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This is Your Portfolio on Winter: Seasonal Affective Disorder and Risk Aversion in Financial Decision Making

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Abstract

This study found that people who suffer from seasonal affective disorder (SAD) displayed financial risk aversion that varied across the seasons as a function of seasonally changing affect. The SAD-sufferers had significantly stronger preferences for safe choices during the winter than non-SAD-sufferers, and they did not differ from non-SAD-sufferers during the summer. The effect of SAD on risk aversion in the winter was mediated by depression.

Keywords

decision making, individual differences, seasonal variations, financial risk tolerance, seasonal depression, behavioral economics, economic behavior

Up to 10% of the U.S. population suffers from seasonal affective disorder (SAD), though "mood fluctuations over the seasons are not only present in SAD, but are—with smaller amplitude—also present in normal subjects as well" (Mersch, Middendorp, Bouhuys, Beersma, & Van Den Hoofdakker, 1999, p. 1020).[1] Recent research in finance suggests that SAD may be sufficiently powerful to move financial markets. For instance, Kamstra, Kramer, and Levi (2003) found that seasonal patterns in international stock market returns are consistent with individuals shunning risk in the more depression-prone fall and winter seasons. Specifically, they found evidence consistent with lower demand for risky stock in the fall and higher demand for risky stock in the spring, even after controlling for standard stock return regularities. To rule out other explanations, Kamstra et al. (2003) showed that these seasonal effects in stock markets were 6 months out of sync in the northern versus southern hemispheres, reflecting the 6-month difference in seasons across the hemispheres. At the other end of the risk spectrum, Kamstra, Kramer, and Levi (2011) found corroborative evidence and the same seasonal pattern of risk preferences in safe government securities. Specifically, they found evidence consistent with higher demand for the safest available investment vehicle, U.S. Treasury securities, in the fall and lower demand in the spring. The seasonal movement of safe Treasury returns is the mirror image of what is found in risky stock returns, again consistent with investors preferring safe investments over risky alternatives in the fall and winter seasons.

Similar supportive evidence for the notion that investor risk preferences vary seasonally is observed in studies of other types of financial quantities, including analysts' stock earnings forecasts (Dolvin, Pyles, & Wu, 2009; Lo & Wu, 2008), the underpricing of initial public stock offerings (Dolvin & Pyles, 2007), the returns to real estate investment trusts (Pyles, 2009), stock market volatility (Kaplanski & Levy, 2009), and the seasonal flows of capital in and out of safe and risky categories of mutual funds (Kamstra, Kramer, Levi, & Wermers, 2011). Historically, the field of financial economics has been skeptical of psychological mechanisms as explanations for market dynamics, so the "SAD" explanation for what looks like risk aversion in winter remains hotly contested (e.g., Jacobsen & Marquering, 2008, 2009; Kamstra, Kramer, & Levi, 2009, 2010; Kelly & Meschke, 2010).

Previous research on this topic has focused exclusively on aggregate financial market data. Consequently, the explanatory role of SAD has been inferred, rather than measured. In the present study, we measured the effects of SAD on seasonal risk aversion for individuals' financial decisions over time. In keeping with the results of economic studies of SAD, we hypothesized a quadratic risk profile for those who suffer from SAD—lower risk aversion in the summer, followed by higher risk aversion in the winter, and a return to lower risk aversion again in the following summer. However, we expected non-SAD

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participants to exhibit a less variable seasonal pattern than their SAD counterparts.

The role of affect and mood in economic choices is a topic of increasing scholarly interest (Loewenstein, Weber, Hsee, & Welch, 2001; Rick & Loewenstein, 2008). As explained by Grable and Roszkowski (2008), there are two competing theories for how mood influences financial risk aversion. Under the affect infusion model (AIM; Forgas, 1995), negative mood should increase risk aversion and positive mood should decrease it. According to AIM, positive (negative) mood causes one to focus on positive (negative) environmental cues, which may influence one's subjective probability assessments and lead to greater risk aversion for individuals in negative moods (cf., De Vries, Holland, Corneille, Rondeel, & Witteman, 2010, for an extension of this work to "strong" or "dominated" choice situations). In contrast, under the mood maintenance hypothesis (MMH; Isen, Nygren, & Ashby, 1988; Isen & Patrick, 1983), people in a positive mood avoid risks to help preserve their state, whereas people experiencing negative mood are willing to take risks in hopes that they experience a positive outcome that bumps them back into a positive mood. In our estimation, AIM is a better model for the behavior of an individual in a relatively persistent negative mood state, such as someone who suffers from SAD, whereas MMH is more consistent with the behavior of an individual who is in a temporarily induced mood state (such as a participant in an experiment in which mood is induced using sad film clips). Experimental evidence is consistent with this hypothesis. Studies of individuals who have been diagnosed as depressed by a mental health professional using structured clinical interviews are uniform in finding that depression is significantly associated with increased risk aversion. See, for instance, experimental results of Pietromonaco and Rook (1987) and Smoski et al. (2008). In contrast, studies of healthy individuals who have been induced to experience temporary sadness, for instance, by watching a brief sad film clip, tend to find that subjects induced to have a sad mood tend to select riskier financial choices over safer ones (e.g., Raghunathan & Pham, 1999). Studies such as these typically measure financial risk aversion using methods that have payouts that mimic financial risk, with a trade-off between risk and return, in an effort to replicate real-world financial decisions. Further, participants' payments are typically risky, with outcomes determined based on the level of risk chosen.

Consistent with the inferences of financial markets research (Kamstra et al., 2003), the principles of AIM (Forgas, 1995) and our hypothesis, we found that people who suffer from SAD exhibited more pronounced seasonal variation in aversion to financial risk than people who do not suffer from SAD. In addition, this dynamic was easily discernable even in data collected during a time of considerable financial turmoil (summer 2008 through summer 2009).

Method

In July 2008, we sent approximately 5,000 e-mail invitations to faculty and staff randomly selected from the staff directory of a large North American university. Respondents completed an online survey that included personality measures and a behavioral assessment of their willingness to assume a real financial risk ($N = 730$). Respondents were also invited to participate in second (December 2008) and third (July 2009) waves of data collection. Additional participants were invited to complete each of the latter waves to ensure that any observed differences between waves were legitimately attributable to season, and not effects attributable to having participated in earlier waves (cf., Shadish, Cook, & Campell, 2002); null differences during Wave 2 between those who joined in Wave 2 and those who had also completed Wave 1 satisfied us that observed differences between waves in our focal sample (those who completed all three waves) were not an artifact of our study design.

In order to test our quadratic interaction hypothesis, our primary analyses focused on those individuals who participated in all three waves ($N = 331$, 31.9% male, Mean age = 43.69, $SD = 12.18$). Participants completed the seasonal pattern assessment questionnaire (SPAQ; Rosenthal, Genhart, Sack, Skwerer, & Wehr, 1987), a diagnostic measure of SAD, and they completed the central risk-aversion measure in all three waves; they also satisfied basic screens for data quality.[2] Following Magnusson (2000), we categorized participants as suffering from SAD if their SPAQ score was 11 or greater ($N = 107$). We measured participants' levels of depression in each wave using the international personality item pool (IPIP) depression scale (Goldberg et al., 2006; $\alpha = .89$).

Behavioral Measure of Risk Aversion: The Safe Asset Versus Risky (SAVR) Task

Participants were promised a guaranteed payment of $20 for each wave completed. At the end of each wave, participants were offered the option of receiving their guaranteed payment of $20, or allocating some or all of it to a risky "investment" that would either increase or decrease their payment with 50:50 odds. To accurately mimic financial risk, where accepting risk leads to higher payoffs on average, the potential gains exceeded the potential losses; see Appendix A for the exact wording of the task, which we call the safe asset versus risky (SAVR) task. We used the proportion of each payment that participants allocated to the safe investment as our measure of their financial risk aversion at that time; that is, 100 minus the proportion they chose to allocate to the risky investment. Participants were paid in accordance with their choices, using the stated odds to generate payment in cases where participants selected a risky choice.[3]

Results

SAD and the Seasonality of Depression

As expected, depression varied over the course of the year only for SAD-sufferers; see Figure 1. A repeated-measures analysis of variance (ANOVA) revealed the expected interaction

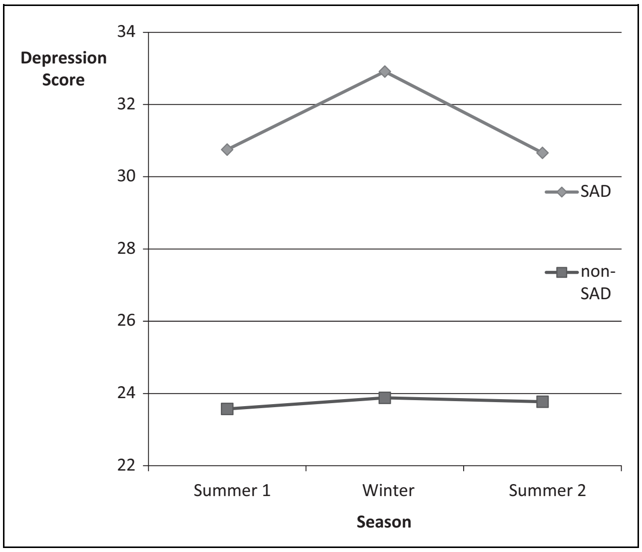

Figure 1. Seasonal fluctuations in depression score (IPIP) over time as a function of seasonal affective disorder (SAD) classification.

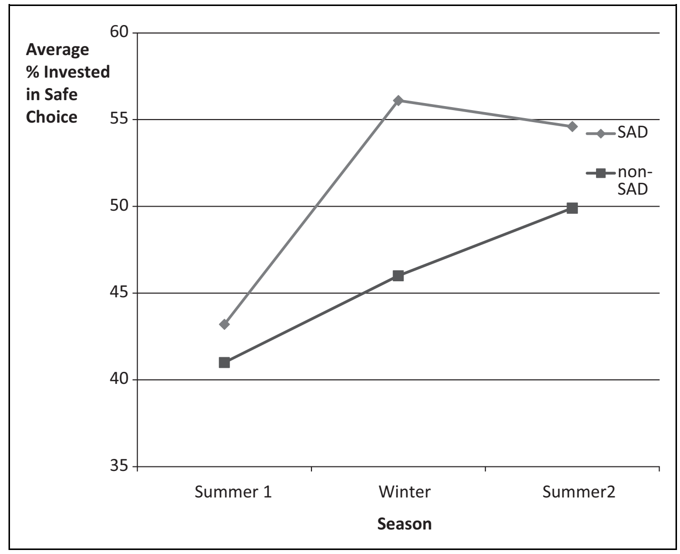

Figure 2. Seasonal fluctuations in financial risk aversion over time as a function of seasonal affective disorder (SAD) classification.

between season (summer, winter, summer) and SAD, $F(1, 280) = 4.64$, $p = .032$. This supports the use of SPAQ as a measure of SAD in this sample.

SAD and Seasonality of Financial Risk Aversion

Measures of financial risk aversion may be confounded by age (Morin & Suarez, 1983), and/or sensation-seeking tendency (Wong & Carducci, 1991). Therefore, we statistically controlled for these factors by including age and dangerous ($\alpha = .82$) and impulsive ($\alpha = .87$) thrill-seeking scores as covariates (see Goldberg et al., 2006) in a repeated-measures analysis of covariance (ANCOVA; with seasons as the within-subject variable).

As predicted, SAD-sufferers were more risk averse in the winter than their counterparts—that is, they chose higher guaranteed payments for their participation and put less money at risk—and the difference in the risk aversion between SAD-sufferers and non-SAD-sufferers decreased in the second summer. The analysis led, as predicted, to a significant interaction between SAD and season, $F(1, 298) = 4.448$, $p = .036$ (see Figure 2). Although severe macroeconomic conditions during the year of data collection may have caused participants to be more risk averse in the second summer than in the first (in absence of the financial crisis, we would have expected risk aversion to be similar in both summers), the critical point is that the SAD and non-SAD participants differed significantly in their winter risk aversion, and that risk aversion rose and declined for SAD participants, exactly as predicted. Planned comparisons revealed no significant differences between the choices of those with and without SAD in the two summers, whereas those with SAD ($M = 56.1$, $SD = 40.5$) were significantly more risk averse than their counterparts ($M = 45.5$, $SD = 42.5$) during winter, $F(1,298) = 5.817$, $p = .016$.

We also tested whether the effect of SAD on risk aversion was mediated by depression. Given that our primary hypothesis was an interaction between SAD status and season, with the degree of depression of the SAD and non-SAD individuals differing most in the winter, we focused on responses in the winter. Since the winter manifestation of SAD is, by definition, heightened depression, one must anticipate a high degree of multicollinearity between SAD and depression, which poses difficulties in formally assessing mediation, as noted by Baron and Kenny (1986). We therefore enhanced the statistical power of our mediation test by including the additional participants who took part in the winter data collection but did not participate in the first and/or second summer data collections (and who passed our data-consistency checks). To ensure the legitimacy of doing so, we tested whether these participants differed from those who had participated in all three waves on any of the relevant variables; they did not.[4] This increased the sample size for this analysis from 331 to 456. We used the Preacher and Hayes (2008) algorithm for estimating the four Baron and Kenny (1986) steps, using the bootstrap to estimate confidence intervals for the effects of SAD on risk aversion through depression. In our mediation tests, the SAD measure was the total score on the SPAQ questionnaire and, as before, risk aversion was the percentage allocated to the safe investment and depression was measured using the IPIP depression measure, all captured in winter.

The results of the Baron and Kenny (1986) steps are as follows. The effect of SAD score on risk aversion, or path c, is 0.91 ($p = .0373$). Step 1 passed. The effect of depression on risk aversion, path a, is 1.17 ($p < .0001$). Step 2 passed. The effect of depression on risk aversion controlling for SAD, or path b, is 0.27 ($p = .0997$). Step 3 passed based on a 10% level of confidence. The effect of SAD on risk aversion controlling for depression, or path c' ($p = .2124$). Step 4 passed. The 90% bias-corrected bootstrap confidence interval based on

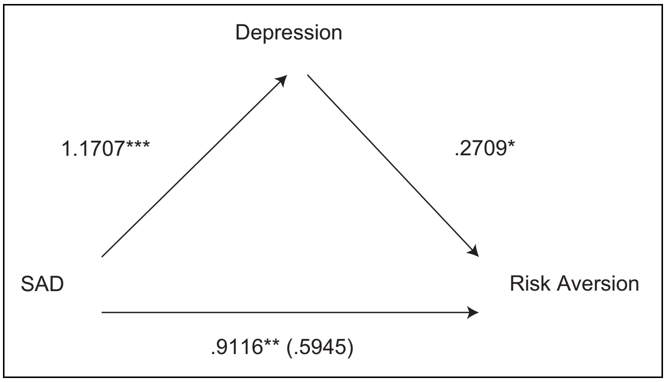

Figure 3. Depression mediates the effect of seasonal affective disorder (SAD) on risk aversion in the winter.
* $p < .10$; ** $p < .05$; *** $p < .01$.

1,000 trials is from 0.0256 to 0.6669. Since zero is not included within this confidence interval, we conclude that the effect of SAD on risk aversion in the winter was mediated by depression. Figure 3 documents this mediation analysis graphically.

Discussion

These results deepen our understanding of human risk-aversion tendencies, showing for the first time that seasonal variation in affect—specifically the depression associated with SAD—is significantly related to seasonal variability in risk preferences. Our findings strengthen the case that seasonal variation in individual risk preferences influences financial market seasonality.

The period of our data collection was not a typical year for financial markets; it ended up being labeled as the financial crisis of 2008/2009. We began our study at a point in time when the New York Stock Exchange (NYSE) Composite Index had declined but was still around 80% of its previous year's peak. (The index value was ~8,600 vs. its peak of ~10,300 in 2007.) By the time of the third wave of our study, in the summer 2009, the NYSE Composite Index suffered further losses, had exhibited considerable volatility, and was still hovering below 60% of its peak (at ~6,000). Consistent with these extreme market conditions, we found participants selected safer options in the second summer relative to the first summer.

The unusual market conditions during our study raise an inevitable question: Were SAD participants more risk averse in winter only because they were more reactive to the dreadful financial market conditions in the winter than non-SAD participants? On the one hand, consistent with Forgas' (1995) AIM and our argument, it seems plausible that SAD participants may well have been more prone to negative market influence than the non-SAD. However, on its own, this alternative account does not constitute a complete and satisfactory explanation. First, the results reported here are consistent both with our theoretically derived hypotheses and with the findings of existing empirical work on financial markets that was conducted on time periods that were untouched by unusual market turbulence. Second, examining the upward trend for non-SAD participants across all three waves, as depicted in Figure 2, one might wonder whether it was the non-SAD who were reacting most uncharacteristically. We think the idea that SAD and non-SAD participants might have responded differently to the crisis conditions in the financial world during the study might be a complementary, rather than alternative, explanation; at most, we think such dynamics might account for the exacerbation of still-real differences.

Another reasonable question is whether the effects documented in this study are sufficiently powerful to drive the empirically observed seasonal variation in financial markets (e.g., Kamstra et al., 2003). We note, first, that economic theory dictates that market equilibrium occurs at prices set by the marginal trader (see the classic economics papers by Bierwag & Grove, 1965; Hicks, 1963). That is, for a price change to occur it is not necessary that all financial market participants agree. Rather, the behavior and decisions of a subset of individuals can easily drive market movements. Further insight arises from a theoretical study by Kamstra, Kramer, Levi, and Wang (2011). Those authors developed an asset pricing model that included the time-varying investor preferences of an investor who suffers from SAD. They found that the amount of seasonal variation in risk aversion required to generate the observed seasonal patterns in actual stock and Treasury security returns was well within the range of values generally accepted as reasonable by economists. That is, small changes in preferences in the range demonstrated by participants in this study are sufficient to move markets.

Importantly, this study offers the first and only direct test of the psychological mechanisms hypothesized to drive a robust and controversial effect in financial markets (e.g., Kamstra et al., 2003). From a methodological perspective, studies like this one should challenge academics across fields of inquiry to look for ways to discipline their own work by borrowing insights, theory, and methods from other areas. From a more applied perspective, this study should prompt researchers to consider how seasonally varying mood might influence financial decision making. If SAD and the depression associated with SAD influence individuals to hold excessively conservative portfolios, that may have far-reaching effects not only on their socioeconomic status but also on their life expectancy and general health and well-being (e.g., Smith, 1999).

Appendix A

Safe Asset Versus Risky (SAVR) Task

As noted at the outset of this study, you can receive a guaranteed $20 for your participation. As of now, you have earned that $20 and have a right to receive it.

However, we would like to offer you the opportunity to "invest" that money now. Like all nonguaranteed investments, this means you might end up with more than $20 or you might end up with less than $20. (As explained below, you are free to elect not to participate in this investment opportunity.)

We will be asking you to indicate what percentage of your $20 payment (if any) you would like to invest. There is a one-in-two (50:50) chance that this investment will more than double the amount you invest (i.e., it will pay a 110% return on your investment), and there is an equal probability that the risky opportunity will pay a –100% return on the amount you invest (i.e., you will lose the amount you invested). For example:

If you invest 100% of your payment ($20), there are equal chances that you will receive either $42 or $0.
If you invest 50% of your payment ($10), then you will receive $10 with certainty, plus there are equal chances that you will receive either $21 or $0. That is, your total payment will be either $31 or $10.
If you invest 0% of your payment, you will receive $20 with certainty.

An independently verified random number generator will be used to determine your outcome. In other words, your payment will be determined in exactly the fashion described.

After you answer this question, we have just a few more brief questions to ask, and then you will have completed the survey.

What percentage of your $20 payment would you like to invest in this risky opportunity? Be aware that if you choose anything other than the last choice, you may not receive the full $20 payment for participating in this study. (You may receive more or less.) This choice is irrevocable.

- 100% (There are equal chances that you will receive either $42 or $0.)
- 90% (There are equal chances that you will receive either $39.80 or $2.)
- 80% (There are equal chances that you will receive either $37.60 or $4.)
- 70% (There are equal chances that you will receive either $35.40 or $6.)
- 60% (There are equal chances that you will receive either $33.20 or $8.)
- 50% (There are equal chances that you will receive either $31.00 or $10.)
- 40% (There are equal chances that you will receive either $28.80 or $12.)
- 30% (There are equal chances that you will receive either $26.60 or $14.)
- 20% (There are equal chances that you will receive either $24.40 or $16.)
- 10% (There are equal chances that you will receive either $22.20 or $18.)
- 0% I prefer not to participate in this investment opportunity (You will receive $20 with certainty.).

Note: We constructed a measure of risk aversion based on the response, ranging from 0 for the first option to 100 for the last option, reflecting the percentage of the "portfolio" allocated to the safe investment option—that is, 100 minus the percentage invested in the risky investment option.

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Notes

1. Seasonal affective disorder (SAD) was first formally described by Rosenthal et al. (1984). Clinical evidence demonstrates that SAD arises as a consequence of seasonal fluctuation in hours of daylight as opposed to other environmental factors, such as precipitation, cloud cover, and atmospheric pressure (Molin, Mellerup, Bolwig, Scheike, & Dam, 1996; Young, Meaden, Fogg, Cherin, & Eastman, 1997).
2. Screens for data quality included removing participants who completed the first survey faster than plausible for someone reading the questions and giving any consideration to their answers, or who failed one of three simple patterned response tests. Participants were removed if they completed the first survey in less than 25 min. The median response time was 48 min. We developed patterned response tests for inclusion in this study. Failure resulted if a subject indicated that they were both over the age of 75 and younger than 75, that they were born on February 29 when in fact they were not born in a leap year, or if they reported having climbed Mount Everest.
3. Note that while this task replicates the trade-off between risk and return inherent in financial risk, a limitation of our study (and many similar studies) is that participants faced no risk of ending the experiment with less money than they began with. In this sense, we mimic imperfectly the risk investors face in financial markets.
4. There were no statistically significant differences between new participants and repeat participants on risk aversion, depression, SAD, age, dangerous thrill-seeking, or impulsive thrill-seeking.

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