Computers & Intelligent Decision Applications, Volume 1, Issue 1 (2026) 69-84

Computers & Intelligent Decision Applications

Journal homepage: www.cidai-journal.org
eISSN: 3123-125X

Who Owns Crypto-Assets in the European Union? Trust Substitution, Digital Readiness and the Speculative Profile of Cyber-Financial Market Participants

Levent Çinko [1,*]

[1] Department of Capital Markets, Faculty of Financial Sciences, Marmara University, Istanbul, Türkiye

ARTICLE INFO

Article history:
Received 2 June 2026
Received in revised form 11 July 2026
Accepted 10 August 2026
Available online 13 August 2026

Keywords:
Crypto-assets; Trust substitution; Financial literacy; Digital financial services; Consumer protection.

ABSTRACT

Crypto-assets have moved from a technological curiosity to a supervised component of European retail finance, and the European Union has responded to this transition with a dedicated legal framework built around consumer protection. The regulatory debate nevertheless rests on a thin evidence base on the demand side, as the characteristics of retail participants and the relationship between crypto-asset ownership and confidence in regulated advice have not been examined systematically at Union level. Single-country studies explain crypto-asset demand either as a speculative portfolio choice under high volatility or as a response to eroding confidence in traditional intermediaries, yet the distinction between these accounts remains untested using European data. This study establishes the individual-level determinants of crypto-asset ownership across the Union. The analysis draws on microdata from a large European survey representative of the adult population across the Member States, the first Union-wide source to combine crypto-asset ownership with cognitive, behavioural, digital, and institutional trust measures. Ownership is modelled using logistic regression with country fixed effects, and coefficient stability is examined through penalized likelihood estimation and shrinkage-based variable selection. Predicted probabilities are computed as sample averages across age, income, and trust strata. Ownership is relatively infrequent but markedly uneven across Member States, with higher prevalence in newer than in older Member States. Ownership is more likely among younger, male, and higher-income respondents, those comfortable with digital financial services, and those already holding a conventional investment product. Both objective and subjective financial knowledge raise the odds of ownership, with self-assessed knowledge showing the stronger association. The distinguishing result is that the likelihood of ownership increases progressively as distrust in regulated investment advice deepens, while respondents reporting no contact at all with advisory channels are the least likely owners in every age group. Trust substitution therefore operates among those who engage with advisory channels but lack confidence in them, rather than among those who remain outside such channels altogether.

* *Corresponding author.*
E-mail address: leventcinko@marmara.edu.tr

1. Introduction

Crypto-assets have completed a decade-long passage from technological curiosity to supervised retail asset class. The European Union answered this passage with a dedicated legal architecture, the Markets in Crypto-Assets Regulation, which obliges service providers to communicate fairly with clients, to warn them about the risks of crypto-asset transactions, to segregate client holdings and to maintain transparent complaint procedures [1]. The regulation entered into general application at the end of December 2024, so the population it governs was formed before supervision arrived. That sequence makes the composition of the existing owner base a question of immediate supervisory relevance rather than a matter of retrospective description.

The environment into which these owners have entered is demonstrably hostile. Survey evidence covering more than twenty-six thousand respondents indicates that roughly one in four adults in the Union has been targeted by online fraud, and fraudulent investment offers rank among the more frequent forms after fake online shopping and impersonation [2]. Ledger-based forensic work suggests that a substantial share of early Bitcoin activity was connected to illicit trade [3], and social engineering remains the dominant intrusion vector against users of financial services [4]. Supervisory monitoring has meanwhile confirmed that household exposure is no longer negligible. Consumer Expectations Survey evidence places crypto-asset ownership at close to a tenth of euro area respondents, with holdings modest in size for the great majority yet with a further tenth of non-owners intending to buy [5].

Against this background, the demand side has attracted far less attention than regulatory architecture. The most influential individual-level study remains that of Auer and Tercero-Lucas [6], who use United States survey data and conclude that distrust in the traditional financial system is not the dominant driver of ownership. European evidence is confined to single countries and to samples that predate the current adoption wave. Stix [7] examines Austrian households and finds that owners are more financially knowledgeable and more risk tolerant than non-owners, while distrust in banks or in conventional currencies does not emerge as an important driver. Náñez Alonso et al. [8] trace the Spanish gender gap to differences in investment experience, knowledge and risk aversion. What is missing is a Union-wide test that treats ownership itself as the outcome and that measures trust in the specific institutional channel crypto-asset platforms most plausibly displace.

The Flash Eurobarometer 525, fielded by the European Commission in the spring of 2023 across the twenty-seven member states, is the first Union-wide survey to combine crypto-asset ownership with a full battery of financial literacy, behavior, resilience, digital readiness and institutional trust measures [9, 10]. The first wave of studies on this dataset has treated the crypto item as a control or has left it aside altogether. Demertzis et al. [11] document that financial knowledge in the Union is modest and unevenly distributed. Tahir [12] shows that the gap between self-assessed and tested knowledge predicts loan-taking propensity through financial fragility. Bialowolski et al. [13] demonstrate that knowledge and confidence operate differently across income groups. Căciulescu et al. [14] construct cyber-financial risk profiles that combine digital comfort, knowledge and fragility. None of these studies models’ crypto-asset ownership as the dependent variable, although ownership is arguably the single most security-sensitive behavior recorded in the questionnaire.

Three research questions guide the analysis. First, which individual characteristics distinguish crypto-asset owners from non-owners in the European Union? Second, does distrust in regulated investment advice predict ownership, as the trust substitution hypothesis suggests? Third, how does the predicted probability of ownership vary across age, income and trust strata, and across the geography of the Union?

The contributions are threefold. To the author's knowledge this is the first study to model crypto-asset ownership as the dependent variable on the Flash Eurobarometer 525 microdata, and the first Union-wide test of the trust substitution hypothesis previously examined on United States data [6]. Methodologically, the analysis combines country fixed effects logistic regression with penalized likelihood estimation and shrinkage-based variable selection, an inferential design not previously applied to this dataset. Substantively, the results place ownership among digitally ready and portfolio-embedded young male investors, establish a graduated association between distrust in regulated advice and ownership, and document higher adoption in the new member states than in the EU15, a geographical pattern that consumer protection policy cannot ignore.

The remainder of the study is organized as follows. The second section reviews the literature and develops the hypotheses. The third section presents data, variables and methods. The fourth section reports the findings. The fifth section discusses their implications and the sixth concludes.

2. Literature Review

2.1 The Drivers of Crypto-Asset Adoption

The adoption literature offers two competing families of explanation. The first treats crypto-assets as speculative investment vehicles whose demand follows the ordinary logic of portfolio choice under extreme volatility. The second treats them as an institutional phenomenon whose appeal grows wherever trust in banks, intermediaries or money itself has weakened.

The institutional account has cross-country support. Saiedi et al. [15] map the global diffusion of Bitcoin infrastructure and find more adoption in regions whose inhabitants report low trust in banks and the financial system, and in countries that have experienced inflation crises. The mechanism they identify has a longer history in literature on cash preference. Stix [16] shows that distrust in banks, memories of banking crises and weak institutions raise the propensity of Central, Eastern and Southeastern European households to hold savings outside the banking system, an escape channel that crypto-assets now extend into digital form.

Individual-level evidence, however, has repeatedly failed to confirm the institutional account. Auer and Tercero-Lucas [6] find that United States owners are concentrated among the young, educated, digitally engaged and risk tolerant rather than among the distrustful. Stix [7] reaches a comparable verdict for Austria, where most owners express neither concern about the stability of the euro nor distrust in banks. Okat et al. [17] extends the finding across a set of fintech products, including cryptocurrencies, and report no consistent evidence that trust in traditional finance drives consumer adoption.

This divergence between the regional and the individual level is instructive rather than contradictory. Aggregate distrust may shape the environment in which crypto-asset infrastructure spreads without being the attribute that distinguishes the individual owner from the individual non-owner. Resolving the tension requires a trust measure specific enough to capture the institutional channel at stake. General confidence in banks is a poor candidate, since a depositor may trust a bank to safeguard deposits while doubting that its investment recommendations serve the client. It is this second judgement that a crypto-asset platform displaces. The Flash Eurobarometer 525 measures precisely that judgement, which is why the present study frames trust substitution around confidence in regulated investment advice rather than around diffuse institutional trust.

2.2 Crypto-Assets and Cyber-Financial Risk

The risk environment surrounding retail crypto-asset participation is unusually adverse, and the sources of that adversity are documented from three directions. Social engineering and phishing remain the dominant intrusion vectors against users of financial services [4]. Blockchain forensics link a meaningful share of early transaction volume to illicit markets, with roughly one quarter of Bitcoin users and close to half of transactions involved in illegal activity in the period studied [3]. Victimization surveys confirm that fraudulent investment offers reach a mass audience across the member states, even though online shopping fraud and impersonation are encountered more often [2].

Identifying who enters this environment is therefore a security question as much as a market research question. Căciulescu et al. [14] show, on the same dataset used here, that digital comfort, financial knowledge and financial fragility combine into distinct cyber-financial risk profiles across the Union. Their exercise stops short of crypto-asset ownership, yet it establishes the analytical premise that vulnerability is patterned rather than random. If ownership proves to be concentrated among individuals who discount regulated advice, then the segment most exposed to fraudulent platforms is also the segment least receptive to the warnings designed to protect it. That configuration is developed further in the discussion.

2.3 Financial Knowledge, Confidence and Portfolio Embedding

The financial literacy literature establishes that knowledge governs participation in formal financial markets. Van Rooij et al. [18] show that individuals with low financial literacy are substantially less likely to invest in stocks, and Lusardi and Mitchell [19] synthesize the broader evidence linking knowledge to planning quality and asset market engagement. Extending this logic to crypto-assets is not straightforward, because knowledge and confidence may pull in opposite directions once the asset in question is speculative.

Hayashi and Routh [20] resolved part of this ambiguity by separating owners according to purpose. Using United States survey data, they find that those who hold crypto-assets for investment are significantly more financially literate than non-owners, whereas those who use them mainly for transactions are less so, with all owner types displaying higher risk tolerance. Ownership therefore does not map onto a single literacy profile; it depends on what the asset is used for. Since the European survey used here records ownership without distinguishing purpose, the estimated knowledge coefficient should be read as a weighted average over these types, in which the investment motive predominates given the prevalence of speculative and investment use recorded in supervisory surveys [5].

Confidence creates further complication. Tahir [12] demonstrates on the Flash Eurobarometer 525 that overconfidence, understood as self-assessed knowledge exceeding tested knowledge, is positively associated with loan-taking propensity, with financial fragility mediating the relationship. Bialowolski et al. [13] finds that subjective confidence matters for some financial outcomes independently of, and occasionally more strongly than, objective knowledge. A model that includes both measures simultaneously therefore separates the contribution of what respondents know from the contribution of what they believe they know, a distinction that matters for the design of investor education.

The gender dimension of crypto-asset participation is well established and theoretically anchored. Barber and Odean [21] demonstrate that overconfidence leads men to trade considerably more than women in equity markets. Nyhus et al. [22] extend the argument to crypto-assets with a nationally representative Norwegian sample, showing that men are more than twice as likely to consider such investments and that financial overconfidence mediates the gender difference. Náñez Alonso et al. [8] identify the barriers operating on the other side of the gap in Spain, namely limited investment experience, limited knowledge and risk aversion. The gender coefficient estimated below is thus expected to be large and to carry a behavioral rather than a purely compositional interpretation.

Participation in one asset market, finally, predicts participation in another. Where crypto-assets are held alongside conventional products rather than in place of them, the observed pattern is one of portfolio extension rather than exit from the regulated system. This distinction bears directly on the interpretation of the trust results, since substitution in the strict sense would require owners to withdraw from conventional investment rather than add to it.

2.4 Hypotheses

The literature reviewed above yields five testable propositions. Digital readiness is treated as an access condition, since crypto-asset acquisition is intermediated exclusively through digital platforms, which leads to the expectation that comfort with digital financial services increases the probability of ownership (H1). The institutional account, refined to the advisory channel, implies that distrust in regulated investment advice increases the probability of ownership, and that this association strengthens as distrust deepens (H2). Given that investment rather than transactional use predominates in European holdings, both objective and subjective financial knowledge are expected to increase the probability of ownership (H3). The speculative account further implies that ownership of conventional investment products increases the probability of crypto-asset ownership, consistent with portfolio embedding (H4). The demographic regularities documented across national studies imply that ownership declines with age, is lower among women and rises with household income (H5).

3. Research Methodology

3.1 Data

The analysis uses the Flash Eurobarometer 525 microdata, archived as GESIS study ZA7985 [10]. The survey was conducted through computer-assisted web interviewing between 29 March and 5 April 2023 and covers 26,124 respondents aged eighteen and over across the twenty-seven member states. National weights are applied to country-level descriptive statistics and the EU27 weight to Union-level estimates. The dependent variable is the binary response to the product ownership battery, recording whether the respondent currently holds or has held crypto-securities including cryptocurrency within the preceding two years. Weighted prevalence in the full sample is 6.4 percent, which reproduces the published tabulation of the Commission and thereby validates the measurement against the official volumes [9]. The analytic sample retains respondents with valid answers on all items entering the model, yielding 23,339 observations of which 2,487 are owners.

Two features of the instrument require comment. The web-based mode excludes respondents who do not use the internet, which is likely to raise measured prevalence relative to the general population. Because internet use is also a precondition for crypto-asset acquisition, this restriction affects the level of the estimates more than the gradients that are the object of interest. The two-year reference window, in turn, aggregates current holders with those who have existed during a period that contained a pronounced market downturn, so the dependent variable measures participation rather than current exposure.

3.2 Variables

The predictor set spans five domains. Cognitive measures comprise the objective financial knowledge score, constructed from the five knowledge questions ranging from zero to five, and subjective knowledge, a self-assessment rescaled so that higher values denote greater self-confidence. Behavioral measures comprise the financial behavior score and financial resilience, the latter recording how many months a household could cover living expenses after losing its main income. Digital readiness is captured by comfort with digital financial services. Institutional trust is measured by confidence that investment advice from banks, insurers or advisors serves the best interest of the client. This item enters as five categories running from very confident, the reference, though not at all confident, with absence of any advisory contact retained as a separate category rather than discarded as missing. Financial structure is represented by ownership of conventional investment products. Socio-demographic controls comprise age, gender, education, household income decile with an indicator for non-response, the mode of household money decisions, settlement type and country fixed effects.

The treatment of the trust variable deserves emphasis, since it carries the central identification logic of the study. Retaining the no-contact group as a distinct category converts what would otherwise be an inconvenience into an informative contrast. Respondents who report no advisory contact differ from the distrustful not in the direction of their judgement but in their exposure to the institution being judged. Their behavior therefore serves as a benchmark that separates active distrust from mere disengagement, and it is this contrast, rather than the trust coefficients alone, that permits an assessment of whether substitution is genuinely at work.

3.3 Method

The baseline specification is a logistic regression with country fixed effects, which absorbs time-invariant national heterogeneity, including differences in taxation, platform availability, banking history and linguistic access to crypto-asset markets, and identifies individual-level gradients net of national composition. Since the object of interest is the association between individual attributes and participation, this specification is preferred to a random effects alternative that would impose distributional assumptions on unobserved national heterogeneity.

Owners constitute 10.7 percent of the analytic sample, which yields 2,487 events. The gap between this figure and the weighted prevalence of 6.4 percent reflects two operations. The weighted estimate refers to the full unrestricted sample, whereas the analytic share is unweighted and conditional on complete responses. In relation to the number of estimated parameters the event count is a comfortable ratio, and the small-sample bias of maximum likelihood is expected to be negligible. Two considerations nonetheless justify a penalized likelihood audit. First, the inclusion of twenty-six country indicators alongside a substantial covariate set creates cells in which events are sparse, a configuration in which quasi-separation can distort individual coefficients even when the overall event count is adequate [23]. Second, in logistic models the bias reduction achieved by the penalized maximum likelihood estimator of Firth is accompanied by a shrinkage effect that also lowers variance, so the comparison is unlikely to entail a material efficiency cost in the present setting [24, 25]. Cook et al. [26] shows that penalized estimation is the appropriate remedy in fixed effects specifications of this kind, since it preserves the full sample and yields unbiased marginal effects. The audit is accordingly interpreted as a diagnostic for sparse-cell distortion rather than as a correction for rare-events bias. Because the penalty of Firth shifts predicted probabilities toward one half even as it improves coefficient estimates [27], and because the modified variants that repair this distortion introduce their own adjustments, all probabilities reported below are computed from the unpenalized model.

Variable selection robustness is assessed with logistic regression under the least absolute shrinkage and selection operator [28], and the retained predictors are compared with the baseline in sign and magnitude. The interpretation of this audit requires care. Shrinkage estimators minimize prediction error rather than test hypotheses, and contraction toward zero carries no inferential content regarding statistical significance. Coefficients that are small but genuine are routinely eliminated, and correlated predictors are represented selectively [29]. The audit therefore establishes which associations are robust enough to survive predictive penalization, while inference on the trust gradient rests on the likelihood-based models.

Predicted probabilities are obtained by the recycled predictions approach, averaging model predictions over the observed sample within age, trust and income strata, which yields population-relevant magnitudes rather than probabilities evaluated at an artificial covariate vector. Results are reported as coefficients with standard errors, odds ratios with 95 percent confidence intervals, average marginal effects and the model fit block. Variance inflation factors were examined prior to estimation and reached 2.79 at most, well below the conventional threshold of five, indicating that multicollinearity does not compromise the estimates. All computations were performed in Python with the stats models and scikit-learn libraries.

4. Findings

4.1 Ownership Is Infrequent, Young and Geographically Uneven

Weighted ownership stands at 6.4 percent across the Union, and its geographical distribution runs counter to a naive core-periphery expectation. Slovenia at 16.7 percent, Croatia at 15.8 percent, Czechia at 13.9 percent, Luxembourg at 12.5 percent and Estonia at 12.4 percent occupy the top of the ranking, while Italy at 3.8 percent, France at 4.1 percent and Spain at 4.4 percent sit at the bottom (Figure 1). The new member states exceed the average of the EU15 by nearly three percentage points, 10.6 against 7.6 percent.

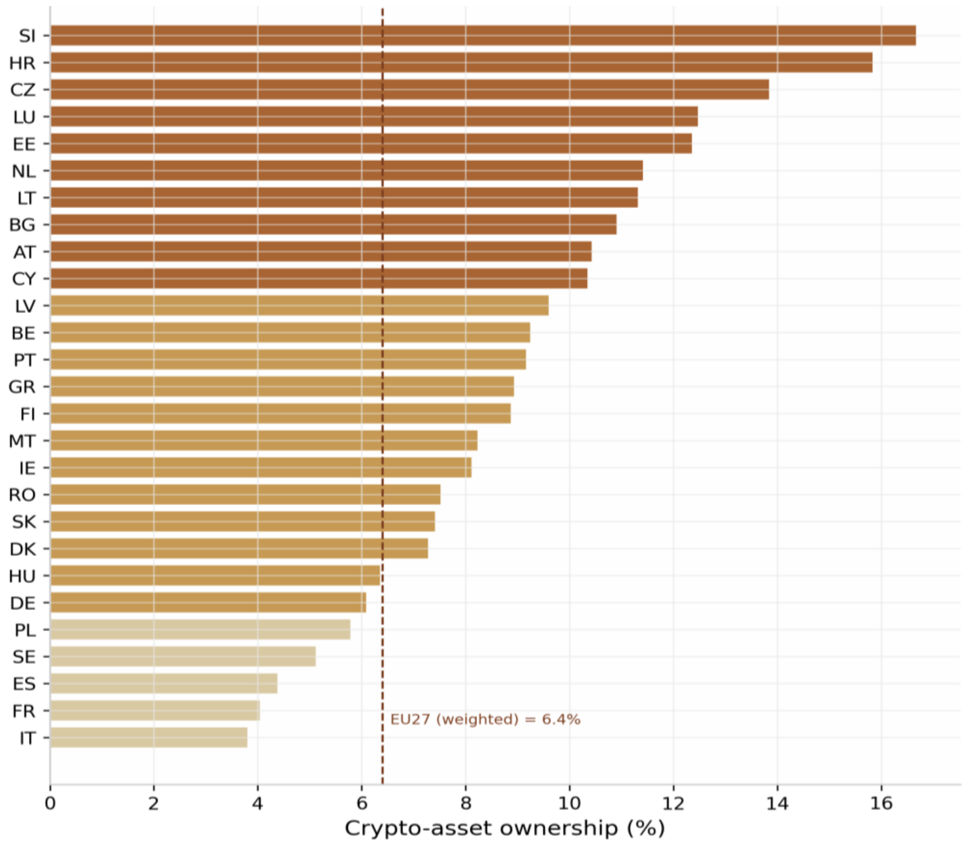

Fig. 1. Crypto-asset ownership by country

This inversion is not readily explained by income or market development, since the low-adoption group contains three of the largest economies in the Union. Two mechanisms documented in the literature are more plausible. Where memories of banking instability and weak institutions persist, households have historically maintained savings outside the banking system [16], and crypto-assets extend that channel into digital form. Where Bitcoin infrastructure has spread most readily, low trust in banks and in the financial system among local inhabitants has been part of the explanation [15]. Because country fixed effects absorb these national differences by construction, the present design cannot adjudicate between them. The geographical pattern is therefore reported as a finding requiring explanation rather than as one the model explains.

Table 1 contrasts owners and non-owners across the study variables. The typical owner is close to twelve years younger than the typical non-owner, 38.5 against 50.3 years, considerably less likely to be female, 26.8 against 52.0 percent, more educated, 46.2 against 31.3 percent holding high education, and more affluent, 6.7 against 5.6 on the income decile scale. Owners score higher on objective knowledge, 3.03 against 2.54, and on subjective knowledge, 3.66 against 3.17, are more resilient, 3.84 against 3.47, and markedly more comfortable with digital financial services, 2.50 against 2.07. More than half of owners hold a conventional investment product, 51.6 against 23.5 percent, while only 3.6 percent report no advisory contact against 10.3 percent of non-owners.

Table 1
Owners and non-owners on the study variables

Variable	Owners (n = 2,487)	Non-owners (n = 20,852)	Difference
Age (years)	38.5	50.3	−11.8***
Female (share)	0.268	0.520	−0.253***
High education (share)	0.462	0.313	0.149***
Household income decile	6.72	5.60	1.12***
Objective knowledge (0–5)	3.03	2.54	0.49***
Subjective knowledge (2–5)	3.66	3.17	0.50***
Financial behaviour score (0–3)	2.67	2.56	0.10***
Financial resilience (1–5)	3.84	3.47	0.37***
Digital comfort (0–3)	2.50	2.07	0.43***
Retirement confidence (1–4)	2.61	2.28	0.33***
Investment product (share)	0.516	0.235	0.281***
No advisory contact (share)	0.036	0.103	−0.067***

Note. Differences are computed on unrounded means. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4.2 A Distrust Gradient Behind a Speculative Profile

Table 2 reports the country fixed effects logistic regression. The model is highly significant, with a likelihood ratio statistic of 3,221.5 on 47 degrees of freedom and a McFadden pseudo R-squared of 0.203, a fit that is substantial for cross-sectional participation models of this kind. Figure 2 displays the odds ratios with their confidence intervals.

All five hypotheses receive support, with one qualification concerning the trust categories. Comfort with digital financial services is among the strongest predictors, raising the odds by a factor of 1.33 per scale point, which supports H1. The magnitude places digital readiness on a par with subjective knowledge and above objective knowledge, an ordering consistent with its status as an access condition rather than a preference.

The knowledge pair enters positively, supporting H3, but the two components are not interchangeable. A one-point rise in objective knowledge multiplies the odds by 1.16, whereas an equivalent rise in self-assessed knowledge multiplies them by 1.31. Since both variables appear in the same specification, the subjective coefficient captures self-assurance net of measured competence, which is the operational definition of overconfidence in this literature. The finding therefore reproduces, in the domain of crypto-asset participation, the pattern Tahir [12] documents for borrowing on the same dataset, and it accords with the evidence of Bialowolski et al. [13] that confidence can outweigh objective knowledge in shaping certain financial outcomes. The positive objective coefficient is meanwhile consistent with Hayashi and Routh [20], who find higher literacy among owners whose motive is investment. Their transactional group, which displays lower literacy, cannot be separated in the present data, so the reported coefficient should be read as an average dominated by the investment motive.

Table 2
Country fixed effects logistic regression for crypto-asset ownership

Variable	Coef. (S.E.)	OR [95% CI]	AME
Subjective knowledge (2–5)	0.267*** (0.034)	1.306 [1.222, 1.395]	0.021
Objective knowledge (0–5)	0.147*** (0.021)	1.158 [1.111, 1.207]	0.012
Financial behaviour score (0–3)	0.089** (0.037)	1.093 [1.017, 1.175]	0.007
Financial resilience (1–5)	0.083*** (0.021)	1.086 [1.043, 1.132]	0.007
Digital comfort (0–3)	0.282*** (0.036)	1.326 [1.234, 1.424]	0.022
Retirement confidence (1–4)	0.032 (0.029)	1.033 [0.975, 1.094]	0.003
Investment product ownership	0.774*** (0.054)	2.167 [1.951, 2.408]	0.061
Trust (somewhat confident)	0.082 (0.081)	1.086 [0.927, 1.272]	0.007
Trust (not too confident)	0.181** (0.084)	1.198 [1.017, 1.412]	0.014
Trust (not at all confident)	0.321*** (0.098)	1.379 [1.137, 1.673]	0.026
Trust (no advisory contact)	0.021 (0.133)	1.021 [0.787, 1.325]	0.002
Age	−0.054*** (0.002)	0.948 [0.944, 0.951]	−0.004
Female	−0.906*** (0.053)	0.404 [0.364, 0.448]	−0.072
Other gender	−0.312 (0.397)	0.732 [0.336, 1.594]	−0.025
Low education (ISCED)	−0.198* (0.101)	0.820 [0.672, 1.001]	−0.016
High education (ISCED)	−0.081 (0.053)	0.922 [0.831, 1.024]	−0.006
Household income decile	0.054*** (0.011)	1.056 [1.034, 1.079]	0.004
Income not reported	−0.494*** (0.099)	0.610 [0.502, 0.741]	−0.039
Shared decision-making	−0.249*** (0.049)	0.780 [0.708, 0.859]	−0.020
Decision made by other	−0.602*** (0.175)	0.547 [0.388, 0.772]	−0.048
Settlement type (second category)	−0.147*** (0.051)	0.863 [0.781, 0.953]	−0.012
Constant	−2.341*** (0.226)	–	–
Country fixed effects	Yes		
Observations (N)	23,339		
Log-likelihood	−6,307.3		
LR χ^2 (df = 47)	3,221.5***		
Prob > χ^2	< 0.001		
McFadden R^2	0.203		
AIC / BIC	12,710.5 / 13,097.3		

Note. Standard errors are in parentheses. The reference category for the trust variable is "very confident". *** p < 0.01, ** p < 0.05, * p < 0.10.

Portfolio embedding dominates the table. Holding a conventional investment product more than doubles the odds of crypto-asset ownership, with an odds ratio of 2.17 and an average marginal effect of 6.1 percentage points, the largest in the model. H4 is supported, and the substantive implication is direct. Crypto-assets in Europe are being added to portfolios rather than substituted for them, which situates them within an extension of retail investment behaviour rather than in an exit from the regulated financial system. Financial resilience points in the same direction, with better-buffered households more likely to own, which is inconsistent with any reading of crypto-asset participation as a response to financial distress.

The demographic profile supports H5. Each additional year of age multiplies the odds by 0.948, which compounds to a reduction of roughly forty percent across a decade. Women are less than half as likely to own as men, with an odds ratio of 0.40 that survives controls for income, education, knowledge and digital comfort. Because compositional differences are held constant, the residual gap is most plausibly behavioural, in line with the overconfidence mechanism identified by Barber and Odean [21] and confirmed for crypto-assets by Nyhus et al. [22], and with the barriers of limited investment experience and risk aversion documented by Náñez Alonso et al. [8]. Each income decile adds 5.6 percent to the odds. Shared or delegated money decisions reduce the probability of ownership appreciably, an association suggesting that household deliberation acts as a brake on speculative acquisition, while respondents who declined to report income are markedly less likely to own.

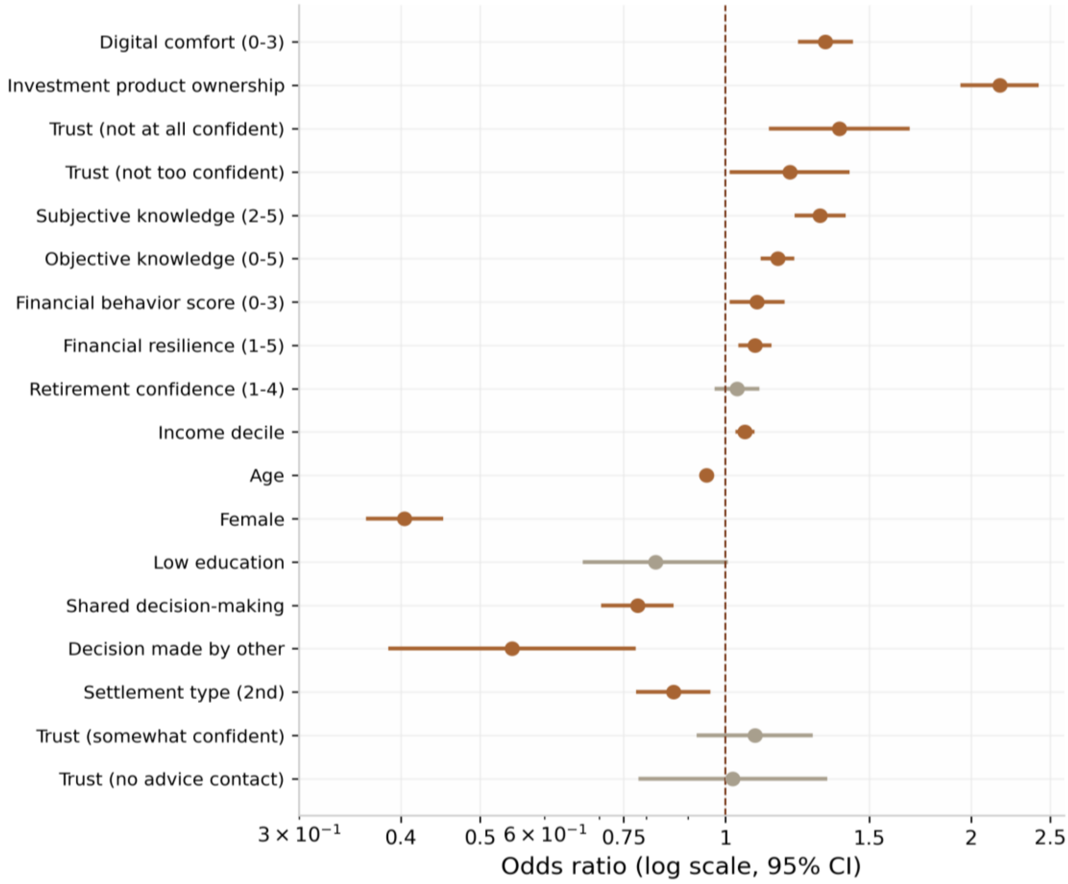

Fig. 2. Determinants of crypto-asset ownership

The central result concerns H2 and appears in Figure 2 as a graduated ladder. Relative to respondents who are fully confident that investment advice serves their best interest, those who are somewhat confident show no difference, with an odds ratio of 1.09 and a p-value of 0.307. Those who are not too confident show higher odds, 1.20 with a p-value of 0.031, and those who are not at all confident show the highest odds, 1.38 with a p-value of 0.001. The association strengthens monotonically with the depth of distrust, which is the signature the trust substitution hypothesis predicts and which a spurious correlation with the omitted determinants of ownership would not readily produce.

The fifth category is equally informative. Respondents reporting no contact with advisory channels do not differ statistically from the fully trusting reference group, with an odds ratio of 1.02, and in absolute terms they are the least likely to own, as the profile analysis below confirms. The contrast between this group and the distrustful is what gives the trust result its interpretation. If crypto-assets simply attracted those situated outside the regulated financial system, the disengaged would be the most likely owners. They are the least likely. Distrust expressed from within the advisory relationship accompanies movement toward crypto-assets, whereas absence from that relationship accompanies non-participation in financial markets altogether.

The magnitude of the effect nonetheless requires proportionate reading. An odds ratio of 1.38 corresponds to an average marginal effect of 2.6 percentage points, far below the contributions of portfolio embedding, gender or age. The result is therefore best characterised as a genuine but secondary gradient operating within a profile that remains fundamentally speculative. This reading reconciles the present finding with the negative verdicts of Auer and Tercero-Lucas [6], Stix [7] and Okat et al. [17]. Those studies reject distrust as the dominant driver, a conclusion the present estimates also support. What the graduated European evidence adds is that distrust in the advisory channel specifically, once separated from disengagement, retains an independent and orderly association with participation.

4.3 Robustness, Penalized Likelihood and Shrinkage Audits

Two audits examine the stability of the estimates. The penalized likelihood of Firth, applied to the full specification with country fixed effects, reproduces the maximum likelihood coefficients with deviations below one percent for every substantive predictor, including the significant distrust categories (Table 3). Only the near-zero no-contact coefficient moves appreciably in relative terms, by 0.002 in absolute terms, which is the arithmetically expected behavior of a percentage change computed on a coefficient close to zero and carries no substantive content. With 2,487 events across 23,339 observations this correspondence is the anticipated outcome, and it indicates that neither sparse country cells nor quasi-separation distorts the coefficients of interest [24, 25, 26].

Table 3
Robustness audit, maximum likelihood versus Firth penalized likelihood

Variable	MLE coef. (S.E.)	Firth coef. (S.E.)	Change (%)
Subjective knowledge	0.267*** (0.034)	0.266*** (0.034)	−0.4
Objective knowledge	0.147*** (0.021)	0.146*** (0.021)	−0.4
Digital comfort	0.282*** (0.036)	0.281*** (0.036)	−0.5
Investment product	0.774*** (0.054)	0.771*** (0.054)	−0.4
Trust (not too confident)	0.181** (0.084)	0.179** (0.083)	−0.9
Trust (not at all confident)	0.321*** (0.098)	0.320*** (0.098)	−0.5
Trust (no advisory contact)	0.021 (0.133)	0.023 (0.132)	10.1
Age	−0.054*** (0.002)	−0.054*** (0.002)	0.3
Female	−0.906*** (0.053)	−0.903*** (0.052)	0.3
Income decile	0.054*** (0.011)	0.054*** (0.011)	−0.4
Shared decision-making	−0.249*** (0.049)	−0.248*** (0.049)	0.4
Observations (N)	23,339	23,339	

Note. Standard errors are in parentheses. Both estimations include the full set of controls and the country fixed effects reported in Table 2. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The shrinkage audit, tuned by cross-validated predictive performance, retains the dominant core of the profile, namely subjective and objective knowledge, digital comfort, investment product ownership, age, gender, income, decision mode, settlement type and the extreme country indicators, with sign agreement on every retained variable. The trust dummies are eliminated by the penalty. This outcome is uninformative about their statistical significance and should not be read as a contradiction of Table 2. Shrinkage estimators minimize prediction error rather than test hypotheses, and they routinely eliminate coefficients that are small in magnitude yet inferentially real, particularly when several correlated predictors compete to represent the same underlying variation [29]. Given that the trust categories carry average marginal effects of two to three percentage points within a model containing much stronger predictors, their elimination is the expected result. The audit accordingly confirms that the profile variables are robust enough to survive predictive penalization, while establishing that the trust gradient contributes little to out-of-sample prediction. The distinction between explanatory and predictive relevance deserves to be stated plainly rather than obscured.

4.4 Predicted Ownership Profiles

Figure 3 translates the estimates into predicted ownership probabilities averaged over the sample. The age gradient is steep. Predicted ownership falls from 20.8 percent among those aged eighteen to twenty-nine to 15.1, 8.2 and 3.5 percent across successively older groups, a sixfold difference between the youngest and oldest cohorts that exceeds the range produced by any other predictor in the model.

The distrust premium is visible within every age group, which establishes that the trust gradient is not an artefact of the correlation between youth and skepticism. Both distrust categories display higher predicted ownership than the fully trusting reference in all four cohorts. Among those aged thirty to forty-four, predicted ownership rises from 14.1 percent for the fully trusting to 16.4 percent for those with no confidence at all, a gap of just over two percentage points that recurs with comparable magnitude across cohorts.

The no-contact category sits far below all others at every age, at 15.8, 10.3, 5.0 and 2.1 percent respectively. The consistency of this ordering across the age distribution strengthens the interpretation advanced above. Disengagement from advisory channels marks general non-participation in financial markets rather than a speculative exit toward alternatives. A binary trust measure would place the distrustful and the disengaged in the same group, yet their behavior moves in opposite directions.

The income panel shows a near-monotone climb from 5.9 percent in the lowest decile to 18.5 percent in the highest, with the steepest gains occurring above the median. The convex profile places crypto-asset participation among households with discretionary financial capacity rather than among those seeking compensation for a financial shortfall. This corroborates the portfolio embedding reading of the investment product coefficient and further weakens any account of European crypto-asset demand grounded in economic distress.

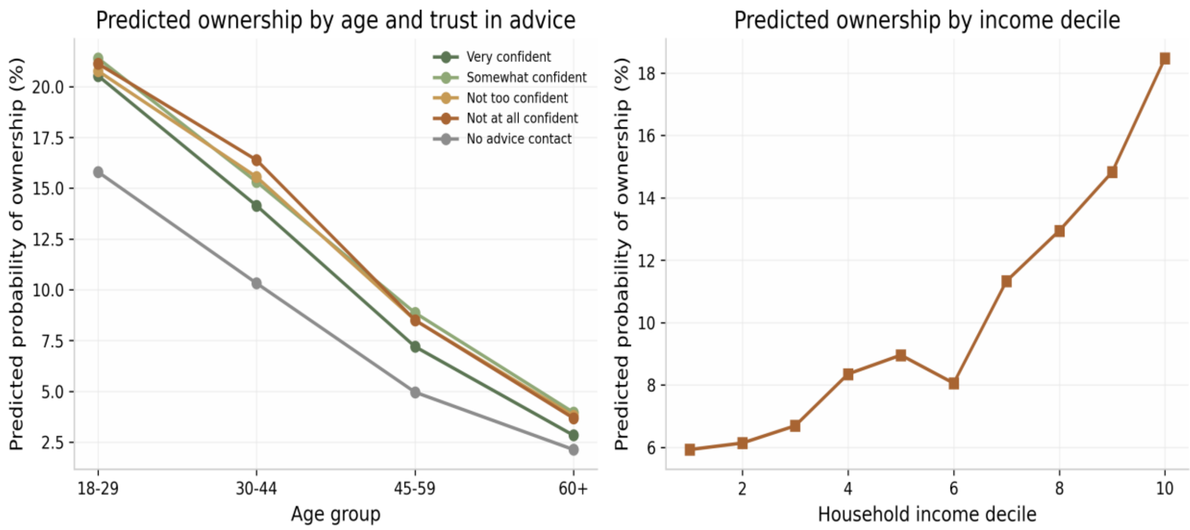

Fig. 3. Predicted ownership probabilities by age and trust and by income decile

5. Discussion

This study asked who owns crypto-assets in the European Union and whether institutional distrust contributes to that choice. The answer to the first question is a coherent and readily identifiable profile. The European crypto-asset owner is young, male, better educated, more affluent, more financially knowledgeable both in tested and in self-assessed terms, comfortable with digital finance, financially resilient and already invested in conventional products. This is not a marginalized outsider but the most market-integrated segment of the retail population. The characterization aligns with the speculative and portfolio-based accounts of adoption [6, 20], and with supervisory evidence that euro area holdings are typically modest and concentrated among households treating them as an investment [5].

The answer to the second question qualifies rather than overturns the first. Behind the speculative profile lies a graduated association with distrust. The deeper the doubt that investment advice serves the interest of the client, the higher the odds of ownership, reaching 38 percent higher odds among the wholly distrustful. Two features make this finding more than a restatement of the trust substitution hypothesis. Its monotonicity indicates a dose-response structure rather than a categorical difference, which is difficult to reproduce through spurious correlation with omitted determinants. Its boundary, meanwhile, identifies the population within which substitution operates. Respondents with no advisory contact at all are the least likely to own crypto-assets at every age, which means substitution takes place among participants inside the advisory system who withhold their confidence from it, not among those the system has never reached. Earlier work obscured this distinction by treating no-contact respondents as missing observations. Recovering it explains part of the discrepancy between the negative individual-level verdicts reported for the United States and Austria [6, 7, 17] and the positive regional associations documented for infrastructure diffusion and cash preference [15, 16]. Distrust matters, but it matters in a specific channel, among a specific population, and with a modest effect size.

Proportion is essential to interpretation. The distrust effect corresponds to an average marginal effect of 2.6 percentage points, against 6.1 points for portfolio embedding and 7.2 points for gender. European crypto-asset demand is therefore predominantly speculative in character, with distrust in the advisory channel functioning as a secondary amplifier among the already market-active rather than as an independent gateway to participation. Any policy conclusion that inverts this ordering would misread the evidence.

The findings carry a security corollary that sharpens the consumer protection problem. Fraudulent investment offers reach a mass audience across the member states, ranking behind online shopping fraud and impersonation yet still affecting a fifth of those targeted [2]. Social engineering remains the principal intrusion vector against users of financial services [4], and the population most exposed to these threats is, by the present estimates, the population least disposed to credit regulated guidance. Investor protection thus confronts a delivery problem rather than merely an information problem. Warnings issued through the advisory channel are least likely to reach those whose behavior they are designed to alter. Platform-level disclosure obligations of the kind the Markets in Crypto-Assets Regulation imposes on service providers are therefore better suited to this population than advisory-channel communication [1].

Three further implications follow. For supervisors, the owner profile is identifiable and stable, and the new member states, where ownership exceeds the average of the EU15 by three percentage points, warrant proportionate supervisory attention rather than treatment as a periphery. For investor education, the finding that self-assessed knowledge predicts ownership more strongly than tested knowledge indicates that programmers should address calibration, the alignment of confidence with competence, rather than knowledge alone. Campaigns that raise confidence without raising competence may increase the very participation they seek to render prudent [12, 13]. For research, the trust ladder demonstrates that categorical trust items carry graduated behavioral content and that the no-contact category is substantively informative, so both should be modelled as ordered structures with disengagement retained rather than collapsed into binary indicators or discarded.

The study has limitations that circumscribe these conclusions. The survey is cross-sectional and the associations cannot be read causally. Reverse causation, in which ownership and its outcomes erode confidence in advice, cannot be excluded and is behaviorally plausible, since a losing position may itself generate distrust in the institutions that counselled against it. Ownership is measured over a two-year window that encompassed a pronounced downturn, so current holders and recent sellers are combined. The web-based mode excludes non-users of the internet, which raises measured prevalence relative to the general population, although it affects levels more than gradients. The trust item measures confidence in advisory motives rather than institutional trust in its full breadth, and no measure of purpose is available, so investment and transactional owners cannot be separated as Hayashi and Routh [20] recommend. Finally, the model explains participation rather than exposure amounts or loss experience and linking the owner profile to fraud victimization data remains the natural next step [2].

6. Conclusions

Crypto-asset ownership in the European Union is infrequent yet unevenly distributed, and it belongs to a clearly delineated segment of the retail population that is young, predominantly male, affluent, digitally ready and already invested in conventional products. Distrust in regulated investment advice raises the probability of ownership in orderly fashion as that distrust deepens, but only among respondents who have access to such advice. Those entirely outside the advisory relationship are the least likely owners in every age group, which locates trust substitution inside the regulated system rather than beyond its reach. The speculative profile and the distrust gradient therefore describe two aspects of one market instead of competing explanations. Because the segment most exposed to fraudulent platforms is also the segment least receptive to regulated guidance, consumer protection under the new legal architecture depends less on the content of warnings than on the channel through which they arrive, and platform-level disclosure carries greater promise here than advisory communication.

Funding

This research received no external funding.

Data Availability Statement

The analysis relies on the microdata of Flash Eurobarometer 525, archived by GESIS as study ZA7985 and available to registered researchers at https://doi.org/10.4232/1.14155. The report accompanying the survey is published by the European Commission. The processed data set and the estimation code are available from the author on reasonable requests.

Conflicts of Interest

The author declares that there is no known competing financial interest or personal relationship that could have appeared to influence the work reported in this paper.

Acknowledgement
This research was not funded by any grant.

References
[1] European Parliament & Council of the European Union. (2023). Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937. *Official Journal of the European Union*, *L 150*, 40–205.
[2] European Union Agency for Fundamental Rights. (2026). *Online fraud: People's experiences across the EU*. Publications Office of the European Union. https://fra.europa.eu/en/publication/2026/victims-online-fraud
[3] Foley, S., Karlsen, J. R., & Putniņš, T. J. (2019). Sex, drugs, and bitcoin: How much illegal activity is financed through cryptocurrencies? *The Review of Financial Studies*, 32(5), 1798–1853. https://doi.org/10.1093/rfs/hhz015
[4] European Union Agency for Cybersecurity. (2024). *ENISA threat landscape 2024*. Publications Office of the European Union. https://doi.org/10.2824/0710888
[5] European Central Bank. (2025). Just another crypto boom? Mind the blind spots. *Financial Stability Review*, May 2025, 105–115.
[6] Auer, R., & Tercero-Lucas, D. (2022). Distrust or speculation? The socioeconomic drivers of US cryptocurrency investments. *Journal of Financial Stability*, 62, 101066. https://doi.org/10.1016/j.jfs.2022.101066
[7] Stix, H. (2021). Ownership and purchase intention of crypto-assets: Survey results. *Empirica*, 48(1), 65–99. https://doi.org/10.1007/s10663-020-09499-x
[8] Alonso, S. L. N., Jorge-Vázquez, J., Rodríguez, P. A., & Hernández, B. M. S. (2023). Gender gap in the ownership and use of cryptocurrencies: Empirical evidence from Spain. *Journal of Open Innovation: Technology, Market, and Complexity*, 9(3), 100103. https://doi.org/10.1016/j.joitmc.2023.100103
[9] European Commission. (2023). *Monitoring the level of financial literacy in the EU* (Flash Eurobarometer 525). Publications Office of the European Union.
[10] European Commission. (2023). *Flash Eurobarometer 525 (Monitoring the level of financial literacy in the EU)* (ZA7985 data file version 1.0.0) [Data set]. GESIS. https://doi.org/10.4232/1.14155
[11] Demertzis, M., Mejino-López, J., & Moffat, L. L. (2024). The state of financial knowledge in the European Union: A new survey. *Journal of Financial Literacy and Wellbeing*, 2(1), 38–62. https://doi.org/10.1017/flw.2024.8
[12] Tahir, M. S. (2025). Financial literacy overconfidence, poor financial behaviour, and loan-taking propensity: The mediating role of financial fragility. *Borsa Istanbul Review*, 25, 10–17. https://doi.org/10.1016/j.bir.2025.07.004
[13] Bialowolski, P., Weziak-Bialowolska, D., & Cwynar, A. (2025). Reassessing the role of financial knowledge and confidence for financial outcomes across income groups in the EU. *Kyklos*, 78(4), 1424–1439. https://doi.org/10.1111/kykl.12477
[14] Căciulescu, A. R., Rughiniș, R., Țurcanu, D., & Radovici, A. (2024). Mapping cyber-financial risk profiles: Implications for European cybersecurity and financial literacy. *Risks*, 12(12), 200. https://doi.org/10.3390/risks12120200
[15] Saiedi, E., Broström, A., & Ruiz, F. (2021). Global drivers of cryptocurrency infrastructure adoption: E. Saiedi et al. *Small Business Economics*, *57*(1), 353-406. https://doi.org/10.1007/s11187-019-00309-8
[16] Stix, H. (2013). Why do people save in cash? Distrust, memories of banking crises, weak institutions and dollarization. *Journal of Banking & Finance*, 37(11), 4087–4106. https://doi.org/10.1016/j.jbankfin.2013.07.015
[17] Okat, D., Paaso, M., & Pursiainen, V. (2025). Trust in traditional finance and consumer fintech adoption. *The Review of Corporate Finance Studies*, 14(2), 408–438. https://doi.org/10.1093/rcfs/cfae011
[18] Van Rooij, M., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2), 449–472. https://doi.org/10.1016/j.jfineco.2011.03.006
[19] Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. https://doi.org/10.1257/jel.52.1.5
[20] Hayashi, F., & Routh, A. (2025). Financial literacy, risk tolerance, and cryptocurrency ownership in the United States. *Journal of Behavioral and Experimental Finance*, 46, 101060. https://doi.org/10.1016/j.jbef.2025.101060
[21] Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *The Quarterly Journal of Economics*, 116(1), 261–292. https://doi.org/10.1162/003355301556400
[22] Nyhus, E. K., Frank, D. A., Król, M. K., & Otterbring, T. (2024). Crypto cravings: Gender differences in crypto investment intentions and the mediating roles of financial overconfidence and personality. *Psychology & Marketing*, 41(3), 447–464. https://doi.org/10.1002/mar.21921
[23] Heinze, G., & Schemper, M. (2002). A solution to the problem of separation in logistic regression. *Statistics in Medicine*, 21(16), 2409–2419. https://doi.org/10.1002/sim.1047

[24] Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika*, 80(1), 27–38. https://doi.org/10.2307/2336755

[25] Rainey, C., & McCaskey, K. (2021). Estimating logit models with small samples. *Political Science Research and Methods*, 9(3), 549–564. https://doi.org/10.1017/psrm.2021.9

[26] Cook, S. J., Hays, J. C., & Franzese, R. J. (2020). Fixed effects in rare events data: A penalized maximum likelihood solution. *Political Science Research and Methods*, 8(1), 92–105. https://doi.org/10.1017/psrm.2018.40

[27] Puhr, R., Heinze, G., Nold, M., Lusa, L., & Geroldinger, A. (2017). Firth's logistic regression with rare events: Accurate effect estimates and predictions? *Statistics in Medicine*, 36(14), 2302–2317. https://doi.org/10.1002/sim.7273

[28] Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 58(1), 267–288. https://doi.org/10.1111/j.2517-6161.1996.tb02080.x

[29] Belloni, A., Chernozhukov, V., & Hansen, C. (2014). Inference on treatment effects after selection among high-dimensional controls. *Review of Economic Studies*, 81(2), 608–650. https://doi.org/10.1093/restud/rdt044