Crypto Tax Evasion*

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ABSTRACT

We quantify the extent of crypto tax noncompliance and evasion, and assess the efficacy of alternative tax enforcement interventions. The context of the study is Norway. This context allows us to address key measurement challenges by combining de-anonymized crypto trading data with individual tax returns, survey data, and information from tax enforcement interventions. We find that crypto tax noncompliance is pervasive, even among investors trading on exchanges that share identifiable trading data with tax authorities. However, since most crypto investors owe little in crypto-related taxes, enforcement strategies need to be well-targeted or cheap for benefits to outweigh costs.

Keywords: Cryptocurrencies, individual investors, tax evasion.

JEL Classification: G50, G10, H20, H26.

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I. Introduction

Taxing cryptocurrency is a priority for governments across the world. In many countries, tax authorities are no longer turning a blind eye to crypto's potential for tax noncompliance and evasion. In the U.S., for example, the IRS is increasingly gathering information on individuals' crypto transactions through subpoenas issued to exchanges (DOJ 2021). The IRS has also started sending reminder letters to taxpayers with crypto transactions who potentially failed to report their crypto income (IRS 2019), and to actively target crypto investors in investigations and audits (IRS 2024b, CNBC 2024).

Advocates of such interventions claim the quasi-anonymity of crypto facilitates widespread tax noncompliance and evasion; thus, they argue, there is a large revenue potential from stricter crypto-related tax enforcement policy. For instance, in a recent letter to the U.S. Treasury, Senators Warren et al. (2023, p. 3) argue that crypto tax evaders "*[...] siphon off billions of dollars a year from the U.S. government.*" Others argue the revenue potential from stricter tax enforcement policy may be more limited, at least in the absence of a coordinated and automated exchange of information on crypto holdings and capital gains across countries (Thiemann 2021, p. 12).

The challenge in assessing these arguments is that the evidence base is scarce. Within the burgeoning literature on crypto, tax aspects have received relatively little attention. Baer et al. (2023, p. 489), in their recent review article on taxation of crypto, summarize the state of the literature well: "[...] *so great is the ignorance in this area that even the crudest back-of-envelope calculations may be helpful.*"

This paper helps to close this knowledge gap by quantifying the extent of crypto tax noncompliance and evasion, and assessing the efficacy of alternative tax enforcement interventions. Our context is Norway in the period 2018–2021. In Section II, we describe relevant institutional information, including a comparison of crypto ownership in Norway and other developed countries. The Norwegian tax system treats cryptos as property, like any other financial asset.[1] Because Norway has a wealth tax, crypto investors are taxed on both their crypto holdings and any realized capital gains.

As described in Section III, our analyses are made possible by three strengths of the Norwegian data environment. The first is the ability to link individuals' crypto transactions on the domestic crypto exchanges to their tax returns and demographic characteristics. The data from the domestic exchanges were collected by the Norwegian Tax Administration through subpoenas, and later shared with us, and cover all individuals trading on the domestic exchanges, regardless of whether they declare cryptos in their tax return. The second is the access to a nationally representative survey with information on crypto ownership. The third is the ability to access and link data from an enforcement intervention by the Norwegian Tax Administration that sent reminder letters to individuals suspected of failing to declare crypto in their tax return.

We show, in Section IV, how the combination of these data sets can be used to point identify the prevalence of crypto tax noncompliance, both in the broader population and for different subgroups. The results of this analysis are presented in Section V. We find that 6% of the broader Norwegian population are crypto tax noncompliers in the sense that they hold undeclared cryptos. Conditional on holding cryptos, 88% fail to declare them. Crypto tax noncompliance is concentrated among young, male, and urban individuals. However, this concentration is driven by differences in crypto adoption across individual characteristics, not by differences in tax noncompliance conditional on holding crypto. This is arguably good news for tax authorities: They could use aggregated survey data on crypto adoption to target crypto tax noncompliers.

Another finding is that 80% of the investors trading on the domestic crypto exchanges fail to declare their cryptos, even though these exchanges share identifiable trading data

[1] Most other developed countries also treat cryptos as (intangible) property. See OECD (2020) and Baer et al. (2023) for an overview of the tax treatment of crypto across countries.

with the Norwegian Tax Administration. Yet, the majority of Norwegian crypto tax noncompliers do not trade on the domestic exchanges. This is in part a composition effect, as many Norwegian crypto investors exclusively trade outside the domestic exchanges. However, behavior also plays a role, as those who trade outside the domestic exchanges have an even higher rate of tax noncompliance. Taken together, these results suggest that subpoenaing identifiable trading data from domestic exchanges, by itself, is not going solve the problem of tax noncompliance in the context of crypto.

While failing to declare crypto is unlawful in Norway regardless of the size of the tax liability, not all tax noncompliers owe taxes. For example, crypto investors may not owe taxes if they are insufficiently wealthy to be liable for wealth taxes and if they do not realize any capital gains. In Section VI, we shift attention from tax noncompliance to tax evasion. Taking a partial identification approach, we construct lower and upper bounds of $200 and $1,087 on the average value of tax evasion across all crypto tax noncompliers. In other words, while a large number of crypto investors fail to declare their cryptos, on average, each owes a modest amount of taxes.

This finding suggests that tax enforcement interventions in the context of cryptos need to be well-targeted or cheap for the benefits to outweigh the costs, an insight further developed in Section VII, where we assess the efficacy of two low-cost tax enforcement interventions. For each intervention, we compare the benefits in terms of increased crypto tax revenue against the cost of the intervention.[2]

The first intervention involves indiscriminately sending letters to anyone who previously declared crypto in their tax returns but then stopped, reminding them that cryptos are taxable. A reminder letter is distinct from an audit as it does not require the recipient to respond, thereby eliminating the need for document review and thus reducing

[2]We focus on the additional revenue collected as the direct result of the interventions. Our analyses abstract from any indirect effects (e.g., deterrence effects) these interventions may have on non-targeted individuals.

costs for the authorities. Using data from an actual intervention carried out in 2020, we find that such reminder letters increase the probability of crypto tax compliance by 25 percentage points, and, on average, raise (just) enough tax revenue to cover the cost of the intervention.

The second intervention, a correspondence audit, involves sending a letter to a taxpayer requesting documentation (e.g., bank statements) to support the claims in the filed tax return.[3] Unlike a reminder letter, the taxpayer must respond to a correspondence audit, which raises the cost of the intervention due to document review. Although correspondence audits in Norway have not (yet) been targeted at crypto investors, we can use our estimates of tax noncompliance and the value of tax evasion to quantify the expected effects of such audits.

A key objective of our analysis of correspondence audits is to inform policy decisions that determine the allocation of such interventions to individuals with different observable characteristics. As explained in Section VII.C, the method of Kitagawa and Tetenov (2018) is attractive for this purpose, both in terms of statistical performance and practical implementation in realistic settings of policy design. Our findings suggest that correspondence audits would be profitable if one could directly target crypto tax noncompliers. However, if tax authorities cannot directly identify tax noncompliers and must draw audit subjects from the broader population, we find that audits would be profitable only if they are targeted at a very narrow part of the population (in terms of age and income). Still, the revenue gains from well-targeted audits would be economically modest, and need to be weighed against the burden (e.g., time cost and lawyer fees) imposed on audited taxpayers.

Our paper contributes to a large empirical literature on tax noncompliance and evasion

[3]Correspondence audits are the most common audit type conducted by the IRS, accounting for approximately 75% of all audits (IRS 2024a, p. 34, 46). These audits also appear to be the primary tax enforcement tool used in the context of crypto (Forbes 2022).

across various sources of income and assets, surveyed by Slemrod (2007, 2019). Our key contributions are to quantify the extent of crypto tax noncompliance and evasion, and to assess the efficacy of alternative enforcement interventions targeted at crypto investors. Hackethal et al. (2022), Weber et al. (2023), and Kogan et al. (2024) show that crypto investors are different from other investors in terms of risk taking, belief formation, and trading strategies, respectively, pointing to the possibility that they may also differ in terms of noncompliance, evasion, and responsiveness to tax enforcement strategies. We find that, conditional on holding cryptos, 88% fail to declare them. This rate of tax noncompliance is higher than for other incomes and assets that similarly lack third-party reporting. For example, Kleven et al. (2011), Bott et al. (2020) and Alstadsæter et al. (2022) estimate tax noncompliance rates in Denmark and Norway of 45%, 45% and 71% for self-employment income, foreign earned income, and real estate abroad.

Baer et al. (2023) review existing work on the taxation of crypto. They argue that although crypto protocols publicly record both the individual transactions and the unique identifiers (wallets) of the transacting parties, tying these transactions to individuals and their demographic characteristics and tax payments has proven difficult. As a result, the research to date has been limited in its ability to quantify the extent of crypto tax noncompliance and evasion, and we are not aware of any scientific studies of the efficacy of alternative enforcement interventions in the context of crypto.[4] There is some scientific evidence, however, on the converse of tax evasion: taxes paid. For the U.S., the results of Hoopes et al. (2022) imply that only one percent of all returns in 2020 reported some sales of crypto. This is well below the share of American adults that self-report to hold crypto, which points to the possibility of widespread tax evasion or that many crypto

[4] Cong et al. (2023) examine how increases in tax scrutiny impacts the trading behavior of American crypto investors. They find that investors increasingly engage in tax-loss harvesting, a legal tax avoidance strategy which involves selling investments at a loss to offset capital gains, following increased tax scrutiny.

investors have not yet realized capital gains or losses from crypto.

Our paper also connects to a broader literature on crypto, reviewed by Kogan et al. (2024). While much of this literature is centered around the question of who holds cryptos and why, our focus is on the extent of tax noncompliance and evasion by individual crypto investors. Consistent with previous findings from the U.S. (e.g., Weber et al. 2023, Federal Reserve 2023) and Europe (e.g., Steinmetz et al. 2021, Levkov et al. 2022), we find that males, young, and urban individuals are more likely to hold crypto.

Finally, we connect to the econometrics literature on statistical decision making, as surveyed by Manski (2021). The objective of this literature is to inform policy decisions that determine the allocation of treatments to individuals with different observable covariates. Kitagawa and Tetenov (2018) propose a framework for determining optimal rules for targeted interventions, which they use to study the optimal assignment of individuals to a job training program. We apply their framework to study tax enforcement interventions in the context of cryptos, and find there may be scope for profitable audits targeted based on individual characteristics available to tax authorities.

II. Institutional Background and Setting

Context of the study. Norway has a population of 5.4 million. It consistently ranks among the richest countries in the world — GDP per capita is about 8% higher than in the U.S. (World Bank 2023). The Norwegian economy is typically described as a small open economy with a large public sector. The population is well-educated with a large middle class and is comparable to other European countries in terms of demographics.

Norwegians are taxed on their worldwide labor income, capital income, and wealth. Labor income is taxed progressively, with a top marginal tax rate of 55.8%. By contrast, capital income, which encompasses realized capital gains and other investment income, such as interest income, is taxed at a flat rate of 22%. Finally, the wealth tax is 0.85%

as of 2021 and applies to taxpayers' net wealth in excess of NOK 1.5 million (≈ USD 150,000) for single taxpayers and NOK 3 million (≈ USD 300,000) for married ones. In other words, only sufficiently wealthy taxpayers are liable for wealth taxes.[5]

Between 2018 and 2022, the share of Norwegians holding crypto increased from 5% to 9.8%, as indicated by survey data in Internet Appendix Table IA.I. For comparison, Weber et al. (2023) finds that the share of Americans holding crypto increased from 2% in 2018 to 11% in 2022. International surveys conducted by Statista (2024) indicate similar levels and trends in crypto adoption across other developed countries. Consistent with survey evidence from the U.S. (e.g., Weber et al. 2023, Federal Reserve 2023) and Europe (e.g., Steinmetz et al. 2021, Levkov et al. 2022), crypto adoption in Norway is considerably higher among males than females and among younger than older individuals.[6]

Crypto taxation. In Norway, cryptos are taxed in the same way as any other financial asset. Let $V \equiv V^D + V^F$ denote an individual's end-of-year crypto holdings, accumulated either on domestic crypto exchanges (V^D) or on foreign crypto exchanges and blockchains (V^F). Similarly, let $G \equiv G^D + G^F$ denote their crypto income, also accumulated either on (G^D) or outside the domestic exchanges (G^F).[7] Since Norwegians pay taxes on their worldwide wealth and income, the total tax liability due to crypto is given by:

$$T = \overbrace{\mathbf{1}^W(\tau^W V)}^{\text{Wealth tax liability}} + \overbrace{\tau^G G}^{\text{Capital income tax liability}} \tag{1}$$

[5] See Mogstad et al. (2024) for more details on taxes and transfers in Norway, and Ring (2024) for a comprehensive overview of wealth taxation in Norway since the early 2000s. Eika et al. (2020), Fagereng et al. (2020), and Hvide et al. (2024) describe household investment behavior in Norway.

[6] In Internet Appendix Figure IA.2, we show that the distribution of crypto holdings among Norwegian investors mirrors that presented in Figure 2 of Weber et al. (2023) for American crypto investors.

[7] Realized capital gains on crypto, income from staking and mining, and bonuses from exchange rewards programs are all considered capital income, and taxed at the same rate.

where τ^W and τ^G are the tax rates on wealth and capital income. In 2021, the tax rates are $\tau^W = 0.85\%$ and $\tau^G = 22\%$. Only individuals with a net wealth exceeding NOK 1.5 million if single and NOK 3 million if married are liable to pay wealth taxes on their crypto. This threshold is captured by the $\mathbf{1}^W$ indicator. Note that T can be positive, zero, or negative, the latter occurring if the individual realizes crypto losses.

Declaring cryptos. Both crypto income and wealth are supposed to be declared in the regular tax return. Every year in April, the Norwegian Tax Administration sends a prepopulated tax return for the previous fiscal year to all Norwegian tax residents. The vast majority of domestic incomes and assets are included in the prepopulated tax return based on extensive third-party reporting from both employers and domestic financial institutions. The taxpayer is required to add any missing incomes or assets. This is done via a (free) online tax preparation platform provided by the Tax Administration. Crypto holdings (V) and crypto income (G) are not prepopulated and must be self-reported through this online platform. The taxpayer has to declare the value of crypto holdings as of December 31 of the tax year and the total amount of crypto income and losses that have been realized that year. These values must be declared regardless of whether or not the taxpayer owes any taxes.

Penalties for misreporting. If caught misreporting crypto holdings V or income G, the taxpayer must pay their full crypto tax liability, T, plus a penalty. The penalty is a 20% surtax. While failing to declare V and G is unlawful even when there is no tax liability, there is typically little if any penalty for such noncompliance.

Detection. The Norwegian Tax Administration's ability to detect tax noncompliance depends on where the cryptos have been accumulated. Norwegians can accumulate crypto wealth and income on domestic exchanges, foreign exchanges, or directly on blockchains.

The domestic exchanges are regulated by the Financial Supervisory Authority of Norway and require government-issued identification for account creation. Since 2019, the Tax Administration has subpoenaed complete and identifiable trading records from the domestic exchanges.[8] Accordingly, the Tax Administration directly observes domestic crypto trading. By contrast, the Tax Administration has less precise information about crypto trading outside the domestic exchanges. Due to third-party reporting from domestic financial institutions, the Tax Administration observes international wire transfers to foreign entities, including foreign crypto exchanges, and they may receive some information about Norwegians' crypto trading from partnering countries' tax authorities through data-sharing agreements (Baer et al. 2023). However, they do not directly observe Norwegians' trading activity on foreign crypto exchanges or blockchains.

It is useful to observe that the Tax Administration is vocal about its data collection efforts: Every year during tax season, the Tax Administration announces on its website and in major newspapers the total number of crypto investors identified in their data (e.g., Norwegian Tax Administration 2021); also, the major domestic exchanges send email reminders about tax rules and provide free tax preparation tools (e.g., Firi 2023).

III. Description of Our Data Sources

Our analyses are based on five data sources.

Tax data. Crypto tax return data come from the Norwegian Tax Administration. We observe declared crypto holdings and crypto income, which we denote V^* and G^*, in the 2018–2021 tax returns for the entire population. We also observe all other tax return

[8]The first regulated exchange was formed in 2019, and by 2021, the number had grown to nine. Trading was modest in 2019, but increased sharply in 2020 and 2021, as shown in Appendix Table IA.III. In 2021, about 26% of all Norwegian crypto investors traded on the domestic exchanges, as shown in Section V. Internet Appendix Section B provides more detail on the domestic exchanges.

Table I. Notation

Notation	Definition	Explanation
V, V^*, V^D		True, declared, and domestically-accrued crypto holdings, respectively
G, G^*, G^D		True, declared, and domestically-accrued capital income, respectively
τ^W, τ^G		Tax rate on wealth and capital income, respectively
$\mathbf{1}^W$		Indicator for being liable for wealth taxation
X		Individual characteristics
T	$\mathbf{1}^W \tau^W V + \tau^G G$	True crypto tax liability
T^*	$\mathbf{1}^W \tau^W V^* + \tau^G G^*$	Declared crypto tax liability
T^D	$\mathbf{1}^W \tau^W V^D + \tau^G G^D$	Crypto tax liability accumulated on the domestic crypto exchanges
T^F	$T - T^D$	Crypto tax liability accumulated outside the domestic crypto exchanges
Set Definitions		
U		Norwegian population aged 15 and above
$B \subset U$	$\{V > 0\}$	... who hold cryptos
$A \subset B$	$\{V^* > 0\}$	... who hold and declare cryptos in their tax return
$D \subset B$	$\{V^D > 0\}$	... who hold cryptos accumulated on domestic exchanges
$A^C \subset B$	$B \setminus A$	... who hold but do not declare cryptos in their tax return
$D^C \subset B$	$B \setminus D$	... who hold cryptos accumulated exclusively outside the domestic exchanges

items, such as taxable income and wealth, which allows us to translate V^* and G^* into the declared tax liability T^* according to the tax function in Equation (1).[9] The dataset includes personal identification numbers and can be linked with other administrative databases.

Exchange data. Transaction-level data from the domestic crypto exchanges also come from the Norwegian Tax Administration. The data cover the years 2019–2021. Internet Appendix Section B describes the exchange coverage. Based on the full history of buys and sells, we calculate, for each individual and year, the crypto holdings V^D and capital income G^D accrued on the domestic exchanges; see Internet Appendix Section C for details on how these are calculated. As the domestic exchanges require identification for account creation, the data include personal identification numbers and can be linked with

[9]Following existing literature (e.g., Carrillo et al. 2021, Kotsadam et al. 2022, Advani et al. 2023), we trim the tax liability distribution at the top and bottom 1% before calculating sample means.

other administrative databases. Linking the Exchange and Tax data, we translate V^D and G^D into the domestically-accrued tax liability T^D according to Equation (1).

Population data. Individual characteristics such as age, gender, and place of residence come from Statistics Norway. The data cover the entire population over the period 2018–2021. The data include personal identification numbers and can be linked with other administrative databases.

Survey data. Annual survey data on crypto ownership by Norwegians aged 15 and older come from Norstat, a leading European statistical agency.[10] The surveys are nationally representative with respect to age, gender, and location (which we verify in Internet Appendix A using our population data), covering the years 2018, 2019, and 2021. Each year, the data provide estimates of the share of Norwegians (overall and by age, gender, and location) who hold crypto, but we do not observe these investors' crypto holdings or capital incomes. Individual survey responses cannot be linked with other databases, a fact known by survey respondents.

Tax enforcement data. Data on 1,401 reminder letters come from the Norwegian Tax Administration. The letters were sent in November 2020 by the Tax Administration to anyone who declared crypto in their 2018 tax return but stopped doing so in 2019. The full letter text can be found in Internet Appendix Section D. The data include personal identification numbers and can be linked with other administrative databases.

[10]Internet Appendix Section A describes the survey sampling methods in more detail. In 2021, the response rate was 25%, which is comparable to the response rate in other surveys used for finance research, e.g. Weber et al. (2023). The surveys were commissioned by Arcane Research, later renamed K33 Research, a European research agency focusing on crypto-related topics. The survey estimates are presented in Arcane's annual "Norwegian Crypto Adoption Survey" publication.

IV. What Can We Learn by Combining the Data?

In this section, we show how it is possible to draw inferences about crypto tax noncompliance by combining the data sources discussed in Section III. We explain this below, while summarizing the arguments in Figure 1.

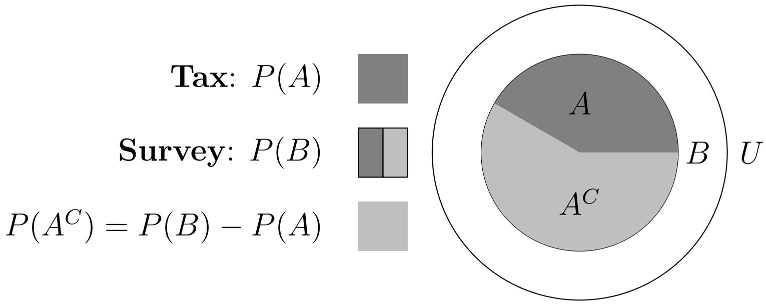
A. *Information available by combining the data*

Combining Tax and Survey data. Let U denote the Norwegian population aged 15 and above. Let $B \subset U$ denote the subset of Norwegians who hold cryptos. Let $A \subset B$ denote the subset of crypto investors who declare crypto holdings in their tax return. Finally, let $A^C \equiv B \setminus A$.

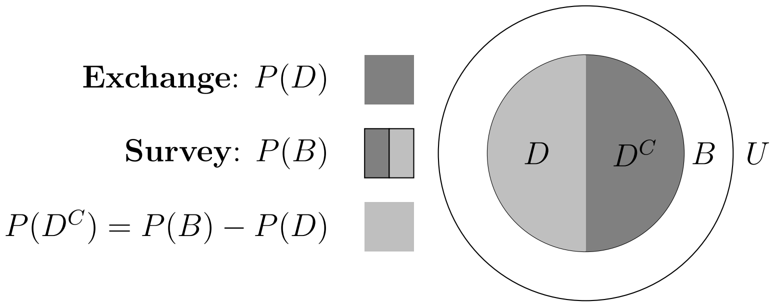
The Tax data give us $P(A)$, the share of the Norwegian population who declare crypto holdings in their tax return, and the Survey data give us $P(B)$, the share of Norwegians who hold crypto. Using the law of total probability, as shown in Panel A of Figure 1, we can solve for $P(A^C)$, the share of Norwegians who hold cryptos but do not declare crypto holdings in their tax return — crypto tax noncompliers.

Combining Exchange and Survey data. Let $D \subset B$ denote the subset of Norwegians who hold cryptos that have been accumulated on the domestic exchanges. Let $D^C \equiv B \setminus D$.

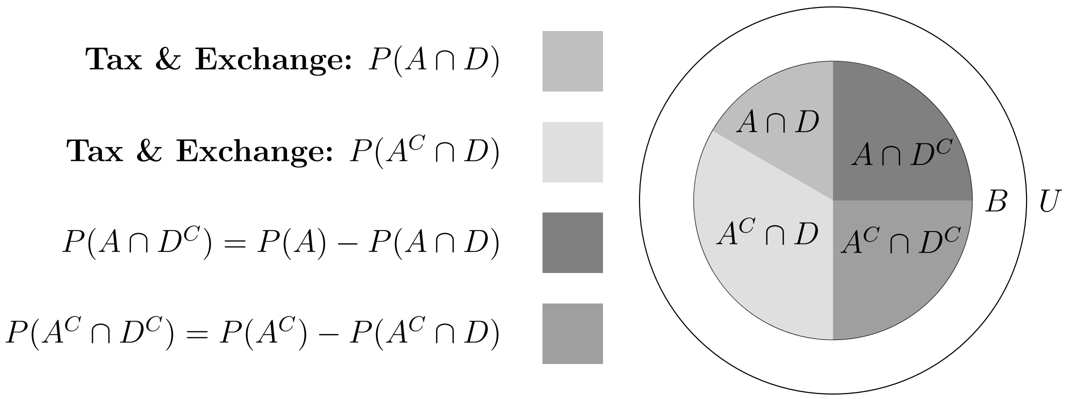
Using the Exchange data, we can calculate $P(D)$, the share of Norwegians who hold cryptos that have been accumulated on the domestic exchanges. Combined with $P(B)$ from the Survey data, as shown in Panel B of Figure 1, we can solve for $P(D^C)$, the share of Norwegians who hold cryptos that exclusively have been accumulated outside the domestic exchanges, again using the law of total probability for identification.



Panel A. Combining the Tax and Survey data



Panel B. Combining the Exchange and Survey data



Panel C. Combining the Tax, Exchange, and Survey data

Figure 1. Identifying the prevalence of crypto tax noncompliance. This figure illustrates how we combine the available data sources to identify and estimate the prevalence of tax noncompliance among different groups of Norwegian crypto investors. Table I summarizes the notation.

Combining Tax, Exchange, and Survey data. Let $A \cap D$ denote the subset of Norwegians who hold cryptos that have been accumulated on the domestic exchanges and declare cryptos in their tax return, and let $A^C \cap D$ denote those who do *not* declare cryptos in their tax return.

Because we can link the Tax and Exchange data using personal identifiers, we can directly identify these subsets and calculate $P(A \cap D)$ and $P(A^C \cap D)$, the shares of Norwegians who are in both the Exchange and Tax data or only in the Exchange data. Combined with $P(B)$ from the Survey data, as shown in Panel C of Figure 1, we can solve for $P(A \cap D^C)$ and $P(A^C \cap D^C)$, the prevalence of tax compliance and tax noncompliance among the investors exclusively trading outside the domestic exchanges, again using the law of total probability for identification.

Population data. Because we can link the Tax and Exchange data with our Population data, we can repeat the analyses above by individual characteristics, denoted by X. However, these analyses are restricted to characteristics that are observed both in the Survey and Population data — age (in bins), gender, and place of residence.

B. Key moments of the (combined) data

Table II presents key moments of our data, which we use in Section V to describe the prevalence of crypto tax noncompliance overall and by subgroups. We focus on 2021, the most recent year of data. For completeness, we also present estimates for each year of data.

Tax data. Column (1) of Panel A, Table II shows that $P(A) = 0.008$, which means that 0.8% of Norwegians declare crypto in their tax return.[11]

[11] We note that in the Tax data a total of 2,259 individuals declare $V^* = 0, G^* \neq 0$, that is, that they have exited crypto during the tax year. These individuals are not included in the $A \subset B$ subset, as our

Table II. Data Moments

Panel A presents aggregate data moments from the Tax, Survey, and Exchange data. Panel B presents data moments broken down by individual characteristics. All moments are measured in 2021. The implied observation counts are presented in parentheses. Table I summarizes the notation.

	Panel A: Aggregate Moments				
	$P(A)$	$P(B)$	$P(D)$	$P(A \cap D)$	$P(A^C \cap D)$
$N = 4,492,182$	0.008 ($N = 36,549$)	0.069 ($N = 308,287$)	0.018 ($N = 80,888$)	0.004 ($N = 16,507$)	0.014 ($N = 64,381$)

	Panel B: Moments By Individual Characteristics				
	$P(A \mid X)$	$P(B \mid X)$	$P(D \mid X)$	$P(A \cap D \mid X)$	$P(A^C \cap D \mid X)$
Male ($N = 2,256,390$)	0.014 ($N = 31,398$)	0.108 ($N = 243,225$)	0.030 ($N = 67,233$)	0.006 ($N = 13,991$)	0.024 ($N = 53,242$)
Female ($N = 2,235,792$)	0.002 ($N = 5,151$)	0.029 ($N = 65,062$)	0.006 ($N = 13,655$)	0.001 ($N = 2,516$)	0.005 ($N = 11,139$)
Oslo ($N = 579,180$)	0.015 ($N = 8,484$)	0.104 ($N = 60,105$)	0.023 ($N = 13,217$)	0.006 ($N = 3,509$)	0.017 ($N = 9,708$)
Non-Oslo ($N = 3,913,002$)	0.007 ($N = 28,065$)	0.063 ($N = 248,182$)	0.017 ($N = 67,671$)	0.003 ($N = 12,998$)	0.014 ($N = 54,673$)
Age: 15–29 ($N = 994,388$)	0.010 ($N = 9,889$)	0.118 ($N = 117,741$)	0.039 ($N = 38,428$)	0.005 ($N = 4,774$)	0.034 ($N = 33,654$)
Age: 30–39 ($N = 730,803$)	0.018 ($N = 13,427$)	0.113 ($N = 82,834$)	0.029 ($N = 21,300$)	0.008 ($N = 5,561$)	0.022 ($N = 15,739$)
Age: 40–49 ($N = 706,524$)	0.011 ($N = 7,544$)	0.048 ($N = 34,125$)	0.016 ($N = 11,505$)	0.005 ($N = 3,412$)	0.011 ($N = 8,093$)
Age: 50+ ($N = 2,060,467$)	0.003 ($N = 5,689$)	0.036 ($N = 73,587$)	0.005 ($N = 9,655$)	0.001 ($N = 2,760$)	0.003 ($N = 6,895$)

Survey data. Column (2) of Panel A shows that $P(B) = 0.069$, which means that 6.9% of Norwegians hold crypto.

Exchange data. Column (3) of Panel A shows that $P(D) = 0.018$, which means that 1.8% of Norwegians hold crypto accumulated on the domestic exchanges.

analysis focuses on the tax compliance of individuals who *currently hold* cryptos. One may be concerned that these investors are "partially tax compliant", that is, that they properly declare their crypto income but choose not to declare their crypto holdings. Reassuringly, including this small number of individuals in the A subset has no meaningful impact on any of our estimates (see Appendix Table IA.VI).

Linked Tax and Exchange data. Column (4) of Panel A shows that $P(A \cap D) = 0.004$, which means that 0.4% of Norwegians both hold crypto accumulated on the domestic exchanges and declare crypto in their tax return. Column (5) shows that $P(A^C \cap D) = 0.014$, which means that 1.4% of Norwegians hold crypto accumulated on the domestic exchanges but do not declare crypto in their tax return.

Panel B of Table II presents estimates by individual characteristic. We find that larger shares of male than female, young than old, and urban than rural Norwegians hold cryptos, as shown by the $P(B \mid X)$ column in Panel B of Table II.

V. Tax Noncompliance

In this section, we will use the data moments in Table II to identify and estimate the prevalence of tax noncompliance among Norwegian crypto investors, and to study how the prevalence varies across individual characteristics and trading venues that do and do not share identifiable trading data with the Norwegian Tax Administration. The identification arguments are summarized in Table III and derived in the text.

Prevalence of crypto tax noncompliance. We begin by showing that 6% of the Norwegian population are crypto tax noncompliers in the sense that they hold undeclared cryptos. Conditional on holding cryptos, 88% fail to declare them. This rate of tax noncompliance is higher than for other incomes and assets that similarly lack third-party reporting. For example, Kleven et al. (2011), Bott et al. (2020), and Alstadsæter et al. (2022) estimate tax noncompliance rates in Denmark and Norway of 45%, 45%, and 71% for self-employment income, foreign income, and foreign real estate, respectively.

To arrive at these conclusions, we first combine our Tax and Survey data to estimate $P(A^C)$, the share of the Norwegian population who hold undeclared cryptos. As illustrated in Panel A of Figure 1, those who hold crypto (B) either declare crypto holdings in their tax return ($A \subset B$) or do not ($A^C \subset B$). Accordingly, by the law of total probability, the prevalence of crypto tax noncompliance can be expressed as follows:

$$P(A^C) = \underbrace{P(B)}_{\text{Survey data}} - \underbrace{P(A)}_{\text{Tax data}} \tag{2}$$

which we can solve because $P(B)$ and $P(A)$ are both directly observed in Table II. As 6.9% of all Norwegians hold crypto, and 0.8% declare crypto, we find that $P(A^C) = 0.06$, which means that 6% of all Norwegians hold undeclared cryptos.

Second, we turn to $P(A^C \mid B)$, the share of Norwegian crypto investors who hold undeclared cryptos. By Bayes law, $P(A^C \mid B)$ can be expressed as:

$$P(A^C \mid B) = \frac{P(A^C \cap B)}{P(B)} = \frac{\overbrace{P(A^C)}^{\text{Equation (2)}}}{\underbrace{P(B)}_{\text{Survey data}}} \tag{3}$$

which we can solve because $P(B)$ is directly observed in Table II and $P(A^C)$ is given by Equation (2) above. We find that $P(A^C \mid B) = 0.88$, which means that 88% of all crypto investors in Norway fail to declare cryptos in their tax return.

One may be concerned that individuals under-report their tendency to hold cryptos in surveys, i.e., that $P(B)$ underestimates the true extent of aggregate crypto ownership. From Equations (2)–(3), it is clear that such under-reporting would imply that our estimates of $P(A^C)$ and $P(A^C \mid B)$ should be interpreted as lower bounds.

Characteristics of crypto tax noncompliers. Next, we characterize the population of crypto tax noncompliers. We find that the vast majority of crypto tax noncompliers are male, young, and reside in the capital. Indeed, crypto tax noncompliers are 1.6, 1.8, and 1.5 times more likely than the broader population to be male, aged 29 or below, and reside in the capital. This finding suggests that crypto tax noncompliers are quite

Table III. Parameters and Identifying Moments

Parameter	Identifying moments	Necessary data: Tax	Necessary data: Survey	Necessary data: Exchange	Estimate(s)
Prevalence of crypto tax noncompliance					
$P(A^C)$	$P(B) - P(A)$	✓	✓		0.060
$P(A^C \mid B)$	$P(A^C)/P(B)$	✓	✓		0.881
Characteristics of crypto tax noncompliers					
$P(X \mid B)$	$P(B \mid X) \cdot P(X)/P(B)$		✓		Table IV
$P(X \mid A)$	$P(A \mid X) \cdot P(X)/P(A)$	✓			Table IV
$P(X \mid A^C)$	$P(A^C \mid X) \cdot P(X)/P(A^C)$	✓	✓		Table IV
Prevalence of crypto tax noncompliance by individual characteristics					
$P(A^C \mid X)$	$P(B \mid X) - P(A \mid X)$	✓	✓		Figure 2
$P(A^C \mid B, X)$	$P(A^C \mid X)/P(B \mid X)$	✓	✓		Figure 2
Prevalence of crypto tax noncompliance by trading venue					
$P(D^C)$	$P(B) - P(D)$		✓	✓	0.051
$P(A^C \cap D^C)$	$P(A^C) - P(A^C \cap D)$	✓	✓	✓	0.046
$P(A^C \mid D^C)$	$P(A^C \cap D^C)/P(D^C)$	✓	✓	✓	0.912
$P(A^C \mid D)$	$P(A^C \cap D)/P(D)$	✓		✓	0.796
$P(D \mid A^C)$	$P(A^C \cap D)/P(A^C)$	✓	✓	✓	0.237
$P(D^C \mid A^C)$	$P(A^C \cap D^C)/P(A^C)$	✓	✓	✓	0.763
$P(A^C \mid D, X)$	$P(A^C \cap D \mid X)/P(D \mid X)$	✓		✓	Figure 2
$P(A^C \mid D^C, X)$	$P(A^C \cap D^C \mid X)/P(D^C \mid X)$	✓	✓	✓	Figure 2
Value of tax evasion					
$E[T \mid A^C]$:					
Lower	$E(T^D \mid A^C, D)$	✓		✓	$200
Point	$E(T^* \mid A)$	✓			$1,035
Upper	$1.05 \cdot E(T^* \mid A)$	✓			$1,087
$E[T \mid A^C, X]$:					
Lower	$E(T^D \mid A^C, D, X)$	✓		✓	Figure 3
Point	$E(T^* \mid A, X)$	✓			Figure 3
Upper	$1.05 \cdot E(T^* \mid A, X)$	✓			Figure 3

different from the broader Norwegian population in terms of observable characteristics.

To arrive at these conclusions, we again combine the Tax and Survey data, but now leverage the fact that we observe gender, age in bins, and place of residence — X's — in both data sources. We first apply Bayes law to express $P(X \mid A^C)$, the characteristics distribution of the population of crypto tax noncompliers, as:

$$P(X \mid A^C) = \frac{P(A^C \cap X)}{P(A^C)} = \frac{\overbrace{P(A^C \mid X)}^{\substack{\text{Equation (2)} \\ \text{by } X}} \overbrace{P(X)}^{\substack{\text{Population} \\ \text{data}}}}{\underbrace{P(A^C)}_{\text{Equation (2)}}} \tag{4}$$

which we can solve because $P(X)$—the characteristics distribution of the broader Norwegian population—is observed in the Population data, $P(A^C)$ is given by Equation (2), and $P(A^C \mid X)$ is given by Equation (2) when repeated by characteristic X.

The estimates of $P(X \mid A^C)$ are presented in column (1) of Table IV. We find that 78% of tax noncompliers are male, 19% reside in Oslo, the capital, and 40% are aged 15–29. To explore over-representation compared to the broader Norwegian population,

Table IV. Investor Characteristics

This table summarizes the characteristics of different crypto investors. Table III summarizes the identification arguments. All moments are measured in 2021.

	$P(X \mid A^C)$	$\frac{P(X \mid A^C)}{P(X)}$	$P(X \mid B)$	$P(X \mid A)$
Male	0.780	1.552	0.789	0.859
Female	0.220	0.443	0.211	0.141
Oslo	0.190	1.473	0.195	0.232
Non-Oslo	0.810	0.930	0.805	0.768
Age: 15–29	0.397	1.793	0.382	0.271
Age: 30–39	0.255	1.570	0.269	0.367
Age: 40–49	0.098	0.622	0.111	0.206
Age: 50+	0.250	0.545	0.239	0.156

in column (2), we divide $P(X \mid A^C)$ by $P(X)$. Compared to the population, we find that tax noncompliers are about 1.6 times more likely to be male, 1.8 and 1.6 times more likely to be aged 15–29 and 30–39, and about 1.5 times more likely to reside in the capital.

Prevalence by individual characteristics. What matters for tax authorities trying to target tax enforcement actions is not the characteristics distribution of crypto tax noncompliers, $P(X \mid A^C)$, but rather the likelihood of noncompliance among individuals with given characteristics, $P(A^C \mid X)$. We show that larger shares of male than female, young than old, and urban than rural Norwegians are crypto tax noncompliers. These group-level differences, however, are driven by differences in crypto adoption, not by differences in tax noncompliance conditional on holding crypto. This is arguably good news for tax authorities: They could use aggregated survey data on crypto adoption to effectively target crypto tax noncompliers.

To arrive at these conclusions, we first repeat Equation (2) by X to estimate how tax noncompliance varies across individual characteristics in the broader population:

$$P(A^C \mid X) = \underbrace{P(B \mid X)}_{\text{Survey data}} - \underbrace{P(A \mid X)}_{\text{Tax data}} \tag{5}$$

which we can solve because $P(B \mid X)$ and $P(A \mid X)$ are known from Table II. The estimates of $P(A^C \mid X)$ are presented in Panel A of Figure 2. We find that 9.4% of Norwegian males and 2.7% of females are crypto tax noncompliers. Around 11% of Norwegians aged 15–29 hold undeclared cryptos; among those aged 30-39, 40–49, and 50+, the numbers are 9.5%, 3.8%, and 3.3%, respectively. A larger share of those who reside in Oslo, the capital, are tax noncompliers compared to those who reside outside the capital.

Next, we repeat Equation (3) by X to estimate how the rate of tax noncompliance

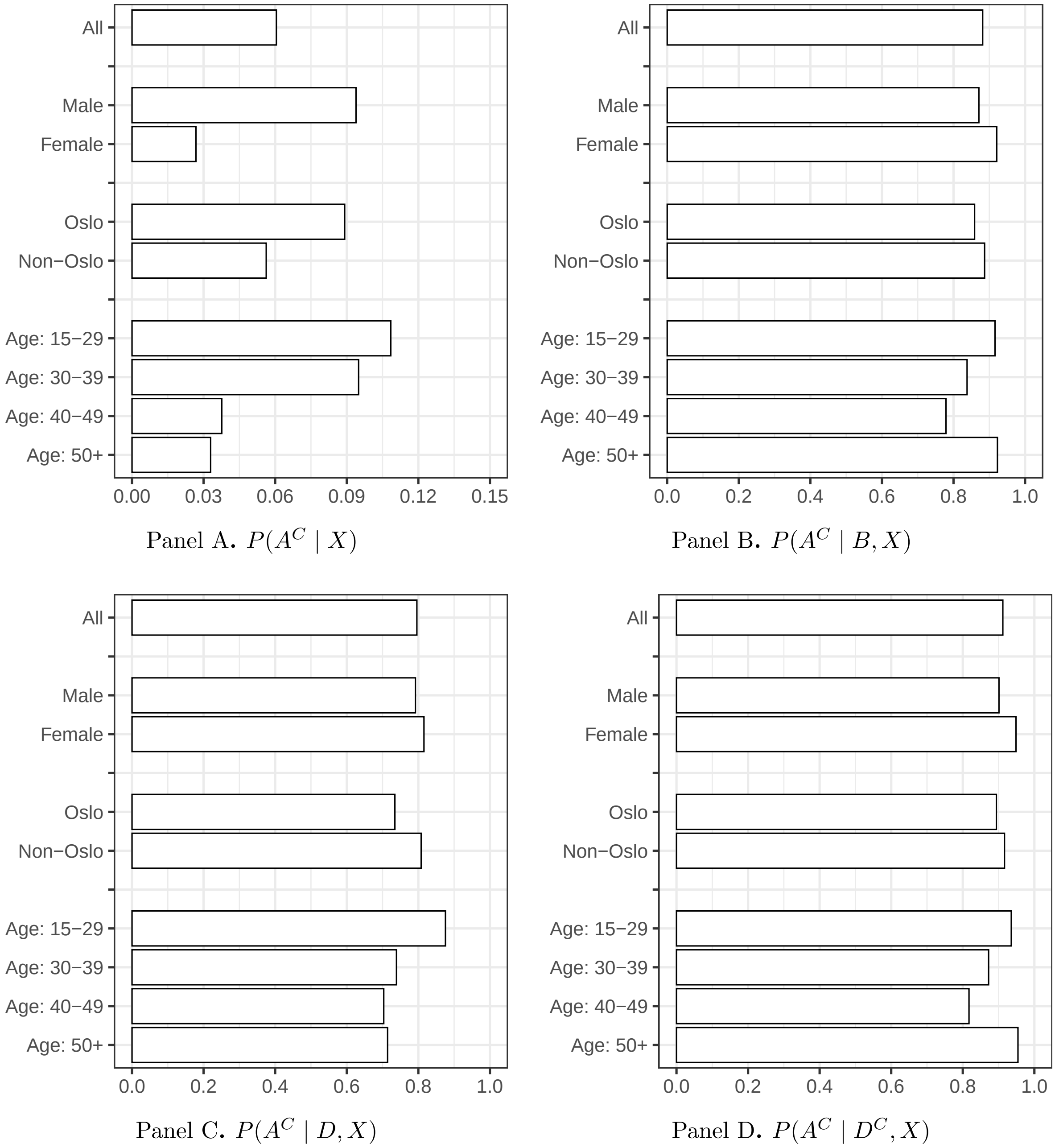


Figure 2. Crypto tax noncompliance by subgroup. This figure shows the prevalence of tax noncompliance for different subgroups of crypto investors. Table III summarizes the identification arguments. All estimates are based on data from 2021.

varies across individual characteristics within the population of crypto investors:

$$P(A^C \mid B, X) = \frac{\overbrace{P(A^C \mid X)}^{\text{Equation (5)}}}{\underbrace{P(B \mid X)}_{\text{Survey data}}} \tag{6}$$

which we can solve because $P(B \mid X)$ is known from Table II and $P(A^C \mid X)$ is given by Equation (5). The estimates of $P(A^C \mid B, X)$ are presented in Panel B of Figure 2. We find that conditional on holding cryptos, the rate of tax noncompliance is remarkably stable across individual characteristics, with tax noncompliance rates exceeding 75% for male and female, young and old, urban and rural crypto investors alike.

Given the strong similarity in tax noncompliance rates across different crypto investors, it is natural to ask what is driving the observed variation in $P(A^C \mid X)$ in Panel A of Figure 2. To answer this question, we use a standard Oaxaca-Blinder approach to decompose the group-level differences in $P(A^C \mid X)$ into a composition effect (e.g., whether men are more likely to hold crypto) and a behavior effect (e.g., whether men are more tax noncompliant conditional on holding crypto). The results are presented in Table V. We find that the observed differences in $P(A^C \mid X)$ are almost entirely explained by differences across groups in crypto adoption, as opposed to differences in tax compliance conditional on holding crypto. In other words, survey data on crypto adoption ($P(B \mid X)$) are highly informative about population-wide crypto tax noncompliance ($P(A^C \mid X)$).

Prevalence by trading venue. Finally, we show that 80% of investors trading on the domestic exchanges fail to declare their cryptos, even though these exchanges share *identifiable* trading data with the Tax Administration. Still, the majority of Norwegian crypto tax noncompliers (76%) do *not* trade on the domestic exchanges. This is in part a composition effect, as many Norwegian crypto investors (74%) exclusively trade outside

Table V. Oaxaca-Blinder Decomposition

This table decomposes the group-level differences in $P(A^C \mid X)$ in Panel A of Figure 2 into group-level differences in $P(B \mid X)$ and $P(A^C \mid B, X)$ using an Oaxaca-Blinder approach (Fortin et al. 2011).

		Gap Due To...	
Group Comparisons	$P(A^C \mid X_1) - P(A^C \mid X_2)$	$P(B \mid X)$	$P(A^C \mid B, X)$
X_1 = Male, X_2 = Female	0.067	0.072	-0.005
X_1 = Oslo, X_2 = Non-Oslo	0.033	0.036	-0.003
X_1 = Age: 15–29, X_2 = Age: 30–39	0.013	0.004	0.009
X_1 = Age: 15–29, X_2 = Age: 40–49	0.071	0.055	0.016
X_1 = Age: 15–29, X_2 = Age: 50+	0.076	0.076	-0.001

the domestic exchanges. However, behavior also plays a role, as those who trade outside the domestic exchanges have a higher (91%) rate of tax noncompliance. Combined, the results suggest that subpoenaing identifiable trading data from domestic exchanges, by itself, is not going solve the problem of tax noncompliance in crypto.

To arrive at these conclusions, we first combine the Exchange and Survey data to estimate how many Norwegians trade *outside* the domestic exchanges. As illustrated in Panel B of Figure 1, those who hold crypto (B) have accumulated some ($D \subset B$) or none ($D^C \subset B$) of their holdings on the domestic exchanges. By the law of total probability:

$$P(D^C) = \underbrace{P(B)}_{\text{Survey}} - \underbrace{P(D)}_{\text{Exchange}} \tag{7}$$

which we can solve because we observe both $P(B)$ and $P(D)$ in Table II. As 6.9% of Norwegians hold cryptos, and 1.8% have accumulated at least some holdings on the domestic exchanges, we find that $P(D^C) = 0.051$. This finding means that 5.1% of all Norwegians have accumulated crypto exclusively outside the domestic exchanges. The conditional probability, given by $P(D^C \mid B) = \frac{P(D^C)}{P(B)}$, is 0.74, implying that 74% of all Norwegian crypto investors exclusively trade outside the domestic crypto exchanges.

Next, we link our Exchange and Tax data to estimate how many of these are tax noncompliers. As illustrated in Panel C of Figure 1, the population of crypto tax noncompliers (A^C) have accumulated either some ($A^C \cap D$) or none ($A^C \cap D^C$) of their cryptos on the domestic exchanges. Accordingly, by the law of total probability:

$$P(A^C \cap D^C) = \underbrace{P(A^C)}_{\text{Equation (2)}} - \underbrace{P(A^C \cap D)}_{\text{Exchange} \times \text{Tax}} \tag{8}$$

where $P(A^C \cap D)$ is known from Table II and $P(A^C)$ is given by Equation (2). As 6% of all Norwegians are tax noncompliers and 1.4% are tax noncompliers and have accumulated at least some holdings on the domestic exchanges, we find that $P(A^C \cap D^C) = 0.046$. This finding means that 4.6% of all Norwegians are tax noncompliers and have not accumulated holdings on the domestic exchanges. The conditional probability, given by $P(D^C \mid A^C) = \frac{P(A^C \cap D^C)}{P(A^C)}$, is 0.76, implying that 76% of all Norwegian crypto tax noncompliers exclusively trade outside the domestic centralized exchanges.

The finding that individuals who trade outside the domestic exchanges account for 74% of all Norwegian crypto investors but 76% of all crypto tax noncompliers suggests a higher rate of tax noncompliance among those who trade outside the domestic exchanges. To examine this, we can use Equations (7)–(8) to solve for $P(A^C \mid D^C)$, the prevalence tax noncompliance among those who only trade outside the domestic exchanges. By Bayes law:

$$P(A^C \mid D^C) = \frac{\overbrace{P(A^C \cap D^C)}^{\text{Equation (8)}}}{\underbrace{P(D^C)}_{\text{Equation (7)}}} \tag{9}$$

We find that $P(A^C \mid D^C) = 0.91$, which means that 91% of investors exclusively trading outside the domestic exchanges fail to declare crypto in their tax return.

We directly observe the prevalence of tax noncompliance among those who trade on the domestic crypto exchanges. Specifically, by Bayes law:

$$P(A^C \mid D) = \frac{\overbrace{P(A^C \cap D)}^{\text{Tax} \times \text{Exchange}}}{\underbrace{P(D)}_{\text{Exchange}}} \tag{10}$$

where $P(A^C \cap D)$ and $P(D)$ are both known from Table II. In Table III, we find that $P(A^C \mid D) = 0.80$. This finding means that 80% of investors trading on the domestic exchanges fail to declare crypto in their tax return, an 11 percentage point lower rate than among those who exclusively trade outside the domestic exchanges. As shown in Figure 2, Panels C and D, this difference persists and is comparable even when conditioning on X.

Estimates by year. The results presented above are based on data for 2021, the most recent year of data we have access to. In Internet Appendix Table IA.VII, we present yearly estimates for a longer time period. We observe crypto tax noncompliance rates of around 90% across all years 2018–2021 for which we have data.

VI. Value of Tax Evasion

Above, we showed that the vast majority of Norwegian crypto investors fail to declare their cryptos. While failing to declare crypto is unlawful in Norway regardless of the size of the tax liability, not all tax noncompliers owe taxes. As shown in Equation (1), crypto investors may not owe taxes if i) they are insufficiently wealthy to be liable for wealth taxes and ii) they do not realize any capital income.

We now shift attention from tax noncompliance to tax evasion. Taking a partial identification approach, we construct lower and upper bounds of \$200 and \$1,087 on the average value of tax evasion across all crypto tax noncompliers. In other words, while a large number of crypto investors fail to declare their cryptos, each owes a modest amount of taxes. This finding suggests that tax enforcement strategies in the context of cryptos need to be well-targeted or cheap for the benefits to outweigh the costs, an insight we further develop in Section VII.

To arrive at these conclusions, we cannot use the same identification arguments as in Section V. The reason is that our survey data provide information about the share of Norwegians who hold any crypto, but not about these investors' crypto holdings or capital income. This creates a key missing data problem: We do not observe investors' true tax liability, T. We do, however, observe the declared tax liability, T^*, for all those who declare crypto in their tax return, and we observe the true tax liability accrued on the domestic exchanges, T^D, for all those who trade on the domestic exchanges.

We now explain how we can combine our data on tax liabilities with various assumptions to construct bounds on the value of tax evasion by crypto tax noncompliers.

A. Data

Table VI summarizes our data on tax liabilities.

Declared tax liabilities. In Panel A, we first estimate the sample mean of declared tax liabilities among those who declare crypto, which we denote $E(T^* \mid A)$. We find that these tax compliers on average pay $E(T^* \mid A) = \$1,035$ in crypto taxes. Decomposing this estimate, we find that about 64% declare a positive tax liability, as given by $P(T^* > 0 \mid A)$, while the remainder declare zero (25%) or negative (11%) tax liabilities.

Undeclared tax liabilities. Since we are able to link the Tax and Exchange data, we can estimate mean tax liabilities also for those who trade on the domestic exchanges but do *not* declare their cryptos. We find that these tax noncompliers on average owe \$200

Table VI. Tax Liabilities

This table shows average tax liabilities for different groups of individual crypto investors. All moments are measured in 2021.

Panel A. All Investors

All Tax Compliers		Domestic Noncompliers		Domestic Compliers		Non-domestic Compliers	
$P(T^* = 0 \mid A)$	0.253	$P(T^D = 0 \mid A^C, D)$	0.071	$P(T^* = 0 \mid A, D)$	0.183	$P(T^* = 0 \mid A, D^C)$	0.312
$P(T^* < 0 \mid A)$	0.110	$P(T^D < 0 \mid A^C, D)$	0.022	$P(T^* < 0 \mid A, D)$	0.128	$P(T^* < 0 \mid A, D^C)$	0.094
$P(T^* > 0 \mid A)$	0.637	$P(T^D > 0 \mid A^C, D)$	0.907	$P(T^* > 0 \mid A, D)$	0.689	$P(T^* > 0 \mid A, D^C)$	0.594
$E(T^* \mid T^* = 0, A)$	$0	$E(T^D \mid T^D = 0, A^C, D)$	$0	$E(T^* \mid T^* = 0, A, D)$	$0	$E(T^* \mid T^* = 0, A, D^C)$	$0
$E(T^* \mid T^* < 0, A)$	–$441	$E(T^D \mid T^D < 0, A^C, D)$	–$151	$E(T^* \mid T^* < 0, A, D)$	–$372	$E(T^* \mid T^* < 0, A, D^C)$	–$518
$E(T^* \mid T^* > 0, A)$	$1,700	$E(T^D \mid T^D > 0, A^C, D)$	$225	$E(T^* \mid T^* > 0, A, D)$	$1,175	$E(T^* \mid T^* > 0, A, D^C)$	$2,208
$E(T^* \mid A)$	$1,035	$E(T^D \mid A^C, D)$	$200	$E(T^* \mid A, D)$	$762	$E(T^* \mid A, D^C)$	$1,262
				$E(T^D \mid A, D)$	$330		

Panel B. By Investor Characteristic

$E(T^* \mid A, X)$		$E(T^D \mid A^C, D, X)$		$E(T^* \mid A, D, X)$		$E(T^* \mid A, D^C, X)$	
Male	$1,138	*Male*	$215	*Male*	$846	*Male*	$1,375
Female	$417	*Female*	$130	*Female*	$305	*Female*	$526
Oslo	$1,259	*Oslo*	$187	*Oslo*	$913	*Oslo*	$1,506
Non-Oslo	$967	*Non-Oslo*	$203	*Non-Oslo*	$722	*Non-Oslo*	$1,182
Age: 15-29	$799	*Age: 15-29*	$197	*Age: 15-29*	$625	*Age: 15-29*	$964
Age: 30-39	$1,184	*Age: 30-39*	$207	*Age: 30-39*	$819	*Age: 30-39*	$1,445
Age: 40-49	$1,139	*Age: 40-49*	$211	*Age: 40-49*	$861	*Age: 40-49*	$1,370
Age: 50+	$960	*Age: 50+*	$188	*Age: 50+*	$766	*Age: 50+*	$1,145

in taxes due to their domestic trading, as given by $E(T^D \mid A^C, D)$. Decomposing this estimate, we find that about 91% of the domestic tax noncompliers have positive tax liabilities, while the remainder have zero (7%) or negative (2%) tax liabilities. In Panel B of Table VI, we report tax liability estimates by individual characteristics.

B. *Identification approach*

We now show how to use the moments in Table VI to construct bounds on $E(T \mid A^C)$, the mean tax liability among all crypto tax noncompliers, which we do not observe.

Lower bound based on undeclared tax liabilities. We begin by using data on $E(T^D \mid A^C, D)$, the mean tax liability accrued by tax noncompliers on the domestic exchanges, to construct a lower bound on $E(T \mid A^C)$. There is a *direct link* between $E(T^D \mid A^C, D)$ and $E(T \mid A^C)$. In particular, by the law of total expectation:

$$E(T \mid A^C) = \overbrace{E(T \mid A^C, D)}^{\text{Unobserved}} \overbrace{P(D \mid A^C)}^{\text{Table III}} + \overbrace{E(T \mid A^C, D^C)}^{\text{Unobserved}} \overbrace{[1 - P(D \mid A^C)]}^{\text{Table III}} \tag{11}$$

where, by linearity of expectations:

$$E(T \mid A^C, D) = E(T^D + T^F \mid A^C, D) = \overbrace{E(T^D \mid A^C, D)}^{\$200} + \overbrace{E(T^F \mid A^C, D)}^{\text{Unobserved}} \tag{12}$$

where T^F is the tax liability accrued due to trading *outside* the domestic exchanges.

Since investors trading on the domestic exchanges can accumulate positive, negative, or zero tax liabilities outside the domestic exchanges, their *total* tax liability, $E(T \mid A^C, D)$, can be greater, smaller, or equal to $E(T^D \mid A^C, D) = \$200$. Even if we were to assume that these investors only trade on the domestic exchanges (which we do not) so that $E(T^F \mid A^C, D) = 0$, we cannot immediately ascertain the relationship between $E(T^D \mid A^C, D)$ and $E(T \mid A^C)$. This is because the tax liabilities of investors exclusively trading outside the domestic exchanges, $E(T \mid A^C, D^C)$, may be greater, smaller, or equal to those of investors trading on the domestic exchanges, $E(T \mid A^C, D)$.

To resolve this identification problem, we use the observed moments in Table VI to inform assumptions. First, we exploit that for tax compliers trading on the domestic exchanges, we observe both the total (declared) tax liability and the tax liability accrued on the domestic exchanges. In Table VI, we find that $E(T^* \mid A, D) = \$762 > E(T^D \mid A, D) = \$330$, which means that these tax compliers on average accumulate *positive* tax liabilities outside our data from the domestic exchanges. This finding motivates the following assumption concerning Equation (12):

Assumption 1: $E(T \mid A^C, D) \geq E(T^D \mid A^C, D)$. *That is, tax noncompliers who trade on the domestic exchanges do not on average accumulate negative tax liabilities based on their trading (if any) outside the domestic exchanges.*

Second, we exploit that for tax compliers, we observe the total (declared) tax liability not only for the investors trading on the domestic exchanges but also for those exclusively trading outside the domestic exchanges. In particular, these investors are present in the tax return data but not in the domestic exchange data. In Table VI, we find that $E(T^* \mid A, D^C) = \$1,262 > E(T^* \mid A, D) = \$762$, which means that tax compliers trading outside the domestic exchanges on average have considerably higher tax liabilities.[12] This finding motivates the following assumption concerning Equation (11):

Assumption 2: $E(T \mid A^C, D^C) > E(T \mid A^C, D)$. *That is, the total tax liability of those who trade exclusively outside the domestic exchanges is on average larger than the total*

[12]In Internet Appendix Table IA.V, we show that tax compliers trading on the domestic exchanges are more likely than tax compliers trading outside the domestic exchanges to be young and rural, groups that on average have lower tax liabilities. The same compositional differences exist between tax *noncompliers* trading on and outside the domestic exchanges, as also shown in Table IA.V.

tax liability of those who trade on the domestic exchanges.

Under Assumptions 1 and 2, it is clear from Equations (11) and (12) that:

$$E(T \mid A^C) > E(T^D \mid A^C, D) = \$200. \tag{13}$$

which means that $E(T^D \mid A^C, D) = \$200$ forms a *lower bound* on $E(T \mid A^C)$.

Upper bound based on declared tax liabilities. Next, we use $E(T^* \mid A)$, the mean declared tax liability, to construct an upper bound on $E(T \mid A^C)$. To explain the identification argument, it is useful to first consider a special case where we can get point identification by imposing two strong assumptions. We then relax these assumptions to construct the upper bound. The two assumptions for point identification are:

Assumption 3: $E(T \mid A^C) = E(T \mid A)$. *That is, the expected tax liability is the same for crypto investors who do and do not declare crypto in their tax return.*

Assumption 4: $E(T \mid A) = E(T^* \mid A)$. *That is, there is no systematic misreporting of tax liabilities conditional on declaring crypto in the tax return.*

Under Assumptions 3 and 4, we have that:

$$E(T \mid A^C) \underbrace{=}_{\text{Assumption 3}} E(T \mid A) \underbrace{=}_{\text{Assumption 4}} E(T^* \mid A) = \$1,035. \tag{14}$$

which means $E(T \mid A^C)$ is *point-identified* from data on $E(T^* \mid A)$.

To assess Assumption 3, we exploit that for investors trading on the domestic exchanges, we observe an identical measure of tax liabilities for both tax compliers and noncompliers, namely, the tax liability T^D accrued on the domestic exchanges. In Table

VI, we find that $E(T^D \mid A^C, D) = \$200 < E(T^D \mid A, D) = \$330$, which means that tax compliers trading on the domestic exchanges have higher tax liabilities than their noncomplier counterparts.[13] Motivated by this finding, we revise Assumption 3:

$$E(T \mid A^C) \underbrace{<}_{\substack{\text{Revised} \\ \text{Assumption 3}}} E(T \mid A) \underbrace{=}_{\text{Assumption 4}} E(T^* \mid A) = \$1,035. \tag{15}$$

which means that under weaker assumptions, \$1,035 forms an *upper bound* on $E(T \mid A^C)$.

To assess Assumption 4, we draw on existing literature. Using random audit data from Denmark, Kleven et al. (2011) find that individuals under-report their true tax liability from self-declared incomes (e.g., self-employment income) by about 5% conditional on declaring *any* such income — that is, $E(T \mid A) \approx 1.05 \times E(T^* \mid A)$.[14] Allowing for the same magnitude of under-reporting in our context, we can revise Assumption 4:

$$E(T \mid A^C) \underbrace{<}_{\substack{\text{Revised} \\ \text{Assumption 3}}} E(T \mid A) \underbrace{=}_{\substack{\text{Revised} \\ \text{Assumption 4}}} 1.05 \times \$1,035 = \$1,087 \tag{16}$$

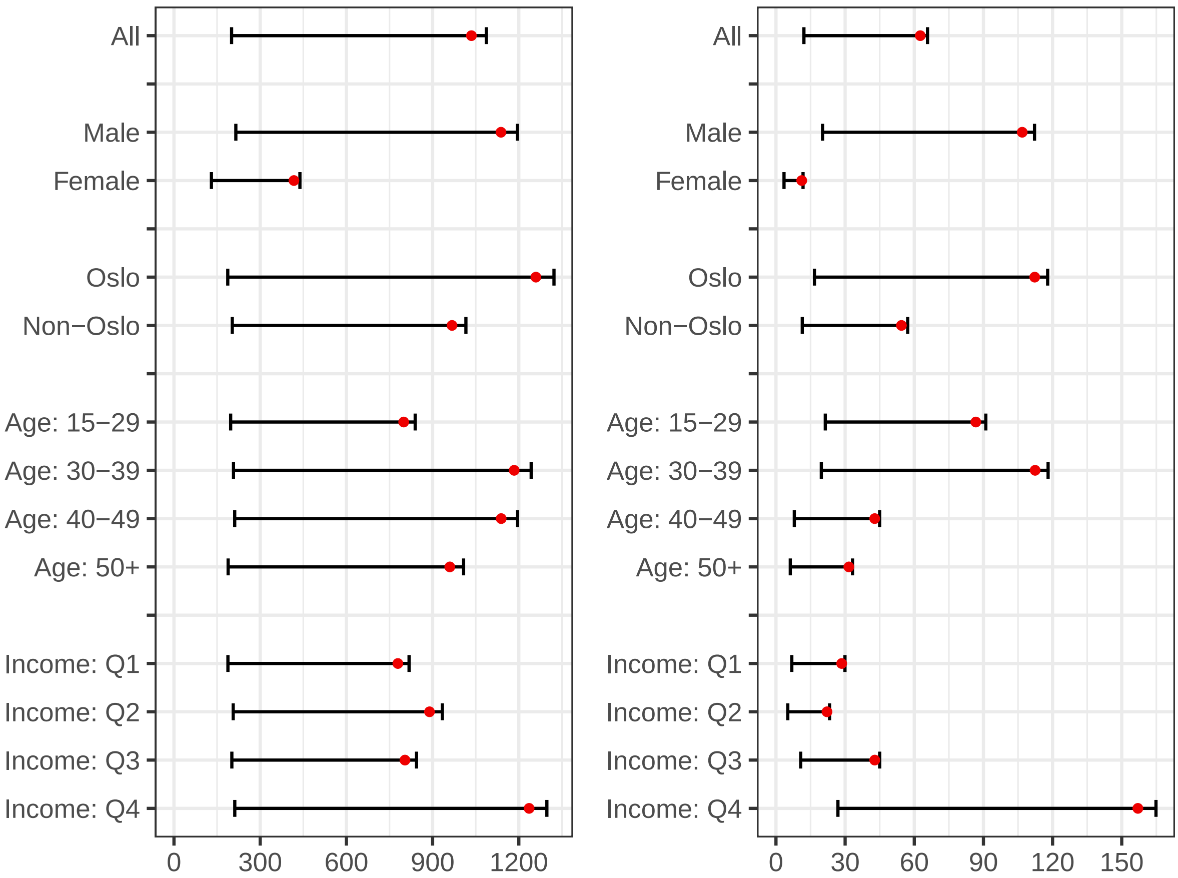
which means that under an arguably weaker version of Assumption 4, the upper-bound estimate on $E(T \mid A^C)$ increases from \$1,035 to \$1,087. Naturally, allowing for a greater magnitude of under-reporting would increase the upper-bound estimate further.

In Panel A of Figure 3, we present bound estimates by individual characteristics. To do so, we apply Assumptions 1–4 conditional on individual characteristics. We find that upper and lower bounds are higher or similar for male than female tax noncompliers, for urban than rural tax noncompliers, for prime-aged tax noncompliers compared to other

[13] In Internet Appendix Table IA.V, we show that tax noncompliers trading on the domestic exchanges are more likely than tax compliers trading on the domestic exchanges to be young, female, and rural, groups that on average have lower tax liabilities. The same compositional differences exist between the broader populations of tax compliers and tax noncompliers, as shown in Table IV.

[14] This figure is derived from Panel A of Figure 3 in Kleven et al. (2011) and its legend.

age groups, and for high-income compared to low-income tax noncompliers.



Panel A. $E(T \mid A^C, X)$ Panel B. $P(A^C \mid X) \cdot E(T \mid A^C, X)$

Figure 3. Average tax liability, bound and point estimates. Panel A shows bound and point estimates of the average crypto tax liability among crypto tax noncompliers differentiated by individual characteristics, obtained by applying Assumptions 1–4 conditional on individual characteristics. Panel B shows point and bound estimates of the average crypto tax liability among the broader Norwegian population differentiated by individual characteristics, obtained by multiplying $P(A^C \mid X)$ from Panel A of Figure 2 with $E(T \mid A^C, X)$ from Panel A above. In both panels, vertical lines indicate the lower and upper bounds, while red dots indicate point estimates. All estimates are based on data from 2021.

Estimates by year. The estimates above pertain to the year 2021. In Internet Appendix Table IA.VII, we present yearly estimates. We find that lower and upper bound estimates are highest in 2021. In 2020, lower and upper bounds are \$74 and \$543, while in 2019, they are \$10 and \$48. We note that we cannot construct a lower bound on $E(T \mid A^C)$ in 2018, as we only have exchange data for the years 2019–2021.

VII. Tax Enforcement

We find that 6% of Norwegians hold undeclared cryptos, each owing a modest amount of taxes. For example, in 2021, the lower and upper bounds on the average tax liability of crypto tax noncompliers are $200 and $1,087, while in 2020, the bounds are even lower, at $74 and $543. Thus, even if tax authorities knew that a person is a tax noncomplier (e.g., by observing their crypto trades) any intervention to recover unpaid taxes would need to cost less than a few hundred dollars to be worthwhile.

Below, we first assess a 2020 intervention by the Norwegian Tax Administration aimed at increasing crypto tax revenue. The intervention involved indiscriminately sending reminder letters to anyone who previously declared crypto in their tax return but then stopped. Next, we use estimates from Sections V–VI to we predict the impact of a counterfactual tax enforcement strategy — correspondence audits. Using the Empirical Welfare Maximization method proposed by Kitagawa and Tetenov (2018), we estimate the impact of targeted implementations of this counterfactual audit intervention. For each alternative enforcement strategy, we compare the benefits in terms of increased tax revenue to the cost of the intervention.

A. Actual letter intervention

Intervention and data. We use data on 1,401 reminder letters sent in November 2020 by the Norwegian Tax Administration to anyone who declared crypto in their 2018 tax return but stopped doing so in 2019.[15] The letter reminds the recipient that cryptos are taxed and explains how to declare them. The letter also makes clear that the Tax

[15] In the U.S., Slemrod et al. (2001) find that recipients of letters warning about increased audit risks subsequently increase their tax payments. In Norway, Bott et al. (2020) find that individuals report more foreign income after receiving a reminder letter from the Norwegian Tax Administration. However, the effect of reminder letter interventions in the context of crypto remains unknown.

Administration has access to crypto transaction data, though it does not disclose the source or extent of the data. We note that reminder letters are distinct from audits in that they do not require the recipient to respond, eliminating the need for document review and thus reducing costs for the authorities; the cost of such interventions is estimated by the Tax Administration to be $30 per letter. For each letter, we observe the recipient's personal identifier, which allows us to link the letters to our tax return data.

Treated vs. control: Difference in means. We first quantify the increase in tax revenue associated with receiving a reminder letter. Figure 4 explains the timing and summarizes how tax compliance and tax revenue change over time.

As the letters were issued in November 2020, the treated group of letter recipients could start declaring crypto as of the 2020 tax return, which is filed in April 2021. As shown in Figure 4, 44.9% of the letter recipients declare crypto in their 2020 return, up from 0% in 2019. Across all letter recipients, including those who do not declare, the average tax revenue is $174. Column (1) of Table VII shows that this estimate is significantly different from zero.

April 2020: Files 2019 tax return → *November 2020*: **Letter intervention** → *April 2021*: Files 2020 tax return

	Data: Treated (April 2020)	Control (April 2020)	*Data*: Treated (April 2021)	Control (April 2021)
$P(A)$	0	0	0.449	0.195
$E(T^* \mid A)$	$0	$0	$388	$145
$E(T^*)$	$0	$0	$174	$28

Figure 4. Timeline: Reminder letter and tax filing deadlines. This figure illustrates the timing of the Tax Administration's crypto reminder letters. After receiving a letter in November 2020, individuals could start declaring crypto as of the 2020 tax return, which was filed in April 2021. The figure also shows data moments from the 2019 and 2020 tax returns for letter recipients and non-recipients.

Of course, letter recipients may have declared positive crypto taxes even absent the letters, suggesting that \$174 is an upper bound on the effect of the intervention. To mitigate this concern, it is useful to compare the behavior of letter recipients to that of a control group of non-recipients. The control group consists of all individuals who hold crypto on the domestic crypto exchanges in 2019 or 2020 and, like the treated group, do not declare crypto in their 2019 tax return. Even absent letters, the control group pays an average of \$28 in crypto taxes in 2020, Figure 4 shows. This gives an estimate of the difference in tax revenue between the treated and control group of \$146. Column (2) of Table VII shows that this difference is statistically significant at the 1% level.

Table VII. Effect of Reminder Letter on Tax Revenue

This table reports estimates of β from the regression $T_i^* = a + \beta \text{Letter}_i + X_i\eta + \varepsilon$, where T^* is the 2020 declared crypto tax liability for individual i and Letter_i is an indicator for whether that individual received a 2020 reminder letter from the Norwegian Tax Administration. In column (1), the estimation sample only includes letter recipients. In column (2), the sample includes letter recipients and a control group of non-recipients. The control group consists of all individuals who hold crypto on the domestic crypto exchanges in 2019 or 2020 and do not declare crypto in their 2019 tax return. In columns (3)–(5), we add controls (X_i) for observable characteristics to the specification in column (2). The controls are age, gender, an indicator for residing in Oslo, an indicator for being married ("social factors"), education in bins, and employment status ("socioeconomic factors"), gross wealth, total income, and total tax liability ("tax return factors"), all measured in 2019. Standard errors are presented in parentheses. Stars indicate statistical significance at the 10% (*), 5% (**), and 1% (***) level.

	Specification				
	(1)	(2)	(3)	(4)	(5)
β	\$174***	\$146***	\$136***	\$127***	\$122***
	(\$23)	(\$23)	(\$24)	(\$24)	(\$24)
Control Group		×	×	×	×
Controls for					
Social Factors			×	×	×
Socioeconomic Factors				×	×
Tax Factors					×
N	1,401	7,997	7,997	7,997	7,997

Adjusting for differences in observables. Next, we turn to regressions to adjust for observable differences between the treated and control group. In columns (3)–(5) of Table VII, we successively control for a wide range of social, socioeconomic, and tax return factors known to impact tax compliance (see, e.g., Kleven et al. 2011), all measured before the letter intervention. (See the table note for the full list of control variables). As expected, adding controls impacts the estimated effect of the letters on tax revenue, decreasing it from \$146 to \$122. However, the difference in tax revenue between the treated and control group remains statistically significant at the 1% level. Taken together, the estimates in Table VII suggest that sending reminder letters to anyone who previously filed crypto taxes but then stopped is a profitable strategy, given a cost of \$30 per letter.

B. Counterfactual audit intervention

Next, we estimate the effect on tax revenue of another widely-used tax enforcement strategy: correspondence audits. A correspondence audit involves sending a letter to a taxpayer requesting documentation — e.g., bank statements — to support the claims in the filed tax return. Unlike the reminder letters studied above, which do not require a response, the taxpayer must respond to a correspondence audit. The Norwegian Tax Administration estimates that a correspondence audit costs \$180 per tax return, higher than the \$30 cost of a reminder letter, reflecting the extra cost of reviewing documentation.

We are unaware of any systematic data on correspondence audits in the context of crypto. Yet, we can use our estimates of tax noncompliance and tax evasion from Sections V–VI to bound the effect of counterfactual correspondence audits on tax revenue. We consider two target populations for these audits: the broader Norwegian population, U, and the population of crypto tax noncompliers, A^C. Although A^C may be difficult to observe in practice, this group is interesting because it represents an ideal starting point for audits. For each of these populations, we first estimate the average effect on gross tax revenue of auditing a random person from the target population. Next, we estimate the effect of audits targeted by the marginal distribution of individual characteristics.

Random audits. We begin with the effect of auditing a random crypto tax noncomplier, A^C. Let $T^*(1)$ and $T^*(0)$ denote the crypto tax liability a person would declare with and without an audit. By definition, crypto tax noncompliers declare no crypto taxes absent an audit, so that $T^*(0) = 0$. We assume that correspondence audits recover the audit subject's true tax liability, so that $T^*(1) = T$. If this assumption is violated, our upper bound estimates are still valid.

Drawing audit subjects at random from A^C, the average effect of audits on gross tax revenue is then given by:

$$\Delta_1 = E(T^*(1) - T^*(0) \mid A^C) = \underbrace{E(T \mid A^C)}_{\text{Table III}}$$

where we have derived bounds and a point estimate of $E(T \mid A^C)$ in Table III. The point estimate is \$1,035, which is close to the upper bound of \$1,087. Importantly, we find that even the lower bound estimate, at \$200, exceeds the audit cost of \$180. Thus, our results suggest that the benefits of such an audit exceed the costs.[16]

Next, we consider the arguably more realistic scenario where authorities must draw audit subjects from the broader Norwegian population, U, where only a fraction $P(A^C)$ are tax noncompliers. The average tax revenue raised from tax noncompliers is then:

$$\Delta_2 = E(T^*(1) - T^*(0) \mid U) = \underbrace{P(A^C)}_{\text{Table III}} \cdot \underbrace{E(T \mid A^C)}_{\text{Table III}} \tag{17}$$

[16]As explained in Section II, the Tax Administration can impose a 20% penalty surtax on the amount of taxes evaded by tax noncompliers. This penalty is not included in our calculations of Δ_1 or Δ_2 below. Naturally, incorporating such a penalty would increase the estimated effect of audits on tax revenue.

where $P(A^C)$ is known from Table III.[17] In Panel B of Figure 3, we find that even the upper bound estimate of Δ_2, at \$65, falls below the audit cost of \$180. Thus, we can confidently conclude that the benefits of such an audit fall below the costs.

Targeted audits. Our estimates of Δ_1 may exceed the audit cost of \$180 either because crypto tax liabilities are consistently high across tax noncompliers, or because a select few tax noncompliers have very high crypto tax liabilities. To distinguish between these alternatives, we allow Δ_1 to vary across sub-populations of tax noncompliers:

$$\Delta_1(X) = E(T^*(1) - T^*(0) \mid A^C, X) = \underbrace{E(T \mid A^C, X)}_{\text{Panel A, Figure 3}} \tag{18}$$

where we have derived bounds and point estimates of $E(T \mid A^C, X)$ in Panel A of Figure 3 according to the marginal distributions of age, gender, location, and income. Across all these individual characteristics, we find that even the lower bound estimates of $\Delta_1(X)$ exceed or are similar to the audit cost of \$180. This finding suggests that the benefits of auditing tax noncompliers consistently exceed the costs.

To explore heterogeneity in the effect of audits in the broader population, we similarly allow Δ_2 to vary across sub-populations by individual characteristics:

$$\Delta_2(X) = E(T^*(1) - T^*(0) \mid U, X) = \underbrace{P(A^C \mid X)}_{\text{Panel A, Figure 2}} \cdot \underbrace{E(T \mid A^C, X)}_{\text{Panel A, Figure 3}} \tag{19}$$

where we have estimated $P(A^C \mid X)$ in Panel A of Figure 2 according to the marginal

[17] Drawing audit subjects from the broader population means there is a probability $P(A)$ that the subject is a tax *complier*, who may also owe taxes. Assuming tax compliers initially under-report their true tax liability by 5% (Revised Assumption 4), and that audits recover the full tax liability, this source of revenue can be captured by adding $0.05 \cdot P(A) \cdot E(T^* \mid A)$ to Equation (17). This adjustment would increase our lower and upper bound estimates of Δ_2 by an economically insignificant \$0.40.

distributions of age, gender, and location; individual characteristics observed in our survey data. To estimate $P(A^C \mid X)$ for characteristics that are not observed in our survey data, such as income, we assume that $P(A^C \mid B, X) = P(A^C \mid B)$. By combining and rearranging Equations (5)–(6), we then have that $P(A^C \mid X) = \frac{P(A^C|B,X)\cdot P(A|X)}{1-P(A^C|B,X)} = \frac{P(A^C|B)\cdot P(A|X)}{1-P(A^C|B)}$, where $P(A^C \mid B)$ is known from Table III and $P(A \mid X)$ can be estimated for any characteristic observed in our register data. Supporting this assumption, Panel B of Figure 2 shows that $P(A^C \mid B, X) \approx P(A^C \mid B)$ for the individual characteristics observed in the survey data.

Our bound and point estimates of $\Delta_2(X)$ are presented in Panel B of Figure 3. Across all the individual characteristics, we find that even the upper bound estimates of $\Delta_2(X)$ fall below the audit cost. Thus, we can confidently conclude that the benefits of such targeted audits within the broader population consistently fall below the costs.

C. Optimal targeted audits

The results above suggest that audits are costly relative to their benefits when drawing audit subjects from the broader Norwegian population, whereas the benefits of exclusively auditing crypto tax noncompliers, if feasible, would exceed the costs. These conclusions hold true even when audits are targeted based on the marginal distributions of age, gender, location, or income. A natural question is whether there exist better ways to target audits that could increase the benefit or reduce the cost of audits.

Kitagawa and Tetenov (2018) propose a framework for determining optimal rules for targeted interventions. As explained below, Kitagawa and Tetenov (2018) restrict attention to targeting rules that are simple enough to feasibly be adopted by policymakers, given the various budgetary, ethical, or legislative constraints policymakers face. Nevertheless, these rules allow for targeting based on the joint distribution of individual characteristics, as opposed to only the marginal distributions considered in Section VII.B.

We now apply their framework to our context of targeted crypto audits.

Objective function. We focus on audits within the broader population, but for completeness, we also report results for audits within the population of crypto tax noncompliers. Let $\Delta_2(X)$ be defined as in Section VII.B, with $X \equiv [X_1, X_2]$ now denoting age and income.[18] Let $c = \$180$ denote the cost of a correspondence audit and let $G : \mathcal{X}_1 \times \mathcal{X}_2 \to \{0, 1\}$ denote the Tax Administration's choice of whom to target for audits based on their age and income.

Optimal targeting involves choosing the targeting rule, G, that maximizes the sum of crypto tax revenue net of audit costs:

$$\max_{G(\cdot)} \sum_{i=1}^{N} \overbrace{(\Delta_2(X_i) - c)}^{\substack{\text{Net Audit} \\ \text{Revenue}}} \overbrace{G(X_i)}^{\substack{\text{Policy} \\ \text{function}}} \tag{20}$$

We follow Kitagawa and Tetenov (2018) and consider a targeting rule of the form:

$$G(x_1, x_2) = \overbrace{1[s_1\ (x_1 - \beta_1) \geq 0]}^{\substack{\text{Above or below the} \\ \text{threshold for } X_1}} \cdot \overbrace{1[s_2\ (x_2 - \beta_2) \geq 0]}^{\substack{\text{Above or below the} \\ \text{threshold for } X_2}}$$

where $\beta_1, \beta_2 \in \mathbb{R}$ and $s_1, s_2 \in \{-1, 1\}$. This targeting rule is easy to implement and often used in practice. For an individual to be selected for an audit under this rule, their age and income must either be above or below some specific thresholds. The thresholds for characteristics x_1 and x_2 are set by β_1 and β_2, while s_1 and s_2 specify whether the audit should be conducted above or below the thresholds. We solve the program by conducting a grid search across all possible combinations of β_1, β_2, s_1, and s_2.

We present our results in two steps.

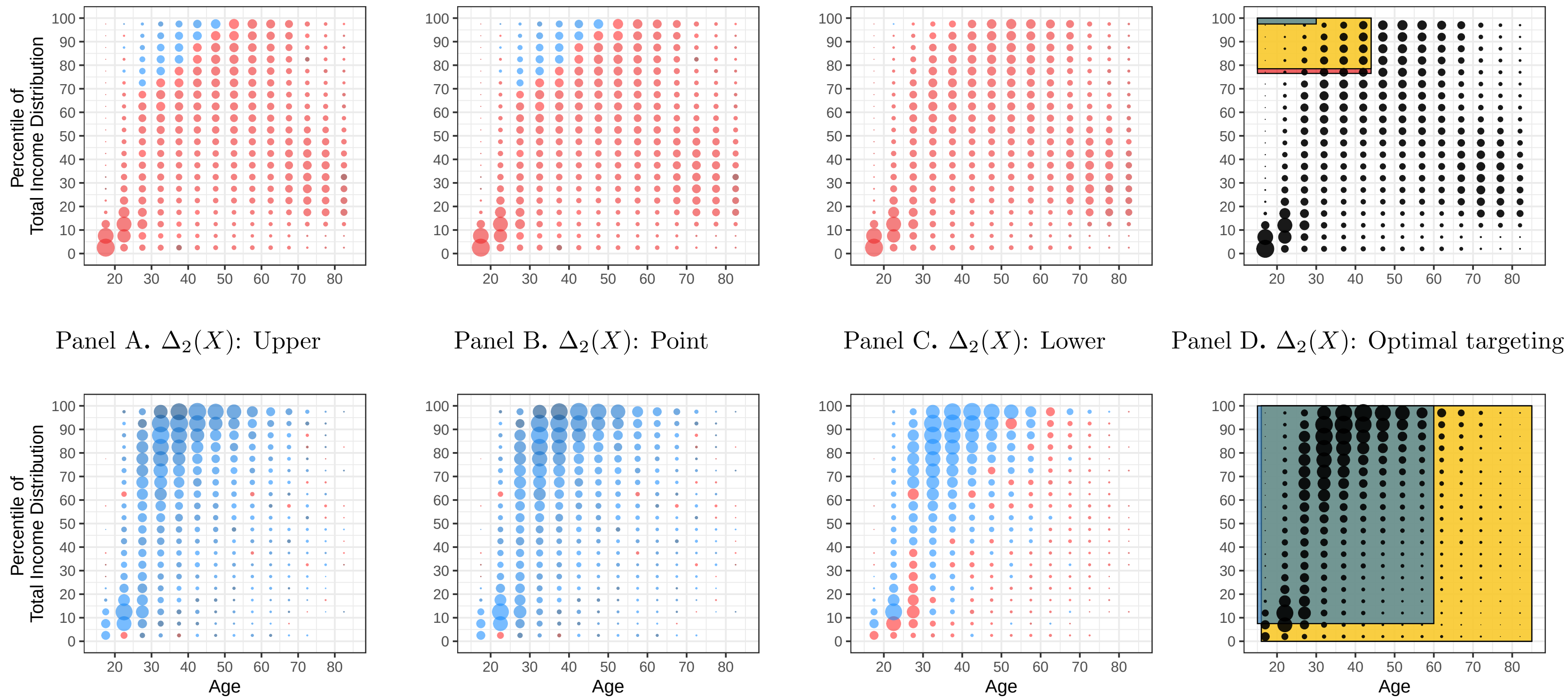
[18] Internet Appendix Table IA.VIII considers alternative combinations of individual characteristics.

Estimates of $\Delta_2(X)$. First, in Panels A–C of Figure 5, we present our bound and point estimates of $\Delta_2(X)$, which are obtained by repeating the identification steps in Section VII.B for each combination of age and income. The color of the dots in Figure 5 indicates the value of the audit effect for a given covariate combination: Blue colors indicate audit effects exceeding the audit cost of \$180, while red colors indicate audit effects below \$180. The darker the color, the further the estimate is above or below the audit cost. The size of the dots represents the number of individuals within each cell.

The figure shows that both our upper bound and point estimates of $\Delta_2(X)$ exceed the audit cost for a meaningful segment of young, high-income Norwegians. The figure also shows that our lower bound estimates generally do not exceed the audit cost, with the exception of a small subgroup of young Norwegians with very high incomes.

Optimal audit strategy. Next, in Table VIII and Panel D of Figure 5, we present the optimal audit strategy given $\Delta_2(X)$. We are primarily interested in determining whether there is any scope for profitable audits without using information on A^C. For this reason, we first solve Program (20) using our point estimates of $\Delta_2(X)$, which are close to the upper bound estimates. We find that the optimal strategy is to audit any Norwegian aged below 44, with income above the 78^{th} percentile. This group represents about 6.5% of the Norwegian population. Within this group, the average effect of audits on gross tax revenue is \$380, which is considerably higher than the effect of random audits in Section VII.B. Auditing everyone in the target group would raise a total of \$58.6 million in net crypto tax revenue, as shown in column (5) of Table VIII.

When considering the point estimates of $\Delta_2(X)$, it is therefore possible to target audits in such a way that their benefits meaningfully exceed the costs. A natural next question is whether profitable targeting can be ensured using our lower bound estimates of $\Delta_2(X)$. Solving Program (20) using our lower bound, we find that there are still benefits from targeting. However, the optimal audit strategy becomes highly selective, targeting only



Panel A. $\Delta_2(X)$: Upper

Panel B. $\Delta_2(X)$: Point

Panel C. $\Delta_2(X)$: Lower

Panel D. $\Delta_2(X)$: Optimal targeting

Panel E. $\Delta_1(X)$: Upper

Panel F. $\Delta_1(X)$: Point

Panel G. $\Delta_1(X)$: Lower

Panel H. $\Delta_1(X)$: Optimal targeting

Figure 5. Effect of correspondence audits by age and taxable income. Panels A–C show upper, point, and lower bound estimates of $\Delta_2(X)$, with $X \equiv [X_1, X_2]$ denoting age and income. Panels E–G show upper, point, and lower bound estimates of $\Delta_1(X)$. The color of the dots indicates their value: Blue colors indicate audit effects exceeding the audit cost of $c = \$180$, while red colors indicate audit effects below \$180. The darker the color, the further the estimate is above or below the audit cost. The size of the dots represents the number of individuals with different covariate values. Panels D and H show the optimal audit targeting rules based on $\Delta_2(X)$ and $\Delta_1(X)$, respectively. The areas shaded in red, yellow, and green represent the individuals recommended for auditing based on solving Program (20) with the upper bound, point, and lower bound estimates of $\Delta_2(X)$ and $\Delta_1(X)$, respectively. All estimates are based on data from 2021.

Table VIII. Optimal Targeted Audits

This table presents optimal audit strategies as determined by Program (20). In Panel A, the program is solved using our point and bound estimates of $\Delta_2(X)$ from Figure 5, while in Panel B, the program is solved using our point and bound estimates of $\Delta_1(X)$ from the same figure. In each panel, Column (1) specifies the optimal targeting rule; Column (2) reports the average effect of audits on gross tax revenue among the optimally chosen target group of individuals, denoted by G; Column (3) reports the average effect on net tax revenue; Column (4) reports the share of the underlying population optimally chosen for audits; and Column (5) reports the total net tax revenue raised if all the individuals in G were audited, calculated as the product of the net audit effect and the number of individuals targeted by the rule in Column (1).

Panel A. Targeting In The Broader Population

	Treatment Rule	$E[\Delta_2(X) \mid G, U]$	$E[\Delta_2(X) - c \mid G, U]$	$P(G \mid U)$	Total Net Revenue ($M)
	(1)	(2)	(3)	(4)	(5)
Using Point Estimate of $\Delta_2(X)$	Age $<$ 44 and Income $\geq 78^{th}$ pctile	$380	$200	6.52%	$58.56
Using Upper Bound of $\Delta_2(X)$	Age $<$ 44 and Income $\geq 76^{th}$ pctile	$375	$195	7.33%	$64.21
Using Lower Bound of $\Delta_2(X)$	Age $<$ 30 and Income $\geq 98^{th}$ pctile	$213	$33	0.01%	$0.02

Panel B. Targeting Crypto Tax Noncompliers

	Treatment Rule	$E[\Delta_1(X) \mid G, A^C]$	$E[\Delta_1(X) - c \mid G, A^C]$	$P(G \mid A^C)$	Total Net Revenue ($M)
	(1)	(2)	(3)	(4)	(5)
Using Point Estimate of $\Delta_1(X)$	Age $\geq$ 16 and Income $\geq 0^{th}$ pctile	$1035	$855	100%	$232.32
Using Upper Bound of $\Delta_1(X)$	Age $\geq$ 16 and Income $\geq 0^{th}$ pctile	$1087	$907	100%	$246.39
Using Lower Bound of $\Delta_1(X)$	Age $<$ 60 and Income $\geq 8^{th}$ pctile	$209	$29	91.35%	$7.13

individuals aged below 30, with income above the 98^{th} percentile. This group represents about 0.01% of the Norwegian population. Within this group, the average effect of audits on gross tax revenue is $213. Still, auditing everyone in this group would raise only about $20,000 in net tax revenue, due to the small size of the targeted group.

VIII. Conclusion

The goal of our paper was to quantify the extent of crypto tax noncompliance and evasion, and to assess the efficacy of alternative tax enforcement interventions. The context of our study is Norway in the period 2018–2021. This context allowed us to address key measurement challenges by combining de-anonymized crypto trading data with individual tax returns, survey data, and information from tax enforcement interventions. We found that crypto tax noncompliance is pervasive, even among investors trading on exchanges that share identifiable trading data with tax authorities. However, since most crypto investors owe little in crypto-related taxes, enforcement strategies need to be well-targeted or cheap for benefits to outweigh costs.

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Internet Appendix

A. Information About the Survey Data

The surveys are conducted by Norstat, a leading European statistical agency. Norstat maintains a panel of about 120,000 active survey subjects. Subjects are continually recruited to maintain a panel that is representative of the Norwegian population in terms of age, gender, and place of residence. From this broader panel, each year since 2018 — except for 2020, due to the COVID-19 pandemic — a random sample has been drawn to answer questions about their crypto ownership.[19] Each survey wave includes about 1,000 interviews, which are conducted over the course of one week. In 2019, 2021, and 2022, the interviews were conducted in end of February or early March, while in 2018, the interviews were conducted in October.

In all survey waves, the subjects are asked "*Do you own bitcoin or any other cryptocurrency?*" (In Norwegian: "Eier du bitcoin eller annen kryptovaluta?"). In the main text, $P(B)$ is given by the share of survey subjects that respond "Yes" to this question. Since we observe the age, gender, and place of residence of the survey subjects, we also obtain $P(B \mid X)$ as the share of subjects by age, gender, and place of residence who own crypto. Table IA.I provides information on survey response rates, the number of interviews, and estimates of $P(B)$ and $P(B \mid X)$ by survey wave.

Representativeness. As explained above, the crypto survey sample is drawn randomly from a subject pool that is supposed to be representative of the broader Norwegian population in terms of age, gender, and place of residence. We can use our population data from Statistics Norway to assess whether the survey sample, indeed, is comparable to the broader Norwegian population in terms of these characteristics. In Table IA.II, we present the characteristics of survey subjects next to the characteristics of the broader

[19]This yearly crypto survey is commissioned by Arcane Research (now K33 Research) and forms the basis of their annual "Norwegian Crypto Adoption Survey" publication; see k33.com.

population. We find that the interviewed survey subjects are almost identical to the broader population in terms of age in bins, gender, and place of residence.

Table IA.I. Overview: Survey

	2018	2019	2021	2022
$P(B)$	5.0%	4.3%	6.9%	9.8%
$P(B \mid \text{Male})$	9.1%	5.9%	10.9%	13.5%
$P(B \mid \text{Female})$	2.0%	2.8%	3.0%	6.1%
$P(B \mid \text{Oslo})$	3.8%	7.6%	10.5%	11.3%
$P(B \mid \text{Non-Oslo})$	5.3%	3.9%	6.4%	9.6%
$P(B \mid \text{Age: 15–29})$	12.1%	8.3%	11.8%	18.1%
$P(B \mid \text{Age: 30–39})$	8.2%	8.7%	11.3%	19.6%
$P(B \mid \text{Age: 40–49})$	2.7%	2.8%	4.8%	7.9%
$P(B \mid \text{Age: 50+})$	2.0%	1.5%	3.6%	2.4%
Other Survey Statistics				
Implied # crypto investors	215,272	190,120	308,287	447,947
Response rate	14%	14%	25%	19%
Number of interviews	1,010	1,016	1,020	1,017

Table IA.II. Composition: Survey and Population

This table summarizes the characteristics distribution, $P(X)$, of survey respondents (Panel A) and the broader Norwegian population (Panel B) each year 2018, 2019, and 2021 for which we have access to both survey data and population data.

	Panel A: Survey			Panel B: Population		
	2018	2019	2021	2018	2019	2021
Male	0.501	0.501	0.502	0.502	0.502	0.502
Female	0.499	0.499	0.498	0.498	0.498	0.498
Oslo	0.130	0.130	0.131	0.127	0.128	0.129
Non-Oslo	0.870	0.870	0.869	0.873	0.872	0.871
Age: 15–29	0.204	0.203	0.232	0.233	0.230	0.221
Age: 30–39	0.169	0.170	0.165	0.162	0.163	0.163
Age: 40–49	0.180	0.176	0.163	0.166	0.163	0.157
Age: 50+	0.447	0.451	0.440	0.439	0.444	0.459

B. Information About the Exchange Data

The regulatory context is useful for understanding our data access. Before 2019, Norway had no clear legal framework for crypto exchanges or their regulation, allowing any business to facilitate crypto transactions for Norwegians. In 2019, new regulations required any business involved in crypto trading — whether registered in, operating from, or targeting the Norwegian market — to register with the Financial Supervisory Authority of Norway, akin to the SEC in the U.S. Registered exchanges must comply with anti-money laundering and counter-terrorism regulations by verifying user identities before account creation, similar to U.S. know-your-customer rules, and reporting suspicious transactions to authorities. The first regulated exchange was formed in 2019, and by 2021, there were nine. However, virtually all regulated crypto trading takes place on a handful of major exchanges (see, e.g., EY and K33 (previously Arcane) Research 2023).

Exchange coverage I. Our data cover trading on the regulated exchanges. The data were subpoenaed in 2021 and 2022 by the Norwegian Tax Administration and later shared with us.[20] For the years 2019–2020, our data cover seven of the nine regulated exchanges. The two remaining exchanges are minor operations organized as sole proprietorships without employees. For 2021, the data cover the three biggest exchanges.

To assess how our coverage of regulated crypto trading changes from 2020 to 2021, in Table IA.III, we calculate each exchange's market share of trading in 2020. We find that the three major exchanges account for 98.1% of all trades and 93.0% of all investors in 2020. Thus, our data cover the vast majority of trading on regulated exchanges over the full 2019–2021 period for which such exchanges have existed in Norway.

[20] The Tax Administration's data collection efforts have been detailed in several public sources, e.g., Finansavisen (2024), Bare Bitcoin (2024), and Office of the Auditor General of Norway (2023). For confidentiality reasons, we cannot disclose how the Tax Administration selects exchanges for data collection.

Exchange coverage II. While unlawful, an estimated 10–20 *unregulated* crypto trading platforms continued to operate in Norway after 2019 (National Authority for Investigation and Prosecution of Economic and Environmental Crime 2021). To assess our coverage of overall domestic trading, we draw on survey evidence. Using the same survey methods described in Appendix A, EY and K33 (previously Arcane) Research 2023 asked Norwegian crypto investors about their choice of trading platform. Among those trading domestically, around 90% report trading on one of the three biggest regulated exchanges. The remaining survey subjects report trading on "Other domestic platforms", which includes the remaining regulated exchanges, which are covered by our data, as well as unregulated domestic exchanges, which are not covered by our data. This suggests that our data cover the vast majority of not only regulated domestic trading, but also overall domestic trading.

Summary. In the main text, we use data from all the available exchange-years in Table IA.III to calculate V^D and G^D; the value of crypto holdings and capital income accrued on the regulated domestic crypto exchanges between 2019 and 2021. (See Internet Appendix Section C for details on how these variables are calculated). Accordingly, these measures do not include any crypto holdings or capital income accrued on *unregulated* domestic exchanges, where trading activity appears minimal, nor do they include crypto holdings or income accrued outside the regulated or unregulated domestic exchanges, for example, on foreign exchanges. The measures also do not account for investors' trading, if any, that takes place before 2019 on any trading platform, domestic or foreign.

All such values are captured by the T^F term in Equation (12).

Table IA.III. Exchange Coverage

This table summarizes our coverage of regulated domestic crypto exchanges over the period 2019–2021. The leftmost panel indicates the years for which we observe data from a given exchange. We note that exchange coverage increases from 2019 to 2020 as new exchanges are formed; exchange coverage decreases from 2020 to 2021 as data was collected from fewer exchanges. The middle panel indicates a given exchange's annual market share of total trading, as measured by the number of transactions. The rightmost panel indicates a given exchange's annual market share of total trading, as measured by the number of active (at least one trade) investors. The footer of the table provides annual totals for the number of trades, trading volume, and number of active investors across all exchanges in our data.

	Observed			**Share of trades**			**Share of investors**		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Exchange A	×	×	×	92.2%	91.3%	97.2%	62.8%	81.9%	91.3%
Exchange B		×	×		6.1%	2.5%		7.4%	5.5%
Exchange C		×	×		0.7%	0.3%		3.7%	3.2%
Exchange D	×	×		7.8%	1.5%		37.2%	5.9%	
Exchange E		×			0.2%			0.5%	
Exchange F		×			0.1%			0.2%	
Exchange G		×			0.0%			0.5%	
Total # of trades	3,812	94,865	2,661,099						
Trading volume (1000s)	42,332	569,268	16,503,032						
Number of investors	258	5,760	84,438						

C. Calculating V^D and G^D

In Section V, we use V^D, the value of crypto holdings accumulated on the domestic exchanges, combined with survey moments to estimate the prevalence of crypto tax noncompliance among investors trading on and outside the domestic exchanges. In Sections VI–VII, we use both V^D and G^D, the capital income accrued on the domestic exchanges, to construct a lower bound on the tax liabilities owed by tax noncompliers.

Here, we explain how V^D and G^D are calculated.

Both V^D and G^D are calculated using the full history of buys and sells from all the domestic crypto exchanges and years tabulated in Table IA.III.

Calculating V^D. To calculate V^D, for each investor, we use the full history of buys and sells from the domestic exchanges to calculate net positions of each coin, for example, bitcoin, by the end of each year. Bonuses from exchange rewards programs are added to the end-of-year coin holding. Then, we use coin exchange rates as of December 31 each year to calculate V^D as the end-of-year crypto holdings measured in USD.

Calculating G^D. We calculate G^D in two steps. First, we account for capital income derived from realized gains. For each investor, we use the full transaction history observed on the domestic exchanges to calculate realized gains for each sale using the first-in-first-out (FIFO) method, as mandated by the Norwegian Tax Administration.

Table IA.IV illustrates the FIFO method for a hypothetical investor who makes two purchases and two sales. The investor buys 100 coins in January at \$10 per coin and another 50 coins in February at \$15 per coin. In March, the investor sells 80 coins at \$20 per coin. According to FIFO, the realized gains on this transaction are evaluated against the earliest purchase — in January — with a price of \$10 per coin, resulting in a gain of

$80 \times (\$20 - \$10) = \$800$. In April, the investor sells another 70 coins at \$25 per coin. The first 20 coins are evaluated against the remaining 20 coins from the January purchase at \$10, and the next 50 coins are evaluated against the February purchase at \$15, resulting in another realized gain of $20 \times (\$25 - \$10) + 50 \times (\$25 - \$15) = \$800$.

Using the FIFO method, we are able to assign realized gains to about 84% of the sales observed in our data. For the remaining 16%, the quantity sold exceeds the investor's previously accumulated balance of coins, which means that we lack a purchase price to evaluate the sales price against. This may occur because investors can transfer coins from external wallets to the domestic exchanges and proceed to sell from these balances. These transactions are not included in the calculation of G^D. Instead, the realized gains from these sales are accounted for in the foreign-accumulated capital income G^F and, subsequently, the foreign-accumulated tax liability T^F in Equation (12).

In the second step, we account for capital income *not* derived from realized capital gains. In Norway, staking, mining, and bonuses from exchange rewards programs are all classified as capital income from crypto, and taxed as the same rate as realized capital gains. One cannot mine crypto on centralized crypto exchanges. In addition, the regulated crypto exchanges in Norway did not introduce staking services until 2022, after our data ends. However, the biggest domestic exchange did offer rewards programs, such as referral and welcome bonuses, which we observe in the data. We therefore add these bonus payments to the yearly domestic capital income for each investor.

Finally, for each year, we add up all realized gains and bonuses received by December 31 that year to arrive at G^D, the end-of-year capital income measured in USD.

Table IA.IV. Illustration: First-in-First-Out Method

Type	**Date**	**Quantity**	**Price**	**Realized Capital Gains**
Buy	Jan 1, 2020	100	\$10	-
Buy	Feb 1, 2020	50	\$15	-
Sell	Mar 1, 2020	80	\$20	\$800
Sell	Apr 1, 2020	70	\$25	\$800

D. Information About the Letter Intervention

In Section VII, we assess the impact of receiving a "reminder letter" from the Norwegian Tax Administration on subsequent crypto tax reporting. Below, we outline the content of the letters.

Letter content. Figure IA.1 presents a copy of the letter text.[21] The letter is in Norwegian. We therefore provide a translation of the key points of the letter.

The letter is organized into five parts:

The first part clarifies the purpose of the letter: "*The Norwegian Tax Administration aims for everyone to accurately report on their tax returns. For 2019, we have noticed an increase in errors and omissions in the reporting of cryptocurrency.*"

The second part identifies two reasons the recipient may have received the letter:

- "*You declared crypto holdings or gains/losses in the tax returns for 2018 or 2019.*"
- "*You are in a group that has been indicated by our analysis tools or transaction records to be part of transactions involving cryptocurrencies.*"

The third part of the letter urges recipients to identify and amend any discrepancies in past tax returns and explains the process for making these amendments. However, the letter does not point out specific discrepancies in the recipient's tax returns.

The fourth part addresses how to ensure tax compliance moving forward. It notes that crypto holdings and income are taxable but not pre-populated in tax returns, requiring self-reporting by the taxpayer. It also explains how to report these items.

The letter concludes by emphasizing the penalties for tax noncompliance.

[21] The letter content is also described in publicly available sources, e.g., Kryptosekken (2020).

Skatteetaten

Vår dato
27. november 2020

Vår referanse
[redacted]

800 80 000
skatteetaten.no

Org. nr
974 761 076

[redacted]

INFORMASJON TIL SKATTEMELDINGEN 2019 – VIRTUELL VALUTA

Skatteetaten har et mål om at alle skal rapportere riktig på skattemeldingen.

For 2019 har vi sett tegn på at det er en stor økning i feil og manglende rapportering innenfor virtuell valuta (kryptovaluta).

Hvorfor mottar jeg dette brevet?

Du mottar dette brevet enten fordi

> du har rapportert gevinst/tap eller beholdning av kryptovaluta på skattemeldingen for 2018 eller 2019 eller
>
> du er i en gruppe som våre analyseverktøy eller transaksjonsoversikter har indikert at er part i transaksjoner med kryptovaluta.

Hva bør jeg gjøre?

Hvis du er du usikker på om du har rapportert formue eller gevinst/tap i kryptovaluta riktig, da oppfordrer vi deg til å kontrollere tidligere skattemeldinger.

Finner du feil i skattemeldingene kan du selv endre din egen skattemelding inntil 3 år tilbake i tid.

> Skattemeldingen for 2019 endrer du ved å logge inn i skattemeldingen, endre og levere på nytt.
>
> For skattemeldingen 2017 og 2018 må du levere endringsmelding som du kan lese mer om her.

Kryptovaluta forhåndsutfylles ikke

Det er ingen forhåndsutfylling av informasjon om kryptovaluta i skattemeldingen per i dag og du må derfor selv fylle ut denne informasjonen. Eide du kryptovaluta ved årsskiftet må du oppgi formue for kryptovaluta. Solgte eller realiserte du på annen måte kryptovaluta i løpet av året må gevinst/tap føres. Utvinning av kryptovaluta (som mining) og andre inntekter skal du også føre opp for det året de er utvunnet/opptjent.

I den nye skattemeldingen for 2019 fyller du enkelt ut kortet *Virtuell valuta/kryptovaluta* som ligger under temaet *Finans*. Det er hjelpetekster til alle postene og du får vite mer om hvordan du fastsetter verdiene her.

Aktuelle regler og lover

Det følger av skatteforvaltningsloven § 8-1 at alle skal gi riktige og fullstendige opplysninger i skattemeldingen. Dersom det blir oppgitt uriktige eller ufullstendige opplysninger kan det ilegges tilleggsskatt etter skatteforvaltningsloven § 14-3 første ledd og skjerpet tilleggsskatt etter § 14-6. Dersom den skattepliktige frivillig retter sin egen skattemelding, vil unntaket fra tilleggsskatt i skatteforvaltningsloven § 14-4 d) komme til anvendelse.

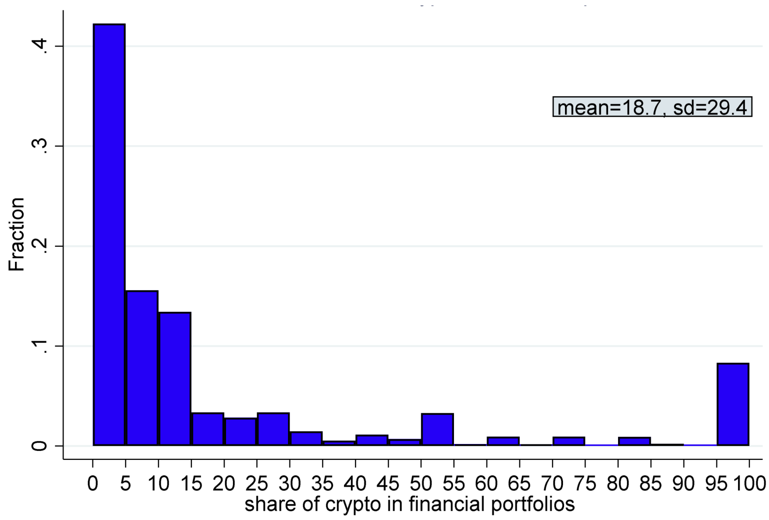
Dette brevet er kun til informasjon, og du trenger ikke å svare på det. Du må levere skattemelding eller endringsmelding om du oppdager feil eller manglende opplysninger i tidligere leverte skattemeldinger.

Med hilsen

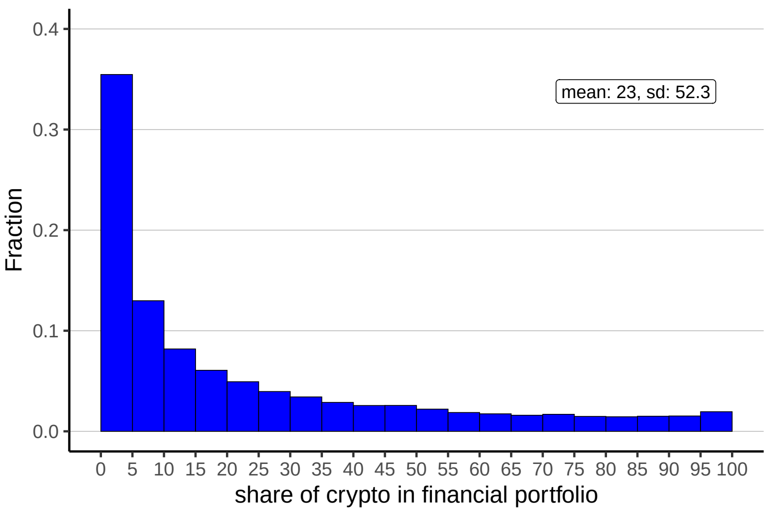
Skatteetaten

Figure IA.1. Reminder letter sent in November 2020

E. Additional Tables and Figures



Panel A. American crypto investors' crypto holdings



Panel B. Norwegian crypto investors' crypto holdings

Figure IA.2. Crypto holdings: American and Norwegian investors. Panel A is a screenshot of Figure 2, Panel A from Weber et al. (2023), which is based on American survey data from the 2021 wave of the Nielsen Homescan Panel. The survey asked respondents, "*What percent of your financial wealth (excluding housing) do you invest in the following categories? Put '0' if you do not invest in a given category.*" The figure shows the distribution of wealth share responses for the category "*Bitcoin and other cryptocurrencies*" among respondents who report owning crypto. Panel B shows the corresponding distribution for Norwegian crypto investors calculated based on administrative data from 2021. Analogous to Weber et al. (2023), we calculate individuals' crypto wealth shares by dividing the value of their declared crypto holdings from their tax returns by their total financial wealth as reported in the tax returns.

Table IA.V. Characteristics By Trading Venue

This table summarizes the characteristics of crypto investors by trading venue. All moments are measured in 2021. For any W_1, W_2, for example, A and D, we have that $P(X \mid W_1, W_2) = \frac{P(W_1 \cup W_2 | X) P(X)}{P(W_1 \cup W_2)}$.

	$P(X \mid D)$	$P(X \mid D^C)$	$P(X \mid A^C, D)$	$P(X \mid A^C, D^C)$	$P(X \mid A, D)$	$P(X \mid A, D^C)$
Male	0.831	0.774	0.827	0.765	0.848	0.869
Female	0.169	0.226	0.173	0.235	0.152	0.131
Oslo	0.163	0.206	0.151	0.202	0.213	0.248
Non-Oslo	0.837	0.794	0.849	0.798	0.787	0.752
Age: 15–29	0.475	0.349	0.523	0.358	0.289	0.255
Age: 30–39	0.263	0.271	0.244	0.259	0.337	0.392
Age: 40–49	0.142	0.099	0.126	0.089	0.207	0.206
Age: 50+	0.119	0.281	0.107	0.294	0.167	0.146

Table IA.VI. Alternative Definition of A

Column (1) presents our baseline estimates of the prevalence of crypto tax noncompliance, the characteristics of crypto tax noncompliers, and the value of tax evasion. Table III summarizes the identification arguments. All moments are measured in 2021. In the main text, the set A includes those who declare positive crypto holdings ($V^* > 0$) and potentially crypto income ($G^* \in R$) in their tax return. Column (2) presents alternative estimates where we re-define A to include also those who declare $\{V^* = 0, G^* \neq 0\}$ in their tax return, that is, that they have exited crypto during the year.

	Baseline estimates	Include $\{V^* = 0, G^* \neq 0\}$ in A
Prevalence:		
$P(A^C)$	0.060	0.060
$P(A^C \mid B)$	0.881	0.872
Characteristics:		
$P(\text{Male} \mid A^C)$	0.780	0.779
$P(\text{Female} \mid A^C)$	0.220	0.221
$P(\text{Oslo} \mid A^C)$	0.190	0.190
$P(\text{Non-Oslo} \mid A^C)$	0.810	0.810
$P(\text{Age: 15–29} \mid A^C)$	0.397	0.398
$P(\text{Age: 30–39} \mid A^C)$	0.255	0.255
$P(\text{Age: 40–49} \mid A^C)$	0.098	0.097
$P(\text{Age: 50+} \mid A^C)$	0.250	0.250
Prevalence by X:		
$P(A^C \mid B, \text{Male})$	0.871	0.860
$P(A^C \mid B, \text{Female})$	0.921	0.915
$P(A^C \mid B, \text{Oslo})$	0.859	0.848
$P(A^C \mid B, \text{Non-Oslo})$	0.887	0.877
$P(A^C \mid B, \text{Age: 15–29})$	0.916	0.908
$P(A^C \mid B, \text{Age: 30–39})$	0.838	0.826
$P(A^C \mid B, \text{Age: 40–49})$	0.779	0.763
$P(A^C \mid B, \text{Age: 50+})$	0.923	0.915
Prevalence by trading venue:		
$P(A^C \mid D)$	0.796	0.788
$P(A^C \mid D^C)$	0.912	0.902
Value of Tax Evasion:		
$E[T \mid A^C]$: Lower	\$200	\$214
$E[T \mid A^C]$: Point	\$1,035	\$995
$E[T \mid A^C]$: Upper	\$1,087	\$1,045

Table IA.VII. Estimates By Year

This table presents estimates of the prevalence of crypto tax noncompliance, the characteristics of crypto tax noncompliers, and the value of tax evasion, by calendar year. Table III summarizes the identification arguments. We observe survey moments only in the years 2018, 2019, and 2021; survey moments for 2020 are interpolated as the average of the 2019 and 2021 survey moments.

	2018	2019	2020	2021
Prevalence:				
$P(A^C)$	0.048	0.042	0.053	0.060
$P(A^C \mid B)$	0.977	0.972	0.944	0.881
Characteristics:				
$P(\text{Male} \mid A^C)$	0.819	0.676	0.739	0.780
$P(\text{Female} \mid A^C)$	0.181	0.324	0.261	0.220
$P(\text{Oslo} \mid A^C)$	0.090	0.222	0.203	0.190
$P(\text{Non-Oslo} \mid A^C)$	0.910	0.778	0.797	0.810
$P(\text{Age: 15–29} \mid A^C)$	0.522	0.433	0.411	0.397
$P(\text{Age: 30–39} \mid A^C)$	0.237	0.314	0.282	0.255
$P(\text{Age: 40–49} \mid A^C)$	0.080	0.100	0.102	0.098
$P(\text{Age: 50+} \mid A^C)$	0.161	0.154	0.205	0.250
Prevalence by X:				
$P(A^C \mid B, \text{Male})$	0.974	0.962	0.933	0.871
$P(A^C \mid B, \text{Female})$	0.990	0.993	0.978	0.921
$P(A^C \mid B, \text{Oslo})$	0.927	0.963	0.927	0.859
$P(A^C \mid B, \text{Non-Oslo})$	0.982	0.974	0.949	0.887
$P(A^C \mid B, \text{Age: 15–29})$	0.989	0.984	0.966	0.916
$P(A^C \mid B, \text{Age: 30–39})$	0.959	0.960	0.921	0.838
$P(A^C \mid B, \text{Age: 40–49})$	0.945	0.946	0.894	0.779
$P(A^C \mid B, \text{Age: 50+})$	0.983	0.979	0.960	0.923
Prevalence by trading venue:				
$P(A^C \mid D)$		0.830	0.771	0.796
$P(A^C \mid D^C)$	0.977	0.972	0.949	0.912
Value of Tax Evasion:				
$E[T \mid A^C]$: Lower		\$10	\$74	\$200
$E[T \mid A^C]$: Point	\$285	\$46	\$517	\$1,035
$E[T \mid A^C]$: Upper	\$299	\$48	\$543	\$1,087

Table IA.VIII. Optimal Targeting: Other Covariates

This table presents optimal audit strategies as determined by Program (20). In Panel A, Program (20) is solved using our point and bound estimates in Figure 5 of $\Delta_2(X)$, while in Panel B, the program is solved using our point and bound estimates of $\Delta_1(X)$. We solve the program using as our targeting variables (X) different combinations of age, taxable income, total declared capital income, and gross wealth. In each panel, Column (1) specifies the optimal targeting rule; Column (2) reports the average effect of audits on gross tax revenue among the optimally chosen target group of individuals, denoted by G; Column (3) reports the average effect on net tax revenue; Column (4) reports the share of the underlying population optimally chosen for audits; and Column (5) reports the total net tax revenue raised if all the individuals in G were audited, calculated as the product of the net audit effect and the number of individuals targeted by the rule in Column (1).

Panel A. Targeting In The Broader Population

	Rule	$E[\Delta_2(X) \mid G, U]$	$E[\Delta_2(X) - c \mid G, U]$	$P(G \mid U)$	Total Net Revenue ($M)
Using Point Estimate of $\Delta_2(X)$					
Age (X_1) and Income (X_2)	$X_1 < 44$ and $X_2 \geq 78^{th}\%$	$380	$200	6.52%	$58.56
Age (X_1) and Capital Income (X_2)	$X_1 < 45$ and $X_2 \geq 78^{th}\%$	$475	$295	4.65%	$61.58
Age (X_1) and Wealth (X_2)	$X_1 < 15$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0
Income (X_1) and Capital Income (X_2)	$X_1 < 0^{th}\%$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0
Using Upper Bound of $\Delta_2(X)$					
Age (X_1) and Income (X_2)	$X_1 < 44$ and $X_2 \geq 76^{th}\%$	$375	$195	7.33%	$64.21
Age (X_1) and Capital Income (X_2)	$X_1 < 49$ and $X_2 \geq 78^{th}\%$	$415	$235	6.33%	$66.9
Age (X_1) and Wealth (X_2)	$X_1 < 15$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0
Income (X_1) and Capital Income (X_2)	$X_1 < 0^{th}\%$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0
Using Lower Bound of $\Delta_2(X)$					
Age (X_1) and Income (X_2)	$X_1 < 30$ and $X_2 \geq 98^{th}\%$	$213	$33	0.01%	$0.02
Age (X_1) and Capital Income (X_2)	$X_1 < 16$ and $X_2 < 3^{th}\%$	$0	$0	0%	$0
Age (X_1) and Wealth (X_2)	$X_1 < 15$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0
Income (X_1) and Capital Income (X_2)	$X_1 < 0^{th}\%$ and $X_2 < 0^{th}\%$	$0	$0	0%	$0

Panel B. Targeting Crypto Tax Noncompliers

	Rule	$E[\Delta_1(X) \mid G, A^C]$	$E[\Delta_1(X) - c \mid G, A^C]$	$P(G \mid A^C)$	Total Net Revenue ($M)
Using Point Estimate of $\Delta_1(X)$					
Age (X_1) and Income (X_2)	$X_1 \geq 16$ and $X_2 \geq 0^{th}\%$	$1035	$855	100%	$232.32
Age (X_1) and Capital Income (X_2)	$X_1 \geq 16$ and $X_2 \geq 3^{th}\%$	$1035	$855	100%	$232.32
Age (X_1) and Wealth (X_2)	$X_1 \geq 16$ and $X_2 \geq 0^{th}\%$	$1035	$855	100%	$232.32
Income (X_1) and Capital Income (X_2)	$X_1 \geq 0^{th}\%$ and $X_2 \geq 0^{th}\%$	$1035	$855	100%	$232.32
Using Upper Bound of $\Delta_1(X)$					
Age (X_1) and Income (X_2)	$X_1 \geq 16$ and $X_2 \geq 0^{th}\%$	$1087	$907	100%	$246.39
Age (X_1) and Capital Income (X_2)	$X_1 \geq 16$ and $X_2 \geq 3^{th}\%$	$1087	$907	100%	$246.39
Age (X_1) and Wealth (X_2)	$X_1 \geq 16$ and $X_2 \geq 0^{th}\%$	$1087	$907	100%	$246.38
Income (X_1) and Capital Income (X_2)	$X_1 \geq 0^{th}\%$ and $X_2 \geq 0^{th}\%$	$1087	$907	100%	$246.39
Using Lower Bound of $\Delta_1(X)$					
Age (X_1) and Income (X_2)	$X_1 < 60$ and $X_2 \geq 8^{th}\%$	$209	$29	91.35%	$7.13
Age (X_1) and Capital Income (X_2)	$X_1 < 61$ and $X_2 \geq 4^{th}\%$	$208	$28	95.31%	$7.13
Age (X_1) and Wealth (X_2)	$X_1 < 58$ and $X_2 \geq 0^{th}\%$	$207	$27	93.42%	$6.87
Income (X_1) and Capital Income (X_2)	$X_1 \geq 8^{th}\%$ and $X_2 \geq 0^{th}\%$	$204	$24	96.47%	$6.26

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