CRYPTOCURRENCY ADOPTION IN THE NORDIC COUNTRIES: HELICOPTER VIEW ON THE SURVEY

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Abstract

Blockchain money, or crypto-currencies / crypto-assets represent a contemporary financial asset class that has attracted massive attention from the public and academia. In this project, we focus on fundamental issues related to crypto assets, i.e., perceived value, adoption and potential utility for respondents in Finland, Denmark and Sweden. Given that this asset class is particularly attractive to the youth, we focus on this age group in designing our survey. We design and launch a survey to collect data on cryptocurrency interest, adoption and usage. The responses to the survey provide us with a unique dataset that enables us to carve out a clear relationship between demographic and other investor characteristics and crypto adoption. Specifically, we focus on the following aspects of crypto adoption: with what objective/s in mind do the individuals invest in cryptocurrencies in the first place – investing for the long-term, emulating others, financing their education etc.? What is their level of familiarity and knowledge about crypto assets? How does investor experience with cryptos affect the willingness to hold these assets in the future? Do economic expectations affect the saving and crypto investing behavior? Do trust and confidence in existing European institutions - government, political and financial, affect crypto adoption and crypto market participation? Does there exist any significant gender gap?

1. Introduction

1.1. The unprecedented growth of cryptocurrencies

Blockchain money, or crypto-currencies / crypto-assets represent a contemporary financial asset class that has attracted massive attention from public and academia. The launch of the Bitcoin (Nakamoto, 2008) marks one of the most critical developments in modern monetary economies (Hendrickson et al., 2016). Further, the introduction of the first Bitcoin futures in 2017 paved the way for the development of cryptocurrency markets as well as general market acceptance of this asset class (Jalan, Matkovskyy, and Urquhart, 2021). As of March 2022, there are about 18,522 traded cryptocurrencies with a global crypto market cap of $2.1T (source: coinmarketcap.com). In general, the crypto industry includes cryptocurrencies, smart contract platforms, stablecoins, centralized and decentralized exchanges, Decentralized Finance (DeFi), and Web3.

Despite its high returns, the skepticism surrounding cryptocurrencies remains unabated. While proponents argue that cryptocurrency is the most efficient medium for asset transfer, an effective diversifier and hedge (Eichengreen, 2019; Jalan et al., 2020; Matkovskyy, Jalan et al., 2020; Matkovskyy, Jalan, Dowling, 2020; Matkovskyy and Jalan, 2021; etc.), conservatives reason that cryptocurrencies possess no real value (Asplund and Ivarsson, 2018; Vries, 2018; etc.) and that they facilitate illegal activities such as asset transfers on the dark-web (Whitford and Anderson, 2020). Despite the aforementioned shortcomings, statistically significant diversification benefits from the inclusion of Bitcoin have been documented in literature, which are more pronounced for commodities (e.g., Corbet et al., 2019; Symitsi and Chalvatzis, 2019). Also, there is increasing interest from Central Banks to explore digital currencies as part of their banking assets (De and Nelson, 2020; European Central Bank, 2020; Fernández-Villaverde et al., 2020 etc.).

One of the major reasons for the notoriety of this asset class is its huge and unprecedented swings in prices. The prices for Bitcoin and other cryptocurrencies (crypto assets) skyrocketed in March 2021, with Bitcoin prices exceeding USD 56,000, and that for Ethereum, the second largest crypto asset, reaching USD 1,790.

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Overall, retail investment in crypto assets continues to increase, although the size of these investments is still not too high compared to other types of financial assets.

1.2. Age factor

Age as a social characteristic has been studied widely in behavioral and financial academic literature. Generally speaking, young ages have been associated with higher risk taking (Jianakoplos and Bernasek, 2006; Rolison et al., 2014 among others), higher ethical concerns (Sikula Sr and Costa, 1994) and higher sensitivity to environmental concerns and sustainability (Yamane and Kaneko, 2021).

According to the Finder cryptocurrency adoption index (January 2022 report) spanning 27 countries, 54.8% of global crypto ownership is dominated by investors in the 18 – 34 years age bracket. It is estimated that about 2.1 million people in France, representing about 3.3% of its total population, currently own cryptocurrency. According to Triple, a FinTech company, 30% of these French cryptocurrency owners lie in the 18-34 age group (similarly to other countries such as the US and the UK). The report also highlights the general profile of cryptocurrency investors in France, Germany, the UK and the US - young, tech-savvy and wealthy males with an 'investment objective' in mind. (This is in sharp contrast with France, where 59% of cryptocurrency investors do so with a 'future purchase objective'.).

Despite the growing literature on cryptocurrencies (Corbet at al. 2019; Bariviera & Merediz-Solà, 2021) there is almost complete lack of academic investigation about the perception and attitude of crypto owners, that mainly are young adults, towards the budding asset class of cryptocurrencies. The same goes for the role of cryptos in the investment portfolio of these young adults – a gap we intend to fill for the euro-area.

1.3. Cryptos and environment

Cryptocurrencies have received mass criticism for their energy footprint and their role in worsening the climate situation in the world. In October 2019, it was estimated that the energy consumption in mining the Bitcoin alone exceeded the national energy consumption of Austria (Malfuzi et al., 2020). It is not to be forgotten that there are more than 4,000 cryptocurrencies available in the market, collectively posing a significant threat to the environment (Wang et al., 2022). The fact that the youth is more sensitive to sustainability concerns and that it dominates crypto holdings globally presents itself as a paradox, something this study will also aim to understand.

1.4. Economic expectations

Recent studies show that monetary policy affects economic expectations in the EU (Galariotis et al. 2018). Consumers form expectations based on comprehensible evaluations of relevant news (Claus & Nguyen 2018). In turn, expectations might implicitly or explicitly affect saving, investment, or another financial asset allocation and risk taking (Beverly et al. 2008; Ampudia & Ehrmann 2017). Given an effective lower bound environment in the euro area countries, the relationship between household economic expectations and their market participation plays an important role in policy making.

Annual inflation rate in the euro area rose to 7.5% in March 2022, a sharp increase from 5.9% in February. Using Quantile on Quantile regression methodology, Matkovskyy and Jalan (2021) document the effectiveness of the Bitcoin as a hedge against inflation in bullish Euro, Japanese and UK Bitcoin markets.

This raises an important question: how do macroeconomic expectations about future income, savings and general economic stability in the country affect cryptocurrency investing and savings?

1.5. Trust and cryptocurrency adoption

Trust plays an important role in situations of risk, uncertainty, and interdependence (McKnight & Chervany, 2001) and is a basic element in almost all interactions between humans (Gambetta, 1988). However, the role of interpersonal trust in crypto adoption is not a priori clear. On the one hand, cryptos are based on the principle of decentralized control, with participants anonymous except for their e-wallet address. On the other hand, the sophistication and fool-proof complexity of the blockchain technology that most cryptocurrencies are built on provides high level of certainty and transparency (Shin & Hwang, 2020), which may mitigate the need for high levels of trust in crypto adoption.

Jalan, Matkovskyy, Urquhart and Yarovaya (2022) quantify the effect of interpersonal trust and cultural preferences on global interest in and adoption of the three largest cryptocurrencies by market capitalization – Bitcoin, Ethereum and Litecoin. They find a positive and statistically significant effect of trust on interest in and adoption of cryptocurrencies, confirming the importance of trust in the growth of financial markets. Using the long/short term orientation index, they also document the role of 'impulse' and myopic vision in cryptocurrency investing.

1.6. Cryptocurrencies – an alternative entry into market participation?

Existing studies show that it is optimal for individuals to hold at least some stocks in their portfolio (Andersen and Nielson, 2011). An increase in stock market participation by households could have a positive effect on social welfare and personal lifetime income and consumption (Campbell, 2006).

Households, however, remain generally underinvested in the stock market, a phenomenon called the 'stockholding puzzle' (Haliassos and Bertaut, 1995), with underinvestment in Europe more pronounced that in the U.S. Using data covering more than 58,000 households across 11 euro-area countries, Ampudia and Ehrmann (2017) postulate that stock market participation by European households could plummet further.

There are several reasons for this phenomenon. For instance, higher market volatility and ambiguity are associated with a significant drop in stock market participation by households (Antoniou et al., 2015). This leads to welfare loss resulting from nonparticipation (Cocco et al., 2005).

Another potential reason cited is the high cost of stock market participation, estimated between 4% and 6% of labor income on average (Khorunzhina, 2013). Since stock market participation costs are higher for first-time investors, a low (and decreasing) participation rate of the euro area households can potentially have a negative effect in the future. This opens up the possibility for households, especially youths, to consider participation in cryptocurrency assets, that do not entail high costs of participation.

However, despite their advantages to first-time investors, crypto currencies continue to be the target of skepticism for a good number of countries in the world. Interestingly, two European nations – Germany and Sweden - feature among the bottom 5 nations that represent those most skeptical about this asset class. (Finder, 2022).

1.7. Cryptocurrencies and the changing geo-political landscape

When Russian forces attacked Ukraine on February 24, 2022, little did one know of how the cryptocurrency landscape would evolve. With significant damage to physical infrastructure and disruption in traditional banking systems in Ukraine, the much-debated asset class has come to the rescue. The Ukrainian government has solicited donations in crypto assets, with amounts exceeding $100 million. On the other side, as credit providers (Visa, Mastercard and Paypal) turn their back towards Russian individuals and institutions and Western nations impose strict banking and financial sanctions among others, cryptos seem to have become the preferred means for the Russian elite to evade and circumvent sanctions.

For the unexpected role that cryptos have assumed in this geo-political crisis, this war has also been termed the 'Crypto War'. In any case, the war in Ukraine seems to highlight beyond

doubt that ultimately, crypto assets have been substituting for traditional banking systems, just as Nakamoto envisaged when the Bitcoin was first introduced in 2008.

2. The survey launch

2.1. General information

Our survey was administered through a private agency, GWI, a well-known in data collection services on a global scale. Their handling of the questions, channels of data collection and global outreach will help us ensure minimal bias in the final sample and consequently, credible and high-quality results from the analysis.

The survey fieldwork was from 8/11/2022 to 7/12/2022. After fieldwork, GWI assigned a "weight" to every respondent based on their age, gender and education profile. This information is collected from various sources including census data to ensure it is representative of each market. This allows us to calculate approximately how many real world people are represented by their responses. The average weight a respondent receives varies by market and is largely influenced by the size of the population in that country, as well as the ease of conducting research there.

Due to the relatively small sample sizes of all the custom studies (around 500 in each country) the finite population corrections (FPC) are close to 1, e.g.: Denmark - 0.9999313, Sweden - 0.9999593, Finland - 0.9999218.

To expand on randomization of the sample, all custom studies are collected completely at random. We also weigh all of our studies back to the population to ensure that the final data for the project in nationally representative of the online population. As the crypto markets have 100% internet penetration it should not be an issue.

2.2. Error and biasness control

Sampling / non sampling error is controlled for in the following ways:

- Population specification error: we are interested in understanding how the general population (with the focus on youth) thinks and feels about cryptos, therefore we target a general population audience. It increases the value of the collected data. Within the questionnaire we include display logic on certain questions to ensure that these are only being asked to those that it makes sense to ask, based on previous questions. e.g., if someone says that they do not have a crypto wallet, we wouldn't then ask which cryptos they own, or how much.

- Sample frame error: According to GWI official information, its panels have large communities of respondents which are balanced to be representative of gen pop 16+. As the markets we are interested in understanding are all at almost 100% penetration then this is deemed to be representative of the population.

- Selection error: we don't use river sampling. Respondents have to be specifically invited to participate in the study and aren't made aware of the subject until the screening section of the study.

- Sampling errors: the agency works closely with experienced panel providers to ensure high quality respondents. Based on information provided, these providers moderate and audit their panel communities on a regular basis. The pool of potential respondents is significantly larger than the sample of our study ensuring we have a wide group to pull from. All qualifying respondents will be invited to participate.

- General sample quality checks - respondents who are not paying attention to the question, provide contradictory answers, or complete the study too quick or too slow are removed from the final sample.

Biasness is controlled in the following ways:

- Carefully designed questionnaires limiting bias from the client to skew the results by eliminating leading questions / answer options, appropriate range of answer options, proper questionnaire flow and designing research that is ethically robust. This also includes critical evaluation and transparency when communicating the limitations of research. The agency's custom research project managers were overseeing the project to ensure it meets

the MRS guides and standards. The provided questionary was checked and adjusted respectively) by the agency to minimize bias.

- Ensuring respondent incentives are not connected in any way to the company purchasing the research.

- Well conducted and executed quota structures.

- Working with well-established and audited panel providers.

3. Survey – general overview of the results

3.1. First impression

The survey field work was from 8/11/2022 to 7/12/2022. The final dataset was prepared at the end of December 2022.

The numbers of the final respondents per country (after quality check) is the following: Denmark – 500, Finland – 518, Sweden – 501. Thus, the distribution of survey responses by country is fairly even: Finland: 34.10%, Sweden: 32.98% and Denmark: 32.92%. The gender distribution among respondents is as follows: Female - 55.50%, Male - 44.50%.

A distribution of ages is presented in Fig. 1 and shows a relatively balanced distributions, though on average older respondents are in Denmark, while Finland is represented by the relatively younger respondents. Overall, the share of respondents younger than 24 y. is approximately 20% of all respondents (Denmark – 108, Finland – 99 and Sweden – 103 respondents).
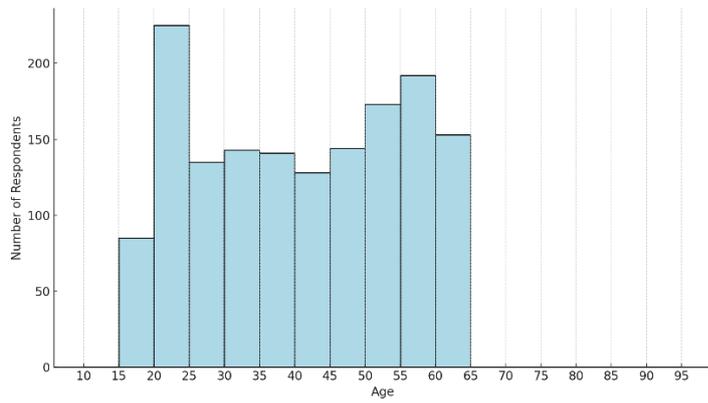
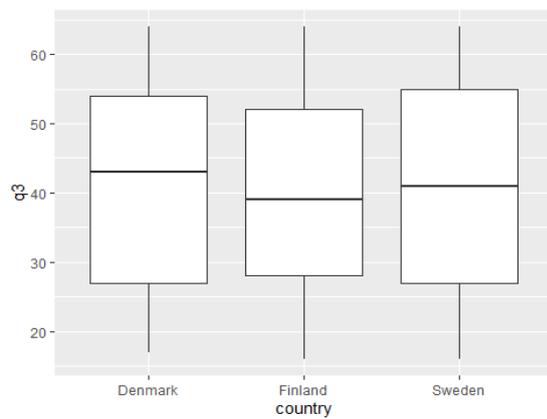Fig.1a. The distribution of the respondents' age groups.

Fig. 1b. Distribution of ages, per country.

Figs 1ab shows that in general, a significant number of respondents are in the age group of 30-35 and 55-60. The number of respondents gradually decreases for age groups beyond 60.
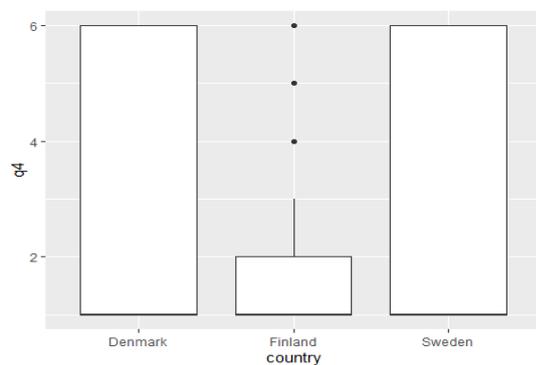

Fig 2. Years lived in the current country of residence (q4).

Note: 1: Since birth, 2: 1-2 years, 3: 2-3 years, 4: 3-4 years, 5: 4-5 years, 6: 5+ years

Fig. 2. shows that overall, 3-4 years of living in Finland is a tail value. Similar situation with dependents (q6), see Fig.3 - the respondents from Finland have the less dependents.
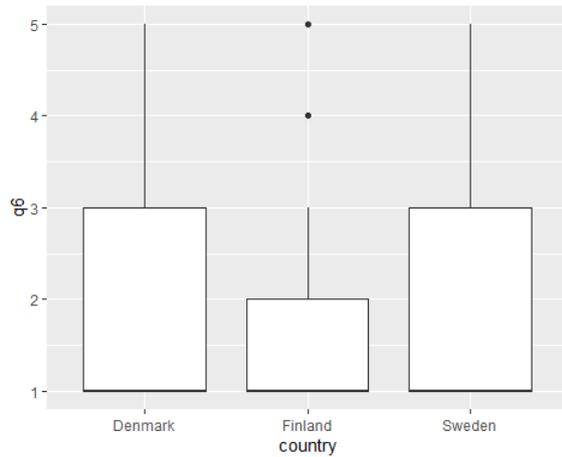

Fig. 3. Dependents (q6).

Note: 1: None, 2: 1 dependent, 3: 2 dependents, 4: 3 dependents, 5: More than 3 dependents)

3.2. Education

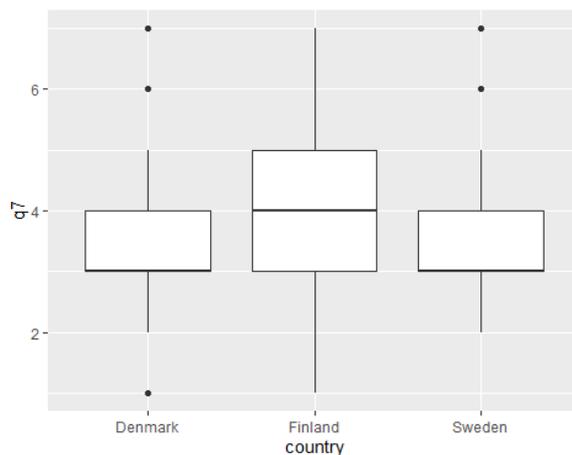Respondents' education levels are, on average, higher in Finland, then in other two countries (Fig. 4)

Fig. 4. Education level (q7)

Note: 1: No formal education, 2: Primary/ Elementary education, 3 - Secondary School/ High School, 4 - University Undergraduate (Bachelor's), 5 -University Postgraduate (Master), 6- University Postgraduate (PhD), 7- Other.

3.4. Ownership and loans

The highest number of respondents personally own their house/apartment (Fig. 5). Across the countries, this distribution is close to similar.
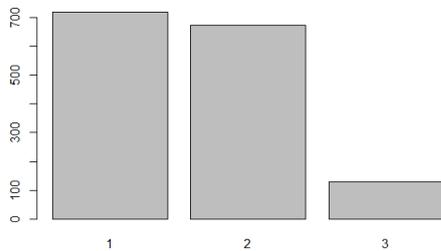
Fig. 5. Overall distribution of ownership of house/apartment (q8)

Note: 1: I personally own my house/apartment; 2: I rent my house/apartment; 3:I do not rent nor own my own house/apartment.

The highest amount of money needed to be paid is observed in the Finish respondents, followed by the respondents from Denmark. Swedish respondents had the lowest amounts (see Figs. 6a-c).

Fig.6a. Personal loans - amount still needed to be paid back (q9)

Fig.6b. Credit cards - amount still needed to be paid back.

Fig.6c. Business loans - amount still needed to be paid back.

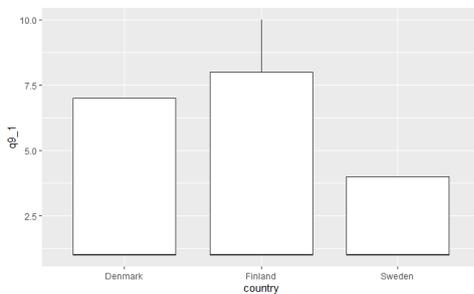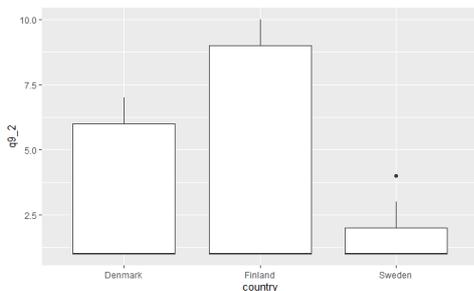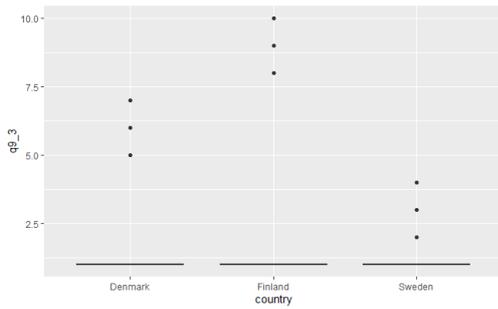### 3.5. Interest in cryptocurrencies, mining and ownership

Interest in cryptocurrencies is presented in Tables 1a-c:

Table 1. Percentage of respondents who are not at all interested or not very interested in different blockchain trends.

Panel a. Denmark

	TOTAL	16 TO 24	25 TO 34	35 TO 44	45 TO 54	55 TO 64
Cryptocurrencies	61.40%	42.90%	42.80%	53.90%	77.40%	87.90%
Stable coins	68.60%	53.40%	50.80%	61.30%	83.10%	92.20%
DeFi	66.90%	49.50%	53.10%	52.60%	83.20%	93.90%
NFTs	68.90%	52.10%	57.30%	61.40%	80.90%	91.30%
Web3	68.40%	55.20%	49.80%	58.80%	83.20%	92.90%

Panel b.: Finland

	TOTAL	16 TO 24	25 TO 34	35 TO 44	45 TO 54	55 TO 64
Cryptocurrencies	54.70%	34.00%	47.30%	48.60%	68.10%	74.00%
Stable coins	73.20%	66.80%	59.00%	75.40%	82.40%	81.40%
DeFi	68.80%	58.10%	54.90%	68.80%	79.40%	81.40%
NFTs	70.90%	59.00%	61.00%	68.90%	81.60%	82.40%
Web3	71.70%	58.80%	61.30%	73.20%	81.40%	82.40%

Panel c: Sweden

	TOTAL	16 TO 24	25 TO 34	35 TO 44	45 TO 54	55 TO 64
Cryptocurrencies	51.80%	40.20%	41.60%	42.90%	59.90%	75.10%
Stable coins	63.60%	58.60%	56.50%	52.80%	70.80%	80.30%
DeFi	61.80%	50.80%	51.20%	53.00%	72.10%	82.80%
NFTs	62.30%	57.30%	51.20%	49.70%	72.80%	81.50%
Web3	63.30%	62.20%	53.30%	50.10%	70.80%	81.80%

Panel d: Gender differences

	Male avg interest	Female avg interest
Cryptocurrencies	2.52	1.99
Stable coins	2.09	1.67
DeFi	1.99	1.65
NFTs	2.13	1.72
Web3	2.05	1.65

Note: 1-Not at all interested; 2-Not very interested; 3-Neutral; 4-Somewhat interested; 5- Very interested.

Thus, based on Tables 1a-c, we can say that in general, youths (16 to 24) in Finland are more interested in crypto-currencies, while Danish youths prefer more NFTs. Panel d of Table 1 shows that males generally show a higher level of interest in all components within the crypto group compared to females. Both genders show the highest interest in "Cryptocurrencies", followed by "NFTs". "Defi", "Stable Coins", and "Web3" have relatively lower interest scores, indicating that these components might not be as well-understood or popular among the general populace.

Table 2. Mining Status

Name	Totals	Male	Female	Denmark	Sweden	Finland
Yes	9.5%	14.2%	4.7%	10.7%	11.1%	5.3%
No but i have in the past	3.5%	5.3%	1.6%	2.1%	4.2%	3.5%
No- i want to but do not have the equipment	7.1%	9.1%	5.1%	6.8%	6.9%	7.8%

No, it's not good for the environment	8.9%	10.6%	7.2%	6.8%	8.8%	11.5%
No but i would like to in the future	13.0%	12.8%	13.2%	9.2%	15.7%	11.9%
No- i am not interested in mining/minting cryptocurrency	58.0%	48.0%	68.2%	64.3%	53.2%	59.9%

Table 2 shows that in general respondents were not interested in mining. In terms of mining the respondents in those three countries are mainly not interested in this activity (58%), while 9.5% of the population mine, and approximately 20% of the respondents would like to mine (Table 2).

Table 3. Ownership of assets (q10)

Asset	Totals	Denmark	Finland	Sweden	Male	Female
1 : Pensions	29.23%	47.4%	8.30%	32.73%	32.25%	26.81%
2: Real estate/property (other than the house you live in)	12.90%	18%	10.04%	10.78%	14.79%	11.39%
3: Savings in the bank	47.07%	54.4%	45.95%	40.92%	44.38%	49.23%
4: Stocks/shares	29.43%	30.6%	26.06%	31.74%	37.87%	22.66%
5: Crypto assets / nfts	11.06%	12.6%	9.46%	11.18%	18.34%	5.22%
6: Antiques / art	6.78%	8.2%	5.79%	6.39%	9.32%	4.74%
7. Bonds	5.66%	11.4%	2.32%	3.39%	7.84%	3.91%
8. Mutual funds	29.95%	18.4%	29.92%	41.52%	34.02%	26.69%
9. Esg products	3.95%	4.4%	0.97%	6.59%	5.92%	2.37%
10. Other	1.18%	0.4%	1.74%	1.40%	1.48%	0.95%
11. Prefer not to say	4.54%	3.6%	3.47%	6.59%	4.44%	4.63%
12. Don't have any	19.42%	12.4%	27.99%	17.56%	14.35%	23.49%

Table 3 indicates that the ownership rate of crypto assets/NFTs is around 11.06%, placing it in the middle range compared to other assets.
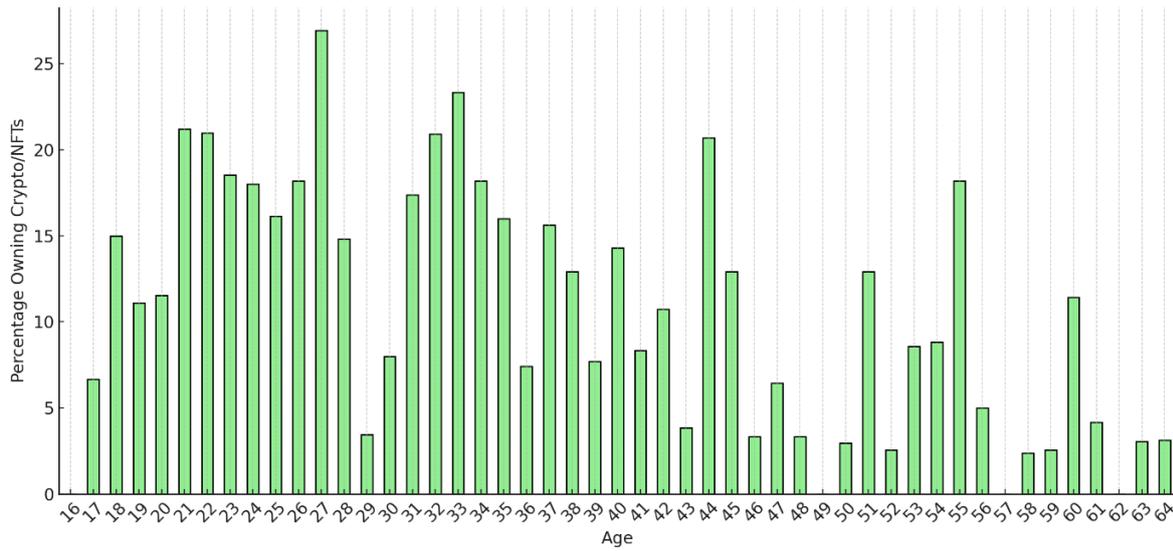
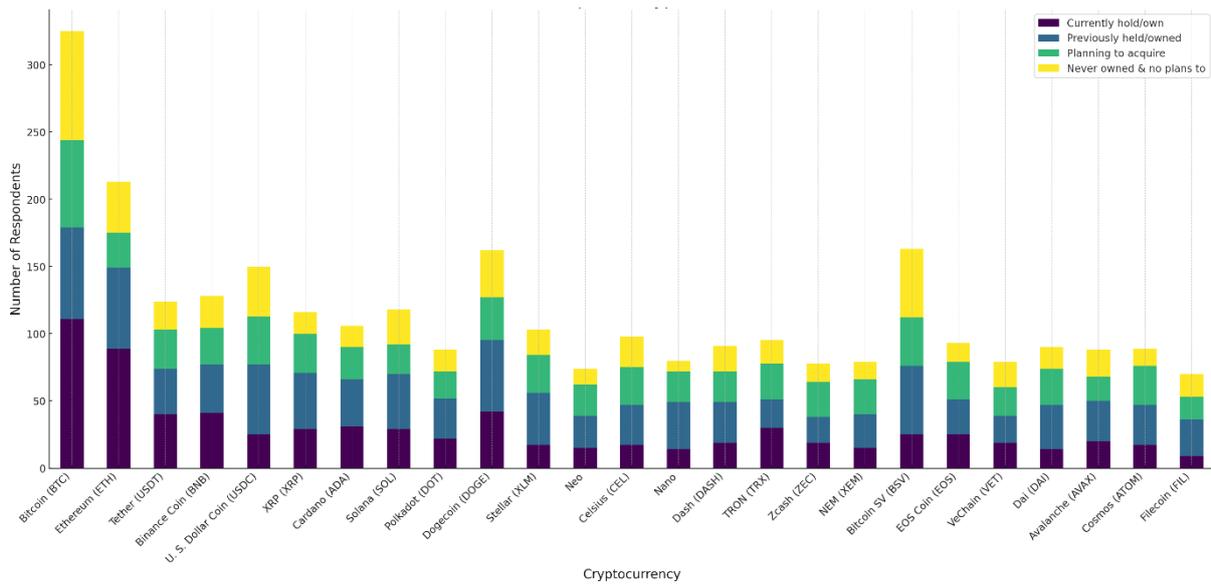Fig. 7a. Distribution of crypto assets/NFT ownership by age.

Fig. 7b. Distribution of crypto assets/NFT by past, current, and future ownership.

Fig 7a illustrates the distribution of crypto assets/NFTs ownership across various age groups. Ownership of crypto assets/NFTs is more prevalent among younger age groups, peaking in the 25-35 age range. There is a noticeable decline in ownership as age increases, with very few individuals above 60 owning crypto assets/NFTs.

Fig. 7b depicts the popularity of cryptocurrencies. Thus, the cryptocurrencies with the highest number of current holders are Bitcoin (BTC): 111 holders, Ethereum (ETH): 89 holders, Dogecoin (DOGE): 42 holders, Binance Coin (BNB) and Tether (USDT) - both around 40 holders. Emerging interest (planning to acquire) is shown towards Bitcoin (BTC) again that tops the list, with 65 respondents planning to acquire it in the near future. U. S. Dollar Coin (USDC) and Bitcoin SV (BSV) are next in line, both attracting similar interest. The top previously owned crypto asset is Bitcoin (BTC) with 68 respondents. Ethereum (ETH) and Dogecoin (DOGE) follow, having been previously held by 60 and 53 respondents, respectively.

The distribution of crypto assets/NFTs ownership across various marital statuses is as follows: Married: 14.35%; In a relationship: 10.89%; Single: 10.40%; Other: 6.45%; Divorced/separated: 3.91%. Thus, it's interesting to note that individuals who are married have the highest rate of crypto assets/NFTs ownership, followed closely by those in a relationship and singles.

The distribution of crypto assets/NFTs ownership across various education levels is as follows:

- University Undergraduate (Bachelor's): 16.89%

- University Postgraduate (Master): 15.61%

- University Postgraduate (PhD): 12.50%

- No formal education: 11.11%

- Secondary School/ High School: 8.80%

- Other; please specify: 4.26%

- Primary/ Elementary education: 3.08%

The data show that the higher the education level the less of crypto assets in ownership.

Fig. 8. Asset ownership rate per country

Note: (i) ordered by descending, (ii) q10_1 – Pensions, q10_2 -Real estate/property (other than the house you live in), q10_3 -
Savings in the bank, q10_4 - Stocks/shares, q10_5 - Crypto assets / NFTs, q10_6 - Antiques / Art, q10_7 – Bonds, q10_8 - Mutual
funds, q10_9 - ESG products, q10_10 – Other, q10_11 - Prefer not to say, q10_12 - I don't have any savings/investments.

Breaking down by country (Fig.8), shows that in Denmark, the most popular asset is "*Savings in the bank*" with a 54.4% ownership rate, followed by "*Pensions*" at 47.4%. In Finland, the most popular asset is also "*Savings in the bank*" with a 45.95% ownership rate. However, the ownership rate for "*Pensions*" is notably lower in Finland (8.30%) compared to Denmark and Sweden. In Sweden, as well, the most popular asset is "*Savings in the bank*" with a 40.92% ownership rate, followed closely by "*Pensions*" and "*Stocks/shares*". The ownership rate of *Crypto assets/NFTs* (q10_5=1) is relatively similar across the three countries, with Denmark having a slightly higher rate.

The analysis of saving of those who owns crypto assets shows the following ("*What is the total value of your current savings?*" (q11) joined with q10=5 (*What kind of savings/investments do you have? = Crypto assets/NFTs*):
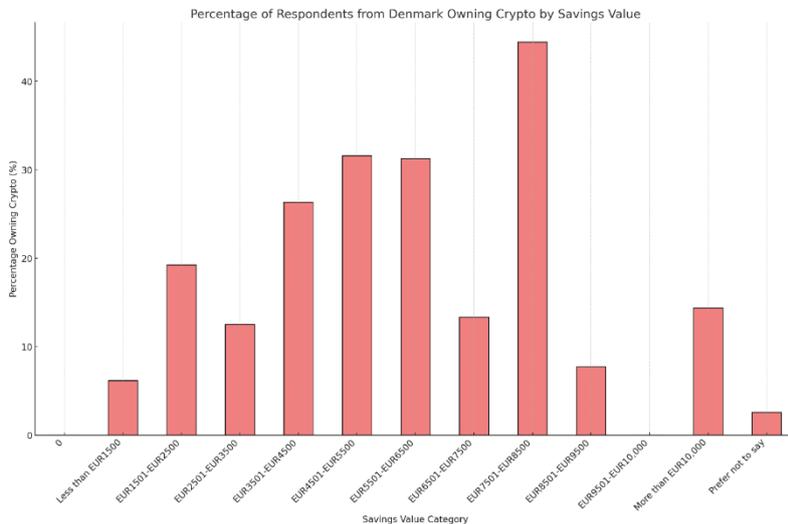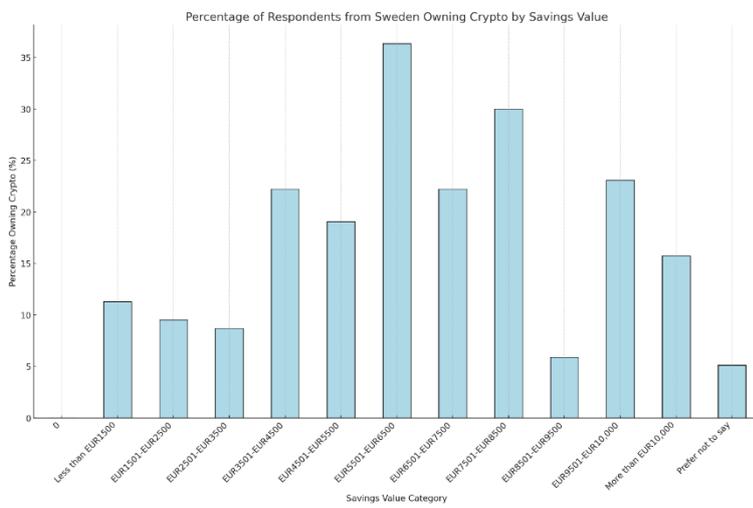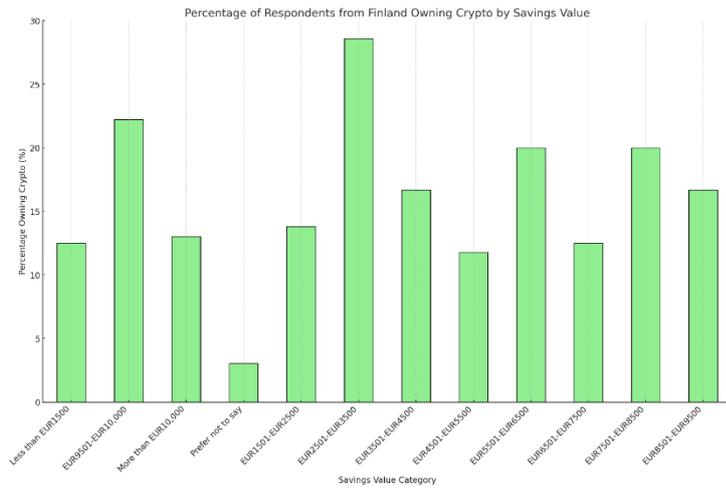
Fig. 9. The percentage of respondents who own cryptocurrency assets/NFTs, segmented by their

reported total savings value

Note: q11a =1: Less than EUR1500; q11a = 2: EUR1501-EUR2500; q11a = 3: EUR2501-EUR3500; q11a=4: EUR3501-EUR4500, q11a = 5: EUR4501-EUR5500; q11a = 6: EUR5501-EUR6500; q11a = 7: EUR6501-EUR7500; q11a= 8: EUR7501-EUR8500; q11a=9: EUR8501-EUR9500; q11a= 10: EUR9501-EUR10,000; q11a=11: EUR10,000; q11a= 12: Prefer not to say.

Figs. 9. show that for savings values like "EUR9501-EUR10,000", about 22.22% of respondents own crypto assets/NFTs. For those who have "More than EUR10,000" in savings, approximately 13.01% have invested in crypto assets/NFTs. On general, the distribution shows variability across different savings categories.

3.6. Purposes of crypto investment

The indicated purposes of crypto investment are depicted in Fig. 10.
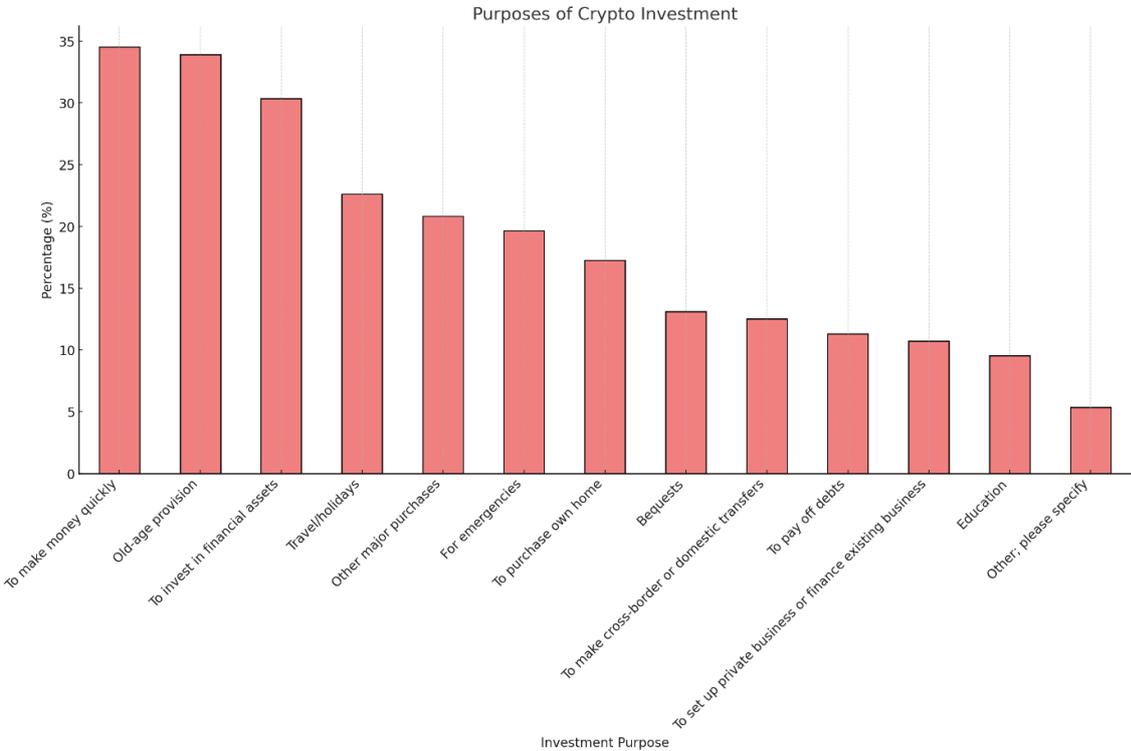
Fig. 10. Purpose of crypto investment

Fig. 10 demonstrates the following:

- **Quick Gains:** The highest motivation for crypto investment appears to be the desire "*To make money quickly*", accounting for about 34.52%.

- **Long-term and Financial Security:** "*Old-age provision*" and "*To invest in financial assets*" are also primary reasons, suggesting that many see cryptocurrencies as a long-term investment or a means of financial security.

- **Lifestyle and Major Purchases:** "*Travel/holidays*" and "*Other major purchases*" are also notable reasons, indicating that some individuals consider crypto investments as a means to fund their lifestyle or significant purchases.
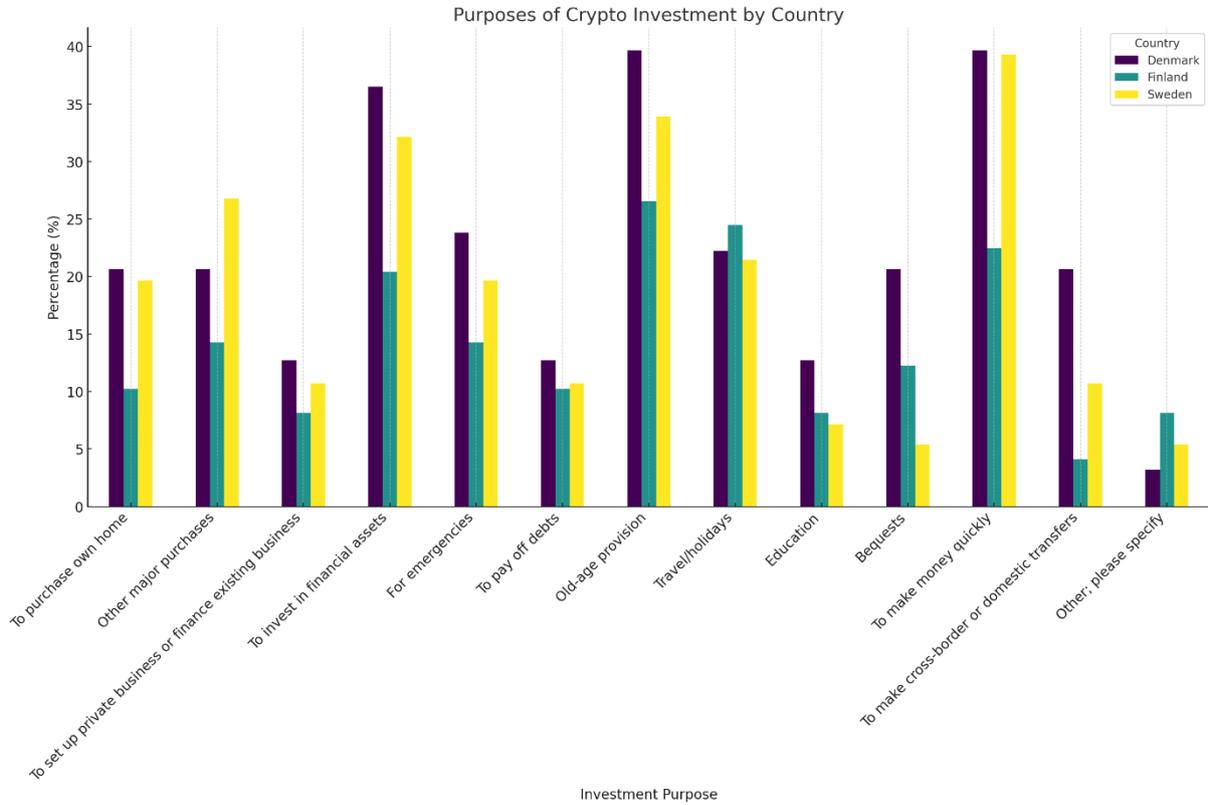
Fig. 11. Purpose of crypto investment per country

Based on Fig. 11, we can say that "*To make money quickly*" is a significant motivation across all three countries, with Denmark and Sweden showing similar percentages, and Finland slightly lower. Denmark and Sweden again show a higher inclination towards investing in cryptocurrencies for "*Old-age provision*" and "*To invest in financial assets*" compared to Finland. Interestingly, Finland has a slightly higher percentage of respondents investing in crypto for "*Travel/holidays*" compared to Denmark and Sweden.
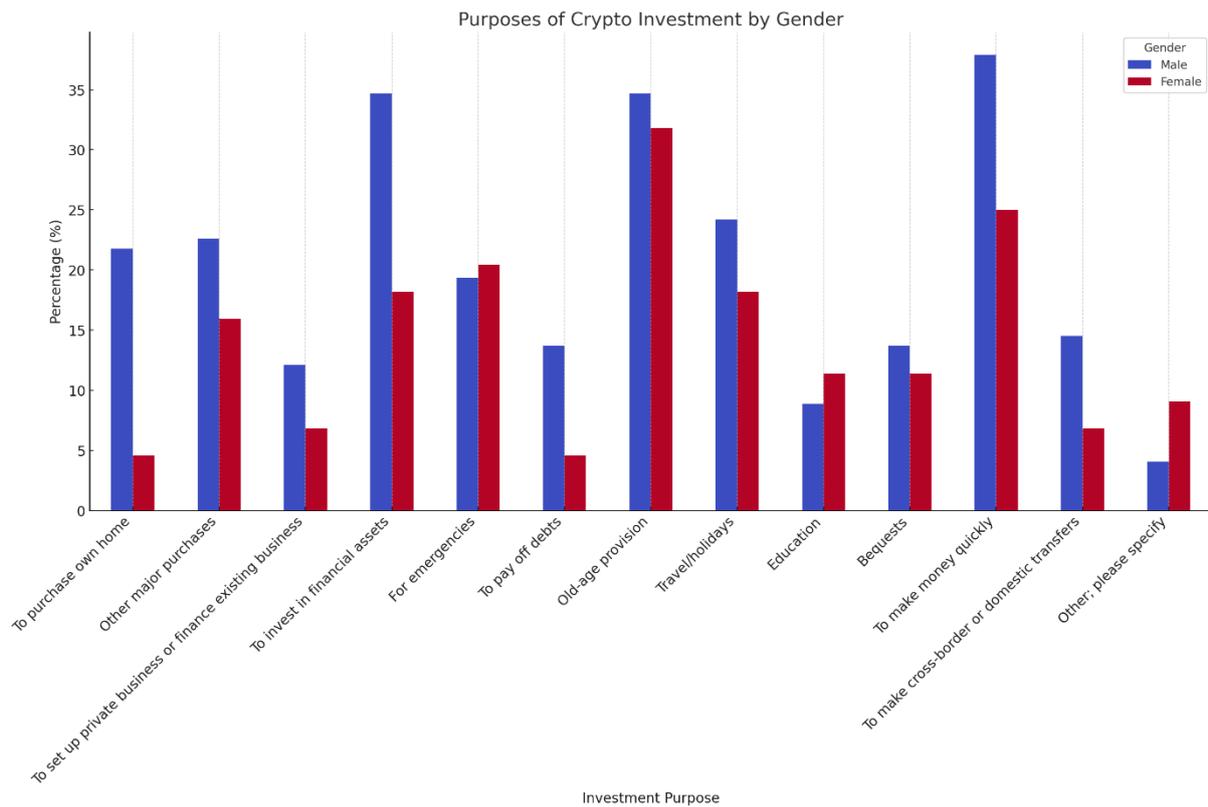
Fig. 12. Purpose of crypto investment per gender.

Fig. 12 demonstrate some interesting aspects, i.e.:

- **Quick Gains**: Males show a higher inclination towards investing in cryptocurrencies "*To make money quickly*" compared to females.

- **Financial Security:** Both males and females consider "*Old-age provision*" and "*To invest in financial assets*" as primary reasons. However, males display a slightly higher percentage.

- **Major Purchases:** Males show a higher tendency to invest in crypto for "*Other major purchases*" and "*To purchase own home*".

- **Emergencies:** The percentages for "For emergencies" are relatively close between the two genders, while females slightly dominate.
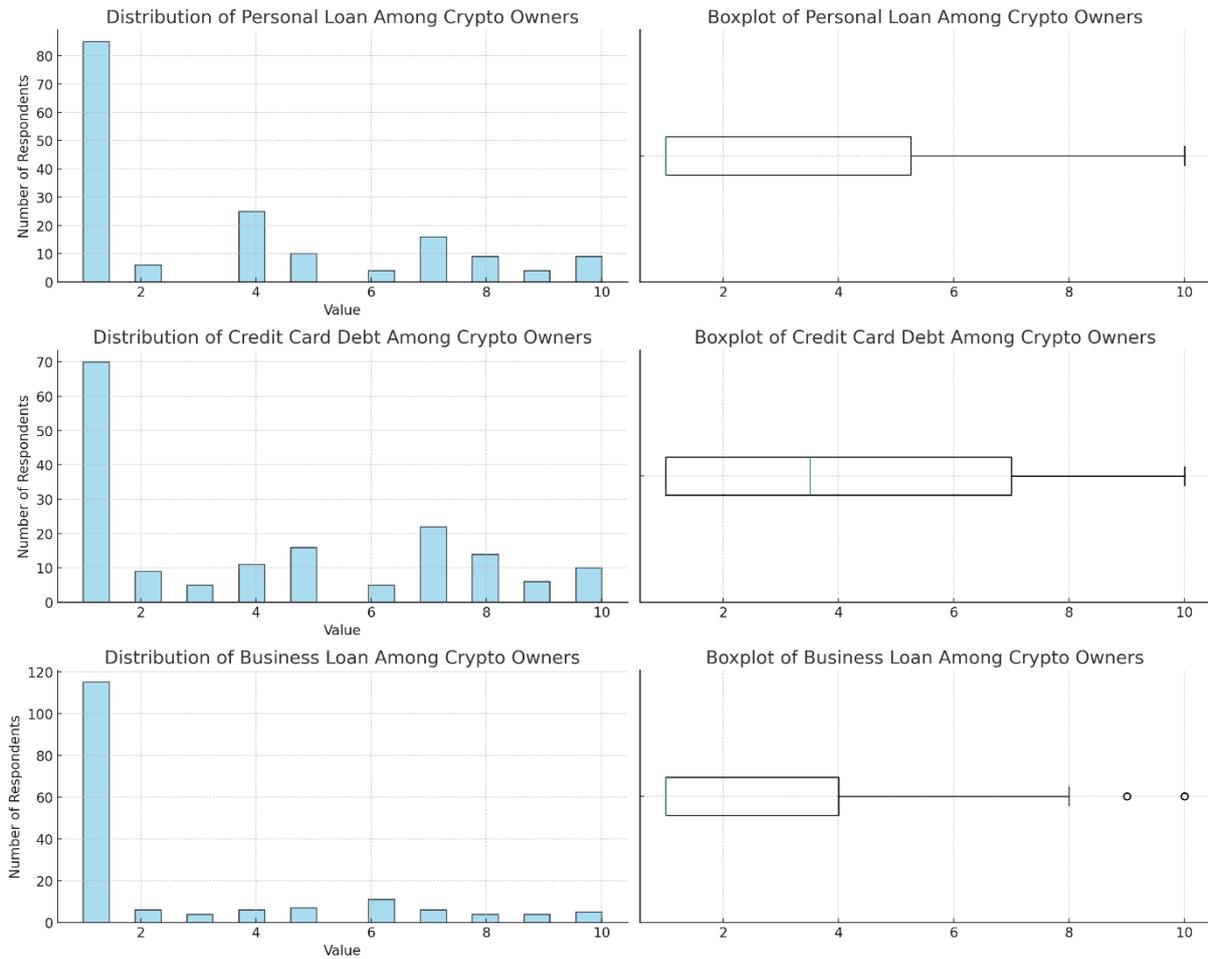
Fig. 13. Distributions of personal loans of crypto asset owners (q9_1, q9_2, q9_3)

The majority of crypto owners have a value of personal loans in the left tail. Fig. 13 shows that the distribution is right-skewed, implying that a few crypto owners have significantly higher personal loans compared to the majority. The figure also indicates that there are a few outliers with very high values of personal loans. Similar to personal loans, most crypto owners have lower values of credit card debts (q9_2). The distribution is also right skewed, indicating that only a few crypto owners have very high credit card debts. The boxplot further confirms the presence of outliers with high values. The distribution of business loans among crypto owners is somewhat more spread out than the other two types of loans, but it is still right skewed (q9_3). There are no as many extreme outliers as the other two types of loans, but there are still some present.

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Thus, a significant portion of crypto owners seems to be financially cautious or prudent, as suggested by the lower values of personal loans and credit card debts. This could be indicative of a segment of crypto owners who see crypto investments as part of a diversified investment strategy and not necessarily as a high-risk gamble.

There is a smaller segment of crypto owners with considerably high personal loans and credit card debts. This could represent risk-takers who might be investing in cryptocurrencies as a potential way to earn quick returns and possibly repay their debts.

The distribution of business loans is broader, suggesting that crypto owners who have businesses might be taking on more significant financial risks. This could be due to the nature of business investments, which often require more substantial capital and can have varied returns. Some of these business owners might be investing in crypto as part of their business strategy or as a hedge.

The presence of outliers in all types of loans, especially in personal loans and credit card debts, suggests that there is a segment of crypto owners who might be over-leveraging themselves financially. These individuals see cryptocurrencies as a potential way to address their financial challenges, which can be risky given the volatility of the crypto market.

3.7. Familiarity with and knowledge of cryptocurrencies

Familiarity with cryptocurrencies is presented in Table 3.

Based on Table 3, the top 3 cryptocurrencies in terms of familiarity in Sweden and Finland are BTC, BSV, ETH, while in Denmark instead of ETH, USDC is more popular. The least familiar cryptocurrencies include ZCash, NEM, VET, FIL, and DAI.

Table 3. Familiarity with cryptocurrencies: the percentage of *Not familiar at all*, ranked from smallest to largest (a smaller number means higher familiarity).

Crypto	**Denmark**	Crypto	**Sweden**	Crypto	**Finland**
BTC	30.8%	BTC	16.9%	BTC	21.6%
BSV	50.9%	BSV	38.4%	BSV	54.9%
USDC	62.7%	ETH	55.6%	ETH	62.0%
ETH	64.1%	DOGE	59.5%	DOGE	68.7%
DOGE	65.5%	BNB	60.3%	USDC	69.8%
BNB	68.2%	USDC	61.4%	BNB	76.7%
USDT	71.6%	USDT	70.8%	XRP	80.5%
Dash	71.7%	AVAX	71.8%	Stella	80.6%
Stella	71.9%	Dash	71.9%	Dash	81.0%
SOL	73.4%	Stella	72.4%	USDT	81.3%
XRP	73.9%	Nano	73.1%	SOL	81.8%
Cel	74.0%	Tron	73.3%	Nano	82.3%
Nano	74.0%	EOS	73.4%	ADA	83.1%
Tron	74.4%	SOL	73.7%	EOS	83.6%
EOS	74.6%	XRP	74.0%	Tron	84.2%
DOT	74.8%	DOT	74.1%	DOT	84.3%
Neo	75.4%	Cel	74.3%	ATOM	84.6%
AVAX	75.8%	Neo	74.8%	Cel	85.0%
ATOM	76.1%	DAI	74.8%	AVAX	85.0%
ADA	76.2%	ADA	75.0%	FIL	85.5%
FIL	76.2%	Zcash	76.5%	VET	86.3%
DAI	77.1%	ATOM	76.6%	DAI	86.6%
VET	77.3%	NEM	77.6%	Neo	86.8%
NEM	77.6%	VET	77.6%	Zcash	86.9%
Zcash	78.0%	FIL	78.2%	NEM	87.2%

Respondents in Sweden show the highest level of familiarity. Male respondents are generally more familiar with cryptocurrencies compared to females. For example, 15.3% of male respondents and 28.7% of female respondents are not familiar with the most popular cryptocurrency, Bitcoin. For ETH, these percentages are even higher, with 41.1% of male and 78.5% of female respondents being unfamiliar with this cryptocurrency, indicating the greatest gender difference in familiarity.

In terms of age, familiarity with cryptocurrencies is highest among respondents aged 22-27, as shown in Figure 14. This is further supported by information on the value of crypto wallets, which are mainly possessed by young people, with values mostly concentrated on the lower end of the distribution.
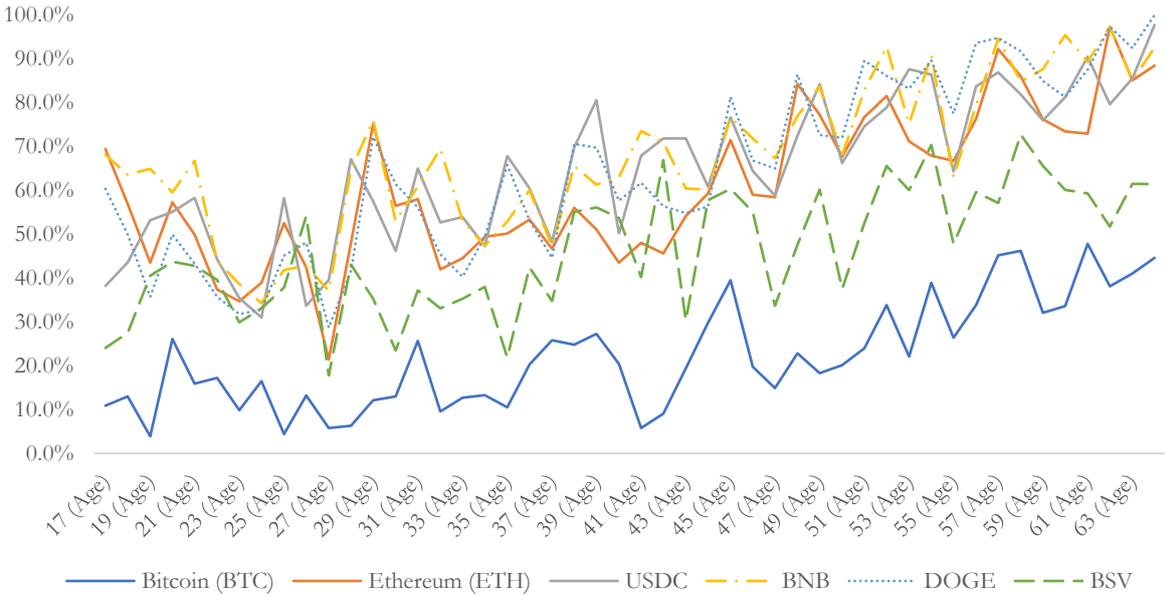
Fig. 14. Distribution of not familiarity with cryptocurrency across ages (the percentage of Not familiar at all meaning the lower the values the higher familiarity)

To check respondents' knowledge about cryptocurrencies we asked them the following question: Which of the following are considered to be cryptos/tokens? The results are presented in Table 4.

Table 4. Which of the following are considered to be cryptos/tokens?

Question	Male respondents (%)	Female respondents (%)
Btc, eth, ltc, uni, bynd, wmt, aapl	28.55%	11.15%
Snp, amzn, ptr, aapl, 3msft	4.44%	1.66%
Aave, usdp, amzn	1.78%	1.54%
Btc, eth, icp, wbtc, leo, cro, xlm	23.52%	7.47%
I don't know	41.72%	78.17%

Table 4 indicates that only 23.5% of mail respondents and 7.5% of female respondents were able to correctly identify which cryptocurrencies/tokens were being referred to, while more than half of the respondents provided incorrect answers or didn't know the answer. The highest percentage of correct answers was observed in Sweden at 27.2%, while in Denmark and Finland, these numbers were 22.8% and 26.2% respectively.

3.8. Crypto funding

In terms of employability, the most active group of the population in holding BTC and ETH are full-time parents/stay-at-home parents, followed by full-time workers and self-employed individuals. The situation is similar in terms of plans to acquire cryptocurrencies.

Table 5. Cryptocurrency Funding

	Totals	Male	Female	Denmark	Sweden	Finland
I paid out of my normal monthly budget	9.7%	14.8%	4.5%	10.7%	10.5%	7.1%
I sold (some of) my assets/investments	4.0%	5.6%	2.3%	5.8%	3.5%	2.9%
I used (some of) my savings	7.9%	12.9%	2.8%	8.3%	9.0%	5.6%
I put the cost on to a credit card	4.6%	7.1%	2.0%	5.2%	5.4%	2.5%
I took out a new loan from a financial institution	2.9%	3.9%	2.0%	4.3%	2.7%	1.7%
I borrowed from friends/family	2.7%	2.9%	2.4%	4.6%	2.6%	0.8%
Other; please specify	0.2%	0.2%	0.1%	0.5%	0.0%	0.2%
Prefer not to say	0.8%	1.2%	0.5%	0.2%	1.2%	0.9%

The main types for cryptocurrency funding (Table 5) are normal monthly budget (9.7%), followed by savings (7.9%), and putting the costs on to a credit card (4.6%).
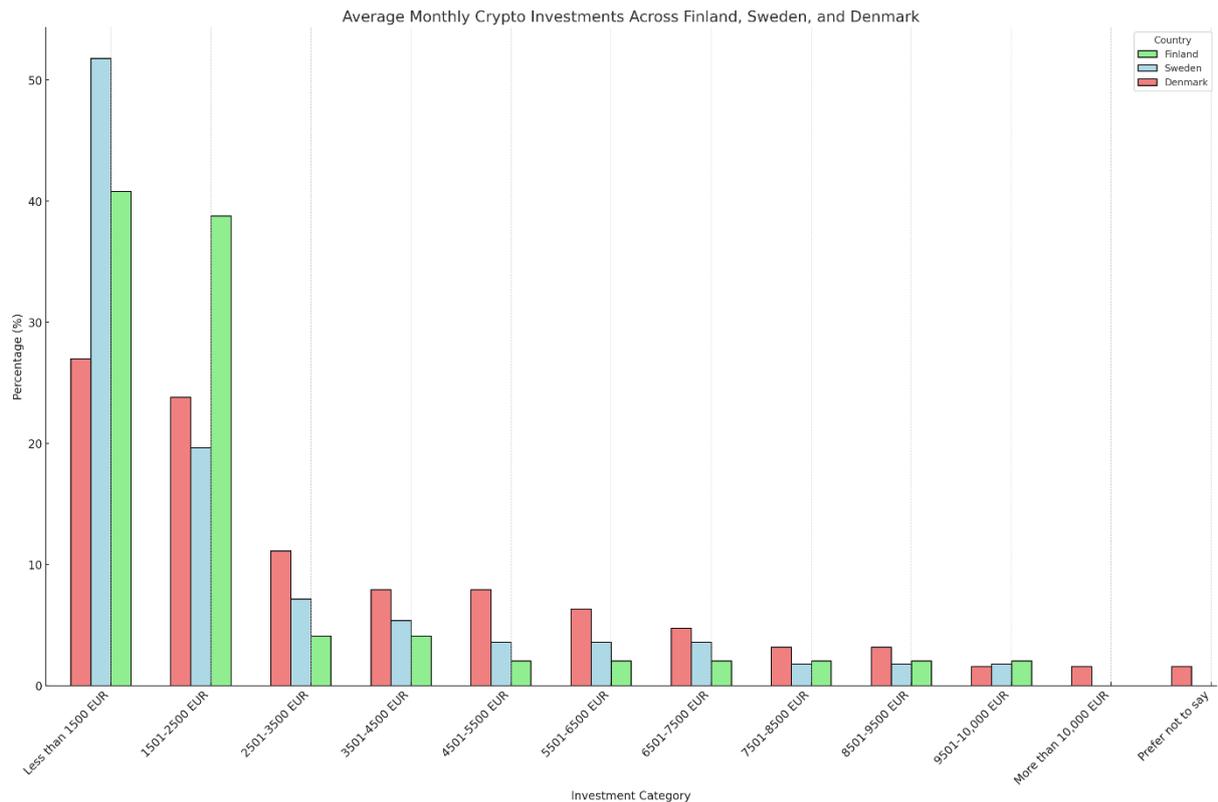
Fig. 15. Average monthly crypto investment across Finland, Sweden and Denmark.

Fig.15 shows that in Finland, respondents predominantly invest less than 1500 EUR. There's a relatively even distribution for investment amounts ranging from "*4501-5500 EUR*" to "*More than 10,000 EUR*", but these categories represent a smaller portion of respondents. In Sweden, similar to Finland, the majority of Swedish respondents invest less than 1500 EUR per month. Notably, there's a slightly higher percentage of people in Sweden who invest between "*6501-7500 EUR*" compared to the other countries. Regarding Denmark, the distribution exhibits more variability. While the dominant category is again "*Less than 1500 EUR*", there's a noticeable portion of respondents investing "*1501-2500 EUR*" and "*5501-6500 EUR.*"

For investment amounts exceeding 10,000 EUR, all three countries have a relatively lower percentage of respondents, indicating that high-volume monthly investments in cryptocurrencies are less common among the survey participants.

Cross country comparison demonstrate that Sweden seems to have the highest percentage of respondents who invest less than 1500 EUR, making it the most conservative among the three in terms of crypto investments. Denmark displays a slightly more varied distribution, with a bit more representation in the mid-investment categories like "*1501-2500 EUR*" and "*5501-6500 EUR*".

The general trend in all three countries is that smaller monthly investments in cryptocurrencies are more prevalent. This could be attributed to various factors such as caution due to the volatile nature of the crypto market, limited disposable income, or a combination of other socio-economic reasons.

Table 6. Cryptocurrency gains/losses

Type	Totals	Male	Female	Denmark	Sweden	Finland
Gained	12.6%	19.9%	5.0%	13.9%	14.9%	6.7%
Lost	4.6%	6.4%	2.7%	5.5%	4.2%	4.2%
Prefer not to say	1.1%	1.2%	1.1%	1.6%	1.2%	0.4%

In terms of experience, the results are the following (Table 6). Males in Sweden have the highest percentage reporting gains from their crypto investments. Females in Finland report the lowest gains. Males in Denmark report the highest losses. Females in Sweden report the lowest losses. Gender dynamics in cryptocurrency investments seem to vary across countries. Males generally report higher gains compared to females. However, the losses are relatively even.

3.9. Perception and understanding of cryptocurrencies.

General perception and understanding of cryptocurrencies is presented in Table 7.
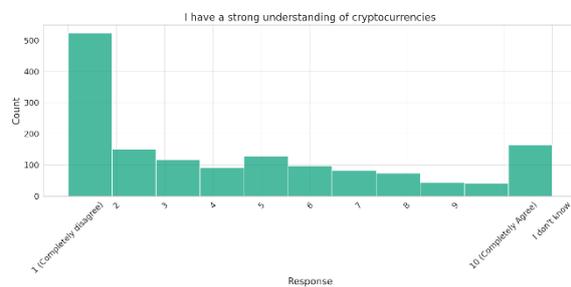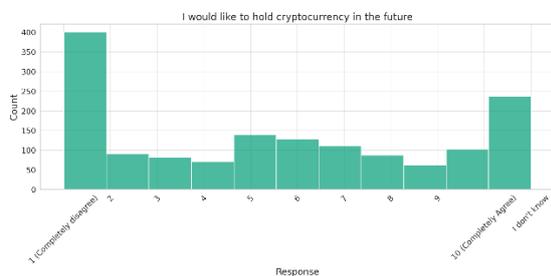
Table 7. Perception and understanding of cryptocurrencies.

	Totals	Male	Female	Denmark	Sweden	Finland
I would like to hold cryptocurrency in the future: 1 completely disagree	24.8%	21.5%	28.3%	28.3%	24.0%	22.5%
I would like to hold cryptocurrency in the future: 10 completely agree	7.4%	10.4%	4.3%	6.6%	7.9%	7.4%
I have a strong understanding of cryptocurrencies: 1 completely disagree	32.9%	22.9%	43.2%	33.7%	34.3%	29.6%
I have a strong understanding of cryptocurrencies: 10 completely agree	3.1%	4.5%	1.6%	2.6%	3.7%	2.5%
I consider cryptocurrency to be a risk: 1 completely disagree	4.0%	3.6%	4.4%	4.2%	4.5%	2.8%
I consider cryptocurrency to be a risk: 10 completely agree	26.0%	28.9%	23.1%	28.1%	24.9%	26.0%
I consider cryptocurrency to be an opportunity: 1 completely disagree	19.3%	16.8%	21.8%	20.6%	19.8%	16.9%
I consider cryptocurrency to be an opportunity: 10 completely agree	6.7%	10.2%	3.2%	6.8%	6.9%	6.4%
Cryptocurrencies are unregulated: 1 completely disagree	4.8%	4.0%	5.6%	4.1%	4.9%	5.2%
Cryptocurrencies are unregulated: 10 completely agree	13.8%	18.3%	9.2%	15.5%	14.0%	11.4%
Cryptocurrency exchanges are vulnerable to cyber attacks: 1 completely disagree	4.2%	3.4%	5.0%	3.8%	5.0%	3.2%
Cryptocurrency exchanges are vulnerable to cyber attacks: 10 completely agree	15.1%	16.5%	13.6%	18.5%	13.4%	14.3%
The legal status of cryptocurrency is always uncertain: 1 completely disagree	4.6%	3.9%	5.3%	3.7%	5.6%	3.6%
The legal status of cryptocurrency is always uncertain: 10 completely agree	14.5%	16.0%	12.9%	16.8%	12.7%	15.2%

The price of cryptocurrencies is highly volatile: 1 completely disagree	4.3%	2.9%	5.6%	3.2%	5.5%	3.1%
The price of cryptocurrencies is highly volatile: 10 completely agree	19.3%	27.0%	11.5%	21.8%	15.6%	23.6%
Cryptocurrencies can be used in illicit activities: 1 completely disagree	4.5%	3.2%	5.7%	3.4%	5.6%	3.4%
Cryptocurrencies can be used in illicit activities: 10 completely agree	23.5%	29.1%	17.7%	22.8%	23.6%	24.0%
Cryptocurrencies are ethical: 1 completely disagree	14.5%	13.8%	15.2%	16.5%	13.3%	14.5%
Cryptocurrencies are ethical: 10 completely agree	4.0%	5.8%	2.1%	4.5%	4.5%	2.4%
Cryptocurrencies are compatible with sustainable development: 1 completely disagree	14.5%	15.2%	13.8%	15.3%	12.9%	16.6%
Cryptocurrencies are compatible with sustainable development: 10 completely agree	4.2%	5.3%	3.1%	3.5%	5.0%	3.5%
Cryptocurrencies are healthy for the environment: 1 completely disagree	16.1%	17.4%	14.9%	16.3%	14.8%	18.4%
Cryptocurrencies are healthy for the environment: 10 completely agree	4.8%	5.7%	3.8%	5.3%	4.9%	4.0%

Note: The answers are presented on the Likert scale, though in this table, we only show the percentage of confident respondents who completely agree or disagree.

The whole distributions of responses are presented in Figures 16.

Figs. 16 Perception and understanding of cryptocurrencies, per question.

Based on Table 7 and Fig. 16, we can say the following:

First, most respondents lean towards wanting to hold cryptocurrency in the future, with many selecting "10 (Completely Agree)". Second, most respondents do not fully agree with the statement of having a strong understanding, with many selecting mid-scale values or "1 (Completely Disagree)". Third, a significant number of respondents consider cryptocurrencies to be a risk, with many leaning towards "10 (Completely Agree)". Fourth, mixed sentiment is observed with opportunity perception. While many see it as an opportunity, a notable number are neutral or disagree. Fifth, a high count of respondents believe cryptocurrencies are unregulated, with many choosing "10 (Completely Agree)". Sixth, there's a strong belief that cryptocurrency exchanges are vulnerable to cyber-attacks. Respondents have mixed feelings about cryptocurrencies being used in illicit activities, but many lean towards agreement. Though, many respondents believe the legal status of cryptocurrency remains uncertain. Next, a significant number of respondents acknowledge the high volatility of cryptocurrency prices.

In terms of ethical consideration, the sentiment is mixed, with some respondents seeing cryptocurrencies as ethical and others not. There's no dominant sentiment regarding the compatibility of cryptocurrencies with sustainable development. In terms of environmental concerns, the majority doesn't strongly believe that cryptocurrencies are healthy for the environment.

Closer analysis of q39_10 that is "Cryptocurrencies are ethical", q39_11 that is "Cryptocurrencies are compatible with sustainable development", and q39_12 that is "Cryptocurrencies are healthy for the environment" linking it with q10 (asset ownership) demonstrates the following (Figs. 17, 18, 19):
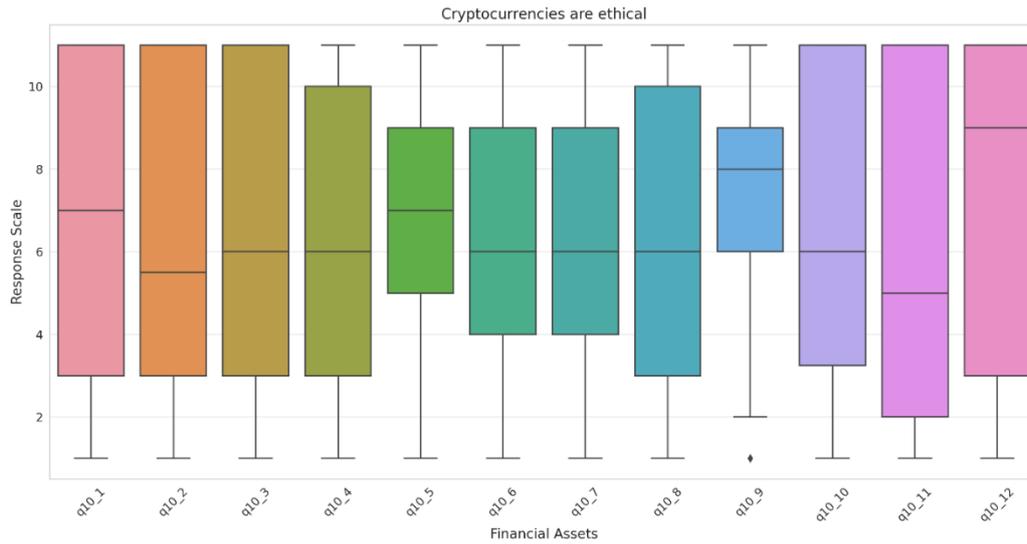
Fig 17. Cryptocurrencies are ethical vs asset ownership

Fig 17. shows that respondents holding bonds, shares, and other equity, as well as investment funds, tend to somewhat agree with the statement. Those with cryptocurrencies/NFTs also seem to lean more positively towards the ethicality of cryptocurrencies. It's interesting to note that people with cryptocurrencies/NFTs (q10_5) do not have the highest median sentiment about the ethicality of cryptocurrencies, suggesting a nuanced perspective even among crypto holders.

Fig 18. Cryptocurrencies are Compatible with Sustainable Development vs asset ownership

Fig. 18. Demonstrates that the median sentiment across different financial assets is closer to neutral. This might reflect the ongoing deb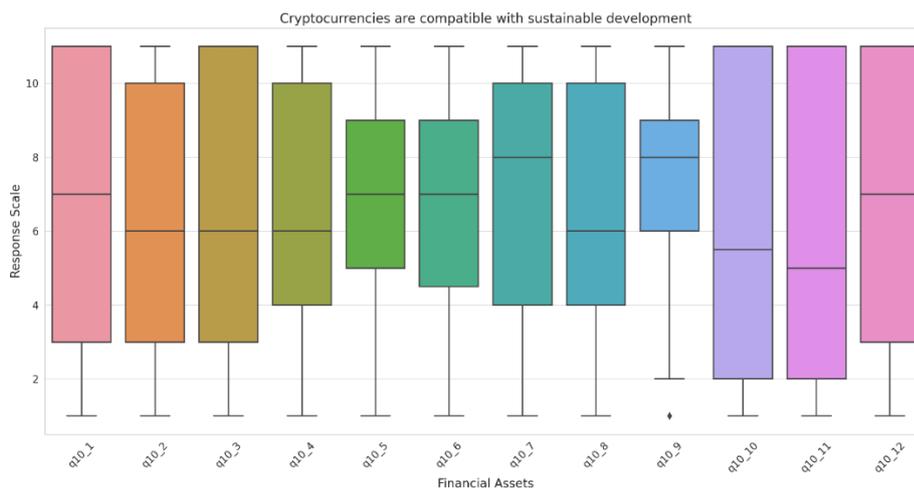ate about the environmental impact of some cryptocurrencies, especially Bitcoin. Again, those with cryptocurrencies/NFTs do not express the most positive sentiment about crypto's sustainability, indicating a more balanced view.
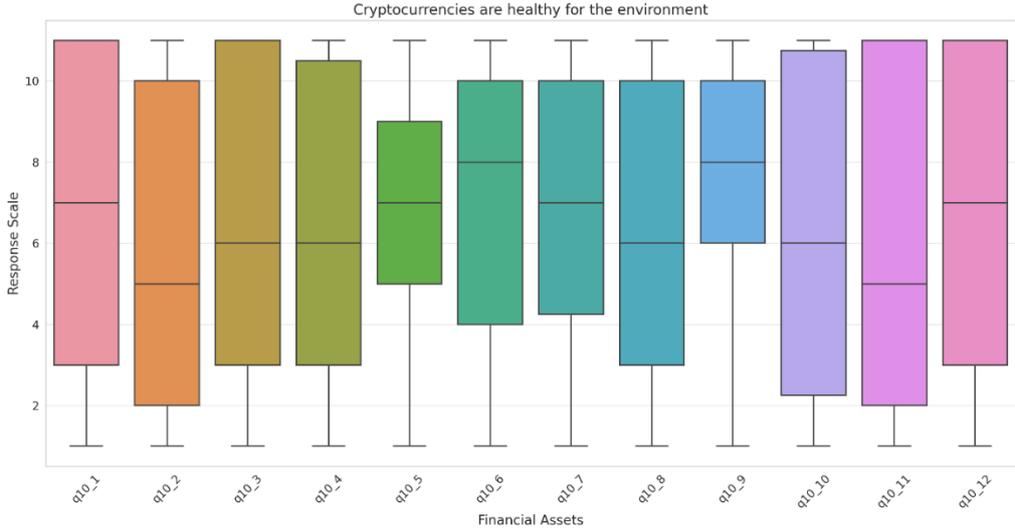
Fig 19. Cryptocurrencies are Healthy for the Environment vs asset ownership

Fig 19 shows that across the board, the median sentiment leans towards disagreement, reflecting the widespread concerns about the energy-intensive processes (like mining) associated with some cryptocurrencies. Cryptocurrency/NFT holders, although not strongly positive, have a slightly more favorable view compared to holders of other assets.

The correlations between the statement q39_1 ("*I would like to hold cryptocurrency in the future*") and other q39_ questions are the following:

1. **q39_4** ("*I consider cryptocurrency to be an opportunity*"): 0.7327

2. **q39_2** ("*I have a strong understanding of cryptocurrencies*"): 0.5492

3. **q39_10** ("*Cryptocurrencies are ethical*"): 0.4728

4. **q39_11** ("*Cryptocurrencies are compatible with sustainable development*"): 0.4515

5. **q39_12** ("*Cryptocurrencies are healthy for the environment*"): 0.4414

6. **q39_8** ("*The price of cryptocurrencies is highly volatile*"): 0.1961

7. **q39_7** ("*The legal status of cryptocurrency is always uncertain*"): 0.1863

8. **q39_5** ("*Cryptocurrencies are unregulated*"): 0.1759

9. **q39_9** ("*Cryptocurrencies can be used in illicit activities*"): 0.1649

10. **q39_6** ("*Cryptocurrency exchanges are vulnerable to cyber attacks*"): 0.1603

11. **q39_3** ("*I consider cryptocurrency to be a risk*"): 0.1384

Thus, the highest correlation is with the belief that cryptocurrency is an opportunity. This is logical: those who see crypto as a future investment likely view it as an opportunity. A strong understanding of cryptocurrencies also correlates positively with the desire to hold them in the future. Perceptions about the ethics, sustainability, and environmental impact of cryptocurrencies also show positive correlations with the desire to invest in them.

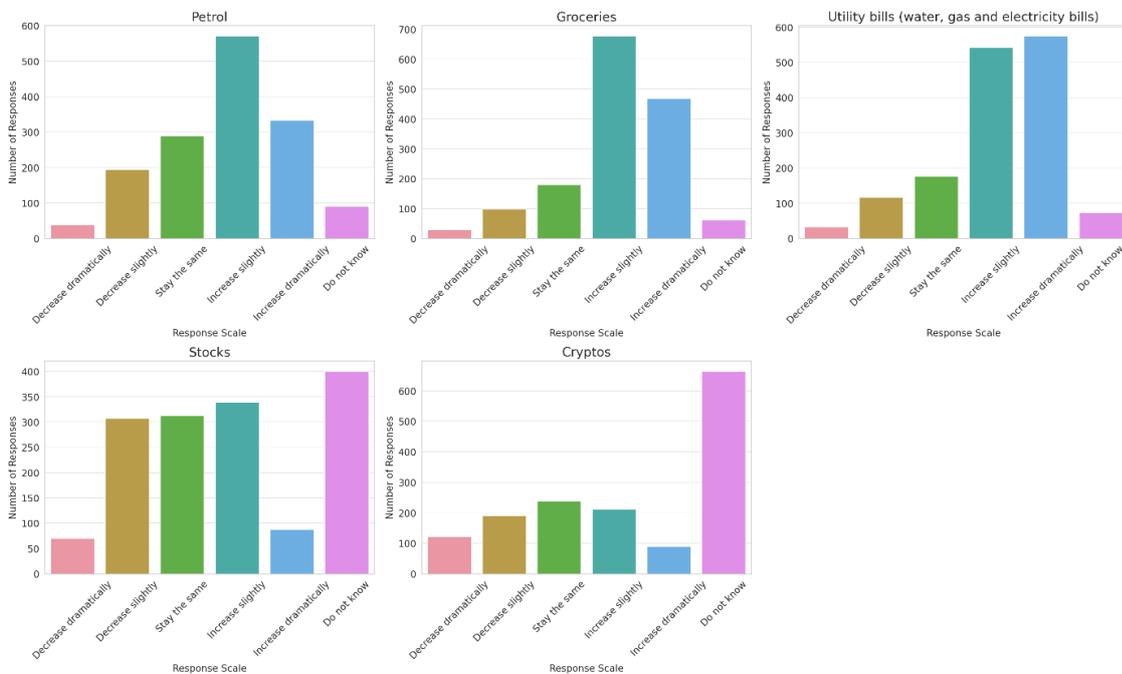### 3.10. Economic expectations and holding of cryptos

Fig. 20. Responses to the questions: *Over the next year, what do you think will happen to the prices of the following?*

Based on Fig. 20. in terms of petrol, most respondents expect the prices to "*Increase slightly*" or "*Increase dramatically*". A smaller proportion believes prices will "*Stay the same*", and very few expect a decrease.

Regarding groceries, the majority expect prices to "*Increase slightly*". This is followed by those who expect prices to "*Stay the same*" or "*Increase dramatically*". Again, very few expect a decrease. The trend in Utility bills is similar to groceries with a majority expecting a slight increase, followed by those expecting prices to remain the same or increase dramatically.

In terms of stocks, the responses are more spread out. A significant proportion expects stock prices to "*Increase slightly*", but there's also a notable amount of uncertainty with many respondents selecting "*Do not know*".

And finally, crypto assets - the distribution here is quite diverse. A significant number of respondents expect prices to "*Increase slightly*" or "*Stay the same*". However, there's a larger uncertainty compared to other categories, with many choosing "*Do not know*".

Averal, a good number of respondents chose "*Do not know*", indicating uncertainty about the future of crypto prices. These insights provide a snapshot of the general sentiment regarding the future prices of different items and assets. Respondents largely expect inflation in essentials like petrol, groceries, and utilities, while having varied opinions on stocks and cryptocurrencies.
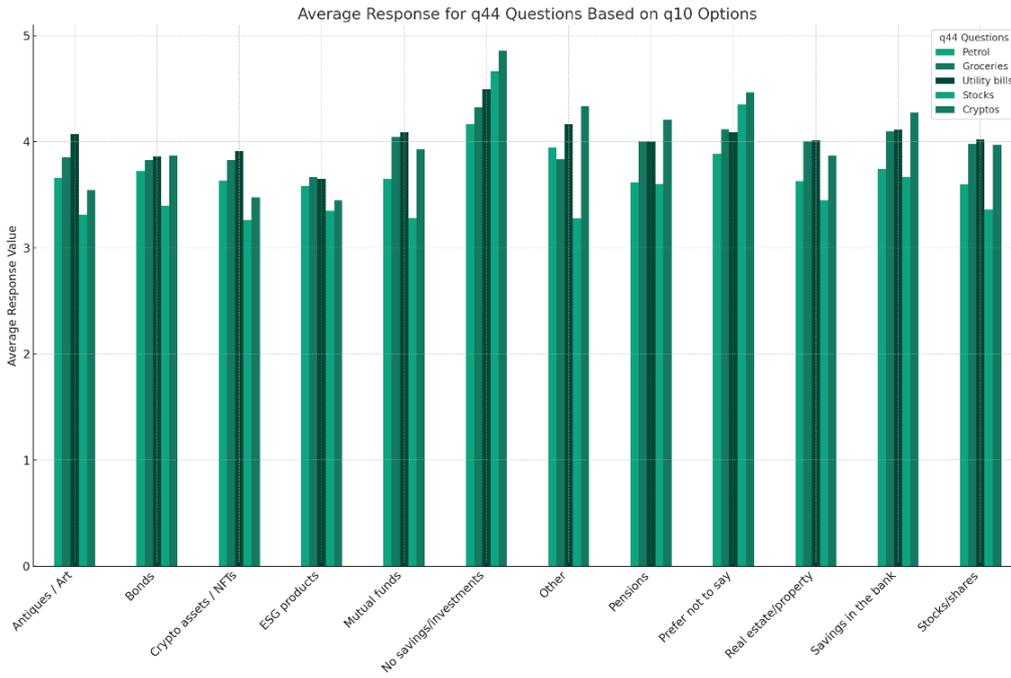
Fig 21a. Average responses for the price expectations questions based on a current asset ownership
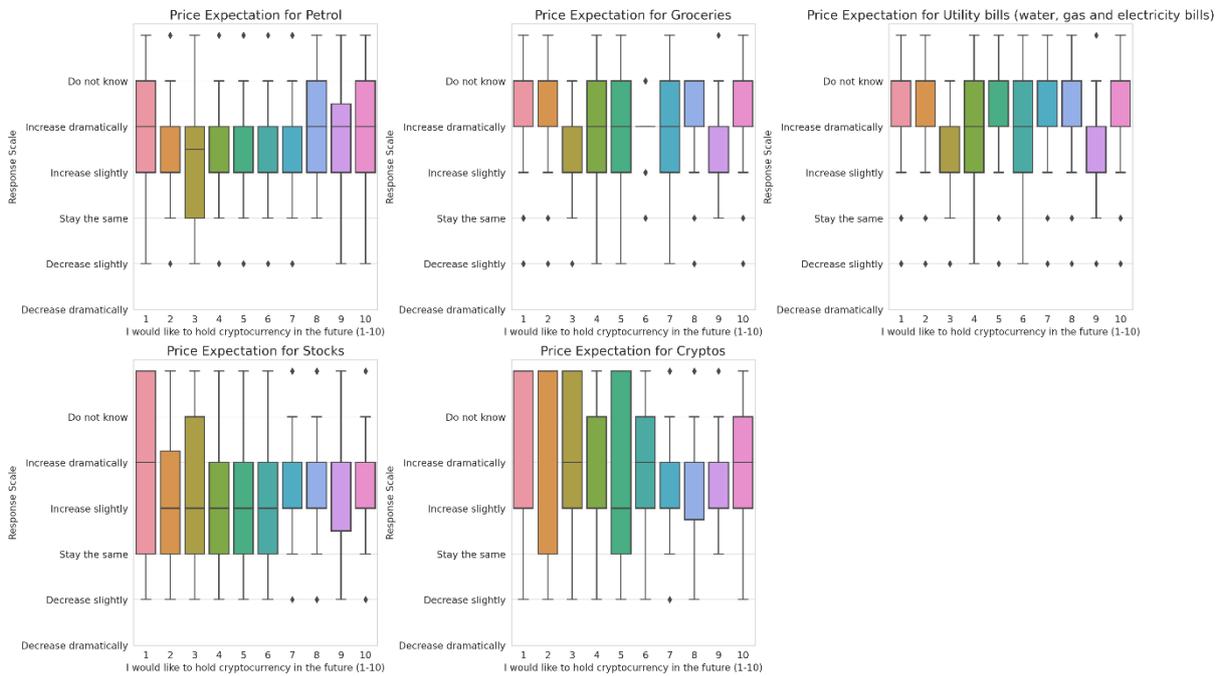

Fig. 21b. Price expectations vs future asset ownership

Fig 21a displays the average response values for the "q44" questions, based on the types of savings/investments respondents have (from the "q10" question). Respondents with *Pensions*, *Real*

Estate, and Savings in the bank generally have a similar pattern in their expectations across all the "q44" categories. They tend to expect prices to increase slightly. Respondents with *stocks/shares* as their investment show a slightly higher expectation of stock prices increasing, which makes intuitive sense. They also have a noticeable expectation of crypto prices increasing.

The group of *Crypto assets / NFTs* owners has a distinct pattern. They show a higher expectation of crypto prices increasing compared to other investment types. They also have a slightly more bullish view on stock prices. Respondents in *Antiques/Art, Bonds, and Mutual funds* categories show patterns similar to the general population, with a tendency towards expecting prices to increase slightly in most "q44" categories.

ESG products and "*Other*" groups have varied expectations, but again, there's a general tendency towards expecting prices to increase slightly.

Prefer not to say group's expectations are generally aligned with the broader population. And finally, respondents without any savings or investments tend to have a slightly more conservative view, especially regarding cryptos.

Fig 21b displays the distribution of responses regarding price expectations (q44_ questions: "*Over the next year, what do you think will happen to the prices for the following?*") for various items and assets over the next year, based on the sentiment towards holding. The results show that irrespectively of their expectation on petrol prices, respondents generally have a similar sentiment towards holding cryptocurrencies. Those expecting a dramatic increase in petrol prices show slightly more inclination towards holding cryptos. Expectations about grocery prices show minor variations in the sentiment towards holding cryptos. Respondents expecting grocery prices to "*Increase dramatically*" seem to have a slightly stronger inclination towards holding cryptos. The sentiment towards cryptos is relatively consistent across different expectations for utility bills. Respondents expecting stock prices to "*Increase dramatically*" or "*Decrease dramatically*" have a stronger inclination towards holding cryptos compared to those with milder expectations. As expected,

respondents who believe crypto prices will "*Increase dramatically*" are highly inclined to hold cryptos in the future. Conversely, those who expect a decrease in crypto prices are less inclined.

In terms of general macroeconomic expectations, they are as follows (Fig. 22):
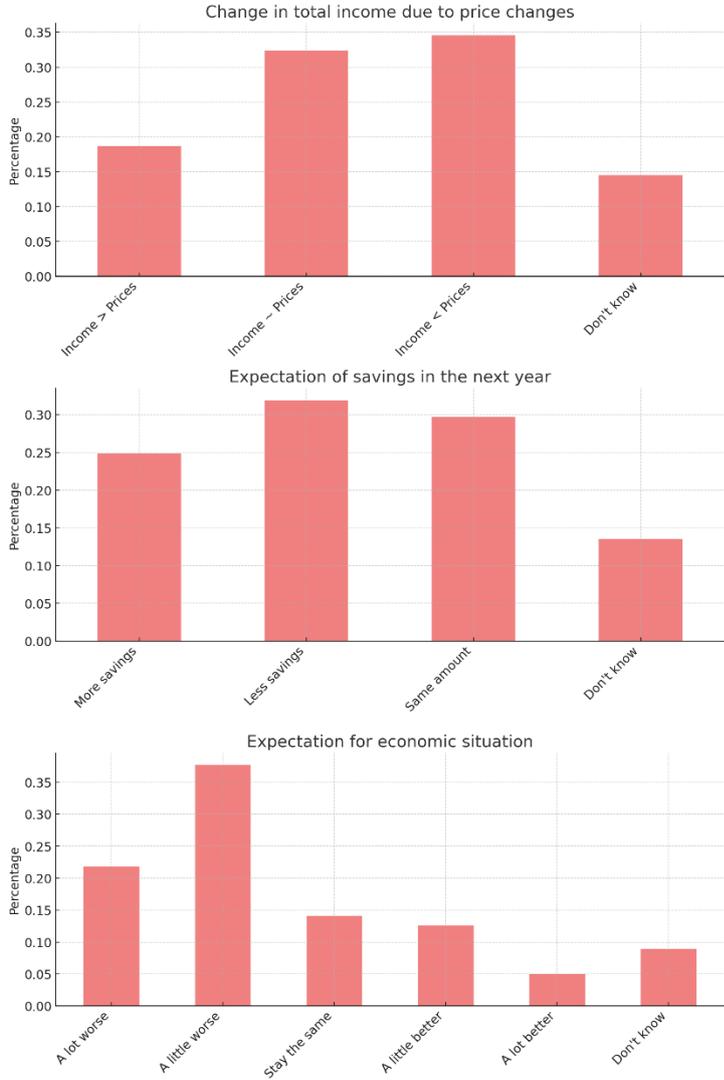

Fig 22. Macroeconomic expectations.

Based on Fig. 22 we can say the following:

Change in total income due to price changes (q45): A significant portion of respondents expect their total income to be around the same as the current prices. Many also believe their total income

will be less than the current prices. Only a small fraction expects their income to exceed current prices, and a similar small proportion are uncertain.

Expectation of savings in the next year (q46): The majority of respondents anticipate having the same amount of savings next year as they currently have. A significant number also expect to have more savings. Fewer respondents believe they will have less savings, and a small portion are uncertain.

Expectation for economic situation (q47): A substantial number of respondents believe the economic situation will remain the same in the coming year. Many also think the situation will get a little better, while a similar number expect it to get a little worse. Fewer respondents are highly pessimistic (expecting it to get a lot worse) or highly optimistic (expecting it to get a lot better). A small portion of respondents are unsure about the economic outlook.

3.11. Economic optimism

To determine which asset owners are the most optimistic, we set criteria for optimism based on the questions we analyzed (Fig.22):

- For q45 (*Change in total income due to price changes*): Optimism would be reflected by the belief that one's total income will be more than the current prices.

- For q46 (*Expectation of savings in the next year*): Optimism would be indicated by the expectation to have more savings.

- For q47 (*Expectation for the economic situation*): Optimism would be demonstrated by the belief that the economic situation will get a little better or a lot better.

41
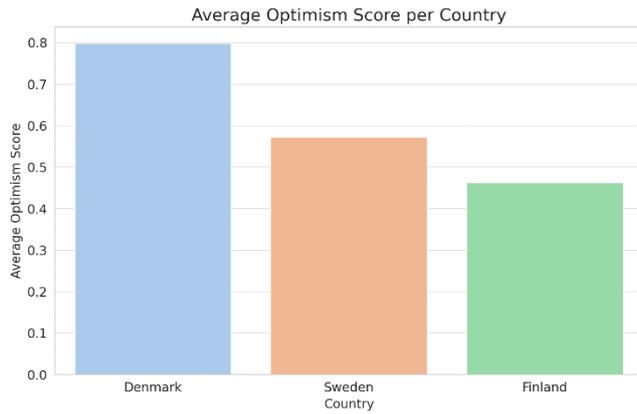
Fig. 23a. Average economic optimism score per country
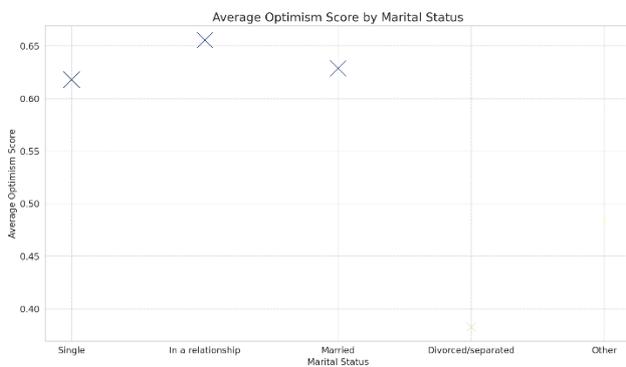
Fig. 23b. Average economic optimism score by marital status, with the size of each marker indicating the number of respondents in that category.
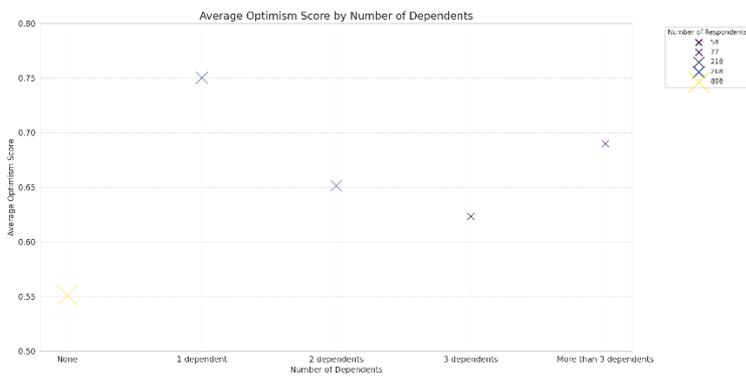
Fig. 23c. Average economic optimism score by the number of dependents.

Note: The color intensity represents the number of respondents, with darker colors indicating more respondents. The marker size also helps visualize the number of respondents in each category.
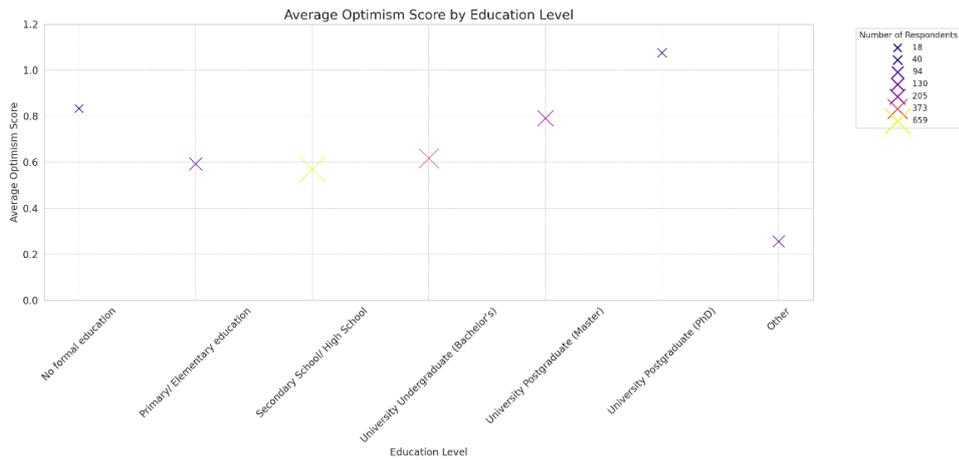
Fig. 23d. Average economic optimism score by education level.
.
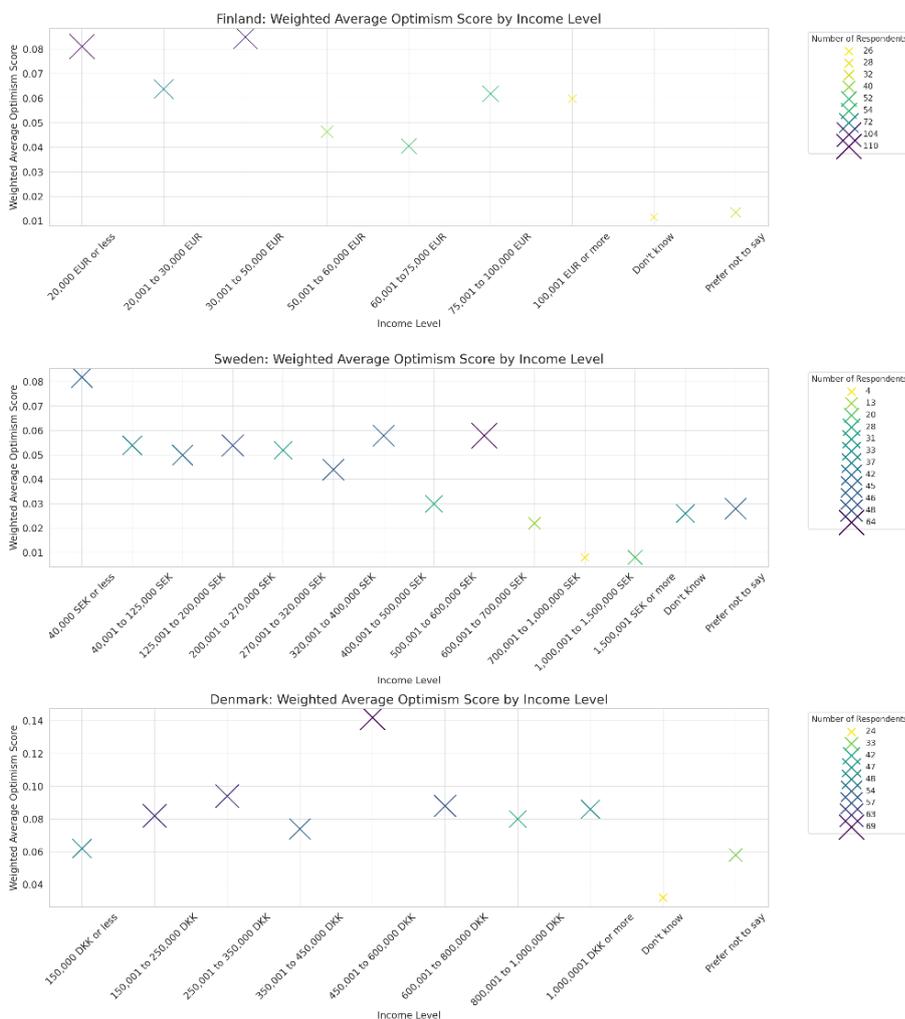
Fig. 23e. Average economic optimism score by household income per country.

Note: The size of each marker indicates the number of respondents in that category, while the color intensity represents the number of respondents, with darker shades indicating more respondents

Fig. 23a demonstrates that that respondents from Denmark are, on average, more optimistic than those from Sweden and Finland. Fig. 23b shows that being in a relationship or married seems to be associated with a higher level of optimism compared to being divorced/separated, that is expected. Fig. 23c suggests that having one dependent seems to correlate with the highest level of optimism. As the number of dependents increases, the optimism score appears to decrease slightly, though there's an uptick for those with more than three dependents. From Fig. 23d we find that individuals with postgraduate degrees (both Master's and PhD) tend to be more optimistic than other education levels. This could be due to various factors, including a higher level of knowledge, financial stability, or job security associated with higher educational qualifications. Fig. 23e demonstrates an absence of a pattern that links higher income with higher economic optimism.

Given the criteria of happiness, we calculate an optimism score for each asset type by summing the proportions of optimistic responses from each question. The asset type with the highest optimism score will be deemed the most optimistic.
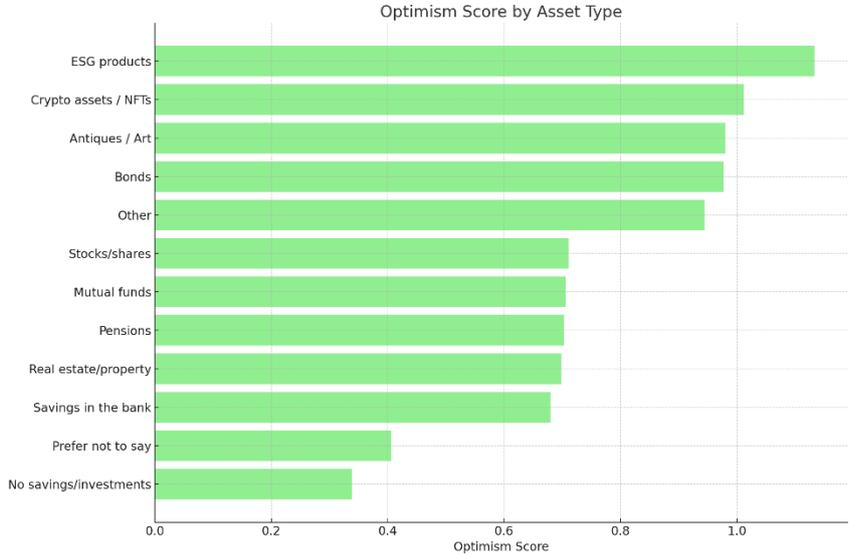
Fig 24. Optimism vs asset ownership

Fig 24 shows that owners of ESG products are the most optimistic, with the highest optimism score. This is followed closely by owners of *Crypto assets / NFTs* and *Antiques / Art*.

Owners of *Bonds* and those who specified *Other* types of assets also show a high level of optimism. On the other end of the spectrum, respondents who selected "*No savings/investments*" and "*Prefer not to say*" exhibit the lowest levels of optimism.

To address the potential bias of more male investors, we normalize the optimism scores by the total number of respondents of each gender within each asset type. This gives us a "per capita" optimism score, allowing for a fair comparison between males and females. Thus, "normalization" in this context means adjusting the optimism scores to account for the differing number of male and female respondents within each asset category. We perform the following steps:

Filter Data: For each asset type, we separate the data into two groups: male respondents and female respondents.

Calculate Raw Optimism Score: For each gender group and asset type, we calculate the raw optimism score. This was done by checking the proportion of optimistic responses, as defined by our criteria, for the questions q45, q46, and q47. For each asset type A and gender G, the raw optimism score *Sraw* is calculated as:

$$Sraw(A,G) = \sum_{i=1}^{n} O(Qi, G) \tag{1}$$

Where: n is the number of questions (in our case, 3: q45, q46, q47), $O(Qi,G)$ is the proportion of optimistic responses for question Qi for gender G. It's a value between 0 and 1, with 1 indicating 100% optimistic responses.

Normalize: The raw optimism score was then divided by the total number of respondents of that gender within the asset type. This gives an average or "per capita" optimism score for each gender in each asset category. The normalized or "per capita" optimism score *Snorm* is:

$$Snorm(A,G) = \frac{Sraw(A,G)}{T(A,G)} \tag{2}$$

where $T(A,G)$ is the total number of respondents of gender G for asset type A.

This "per capita" optimism score tells us, on average, how optimistic each individual is within a gender group, for each asset type. By using this normalized score, we can fairly compare

optimism between males and females without the results being skewed by the sheer number of respondents from one gender.
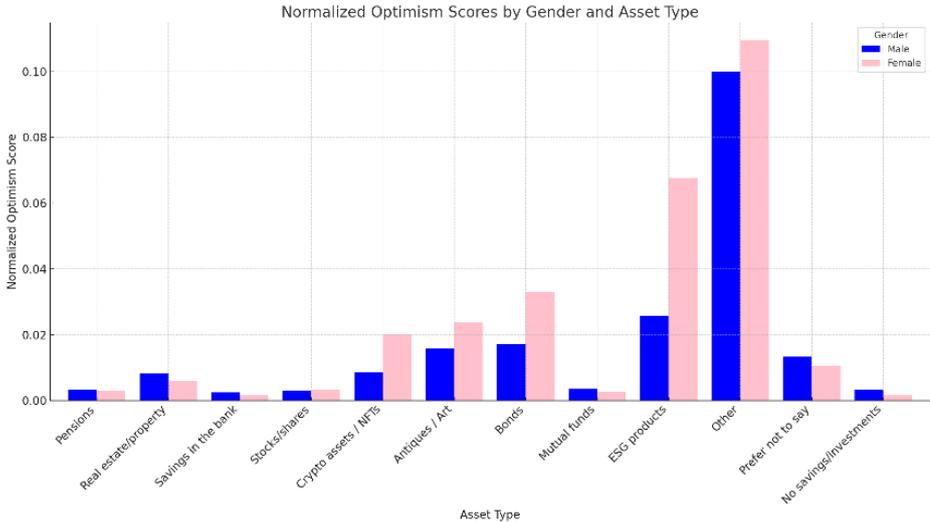
Fig. 25. "Normalized" optimism score (accounting for imbalance in the number of respondents between categories or groups).

Fig. 25 shows a "micro" view, indicating the average sentiment of individuals within each category. For most asset types, the optimism levels between males and females are relatively close. However, in categories like *Crypto assets / NFTs, Antiques/Art,* and *ESG products*, females are more optimistic on a per capita basis than males. In contrast, for assets like *Pensions, Real estate/property, Savings in the bank,* and *Stocks/shares*, males tend to be more optimistic.

3.12. Trust and confidence

Trust is a crucial factor in scenarios involving risk, uncertainty, and interdependence and existing literature has explored its significance even in the digital context. Jalan et al. (2023) find a positive and statistically significant relationship between societal trust and interest in and adoption of cryptocurrencies globally.
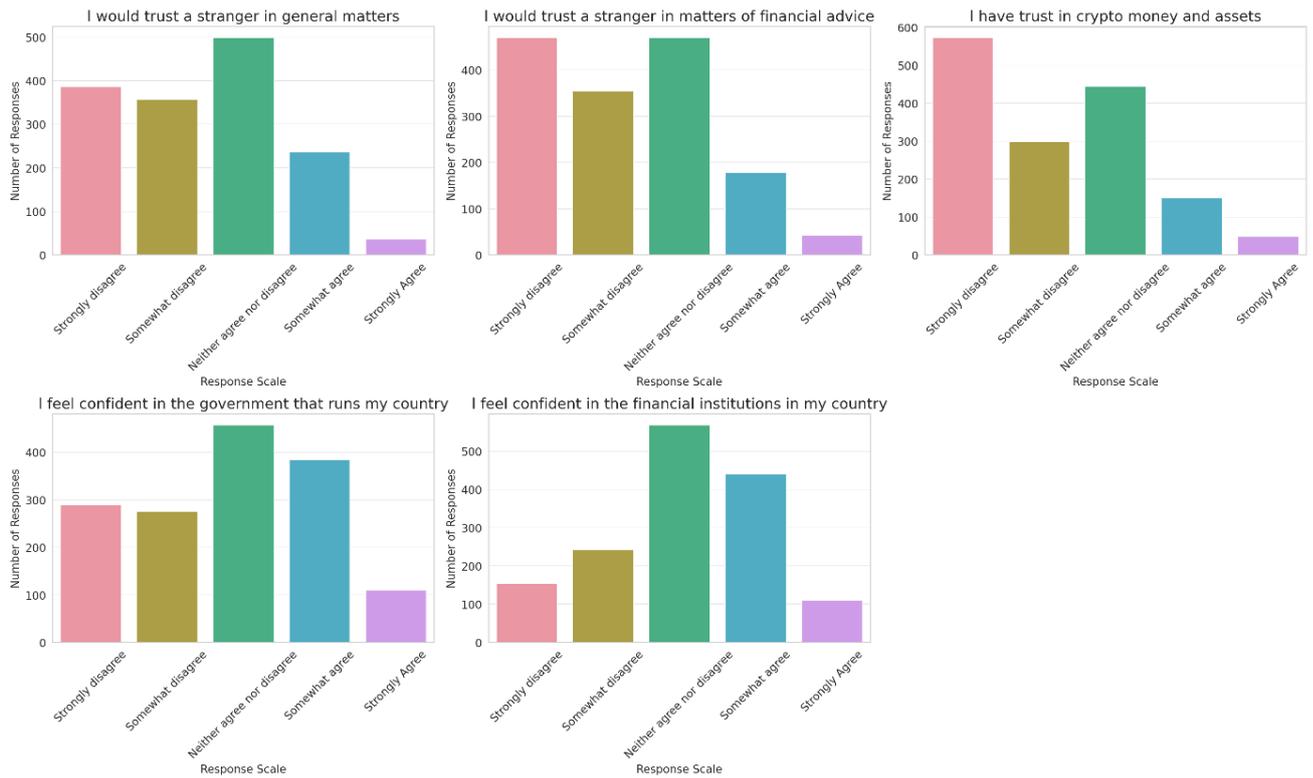
Fig. 26. Trust and confidence (q48 questions)

Fig. 26 demonstrates that most respondents disagree with the statement "*I would trust a stranger in general matters*" with "*Strongly disagree*" and "*Somewhat disagree*" being the most common responses. This indicates a general reluctance to trust strangers in unspecified matters.

An even stronger disagreement is observed for the statement "*I would trust a stranger in matters of financial advice*". The majority "*Strongly disagree*", indicating a heightened reluctance to trust strangers, especially when it comes to financial advice.

For the statement "*I have trust in crypto money and assets*", the responses are more evenly distributed. While many respondents somewhat agree or strongly agree, a significant portion also disagrees or remains neutral. This reveals mixed feelings about trusting cryptocurrencies.

"I feel confident in the government that runs my country" sentiment is divided. A good number of respondents express confidence (somewhat or strongly agree), but a significant portion also disagrees.

Like the sentiment towards governments, responses to *"I feel confident in the financial institutions in my country"* are spread across the scale. A slightly larger portion seems to have confidence in their country's financial institutions compared to their governments.
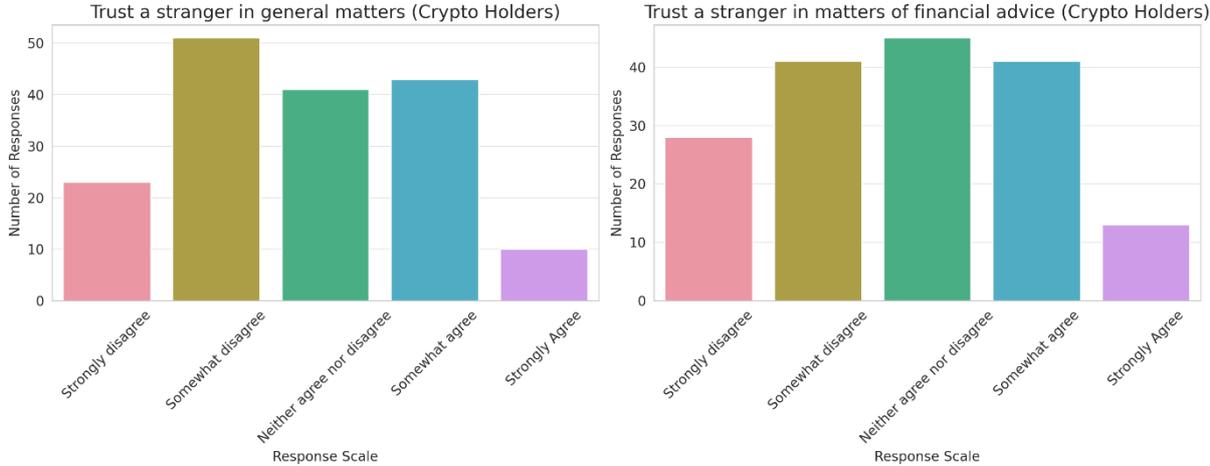
Fig. 27. Trust for crypto asset holders

Fig. 27 shows the sentiments of respondents who hold crypto assets/NFTs (q10_5 = 1) towards trusting strangers, i.e.:

- **Trust a stranger in general matters:** Among crypto holders, the majority tend to "*Strongly disagree*" or "*Somewhat disagree*" with the idea of trusting strangers in general matters. This suggests a general sense of skepticism among this group, even if they are open to the novel idea of cryptocurrency.

- **Trust a stranger in matters of financial advice:** The skepticism becomes even more pronounced when it comes to trusting strangers with financial advice. A vast majority "*Strongly disagree*", highlighting a clear reluctance to rely on unfamiliar sources for financial counsel.

From this analysis, it's evident that while crypto holders might be adventurous in their financial choices, they are also discerning and cautious when it comes to trusting unknown individuals, especially in the realm of financial advice.

We calculated the trust mean levels (Table 8):

Table 8. Trust vs current holding financial assets

Asset	Trust in general matters	Trust in financial advice
Bonds	2.872093	2.848837
Esg products	2.85	2.9
Antiques/art	2.84466	2.708738
Crypto assets/nfts	2.797619	2.821429
Stocks/shares	2.60179	2.438479
Pensions	2.581081	2.315315
Mutual funds	2.496703	2.406593
Real estate/property (other than the house you live in)	2.494898	2.30102
Savings in the bank	2.475524	2.307692
Other	2.333333	2.111111
Prefer not to say	2.275362	2.115942
I don't have any savings/investments	2.230508	2.115254

Based on Table 8, we can say that individuals holding *Bonds* exhibit the most trust in strangers for general matters, followed by those with *ESG products* and *Antiques/Art*. Those who don't have any savings or investments ("*I don't have any savings/investments*") exhibit the lowest trust, preceded by respondents who prefer not to say their assets and those with *Other* assets.

In terms of "*Trust in strangers for financial advice*" those invested in *ESG products* demonstrate the highest trust in strangers for financial advice, followed by *bondholders* and those invested in *Crypto assets/NFTs*. Individuals with *Other* assets display the least trust in strangers for financial advice, followed by those who don't specify their assets ("*I don't have any savings/investments*") and those who prefer not to reveal their assets.

Thus, this pattern highlights a positive sentiment towards trust among individuals with assets perceived as newer or more ethical (like *ESG products*) and traditional secure assets (like *bonds*). Notably, *crypto asset* holders, though in the middle of the trust spectrum, rank higher when it comes to financial advice, indicating their openness or desire for more information.

A comparison of trust levels between those who would like to hold cryptocurrency in the future and those who wouldn't:

Table 9. Trust vs future holding crypto assets

Statement	Future crypto holders	Non-future crypto holders
I would trust a stranger in general matters	2.62	2.19
I would trust a stranger in matters of financial advice	2.53	1.96
I have trust in crypto money and assets	2.70	1.46
I feel confident in the government that runs my country	2.90	2.73
I feel confident in the financial institutions in my country	3.12	2.99

Table 9 demonstrates that future crypto holders exhibit a higher level of trust in strangers for both general matters and financial advice. Cryptocurrency transactions are typically peer-to-peer, without intermediaries. This decentralized nature might appeal more to those who inherently trust others, even if they are strangers.

In terms of "*Trust in Cryptocurrencies*" Table 9 shows that there's a stark difference in the trust levels towards crypto assets between the two groups. A fundamental trust in the concept, technology, and potential of cryptocurrencies is a driving factor for those wanting to invest in or hold them. Thus, this trust might stem from a deeper understanding, positive experiences, or optimism about the future of digital currencies.

Regarding *Confidence in Government and Financial Institutions,* both groups have relatively similar confidence levels in their governments and financial institutions, although future crypto holders rate slightly higher. While crypto enthusiasts sometimes perceive cryptocurrencies as an alternative to traditional financial systems, it doesn't necessarily translate to a lack of confidence in existing government and financial institutions.

In general, the tendency towards holding cryptocurrencies seems to correlate with higher trust levels in both traditional systems and novel concepts, suggesting that future crypto holders are not just rebels against the traditional system but might be individuals who are open to embracing new technologies and ideas while still understanding and trusting the existing ones.

The data also supports the idea that trust – whether in a new technology like cryptocurrencies or in traditional institutions – plays a significant role in financial decisions.

Thus, increasing awareness and education around cryptocurrencies can potentially enhance trust levels, making individuals more open to embracing them. On the other hand, for those skeptical about cryptos, focusing on building trust and understanding can be a strategy to encourage broader adoption.

3.12. Gender dimension

The gender distribution in the survey is as follows: Female: 55.5%, Male: 44.5%.

Table 10. Distribution of assets by gender

Assets	Male (%)	Female (%)
Pensions	32.25	26.81
Real Estate/Property (Other than the house you live in)	14.79	11.39
Savings In The Bank	44.38	49.23
Stocks/Shares	37.87	22.66
Crypto Assets / Nfts	18.34	5.22
Antiques / Art	9.32	4.74

Bonds		7.84	3.91
Mutual Funds		34.02	26.69
ESG Products		5.92	2.37
Other; Please Specify		1.48	0.95
Prefer Not to Say		4.44	4.63
I Don't Have Any Savings/Investments		14.35	23.49

Table 10 demonstrates a gender distribution per assets. The most "feminine" assets is bank saving due to its popularity. Also, more females than males don't have any savings/investments. Crypto asset ownership has the biggest gender gap.

Table 11. Average familiarity

	Cryptocurrency	Male Avg Familiarity	Female Avg Familiarity
1.	Bitcoin (BTC)	2.87	2.14
2.	Ethereum (ETH)	2.29	1.39
3.	Tether (USDT)	1.79	1.24
4.	Binance Coin (BNB)	1.87	1.33
5.	U. S. Dollar Coin (USDC)	1.90	1.46
6.	XRP (XRP)	1.75	1.21
7.	Cardano (ADA)	1.66	1.21
8.	Solana (SOL)	1.72	1.23
9.	Polkadot (DOT)	1.60	1.23
10.	Dogecoin (DOGE)	2.05	1.35
11.	Stellar (XLM)	1.70	1.24
12.	Neo	1.54	1.22
13.	Celsius (CEL)	1.58	1.25
14.	Nano	1.58	1.26
15.	Dash (DASH)	1.68	1.24
16.	TRON (TRX)	1.64	1.21
17.	Zcash (ZEC)	1.53	1.20
18.	NEM (XEM)	1.53	1.19
19.	Bitcoin SV (BSV)	2.09	1.72
20.	EOS Coin (EOS)	1.60	1.23
21.	VeChain (VET)	1.52	1.21
22.	Dai (DAI)	1.58	1.21
23.	Avalanche (AVAX)	1.61	1.22
24.	Cosmos (ATOM)	1.58	1.21
25.	Filecoin (FIL)	1.53	1.20

Note: the categories are: 1 Not familiar at all; 2 Somewhat familiar; 3 Moderately Familiar; 4 Significantly familiar; 5 Extremely familiar
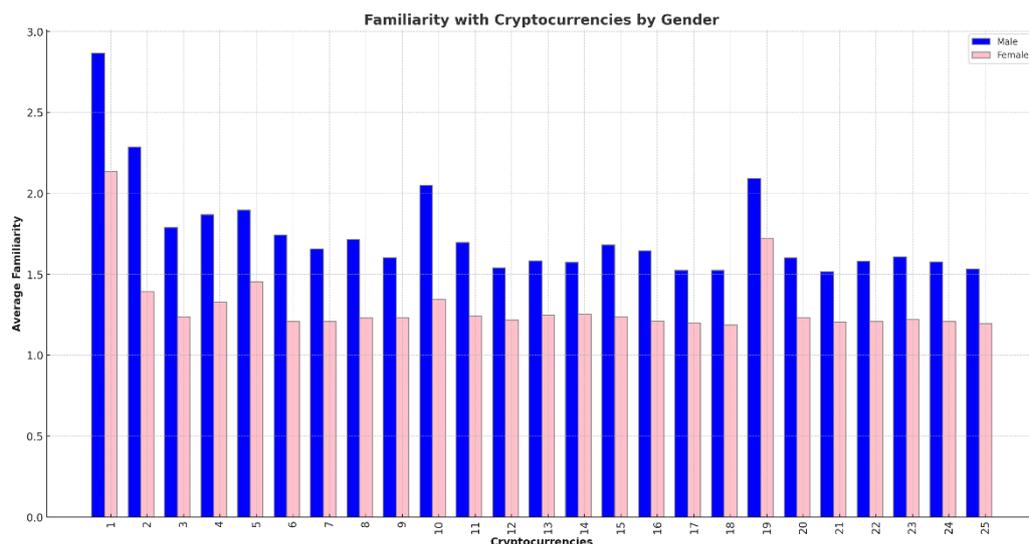
FIg. 27 Familiarity with cryptos

Table 11 and Fig. 27 show that males tend to have higher average familiarity scores for almost all the cryptocurrencies compared to females. Bitcoin (BTC) and Ethereum (ETH) are the most recognized cryptocurrencies among both genders, with a noticeable gap in familiarity between them and the other cryptocurrencies. The familiarity drops significantly for other cryptocurrencies after Bitcoin and Ethereum, but the pattern of males being generally more familiar persists.

Table 12. Relationship with each cryptos, categorized by gender and relationship category, %

Cryptocurrency	Male, %				Female, %			
	Currently hold/own	Previously held/owned, don't currently	Planning to acquire in next 6 months	Never owned, no plans to	Currently hold/own	Previously held/owned, don't currently	Planning to acquire in next 6 months	Never owned, no plans to
Bitcoin (BTC)	12.130	7.544	5.030	7.840	3.440	2.017	3.677	3.321
Ethereum (ETH)	9.615	7.692	2.515	4.734	2.847	0.949	1.068	0.712
Tether (USDT)	4.438	4.142	3.550	2.367	1.186	0.712	0.593	0.593
Binance Coin (BNB)	4.438	4.142	2.959	2.959	1.305	0.949	0.830	0.474
U. S. Dollar Coin (USDC)	2.219	6.065	3.107	3.402	1.186	1.305	1.779	1.661
XRP (XRP)	3.698	5.325	3.254	1.775	0.474	0.712	0.830	0.474
Cardano (ADA)	3.254	3.994	2.367	1.775	1.068	0.949	0.949	0.474
Solana (SOL)	3.550	4.438	2.219	2.515	0.593	1.305	0.830	1.068
Polkadot (DOT)	2.071	3.550	2.071	1.627	0.949	0.712	0.712	0.593
Dogecoin (DOGE)	5.178	5.917	3.550	3.994	0.830	1.542	0.949	0.949
Stellar (XLM)	1.923	4.142	3.107	1.923	0.474	1.305	0.830	0.712
Neo	1.479	2.515	2.367	1.479	0.593	0.830	0.830	0.237

Celsius (CEL)	1.183	3.254	2.515	2.071	1.068	0.949	1.305	1.068
Nano	1.331	3.846	2.071	0.888	0.593	1.068	1.068	0.237
Dash (DASH)	2.219	3.254	2.663	2.219	0.474	0.949	0.593	0.474
TRON (TRX)	3.402	2.515	2.959	1.923	0.830	0.474	0.830	0.474
Zcash (ZEC)	1.775	1.479	2.959	1.627	0.830	1.068	0.712	0.356
NEM (XEM)	1.331	2.811	2.515	1.627	0.712	0.712	1.068	0.237
Bitcoin SV (BSV)	1.775	5.325	3.698	4.438	1.542	1.779	1.305	2.491
EOS Coin (EOS)	2.515	3.254	2.811	1.331	0.949	0.474	1.068	0.593
VeChain (VET)	2.219	2.071	2.219	1.627	0.474	0.712	0.712	0.949
Dai (DAI)	1.331	3.402	2.811	1.479	0.593	1.186	0.949	0.712
Avalanche (AVAX)	2.071	3.698	1.775	1.923	0.712	0.593	0.712	0.830
Cosmos (ATOM)	1.775	3.254	3.550	1.183	0.593	0.949	0.593	0.593
Filecoin (FIL)	1.036	2.811	1.775	1.627	0.237	0.949	0.593	0.712

Table 12 demonstrates again, that overall, male respondents have a higher ownership rate for almost all the listed cryptocurrencies compared to female respondents. Bitcoin and Ethereum are the most popular among both genders, with a clear lead in ownership rates. For many of the other cryptocurrencies, a large proportion of respondents (both male and female) indicated that they have "never owned and have no plans to." This suggests that while Bitcoin and Ethereum have penetrated mainstream awareness to some extent, many other cryptocurrencies remain niche.

The data also shows a considerable number of respondents who have previously held but currently do not own certain cryptocurrencies. Thus, this could indicate that while many have ventured into the crypto world, not all have decided to stay invested.

Table 13. Interest in cryptos

Component	Male Avg Interest	Female Avg Interest
Cryptocurrencies	2.52	1.99
Stable Coins	2.09	1.67
DeFi	1.99	1.65
NFTs	2.13	1.72
Web3	2.05	1.65

Note: 1-Not at all interested; 2-Not very interested; 3-Neutral; 4-Somewhat interested; 5- Very interested.

Table 13 shows that males generally show a slightly higher level of interest in all components within the crypto group compared to females. Both genders show the highest interest in "*Cryptocurrencies*", followed by "*NFTs*". "*DeFi*", "*Stable Coins*", and "*Web3*" have relatively lower interest scores, indicating that these components might not be as well-understood or popular among the general populace.

Table 14. Average units held for each cryptocurrency, split by gender

Crypto asset	Male	female
Bitcoin (BTC)	1.56	0.29
Ethereum (ETH)	21.54	1.42
Tether (USDT)	81.21	3.96
Binance Coin (BNB)	10.53	0.16
U.S Dollar Coin (USDC)	18.82	73.36
XRP (XRP)	58.48	0.14
Cardano (ADA)	20.98	1.39
Solana (SOL)	24.08	0.32
Polkadot (DOT)	0.70	0.20
Dogecoin (DOGE)	1141.10	344011.32
Stellar (XLM)	85.96	0.14
Neo	1.50	0.13
Celsius (CEL)	1.86	0.41
Nano	9.30	0.13
Dash (DASH)	9.86	0.14
Tron (TRX)	225.68	0.73
Zcash (ZEC)	1.25	0.14
Nem (XEM)	8.28	0.14
Bitcoin SV (BSV)	0.19	1.16
EOS Coin (EOS)	20.80	0.19
VeChain (VET)	15.05	0.13
Dai (DAI)	3.17	0.13
Avalanche (AVAX)	7.54	0.13
Cosmos (ATOM)	2.17	0.15
Filecoin (FIL)	5.94	0.12
Others	3812.72	7.65

Table 14 demonstrates that there are noticeable discrepancies in holdings between males and females for all cryptocurrencies.

Table 15. Gains/Losses

Gender	Gained	Lost	Prefer not to say
Male	116 (17.16)%	41 (6.07%)	8 (1.18%)
Female	36 (4.27%)	24 9 2.85%)	8 (0.95%)

Table 15 shows a higher number of male respondents reported gains compared to female respondents. The number of respondents reporting a loss is relatively lower for both genders, with more males reporting a loss than females.

Table 16a. Distribution of the responses to the question: "*How much money have you made through the appreciation of your crypto investments since you started investing? By this we mean the difference between the amount you put in vs how much it is worth now.* "

	q32a Finland												
q32a	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Male	32.002	0.345	0.148	0.099	0.099	0.099	0.049	0.049	0.148	0.099	0.049	0.049	0.099
Female	33.215	0.000	0.040	0.040	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	q32b Sweden												
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Male	30.917	0.542	0.345	0.444	0.148	0.197	0.099	0.148	0.049	0.099	0.049	0.197	0.099
Female	32.661	0.158	0.119	0.000	0.040	0.000	0.119	0.079	0.000	0.000	0.000	0.079	0.079
	q32c Denmark												
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Male	31.361	0.099	0.099	0.099	0.247	0.197	0.148	0.345	0.148	0.148	0.247	0.099	0.099
Female	32.701	0.079	0.119	0.040	0.000	0.119	0.040	0.040	0.040	0.040	0.040	0.079	0.000

Table 16b. Distribution of the responses to the question: "*How much money have you lost through the depreciation of your crypto investments since you started investing? By this we mean the difference between the amount you put in vs how much it is worth now.*"

	q33a Finland							
	0	**1**	**2**	**5**	**7**	**8**	**9**	**11**
Male	32.692	0.345	0.049	0.049	0.099	0.000	0.000	0.099
Female	33.017	0.237	0.000	0.000	0.000	0.040	0.040	0.000
	q33b Sweden							
	0	**1**	**2**	**3**	**4**	**5**	**10**	**12**
Male	32.643	0.296	0.148	0.049	0.099	0.000	0.049	0.049
Female	33.096	0.119	0.000	0.040	0.040	0.040	0.000	0.000
	q33c Denmark							
	0	**1**	**2**	**3**	**4**	**5**	**7**	**12**
Male	32.643	0.345	0.000	0.099	0.099	0.099	0.049	0.000
Female	32.938	0.237	0.040	0.040	0.000	0.000	0.040	0.040

Note: 1 Less than 1500 EUR, 2 1501-2500 EUR, 3 - 2501-3500 EUR, 4 - 3501-4500 EUR, 5 - 4501-5500 EUR, 6 - 5501-6500 EUR, 7 - 6501-7500 EUR, 8 - 7501-8500 EUR, 9 - 8501-9500 EUR, 10 - 9501-10,000 EUR ; 11 - More than 10,000 EUR; 12- Prefer not to say.

Table 16a shows that most respondents, especially females, did not specify their crypto gains. This could be due to various reasons, including not understanding the question, not wishing to answer, or the data collection method. Among those who specified their investment values, male respondents generally reported a more diverse range of gains across the categories, suggesting that they might be more active or diversified in their crypto investments compared to female respondents.

Table 16b, demonstrates that in Finland (q33a) about 32.69% of males did not specify the amount they lost, 0.35% indicated a loss of 1501-2500 EUR. Regarding females, about 33.02% did not specify the amount they lost while 0.24% indicated a loss of less than 1500 EUR. In Sweden (q33b) and Denmark (q33c) similar patterns are observed for both countries. A significant portion of respondents, especially females, did not specify the amount they lost through depreciation. Among those who did, the percentages are relatively low.

In terms of duration of crypto investments, males seem to have a stronger inclination towards long-term investments with about 64.52% indicating this preference. Only about 26.61% prefer short-term investments. Females, on the other hand, show a more balanced distribution. While 50.00% indicate a preference for long-term investments, an equal percentage of 25.00% favor short-term investments. Therefore, while both genders show a preference for long-term crypto investments, males seem to have a more pronounced inclination towards them compared to females.

In terms of loss toleration, for males:

- 10.48% did not specify their loss tolerance.

- 8.06% are not willing to tolerate any loss.

- 4.84% are willing to tolerate a loss of up to 5%.

- 26.61% are willing to tolerate a loss of up to 10%.

- 16.13% are willing to tolerate a loss of up to 15%.

- 12.10% are willing to tolerate a loss of up to 30%.

- 18.55% are willing to tolerate a loss of up to 50%.

- 3.23% selected "Other".

While for female respondents the results are as follows:

- 25.00% did not specify their loss tolerance.

- 9.09% are not willing to tolerate any loss.

- 9.09% are willing to tolerate a loss of up to 5%.

- 4.55% are willing to tolerate a loss of up to 10%.

- 11.36% are willing to tolerate a loss of up to 15%.

- 15.91% are willing to tolerate a loss of up to 30%.

- 18.18% are willing to tolerate a loss of up to 50%.

- 6.82% selected "Other".

Thus, males seem more willing to tolerate higher losses, with 26.61% of respondents indicating they could bear a loss of up to 10%, and another 18.55% stating they could withstand losses up to 50%. Females have a more diverse spread in their risk tolerance. While 18.18% mentioned they could tolerate losses up to 50%, there's also a significant percentage (25.00%) that didn't specify their tolerance level. The distribution across the other categories for females is relatively even.

3.13. Gender gap

Simplest gender gap index (sGGI)

The gender gap is calculated as the difference between the values for males and females, divided by the average of the two, and then multiplied by 100. This provides a percentage that represents the gap, with positive values indicating a gap in favor of males, and negative values indicating a gap in favor of females.

$$sGGI = \left(\frac{Male\ Value - Female\ Value}{\frac{Male\ Value + Female\ Value}{2}} \right) \times 100 \qquad (3)$$

where *Male Value* represents the mean value (e.g., average familiarity, proportion owning cryptocurrency, etc.) for the male group, and *Female Value* represents the mean value for the female group.

For categorical data (like willingness to tolerate loss), the proportion of a specific category is calculated as:

$$Proportion\ (Male, Category\ X) = \frac{Number\ of\ Males\ in\ Category\ X}{Total\ number\ of\ Males} \qquad (4)$$

$$Proportion\ (Female, Category\ X) = \frac{Number\ of\ Females\ in\ Category\ X}{Total\ number\ of\ Females} \qquad (5)$$

Where **Category X** represents *Cryptocurrency ownership, Familiarity with cryptocurrencies, Relationship with cryptocurrencies, Interest in various cryptos, Crypto wallet value, Gains from crypto investments, Losses from crypto investments, Willingness to tolerate loss in crypto investments*

The sGGI provides a simple quantitative measure of the disparity between genders for various aspects related to cryptocurrencies. A positive value signifies a gap in favor of males, while a negative value denotes a gap in favor of females.

The sGGI for Cryptocurrency Ownership is 111.39% while for Familiarity with Cryptocurrencies it equals 29.34%, suggesting that males are more familiar with cryptocurrencies than females, but that gap is not as big as in *Cryptocurrency Ownership*. SGGI for *Relationship with Cryptocurrencies* is 64.98%, indicating that males have a stronger relationship with cryptocurrencies compared to females. The index for *Interest in Crypto Facets* is 21.50%, suggesting that males are more interested in various crypto assets than females.: The Crypto Wallet Value sGGI is −198.19%, implying that, on average, females have a higher value in their crypto wallets than males. The negative value denotes a gap in favor of females (one female wallet equaled 20BTC). The other three sGGI, i.e., for *Gains from Crypto Investments*, *Losses from Crypto Investments* and *Willingness to Tolerate Loss* equal 121.83%, 83.69%, and 1.99% respectively, suggesting that males have incurred

higher gains, losses, and willingness to tolerate higher losses in their crypto investments than females.

Improve Gender Gap Index (iGGI)

The iGGI will represent the difference between male and female values as a percentage of the maximum possible value (which can be either the male or female value, depending on which one is higher). It can give a clearer representation of the gender gap, especially when you want to compare the gender gap across different metrics, providing a direct percentage representation of the gap relative to the gender with the higher value. It can be calculated as follows:

$$iGGI = \frac{Male\ Value - Female\ Value}{max(Male\ Value, Female\ Value)} \times 100 \qquad (6)$$

This approach has a couple of advantages, e.g., the iGGI will always fall between -100% (indicating maximum female advantage) and 100% (indicating maximum male advantage). A value of 0 means there's no gender gap. The iGGI provides.

Thus, the iGGI for Cryptocurrency Ownership: is 71.55, indicating that men are significantly more likely to own cryptocurrencies than women. Familiarity with Cryptocurrencies gender gap is described by iGGI equals 25.59, showing that men are more familiar with cryptocurrencies than women, but the gap is less pronounced than ownership. For Relationship with Cryptocurrencies, this index is 49.04 suggesting that men have a stronger relationship with cryptocurrencies (likely to currently hold or have previously held) than women. Interest in Cryptos iGGI of 19.41 indicates that men have a slightly higher interest in various facets of crypto, like DeFi or NFTs, compared to women.

The iGGI for Crypto Wallet Value is -99.54, suggesting that, on average, women reported holding more significant values in their wallets. The negative value implies the gap is in favor of women. However, this number is a bit surprising and might require further validation (there is on significant outlier of 20BTC)

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Gains from Crypto Investments have iGGI of 75.71, demonstrating that men reported higher gains from their crypto investments than women, while for the Losses from Crypto Investments iGGI that equals 59.00. The iGGI of Willingness to Tolerate Loss is 1.98, showing a minimal gender gap regarding the willingness to tolerate a loss in crypto investments.

Therefore, based on iGGI the most pronounced gender gaps are in cryptocurrency ownership and gains from crypto investments, both favoring men. Men are generally more familiar with, have a stronger relationship with, and show more interest in cryptocurrencies than women. In terms of wallet values, women reported higher amounts. This result might seem counterintuitive, especially given the other metrics. It could be due to a few women holding significantly large amounts, or it might be an anomaly in the dataset. The gender gap is minimal when it comes to the willingness to tolerate a loss in crypto investments, suggesting that risk perceptions might be somewhat uniform across genders in this domain.

More Robust Gender Gap indexes

To address the potential anomaly with Crypto Wallet Value we incorporate the following adjustments:

Standardized Scores (Z-scores):

By transforming the values for each gender into Z-scores, we can compare the gender disparities across different aspects on a standardized scale. This method considers the mean and standard deviation of the data. The higher the gap, the more pronounced the gender disparity is in the given aspect.

$$Z - score = \frac{Value - Mean}{Standard\ Deviation} \qquad (7)$$

The Gender Gap can then be determined as the absolute difference between the Z-scores of males and females for each aspect.

Percentile-Based GGI:

Instead of raw values or averages, use percentiles (e.g., median, 25th percentile, 75th percentile) to measure the gender gap. The advantage is that percentiles are less affected by outliers.

Coefficient of Variation (CV):

The CV is a normalized measure of dispersion. By calculating the CV for each gender and then computing the difference or ratio, we can capture disparities in variability, not just central tendency.

$$CV = \frac{Mean}{Standard\ Deviation} \tag{10}$$

Effect Size:

We compute the effect size (like Cohen's d) between genders for each aspect. It measures the difference between two groups in standard deviation units. A larger effect size indicates a more significant gender disparity.

$$Cohen's\ d = \frac{MeanMale - MeanFemale}{Pooled\ Standard\ Deviation} \tag{11}$$

MinMax Scaling:

Normalize the gender values for each aspect between 0 and 1. The gender gap can then be computed as the difference between the scaled values.

$$Scaled\ Value = \frac{Value - Min}{Max - Min} \tag{12}$$

Entropy-Based GGI:

Use entropy, a measure from information theory, to capture the uncertainty or disparity between male and female distributions. A higher entropy value indicates more disparity. Given a series of observations with probabilities $p1, p2, ..., pn$, the entropy is calculated as:

$$H(X) = -\sum_{i=1}^{n} p_i log(p_i) \tag{13}$$

The gender gap is the absolute difference between the entropy values for male and female datasets.

Difference in means

In a regression context, we use the difference in means as a basic measure of the gender gap. However, when additional covariates are present, a regression model can be fitted to predict an aspect using gender and other covariates. The coefficient of the gender variable then gives the adjusted gender gap, controlling for other factors. In our simple analysis, without additional covariates, the gender gap is the raw difference in means between males and females.

Table 17. Several GGIs

GGIS	Familiarity (q21_1)	Relationship (q22_1)	Interest (q25_1)	Wallet value (q28a)	Gains (q32a)	Losses (q33a)	Tolerance for loss (q37)
Standardized score gap (z-score)	0.429	0.122	0.384	0.13	0.310	0.085	0.159
Percentile-based gap (median)	0.000	0.000	0.000	0.000	0.000	0.000	0.500
Coefficient of variation gap (cv)	0.103	0.250	0.077	5.6	3.169	3.074	0.225
Effect size gap (cohen's d)	0.436	0.121	0.388	0.13	0.312	0.085	0.159
Minmax scaling gap	0.119	0.033	0.104	0.01	0.052	0.008	0.048
Entropy-based gap	0.335	0.039	0.230	1.07	0.735	0.066	0.064
difference in means	0.477	0.133	0.418	5.29	0.624	0.088	0.337

Note: larger values across multiple indices likely have more pronounced gender disparities.

Current crypto holding gender gap

To estimate a gender gap for the current crypto holding (q10_5=1), we use the rest variables from the survey and apply Ridge regression that is a regularization technique, which constrains the

sum of the squared values of regression coefficients (Hoerl and Kennard, 1970). Unlike LASSO, ridge regressions do not set any coefficients to zero but rather shrink all coefficients towards zero. This method reduces multicollinearity and overfitting, particularly in situations where there are a large number of correlated predictor variables.

We created two additional binary variables: (1) gender_male, that equals to 1 if a respondent's gender is male (q2=1) and 0 otherwise; (2) gender_female that equals to 1 if a respondent's gender is female (q2=2) and 0 otherwise. The Ridge regression results for those two variables (the total amount of the coefficients is 249) are the following (optimal $\lambda = 0.01201259$):

gender_male   = 0.048426

gender_female = -0.04845

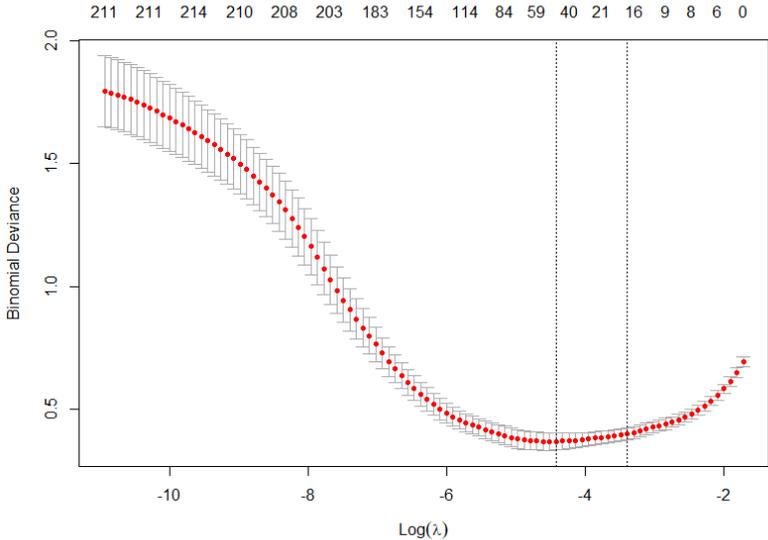Thus, being female has a negative effect on the current cryptocurrency ownership.

Fig 28. Optimal λ . Note: X-axis: the values of λ are displayed on a logarithmic scale. Y-axis (Error) represents the cross-validated error. For logistic regression, it's typically the deviance; for linear regression, it's the mean squared error. The plot displays the error as a curve, with each point representing the error for a specific λ value. The curve is typically accompanied by standard error bands, giving an indication of the uncertainty surrounding the error estimates.

Fig 28 shows how the error changes as λ changes, and helps you in choosing an optimal λ either for prediction accuracy or for model simplicity. To check the quality of the estimates based on the optimal λ, we build a Validation Curve – i.e., the model's performance (e.g., RMSE) on both

the training and validation datasets against the strength of regularization, that can help identify whether the model is overfitting or underfitting (Fig 29 below)
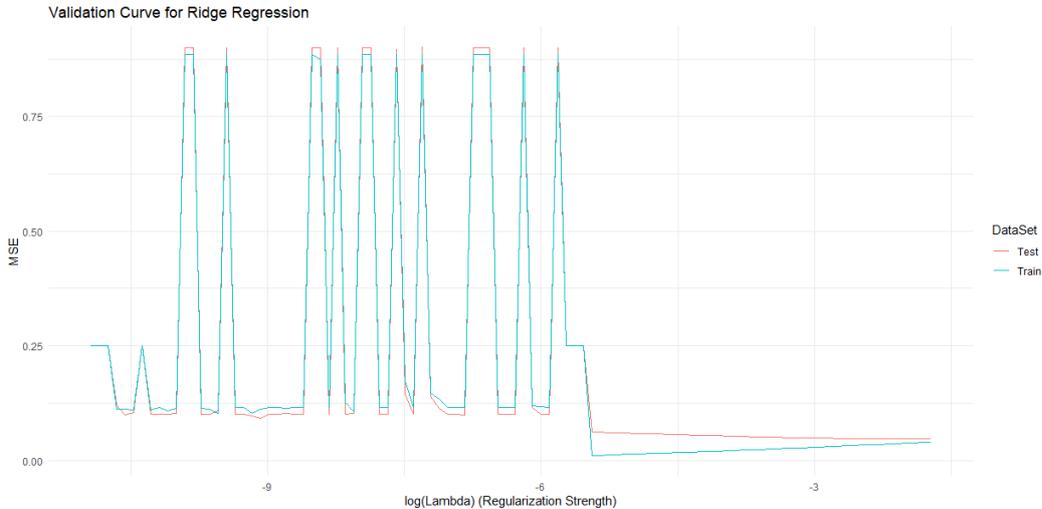

Fig. 29 Validation Curve for the ridge regression

As λ increases, a Ridge Regression tends to shrink the coefficients of the predictors towards zero. This introduces bias into the model but reduces variance. Typically, a validation curve for Ridge Regression will have a U-shape. At very low λ values, the model is very flexible and might overfit the training data. This leads to low training error but high-test error. As λ increases, both training and test errors might initially decrease. This is because the model is reducing its complexity and becoming better generalized. After a certain point, as λ becomes too large, both training and test errors start to increase because the model becomes overly simplistic and starts to introduce too much bias. A large gap between training and test errors indicates overfitting. The model performs well on the training data but poorly on unseen data. A small gap where both errors are high indicates underfitting. The model is too simplistic and doesn't capture the underlying patterns in the data. Overall, based on Fig 29 the fitted ridge regression with λ = 0.01201259 can be considered as a good fit.

<u>Future gender gap</u>

We employ multinomial survey-weighted generalized linear models with inverse-probability weighting and design-based standard errors following Lumley and Scott (2017).

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A GLM relates a linear predictor to the response variable through a link function. It's given by:

$$g(E[Y_i]) = x_i^T \beta \tag{14}$$

where $g(.)$ is the logit link function, $E[Y_i]$ is the expected value μ_i of the response variable that is the responses to the statement "*I would like to hold cryptocurrency in the future*" (with the categories: 1 - Strongly disagree, 2 - Somewhat disagree, 3 - Neither agree nor disagree, 4 -Somewhat agree, 5- Strongly Agree, 6 - Not applicable/Don't know) for the i-th observation, x_i is the vector of predictors for the i-th observation. All predictors are provided in Appendix, though in this study we focus on the responses to the statement "*Since you started investing, have you gained or made a loss on your crypto investments?*" with the following categories: 1 – Gained, 2 – Lost, 3 - Prefer not to say. β is the vector of coefficients.

In our study a multinomial model for nominal response variables with more than two levels. In this model, the probabilities of the different outcomes (or categories) of the response variable are related to the predictors through the multinomial logit link function.

Given J categories for the response variable "*I would like to hold cryptocurrency in the future*", with one category (often the last one, J) taken as the reference, the multinomial logit link for category j is defined as $log(\frac{P(Y=j)}{P(Y=J)}) = x^T \beta_j$ for j=1,2,…,J−1, where $P(Y=j)$ is the probability that the response falls into category j, **x** is the vector of predictors, βj is the vector of coefficients for category j.

Inverse-probability weights (often derived from the inverse of the probability of being sampled) adjust the model for unequal probabilities of selection. Let's denote these weights as *wi* for observation *i*. The weighted log-likelihood for observation *i* is:

$$L_i(\beta) = w_i \cdot log(P(Y_i = j \mid x_i, \beta_j)) \tag{15}$$

where w_i is the inverse-probability weight for observation i and is typically defined as the inverse of the probability of observing that particular data point given the characteristics as respondents

age, gender, education profile etc.[1] The overall weighted log-likelihood is the sum of $Li(\beta)$ over all observations.

For complex survey designs, especially those involving stratification and clustering, as in our case[2], standard errors need to be adjusted. One common method is Taylor linearization, which approximates the variance of the estimator by linearizing around the estimated coefficients.

Using Taylor linearization, the design-based variance for a coefficient $\hat{\beta}$ can be approximated as:

$$Var(\hat{\beta}) \approx X^T W V W X \tag{16}$$

where X is the design matrix, W is a diagonal matrix of survey weights, V is a diagonal matrix of residuals.

Table 18. Regression results

Variable	Estimate	Std.Error	z_value	Pr_z
Dependent variable is "I would like to hold cryptocurrency in the future: Strongly disagree"				
Gender(female)	3.692820783	1.582106	2.334117	0.01975
Dependent variable is "I would like to hold cryptocurrency in the future: Somewhat disagree"				
Gender(female)	0.13095713	0.568885	0.2302	0.817975
Dependent variable is "I would like to hold cryptocurrency in the future: Neither agree nor disagree"				
Gender(female)	-0.375546034	0.276588	-1.35778	0.174782
Dependent variable is "I would like to hold cryptocurrency in the future: Somewhat agree"				
Gender(female)	4.94761E+14	1.1E+14	4.495447	0
Dependent variable is "I would like to hold cryptocurrency in the future: Strongly Agree"				
Gender(female)	-10.63063156	0.624313	-17.0277	0
Dependent variable is "I would like to hold cryptocurrency in the future: Don't know"				
Gender(female)	-21.73006686	0.382777	-56.7695	0

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[1] After fieldwork, GWI assigned a "weight" to every respondent. The average weight a respondent receives varies by market, and is largely influenced by the size of the population in that country, as well as the ease of conducting research there.

[2] Each stratum (country) and each category of the selected statement.

Females are roughly $e^{3.692820783}$ times more likely to "strongly disagree" with the statement *"I would like to hold cryptocurrency in the future"* compared to males, holding other factors constant.

Being a female has a statistically significant effect on future holding of crypto assets, indicating a statistically significant future gender gap.

4. Conclusion

This work presents an overview of the survey for three Nordic countries – Sweden, Denmark and Finland. This unique survey was conducted (field work) from 8/11/2022 to 7/12/2022.

We believe that this study adds significantly to our understanding of investor behavior in the Nordic region, known for its high rates of digital and technological advancement. The three Nordic countries included in this study have been slowly, but steadily opening up to cryptocurrencies. The Swedish Riksbank is contemplating the issue of e-krona, a digital complement to cash. Sweden and Denmark have recently opened doors for crypto exchanges Binance and Zonda, respectively. Finland has seen an increase in taxpayers declaring income from cryptocurrencies from 3,400 in 2000 to more than 150,000 in 2021.[3] Interestingly, there exists no dedicated regulatory framework for cryptocurrencies and blockchain in these three countries.

To understand the typical profile of a crypto investor in these countries, we analyze interest in cryptocurrencies using several personal and demographic characteristics such as country, marital status, number of dependents, education level, household income etc. Some interesting insights emerge here.

Personal characteristics: We find that the ownership rate of crypto assets/NFTs is around 11.06%, placing it in the middle range compared to other assets. Interestingly, we find that the youth (16 to 24) in Finland are more interested in cryptocurrencies, while Danish youths prefer more NFTs. Males generally show a higher level of interest in all components within the crypto

[3] Source: https://yle.fi/a/3-12359333

group compared to females. Both genders show the highest interest in "Cryptocurrencies", followed by "NFTs". "Defi", "Stable Coins", and "Web3" have relatively lower interest scores, indicating that these components might not be as well-understood or popular among the general population in these countries. Most respondents lean towards wanting to hold cryptocurrency in the future.

Investment objectives: In terms of investment objectives, the highest motivation for crypto investment appears to be the desire "To make money quickly", accounting for about 34.52% of all responses. Most of these respondents who desire to make money quicky using cryptos tend to be males. Also, males show a higher tendency to invest in crypto for "Other major purchases" and "To purchase own home". The main sources of cryptocurrency funding are the normal monthly budget (9.7%), followed by savings (7.9%), and credit card borrowing (4.6%).

Financial prudence: Most crypto owners have low personal and credit card debt. This seems to indicate that a significant proportion of crypto owners are financially cautious or prudent in terms of personal borrowing. This could also be indicative of a segment of crypto owners who see crypto investments as part of a diversified investment strategy and not necessarily as a high-risk gamble.

Familiarity with cryptos: Respondents in Sweden show the highest level of cryptocurrency familiarity. Male respondents are generally more familiar with cryptocurrencies compared to females. In terms of age, familiarity with cryptocurrencies is highest among respondents aged 22-27. Only 23.5% of male respondents and 7.5% of female respondents were able to correctly identify which cryptocurrencies/tokens were being referred to, while more than half of the respondents provided incorrect answers or didn't know the answer.

Experience with cryptos: In terms of experience, Swedish males report the highest gains from their crypto investments. Females in Finland report the lowest gains. Males in Denmark report the highest losses. Females in Sweden report the lowest losses. Gender dynamics in cryptocurrency investments seem to vary across countries.

Self-evaluation of crypto knowledge: Most respondents do not fully agree with the statement of having a strong understanding, with many selecting mid-scale values. A significant number of respondents consider cryptocurrencies to be a risk. A mixed sentiment is observed with respect to whether cryptos are perceived as an opportunity. While many see it as an opportunity, a notable number are neutral or disagree. A high count of respondents believe cryptocurrencies are unregulated. There's a strong belief that cryptocurrency exchanges are vulnerable to cyber-attacks. Many respondents believe the legal status of cryptocurrency remains uncertain. But the respondents have mixed feelings about cryptocurrencies being used in illicit activities, but many lean towards agreement.

Ethical considerations: Sentiment concerning the ethics of cryptocurrencies remains mixed, with some respondents viewing cryptocurrencies as ethical and others not. There is no dominant sentiment regarding the compatibility of cryptocurrencies with sustainable development. In terms of environmental concerns, the majority doesn't strongly believe that cryptocurrencies are healthy for the environment.

Expectations – future income and savings: In terms of expectations, many respondents expect their total income to match or exceed current prices. The majority anticipate their savings to remain consistent, while a significant number expect an increase.

Macroeconomic expectations: Responses concerning eexpectations about the general economic situation, vary. Many foresee it as remaining constant, while others anticipate slight improvements or declines. ESG investors are the most trusting when it comes to financial advice, followed by bond and crypto investors. In terms of optimism, ESG product owners are the most optimistic, followed by Crypto/NFT and Antiques/Art owners. Respondents with no savings or who preferred not to share their investments showed the least optimism.

Confidence in traditional institutions: Both crypto enthusiasts and skeptics showed relatively similar confidence levels in traditional institutions, suggesting crypto enthusiasts are not necessarily opposed to traditional systems, as is often believed.

In a nutshell, our unique dataset offers several important insights into crypto investment dynamics in Denmark, Sweden and Finland. Our results underscore the fact that interpersonal trust plays a pivotal role in financial decisions, hinting that increased awareness and education could foster trust and potentially wider adoption of cryptocurrencies.

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