UNDERSTANDING THE SOURCES OF THE INSURANCE RISK PREMIUM

The insurance risk premium, also known as the volatility risk premium, refers to the observed phenomenon that option-implied volatility tends to exceed realized volatility of the same underlying asset over time, thus creating a profit opportunity for the volatility sellers¹. This difference is most apparent in broad market equity indices such as the S&P 500 Index.
For example, the implied volatility of S&P 500 Index options has exceeded the realized index volatility 85% of the time from January 1990 to September 2014 (shown in Figure 1). If options were priced at their fair theoretical value, the volatility embedded in options prices should, on average, be very close to the subsequent “realized” volatility of the S&P 500. However, options have historically traded about 4.4 percentage points above subsequent realized volatility. Said another way, the option market tends to overestimate future volatility, which means that options prices tend to trade with an embedded risk premium.

Figure 1: Implied volatility vs. average realized volatility for S&P 500 Index

This paper surveys the literature on the insurance risk premium and identifies three commonly accepted sources of the premium: behavioral biases of investors, economic factors, and structural constraints (Figure 2). The first source is the behavior of investors, namely, risk aversion, loss aversion, and availability bias—psychological heuristics developed through evolution for survival, but not necessarily suitable for the modern global financial marketplace. These behavioral biases then translate into financial and economic patterns that reinforce such premia. And a third source of this risk premium is found within market structural constraints, which can lead to a dearth of volatility sellers and cause an imbalance of buyers and sellers. The insurance risk premium, then, results from a combination of these behavioral, economic and structural factors. Its presence has been stable across time and is likely to persist in the future.

Figure 2: List of the factors behind the Insurance Risk Premium

Note: For informational purposes only.
There are several possible ways to monetize the insurance risk premium, including option strategies (selling calls, selling puts, selling straddles or strangles), swap strategies (selling volatility or variance swaps), or futures strategies (trading VIX futures). Such strategies are not without risks though, and attempting to monetize the insurance risk premium is not suitable for all investors. However, investors with long-term investment horizons, including institutional investors or high net worth individuals, who are willing, and able to bear the unique risks involved, may be in a good position to take advantage of the insurance risk premium and potentially harvest superior risk-adjusted long-term returns for their portfolios.

**BEHAVIORAL BASIS OF THE INSURANCE PREMIUM**

The ultimate behavioral bias is risk aversion. Humans hate uncertainty. Given the choice of two investments with equal expected returns, one with no volatility and the other with significant return volatility, most investors will choose the former. Most investors are even willing to sacrifice a certain amount of return in exchange for potentially more stable return streams. This preference for greater certainty of returns is generally the most important source of the insurance risk premium. Risk aversion may be evolutionary in origin. Early humans lived in a perilous world where all types of dangers were lethal, including carnivorous predators, harsh conditions, natural disasters and invisible pathogens. The trait of risk aversion may provide a significant competitive advantage in the race for survival, and kept our ancestors away from harm's way. In this way, risk aversion may be seen as ingrained in investors' DNA.

Loss aversion is another intrinsic bias for most investors. People are recognized to feel much more pain from losses than joy from gains, and to behave in ways that minimize potential losses, even at the expense of foregoing large potential gains. The psychologist Daniel Kahneman, one of the founders of behavioral finance, once found that to persuade people to play a simple coin-toss betting game, the gain must be more than $20 to offset the possible loss of $10. This phenomenon is nicely summarized in Figure 3.

Figure 3: Prospect Theory – Asymmetric psychological values of gains and losses

Source: Prospect Theory, Kahneman and Tversky (1979)
Starting with an understanding of people’s aversions to risk and loss, it follows naturally that when people are presented the possible payout curves for long or short option positions, they will strongly favor the long option positions of either calls or puts (Figure 4) that offer limited downside and large potential upside. Buying out-of-the-money put options appears naturally more valuable to investors since they offer investors protection on the downside when they face potential large losses, and act like the financial equivalent of insurance policies. Out-of-the-money call options have potential value since they embody potential large winnings with small premiums, becoming the financial equivalent of lottery tickets. Few investors want to be on the short side of either call or put option trades due to the limited upside and potentially large downside consequences. Because there are large numbers of potential buyers and few potential sellers, somewhat counter-intuitively, the economic law of supply and demand allows short options, and especially put options, to demand significant premiums in order for market demand to balance.

Figure 4: Payout curve for long/short option positions.

Another explanation for the large premium on put options may be the fact that put-selling has long been stigmatized as a gambler’s game. This bad reputation is probably justified due to the risk of a large potential payout associated with a short put position. This stigma is reinforced by the fact that the big payout may happen exactly when funds are needed the most by investors, during a crisis, and at the same time as all other assets in a portfolio are losing money. The economic law of supply and demand stipulates, again, that such a stigmatized trade can demand a significant premium for its associated risks.

The next behavioral bias that may further increase investors’ appetite for long options is the availability heuristic, which states that people tend to judge the importance of events based on the ease with which such events are recalled. Some events are recalled with great vividness and strong sentiments, negative events such as the Global Financial Crisis, Black Monday, and September 11, 2001 (many of us still remember every single detail of that morning). On the upside, the IPOs of Facebook, Google, or any other high flying stocks are still fresh in the minds of many investors. Such events weigh disproportionally high in our decision-making process. Many investors demand downside protection due to the enormous fear such crises evoke in their minds, or seek to participate in the rise of another miracle company, regardless of the actual probability that such events may ever happen again in the marketplace.

Lastly, the research reveals that people simply cannot grasp very small probabilities or other extreme numbers (Figure 5). They tend to overestimate their chances of winning the next Power Ball (approximately 1 in 200 million) or dying in a plane crash (approximately 1 in 50 million), which makes selling lottery tickets and air travel insurance profitable businesses. The blanket media coverage of lottery winners or plane crashes further strengthens this tendency, because of the impact of the availability bias. The public tends to value perfection, and any small deviation...
from a 100% score or a 0% error is thus given more attention than warranted. In the stock market, the Black Monday type of loss has (down 22.61% in one day) only happened once in history. But since it happened, people are constantly fretting when the next Black Monday will happen. The persistence of the insurance risk premium reflects this concern.

Figure 5: Weights of human decision on different probabilities

![Figure 5: Weights of human decision on different probabilities](image)

Source: Prospect Theory, Kahneman and Tversky (1979)

All market participants are human beings with human emotions, such as hope, greed, fear, excitement, dismay, frustration, etc. The market trends and prices are inevitably affected by such human emotions and the tendency to be risk averse, effectively preserving the continued good health of the insurance risk premium.

**ECONOMIC FACTORS**

Stock price dynamics include not only small incremental changes (random walks), but also the possibility of sudden and large price jumps. Option strategies can be designed to offer protection against unfavorable price movements and the premiums include coverage for both types of movements. The coverage against jump risk includes participation in a sudden upward jump (lottery tickets) or protection from a downward jump (disaster insurance). The potential for lottery ticket style returns are large for call options on some individual stocks due to the nature of the underlying business (such as small growth firms) but are less prominent for put options. While index level movements are similar to the dynamics of individual stocks, sudden upward jumps are relatively rare for indices. Purchasing equity index put options, especially out-of-the-money options, helps to "insure" buyers from market meltdowns, which is valuable for most investors.

Disasters do happen in the marketplace and the threat is very real for all market participants. Everyone remembers Black Monday, the Great Depression, and the more recent Global Financial Crisis, but no one can predict when the next disaster will strike. One measure asset managers can take to protect their portfolios is to purchase insurance against this unpredictable possibility. This search for protection creates significant demand in the market place for index put options. Index put options may appear cheap, costing less than $10 to $15 each for a potential payout of hundreds of dollars, but actually they are quite expensive in terms of the implied risk. Like tsunamis
or large earthquakes, stock market disasters actually happen very rarely. For example, even during
the two years of the Global Financial Crisis (July 2007 to June 2009), there were only two months
that the S&P 500 Index suffered losses of more than 10% (October 2008 and February 2009)
and put option prices were also at their most expensive levels during this time.

Alternatively, the insurance risk premium can be viewed as compensation for bearing certain
undesirable return/risk profiles. Besides jump risk and tail risk, correlation risk is another feared
risk\(^9\). Losses in the portfolio can accelerate when correlations converge to one. Some argue
that the main driver for the higher insurance risk premium for index put options is the increased
correlation both within the index and between asset classes. The payout of short put options
shows a negative skewness and a concave payout profile. This is the most detested return profile
for investors due to our natural aversion to losses\(^{10}\). Compensation must be high for bearing such
unwelcome risk factors.

The range of premiums and payouts for option contracts can vary widely, and thus carry very
different utility functions for investors. The premiums paid are usually small and do not represent
a significant burden for buyers. The payouts of options that are exercised are usually much larger
and carry much more weight in people's minds. For example, the payout for call options usually
happens when the market experiences upswings, investors are optimistic, market players are
willing to lend, liquidity is abundant, and the utility of such an expected payout is relatively low.
In contrast, the payout of put options usually occurs when the market is in a crisis mode, when
prices of other risky assets are plummeting, when liquidity is scarce and market participants are
unwilling to lend, and when many firms are worried about their balance sheets or even potential
bankruptcies. The purchase of a put option represents the frantic search for protection when it is
most precious and needed the most. Thus, put option sellers can be viewed as liquidity providers
of the last resort. Liquidity at this moment is such a precious resource that promises for providing
it warrants a significant premium. Constrained liquidity availability during a crisis also creates a
high threshold for volatility selling investors. Only a select group of investors can afford to take
the role of the liquidity provider during a crisis. Such investors usually have stable sources of cash
flows that are less affected by the economic cycle, e.g. endowments, foundations, pension funds,
sovereign wealth funds and high net worth individuals. Those who can embrace the role of liquidity
provider of the last resort get richly rewarded for providing this precious service for other investors
during a financial crisis.

**MARKET STRUCTURAL CONSTRAINTS**

The asymmetric payout profiles of long and short positions of option contracts can generate many
potential buyers, but few natural sellers. As the economic law of supply and demand generally
stipulates, the short positions must carry significant premiums for the market to balance between
the two sides of the equation.

Who are the option buyers and sellers? Option buyers can be divided into two groups, hedgers
and speculators. Speculators are investors betting on market directions and wishing to profit from
the movements. In comparison with betting on market indices, buying options may offer some
advantages. For example, potential loss is limited to the premiums paid vs. potentially unlimited
losses. Hedgers are usually asset managers who seek downside hedging positions to protect their
portfolios. When asset managers are concerned about possible market downturns, put options
potentially become convenient insurance instruments. Since there are many asset managers, and
as a group they invest trillions of assets that may need protection, this class of hedging forms
a potentially large basis for put option buyers. After the Global Financial Crisis, the concept of
downside protection, especially protection against tail risk, became popular among asset managers, maintaining a huge market for volatility products.

In comparison, the potential pool for option sellers is much smaller. Option market makers sell options but they usually seek to make money from bid-ask spreads and they are not systematically betting on volatility. Though they may accumulate net short positions due to the higher demand for long option positions by the customers, it is not their intention to make money from shorting volatility. They may hedge away the market directional risks embedded in their net option positions. Option selling may be perceived as a new investment strategy that is utilized primarily by sophisticated investors, and is classified as an alternative investment, which may further limit the potential number of sellers and the overall asset size for short positions. For example, a typical large multi-asset portfolio may have a 40% allocation to equity, 40% to fixed income, 10% to commodities, 5% to real estate, and only 5% allocation to other alternative investments. Of the 5% alternative allocation, the bulk may be allocated to “traditional” alternatives such as hedge funds or private equity, and maybe less than a percent to an volatility selling program, if any. On the other hand, many hedge funds may be utilizing option shorting strategies. When we compare the entire 40% allocation to equity that may need protection with the small allocation to option selling or related hedge fund strategies, we can more clearly see the impact of this essential imbalance between buyers and sellers of options.

Furthermore, when comparing put selling with call selling of index options, call selling may be a more attractive choice for many investors than put selling. Though call selling has the risk of potentially unlimited loss, large upward jumps are potentially very rare for equity indices. The payout of a call option happens when there is liquidity in the market. Any losses from shorting calls can potentially be offset by the gains in the equity portion of the portfolio if the call selling strategy is a part of a larger portfolio. Put selling, in contrast, faces many more obstacles. Because of the stigma associated with put selling (“conventional wisdom”), many investors may not even consider put selling as an investment strategy. The policy constraints of many mandates may also prevent investors from becoming put sellers. In recent years, writing call options has gained some traction in the market as a viable investment strategy. However, writing put options is a strategy that few are intrepid enough for, and the premiums embedded in put options are still significant, making it an unconventional but potentially attractive investment opportunity.

When we view the proposition of option selling (especially puts) from an asset manager’s point of view, we may find it associated with great career risk for the manager personally. If the market rallies and the trade goes well, they may still need to explain why they took the risk and why (they believe) the profit will persist in the future. On the other hand, if a crisis hits and the strategy suffers the initial losses (before the heightened premiums pull the strategy back above water), the manager may be blamed for the losses and risks being fired. On the other hand, if they are long options as a protective measure, few will blame them for buying insurance for portfolios, even though it is very expensive. John Maynard Keynes once commented on this unique risk for managers: “It is better for reputation to fail conventionally than to succeed unconventionally.”

**A PERSONAL ANECDOTE: BUYING EARTHQUAKE INSURANCE IN CHICAGO**

I used to live in Chicago and when I bought a house in a nice suburb of the city, the property insurance salesperson asked me if I would like an earthquake add-on to the insurance policy. I was not a geology expert but I did understand that earthquakes tend to happen at the edges of tectonic plates. Chicago, located in the center of the North American Plate, is unlikely to experience the large earthquakes that happen in Japan or California. I even checked the detailed seismology
records and found that the worst earthquake Chicago ever experienced in 250 years happened in 1909 and the only damage was a few chimneys in a remote town almost 30 miles from city limits. Given metro Chicago is virtually earthquake free, I expected the earthquake add-on to be fairly cheap. But to my surprise, it was very expensive and constituted a sizable portion of the whole property insurance. Naturally, I said, “No.”

To my wife’s and my own surprise, I changed my mind the very next day and purchased the earthquake insurance after all. Why?

First, the vivid images of devastating earthquakes are seared into our minds and will always pop up whenever an earthquake is mentioned (availability bias). Do you remember the images from the disastrous 2010 Haiti earthquake, or the 2011 Japanese earthquake and tsunami, or the 2008 Sichuan earthquake of China? No matter how small the chance of earthquake in Chicago, the threat of an earthquake never seems to be far away. Better safe than sorry!

Second, financially, when I thought about the cash flows of my family, the premium for the earthquake insurance constituted only a tiny portion of the annual budget and had almost no effect on the cash flows. However, if an earthquake does happen, liquidity will become very scarce for my family and the prospect of cash availability in such an emergency certainly sounds attractive.

Third, economically speaking, the utility of the premium for me was almost zero during normal times and when cash was abundant. However, the economic utility of the insurance payout would be priceless when my family was facing a certain financial ruin if earthquake did happen, no matter how unlikely it was. Also, it is unlikely I can get help from friends or neighbors when an earthquake does happen in Chicago as they will face the same problems.

In the end, even though I knew very clearly that earthquakes were as unlikely as ever in Chicago and the insurer was literally collecting (almost) free money, I still purchased the policy. The insurer was acting as a potential liquidity provider when cash is in urgent need and both parties of the transaction knew this clearly.

When I think about this experience, I can relate to put option buyers in the market place. Granted, there are no free lunches in the market and any potential returns should be balanced against commensurate risk. But there are risks that only a few are willing and able to bear, and those who do will expect to be rewarded richly.

**CONCLUSION: WHEN A LARGE EARTHQUAKE STRIKES CHICAGO**

Consider the following thought experiment. Imagine an unlikely event such as a large earthquake striking Chicago. Will the earthquake insurers be wiped out if this happens?

Very counter-intuitively, the answer is a likely no! Of course, the insurers will face an initial loss due to the large scale payouts for existing earthquake policy holders. The payout will be limited by the fact that there are not a lot of earthquake policy holders in Chicago. On the other hand, the premiums for earthquake insurance will skyrocket, and at the same time everyone will swarm to purchase policies. The insurers will likely make a fortune instead because of the increased demand and higher premiums, and future earthquakes remain as unlikely as before, since Chicago is still located in the center of the North American tectonic plate.

This is somewhat analogous to the performance of a put selling strategy during the Global Financial Crisis (Figure 6). As the market entered a tailspin in September of 2008, a systematic put selling strategy suffered initial losses comparable to the initial claims of an earthquake policy. However, in contrast to conventional wisdom, as fear prevailed in the market place, the insurance risk premium skyrocketed and the put selling strategy recovered quickly. The maximum drawdown happened
months earlier than the S&P 500 Index, and the put selling strategy recovered lost ground in just half a year. In contrast it took the S&P 500 Index five and half years to come back to its pre-crisis peak level.14

Figure 6 – Simulated cumulative drawdown of a put selling strategy in the Global Financial Crisis (Jan 2007 – Dec 2009)

Many investors question the validity of the insurance risk premium and these questions are quite reasonable. For example, certain trading strategies accumulate steady small gains with very low volatility but may incur disastrous losses, though with a small probability16. This aspect is certainly true prior to 2008 as the Global Financial Crisis showed the magnitude of the potential headwinds. Volatility selling, however, is not a static strategy but a dynamic one. Old contracts expire and new contracts are initiated. Our research and empirical experience show that volatility selling strategies tend to be more profitable during or immediately after a financial crisis.

Some critics have tried to simplify the insurance risk premium as compensation for unconventional risks such as increased correlations in a crisis, the negative skewness of the payoff, and the overall concave payout curve of volatility shorting strategies. We agree with this explanation and believe that it is an important reason behind the insurance risk premium, but it is by no means the full explanation. The insurance risk premium is a complex phenomenon and there are multiple drivers behind it, as this paper tries to explain. We want to point out that the premiums garnered for taking such risks are predominantly caused by investors' behavioral biases in the form of overestimating price movements, and the structural constraints in the market, namely the natural imbalance between options buyer and sellers.

It is important to emphasize again that monetizing the insurance risk premium in portfolios is not appropriate for all investors, but generally only for those investors with long investment horizons and adequate resources, who are less liquidity-constrained during times of market stress. The potential rewards for those who take on risk are generally driven by supply and demand in the market place, and when a crisis does hit, the contrarian investors and the well-resourced players should expect to be rewarded for providing financial assistance when it is most valued.

Investment strategies designed to harvest the insurance risk premium should be utilized throughout
the market cycle. The expected premium is usually higher when the market is in turmoil. However, as no one can time the market successfully, investors should or may want to consider having exposure to an insurance risk premium harvesting strategy at all times. The benefits of such a strategy include its simplicity, transparency, liquidity, and the expectation that the insurance risk premium will continue to exist in the markets. Investors who take on this unique risk premium thus should expect to benefit from it in good times and bad.

REFERENCES


NOTES

1 There are several reference articles explaining the insurance or volatility risk premium in depth: (Rennison & Pedersen, 2012) (McFarren, 2013) (Grant, Gregory, & Lui, 2007), and (Bakshi & Kapadia, 2003)
2 Some may argue that the implied volatility calculated from option prices are model driven and depend on the implicit assumptions of these models, and thus does not represent an unbiased expectation of future market volatility. However, implied volatility actually forms a “smile” shape when we plot implied volatilities against a range of different strike prices (the so-called Volatility Smile) due to the “fat-tail” of return distributions. Because of this, the VIX index is constructed to give an unbiased gauge of the market expectation on volatility for the next 30 days using a range of option prices (taking volatility smile into account). The insurance risk premium is easily observed when by noting that the VIX index is typically higher than the following 1-month realized volatility of the S&P 500 index. It is generally accepted in the industry that VIX serves as an unbiased market gauge of future volatilities, as the effects of fat tails are incorporated into the calculation of VIX.
3 Some may argue that options prices can’t get too far from “true value” because there are natural ways for supply to be created – options replication is one. Please note we are not arguing that options prices are inefficient. They are simply rewards for unconventional return/risk profiles and only a small number of investors are able to undertake such return/ risk profiles.
4 S&P 500 Index options relative valuation is measured by taking daily observations of implied volatility (the VIX Index) and subtracting the subsequent realized volatility of the S&P 500 over the following 30 days. VIX is the Chicago Board Options Exchange volatility index.
5 See (Litterman, 2011)
6 Figure 3 shows the main finding of the Prospect Theory. People generally value gains and losses very differently, with the pains from losses hurt much more than the joys over gains. The diagram shows that the utility of gain/loss shows an asymmetric S curve, with the lower portion (losses) much larger in magnitude. See (Kahneman & Tversky, 1979)
7 Figure 5 is a generic illustration based on the Prospect Theory by Daniel Kahneman and Amos Tversky. The graph shows that small deviation from a base state (0% or 100% probability) is usually given more weights in human decisions than warranted by probability. As a result, lottery prices are usually much higher than their true values implied by winning probability and insurance premiums for small probability events are also much higher than the true values implied by the
Understanding the Sources of the Insurance Risk Premium

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