A Note on Option Returns

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Abstract.

I examine option returns for international equity indices, commodity classes and interest rate swaps and report abnormal profits for a number of strategies, which are short shorter-dated options, either outright or against being long longer-dated options. Our findings compliment the option literature and provide support to the liquidity-based "Betting-Against-Beta"-hypothesis of Black-Frazzini-Pedersen.

* ATP Group, e-mail: kas@atp.dk. This note summarizes a subset of results from earlier drafts; "Global Gamma", "Betting Against Convexity", "Momemtum-Value in Options". The views expressed are mine and do not necessarily reflect the views of ATP. I thank Lasse H. Pedersen and Antti Ilmanen for great inspiration and helpful comments.

Option contracts provide substantial market exposure to the underlying asset, (1) without using leverage and (2) with loss limited to the option premium paid. Investors, facing leverage and/or value-at-risk constraints, might be willing to pay a premium for these benefits, therefore bidding up implied volatility up and potentially causing an "abnormal" volatility risk premium. Market makers, with risk budget and operational platform in place to meet this demand, can supply options and take advantage of the excess spread between implied and realized volatility. Part of the spread might be explained by stochastic volatility and jumps in the underlying asset, part of the spread coming from the investor demand premium.[1]

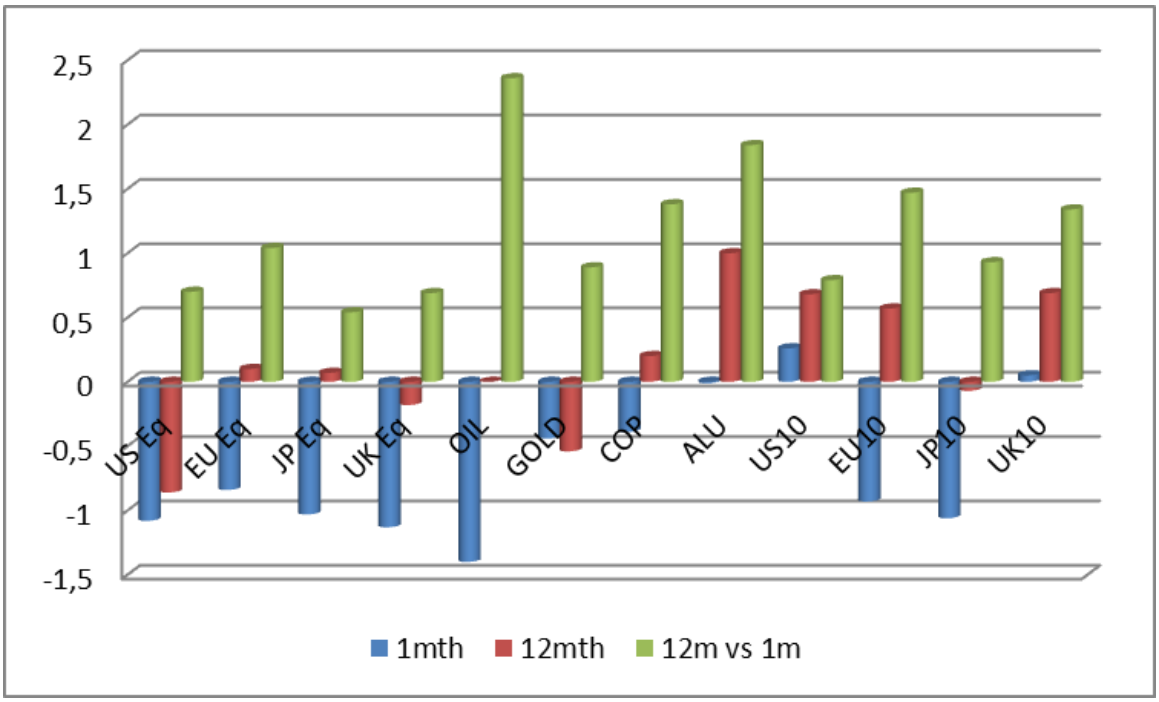
Conceptually, option operators are segmented into "investors", who demand options as a way to gain beta exposure and do not engage in dynamic delta-hedging and "market-makers", who supply options and delta-hedge that position dynamically. The volatility risk premium in equilibrium is supply/demand-based, and a function of the relative risk capacity between investors and market makers.[2] Liquidity conditions also play a role; tighter funding liquidity increase investor demand for options as it becomes more expensive to use leverage; tighter market liquidity increase the required return from supplying implied volatility.[3] The actual price dynamics might also have an effect; assets that exhibit trending behaviour (time series momentum), as measured by Cochrane's variance ratio for example, are more attractive in the option contract for the investor, ceteris paribus.[4]

In this note we examine option returns from the "market-makers" point of view i.e. assuming daily delta-hedging[5]. The underlying assets are equity index futures and interest rate swaps in US, EU, JP and UK and commodity futures within energy and metals[6]. We report annualized Sharpe ratios[7] for 1 and 12 month option maturities in the figure below. Our findings compliment the broader option

[1] Garleanu, Pedersen & Poteshman (2009) study demand (supply) effects in US equity options relative to the Bates model
[2] Garleanu & Pedersen (2011) present a model with heterogeneous agents where liquidity constraints result in price gaps between securities with different margins but otherwise identical cashflows; similarly investor constraints in a simple geometric Brownian motion model could cause price (volatility) gaps between an option contract and its replicating hedge
[3] Brunnermeier & Pedersen (2009) study how funding liquidity and market liquidity is related, potentially creating liquidity spirals. Nagel (2011) study how market-makers providing liquidity in the underlying asset is a reversal strategy and therefore closely related to selling of options (also a reversal strategy due to negative gamma); both type of business is competing for their share of a trading floor risk budget creating links between liquidity provision and gamma reward
[4] The ratio of realized volatility measured on yearly changes relative to the one measured on daily is higher than 1 for most assets, which indicates trending behavior; short interest rates and energy assets in particular seem to have that property.
[5] Option portfolio formation is done on the first business day of the month (1$ option premium invested), options are delta-hedged daily, option positions are rebalanced daily (to 1$) and profit-loss is invested in the money-market-account, the option portfolio is closed on the last business day of the month and monthly return is calculated based on the accumulated capital in the money-market account, all execution is done at mid; this is same procedure as Frazzini & Pedersen (2011b)
[6] Daily volatility data is kindly provided by Morgan Stanley (3/2000-6/2012 for equities, 1/1996-6/2012 for SPX), Goldman Sachs (1/2000-6/2012 for commodities) and Bloomberg (5/2004-6/2012 for interest rates). Any errors are mine.
[7] Alpha (not reported) is statistically significant for all equity indices relative to the five standard risk factors; three Fama-French factors, the Carhart momentum factor and the Pastor-Stambaugh liquidity factor

literature[8], particular for assets outside US index options, and document a generous compensation for shorting short-dated at-the-money options on most underlying assets.[9] We also construct option strategies, that are long longer-dated and short shorter-dated at-the-money straddles[10].

The results, summarized in the figure below[11], provide additional support to the "Betting Against Beta" (BAB) hypothesis of Black-Frazzini-Pedersen[12]. Skewness is generally negative for the long-short strategies, but acceptable in magnitude. There are obviously numerous ways to take advantage of diversification benefits across markets and thereby improving risk-adjusted returns.



[8] Recent papers include Broadie et al (2007, 2009) and Constantinides et al (2009, 2011)

[9] This note is ultimately about "value" in options i.e. what to buy and what to sell? Our evaluation metric assumes delta-hedging and is (more) relevant for the market-maker. The investor should (also) evaluate options without delta-hedging where momentum in the underlying asset play a role, see Moskowitz et al (2012) for momentum (not related to options). Longer-dated swaptions on short interest rates have historically been attractive for the investor segment.

[10] Notionals in the option long-short is set to ensure omega-neutrality i.e. the strategy is locally immune to relative changes in the underlying asset, similar to Frazzini & Pedersen (2011b); for at-the-money options (delta-50) the notional ratio is approximately equal to the option premium ratio; we would reach similar conclusions under gamma-neutral sizing.

[11] Option portfolio formation for equities and commodities are done on the first business day of the month i.e. *monthly*, see footnote 5. For swaptions we calculate daily returns assuming *daily* option portfolio formation (no delta-hedging) as I don't have volatility smile data and the approximation is better assuming daily trading (options are less out-of-the-money). In my new (old) capacity as an interbank trader in swaptions, daily rebalancing at mid is realistic; however the degree of realism in the trading assumptions are franchise depend (what is *implementable* for one player might only be *observable* for another), and daily formation is generally harder to justify (at mid) than monthly formation. Daily option rebalancing also avoids the uncertainty coming from the specific choice of option formation date; results often change significantly when that specific monthly trading is changed. You might argue for another Uncertainty Principle: there is an inverse relationship between the uncertainty of the assumptions (frequency and cost) and uncertainty of the risk-adjusted returns.

[12] Black (1972,1992), Frazzini & Pedersen (2011ab) show that assets with high (low) leverage have lower (higher) risk-adjusted return; shorter-dated options have higher omega (leverage) than longer-dated options and the option strategies presented above are therefore beta-neutral bets against beta (BAB). Our results also support Moskowitz et al (2012), who show that high carry assets (shorter-dated options) is good value relative to low carry assets (longer-dated options).

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