

Cluster Analysis of Financial Risk Profiles Across the EU

Razvan UIFALEAN

Bucharest University of Economic Studies

uifaleanrazvan17@stud.ase.ro

Abstract. *This study examines financial risk profiles across EU Member States, exploring their relationships with financial literacy, financial behavior, education, income, and digital competencies. We utilize data from the Flash Eurobarometer 525, surveying over 26,139 individuals across the EU, and employ cluster analysis based on self-reported financial fragility as a proxy for risk aversion. Statistical methods, including correlation analysis, unifactorial regressions, and t-tests for means, assess the relationships between variables above. The t-tests results highlight significant differences in risk attitudes across quartiles, with higher quartiles (less risk-averse) showing systematically distinct risk profiles. In contrast, the corresponding financial literacy, digital competencies, and financial behavior show limited variation, except for a marginal difference between intermediate quartiles. Education and household income reveal significant disparities primarily in the extreme quartiles, suggesting that economic conditions and educational attainment shape risk preferences. Findings challenge classical economic theories by showing that higher financial literacy correlates with greater risk aversion, while higher education levels align with lower risk aversion. Household income exhibits a moderate negative relationship with risk tolerance. The results underscore the heterogeneity in financial behaviors across the EU, emphasizing the need for tailored financial policies—ranging from risk-mitigating regulations in risk-tolerant clusters to strategies fostering financial market participation in risk-averse ones.*

Keywords: risk aversion, financial literacy, financial behavior, education, household income, cluster analysis, European Union.

Introduction

Making sound financial decisions is essential not only for individual well-being but also for the broader stability and growth of economies. In a world where financial systems become more complex and globally interconnected, it is of grater importance to understand what drives people's attitudes toward risk and how these attitudes influence their financial choices. The European Union, with its wide-ranging economic, educational, and cultural diversity, offers an ideal context for investigating these issues. Although factors like financial literacy, education, income, and digital skills are commonly acknowledged as important influences on financial behavior, the ways in which they interact—and how they shape individuals' willingness to take financial risks—are still not fully understood, especially when comparing across countries. This study aims to fill that gap by analyzing the financial risk profiles of individuals in EU Member States, bringing together multiple aspects of financial behavior to better understand what influences risk tolerance in different national contexts.

Financial literacy is widely recognized as a key pillar of informed financial decision-making. It shapes individuals' ability to plan for the future, assess risks, and make choices that support long-term financial security. Yet, gaps in financial literacy remain evident across different demographic and regional groups, raising concerns about financial inclusion and overall economic stability. Education and income are also commonly seen as influential factors in shaping financial behavior, but their connection to risk tolerance is more nuanced than often assumed. While higher education can foster greater financial awareness and confidence, it may also prompt more cautious

decision-making due to a heightened understanding of potential risks. Similarly, although higher income is usually thought to offer protection against financial shocks, some low-income individuals may take on greater risks—not out of preference, but from a lack of alternatives.

The digital transformation of financial services has added further complexity to this picture. As digital tools become more central to managing personal finances, digital literacy plays an increasingly important role in determining who can effectively engage with modern financial systems. While digital competencies can open new opportunities and improve access to financial products, their influence on individual risk preferences remains less well understood.

This study brings these interconnected themes together, exploring how financial literacy—both perceived and tested—along with education, income, and digital skills, interact to shape financial risk tolerance across EU Member States. Drawing on data from Flash Eurobarometer 525 and using techniques such as cluster and correlation analysis, the research identifies broad patterns and national differences in financial behavior and literacy. These findings show where targeted interventions may be needed to close knowledge gaps and better support individuals in managing financial risks.

By providing a cross-country perspective on financial risk profiles in the EU, my research contributes to a deeper understanding of the complex factors that influence financial behavior. The results offer practical insights for those aiming to develop more inclusive and effective financial education strategies. Ultimately, this research supports efforts to strengthen financial resilience and promote economic well-being across diverse European contexts.

Literature review

Risk aversion is a fundamental concept in financial decision-making, influencing investment behavior, savings patterns, and broader economic activities. The degree of risk aversion varies among individuals, shaped by factors such as income, wealth, financial literacy, socio-demographic characteristics, as well as many other factors. Cluster analysis has emerged as a valuable tool for segmenting financial risk profiles, offering insights into how different groups approach financial decisions. This literature review explores how risk aversion is examined in academic literature, its relationship with financial behavior, and its implications for household income and economic stability.

Risk aversion is a cornerstone of economic and financial theory. Pratt (1964) and Arrow (1971) laid the theoretical groundwork for understanding risk aversion, defining it through utility functions and the curvature of individuals' utility preferences. Their work established that risk-averse individuals prefer a certain outcome over a risky one with the same expected return. Empirical studies have extended this foundation by linking risk aversion to financial decision-making. Kahneman and Tversky's (1979) prospect theory introduced the concept of loss aversion, showing that people weigh losses more heavily than equivalent gains. This principle helps explain conservative financial behavior, such as reluctance to invest in volatile assets.

Risk aversion significantly influences financial behavior, including investment decisions, asset allocation, and savings. Studies such as Guiso et al. (2008) show that risk-averse individuals tend to allocate a lower proportion of their wealth to equities. Instead, they prefer low-risk investments such as government bonds and savings accounts. Thus, risk aversion affects participation in financial markets. Calvet et al. (2009) found that households with higher risk aversion are less likely to invest in stocks, resulting in lower long-term returns and wealth accumulation. This conservative approach to investing can contribute to lower overall economic growth, as capital is allocated in a suboptimal manner.

Moreover, household income plays a crucial role in determining risk aversion. Empirical evidence, such as the study of Carroll (1997), suggests that individuals with higher incomes and wealth levels exhibit lower risk aversion, as they have greater financial buffers to absorb potential losses. Conversely, lower-income households tend to be more risk-averse, prioritizing financial security over potentially higher returns. Gollier (2001) further explored how income uncertainty affects risk-taking behavior, arguing that individuals with unstable income streams are more likely to avoid risky investments. This phenomenon is particularly relevant in economic downturns, where increased uncertainty amplifies risk-averse behaviors, leading to reduced investment and consumption.

Gender differences in risk aversion have been widely studied in financial literature. Croson and Gneezy (2009) reviewed experimental and empirical studies, concluding that women generally exhibit higher risk aversion than men. This difference influences investment choices, entrepreneurial activities, and retirement planning. Barber and Odean (2001) found that men tend to trade stocks more frequently than women, often leading to lower net returns due to excessive transaction costs. Women, being more risk-averse, tend to adopt buy-and-hold strategies, which may yield better long-term financial outcomes.

Furthermore, several studies have applied cluster analysis to categorize individuals based on their financial risk profiles. Cluster analysis is a powerful statistical technique that allows researchers to identify distinct groups within a dataset based on shared characteristics. For example, Grable and Lytton (1999) used cluster analysis to segment individuals based on their risk tolerance and demographic factors such as income, education, and financial knowledge. Similarly, Gilliam et al. (2010) applied cluster analysis to identify different investor profiles based on risk tolerance and financial planning behaviors, finding that financial literacy and demographic factors significantly influenced investment decisions. Moreover, Anderson et al. (2012) utilized cluster analysis to examine how financial risk profiles were related to financial literacy, identifying distinct groups with varying levels of risk tolerance and financial knowledge.

Other factors, such as financial fragility, have been proven to also influence individuals' risk aversion. Studies such as National Endowment for Financial Education (2017) reveals that financial fragility is linked to having too few assets, excessive debt, and low levels of financial literacy. These factors contribute to an individual's inability to manage unexpected expenses, thereby increasing their risk aversion, as showed by the aforementioned literature. Their study also emphasized the impact of education on financial decision-making and highlighted disparities in financial knowledge across different demographic groups.

Conclusively, the uniqueness of this study lies in its novel cross-country approach within the EU context, integrating financial literacy, education, income, and digital competencies as multidimensional factors influencing risk tolerance. While existing literature extensively explores the role of risk aversion in financial decision-making, such as Pratt (1964), Guiso et al. (2008), and identifies significant demographic and psychological influences, there is a gap in understanding how these factors interact across different EU member states. Previous research, such as Brooks et al. (2024). has highlighted some regional differences in financial risk behavior but has not fully captured the complex interactions of all these variables at the European level. This study addresses this gap by using advanced cluster analysis techniques to provide a comprehensive, cross-country examination of financial risk profiles, offering new insights into the drivers of risk tolerance and informing targeted interventions for financial education and policy development.

Methodology

Data source and description

We used data from the Eurobarometer survey, specifically the dataset "Monitoring the Level of Financial Literacy FL525" published by the Directorate General for Communication of the European Commission. The data, which was updated in July 2023, provides a comprehensive assessment of financial literacy levels across EU Member States, along with insights into other variables, such as financial behavior, education, digital competencies, and household income. A total of 26,139 answers were collected by the survey, ensuring a broad representation of financial literacy scores across the European population.

Risk profile proxy

To examine how risk aversion varies across EU countries, we conducted a cluster analysis using Question 8 from the Flash Eurobarometer survey as a proxy for risk aversion. This question assesses financial fragility by asking respondents: "If you lost your main source of income today, how long could you continue to cover your living expenses without borrowing money or moving house?" The response options are as follows:

- I don't have emergency savings
- At least 1 week, but less than 1 month
- At least 1 month, but not 3 months
- At least 3 months, but not 6 months
- 6 months or more
- Don't know/Prefer not to answer

Individuals were segmented based solely on their responses, which reflect self-reported financial risk-taking behavior. This approach allowed for the identification of distinct financial risk profiles by grouping individuals with similar risk attitudes. Each response was assigned a value ranging from 1 ("6 months or more") to 5 ("I don't have emergency saving"), with 5 representing the highest level of risk tolerance and 1 indicating the most risk-averse behavior. These values were then used to compute average risk indices for each country. The responses "Don't know/Prefer not to answer" were excluded from the total response pool when calculating the countries' average risk profiles to ensure a more accurate representation of financial risk attitudes.

In the academic literature, financial fragility is often used as a proxy for risk tolerance. It usually reflects an individual's or household's vulnerability to financial shocks and their corresponding risk preferences. Authors such as Kahneman & Tversky (1979) suggest that financially fragile individuals—those with low savings, high debt, or poor financial security—may exhibit heightened risk-taking behaviors rather than risk aversion. This phenomenon can be attributed to the "gambling for resurrection" effect, where individuals facing financial hardship engage in riskier financial decisions in an attempt to regain economic stability. Lower financial literacy and poor economic circumstances may lead to a less than optimal risk assessment. This, in turn, makes financially fragile individuals toward riskier investments or high-risk financial instruments. More recently, Lusardi et al. (2011) examined households' capacity to access emergency funds, highlighting that a significant portion of U.S. households are unable to come up with \$2,000 in 30 days. This inability indicates a high degree of financial fragility, which the authors associate with lower risk tolerance and limited financial literacy.

The same methodology was applied to additional key variables, including financial literacy, financial behavior, formal education, digital competencies, and household income. After

processing the data, we calculated an average risk coefficient for each EU country. Based on this coefficient, countries were categorized into four quartiles representing varying levels of risk tolerance: very low, low, high, and very high. Each quartile was subsequently analyzed in relation to financial and socioeconomic indicators, facilitating an assessment of how financial literacy and broader economic factors correlate with risk aversion across European populations.

Other analyses

After clustering the data, we conducted statistical analyses to examine the relationship between financial literacy, socioeconomic factors, and risk profile at the country level. Descriptive statistics and visual representations provided an overview of the analysed variables across EU countries. The t-Test for means evaluated significant differences between clusters. Correlation analysis assessed the strength of associations between risk aversion and key variables, such as education, income, and digital skills. We further applied unifactorial regressions to estimate how individual factors influence risk tolerance, quantifying their impact on financial decision-making.

This methodology enables a robust examination of how all the aforementioned variables, such as financial literacy, financial behavior, and socioeconomic factors influence financial decision-making and risk preferences within the European context. By employing Eurobarometer data and cluster analysis, we provide empirical insights into the heterogeneity of financial risk profiles across EU Member States.

Results & discussions

Clusterisation, heatmap & trend analysis

The clustering was conducted based on each country's risk profile (as shown in the first column of Figure 1), after which the remaining variables were sorted accordingly. This methodological approach is grounded in the premise that higher financial fragility corresponds to greater risk tolerance, as discussed in our methodology.

Risk attitudes vary significantly across EU nations, with individuals displaying different levels of financial risk aversion depending on their financial literacy, behavior, education, digital competencies, and household income. Based on the heatmap shown in Figure 1, these variables exhibit notable variations. The color coding suggests a gradient representation of financial metrics, with red indicating lower values, green representing higher values, and yellow marking the mid-range.

Cluster 1, characterized by low-risk tolerance and financial fragility, exhibits higher financial literacy and stronger financial behavior, alongside surprisingly lower education levels. This suggests that greater financial knowledge fosters cautious decision-making and reduced risk-taking. Conversely, Cluster 4, with the highest risk tolerance, shows lower financial literacy and weaker financial behavior, alongside the lowest household income, reinforcing the link between financial vulnerability and increased risk-taking.

Financial literacy declines as risk tolerance increases, with the Netherlands (3.98) and Denmark (3.99) exhibiting the highest financial literacy in low-risk clusters, while Romania (3.12) and Bulgaria (3.33) in Cluster 4 display the lowest. This pattern aligns with Lusardi and Mitchell (2014), who argue that greater financial knowledge reduces risk-taking behavior. In contrast, financial behavior does not follow a clear gradient with risk tolerance. While Cluster 1 demonstrates strong financial behavior, Cluster 4 does not exhibit a uniform decline. For example, Romania (3.77) and Greece (3.63) report relatively high financial behavior scores, despite their higher risk tolerance.

Clusters	Countries	Risk Profile (the higher the more fragile/more risk loving)	Financial Literacy (the higher, the more financial educated)	Financial Behavior (the higher, the more financial well behaved)	Education (the higher, the more educated)	Digital Competencies (the higher, the more digitally educated)	Household Income (the higher, the wealthier)
Cluster 1 scores <= Q1 (lowest risk tolerance & financial fragility)	LU	1.9207	3.7140	3.5540	2.3050	3.1183	2.1474
	NL	2.0109	3.9810	3.4690	2.2632	3.4293	2.4486
	SE	2.1300	3.8120	3.6490	2.4394	3.4902	2.2160
	MT	2.3296	3.6210	3.6270	2.6200	3.1489	2.4613
	IT	2.3322	3.4600	3.5360	2.7815	2.8788	2.6663
	BE	2.3409	3.5620	3.4690	2.6677	3.0911	2.5486
	ES	2.3413	3.3590	3.4630	2.5225	2.8332	2.5760
Cluster 2 Q1< scores <= Q2	DK	2.3437	3.9920	3.4680	2.2637	3.4051	2.4739
	FR	2.4824	3.4280	3.5630	2.7986	2.8377	2.5860
	LT	2.4881	3.5530	3.4620	2.9383	3.4725	2.2465
	DE	2.4909	3.6840	3.5760	2.5120	3.2107	2.5060
	EE	2.5459	3.9920	3.3690	2.9413	3.3740	2.4406
	AT	2.5579	3.6080	3.5770	2.4638	3.4032	2.8417
	SK	2.6368	3.6250	3.5170	2.9557	3.3604	2.5541
Cluster 3 Q2< scores <= Q3	CZ	2.6443	3.5850	3.5680	2.8088	3.4313	2.3441
	IE	2.6517	3.6650	3.4790	2.5800	3.1322	2.7356
	SI	2.6572	3.8830	3.6290	2.8675	3.1200	2.5886
	PT	2.6674	3.2490	3.6040	2.7968	2.7886	2.4498
	PL	2.7918	3.3580	3.5450	3.1745	3.2614	2.3213
	CY	2.8313	3.2810	3.6810	2.8731	3.0491	2.8793
	HR	2.8355	3.4750	3.6160	2.8897	3.3600	2.3116
Cluster 4 scores >= Q3 (highest risk tolerance & financial fragility)	HU	2.8815	3.5810	3.5810	3.0956	3.1402	2.0848
	BG	2.9220	3.3330	3.5470	2.9867	3.1218	1.9537
	FI	2.9347	4.0540	2.9680	2.6197	3.6341	2.6353
	EL	2.9648	3.2990	3.6300	3.0889	2.7230	2.4808
	RO	3.0049	3.1220	3.7720	2.7887	3.2279	1.7206
	LV	3.1180	3.3940	3.3910	3.0142	3.2290	2.4031

Figure 1. Clusterisation & Heatmap of EU countries

Source: Authors' own research.

A better visualisation of the trends within the data is shown in Figure 2. Education levels display a more clear trend, increasing as risk aversion decreases. The highest education level is observed in the fourth quartile at 2.93, whereas the lowest is in the first, at 2.51. This trend suggests that individuals with higher educational attainment tend to exhibit lower risk aversion. This pattern is consistent with the classical literature, such as Dohmen et al. (2011), who found that higher educational attainment correlates with a greater willingness to take financial risks. They argue that education enhances cognitive abilities, financial literacy, and decision-making confidence, enabling individuals to better assess and manage risks, ultimately reducing their level of risk aversion.

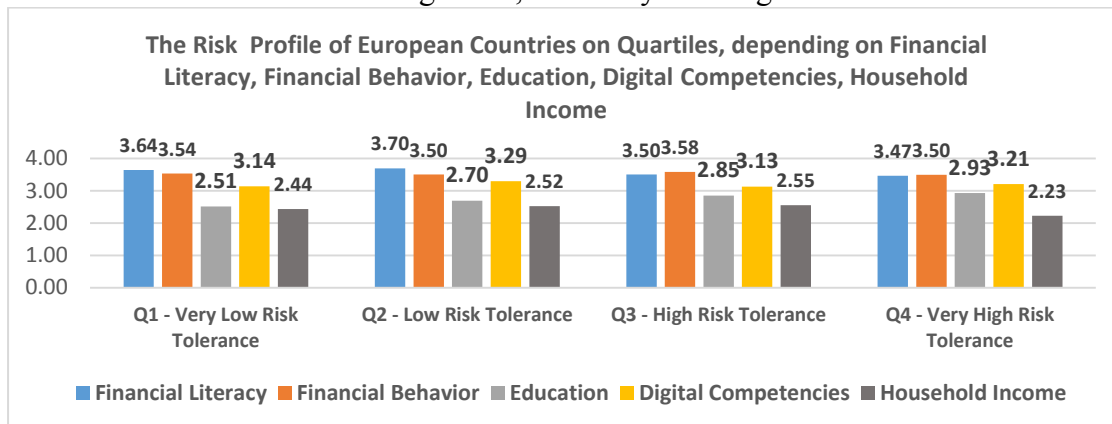


Figure 2. Clusterisation & Heatmap of EU countries

Source: Authors' own research.

Digital competencies exhibit a relatively stable pattern across risk tolerance quartiles, ranging between 3.13 and 3.29, suggesting that technological proficiency does not strongly influence financial risk-taking behavior. However, a slight increase in digital competencies within the second quartile (low-risk tolerance) at 3.29 may indicate that individuals with greater technological fluency are less inclined to engage with modern financial instruments and investment platforms. This aligns with studies such as Lusardi and Mitchell (2017), who highlight that, while digital competencies contribute to information accessibility, they do not necessarily translate into higher financial engagement, particularly among risk-averse individuals. Their findings suggest that financial literacy, rather than digital fluency alone, plays a crucial role in fostering investment participation. Additionally, Finland (3.63) and the Netherlands (3.43) report higher digital competency scores, while Greece (2.72) and Portugal (2.79) rank lower, reflecting broader disparities across European countries. Given the increasing shift toward digital financial tools, individuals with lower digital literacy may be more risk-averse due to limited access to financial information and resources, reinforcing the importance of digital education.

Household income does not seem to have a clear trend, with the highest value in the third quartile at 2.55 and the lowest in the fourth quartile at 2.23. The observation suggests a complex relationship between risk preferences and income. This pattern implies that individuals with more risk-loving behaviors are not necessarily the wealthier groups; rather, the poorer individuals exhibit lower income despite potentially higher risk tolerance. One possible explanation is that risk-loving individuals in lower-income groups may face greater financial constraints that prevent them from fully capitalizing on risk-taking opportunities, leading to less wealth accumulation despite a preference for risk. Alternatively, it may also suggest that wealthier individuals, despite being more risk-averse, are better equipped to manage financial risks, resulting in more stable income profiles.

Cluster mean analysis

The results from the t-tests comparing different quartiles based on their risk profile, financial literacy, financial behavior, education, digital competencies, and household income provide insights into the statistical differences between these groups of countries, as highlighted in Table 1.

For the risk profile, all comparisons yield statistically significant differences at conventional significance levels ($p < 0.05$). This indicates that individuals in higher quartiles (least risk-averse and most financially fragile) exhibit significantly different risk profiles compared to those in lower quartiles. The consistent significance suggests that risk attitudes differ systematically across quartiles.

In contrast, financial literacy does not exhibit significant differences across quartiles. This suggests that financial literacy levels remain relatively stable across risk quartiles, implying that risk preferences may not be strongly associated with financial literacy levels.

Similarly, financial behavior exhibits mixed results. While one comparison (Q2 vs. Q3) has a one-tailed p-value of 0.03, indicating marginal significance at the 5% level, the other comparisons do not show significant differences. The p-values for the remaining comparisons are above 0.05, suggesting that financial behavior does not systematically differ across quartiles, except for a potential difference between Q2 and Q3.

Table 1. Results for t-Test: Two-Sample Assuming Unequal Variances

Variable	Statistics	Q1	Q2	Q2	Q3	Q3	Q4	Q1	Q4
Risk Profile	Mean	2.2008	2.5065	2.5065	2.7073	2.7073	2.9516	2.2008	2.9516
	Variance	0.0321	0.0081	0.0081	0.0067	0.0067	0.0084	0.0321	0.0084
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	9		11		11		9	
	t Stat	-4.0310		-4.1985		-5.0751		-9.8715	
	P(T<=t) one-tail	0.0015		0.0007		0.0002		0.0000	
	t Critical one-tail	1.8331		1.7959		1.7959		1.8331	
	P(T<=t) two-tail	0.0030		0.0015		0.0004		0.0000	
	t Critical two-tail	2.2622		2.2010		2.2010		2.2622	
Financial Literacy	Mean	3.6441	3.6974	3.6974	3.5035	3.5035	3.4654	3.6441	3.4654
	Variance	0.0448	0.0467	0.0467	0.0624	0.0624	0.0880	0.0448	0.0880
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	12		10		11		11	
	t Stat	-0.4659		1.4837		0.2511		1.2972	
	P(T<=t) one-tail	0.3248		0.0843		0.4032		0.1106	
	t Critical one-tail	1.7823		1.8125		1.7959		1.7959	
	P(T<=t) two-tail	0.6496		0.1687		0.8063		0.2211	
	t Critical two-tail	2.1788		2.2281		2.2010		2.2010	
Financial Behavior	Mean	3.5381	3.5046	3.5046	3.5843	3.5843	3.5007	3.5381	3.5007
	Variance	0.0059	0.0059	0.0059	0.0049	0.0049	0.0680	0.0059	0.0680
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	12		11		7		7	
	t Stat	0.8160		-1.9547		0.8147		0.3642	
	P(T<=t) one-tail	0.2152		0.0383		0.2211		0.3632	
	t Critical one-tail	1.7823		1.7959		1.8946		1.8946	
	P(T<=t) two-tail	0.4304		0.0765		0.4421		0.7265	
	t Critical two-tail	2.1788		2.2010		2.3646		2.3646	
Education	Mean	2.5142	2.6962	2.6962	2.8501	2.8501	2.9262	2.5142	2.9262
	Variance	0.0364	0.0786	0.0786	0.0367	0.0367	0.0301	0.0364	0.0301
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	11		11		10		12	
	t Stat	-1.4198		-1.1685		-0.7454		-4.2251	
	P(T<=t) one-tail	0.0917		0.1336		0.2366		0.0006	
	t Critical one-tail	1.7959		1.7959		1.8125		1.7823	
	P(T<=t) two-tail	0.1834		0.2673		0.4732		0.0012	
	t Critical two-tail	2.2010		2.2010		2.2281		2.1788	

Digital Competencies	Mean	3.1414	3.2948	3.2948	3.1304	3.1304	3.2052	3.1414	3.2052
	Variance	0.0619	0.0470	0.0470	0.0463	0.0463	0.0754	0.0619	0.0754
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	12		11		11		12	
	t Stat	-1.2299		1.3688		-0.5495		-0.4551	
	P(T<=t) one-tail	0.1212		0.0992		0.2968		0.3286	
	t Critical one-tail	1.7823		1.7959		1.7959		1.7823	
	P(T<=t) two-tail	0.2423		0.1984		0.5936		0.6571	
	t Critical two-tail	2.1788		2.2010		2.2010		2.1788	
Household Income	Mean	2.4377	2.5213	2.5213	2.5531	2.5531	2.2271	2.4377	2.2271
	Variance	0.0363	0.0321	0.0321	0.0498	0.0498	0.1034	0.0363	0.1034
	Observations	7	7	7	6	6	7	7	7
	Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000	
	df	12		10		11		10	
	t Stat	-0.8451		-0.2808		2.1459		1.4906	
	P(T<=t) one-tail	0.2073		0.3923		0.0275		0.0835	
	t Critical one-tail	1.7823		1.8125		1.7959		1.8125	
	P(T<=t) two-tail	0.4146		0.7846		0.0550		0.1669	
	t Critical two-tail	2.1788		2.2281		2.2010		2.2281	

Source: Authors' own research.

For education, most comparisons fail to reach statistical significance except for Q1 vs. Q4 ($t = -4.22$, $p = 0.0012$). This suggests that individuals in the lowest quartile (most risk-averse or least financially fragile) have significantly lower education levels than those in the highest quartile. However, comparisons between intermediate quartiles do not show meaningful differences.

Digital competencies also do not show significant differences across quartiles, as all p-values exceed 0.05. The t-statistics are relatively small, indicating that digital competencies remain relatively stable across different risk profiles.

Finally, household income exhibits a single near-significant comparison (Q3 vs. Q4, $t = 2.14$, $p = 0.05$). This suggests a potential income difference between these quartiles, though it does not meet the conventional 5% threshold. Other comparisons show no significant differences, implying that household income distribution does not strongly differentiate individuals based on their risk profiles.

Overall, the results highlight that risk profile is the most distinctively different variable across quartiles, while financial literacy, digital competencies, and financial behavior show fewer significant differences. Education and household income exhibit some significant differences, particularly when comparing the most extreme quartiles. Economically, these findings highlight substantial heterogeneity in risk preferences across the EU, suggesting that financial policies and educational programs should be tailored to the specific risk profiles of each cluster. Countries in Cluster 1, being more risk-averse, may benefit from policies that encourage participation in financial markets by reducing perceived risk barriers, whereas those in Cluster 4 may require financial regulations that prevent excessive risk-taking.

Correlation analysis

The correlation analysis from table 2 reveals key relationships between financial characteristics and risk tolerance. Financial literacy shows a strong negative correlation with risk tolerance (-0.81),

suggesting that individuals with higher financial knowledge tend to be more risk-averse. This aligns with findings by Lusardi and Mitchell (2014), who argue that financially literate individuals are more aware of potential financial pitfalls, enabling them to make informed decisions and manage risks appropriately. This knowledge allows them to balance risk and return more effectively, rather than simply adopting more conservative financial strategies.

Financial behavior exhibits a weak negative correlation (-0.14), indicating that responsible financial habits have little direct impact on risk-taking. This is consistent with findings by Van Rooij, Lusardi, and Alessie (2011), who argue that while financial literacy and behavior are linked, behavioral caution does not necessarily translate into a willingness to engage with financial risk. Education, in contrast, shows an almost perfect positive correlation with risk tolerance (0.99), supporting evidence from Behrman et al. (2012) and Calvet et al. (2009) that higher education fosters financial confidence and an increased propensity to invest in riskier assets. Education may equip individuals with analytical skills that help them assess financial opportunities, reducing uncertainty and increasing risk-taking behavior.

Table 2. Correlation Analysis

	Risk Profile
Financial Literacy	-0.81
Financial Behavior	-0.14
Education	0.99
Digital Competencies	0.12
Household Income	-0.50

Source: Author's own research.

Digital competencies display a weak positive correlation (0.12), suggesting a limited relationship between technological proficiency and financial risk tolerance. This finding aligns with Grohmann et al. (2018), who argue that digital literacy primarily facilitates access to financial markets rather than directly influencing risk preferences. However, as financial services become increasingly digitalized, higher digital competencies may play a growing role in shaping investment behavior.

Household income demonstrates a moderate negative correlation (-0.50) with risk tolerance, suggesting that wealthier individuals tend to be more risk-averse. This goes against the classical theories affirming that higher income provides a greater financial cushion against potential losses, thereby encouraging riskier investment behavior (Guiso & Paiella, 2008). A possible justification for this phenomenon might be that low-income individuals may engage in higher risk-taking, not necessarily out of preference, but as a response to financial constraints. Kahneman and Tversky's (1979) prospect theory suggests that individuals facing losses or economic hardship may adopt risk-seeking behavior in an attempt to recover, as losses weigh more heavily than equivalent gains.

Overall, the findings emphasize the role of education as a key driver of financial risk tolerance, while financial literacy and income are associated with more cautious financial behavior.

Scatter plots

Furthermore, we used scatter plots to illustrate the relationship between risk profile and the other explanatory variables. They demonstrate the direction and strength of these relationships through

trend lines and dispersion of data points. The scatter plot from Figure 3 presents the negative linear relationship between financial literacy and risk profile. The downward-sloping trend line suggests that as financial literacy increases, individuals tend to exhibit lower levels of risk aversion, meaning they are more willing to take financial risks.

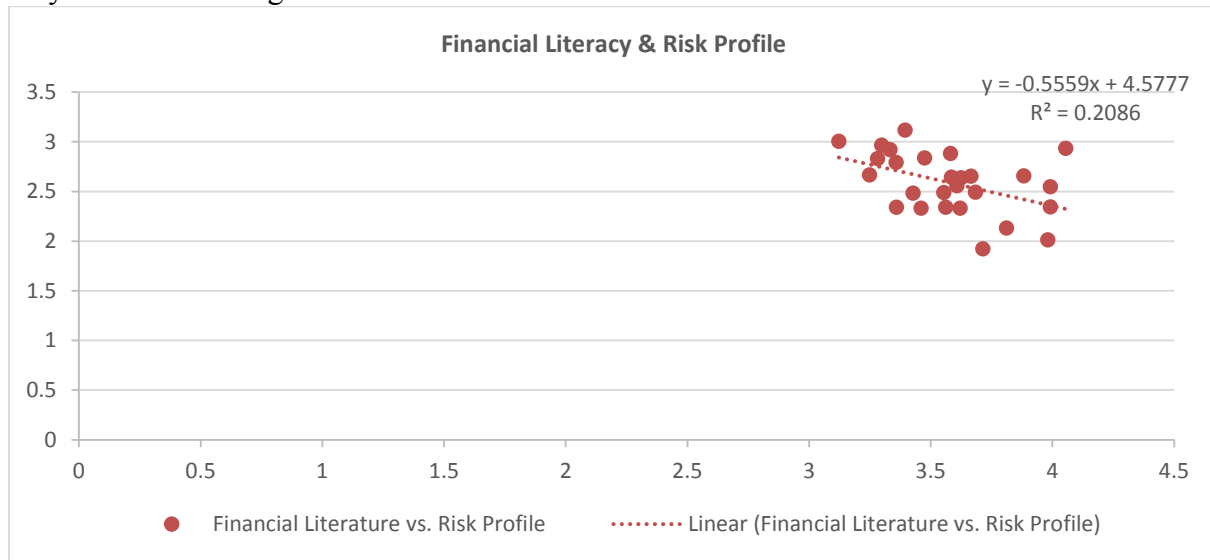


Figure 3. Scatter plot of financial literacy & risk profile

Source: Authors' own research.

The regression equation provided in the plot indicates that for every one-unit increase in financial literacy, the risk profile score decreases by approximately 0.56 units. The observed negative correlation between financial literacy and risk aversion aligns with findings in academic literature. For instance, a study by Capponi and Zhang (2020) found that individuals with greater financial literacy tend to exhibit higher risk aversion, possibly due to a better understanding of potential financial risks. Conversely, a study by Stoian et al. (2021) found that higher financial literacy levels are associated with reduced risk aversion among young adults in Romania. Given these mixed findings, it's evident that the relationship between financial literacy and risk aversion is influenced by various factors, including individual differences, cultural contexts, and specific financial situations. Therefore, while enhancing financial literacy is generally beneficial, its impact on risk tolerance may vary among individuals.

The coefficient of determination suggests that approximately 20.86% of the variation in risk profile can be explained by financial literacy alone. While this indicates a moderate relationship, it also suggests that other factors contribute significantly to risk preferences. Socioeconomic variables such as income, education level, cultural attitudes, and cognitive biases likely play a role in shaping financial risk-taking behavior. The dispersion of data points around the trend line further highlights this complexity, as individuals with similar financial literacy levels display varying risk attitudes. Despite this, the observed negative correlation reinforces the argument that improving financial literacy may encourage more calculated risk-taking, reducing the likelihood of overly conservative financial behaviors that could hinder long-term wealth accumulation.

The plot from Figure 4 illustrates a positive linear relationship between education and risk profile. The upward-sloping trend line suggests that as education levels increase, individuals tend to exhibit higher risk tolerance, indicating a greater willingness to take financial risks.

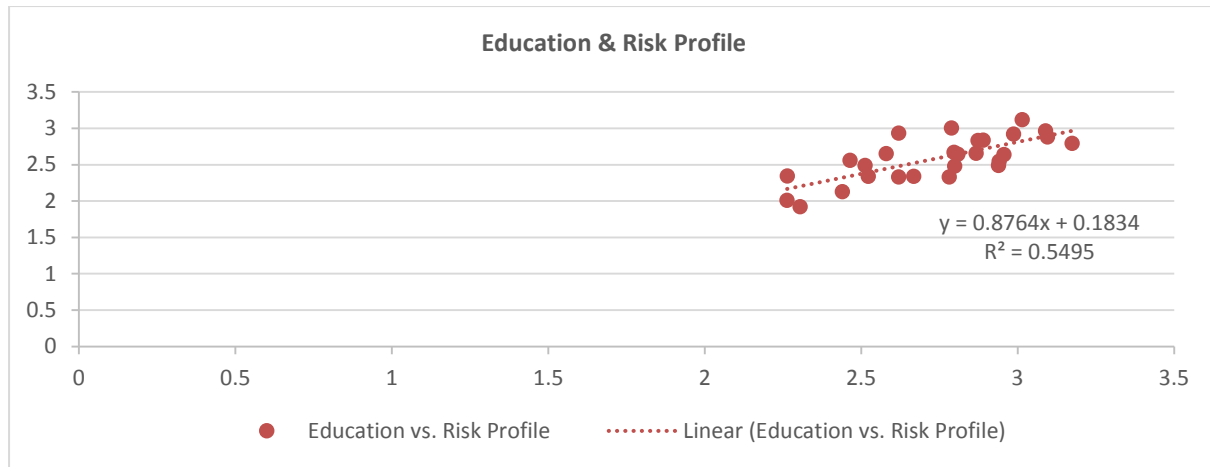


Figure 4. Scatter plot of education & risk profile

Source: Authors' own research.

The regression implies that for every one-unit increase in education, the risk profile score rises by approximately 0.88 units. This result aligns with existing literature demonstrating that higher education levels are associated with greater financial risk-taking. Studies such as those by Grable and Lytton (1999) and Dohmen et al. (2011) have established that individuals with higher educational attainment tend to engage in riskier investment behaviors due to increased cognitive abilities and financial decision-making skills. Furthermore, Christelis et al. (2010) found that higher education fosters greater financial sophistication, reducing the tendency for excessive risk aversion. The coefficient of determination indicates that approximately 54.95% of the variation in risk profile can be explained by education alone, signifying a strong relationship. The data dispersion around the trend line suggests that even among individuals with similar education levels, risk preferences vary due to personal experiences, psychological traits, and economic conditions. Nevertheless, the observed positive correlation reinforces the argument that increasing education can enhance individuals' ability to assess financial risks effectively, potentially leading to more optimal investment and savings decisions.

Figure 5 shows the relationship between financial behavior and risk profile, with a slightly negative trend.

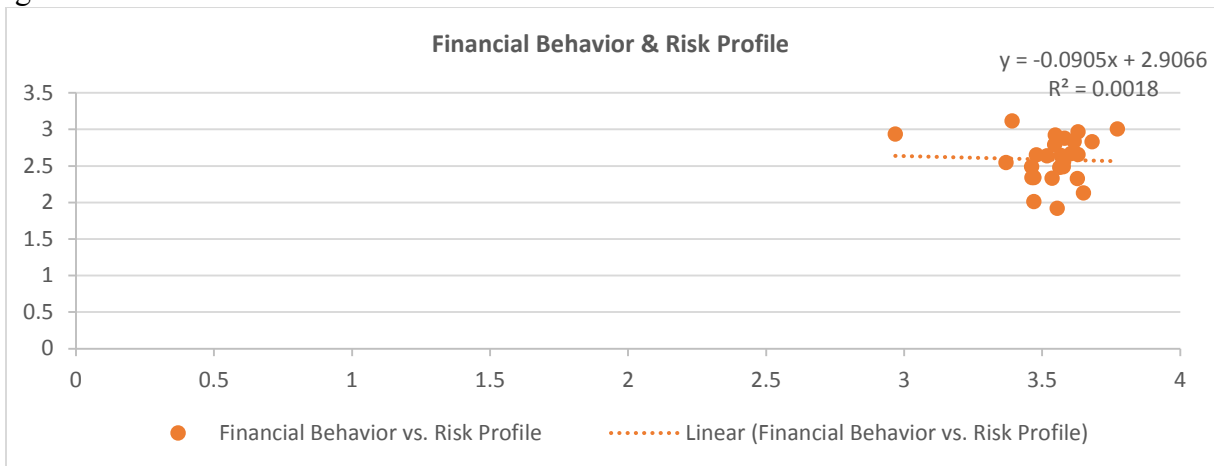


Figure 5. Scatter plot of behavior & risk profile

Source: Authors' own research.

The small negative coefficient suggests that as financial behavior improves, risk-taking slightly decreases, but the effect is minimal. The R-squared value of 0.0018 indicates an extremely weak significance, meaning financial behavior explains only 0.18% of the variation in risk profile. This weak relationship contrasts with the stronger links observed between education and risk-taking, reinforcing the idea that while financial habits shape financial well-being, they may not directly influence one's willingness to take risks.

Figure 6 illustrates the relationship between digital competencies and risk profile. The trend line represents a slight negative correlation, suggesting that higher digital competencies are marginally associated with lower risk profiles. However, the R-squared value of 0.003 indicates an extremely weak explanatory power, meaning digital competencies explain almost none of the variation in risk profiles.

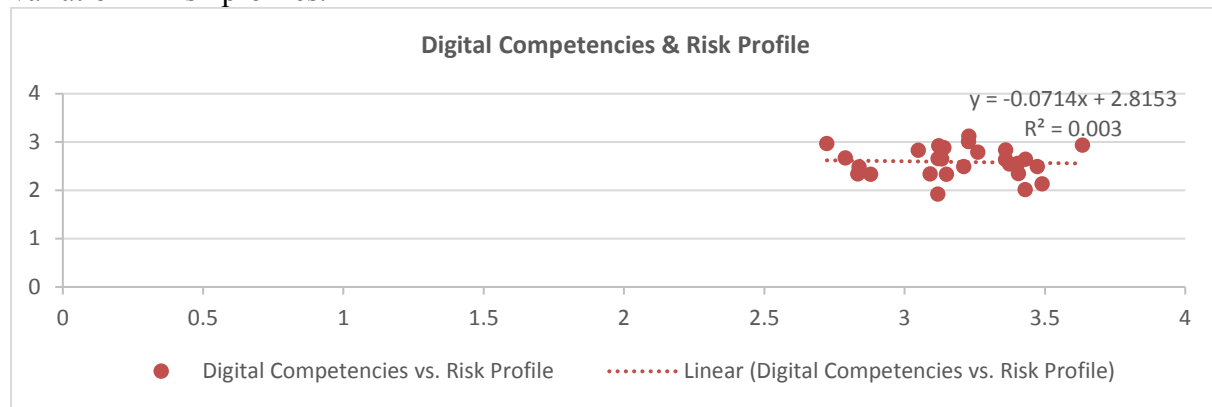


Figure 6. Scatter plot of digital competencies & risk profile

Source: Authors' own research.

The data points appear to be relatively concentrated in a small range, implying that digital competencies do not significantly differentiate risk-taking behavior. The near-horizontal trend line further reinforces this observation, suggesting that individuals' digital skills do not strongly influence their financial risk attitudes. Consequently, this result implies that other factors beyond digital competencies may be more influential in shaping risk preferences.

Lastly, the scatter plot from figure 7 depicts the relationship between household income and risk profile. The trend line has a negative slope, suggesting that higher household income is weakly associated with a lower risk profile. However, the R-squared value of 0.0182 is very low, indicating that household income explains only a small fraction of the variance in risk profiles.

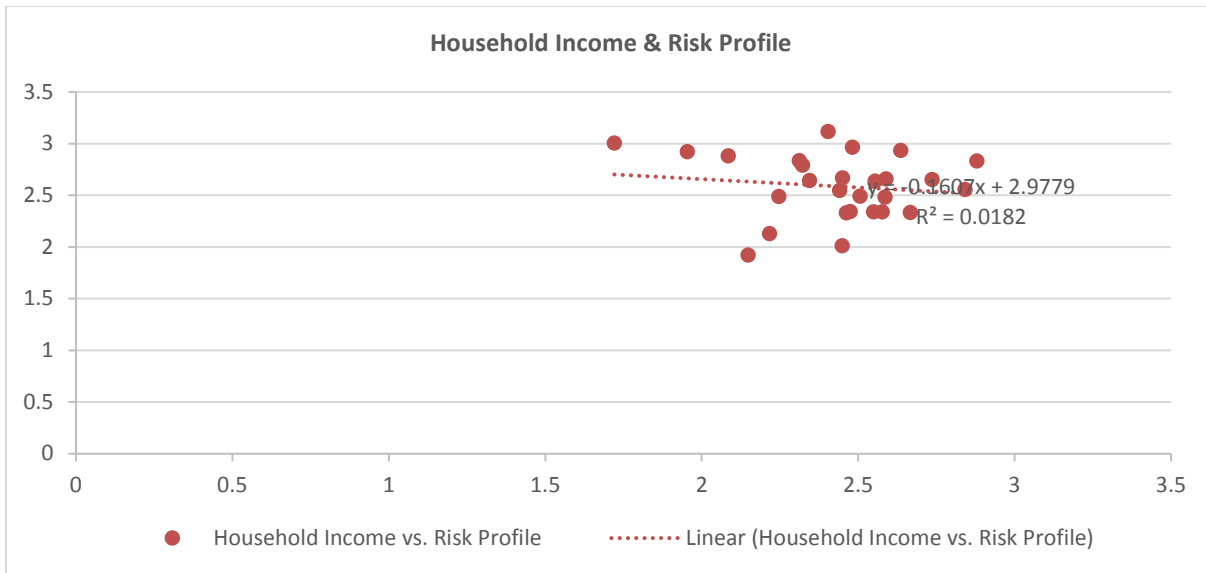


Figure 7. Scatter plot of digital competencies & risk profile

Source: Authors' own research.

The data points are somewhat dispersed, implying that while there may be a weak negative relationship, household income is not a strong determinant of an individual's risk profile. The nearly flat trend line reinforces the notion that other factors beyond income may play a more significant role in shaping risk attitudes.

Conclusion

This study presents an in-depth examination of financial risk profiles across EU countries. It uncovers the intricate relationships among financial literacy, behavior, education, income, and digital skills and how these variables are shaping individuals' risk tolerance. Notably, our findings challenge classical economic theory: risk tolerance is negatively associated with financial literacy, implying that an individual with higher financial knowledge may be more cautious rather than more prone to take calculated risks. This comes in contrast to the common assumption that financial expertise leads to risk-taking and shows the importance of further exploring psychological and behavioral influences on financial decision-making.

The analysis of financial behavior reveals inconsistent links with risk-taking, suggesting that prudent habits like budgeting and saving do not straightforwardly predict risk preferences. Instead, factors such as cultural norms, institutional trust, and overall economic stability may play more decisive roles. Education, on the other hand, shows a strong positive correlation with risk tolerance—particularly at the highest and lowest levels—supporting the idea that higher educational attainment can enhance financial confidence. Yet this relationship is nuanced; those with lower education may take risks out of necessity rather than confidence, and overconfidence among less-educated individuals might also drive risk-seeking behavior.

Digital competencies appear relatively stable across risk quartiles, indicating that while digital literacy is crucial for accessing financial tools, it does not strongly shape attitudes toward risk. Similarly, household income shows only marginal statistical relevance to risk tolerance, with significance emerging in just one quartile comparison. This suggests that income disparities alone do not systematically explain variations in financial risk preferences, though lower-income

individuals might still engage in riskier financial choices when constrained by limited resources—an idea consistent with Kahneman and Tversky's (1979) prospect theory.

Cluster analysis reveals considerable diversity in national risk profiles across the EU. Countries like the Netherlands, Denmark, and Sweden demonstrate low financial fragility and high financial literacy, yet maintain relatively cautious attitudes toward risk. In contrast, Romania, Hungary, and Latvia show higher financial fragility and lower financial literacy, pointing to increased financial vulnerability and exposure to risk. Mean comparison tests confirm that risk profile stands out as the most distinctive variable across quartiles, with notable differences in education and household income, especially at the extremes.

By applying cluster analysis to Eurobarometer data, this research identifies differentiated risk profiles that can inform more tailored financial education and policy strategies. In countries with higher risk tolerance, regulatory measures may be needed to curb excessive risk-taking, whereas in more risk-averse populations, policies could focus on promoting participation in financial markets and reducing perceived risk barriers.

The study's novelty lies in its multidimensional, cross-national perspective, integrating behavioral insights and digital competencies into the assessment of financial risk profiles. A key limitation is the reliance on financial fragility as a proxy for risk aversion, which may not fully reflect the range of psychological, cultural, and experiential factors shaping individual risk preferences. Nonetheless, the research contributes valuable evidence on the intersection of financial literacy, socioeconomic context, and risk attitudes across EU Member States. Future studies could expand this framework by incorporating factors such as personality traits and cultural values to further enrich our understanding of financial behavior.

References

- Anderson, A., Baker, F., & Robinson, D. T. (2012). Precautionary savings, retirement planning, and misperceptions of financial literacy. *Journal of Financial Economics*, 102(3), 593–610.
- Arrow, K. J. (1971). *Essays in the theory of risk-bearing*. North-Holland Publishing.
- 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>
- Behrman, J. R., Mitchell, O. S., Soo, C. K., & Bravo, D. (2012). How financial literacy affects household wealth accumulation. *American Economic Review*, 102(3), 300–304. <https://doi.org/10.1257/aer.102.3.300>
- Brooks, C., & Williams, L. (2024). People are people: A comparative analysis of risk attitudes across Europe. *International Journal of Finance & Economics*, 29(3), 3545–3566. <https://doi.org/10.1002/ijfe.2837>
- Calvet, L. E., Campbell, J. Y., & Sodini, P. (2009). Measuring the financial sophistication of households. *American Economic Review*, 99(2), 393–398. <https://doi.org/10.1257/aer.99.2.393>
- Capponi, A., & Zhang, Z. (2020). Risk preferences and efficiency of household portfolios. arXiv. <https://doi.org/10.48550/arXiv.2010.13928>
- Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *Quarterly Journal of Economics*, 112(1), 1–55. <https://doi.org/10.1162/003355397555109>
- Christelis, D., Jappelli, T., & Padula, M. (2010). Cognitive abilities and portfolio choice. *European Economic Review*, 54(1), 18–38.

- Croson, R., & Gneezy, U. (2009). "Gender Differences in Preferences." *Journal of Economic Literature*, 47(2), 448-474.
- Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, 9(3), 522-550. <https://doi.org/10.1111/j.1542-4774.2011.01015.x>
- Gilliam, J., Chatterjee, S., & Grable, J. E. (2010). Measuring the perception of financial risk tolerance: A tale of two measures. *Journal of Financial Counseling and Planning*, 21(2), 30-43.
- Gollier, C. (2001). *The economics of risk and time*. MIT Press.
- Grable, J. E., & Lytton, R. H. (1999). Financial risk tolerance revisited: The development of a risk assessment instrument. *Financial Services Review*, 8(3), 163-181. [https://doi.org/10.1016/S1057-0810\(99\)00041-4](https://doi.org/10.1016/S1057-0810(99)00041-4)
- Grohmann, A., Klühs, T., & Menkhoff, L. (2018). Does financial literacy improve financial inclusion? Cross-country evidence. *World Development*, 111, 84-96. <https://doi.org/10.1016/j.worlddev.2018.06.020>
- Guiso, L., & Paiella, M. (2008). Risk aversion, wealth, and background risk. *Journal of the European Economic Association*, 6(6), 1109-1150. <https://doi.org/10.1162/JEEA.2008.6.6.1109>
- Guiso, L., Sapienza, P., & Zingales, L. (2008). Trusting the stock market. *Journal of Finance*, 63(6), 2557-2600. <https://doi.org/10.1111/j.1540-6261.2008.01408.x>
- Hermansson, C., & Jonsson, S. (2021). Financial literacy and risk aversion: The role of financial education in shaping financial behaviors. *Journal of Financial Counseling and Planning*, 32(2), 189-205. <https://doi.org/10.1891/JFCP-19-00083>
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 263-291. <https://doi.org/10.2307/1914185>
- 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>
- Lusardi, A., & Mitchell, O. S. (2017). How ordinary consumers make complex economic decisions: Financial literacy and retirement readiness. *The Quarterly Journal of Finance*, 7(3), 1750008. <https://doi.org/10.1142/S2010139217500082>
- Lusardi, A., Schneider, D., & Tufano, P. (2011). Financially fragile households: Evidence and implications. *Brookings Papers on Economic Activity*, 2011(1), 83-134. https://www.brookings.edu/wp-content/uploads/2011/03/2011a_bpea_lusardi.pdf
- National Endowment for Financial Education. (2017). 2017 year in review. <https://www.nefe.org/news/nefe-digest/2017/2017-year-in-review.aspx>
- Pratt, J. W. (1964). Risk aversion in the small and in the large. *Econometrica*, 32(1-2), 122-136. <https://doi.org/10.2307/1913738>
- Sinha, G., Sharma, A., & Kumar, R. (2016). Financial literacy, behavior, and precarity among young adults. *Journal of Financial Education*, 42(1), 123-137.
- Stoian, A., Vintilă, N., Iorgulescu, F., Cepoi, C. O., & Dina Manolache, A. (2021). How risk aversion and financial literacy shape young adults' investment preferences. MPRA Paper No. 109755. University Library of Munich, Germany.
- 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>