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EMPIRICAL ARTICLE

No evidence of risk aversion or foreign language effects in incentivized verbal probability gambles

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Abstract

Risk aversion—the preference for certainty over potential gains or losses—is reduced when using a foreign language. We investigated 2 mechanisms for this foreign language effect using incentivized gambles with verbal probability expressions: (1) that people perceive prospects of winning as larger when a decision is made in their foreign language; (2) that people experience reduced negative affect toward risk in a foreign language. In Experiment 1, $N = 229$ proficient Polish–English bilinguals, using ungridded slider, assigned numerical values to 29 verbal probability expressions in both languages. We found small bidirectional differences in 13 of them, leading us to reject the first mechanism. In Experiment 2, $N = 281$ participants gambled in incentivized neutral expected value lotteries using a sample of the verbal probability expressions from Experiment 1. Participants gambled in either their native or foreign language, where participants could either accept around 50% of gambles (debiased to risk-neutral) or more than 50% (biased to risk-seeking). Surprisingly, we observed no significant risk aversion in either language condition, with participants' gambling behavior close to 50% in both cases. The finding that participants showed no risk aversion in native language condition meant we could not test whether foreign language reduces risk aversion. However, this result did show that using a foreign language does not promote excessive risk-taking. Our findings suggest that using verbal probability expressions does not bias participants' responses, and may inherently reduce risk aversion.

1. Introduction

Risk aversion leads people to avoid risks even when taking them would be beneficial in the long run. For example, people may prefer a certain gain of $40 rather than a 50% gamble of $100 or nothing (Von Neumann and Morgenstern, 1944). While risk aversion can be adaptive in many situations, providing a safeguard against potentially catastrophic losses, excessive risk aversion can also have negative consequences in certain contexts.

From an economic perspective, high levels of risk aversion can lead to suboptimal decision-making, particularly in domains such as entrepreneurship and investment. For instance, overly risk-averse behavior may limit entrepreneurial initiatives and result in conservative investment strategies, potentially hindering economic growth, and resilience (Rabin, 2000).

The tendency to prefer safer, lower-yield investments not only leads to inefficient capital allocation but also reduces funding for high-risk, high-reward projects crucial for technological, and economic advancements (Bernanke, 1983; Lerner and Wulf, 2007). Economies dominated by risk-averse behaviors may experience slower growth and reduced adaptability to global economic changes, impacting their overall competitiveness, and ability to recover from financial downturns (Aghion et al., 2009; Zingales and Rajan, 2003).

On an individual level, while there is no objective criterion for determining optimal levels of risk aversion, some decisions clearly reflect excessive caution. For example, selling a 50–50 gamble of winning either $0 or $100 for $1 represents more extreme risk aversion than selling it for $40. Both of these risk-averse decisions can be rational in a particular decision context, yet the former is less likely to be beneficial in the long run. Therefore, rather than attempting to eliminate risk aversion entirely, interventions should aim to moderate extreme risk-averse decisions while promoting a more strategic risk assessment.

Current interventions against excessive risk aversion include enhancing information and expertise through financial and entrepreneurial training (Lusardi and Mitchell, 2014; Martin et al., 2013), and modifying societal contexts to reduce the negative consequences of risk-taking, such as incentive-based innovation policies (Hall and Van Reenen, 2000) or social protection programs (Banerjee et al., 2024). These interventions target reflective decision-making, which people rarely engage in daily life. When deciding, people typically rely on intuitive, affect-driven responses (De Neys, 2023; Kahneman, 2011). Hence, risk avoidance based on gut feelings and learned attitudes toward risk, often occurs before analytical considerations (Loewenstein et al., 2001; Slovic et al., 2007). Consequently, providing rational knowledge about risk-taking is effective only when individuals are emotionally prepared to consider risk. To see how this is critical to understanding decision-making, consider a finding that entrepreneurial training benefits people who are less risk-averse the most (Fairlie and Holleran, 2012). So, the knowledge-based intervention is limited in effectiveness to people who are dispositionally ready to use it. To effectively influence decision-making, we must address the decision-maker's psychology, focusing on their affective reactions to risk and overall risk attitudes.

Psychological literature offers various simple interventions that can influence decision-making, including choice architecture techniques like setting defaults (Thaler and Sunstein, 2021), priming (Cohn and Maréchal, 2016), mindset manipulations (Murphy and Dweck, 2016), or language-related manipulations such as framing (Homar and Cvelbar, 2021).

A recent extension of this approach suggests that decision-making in a foreign language differs from that in one's native language, potentially reducing bias (Keysar et al., 2012), particularly in risky choice scenarios. Individuals appear less risk-averse when using a foreign language, especially in gambles with positive expected value (EV; Circi et al., 2021; Del Maschio et al., 2022). Unlike methods that provide relevant knowledge or alter incentive structures, this approach appears to directly influence risk aversion.

Most evidence for reduced risk aversion in a foreign language comes from research using hypothetical choices. These experiments typically use lottery tasks with numerical probabilities, such as: 'You can lose ₩200 or win ₩500. The chance of each outcome is 50%. Would you take part?' (Keysar et al., 2012). A critical limitation of these tasks is that they use unambiguously positive gambles. The EV of such a gamble is calculated by multiplying each outcome by its probability and summing the results. In the example above: (0.50 * −₩200) + (0.50 * ₩500) = −₩100 + ₩250 = ₩150. From a purely mathematical perspective, rejecting such a gamble (effectively turning down ₩150) indicates a decision bias. While real-world considerations (such as not being able to afford the potential loss) might justify rejecting such gambles, the focus of the foreign language effect-related experiments is on the normative, mathematical aspects of the decision.

Critically for our project, risk-taking in positive EV gambles is indistinguishable from reckless risk-taking. In such tasks, the normatively correct response is to accept all bets. Yet, observed decisions might show only 30% acceptance. Any post-intervention increase can be interpreted as improved decision-making by a more strategic risk-taker. But this interpretation is problematic because

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a completely risk-seeking person would also accept all of these gambles, regardless of the specific positive EV. The true benefit of using a foreign language should be promoting more strategic risk-taking, not simply eliminating (adaptive) risk aversion entirely. Gambles with positive EVs alone cannot effectively measure this distinction. They cannot differentiate between improved strategic decision-making and a potentially harmful reduction in risk aversion.

To address this problem, we decided to use gambles with neutral EVs. Then, the normative answer is to be risk-neutral, which translates to taking 50% of gambles. Using neutral gambles allowed us to differentiate between merely increased willingness to risk, whether reasonable or not, and increased willingness to risk only when the EV is more positive.

There is another potential issue associated with the previous literature. Typical studies on the foreign language effect on risk-taking present probabilities using numbers, for example, there is a 50% chance of a positive event. However, there are several limitations of this method, which is why we decided to use verbal probability expressions in our study. First, people typically think about numbers in their native language or revert to the language of their early schooling (Pavlenko, 2006). Such language switching during numerical tasks can independently affect cognitive processing (Oganian et al., 2016). So, changes in risk-taking can be a result of using a foreign language or language switching.

Second, verbal probability expressions better reflect real-world communication about uncertainty than numerical expressions. People naturally prefer verbal expressions over numerical probabilities because they feel more personal and intuitive (Wallsten et al., 1993). For example, a Londoner asked about rain would say 'very likely' rather than '81% chance'.

Finally, verbal probability expressions carry richer social context than numbers. They more easily convey whether outcomes are positive or negative, indicate the speaker's intentions (Honda and Yamagishi, 2017), and communicate information about uncertainty sources and outcome severity (Teigen, 2023).

In sum, using verbal probability expressions provides a more natural and real-life mimicking test of the effects of using a foreign language. However, rather than affecting risk preferences, foreign language can change what people understand using those verbal probability expressions[1]—that is, their meaning might get 'lost in translation'. In previous studies, numerical values assigned to verbal probability expressions in English were different to those obtained for equivalents in Dutch (Willems et al., 2020), French (Davidson and Chrisman, 1994), German (Doupnik and Richter, 2003), and Chinese (Harris et al., 2013). In contrast to our research, none of the above studies asked the participants to deal with expressions in a foreign language, rather they compared their native language judgments to the native language judgments of English speakers. If bilinguals show the same pattern, using a foreign language could distort the perceived probabilities and guide the subsequent choice. For example, the chance of winning, described as *very likely* could be understood as 70% in one's native language, but 80%, in their foreign language. In such a case, participants would be more willing to gamble in their foreign language. Yet, this effect would not be considered reduced risk aversion, as it would reflect a rational reaction to increased chances of winning.

To sum up, risk aversion can be excessive and decrease the quality of decisions made under risk. Using a foreign language has been suggested to reduce risk aversion, and result in decision-making closer to the one predicted by normative models.

[1]This has an underlying assumption that, when facing statements such as 'likely', people perform mental arithmetic by substituting the word likely with some number they believe fits this word best. We do not necessarily agree with it but cannot exclude it from the potential mechanisms guiding risky choice. Instead, verbal probability expressions can be understood as a numerical range rather than a precise number. For example, 'likely' can be mentally represented as placed somewhere between 65% and 75%, rather than being exactly 70%. Such decision context taps on a psychological effect of uncertainty aversion: the union of risk aversion and ambiguity aversion (Calford, 2020). We return to this problem in 'General Discussion' section.

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2. Hypotheses and overview of the experiments

As discussed above, there are 2 possible mechanisms of how risk preferences might be affected by the use of a foreign language in gambles with verbal probability expressions:

1. Differential perception of verbal probability expressions: People might interpret verbal probability expressions differently across languages. For example, 'very likely' might be perceived as a 70% chance in Polish but an 80% chance in English. If this mechanism is responsible for reduced risk aversion in a foreign language, we would expect to observe consistently higher numerical values assigned to verbal probability expressions in the foreign language compared to the native language. This would lead participants to perceive winning as more probable, in turn increasing their willingness to gamble.
2. Altered risk attitudes: The use of a foreign language might change people's willingness to take risks. If this mechanism is responsible for reduced risk aversion in a foreign language, we would expect to observe the following pattern of decisions in neutral gambles (mathematically designed so that participants should be indifferent between certain and risky payoffs): in their native language, participants would exhibit risk-averse behavior, accepting less than 50% of the offered gambles. In the foreign language, participants would show either risk-neutral behavior, accepting around 50% of the gambles, or risk-seeking behavior, accepting significantly more than 50% of the gambles. The former shift to risk-neutral behavior would indicate greater consistency with a normative model of decision-making under risk. The latter shift from risk-averse behavior in the native language to risk-seeking behavior in the foreign language would indicate that using a foreign language alters participants' risk attitudes, making them open to taking risks. As such, it would replace one bias (more adaptive—risk-aversion) with another bias (less adaptive—risk-seeking).

Experiment 1 examined the first mechanism by asking participants to assign numerical values to verbal probability expressions in both their native language (Polish) and a foreign language (English). We found only small and inconsistent differences. Experiment 2 tested the 2 mechanisms. Participants made decisions in neutral gambles presented in either their native or foreign language. The probability of winning in these gambles was expressed verbally rather than numerically, and participants received real money based on their choices. We observed similar proportions of risky choices regardless of the language used that can be classified as risk-neutral (i.e., close to 50% of gambles taken).

Our findings suggest that risk-taking behavior is robust to the simple manipulation of presentation language. Neither the perception of verbal probability expressions nor risk attitudes appear to be significantly affected by the use of a foreign language in our study.

Experiment 1 was preregistered and is available at https://aspredicted.org/mm3xx.pdf. Data and materials for all experiments are located at https://osf.io/ydvxj/.

2.1. Experiment 1

As explained above, people can be less risk-averse using their foreign language. Such findings come from experiments where probabilities are expressed numerically. We wanted to have a more real-life relevant test of risk-taking and used verbal probability expressions instead. Thus, we wanted to know whether such expressions are understood differently in bilinguals, depending on whether they are presented to them in their native or foreign language. If this is the case, and people assign different numerical values to probability expressions, we would attribute potential differences in risk-taking in native and foreign languages to the different EV estimations driven by those estimations. In such a case, to test for potential changes in risk aversion driven by language, we would be interested in finding such expressions, that participants unambiguously understand.

This and the follow-up experiment were approved by the Institute of Psychology Ethics Committee at the University of Wrocław.

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2.1.1. Participants

We analyzed data from $N = 229$ (70 women, 155 men, 4 other; mean age 25, age range 18–58) native speakers of Polish of a mixed socio-economic background, who lived in Poland and had Polish native speakers for parents. They were recruited online using the Prolific platform. Additionally, we tested $N = 77$ individuals, who were excluded. Some of them ($N = 55$) failed the attention check question ('How often do you die of a stroke while watching Netflix?') by picking an option other than 'never'. The remaining $N = 12$ participants reported English proficiency scores below '5' on a 10-point scale.

2.1.2. Materials

We adapted probability expressions from Willems et al. (2020), employing the English phrases in their original form and translating them into Polish. The translations were provided by 4 independent translators to ensure that they accurately convey the original meaning.

2.1.3. Procedure

Each participant saw all 29 probability expressions in Polish (native language condition) and English (foreign language condition). They provided numerical values of the probabilities they associated with the phrases by moving a slider on a scale from 0 to 100%. To prevent the participants from rounding the numbers, they did not see the exact chosen numbers, and the slider did not snap to gridlines. Half of the individuals saw the native language version first; the other half saw the foreign language version first with a break between the blocks. There was also a training session preceding the main part of the experiment. The participants also solved the Berlin Numeracy Test (BNT)[2] (Cokely et al., 2012). That allowed us to investigate the potential dependencies between numerical abilities and the judgments provided. All individuals filled in the metrics, including questions about their English proficiency.

2.1.4. Results

Figure 1 illustrates that the variability in numerical interpretations of verbal probability expressions is similar both within and between languages.

We ran 29 independent *t*-tests comparing numerical value estimations between languages. Of these, 13 showed significant differences between languages. However, the differences were in opposite directions; some estimates were larger in native and some in foreign languages, and the average difference between estimates was 2% points (Table 1).

2.1.5. Discussion

Our first hypothesis proposed that increased gambling in a foreign language occurs because people overestimate their chances of winning. If this were true, we would expect probability estimates in the foreign language to be consistently higher than in the native language. However, our results showed no systematic bias in understanding probability expressions that could explain the previously reported decrease in risk aversion when using a foreign language. Although there may be differences in how native English and Polish speakers understand these expressions (see Supplementary Material), these differences don't significantly affect how bilingual speakers interpret direct translations of probability expressions in either language.

Given these findings, our second hypothesis—that foreign language use reduces risk aversion directly—appears to be a more promising explanation for the foreign language effect on risk-taking behavior. We tested it in Experiment 2.

[2]Additionally, we asked participants to judge how others perceive their personality on 4 dimensions (intelligence, creativity, impulsiveness, and extraversion) for the purposes of another study.

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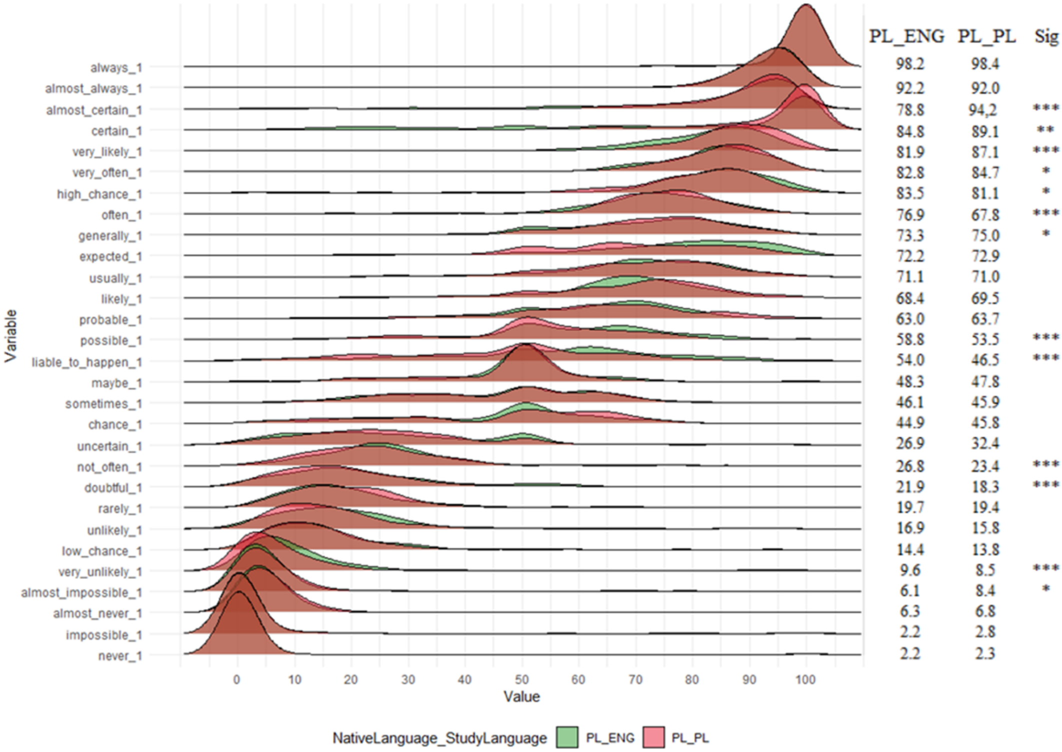

Figure 1. *Experiment 1 results—data distribution between languages.*

Note: Numerical values represent mean estimates in a given condition: PL_ENG (foreign language estimate); PL_PL (native language estimate). Column *Sig* refers to *p*-value of the corresponding *t*-tests: * <.05, **<.01, ***<.001

2.2. Experiment 2

Experiment 2 tested our second hypothesis—that using a foreign language directly reduces risk aversion, leading to either risk-neutral, or risk-seeking behavior. To investigate this, we designed a series of incentivized gambles using verbal probability expressions from Experiment 1. Participants were asked to choose between playing these lotteries or receiving a guaranteed amount of money calculated so that people should be indifferent between certain and risky options. If foreign language use generally reduces risk aversion, we would expect more risk-taking across all gambles in the foreign language condition. If using a foreign language promotes strategic risk-taking, the participants should take around 50% of the gambles. If using a foreign language increases risk-seeking, the participants should take more than 50% of the gambles.

While Experiment 1 was preregistered, Experiment 2 was not. The preregistration document was prepared but, due to an oversight, was never uploaded to the OSF platform. To ensure transparency and reproducibility, we have made all data, materials, and analysis scripts publicly available. Given the lack of preregistration, we encourage readers to consider the analyses of Experiment 2 as exploratory.

2.2.1. Participants

We analyzed data from N = 281 participants (age range: 18–47, mean 22, 200 women, 68 men, 13 others). They were a convenience sample consisting mostly of students at the University of Wrocław. On top of the possibility of the payment, they were offered course credits. Additionally, we tested N = 9 individuals, who were excluded since they assessed their proficiency in English as lower than '5' on a 1-to-10 scale.

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Table 1. *Eight chosen verbal probability phrases with descriptive statistics.*

Expression English	Expression Polish	Mean English	Mean Polish	P_diff (differences between means PL and ENG)	*p*-Value	Effect size [*d*]—Cohen's *d*
Certain	Pewne	78.8	94.2	15.4	<.001	−0.560, 95% CI [−0.699, −0.420]
Expected	Oczekiwane	76.9	67.8	−9.1	<.001	0.521, 95% CI [0.383, 0.659]
Very_likely	Bardzo_ prawdopodobne	81.9	87.1	5.2	<.001	−0.392, 95% CI [−0.526, −0.257]
Possible	Możliwe	58.8	53.5	−5.3	<.001	0.267, 95% CI [0.135, 0.398]
Usually	Zwykle	71.1	71	–0.1	.947	0.004, 95% CI [−0.125, 0.133]
Likely	Prawdopodobnie	68.4	69.5	1.1	.328	−0.064, 95% CI [−0.194, 0.065]
Uncertain	Niepewne	26.9	26.9	0	.997	0.00, 95% CI [−0.130, 0.129]
Probable	Można_oczekiwać	63	63.7	0.7	.610	−0.034, 95% CI [−0.163, 0.096]

2.2.2. Materials

The main part of the experiment consisted of 8 neutral EV lottery tasks employing the verbal probability expressions from Experiment 1 to describe the chance of winning. We strategically selected 8 verbal probability expressions from Experiment 1: 4 expressions with the largest differences in numerical estimates between languages (2 higher in the native language, 2 higher in the foreign language) and 4 expressions with closely matched estimates between languages.

For each task, the participants could choose to receive 15 PLN or take part in a lottery allowing them to win a larger amount. For example: 'Would you rather receive 15 PLN or take part in a lottery where it is uncertain that you will receive 61.20 PLN?'. We designed these as neutral lotteries by calculating the larger amount so that the EV would equal 15 PLN, based on the mean probability ratings from Experiment 1. For instance, because participants in Experiment 1 interpreted uncertain as corresponding to 24.5% on average, we calculated the lottery reward as 15/0.245 = 61.20 PLN. A risk-neutral person would have no preference between the guaranteed amount and the lottery only if they interpret the verbal probability expression similarly to the average participant from Experiment 1, and not in some other way, for example, as a probability range. Under this assumption, a group of risk-neutral individuals should gamble in about half of the tasks. Table 2 provides details for the complete set of gambles.

On top of testing the predictions described above, we speculated that people with higher numeracy may be better at estimating or/and using the EV (Mondal and Traczyk, 2023). Therefore, we controlled

Table 2. *Calculated payoffs for each probability phrase.*

Expression English	Expression Polish	Median English	Median Polish	Mean of medians (MoM)	Guaranteed amount	Reward ((15/MoM) /100)	Percent of the decision to gamble per language	
							Native	foreign
Certain	Pewne	93	100	96.5	15	15.5	81.1	77.5
Expected	Oczekiwane	79	69	74	15	20.3	40.6	55.1
Very likely	Bardzo prawdopodobne	84	88	86	15	17.4	49.7	50.7
Possible	Możliwe	59.5	52	55.75	15	26.9	34.5	28.3
Usually	Zwykle	72	73	72.5	15	20.7	58.0	47.8
Likely	Prawdopodobnie	70	72.5	71.25	15	21.1	32.9	34.8
Uncertain	Niepewne	24	25	24.5	15	61.2	53.8	47.8
Probable	Można_oczekiwać	66	66	66	15	22.7	26.6	29

individual differences in numeracy by having the participants solve the Berlin Numeracy Test (BNT, Cokely et al., 2012) to check whether mathematical abilities interacted with risk-taking. In other words, numeracy could control for part of the variance in risk-taking (not attributable to risk aversion), and potentially moderate the use of probability information (greater for more numerically able individuals). The BNT consists of 4 open-ended mathematical tasks without lures. An example item reads: 'Imagine we are throwing a 5-sided die 50 times. On average, out of these 50 throws, how many times would this 5-sided die show an odd number (1, 3, or 5)?'

2.2.3. Procedure

This face-to-face study consisted of 2 parts. First, the participant filled out a printed form containing the 8 lottery tasks; some participants made judgments in their native language ($N_{PL} = 143$), others in a foreign language ($N_{ENG} = 138$). The form also included the Berlin Numeracy Test (Cokely et al., 2012) and some metrics questions administered in Polish. In the second part, each participant used an 8-sided dice to draw one of the gambles they decided in the first part of the study. Depending on their previous choice, they were either given the guaranteed amount or took part in the lottery[3]. Here, participants drew a number using a random number generator. If the drawn number was smaller than the probability of winning estimated in Experiment 1, they received the prize. Else, they ended up with nothing.

2.2.4. Incentives

Participants knew beforehand that the lotteries would be incentivized, and in case of winning, paid out. In each of the lotteries, they could choose either guaranteed 15 PLN or a given larger amount of money that they could win with some probability. For reference, 15 PLN can buy you a small latte at Starbucks in Poland. Participants were paid right after the conducted experiment (mean win = 15.16 PLN, maximum win = 61.20 PLN). The incentive allowed us to obtain answers as close to real-life behavior as we could in an experiment.

[3]For exploratory reasons, we also asked participants for the estimations of the probabilities in the lotteries that were chosen for them to play (but before providing them with the result of the lottery). However, we do not report the data in the text because more than half of the participants did not provide the estimations due to experimental error. The data are available at the osf for independent analyses of the interested parties.

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Table 3. *The results of the experiment.*

Names	*B*	*SE*	*OR*	95% OR confidence interval		*z*	*p*
				Lower	Upper		
(Intercept)	−0.14	0.08	0.87	0.75	1.01	−1.89	058
Numeracy (0–4)	−0.07	0.06	0.93	0.82	1.05	−1.15	.251
P_diff (PL—ENG)	0.02	0.01	1.02	1.00	1.04	1.75	.08
Language (PL—ENG)	0.03	0.15	1.03	0.76	1.39	0.18	.855
Numeracy * language	0.19	0.13	1.21	0.94	1.55	1.49	.136
P_diff * language	0.03	0.02	1.03	0.98	1.07	1.17	.241
Numeracy * p_diff	0.00	0.01	1.00	0.98	1.02	0.29	.772
Numeracy * p_diff * language	−0.01	0.02	1.00	0.96	1.03	–0.28	.783

2.2.5. Results

We submitted the data to a generalized linear mixed model, with the decision to gamble as a dependent variable (yes/no), language of materials as a factor (Polish, English). Numeracy (0–4) and the difference between probability estimates (PL–EN) were covariates. The ID of a participant was a clustering variable. We centered all covariates, and coded factors as −0.5 and 0.5. For predictors, we used language (native vs. foreign) and the difference in assigned numerical values to the probability expressions (as a difference between median estimates).

If participants' choices align with their numerical estimates from Experiment 1, we would expect:

a) More risk-taking in foreign language for expressions estimated higher in that language.
b) Similar risk-taking for expressions with matched estimates.
c) Less risk-taking in foreign language for expressions estimated lower in that language.

For example, if 'expected' was estimated at 77% in English, but 68% in Polish, we might see more gambling in English for this term. Conversely, if 'certain' was estimated at 79% in English, but 94% in Polish, we might observe more gambling in Polish. To quantify these differences, we created a 'p_diff' parameter, calculated as the difference between Polish and English median estimates for each expression. This design allowed us to disentangle whether any observed differences in risk-taking were due to a general effect of foreign language use or to specific differences in the interpretation of verbal probability expressions.

Our analysis revealed no significant effects (Table 3). None of the fixed effects, including the effect of language, were significant.

2.2.6. Discussion

The analysis revealed no significant effects, including a non-significant intercept indicating that participants' gambling behavior was not different from 50% in either language condition. This risk-neutral behavior in the native language condition made it impossible to test whether foreign language use reduces risk aversion—we cannot reduce a bias that isn't present. However, our results do exclude the possibility that foreign language promotes excessive risk-taking, as participants didn't gamble more than 50% in that condition. Thus, while we cannot demonstrate that foreign language improves decision-making by reducing risk aversion, we can conclude it doesn't harm decision-making by promoting reckless risk-taking.

3. General discussion

Our initial goal was to study the debiasing effect of using a foreign language in risk-taking. We used verbal probability expressions to increase the ecological validity of our task. Surprisingly, our

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experiment showed no risk aversion in either language. Hence, we lacked a positive control condition, a condition in which risk aversion was robustly observed. This was a surprising finding since we expected people to be risk-averse at least in the native language condition. Because of this, we could not verify our main hypothesis regarding the debiasing nature of the foreign language effect: there was simply no bias to be debiased. Below, we will discuss the 2 results. First, we will look at the results of our focal hypothesis, namely the hypothesized debiasing nature of using a foreign language. However, we then will focus on the possibly more important, serendipitous finding regarding the overall lack of risk aversion in Experiment 2.

3.1. Foreign language effect

We observed no effects of using a foreign language on risk-taking, with all participants showing risk-neutral decisions. These null results do not necessarily refute the foreign language effect on risk-taking. It is possible that using a foreign language promotes strategic risk-taking rather than decreasing risk aversion (Hayakawa et al., 2019). Risk aversion reduction would increase gambling across all lotteries, while strategic risk-taking would increase gambling only in profitable (positive EV) lotteries. This is a critical distinction, because tasks with positive gambles, used in most prior research, should prompt people to accept 100% of offers. Such gambles allow us to differentiate between only 2 types of responding: non-risk-averse (strategic or risk-seeking) responding, where almost 100% of the gambles are taken, and risk-averse responding, where fewer gambles are taken. In such tasks, strategic risk-taking and reckless risk-seeking are indistinguishable. In contrast, neutral gambles that we employed in the study, should prompt people to accept around 50% of offers. They allow us to differentiate between 3 types of responding: risk-averse responding, where fewer than 50% of gambles are taken, risk-neutral (strategic) responding, where 50% of the gambles are taken, and risk-seeking responding, where more gambles are taken. Because the participants using a foreign language did not take gambles less or more than 50% of the time, we know that they did not become more risk-averse or risk-seeking. This excludes the negative effect of using a foreign language.

However, because the participants using a native language already took gambles 50% of the time, we cannot decide whether using a foreign language made participants more strategic or whether it had no effect at all. All would produce the same pattern of decisions, that is, gambling in approximately half of the neutral gambles. Future studies could differentiate between these possibilities using a mix of positive-EV, neutral-EV, and negative-EV gambles (e.g., as used in Hayakawa et al., 2019; Voudouri et al., 2024). If foreign language use promotes strategic risk-taking, participants should accept more positive-EV gambles, about 50% of neutral-EV gambles, and fewer negative-EV gambles compared to the native language condition.

3.2. No risk aversion

To the best of our knowledge, prior literature on verbal probability expressions focused exclusively on differences in how users of different languages interpret them, rather than on their effects on actual, incentivized risk-taking behavior. Our novel approach to studying risk aversion using such expressions instead of numbers led to an unexpected observation: participants exhibited risk-neutral choices, regardless of the language used to describe the decision problem.

The results need to be confirmed by experimentally comparing verbal versus numerical probability expressions in risk-taking tasks. Such comparison is crucial to determine whether verbal expressions genuinely reduce risk aversion or whether our results reflect other methodological factors. This is a necessary next step before drawing strong conclusions about the debiasing properties of verbal probability expressions.

Meanwhile, if the effect is replicated, several theoretical explanations are worth considering. The reduction in risk aversion might stem from the fact that processing numbers are more cognitively taxing than processing words. Cognitive load (unintendedly imposed by using numbers to express risk)

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can result in more risk-averse behavior (Deck and Jahedi, 2015) or decreased response consistency (Olschewski et al., 2018). By using verbal probability expressions, we may have unintendedly reduced the cognitive load, potentially prompting more normative responses.

While these explanations remain speculative until validated by direct comparison studies, they suggest promising directions for future research. Studies should not only compare verbal and numerical probability expressions directly but also test these potential mechanisms across diverse languages and decision contexts.

3.3. Limitations

Other than lacking a positive control condition, the study had additional limitations. We only researched 1 language pair. Perhaps it is the specifics of this particular pair that yielded such results. We also used gambles that are on average neutral, that is, the numerical value was assigned to each expression based on the median estimate provided by participants. Yet, these estimates are not identical for each person. Thus a gamble that is on average natural could be positive or negative for a particular participant based on their understanding of each expression.

Our study may have inadvertently tested uncertainty aversion rather than risk aversion. This distinction arises because our participants were not provided with precise numerical probabilities for outcomes in the lotteries. Instead, they were given probability ranges (e.g., a 'likely' outcome having a 60–70% chance), which represents uncertainty rather than risk. Risk scenarios typically involve known, exact probabilities (e.g., a 50% chance for each outcome in a coin toss). To illustrate the difference between risk and uncertainty, consider Simonsohn's (2009) study. In 2 experiments, participants were asked to value a gift card for a popular shop chain, worth either $50 or $100. Due to the uncertainty of the gift card's value, participants consistently valued it below the worst possible outcome—less than $50. This demonstrates how people tend to undervalue uncertain options. The Foreign Language effect has not been studied in the context of the uncertainty effect. Future research could address this gap by asking participants to provide numerical interpretations of verbal probability expressions, either as specific percentages or as ranges. This approach would help clarify whether we are observing risk aversion (if participants mostly provide exact numbers) or uncertainty aversion (if they predominantly give percentage ranges). This clarification is crucial for accurately interpreting our results and for guiding future research in this area.

4. Conclusions

Our study yielded 3 key findings. First, we found no evidence that using a foreign language reduces risk aversion in incentivized gambling decisions, though our data did exclude potential negative consequences of foreign language use, such as promoting reckless risk-taking. Second, while bilinguals showed some differences in their numerical interpretations of verbal probability expressions across languages, these differences did not translate into systematic differences in gambling behavior. Third, participants in both language conditions exhibited neither risk-averse nor risk-seeking behavior, with gambling rates consistently close to 50%. This unexpected risk-neutral behavior warrants further investigation, particularly through a direct comparison of verbal versus numerical probability expressions.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/jdm.2025.3.

Data availability statement. The data that support the findings of this study, as well as the materials used, are openly available in OSF at https://doi.org/10.17605/OSF.IO/YDVXJ. The pretest was preregistered and is available at https://aspredicted.org/mm3xx.pdf.

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Ethical standards. The study presented in this article was approved by the Institute of Psychology Ethics Committee at the University of Wrocław (decision number: 2021/DESCO).

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