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The Lehman Sisters Hypothesis: Gender Differences in Risk-taking and Insights from the 2008 Polish Currency Options Crisis

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ABSTRACT

Objective: This study investigates gender differences in risk-taking behaviour, specifically in entrepreneurial decision-making, in line with the Lehman Sisters Hypothesis. The research, motivated by the 2008 Polish currency options crisis, seeks to understand the factors driving risky decisions, examining how both economic and behavioural factors – such as overconfidence and loss aversion – are influenced by the gender of the decision-maker.

Research Design & Methods: A survey of entrepreneurs from the Podkarpackie voivodeship (N = 392) was conducted, focusing on behavioural risk attitudes, overconfidence bias, and economic decision-making traits. The survey also addressed behaviours during the 2008 currency

options crisis. The collected data were analysed through statistical tests, decision trees, and the logit function, comparing responses between men and women.

Findings: The results confirm that men were predominantly responsible for making risky option strategy decisions, often driven by overconfidence and excessive optimism, which led to underestimation of risk. Women, in contrast, were more likely to base their decisions on external advice. These findings align with the Lehman Sisters Hypothesis, suggesting that gender diversity in leadership roles may improve risk management.

Implications/Recommendations: The study reinforces the recommendation to reduce gender inequality in leadership, as a greater presence of women in senior roles could contribute to more balanced risk-taking and potentially reduce the likelihood of financial crises.

Contribution: This research fills a gap in the literature by exploring gender differences in decision-making during a real-world financial crisis. It highlights the role of behavioural factors such as overconfidence in men and reliance on external advice in women. Additionally, it contributes to understanding gender differences in economic behaviour, including hedging strategies, currency risk exposure, and funding sources utilised by their companies during crises.

Article type: original article.

Keywords: risk attitudes, gender differences, Lehman Sisters Hypothesis, options strategies, hedging.

JEL Classification: G01, G41.

1. Introduction

The Lehman Sisters Hypothesis (LSH) posits that having more women in leadership roles in financial institutions could have mitigated the 2008 financial crisis due to women's generally more risk-averse nature. While Poland avoided a negative GDP growth rate during the crisis, the sudden weakening of the złoty caused significant losses for Polish exporters. Many used misunderstood option strategies, widely marketed by banks, which led to bankruptcies and restructurings. While much research has focused on the economic aspects of Poland's currency crisis, there is little on the role of gender differences in risk-taking, particularly in relation to the LSH.

This paper explores the differences between men and women in entrepreneurial decision-making, aligning with the LSH. It focuses on the 2008 Polish currency options crisis, where many businesses faced losses due to risky option strategies. The study aims to understand how gender influences risk-taking in business decisions, filling a gap in the literature that often overlooks behavioural factors like overconfidence and loss aversion in favour of economic analysis.

The research uses survey data from entrepreneurs in the Podkarpackie voivodeship, examining risk attitudes, overconfidence, and economic decision-making

traits. Findings reveal that while both genders engaged in option strategies, their motivations differed: Men were driven by overconfidence, leading to excessive risk--taking, while women tended to follow external advice. These results support the LSH, indicating that gender differences in risk preferences affect decision-making in high-risk scenarios.

This study contributes to the literature by highlighting gender-based differences in susceptibility to behavioural biases and economic behaviours, such as hedging strategies and exposure to currency risk. It underscores the importance of gender diversity in leadership, as it can lead to improved risk management and better decision-making during financial crises. The paper also provides practical recommendations for promoting gender diversity in leadership to foster more balanced decision-making in risky financial environments.

2. Literature Review

2.1. Repercussions of the 2008 Global Recession in the Polish Economy

Poland was the only country in the European Union, which did not experience recession during the financial crisis 2008 (Gierczyńska & Wojciechowski, 2009) (GDP growth rate was 1.6% for Poland in 2009, while the average for 27 EU countries was –4.3%, compare Table 1).

Table 1. GDP Growth Rate of the Euro Area Countries in the Years 2007–2011

State	2007	2008	2009	2010	2011
EU (27 countries)	3.2	0.3	–4.3	2.1	1.5
Euro area (17 countries)	3.0	0.4	–4.4	2.0	1.4
Belgium	2.9	1.0	–2.8	2.4	1.8
Germany	3.3	1.1	–5.1	4.2	3.0
Estonia	7.5	–4.2	–14.1	3.3	8.3
Ireland	5.4	–2.1	–5.5	–0.8	1.4
Greece	3.5	–0.2	–3.1	–4.9	–7.1
Spain	3.5	0.9	–3.7	–0.3	0.4
France	2.3	–0.1	–3.1	1.7	1.7
Italy	1.7	–1.2	–5.5	1.8	0.4
Cyprus	5.1	3.6	–1.9	1.3	0.5
Luxembourg	6.6	–0.7	–4.1	2.9	1.7
Malta	4.1	3.7	–2.4	2.7	1.6
The Netherlands	3.9	1.8	–3.7	1.6	1.0
Austria	3.7	1.4	–3.8	2.1	2.7
Portugal	2.4	0.0	–2.9	–1.9	–1.6

Table 1 cnt'd

State	2007	2008	2009	2010	2011
Slovenia	7.0	3.4	–7.8	1.2	0.6
Slovakia	10.5	5.8	–4.9	4.4	3.2
Finland	5.3	0.3	–8.5	3.3	2.7
Poland	6.8	5.1	1.6	3.9	4.3

Source: Eurostat (2025b).

Many factors contributed to the non-negative growth rate of the Polish GDP, including the depreciation of the złoty, tax reform, large public investments, and consumer optimism. However, it should not be forgotten that the depreciation of the złoty led to an increase in the value of Poland's foreign debt expressed in złoty, and while the GDP growth rate for Poland remained positive, it significantly declined compared to previous years (Buszkowska & Płuciennik, 2013). From the perspective of the business sector, manufacturing and transport were particularly affected (Opałka, 2012), with total sales dropping and many companies in this sector reporting losses. Nevertheless, it seemed that the economy was coping reasonably well with the crisis. Unfortunately, imprudent foreign exchange risk management, based on the assumption that the Polish złoty would continue to appreciate (Kundera, 2010), as had been the case for at least 5 years, led to enormous losses and bankruptcies among companies that speculated on the appreciation of the złoty instead of correctly hedging their exposure to foreign exchange risk (Czapiewski & Nowaczyk, 2012; Liberadzki, 2015b).

2.2. Currency Options Crisis in 2008 in Poland

As stated earlier, despite the good condition of the Polish economy during the global crisis, many Polish companies suffered losses due to the exchange rate risk. Poland joined the European Union on 1 May 2004, and from that moment on, the Polish złoty began to strengthen. As Figure 1 shows, the PLN/EUR exchange rate was falling, from around 4.76 at the beginning of May 2004 to 3.20 in July 2008. Polish exporters made losses from year to year, due to the drop in the Polish złoty exchange rate from 2004 till 2008.

Many exporters hedged their exposure to currency exchange rate risk. Experts claim that entrepreneurs should use financial instruments which they are sure were created for hedging (Majewski, 2011). Classic instruments like selling futures contracts (short futures), selling forwards, or the purchase of a put option (long put) should be used. Instead of that, option strategies were the most popular in 2007–2008 (Lach, 2008) which were offered on the OTC market and eventually caused large losses (Liberadzki, 2015a, 2015b).

Option strategies involved a series of options expiring monthly or weekly throughout the year, typically consisting of a long put and a short call, with the call option at double the volume of the put. This setup offered a more favourable exchange rate than a forward contract and was zero-cost due to the call option issuance. However, if the trend reversed (e.g., a weakening of the złoty), exporters faced losses from the double-volume call options. The rapid trend reversal in August 2008 led to substantial losses for exporters, with losses continuing over the year due to the structure of the strategies. By March 2009, the Polish Financial Supervision Authority (2010) reported exporter losses totalling 9 billion PLN (2,000,000,000 EUR). These strategies, while promising in certain conditions, proved highly risky and led to significant financial damage when trends reversed.

Fig. 1. PLN/EUR Exchange Rate

Source: Polish Central Bank database.

Currency risk hedging can be implemented using simple financial instruments such as vanilla options, including call or put options, depending on the position taken. In more advanced strategies, complex financial instruments such as barrier options may also be utilised (Kuźmierkiewicz, 1999). One of the simpler methods of risk hedging involves the use of futures or forward contracts. For exporters exposed to the risk of a declining złoty exchange rate, a straightforward hedge would be to take a short position in a futures (forward) contract or purchase a put option. However, these basic hedging instruments present certain limitations. In the case of futures (forward) contracts, the only cost-free rate available is the futures price, which was often deemed unattractive by exporters. Conversely, with put options,

the exchange rate can be set freely, but if the rate becomes more favourable, the option itself may become expensive, which was also viewed unfavourably by exporters (Knop, 2002; Hull, 2014).

In 2007, new option strategies emerged on the Polish market, offering highly advantageous exchange rates within so-called zero-cost strategies (Konopczak, Sieradzki & Wiernicki, 2010). An example is the covered call strategy, which involves selling a call option while simultaneously holding (or potentially buying) the underlying asset (Wystup, 2006). Selling options without coverage in the underlying asset is usually classified as a speculative strategy, but it is also considered a hedging transaction by some authors (Cuthbertson & Nitzsche, 2001). However, these strategies carry significant risks of substantial losses in the event of adverse exchange rate movements, particularly in the case of a weakening złoty.

2.3. Gender Differences

If we look at the data, although, depending on the source, the statistics are different, Polish women occupy 17% of managerial positions in companies (Dun & Bradstreet, 2023) if we take into account all the companies apart from sole proprietorships. If we include sole proprietorships, this percentage grows to 44% (Eurostat, 2025a). If we look at senior positions, Polish women occupy 27.2% of such positions which is below the EU average 33.8% (European Commission, 2024). Poland's position is still above many other EU countries, but still trails behind the top-performing countries like France and Norway, where gender quotas have significantly increased female representation in leadership. Despite progress, cultural factors and the glass ceiling effect continue to challenge further advancement in gender equality in senior decision-making roles in Poland.

In 2023 Poland's score on the Gender Equality Index was below the EU's score – 61.9 (out of 100) vs. 70.2 points (EU) which puts Poland 18th place in the EU. Domains with the lowest scores in Poland were power (20th place in the EU) and social decision-making (26th place). The best performance for women in this index is in the domain of money, in which Poland was in 16th position. Poland's scores are consistently improving but at a slower pace than other EU Member States, which keeps Poland in the same place in the ranking.

Poland's figures on the participation of men and women in senior decision--making positions in enterprises reveal some interesting contrasts when compared to EU and global averages. Poland's relatively good standing can be partly attributed to cultural and historical factors, such as the strong role of women in the workforce during the socialist era. However, challenges remain, including the persistence of traditional gender roles and the glass ceiling effect, which may limit further progress.

Overall, Poland's statistics on gender representation in senior decision-making roles are comparable to or slightly better than the EU and global averages, reflecting both progress and the need for ongoing efforts to improve gender diversity in leadership.

Gender differences in decision making and management styles are subject to a growing interest in many disciplines (Powell & Ansic, 1997). Women have a lower propensity towards risk (Powell & Ansic, 1997) which among other things leads to more conservative investing (Montford & Goldsmith, 2016) and greater propensity for saving (Qiao, 2012). As a result, firms supervised by women have lower leverage and lower variability of profits (Faccio, Marchica & Mura, 2016). This is partly driven by practical reasons – more women are entering the workforce, but few rise to senior positions, leaving only a select few to make executive decisions (Lawson *et al*., 2022).

Financial decision making, a basic activity in every firm, involves risk. Evidence from different fields: economics, psychology, and neuroscience supports the existence of gender differences in financial behaviour. In their analysis of 150 studies conducted between 1967 and 1997, Byrnes, Miller and Schafer (1999) found that women were systematically more risk averse than men. In similar vein many other studies reported analogous results, confirming higher risk aversion of women (e.g., Eckel & Grossman, 2002; Croson & Gneezy, 2009; Charness & Gneezy, 2012). Women were also found to be more loss averse (Schmidt & Traub, 2002; Gächter, Johnson & Herrmann, 2007). Studies of financial decision making related to investment systematically show that women tend to trade less actively than men (Barber & Odean, 2001), hold less risky retirement investment portfolios (Bajtelsmit & Bernasek, 1996; Jianakoplos & Bernasek, 1998) and are more likely to invest in risk-free assets (Hariharan, Chapman, & Domian, 2000).

Similar to the differences in risk and financial decision making, the conclusion that, in general, women are less confident than men is also well supported empirically. Let us begin with very general measures such as evaluations of self-esteem, as used by Bleidorn *et al*. (2016) who conducted a cross-cultural study in which they measured how much people agreed with the statement "I see myself as someone who has high self-esteem." They asked almost 1,000,000 participants in 48 nations and in all of them they found that men's agreement with the statement was higher than women's. Overconfidence can be defined as the underestimation of confidence intervals, or as the overestimation of outcomes related to one's abilities (Fig. 2). In a study by Gneezy, Niederle and Rustichini (2003) women were found to underestimate their abilities compared to men, and they felt less competent in their abilities to solve problems. Moreover, women overestimated their past behaviour to a much smaller degree than men (Reuben *et al*., 2012) and predicted lower performance level (Jakobsson, 2012).

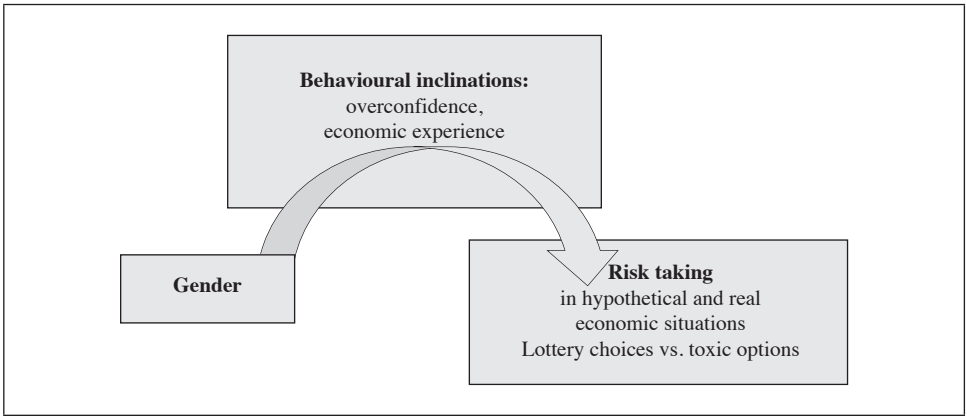

Fig. 2. Chart to Illustrate the Lehman Sisters Hypothesis
Source: the authors.

The collapse of Lehman Brothers in 2008 started the financial crisis and some commentators drew attention to the behaviour exhibited by largely male bankers as a key factor behind the crisis. The LSH, according to which big bank failures would not have happened if there had been more females at the top in banking was subsequently created, implying that more female staff in management would result in better risk management, reducing the possibility of bank failure (van Staveren, 2014). However, the LSH has been questioned. As shown by Sheedy and Lubojanski (2018) women in financial services display more desirable risk management behaviour (like e.g., questioning business practices that may create poor outcomes later; Feige, 2018), and the effect is explained by the well-known gender differences in individual risk tolerance (risk loving) (which so far supports LSH). Nevertheless, risk tolerance between women and men varied only at junior levels but disappeared at higher levels of the corporate ladder. In a similar vein, Cupples, Rasure and Grable (2013) found gender differences in risk aversion, but they also found that education played a mediating role, reducing gender differences in risk tolerance.

3. Goal and Hypothesis

As already mentioned, in 2008 Poland experienced a sharp and unexpected weakening of the złoty exchange rate against foreign currencies, which took place after almost 5 years of appreciation. The reason was the disturbances in the markets caused by the subprime crisis. As we have already explained, the collapse of the złoty impacted both importers and exporters, with exporters being affected due to their options strategies. These strategies were offered to them by banks with relatively aggressive marketing of these products and a commensurate avoidance of

threat communication. As a result of the exercise of these options, many exporters went bankrupt, others were forced to undergo restructuring. It should come as no surprise then, that in Poland it is the subject of many studies aimed at taking lessons for the future from this situation.

The LSH suggests that if more women had been in leadership positions in financial institutions, the 2008 financial crisis might have been mitigated due to the generally more risk-averse nature attributed to female decision-makers. Since risk taking might be to some extent a result of behavioural inclinations and biases of decision-makers, the goal of the study was threefold. First, the study aimed at comparison of the susceptibility to behavioural biases of men and women holding top positions in their companies. Second, the study compared economic behaviour of men and women in particular, the use of simple and complex derivatives, exposure to currency risk and hedging against currency risk, losses due to option strategies and the number of sources of funds used in the company in the past and future time perspective (as yet another aspect of potential risk aversion through diversifying sources of financing). Third, it examined the relative importance of different behavioural factors in the decision to buy toxic options in groups of male and female decision-makers.

4. Materials and Methods

4.1. Participants

The questionnaire was addressed to 392 micro, small and medium enterprises operating in the Podkarpackie voivodeship. Most of the surveyed companies were very small, 57.7% were employing up to 9 employees, 37.2% from 10 to 50 employees, only 5.1% were employing more than 50 employees. 70.4% had been operating for more than 5 years, only 6.1% up to one year, the rest 23.5% between 1 and 5 years.

The sample structure reflects the distribution of gender proportions regarding ownership of SMEs in Poland. For firms employing fewer than 9 people, women own approximately 31% of such firms. For small firms (10 to 50 employees), the proportion of women owners is 25.5%. For medium-sized firms (51 to 250 employees), this percentage is around 15.7%, and for large firms, it is only 13.3% (Dun & Bradstreet, 2023, 2024).

4.2. Procedure and Measures

The surveys were collected at entrepreneur training sessions organised by MARR (Małopolska Agencja Rozwoju Regionalnego, Małopolska Regional Development Agency), aimed at owners of SMEs.

The survey was carried out with the personal participation of the research organiser after an earlier announcement by e-mail and after arranging the date of the meeting in a telephone conversation. The survey also included questions other than those reported in this paper and took an average of 60 minutes to complete.

Respondents were asked about their involvement in option strategies in 2008, as well as questions related to economic and behavioural issues. In the group of economic questions, respondents were asked about currency risk exposure, and whether they used any simple or more advanced hedging strategies. Entrepreneurs also gave information about whether their company had experienced losses in the years 2007–2009 due to toxic options. There was also a group of questions about sources of funds that were used in the past and prospectively to be used in the future in the company (as a measure of management style). The entrepreneurs were asked to identify the sources of funds out of the presented list of 22 items: 1) self--financing, 2) retained profit, 3) sale of redundant assets, 4) depreciation write-offs, 5) owners' surcharges, 6) share issue, 7) bond issue, 8) long-term loan, 9) short--term loan, 10) loan, 11) operating lease, 12) financial leasing, 13) subsidies, 14) state subsidies, 15) EU grants, 16) factoring, 17) issue of securities other than bonds, 18) venture capital, 19) business angels, 20) supply chain financing, 21) overdraft, 22) trade credit.

Questions related to behavioural issues were classical questions from the field of economic psychology measuring cognitive reflection (CRT – cognitive reflection test), susceptibility to heuristics and biases (conservatism bias and availability heuristic), risk attitudes in the area of profits or losses, and overconfidence.

Questions in the CRT were the following: 1) A bat and a ball cost $1.10 in total. The bat costs $1 more than the ball. How much does the ball cost? 2) If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? 3) In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? There were two questions examining the availability heuristic: 1) Do you think more words start with K or end with K? and 2) Do you think more people die in car accidents or through suicide attempts? These questions are classic tools for measuring respondents' propensity to succumb to the availability heuristic (see Tversky & Kahneman, 1974).

In the question on conservatism heuristics, we have adopted the classical question of Edwards (1968): Two bookbags contain 700 red and 300 blue chips, the other containing 300 red and 700 blue. Take one of the bags. Now, you sample, randomly, with replacement after each chip. In 12 samples, you get 8 reds and 4 blues. What is the probability that this is the predominantly red bag? This question was adapted to business decisions and presented as the choice of which advising company out

of two on the market. They help in granting funds for financing enterprises; it was stated that one company is 70% efficient, the other company is 30%.

In the survey there were four questions measuring the risk attitude where the respondents had to choose between a safe and a risky option. Two questions were expressed in terms of losses and two in terms of gains.

Overconfidence was measured in the form of better than average effect. Entrepreneurs were asked to give their opinions about their own knowledge or skills in different areas of everyday life. There were five statements:

1) I am more financially competent than the average entrepreneur,
2) I know politics better than the average entrepreneur,
3) I have more knowledge about culture than the average entrepreneur,
4) I have a better sense of humour than the average entrepreneur,
5) I am more observant when watching a movie than the average viewer.

The number of "yes" answers, where the respondents admit that they are better than the average entrepreneur, is the measure of overconfidence.

To compare the responses of women and men, we used a classical *t*-test, where no equality of variance was assumed. Next, we employed a logit function to identify significant factors that influenced the decision to use option strategies, taking gender into account. For constructing the logit model, we applied the forward selection method, i.e., we added variables to the model that significantly influenced the dependent variable (see Verbeek, 2017).

Finally, we narrowed down our analysis to compare only the behavioural characteristics between entrepreneurs who purchased option strategies and the rest of the sample, but with a gender-based division. For this purpose, we used decision trees. The use of decision trees to describe or model behaviour and decision processes has been employed for a long time by many researchers.

For example, Caliendo, Fossen and Kritikos (2010) use a decision tree to show the individual decisions of entrepreneurs taking into account different reasons to continue the investment project or to exit. Besancenot and Vranceanu (2007) use a decision tree to describe the possible decisions of managers who may work for good or bad firms and decide to buy an honest or dishonest auditor's report. Depending on the decisions made by the managers' firms they end up in different leaves of such a decision tree with different outcomes. Kogut and Phillips (1994) use the decision tree to describe the possible output of the artificial investment which was used to observe investors' decisions about continuation or early exit from the investment project. Bianchi (1995) uses a decision tree to describe different contracting situations: The existence of three different factors (uncertainty about the future, asset specificity, and opportunistic behaviour) changes free market transactions into more costly ones, but the cost depends on the combination of the fore-

mentioned three factors (which "contaminate" the free market). Stahl and Haruvy (2006) use the decision trees to describe finite extensive-form game decisions where a player on every node chooses between selfish and kind actions. Every leaf presents a different combination of kind and selfish decisions and their pay-off.

5. Results

5.1. Group Comparisons

Table 2 compares economic variables between groups of men and women. Statistically significant differences were noted between women and men in all of the examined issues. As seen in Table 2, men more frequently (within their gender group) admitted to being exposed to currency risk than women. Not surprisingly, men also more often reported (again, within their gender group) using hedging against currency risk with both complex and simple derivative instruments. The question about the number of current sources of finance, where men reported more sources, needs to be further explained by the fact that we observed a statistically significant difference in the size of firms owned by women and men in the sample. Women ran smaller firms than men, and hence it is understandable that they used fewer sources of financing. The difference in firm size also indicates a greater conservatism in women's management of firms. Nevertheless, the question about planned future financing sources shows that as their firms develop, women plan to use more sources than men. In our view, planning for greater diversification of sources in the future also indicates greater conservatism among women, as diversification of financing sources limits potential risks associated with each form of financing (e.g., a leased asset cannot be sold, and a financial lease agreement cannot be terminated in a crisis). In our opinion, these are different aspects of the LSH. The LSH is also supported by the higher percentage of men (within their gender group) who incurred losses from using option strategies during 2007–2009. Thus, all aspects of economic decisions in firms covered by our study demonstrated greater conservatism among women when compared to men.

Table 2. Economic Variables in the Groups of Women ($N = 97$) and Group of Men ($N = 295$)

Specification	Women		Men		*t*-test (No Equality of Variance Was Assumed)		
	Mean	Standard deviation	Mean	Standard deviation	*t*	*df*	*p*-value (2-sided)
Use of complex derivatives such as option strategies (1 = yes, 0 = no)	0.03	0.17	0.15	0.36	–4.29	331.21	0.000

Table 2 cnt'd

Specification	Women		Men		*t*-test (No Equality of Variance Was Assumed)		
	Mean	Standard deviation	Mean	Standard deviation	*t*	*df*	*p*-value (2-sided)
Use of simple derivatives such as currency options, futures, swaps (1 = yes, 0 = no)	0.00	0.00	0.04	0.20	–3.53	286.00	0.000
Exposure to currency risk (1 = yes, 0 = no)	0.15	0.35	0.48	0.50	–7.24	229.82	0.000
Company does not hedge against currency risk (1 = yes, 0 = no)	0.97	0.17	0.82	0.38	5.08	347.29	0.000
Number of sources of funds already used in the company	3.06	2.53	4.54	3.40	–4.56	219.01	0.000
Number of sources of funds, that are going to be used in the company	15.70	4.92	13.44	5.36	3.84	176.54	0.000
Losses in 2007–2009 due to option strategies (1 = yes, 0 = no)	0.04	0.20	0.16	0.37	–4.07	303.78	0.000

Source: the authors' own calculations.

As shown in Table 3, there are no statistically significant differences in information processing; women and men are equally affected by heuristics and cognitive biases. Both groups scored very low on the CRT, answering correctly on fewer than one question out of three (we investigated whether respondents relied on fast thinking or aimed for slow thinking). Another question addressed cognitive errors such as the availability heuristic and conservatism, where we found no differences between women and men.

Risk attitude was examined using lottery choices, based on the selections proposed by Tversky and Kahneman (1974) within the framework of prospect theory. Two lottery choices were presented in the domain of gains and losses. In both cases, differences were noted between the responses of men and women. Men were more likely to take risks in lottery choices. However, the difference was weaker in the domain of gains ($p = 0.075$)[1] than in the domain of losses ($p = 0.006$). Overconfidence, measured by the number of "better than average" responses, also

[1] In this study, a *p*-value of 0.1 is considered statistically significant, as sometimes accepted in econometric analysis (Wooldridge, 2016).

Table 3. Behavioural Variables in the Groups of Women ($N = 97$) and Group of Men ($N = 295$)

Specification	Women		Men		*t*-test (No Equality of Variance Was Assumed)		
	Mean	Standard deviation	Mean	Standard deviation	*t*	*df*	*p*-value (2-sided)
Number of correct answers in CRT	0.16	0.55	0.20	0.56	–0.54	166.28	0.591
Availability heuristics (1 = more words starting with the letter)	0.82	0.38	0.75	0.43	1.63	183.98	0.104
Availability heuristics (1 = more deaths caused by a car)	0.55	0.50	0.55	0.50	–0.05	163.17	0.962
Availability heuristics – number of answers coherent with the bias in two tasks	1.37	0.60	1.30	0.55	1.06	151.66	0.291
Conservatism task – correct answer: 3.26	44.36	30.97	42.93	30.84	0.40	163.18	0.693
Number of risky choices in two decision problems expressed in gains	1.15	0.83	1.32	0.68	–1.79	139.91	0.075
Number of risky choices in two decision problems expressed in losses	1.16	0.79	1.41	0.66	–2.81	142.92	0.006
Number of answers "better than the average entrepreneur" out of 5 possible	2.54	1.53	3.11	1.45	–3.22	156.95	0.002

Source: the authors' own calculations.

differed between the groups of men and women. Men exhibited higher levels of overconfidence compared to women, men gave 3.11 out of 5 "yes" answers, while women provided 2.54 out of 5 positive answers on average.

5.2. Decision Trees Explaining Decisions on Taking Position of Options Strategies

Investigating the differences between women and men in decision-making within corporate finance (adopting the perspective of the LSH), we particularly focused on risk-taking tendencies, with behavioural factors being assigned a key explanatory role due to the research gap.

Given our focus on behavioural factors and decision-making processes, using decision trees to analyse firms that experienced losses (from option strategies) deepens our investigation into gender differences in risk taking (Tables 2 and 3).

While examining the differences in risk-taking tendencies between women and men, operationalised as the purchase of option strategies, we attempted to build decision trees based solely on behavioural determinants (separately for women and men), disregarding economic factors. The dependent variable for which decision trees are constructed for women and men separately, is whether a company incurred losses as a result of option strategies in 2008 ("yes" response). The "no" response includes two subcategories: Firms that existed in 2008 and did not incur losses, as well as firms that did not yet exist. The decision tree was focused on companies that responded "yes" to the binary question regarding losses, and it reveals the relationships between behavioural factors influencing risk-taking, particularly through engagement in option strategies.

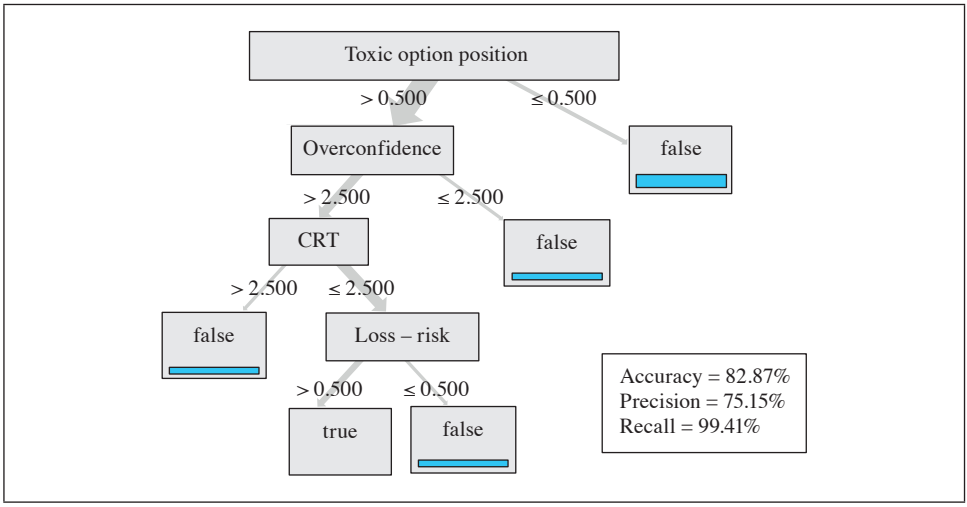

Fig. 3. Decision Tree for Male Gender

Source: the authors.

Table 4. Confusion Matrix for Male Gender (in %)

Specification	True false	True true	Class precision
Predicted false	66.28	0.58	99.13
Predicted true	33.72	99.42	74.67
Class recall	66.28	99.42	×

Source: the authors.

Figure 3 illustrates the decision tree derived from the survey results for the male gender only. Table 4 presents the confusion matrix for this tree (for the training sample). As shown in Figure 3, for men, significant factors leading to the use of option strategies included overconfidence, a low CRT score, and a high propensity for loss-related risk. In other words, men who decided to purchase option strategies were characterised by overconfidence, fast thinking (acting without deeper reflection or giving themselves time to thoroughly consider the problem), and a high tolerance for risk, even if it involved the potential for significant losses.

The overall accuracy of this decision tree was 82.87%, with a precision (how many people who actually purchased option strategies were correctly classified, relative to all those who purchased option strategies) of 74.67%, and a recall (indicating how many people identified by the model as having purchased option strategies actually did so) of 99.41%.

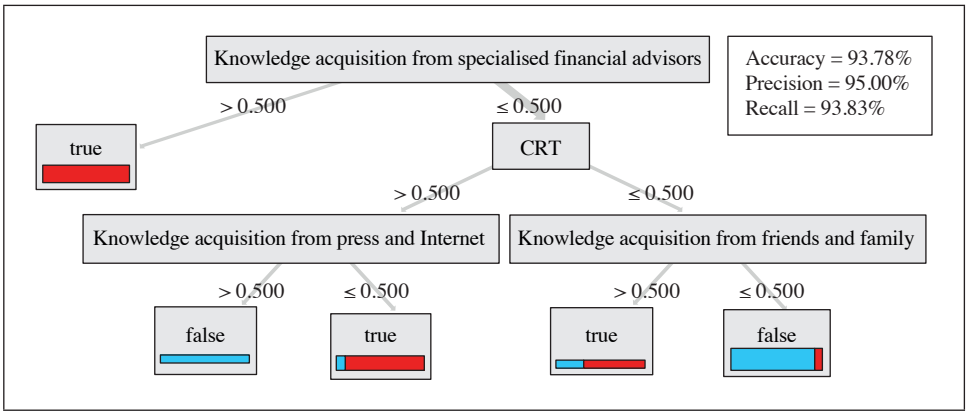

Fig. 4. Decision Tree for Female Gender

Source: the authors.

Figure 4 displays the decision tree for women. In their case, significant factors included reliance on the opinions of others and trust in financial advisors. Women who trusted financial advisors were more likely to purchase option strategies. For women who did not trust such advice, it was then the CRT score that turned out to be significant in determining the final involvement in option strategies. If a woman took time to reflect on the issue (CRT score high), then a key factor was whether she sought additional knowledge from the press and the Internet. If she made the effort to gather information, she did not purchase option strategies; if she did not, she went ahead with the purchase. In the case of fast thinking (CRT score low), consultations with family and friends were significant. Women who did

not rely on their advice did not purchase option strategies, whereas those who listened to such advice made the purchase. The overall accuracy of this decision tree was 93.78%, with a precision of 95% and a recall of 93.83% (the confusion matrix for the decision tree is given in Table 5).

Table 5. Confusion Matrix for Female Gender (in %)

Specification	True false	True true	Class precision
Predicted false	93.75	6.25	99.13
Predicted true	6.25	93.75	74.67
Class recall	66.28	99.42	×

Source: the authors.

As can be seen, the decision tree reveals a set of behavioural determinants influencing women's decisions to purchase option strategies, and these factors differ greatly from those affecting men. While men's decisions were often driven by overconfidence, women tended to be influenced by excessive trust in financial advisors and family, combined with a lack of deeper reflection and verification of information through press and Internet sources. It is worth noting that, although the decision trees do not show this explicitly, only a marginal number of women ended up purchasing option strategies. However, the trees do significantly classify risk-taking behaviour through engagement in option strategies, including in the case of women.

5.3. Logit Model of Factors Influencing Choices Regarding the Use of Option Strategies

Finally, we used the logit function to confirm significant factors that affected the decision to use option strategies. Tables 6–7 show estimated parameters of the model for coefficient and odds ratios.

Table 6. Logistic Regression Representing Determinants of Using Toxic Options, Logistic Version*

Toxic Option Exposure	Odds Ratio	Standard Error	z	$P > \|z\|$	95% Confidence Interval	
Gender_male	3.3047	1.9087	2.07	0.038	1.0653	10.2511
Overconfidence	1.9666	0.3163	4.20	0	1.4347	2.6955
Using opinions of other people	0.7195	0.0806	–2.94	0.003	0.5775	0.8963
Luck	1.8527	0.6630	1.72	0.085	0.9187	3.7361

Table 6 cnt'd

Toxic Option Exposure	Odds Ratio	Standard Error	*z*	*P* > |z|	95% Confidence Interval	
Knowledge acquisition from specialist financial advisors	2.9474	1.0309	3.09	0.002	1.4850	5.8501
Constant	0.01037	0.0099	–4.78	0	0.0016	0.0676

* Number of observations = 383, LR chi^2(5) = 67.58, Prob > chi^2 = 0.0000, Log likelihood = = –116.47895, Pseudo R^2 = 0.2249.

Notes: Constant estimates baseline odds.

Source: the authors' own calculations.

Table 7. Logistic Regression Representing Determinants of Using Toxic Options, Logit Version*

Toxic Option Exposure	Coeffi-cient	Standard Error	*z*	*P* > |z|	95% Confidence Interval	
Gender_male	1.1953	0.5775	2.07	0.038	0.0633	2.3273
Overconfidence	0.6763	0.1608	4.20	0	0.3610	0.9916
Using opinions of other people	–0.3291	0.1121	–2.94	0.003	–0.5489	–0.1094
Luck	0.6166	0.3578	1.72	0.085	–0.0847	1.3180
Knowledge acquisition from specialist financial advisors	1.0809	0.3497	3.09	0.002	0.3954	1.7664
Constant	–4.5680	0.9563	–4.78	0.00	–6.4424	–2.6936

* Number of observations = 383, LR chi^2(5) = 67.58, Prob > chi^2 = 0.0000, Log likelihood = = –116.47895, Pseudo R^2 = 0.2249.

Notes: Constant estimates baseline odds.

Source: the authors' own calculations.

Table 8. Marginal Effects Calculated Based on the Logistic Regression

Variable	*dy*/*dx*	Standard Error	*z*	*P* > |z|	95% Confidence Interval		Mean of Indepen-dent Value
Gender_male	0.0616	0.0234	2.63	0.008	0.0157	0.1075	0.7493
Overconfidence	0.0435	0.0096	4.51	0	0.0246	0.0624	2.989
Using opinions of other people	–0.0211	0.0075	–2.82	0.005	–0.0358	–0.0064	4.613
Luck	0.0391	0.0225	1.74	0.082	–0.0049	0.0832	0.5430
Knowledge acquisition from specialist financial advisors	0.0921	0.0395	2.33	0.020	0.0147	0.1695	0.2161

Source: the authors' own calculations.

As can be seen in Table 8, presenting marginal effects calculated based on the logistic regression, being a man (not a woman) has a significant impact on the decision to take a position on option strategies: Being male gender increases the probability by about 6.16 percentage points (p.p.). The second significant factor is overconfidence which increases the probability of using option strategies by 4.35 p.p. The third statistically significant factor turned out to be the fact of acquiring knowledge from other people (as opposed to using only one's own opinion and knowledge) which reduced the probability by 2.11 p.p. The fourth significant factor was the belief that one is lucky in life; as it increased the probability by 3.9 p.p. The last factor was acquiring knowledge from specialist financial advisors; it increased the probability of using option strategies by 9.2 p.p.

6. Conclusions and Recommendations

A comparison of men and women making financial decisions within companies revealed that, while they differ in some respects, they are similarly susceptible to behavioural biases. There are no statistically significant differences in information processing; men and women are equally prone to heuristics and cognitive biases. Both groups scored low on the CRT and demonstrated similar susceptibility to the availability heuristic. However, men exhibited greater overconfidence, particularly in the form of the "better-than-average" effect, believing themselves superior to the average entrepreneur in different areas of life. They also displayed a higher tendency towards risk-taking.

Decision tree analysis indicated different factors influencing men's and women's decisions regarding option strategies. The results support the LSH, showing that men were more overconfident and risk-prone, with overconfidence as the primary driver of their decision to invest in option strategies. In contrast, women's key determinant was their tendency to seek advice from financial advisors, family, or friends. By analysing relationships between variables, decision trees identified pathways leading to decisions about engaging in option strategies.

The final logit model confirmed the LSH, showing that being male increased the probability of using option strategies. Other significant factors included overconfidence, reliance on external knowledge rather than personal expertise, belief in luck, and seeking guidance from financial advisors.

Although the LSH aligns with the results, other factors may also explain these differences. Some are situational, such as economic cycles and institutional sales practices, while others are individual-related, such as financial literacy.

Risk-taking fluctuates with economic conditions. During economic booms, optimism and overconfidence drive risk-taking, while downturns encourage more conservative strategies. Before the financial crisis, Poland experienced strong economic growth, partly due to its EU accession. The appreciating złoty created

economic optimism, leading many exporters to take substantial foreign currency exposure, assuming continued appreciation. Financial institutions aggressively marketed complex option strategies as cost-effective hedging tools, and with limited financial literacy, many companies engaged in speculative transactions without fully understanding the risks.

This study has some limitations. The sample includes fewer women, reflecting the lower number of female entrepreneurs in Poland, which itself aligns with the LSH. Additionally, the sample consists of entrepreneurs from the Podkarpackie voivodeship, which may not fully capture business diversity across Poland. Finally, selection bias may be present, as participants were drawn from entrepreneurial training sessions, potentially skewing the sample toward individuals open to new experiences. Future research should expand the sample and incorporate longitudinal data to analyse financial decision-making over time.

Key recommendations include increasing women's participation in financial decision-making to mitigate losses caused by overconfidence and heightened propensity for risk. Some countries, such as France and Norway, have successfully increased female leadership through gender quotas. Similar policies could be implemented in financial institutions, requiring a minimum percentage of women in top roles. The EU Directive 2022/2381 on gender balance in corporate leadership, adopted in 2022, sets a precedent for this approach.

Another strategy is offering tax relief or funding incentives for companies that meet gender diversity targets in leadership. Since women in finance often lack access to influential networks, structured mentorship programmes could help bridge this gap. Encouraging financial firms to implement blind recruitment practices and structured interviews could further minimise hiring biases.

Finally, work-life balance challenges are a common barrier to career advancement for women. Addressing these issues through parental leave policies and hybrid work models could facilitate greater female participation in executive and financial leadership roles.

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Authors' Contribution

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Conflict of Interest

The authors declare no conflict of interest.

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