto market opaque to tax authorities. As CARF is implemented and the crypto market adapts, understanding this residual evasion channel remains an important area for future research.

VI. Concluding remarks

We study the effectiveness of third-party reporting for tax enforcement in the highly digitalized crypto market. While third-party reporting induces a meaningful increase in tax compliance, it also generates a flight to opacity, as investors shift activity toward foreign exchanges outside regulatory reach. The features of the crypto market that give rise to the tax enforcement challenges and opportunities documented in this paper – global reach, cross-border mobility, and platform-based intermediation – are shared across the digital economy. Similar properties are behind platform-mediated retail sales (United Nations 2024), the gig economy (Stanton and Thomas 2025), prediction markets (Goodell Ugalde 2026), and blockchain-based venture capital markets (Aquilina et al. 2025). Our findings therefore speak more broadly to the design of tax systems in a digitalized economy, suggesting that effective tax enforcement will require international institutions that match the economy's increasingly global, mobile, and data-rich nature.

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Supplemental Appendix

A Crypto income and wealth calculation

Calculating crypto gains and losses. To construct measures of realized crypto gains and losses, we apply the first-in, first-out (FIFO) principle. Under FIFO, the earliest acquired units of a given cryptocurrency are assumed to be the first units sold. That is, each sale is matched to the oldest available purchase in the investor's transaction history. For each investor and each crypto asset, we order all purchases chronologically. When a sale occurs, the quantity sold is sequentially matched to the earliest remaining purchases, and the corresponding purchase prices are used to compute realized gains or losses. The realized gain on a transaction is defined as the difference between the sale price and the matched purchase price, multiplied by the quantity sold. For 8.7% of investors, sales exceed their observed purchases, which may occur if investors traded before 2016 or transferred crypto to Danish exchanges. For these investors, we assume zero realized crypto income. We subtract transaction fees and aggregate gains and losses within each year to obtain annual crypto income, which corresponds to the amounts taxpayers are required to report.

Our implementation relies on the assumption of complete transaction histories. In practice, this assumption may be violated if investors traded before 2016 or on foreign exchanges that are not observed in our data. Missing purchases or sales can therefore bias measured income. For example, if earlier purchases with higher prices or additional loss-making sales are unobserved, realized income will be overstated; conversely, if earlier purchases with lower prices or additional gain-making sales are unobserved, realized income will be understated.

Calculating crypto wealth. We use transaction histories on Danish exchanges to track purchases and sales over time and construct each investor's net crypto position at the end of each year. These positions are converted into Danish kroner using end-of-year exchange rates. For the 8.7% of investors with negative computed net positions (as discussed above), we assume that all crypto holdings have been liquidated and set crypto wealth to zero.

To the extent that investors have unobserved purchases before 2016 or on foreign exchanges, our measure understates true crypto wealth. Conversely, unobserved sales would lead to an overstatement of crypto wealth.

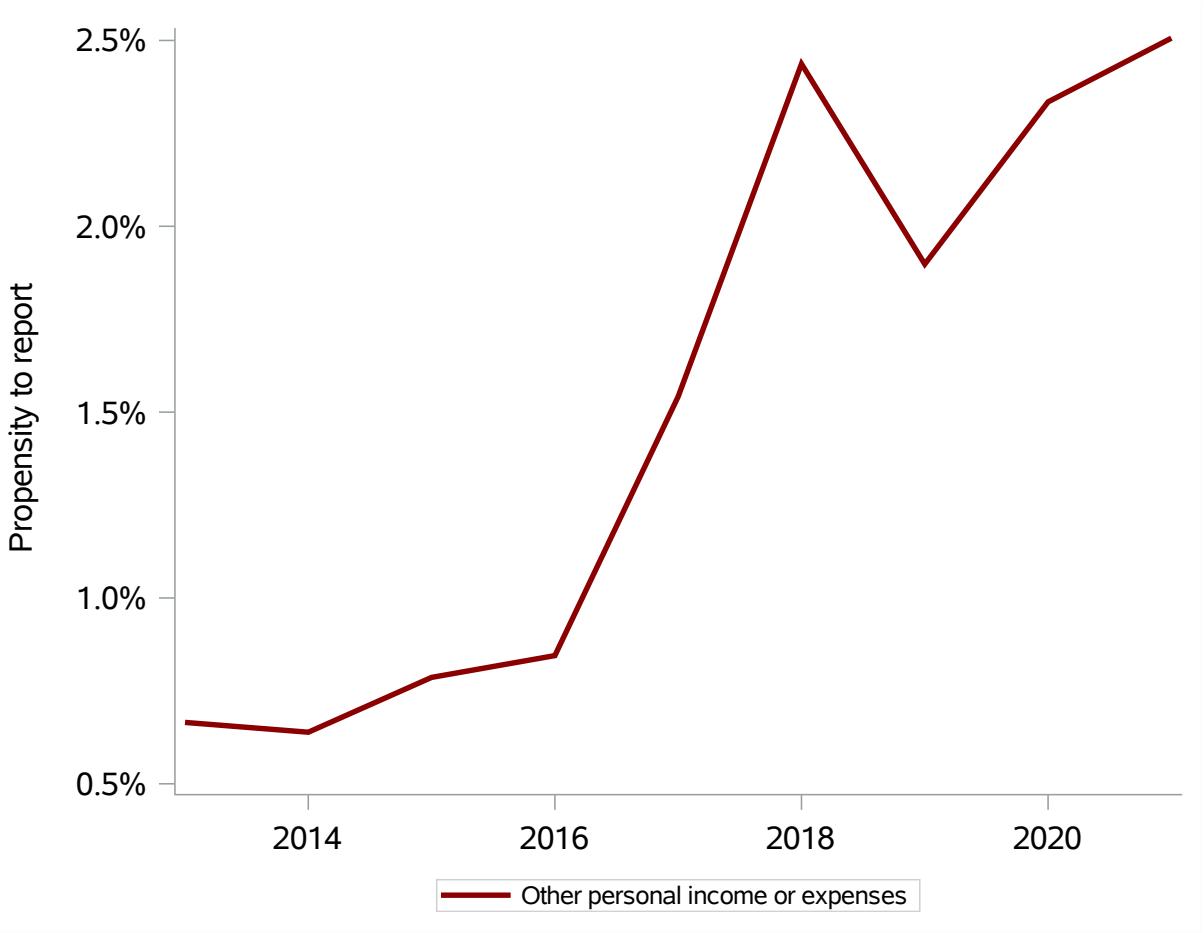
B Taxation and Self-Reporting Obligations

As a relatively new asset class with unique properties, there is still no consensus on how to regulate crypto income effectively. Countries have adopted various practices to incorporate crypto income into their tax systems. (Baer et al. 2023). In Denmark, crypto income is taxed under the personal income tax scheme, which includes salaries, self-employment income, and pension income. Crypto gains and losses are treated separately with asymmetric tax and deduction rates. Crypto gains are taxed at the marginal tax rate reaching up to 53%, while up to 26% of crypto losses can be deducted from the tax liability. Gains and losses must be calculated based on the first-in-first-out (FIFO) principle, which is detailed in Appendix A.

Crypto gains and losses must be self-reported in two residual tax return fields labeled "Other personal income" and "Other personal expenses". These fields are not specific to crypto and aggregate a variety of income types that do not fit into standard categories.[19] To assess whether these residual fields are primarily used to report crypto income among crypto investors, Appendix figure A.1 plots the share of individuals trading on Danish crypto exchanges who report income in these fields from 2013 to 2021. Usage of the fields is negligible before 2017 but increases sharply starting in 2017, coinciding with the first major expansion of the crypto market. This pattern suggests that, for the sample of crypto investors on Danish exchanges, the residual fields are predominantly used to report crypto-related income. We therefore interpret reported amounts in these fields as crypto gains and losses. To the extent that these fields also contain other types of income, our estimates of tax noncompliance should be interpreted as a lower bound.

[19] "Other personal income" must be reported in field 250 and includes, besides crypto gains, e.g., income from rental services, taxable scholarships, or taxable employee benefits. "Other personal expenses" must be reported in field 449 and includes, besides crypto losses, e.g., personal expenses to work-relevant courses, work-related IT equipment, or professional literature.

Figure A.1: Propensity to report other personal income or expenses on the tax return



Notes: The figure reports the share of crypto investors on Danish exchanges who self-report income in the tax return fields "other personal income" or "other personal expenses". The balanced sample includes all taxpayers with crypto purchases or sales on Danish exchanges in 2016–2021 and with a tax return filed in each year from 2013 through 2021.

C Linking crypto exchange data to tax returns

Data from Danish crypto exchanges were collected in 2019 for the period 2016–2018 and updated in 2022 for 2019–2021. During the first period, exchanges were not required to comply with know-your-customer (KYC) regulations and therefore did not systematically record taxpayer identification numbers (TINs). To link transaction data to tax returns, the tax authorities used fuzzy string matching based on names, dates of birth, and addresses to identify corresponding TINs in the population registry. This procedure resulted in a matching score for each crypto investor on the exchanges, which we require to be higher than 0.5 to reflect a match. In the second period (2019–2021), exchanges were subject to KYC regulations and required to record customers' TINs. As a result, the tax authorities directly used these identifiers to link exchange data to tax returns, eliminating the need for string matching.

Table A.1 summarizes the outcome of the matching procedure. Overall, 49.8% of exchange customers (14,104 customers) cannot be matched to a Danish taxpayer in the population registry, reflecting the presence of both firms and individuals in the data. Among unmatched individual transactions, 97.8% lack information on dates of birth, making it difficult to uniquely identify individuals through string matching. The remaining 2.2% lack name information, precluding any match. Among the matched investors, 542 do not have a tax return, resulting in a final sample of 13,755 individuals that can be linked to tax records.

Unmatched individuals tend to be less active, conducting fewer transactions (2.5 on average) than matched individuals (4.1), and involve smaller transaction amounts (average purchases of DKK 12,826 and sales of DKK 33,485). This pattern suggests that due diligence is less stringent for smaller customers.

Table A.1: Summary of transactions in Danish crypto exchanges, 2016-2021

	Number of Investors	Number of Transactions		Purchases, DKK		Sales, DKK	
		Sum	Mean	Sum	Mean	Sum	Mean
All crypto investors	**28,334**	**94,141**	**3.3**	**483,288,498**	**17,901**	**220,547,924**	**61,865**
No match to Danish individual	14,104	36,112	2.6	191,967,611	14,083	95,584,490	102,339
- Firms	86	583	6.8	18,056,492	250,784	65,179,755	250,6914
- Individuals	14,018	35,529	2.5	173,911,119	12,826	30,404,735	33,485
Match to Danish individual	14,230	58,029	4.1	291,320,886	21,794	124,963,435	47,497
- No tax return	542	2,141	4.0	14,643,241	29,345	4,033,749	42,912
Crypto investors with tax returns	**13,735**	**55,888**	**4.1**	**276,677,645**	**21,433**	**120,929,685**	**47,610**

Notes: This table summarizes crypto transactions on Danish exchanges over the period 2016–2021. A total of 14,104 customers cannot be linked to a Danish taxpayer identification number (TIN), consisting primarily of individuals in terms of count, but with firms accounting for a substantial share of transaction values. Firms are identified by the presence of a business registration number in the crypto exchange data. In contrast, 14,230 customers can be matched to a TIN, of whom 542 do not have a corresponding tax return. The final dataset includes 13,735 customers who can be linked to a Danish tax return. Average purchases and sales are calculated conditional on having purchases or sales, respectively. Monetary amounts are in Danish kroner (DKK).

D Survey on crypto investment behavior

In 2021, the Danish tax authorities commissioned the market research firm Advice and the statistical agency Userneeds to conduct an online survey on crypto investment behavior. The survey includes 4,942 respondents drawn from a panel representative of the Danish population between age 18 and 75 in terms of gender, age, and education. Responses were collected between October 13 and November 5, 2021 (Skattestyrelsen (2021)).

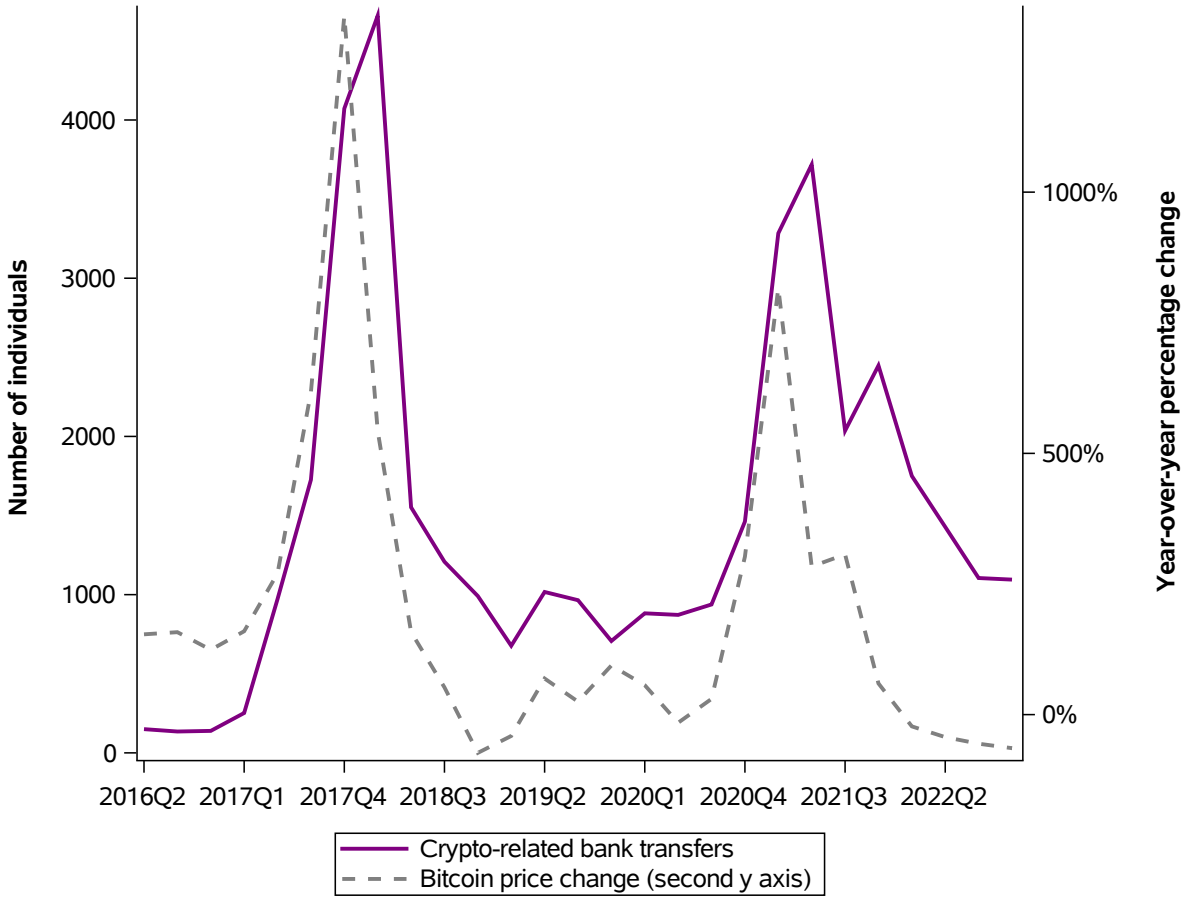
Using the survey to estimate the number of crypto traders in 2021. The survey asks respondents about their crypto investment activity through the question: "How long has it been since you traded cryptocurrency for the first time?" (in Danish: "Hvor længe er det siden, at du handlede kryptovaluta for første gang?"). Respondents choose among seven intervals: 1–4 weeks, 1–3 months, 3–6 months, 6–12 months, 1–2 years, 2–5 years, and more than 5 years.

We classify respondents selecting "1–4 weeks," "1–3 months," "3–6 months," or "6–12 months" as purchasing or selling crypto in 2021. This definition may both overstate and understate the true number of crypto investors active in 2021. On the one hand, the question refers to the timing of the first crypto trade. Investors who entered the market prior to 2021 but continued trading in 2021 are therefore not captured, leading to an understatement. Additionally, because the survey was conducted in October–November 2021, trading activity in the final months of the year is not observed, which further contributes to understatement. On the other hand, respondents reporting their first trade occurred up to 12 months before the survey date may include transactions from late 2020. This will lead to an overstatement of the number of crypto investors trading in 2021.

With this approach, we classify 458 respondents as either purchasing or selling crypto in 2021, which corresponds to 9.3% of the survey sample. There are 4,210,211 individuals in Denmark between age 18 and 75, which implies an estimated 390,181 ($9.3\% \times 4,210,211$) individuals either purchased or sold crypto in 2021.

E Appendix Tables and Figures

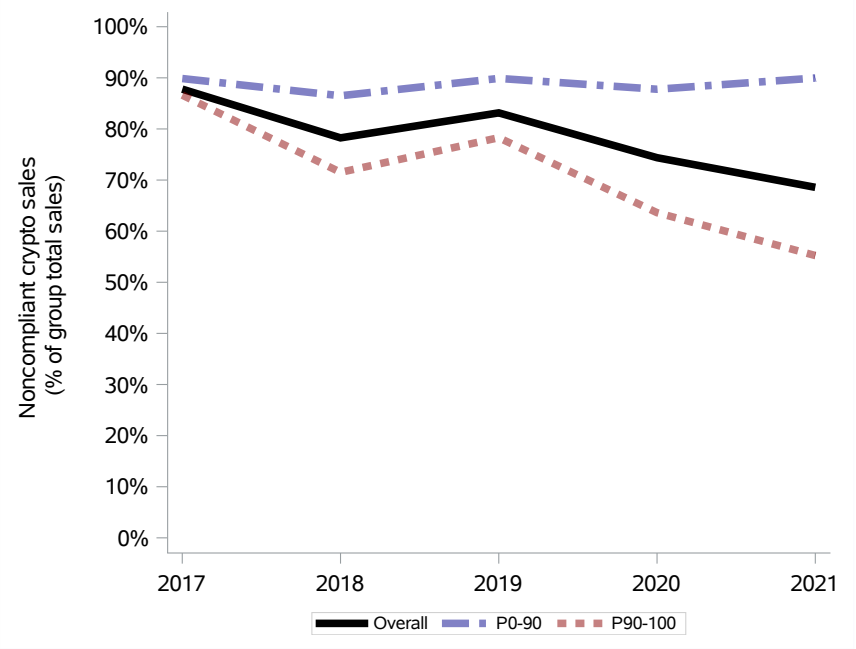
Figure A.2: Number of individuals with bank transfers to or from foreign crypto exchanges and the Bitcoin price change



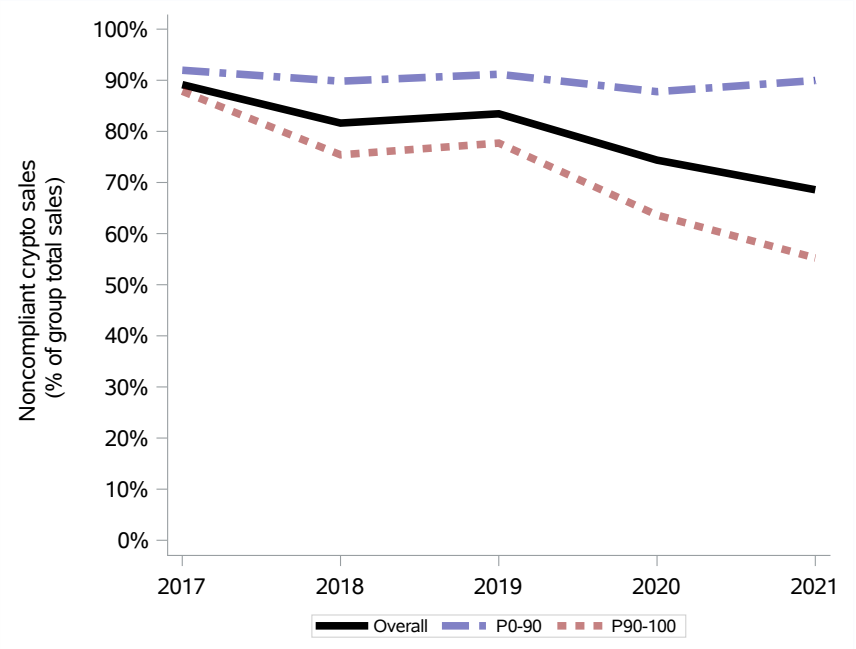
Notes: The figure presents the number of individuals who either transfer funds to or from foreign exchanges (purple line) along with the year-over-year percentage change in the Bitcoin price (dashed line).

Figure A.3: Crypto Tax Noncompliance, different matching score thresholds

(a) Noncompliant Sales, matching score >= 0.8



(b) Noncompliant Sales, matching score = 1



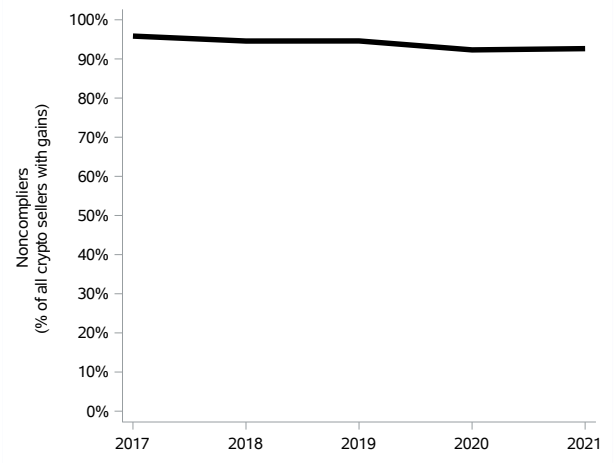
Notes: Panel (a) shows noncompliant crypto investors' share of total crypto sales for investors matched to a TIN if a match score is 0.8 or higher. The black line represents the overall noncompliant share of total crypto sales, and the blue and red lines show the shares for the bottom 90% and top 10% in the sales distribution, respectively. Panel (b) shows noncompliant crypto investors' share of total crypto sales for investors matched to a TIN if a match score is 1. See Appendix C for a description of the matching procedure.

Figure A.4: Noncompliers by wealth groups, 2017 and 2018-2021

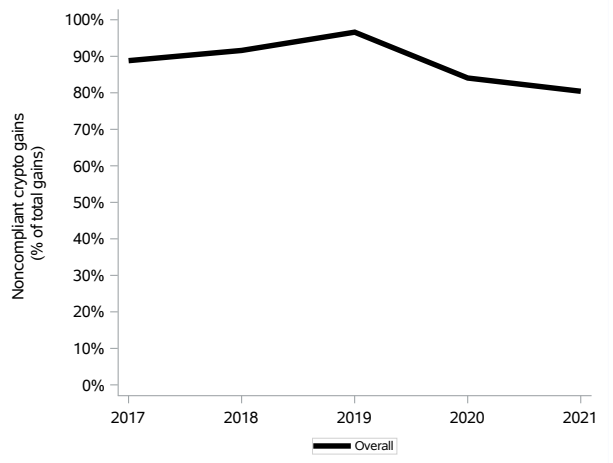
Notes: The figure shows the share of noncompliant crypto investors by wealth deciles in the pre-reform tax year 2017 (blue line: same as figure 1 panel (c)) and in the pooled post-reform tax years 2018-2021 (red line). The bottom 50% of the wealth distribution exhibit similar noncompliance rates for the two periods, whereas the top 50% are more compliant in 2018-2021, although noncompliance is still above 80% in all wealth groups.

Figure A.5: Crypto Tax Noncompliance, Gains and Losses

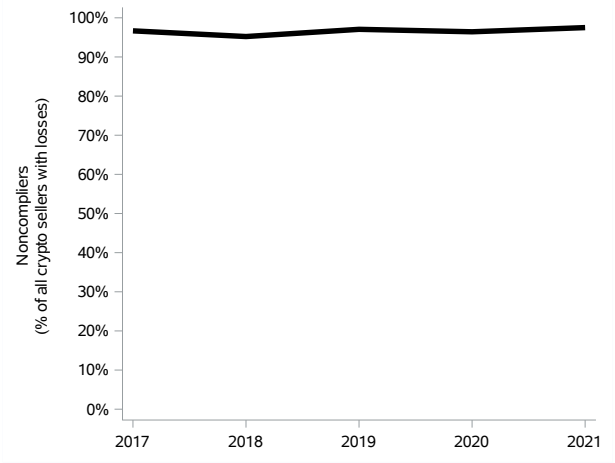
(a) Noncompliers with realized gains



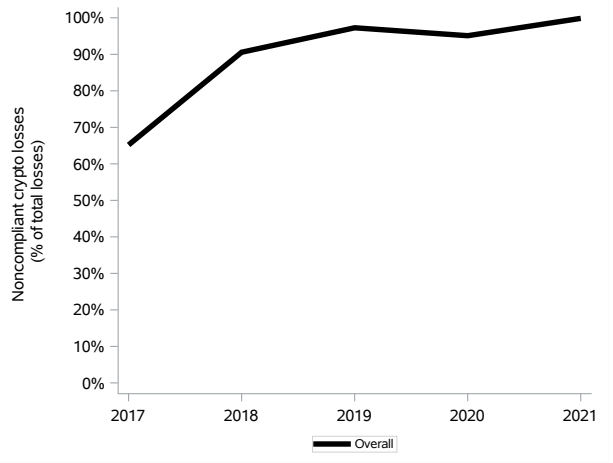
(b) Noncompliant realized gains



(c) Noncompliers with realized losses



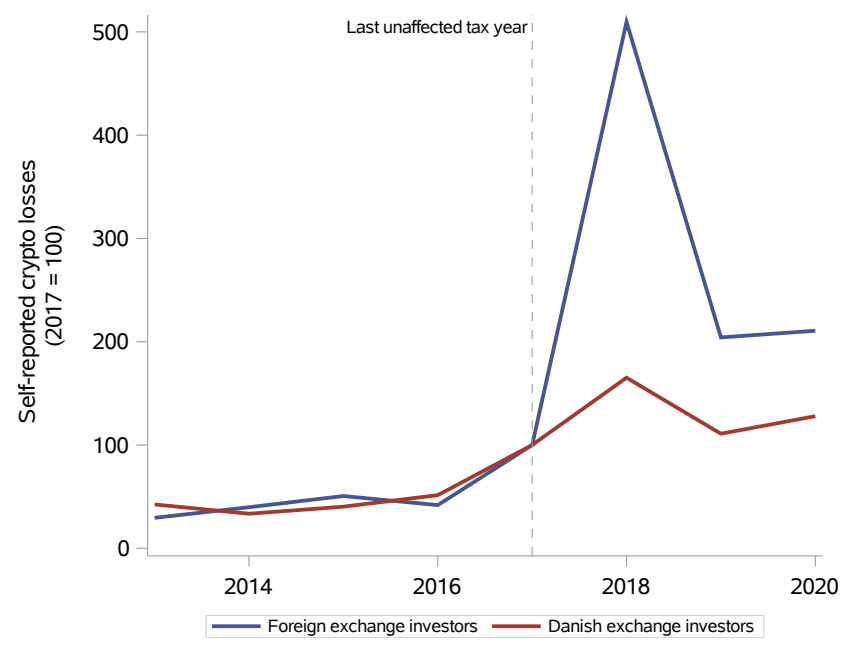
(d) Noncompliant realized losses



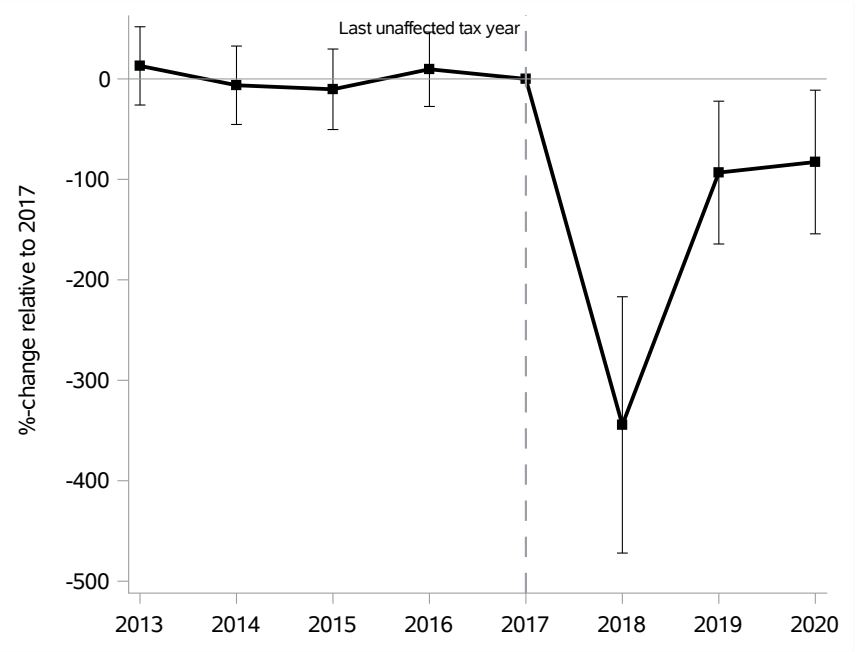
Notes: Panel (a) shows the share of noncompliant crypto investors with realized gains over time. Noncompliers are defined as investors who realized a gain on Danish exchanges but reported zero gains on their tax returns. Panel (b) shows noncompliant crypto gains as a share of total realized gains, where noncompliant gains are defined as realized gains on Danish exchanges that exceed self-reported gains. Unlike Figure 1, the analysis is not split by trading volume because the number of observations is too small. Panel (c) shows the share of noncompliant crypto investors with realized losses over time. Noncompliers are defined as investors who realized a loss on Danish exchanges but reported zero losses on their tax returns. (d) shows noncompliant crypto losses as a share of total realized losses, where noncompliant losses are defined as realized losses on Danish exchanges that exceed self-reported losses.

Figure A.6: Self-reporting response to domestic third-party reporting

(a) Self-reported crypto losses

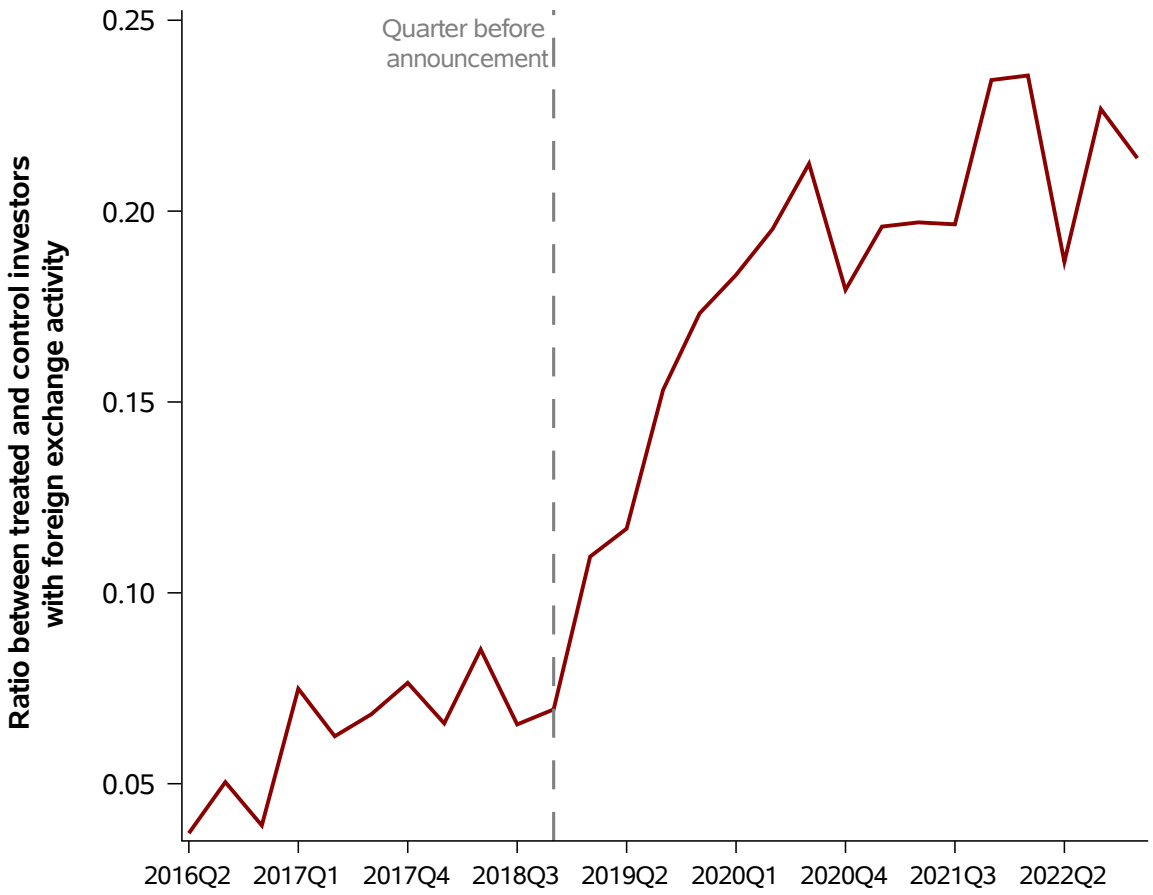


(b) Self-reported crypto losses, DiD estimates



Notes: Panel (a) reports self-reported crypto losses for investors on Danish exchanges (red line) and foreign exchanges (blue line), normalized to 100 in 2017, the last tax year unaffected by the policy. In 2017, investors on Danish exchanges reported a total of DKK 1.9 million in crypto losses, compared to DKK 2 million for investors on foreign exchanges. Panel (b) reports the corresponding difference-in-differences estimates from regression (1). 95% confidence intervals (vertical error bars) are based on robust standard errors clustered at the individual level. Self-reported losses are measured prior to any enforcement interventions (audits or compliance letters) and are winsorized at the 99.9th percentile.

Figure A.7: Ratio of treated investors relative to control investors with foreign exchange activity



Notes: The figure presents the ratio of the number of treated investors with foreign exchange activity to the number of control investors with foreign exchange activity. Activity on foreign exchanges is defined as a crypto investor making at least one bank transfer to or from foreign crypto exchanges in a given quarter. In the quarter before the policy announcement, 2018Q4, 63 treated investors versus 907 control investors had foreign exchange activity. In the last quarter of our sample period, 2022Q4, 37 treated investors versus 173 control investors had foreign exchange activity.

Table A.2: Sample selection for investors on Danish exchanges

	Number of Investors	Average quarterly activity	Purchases, DKK		Sales, DKK	
			Sum	Mean	Sum	Mean
Full period (2016-2021)						
Match to Danish individual	14,230	7.1%	291,320,886	21,794	124,963,435	47,497
Pre-reform period (2016-2018)						
Match to Danish individual	10,815	12.4%	138,439,149	13,109	55,171,038	41,987
- Treatment sample for self-reporting analysis	9,903	13.4%	125,033,239	12,943	52,148,640	42,570
- Treatment sample for shifting analysis	835	15.3%	15,813,148	19,866	6,131,570	42,878

Notes: This table summarizes the sample selection for the different estimation samples. Of the 14,230 crypto investors on Danish exchanges who can be matched to a Danish taxpayer identification number (TIN), 10,815 are active in the pre-reform period before 2019. For the self-reporting analysis, we further restrict the sample to fully taxable individuals, resulting in 9,903 investors. For the shifting analysis, we require investors to exhibit pre-reform activity on foreign exchanges, yielding a sample of 835 investors. Average quarterly activity is defined as the share of investors who are active in an average quarter. Summary statistics are reported for the full sample period (2016–2021) and the pre-reform period (2016–2018), depending on the sample. Average purchases and sales are calculated conditional on having purchases or sales, respectively. Monetary amounts are in Danish kroner (DKK). The samples with pre-reform activity have broadly similar average purchases and sales, although those included in the shifting analysis are somewhat more active.

Table A.3: Self-reporting gains, DiD estimates

	Self-reported gains			
	(1)	(2)	(3)	(4)
β_{2013}	0.032	0.034	0.059	0.091
	(0.245)	(0.237)	(0.301)	(0.361)
β_{2014}	0.021	0.022	0.019	0.048
	(0.245)	(0.237)	(0.300)	(0.360)
β_{2015}	0.053	0.058	0.044	0.031
	(0.244)	(0.235)	(0.295)	(0.359)
β_{2016}	0.090	0.099	0.094	0.044
	(0.240)	(0.231)	(0.285)	(0.357)
β_{2018}	0.327	0.424	0.532	0.882
	(0.271)	(0.265)	(0.346)	(0.400)
β_{2019}	0.286	0.375	0.622	0.527
	(0.240)	(0.236)	(0.342)	(0.424)
β_{2020}	1.043	1.210	0.734	1.065
	(0.325)	(0.329)	(0.364)	(0.546)
γ_{2013}	-0.996	-0.997	-0.996	-0.997
	(0.187)	(0.184)	(0.183)	(0.192)
γ_{2014}	-0.991	-0.992	-0.992	-0.994
	(0.187)	(0.184)	(0.183)	(0.192)
γ_{2015}	-0.968	-0.959	-0.968	-0.969
	(0.188)	(0.184)	(0.183)	(0.191)
γ_{2016}	-0.946	-0.944	-0.944	-0.948
	(0.186)	(0.183)	(0.182)	(0.190)
γ_{2018}	-0.026	-0.042	-0.004	-0.203
	(0.190)	(0.185)	(0.186)	(0.182)
γ_{2019}	-0.759	-0.763	-0.759	-0.792
	(0.185)	(0.181)	(0.180)	(0.185)
γ_{2020}	-0.561	-0.569	-0.509	-0.575
	(0.181)	(0.178)	(0.179)	(0.180)
Individuals	17,991	18,479	11,480	10,028
Observations	143,928	147,832	91,840	80,224
R^2	0.002	0.003	0.003	0.003
Robustness checks				
Fully taxable	Yes	No	Yes	Yes
Match score ≥ 0.50	Yes	Yes	No	No
Match score ≥ 0.80	No	No	Yes	No
Match score $= 1$	No	No	No	Yes

Notes: The table shows the point estimates of regression 1 applying various robustness checks. The outcome, self-reported gains, is normalized by group-specific baseline propensities in 2017. The β coefficients are the difference-in-differences coefficients, and the γ coefficients represent the percentage change of self-reported gains relative to 2017 for the control group. Column (1) shows the baseline results presented in Figure 2 panel (b). Column (2) includes individuals who are not fully taxable throughout the whole period, column (3) changes the TIN matching threshold to 0.8 instead of 0.5, and column (4) changes it to 1.

Table A.4: Self-reporting losses, DiD estimates

	Self-reported losses			
	(1)	(2)	(3)	(4)
β_{2013}	0.130	0.135	-0.078	-0.145
	(0.199)	(0.198)	(0.280)	(0.413)
β_{2014}	-0.063	-0.058	-0.187	-0.180
	(0.199)	(0.198)	(0.281)	(0.412)
β_{2015}	-0.103	-0.110	-0.326	-0.402
	(0.204)	(0.204)	(0.286)	(0.417)
β_{2016}	0.096	0.069	0.040	-0.003
	(0.189)	(0.188)	(0.271)	(0.410)
β_{2018}	-3.444	-4.268	-3.842	-2.884
	(0.651)	(0.834)	(0.682)	(0.926)
β_{2019}	-0.932	-0.999	-1.195	-0.862
	(0.363)	(0.356)	(0.443)	(0.712)
β_{2020}	-0.827	-0.718	-0.211	0.201
	(0.365)	(0.373)	(0.608)	(0.952)
γ_{2013}	-0.705	-0.706	-0.686	-0.695
	(0.135)	(0.135)	(0.134)	(0.132)
γ_{2014}	-0.602	-0.603	-0.596	-0.619
	(0.140)	(0.140)	(0.139)	(0.136)
γ_{2015}	-0.494	-0.487	-0.466	-0.490
	(0.141)	(0.141)	(0.141)	(0.138)
γ_{2016}	-0.582	-0.571	-0.569	-0.577
	(0.128)	(0.128)	(0.127)	(0.126)
γ_{2018}	4.096	4.965	4.142	3.884
	(0.621)	(0.810)	(0.615)	(0.579)
γ_{2019}	1.042	1.068	1.067	1.060
	(0.292)	(0.293)	(0.294)	(0.294)
γ_{2020}	1.106	1.115	1.127	1.099
	(0.288)	(0.288)	(0.288)	(0.287)
Individuals	17,991	18,479	11,480	10,028
Observations	143,928	147,832	91,840	80,224
R^2	0.004	0.004	0.004	0.004
Robustness checks				
Fully taxable	Yes	No	Yes	Yes
Match score ≥ 0.50	Yes	Yes	No	No
Match score ≥ 0.80	No	No	Yes	No
Match score $= 1$	No	No	No	Yes

Notes: The table shows the point estimates of regression 1 applying various robustness checks. The outcome, self-reported losses, is normalized by group-specific baseline propensities in 2017. The β coefficients are the difference-in-differences coefficients, and the γ coefficients represent the percentage change of self-reported losses relative to 2017 for the control group. Column (1) shows the baseline results presented in Figure 2 panel (b). Column (2) includes individuals who are not fully taxable throughout the whole period, column (3) changes the TIN matching threshold to 0.8 instead of 0.5, and column (4) changes it to 1.