WILEY Trading

OPTIONS MATH FOR TRADERS

How to Pick the Best Option Strategies for Your Market Outlook

+ WEBSITE

SCOTT NATIONS

Options Math for Traders

Founded in 1807, John Wiley & Sons is the oldest independent publishing company in the United States. With offices in North America, Europe, Australia and Asia, Wiley is globally committed to developing and marketing print and electronic products and services for our customers' professional and personal knowledge and understanding.

The Wiley Trading Series features books by traders who have survived the market's ever-changing temperament and have prospered—some by reinventing systems, others by getting back to basics. Whether the reader is a novice trader, professional or somewhere in-between, these books will provide the advice and strategies needed to prosper today and well into the future.

For a list of available titles, visit our Web site at www.WileyFinance.com.

Options Math for Traders

How to Pick the Best Option Strategies for Your Market Outlook

SCOTT NATIONS

John Wiley & Sons, Inc.

Cover image: © emily2k / iStockphoto
Cover design: Michael Rutkowski

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Published simultaneously in Canada.

Library of Congress Cataloging-in-Publication Data:

Nations, Scott.
Options math for traders : how to pick the best option strategies for your market outlook / Scott Nations.
p. cm. – (Wiley trading series)
Includes index.
ISBN 978-1-118-16437-2 (cloth); 978-1-118-23940-7 (ebk); 978-1-118-26416-4 (ebk); 978-1-118-22621-6 (ebk)
1. Options (Finance)–Mathematics. 2. Investments–Mathematics. I. Title.
HG6024.A3N35 2012
332.64′530151–dc23 2012022697

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

For Wendi

Contents

Preface

The goal of option trading is to make money. It's a fascinating endeavor—it will make you a better investor, will help you learn something, and will teach you something about yourself. But the goal is to make money, please don't forget that. Too often people start to trade options because it seems interesting. It is and it can be lucrative, but it's the lucrative part that matters.

Option theory relies on certain concepts and formulas but is ultimately used by humans. In order for the extraordinary complex financial world to be distilled to formulas that are actually usable, those concepts and formulas have to make certain assumptions; those assumptions aren't always consistent with the way the world really works. Once humans start using those concepts and formulas, they use them in such a way that attempts to correct for some of those flawed assumptions. The result is that there are certain naturally occurring phenomena in the option world that we can use to our advantage and that will help us make money.

Some of these phenomena are the result of human behavior. Some are a function of the way markets work. Some are a result of the over-idealized world of option pricing models, but all are robust and persistent. They may not exist at each and every moment but they're generally at work, and even if some market force has temporarily overshadowed one of them we can be confident it will return.

This book is not intended for the absolute beginner. We'll define our terms but if you're still unsure of the difference between a call and a put, then there are other works you should read first. Rather, this book is intended for the novice, meaning someone who knows a little about options and understands most of the concepts. The ideal reader doesn't need to know about option pricing models and the arcane variables they throw off; this book explains certain structural phenomena that exist in the option world and how an option trader can take advantage of them to reduce risk and/or increase return. In using these phenomena we put the math of option trading to work for us. Short-term bad luck is always a possibility, but understanding and using these phenomena is a little like putting yourself in the shoes of the casino rather than the gambler.

THE PHENOMENA

Some of the phenomena that we'll discuss have to do with option math and the nature of risk. For example, the passage of time affects investment returns in one way and affects the volatility of those returns in a very different way. Since options are all about volatility and the passage of time, this is a difference we can use to our benefit.

Some have to do with the fact that, in order to understand and generate prices for options, we've come up with idealized versions of the investment universe and then called these idealized worlds *option pricing models*. Certain assumptions have been made in these option pricing models so that the models remain manageable. If option models didn't hold some elements static, the sheer number of possible outcomes for any set of facts and set of potential future facts would be so large that the model couldn't render a result; even if it could manage to generate a result that result would be useless. The option trading world isn't idealized, and thus it has responded to these assumptions in ways that seem contradictory or nonsensical. Taken alone, the results are indeed nonsensical. Once we understand that the real-world contradiction is intended to make up for the real-world failings of our idealized-world option pricing models, then we understand that some of these accommodations can be used to our advantage.

So some of the phenomena are a result of math, and some are the result of the models we use. Some are also the result of failures of the humans who use options, option math, and the models. The math tells us that buying a lottery ticket doesn't make much sense, yet millions do it every day. This is a failure of people rather than math (for the record, I've bought plenty of lottery tickets in my life). These people know that buying a lottery ticket is an extremely long shot and most know that what you get (the expected value of that lottery ticket) is less than what you give (the cost of that lottery ticket). Those who recognize this don't care that the math is working against them; they buy the ticket and without realizing it write off the difference between what they get and what they give as entertainment. In fact, millions of us buying lottery tickets contribute to a giant victory of math for the state selling the tickets. You really have to have the math on your side if you can repeatedly give away $250 million or more while constantly producing a profit.

The gambling analogy is problematic because gambling has no purpose other than enjoyment. The risk in gambling is fabricated by the shuffle of the cards, the tumble of the dice, or the bounce of the ball in the roulette wheel. This gambling risk is without redeeming value. This isn't a moral judgment as long as we recognize that gambling should be entertainment (by the way, I've also spent a little time and money in casinos).

Investing and option trading, on the other hand, should be enjoyable, but both have a redeeming goal. The risk in the capital markets serves a purpose. It allows entrepreneurs to raise money. It allows investors to deploy their money. It allows those investors to use vehicles and strategies to increase their return or reduce their risk. It allows corporations to hedge risk. It creates wealth for investors. That said, who would you rather be, the gambler or the casino?

While we should be leery of introducing the gambling analogy, it's only because we don't want option trading or investing or risk hedging to be unfairly tarnished by association with the frivolous nature of gambling. Nonetheless, the analogy can be instructive and often serves to illustrate a point or concept. Since 1944, when John von Neumann published *The Theory of Games and Economic Behavior*, we've been making the comparison. I'll continue to do so occasionally.

THE GOAL

The goal of this book is to describe some of the structural phenomena that persist in the option world, and to describe whether they exist because of option math, the failure of an option model, the failure of people, or a combination of all three. I'll also describe the magnitude of some of them.

In Part Three of this book we'll discuss certain option strategies that can take advantage of these phenomena. We'll revisit the relevant phenomena and discuss how each impacts our trade. We'll discuss when the trade will work and when it won't, and the risk and reward in both cases. Occasionally we'll also discuss how and when you might make a subsequent trade to change, adjust, or close your initial trade, and how to do so without destroying the mathematical edge we got initially, if that's possible. We'll discuss what to do next because one of the most important takeaways for a trader of any sort is to remember that you always have the right to make a better informed decision as new information comes out. Don't think, just because you've put an option trade on, that you have to let it go to expiration. You always have the right to do the right thing.

THE STRATEGIES

We won't discuss every option strategy or trade type, so you won't see a laundry list of option spreads with intriguing names. We'll discuss vertical spreads, calendar spreads, put selling, and some other strategies, but you won't see Christmas trees, condors, or iron butterflies discussed here. It's

not that the phenomena don't apply to those structures; it's simply that they're not the best expression of the phenomena we're trying to capture. The structures we don't discuss can still be valuable structures because a good trader is flexible and imaginative, folding new concepts and lessons into an existing foundation.

I often use real-world examples, and I don't hide the name of the underlying stock, index, or asset. Why, given that fabricating an example might actually be easier? Because many of the phenomena we'll discuss manifest differently from one asset to another. For example, option skew (Chapter 6) is completely different in the Standard & Poor's (S&P) 500 Index than it is in crude oil. We can take advantage of it in both markets, but it's important to understand that some of these phenomena exist differently across assets and they may express themselves to different extremes. If I hid or changed the name of the underlying asset, then it would be easy to misapprehend how and when some of these phenomena exist. Occasionally I'll use a generic example. This usually means the theory or phenomenon is robust but might be observable only after removing a bunch of market-induced noise that obscures our vision.

One strategy that you won't see discussed at all, even though logically extending some of the phenomena might make one think it would be a profitable strategy, is naked call selling. Please don't do it, even if your broker will let you. Little good and much regret can come of it. I'll explain naked put selling, which some might say is being hypocritical, but even when we discuss selling naked puts they're not really naked. You'll have the cash segregated in your account ready to buy the stock if you have it put to you. We'll always treat naked put selling as another form of a limit buy order for the stock, even if we don't explicitly say so in every instance. On the other hand, it's impossible to set aside enough cash to cover the risk from selling naked calls.

Don't expect this book to offer the keys to the kingdom by divulging the "best" option strategy. It won't. Rather, we'll discuss several "good" option strategies, and I'll describe why they're good, when they're great, and when they're only fair. Just because a strategy or structure isn't discussed here doesn't mean it's bad or that you should avoid it—although that's a pretty reasonable bet. For example, I can't imagine a situation when buying a straddle makes sense for a directional trader, so we won't discuss it.

Option trading ultimately becomes a pretty personalized endeavor. Experienced traders tend to have their own styles, which they develop over time. They have strategies that they like and that fit their personality. They develop the ability to recognize the patterns in prices and circumstances that repeat. Because these traders have seen the patterns before they understand the situations that are likely to result in profitable trades. But don't ignore the other strategies we discuss, or even the ones we don't discuss, just because you've found one that you really like and that works

for you. Really advanced traders will recognize that the *reason* a certain trade structure works can be co-opted to make another strategy that they like work even better. We can use that phenomenon to spin out of the first trade (e.g., selling a put) we've had on for some time and into a different structure (e.g., long a put calendar spread) when the option math for the first structure can be improved with the second structure.

THE TAKEAWAYS

Each chapter ends with a section called "Takeaways." These takeaways comprise general themes that tend to exist in the context of the phenomena or trade structures we'll discuss. The phenomena won't always occur at a constant level. For example, the volatility risk premium (Chapter 5), the first phenomenon we'll discuss, tends to be very high in times of turmoil and is generally lower when markets are calm. It ebbs and flows. The general themes tend to be the fundamental, robust "problems" concerning either the math or the models, and sometimes with the people who use them. These are problems we can take advantage of. They're not ironclad or bulletproof solutions—you have to use them judiciously—but they provide a way to get the option math working for you.

Finally, there's never been a better time to be a directional or retail option trader. Electronic brokers can do a great job of execution, even on complex spreads. They've reduced the cost of trading substantially. Option exchanges have embraced technology, meaning that markets are more democratic than ever before and also that the sometimes-hidden costs of option trading (e.g., the bid/ask spread, which we discuss in Chapter 8) have plummeted.

Professional option traders operate in a world filled with advanced math and exotic language. They talk about concepts like *gamma* and *theta* and how they affect their iron fly or condor. Many retail and directional traders, on the other hand, treat options as a proxy for the stock. They think a stock is going higher so they buy some call options. This book is intended to bridge the gap between the two. We'll look at directional strategies and consider as well the issues confronted by the professional trader, and then look at how those issues can inform our directional strategies.

JUST ONE EQUATION

In *A Brief History of Time*, Stephen Hawking famously tells of an editor's warning that for each equation he included he'd lose half of his audience. As a result, Dr. Hawking included just one equation. I think this book faces a similar problem, so there will be just one equation as well. It's the

Black-Scholes option pricing model. There are many option pricing models in use now, since Black-Scholes is intended for a pretty narrow set of circumstances, but Black-Scholes is where it all started and throws into sharp focus some of the problems inherent, to one degree or another, in all option pricing models. We'll discuss Black-Scholes in Chapter 4. It's the only equation in the book until the Appendix, I promise. In certain sections we'll use an option pricing model to generate an apples-to-apples comparison of how expensive an option is. In doing so we might use an option pricing model other than Black-Scholes, but the precise equation isn't important, it's the concepts that are important.

ABOUT THE WEBSITE

Because the option math is so important to our analysis and to understanding the phenomena that we're seeking to exploit, we've developed a website at www.wiley.com/go/optionsmath that provides option pricing models and option analysis. Feel free to use it. It can help you calculate the theoretical value of an option as well as the sensitivities of the option to changes in the price of the underlying asset, or the passage of time as well as the expected daily price erosion of the option. Volatility is a vital concept in option trading, and www.wiley.com/go/optionsmath will also calculate the volatility of the underlying asset that is implied by the option prices that we actually see trading.

The website can be a valuable tool in quantifying some of the phenomena. For example, the amount by which the price of an option is expected to erode changes over time. You can use the site to see how this erosion changes, and I imagine you'll be surprised by what you learn.

Different options might also say different things about how much the underlying asset is expected move. This can seem odd: The underlying can only have a single path, but ten options might say it's going to have ten different paths. This is a phenomenon we can take advantage of and the option model at the website can help you understand and quantify this.

When we refer to an option pricing model you're welcome to use www.wiley.com/go/optionsmath but you're also free to use any model that you're comfortable with.

GETTING STARTED IN OPTION TRADING

Finally, I'd like to say a word about getting started in trading. All professional traders, at the beginning of their careers, had to make their very first trade (I still remember mine). It was probably a very small trade (mine

was). The traders were almost certainly nervous (I was). Once they got over the hurdle of actually executing that first trade they were able to grow and learn (I'd like to think I did). If you've never made an option trade, then don't try to find the perfect one to be your first. Find a good one that takes advantage of the issues we discuss. Focus on underlying instruments that boast options with good liquidity and a small bid/ask spread. Make the structure one that defines your risk, such as a vertical spread. Then enter the order. Welcome.

Acknowledgments

Thank you to everyone at Live Vol. They've been great partners and I look forward to doing more interesting things with them in the near future. They were also the source of all the actual option prices we've used.

Thanks also to Kevin Commins, Meg Freeborn, and Stacey Fischkelta at John Wiley & Sons. They've provided a great platform for works that help people become better at the things that are important to them.

Thanks also to everyone who's helped me learn about options over the years. Spending so many years in the option pits in Chicago provided a unique education; unfortunately it's a lifestyle that is fading as trading becomes increasingly electronic. That simply means there are different opportunities, not fewer opportunities.

Thanks to Melissa Lee, Max Meyers, Dan Nathan, and Mike Khouw of CNBC's *Options Action*. Helping viewers learn a little more about options would always be fun but it's a tremendous delight to do it with these talented people.

And again, thanks to Wendi.

PART ONE

The Basics

CHAPTER 1

The Basics

The word *option* has come to mean many things beyond a financial instrument. The meaning includes the concept of choices or alternatives. In our context that's appropriate because at the heart of an option is the fact that owners of options have a clear choice. They have the right to do something, but no obligation to do anything, once they've paid for the option. It's this freedom, this choice, and this luxury of waiting that result in the unusual risk/reward profile for an option. The most that option owners can lose is the cost of the option. The amount that option owners can make is literally infinite in the case of a call option. On the other hand, the seller of an option has no choices other than the choice to reenter the market and repurchase the option, paying whatever the market demands.

Add to this element of choice the impact of an option being a wasting asset, since it will expire at some point, and we are left with a wonderfully nuanced instrument. All of these factors and others, such as the date of expiration as well as the price we'd pay or receive for the underlying asset, go into the calculus of considerations that is option trading.

OPTION SPECIFICS

A *call option*, often just referred to as a *call*, gives its owner the right to buy something. A *put* option, often referred to simply as a *put*, gives its owner the right to sell something. It's an oversimplification in the extreme but instructive to say that if you think the price of something is going higher,

you'd buy a call option on that something. If you think the price of something is going lower, you'd buy a put option on that something.

The "something" in our simple example is the *underlying asset* (often simply referred to as the *underlying*). It is the asset or instrument that the owner of the call option has the right to buy. It is the asset or instrument that the owner of the put option has the right to sell. It's fixed for the term of the option although its price or value might well change during that term. That potential for change in price is one of the reasons we use options.

For an option, the price you'd pay or receive for the underlying asset is predetermined and standardized. This predetermined price, the price that you'd pay for the underlying asset if exercising a call option or that you'd receive for selling the underlying asset if exercising a put option, is the *strike price*, sometimes referred to as the *exercise price*.

Each option has an expiration date. Technically, the expiration date is usually the Saturday after the third Friday of the expiration month, that third Friday being the last trading day. Effectively, that last trading day is the last day for you to determine whether or not you're going to exercise your option.

Some will recognize that the occasional option will have a final trading day that is other than the third Friday of the month. For example, weekly options are listed that trade for one week and then expire on Friday. The result is a series of expirations each and every Friday. Quarterly options expire on the last business day of the quarter regardless of what day of the week that is. Some index options, such as options on the Standard & Poors (S&P) 500 Index (i.e., SPX options), expire on the open of trading on that third Friday. Options on the Chicago Board Options Exchange Volatility Index (VIX) settle on Wednesday. But the vast majority of individual equity and exchange traded fund (ETF) options follow the normal pattern; the last trading day is the third Friday. And why did the exchanges pick a convoluted day like the third Friday of the month as the typical final trading day rather than something simple like the last day of the month? Because they pored over the calendar and determined the third Friday would have the fewest conflicts with holidays and such. In option trading there is a reason or mathematical basis for everything even if it's not readily apparent. This includes the selection of the day for expiration.

DESCRIBING AN OPTION

We can fully describe any specific option using just these details:

- Underlying asset
- Put or call

- Expiration date
- Strike price

For example, describing an option as the "SPY March 150 call" tells us all we need to know. We have fully described the option and there is no confusion about the specific option we're discussing. The underlying is the S&P 500 Index ETF (SPY). It's a call option so it's an option to buy SPY. The last trading day of this option is the third Friday in March (if we don't mention a specific year then it's assumed to be March of this year or March of next year if the third Friday in March of this year has already passed) and it expires the next day. Finally, the strike price is 150. If owners of the option choose to exercise it, then they'll buy SPY at $150 a share regardless of where SPY is at the time.

By convention for equities and ETFs, each option controls 100 shares of the underlying. A single SPY March 150 call option gives the owner of the option the right, but not the obligation, to pay $150 for each of 100 shares of SPY on or before the third Friday in March.

Most options allow the owner to exercise the option on or before the last trading day. However, some options only allow the owner to exercise the option on the last trading day. These options are rare when talking about options on individual equities, almost every one of which has the freedom to be exercised at any time. These options that provide the freedom to be exercised at any time are American-style options (think American-style for more freedom). The options that can only be exercised on the last trading day are European-style options. As you might imagine, European-style options (which can only be exercised on the last trading day) are more common in Europe. A few European-style options trade in the United States, and SPX options (when referring to SPX options we're always referring to options on the S&P Index, not on SPX Corporation) are easily the most popular European-style option in the United States.

OPTION COST AND VALUE

The price of an option is determined by the marketplace. Potential buyers and sellers will meet, generally electronically, and determine what an option is worth, with supply and demand being the invisible hand that results in a price acceptable to buyer and seller. For an option, this price is referred to as the *premium*. The option buyer pays the premium to the option seller, and the seller gets to keep this premium regardless of what happens in the future. Sellers may end up sustaining a loss when they pay more than they initially received in order to buy back the option they had sold,

but they keep the initial premium they received. Option premium is quoted in dollars per underlying share of stock. Since the standard option contract covers 100 shares, the total an option buyer would be out of pocket if they paid $2.25 in premium for a call option would be $225.

That premium has two elements. The first element is the *inherent* or *intrinsic value*. The second, the value of being able to wait to make a decision and to get more information as time passes, is the *time value*.

Inherent Value

The inherent or intrinsic value is how much you'd get immediately if you exercised your option and then immediately closed your stock position by selling or buying your stock. For a call option the inherent value is the amount by which the strike price of the call option is below the market price of the underlying, as you can see in Figure 1.1.

If the underlying is at $40 then the 30 call is inherently worth $10.

Inherent value for a put option is the amount by which the strike price of a put option is above the market price of the underlying, as you can see in Figure 1.2.

If the underlying is at $40 the 45 put is inherently worth $5.

It's entirely possible for an option to have zero inherent value. If the strike price of a call option is above the current market price for the underlying asset, then the call has no inherent value and its entire price is derived from the luxury of having time on your side.

If the strike price of a put option is below the current market price of the stock, then the put has no inherent value.

FIGURE 1.1 Call Option Inherent Value

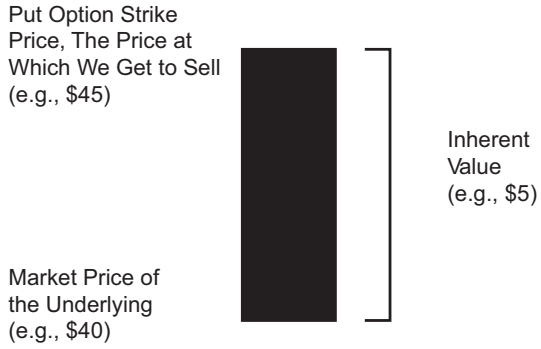

FIGURE 1.2 Put Option Inherent Value

Time Value

The time value of an option is the portion of the option price that you're willing to pay for the luxury of waiting to make a decision or to see what happens in the future. It is an option's entire price exclusive of the inherent value.

It's entirely possible for an option to have zero time value. If the strike price of our call option is hugely above the current price of the underlying and our option expires very soon, then the option will have no time value. The likelihood of the option being profitable is so infinitesimal that no one is willing to pay anything for it; there's no point in waiting for something that's never going to happen. No one would be willing to buy this call option because it provides no luxury of waiting.

Likewise, it's possible for a put option to have zero time value. If the strike price of a put, the price as which the put owner would get to sell the underlying asset, is so far below the current market price for the asset that there's essentially zero chance that the underlying will drop that low, then no one would be willing to pay anything for that option, particularly if it's due to expire soon.

An option's price is always the sum of its inherent value and its time value, as you can see in Figure 1.3, which shows that the combination of inherent value and time value equals the total value of a call option.

Figure 1.4 shows that the combination of inherent value and time value equals the total value of a put option.

If a stock is trading at $100, then how much is the 90 call option worth? Assuming you could exercise the option immediately, it's worth at least $10 because that's the inherent value of the option. But would you also be willing to pay a little bit more for the luxury of waiting a little longer