

September 30, 2012

“When I was young, I had to learn the fundamentals of basketball. You can have all the physical ability in the world, but you still have to know the fundamentals.”

— Michael Jordan

In the age of technology and innovation, it is easy to forget about fundamental principles. Behind the flashing lights and ringing bells of trading screens lies a litany of formulas, calculations and assumptions.

In the options market, pricing models, including the Black-Scholes and binomial models as well as many others, are ultimately based on the idea of *replication*. The ability to replicate a standardized listed option using the underlying shares is an important concept in deriving its arbitrage-free value.

One form of option replication is dynamic hedging, also known as delta-hedging. The idea is to neutralize the directional risk of an option by trading the underlying shares (e.g. buying a call and shorting stock against it in the proper hedge ratio). The activity of delta-hedging effectively replicates the inverse of the option position. If you buy a call and dynamically hedge it, the payoff of the underlying hedge will mirror that of the call.¹

For example, an investor buys 100 SPY August expiration \$137 strike calls for \$1.86 on July 20th. In order to be delta-hedged, the investor will have to sell short 4,695 shares, which is equal to the hedge ratio as stated by the option’s delta of 0.469. As the underlying shares move, the delta of the option will change and the investor must recalibrate the stock position by buying and selling shares to match the correct hedge ratio.² The cumulative P/L of the daily delta-hedges will have nearly the inverse payout of the options position; that is, the payoff will be similar to being short the call.³ The table in Figure 1 lists the daily values over the course of this trade.

¹ The caveats of replication include the investor’s ability to buy or sell the underlying shares, borrowing, transaction costs, and gap risk.

² We assume that the investor hedges at the end of each trading day.

³ The difference between implied and realized volatility will affect the P/L. Additionally, we assume no transaction costs, borrow costs, or bid-offer spread.

Date	Share Price (\$)	Option Price (\$)	Delta	Shares Delta-Hedge	Shares Bot / Sld	Option Total P/L (\$)	Delta-Hedge Total P/L (\$)
Jul 20	136.47	1.86	0.469	-4,695	-4,695	0	0
Jul 23	135.09	1.35	0.371	-3,712	983	-5,100	6,479
Jul 24	133.93	0.99	0.296	-2,957	755	-8,650	10,785
Jul 25	133.96	0.83	0.278	-2,776	181	-10,300	10,696
Jul 26	136.17	1.60	0.442	-4,421	-1,646	-2,600	4,562
Jul 27	138.68	2.99	0.637	-6,375	-1,953	11,300	-6,536
Jul 30	138.68	3.01	0.636	-6,362	13	11,550	-6,536
Jul 31	137.71	2.74	0.557	-5,573	789	8,850	-365
Aug 01	137.71	2.37	0.554	-5,541	32	5,150	304
Aug 02	136.64	1.53	0.474	-4,736	805	-3,300	5,567
Aug 03	139.35	2.96	0.740	-7,404	-2,668	11,050	-7,266
Aug 06	139.62	3.14	0.768	-7,678	-274	12,800	-9,265
Aug 07	140.32	3.65	0.832	-8,317	-639	17,950	-14,640
Aug 08	140.49	3.61	0.912	-9,117	-801	17,500	-16,054
Aug 09	140.61	3.67	0.945	-9,449	-332	18,150	-17,148
Aug 10	140.84	3.94	0.926	-9,262	188	20,800	-19,321
Aug 13	140.77	3.78	0.936	-9,358	-96	19,200	-18,673
Aug 14	140.79	3.80	0.941	-9,411	-53	19,400	-18,860
Aug 15	140.95	3.95	0.957	-9,575	-164	20,950	-20,366
Aug 16	141.99	4.92	0.984	-9,837	-262	30,650	-30,324
Aug 17	142.18	5.28	1.000	-10,000	-163	34,250	-32,193

Figure 1: Cumulative P/L of a call option and underlying delta-hedge.

An investor can replicate the P/L of an entire option portfolio with **no options positions using only the underlying shares and never trading a single option!**

For another example, in Figure 2 we compare a theoretical call option's payoff with that of a trend follower with a stop loss. The investor buys 2,000 shares of a stock at \$50, and implements a stop loss should the stock trade down to \$40. If the stock rises to \$70, the investor will double the position, and double it again if stock rises to \$90. It is clear the payoff of such a strategy looks very similar to that of being long a naked call option even though the investor has no options in the portfolio.

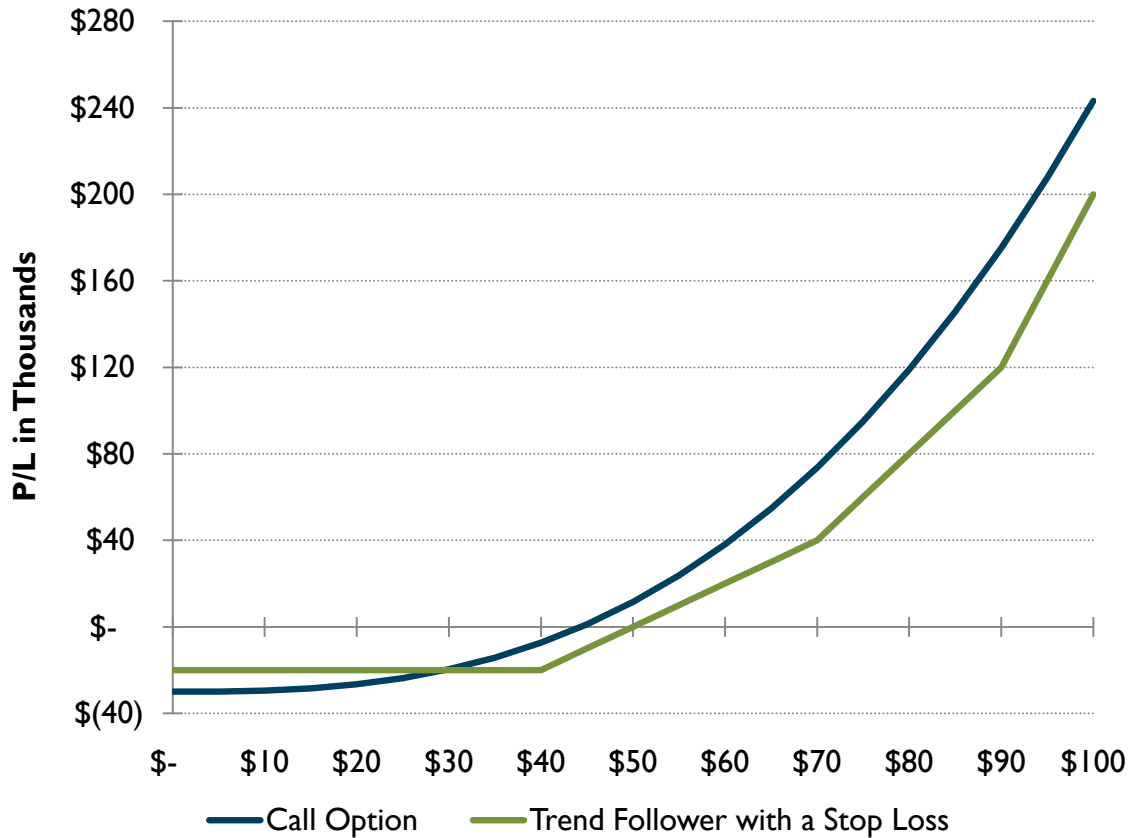


Figure 2: Comparison of the P/L of a call option and trend following investment strategy.

We frequently find these payoff profiles within many investment programs including Structured Credit, CTAs, Macro, Long-Short, Fundamental Value and many more. Professionals will invest in strategies with no underlying options positions, but have option-like payouts, option-like risks, and not even know it.

Investors who “don’t invest” in options but are comfortable with traditional strategies should consider taking a fresh look at option fundamentals. *Replication* may be an important source of alpha. If so, understanding options becomes critical.

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