(Almost) Everything You Wanted To Know About FX Volatility Smile (Part III) — Options Flows, Dealers' Positioning, and Market Volatility

Harel Jacobson · Follow

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The first two chapters of this series have taken us through a fascinating journey into the FX derivatives jungle (or at least I find that fascinating, but I'm probably biased). However, there is still one giant missing piece of the entire "buy-side,sell-side, and volatility dynamic" puzzle, and that's "how does the flow that is traded in the market (both on the vanilla side and on the exotic side) impact the volatility smile (and spot/vol dynamic)?". The last chapter of our trilogy is going to address that question. This part is mainly based on my research in FX market microstructure, dealers' positioning in the options space, and the feedback loop between positioning and short-term volatility dynamics. As the scope of this write-up is not to delve deep into the quantitative aspect of this topic but rather to provide insights and food for thought, I will not burden you with the underlying model (and its logic).

Shall we begin?

A Lesson From The Equity Index Options Market

The idea of gauging market-makers positioning in the options space was originally conceived in the equity index options market (liquid markets like S&P500). There has been extensive research on that topic, and it was found that the correlation between market volatility and dealers' gamma positioning is statistically significant. If you want to read these studies and research papers, I recommend finding them on Google Scholar. One of the groundbreaking works on that topic is the work of SqueezeMetrics. Many industry practitioners used SqueezeMetrics' white paper about quantifying hedge rebalancing in the SPX options as the base for their work. The idea behind the paper is that the ability to quantify market-makers gamma exposure explains the lion’s share of intraday realized volatility of the underlying asset. The paper makes a few basic assumptions (not all of which apply in the FX market):

1. **Delta-hedgers facilitate all traded options** — This assumption is crucial in any "greeks" exposure model, as it allows us to estimate/predict the agent's reaction function. Assuming we know nothing about the end-users reaction function, we can only make assumptions regarding the sell-side (MMs) because we are confident that they dynamically hedge their portfolios and rebalance their greeks.

2. **Calls are sold by investors while Puts are bought by investors** — the idea behind that is that in the equity index options market, "call overwriting" is supplying dealers with long call positions while pension funds' "protective put" hedges on their core long equity positions make market-makers short put options. In recent years, the significant increase in retail trading volumes dented that assumption to some degree. In the FX derivatives space, however, this assumption is completely invalid, as there is no clear distinction between the end-users desire to trade either calls or puts.

3. **Market-makers hedge precisely to the option delta** — this is a crucial assumption, as we assume that market markers try to minimize their directional (delta) risk and, therefore, trade the underlying delta according to their options book's accumulated delta. When market-makers are long gamma, they will sell when the market goes up (and buy when it goes down), and when market-makers are short gamma, they will "chase the market" (sell low, buy high). While in FX, we don't care about the precise figure of dealers' delta accumulation (as it's practically impossible to gauge the underlying trading volumes), the assumption of dealers' delta hedging is key in understanding the short-term market volatility and smile dynamic.

The Catch-22 of an OTC Market

The one thing that any OTC market lacks is transparency. Listed markets (like equity, bond, and commodities) are traded mainly on exchanges. The fact that these markets are traded on exchanges makes trade reporting extremely transparent (as all trades are recorded and published). The story is completely different in an OTC market like the FX market. Although some of the flow in the options space goes through options chains (like the CME currency options chains), most of the flow (about 75–80%) is traded on the interbank (OTC) market. For the most part, OTC transactions are not required to be reported by dealers, which makes the visibility of flow/trades relatively low. Luckily, regulators worldwide (probably part of the lessons learned from the 2008–2009 GFC) try to make these markets slightly less opaque. Legislation like the Dodd-Frank act and regulator bodies like ESMA (European Securities and Market Authority) dictate a minimal threshold for trade reporting by dealers (and they require the bare minimum that should be reported). For example, as per Dodd-Frank legislation, all trades done by (at least) one US-regulated party are required to be reported via designated venues (Swap Execution Facilities, or SEF) that act as repositories for trade data. The largest trade repo is the DTCC (Depository Trust & Clearing Corp.) which captures the vast majority of traded volume in the OTC market (whether these are forwards/NDFs or options of any kind). The problem, as you may have guessed, is that the scope of the trade details is minimal and requires us to apply many assumptions/logic and go through a meaningful data engineering process to extract value from the raw data that will eventually allow us to classify a single trade as either bought or sold by dealers (which is what we ultimately want to know)

Meet FloRider

Before I introduce to you FloRider, my "toy model" for gauging dealers' exposure, I must disclose one fact — Since day one as a trader, I've always traded on the buy-side (doing proprietary trading). Now you are probably

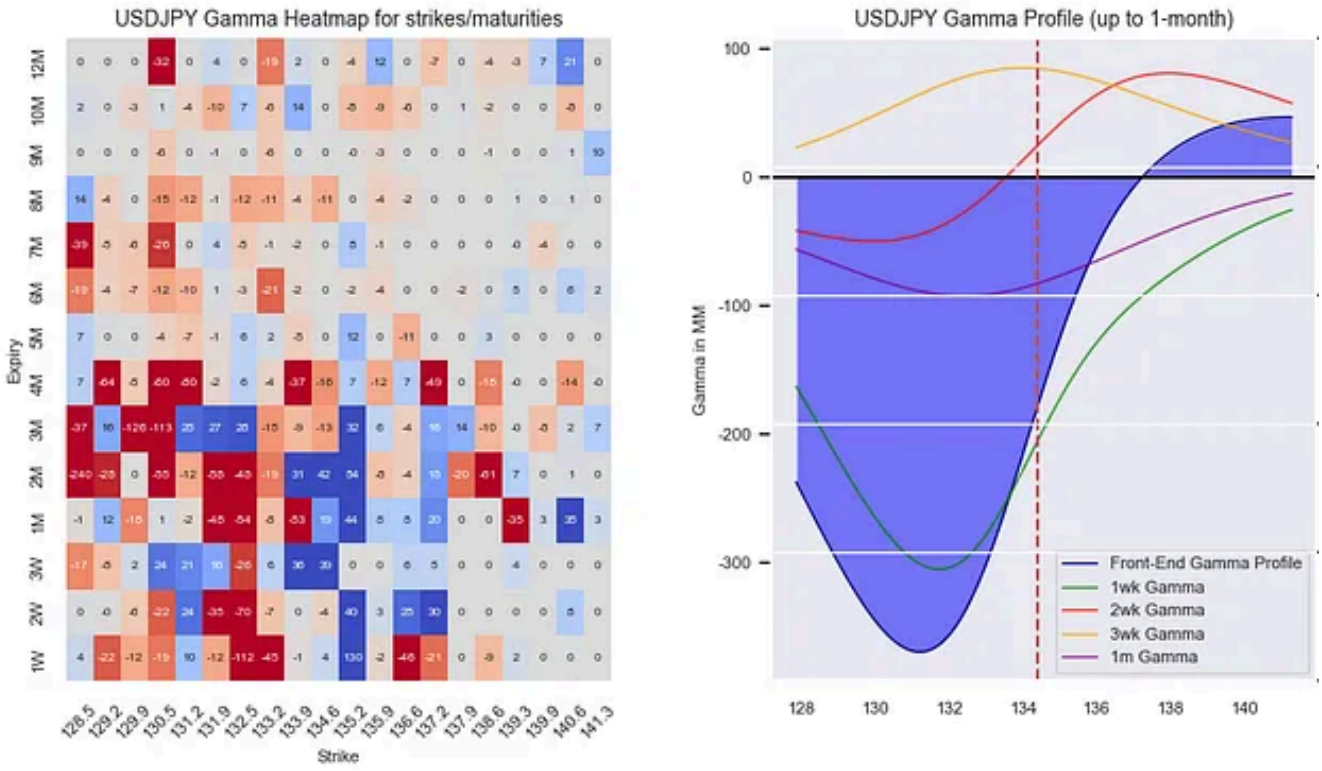
asking why this fact is important, and the reason it's important is that the most significant advantage a sell-side trader has (besides paying at the bid and selling at the offer) is information. Information can make or break your trading strategy, especially in opaque markets like the FX market. If we enter into a position without having sufficient information about the flow, the nature of the flow (who is selling? what they are selling? and why?), and how the market is positioned in general, our trading strategy can get run over due to some random flows (yet powerful in their effect on the market and on our P&L).

Yes, you can ask your sales coverage at your go-to dealer (hopefully you have more than one) for some "market color" or whether they are seeing something that drives vol/skew up/down, but they will most probably not be so eager to share information with you (or at least not information that you can utilize in your trading process). So what can we do about it? You guessed right, build our own positioning monitor!

Very much like the OG of market-makers gamma exposure models (SqueezeMetrics), our base assumption is that dealers dynamically hedge their delta and try to maintain a delta-neutral position (this assumption is vital for us, as we practically have no way of knowing who the end-user is, and whether they are managing the greeks or not). Also, we assume that all reported trades are made with the end-users (i.e., if there is an interbank trade between two dealers, it won't show on the DTCC/SDR data).

To build our positioning monitor, we need to classify each trade as either sold or bought by dealers, but unlike equity GEX models, that try to estimate the delta market-makers need to trade, we are merely interested in the aggregated strike distribution (across strikes/maturities) and how the gamma profile (generally, all trades expiring sub-1-month) of dealers (we can think

about it as the average positioning of a dealer like Goldman Stanley in the market). After applying our fairy dust, slicing, dicing, and beautifying our raw data, we end up with an output that looks like the below output:



It is important to note that the above positioning is based only on vanilla options. Later we will address the existence of exotic options and how they affect dealers' overall positioning and volatility dynamic.

So what are we exactly looking at here? On the left side, we see the aggregated dealers' position (in total notional values) binned by strikes and maturities. It does a good job pointing out where possible weak positioning is found along the different strike levels and how dealers are positioned along the term structure. On the right side, we get something similar to the good old gamma profile most knows from the equity index GEX. If you are not familiar with that, it's simply aggerating all options by different maturities (because we are looking at gamma, we mostly care about short-

dated options) and calculating the aggregated gamma for different spot levels (very much like spot-ladder analysis). The dealers' gamma accurately indicates when dealers are net long or short gamma.

Why should we care about their gamma (or vega) positioning, right?

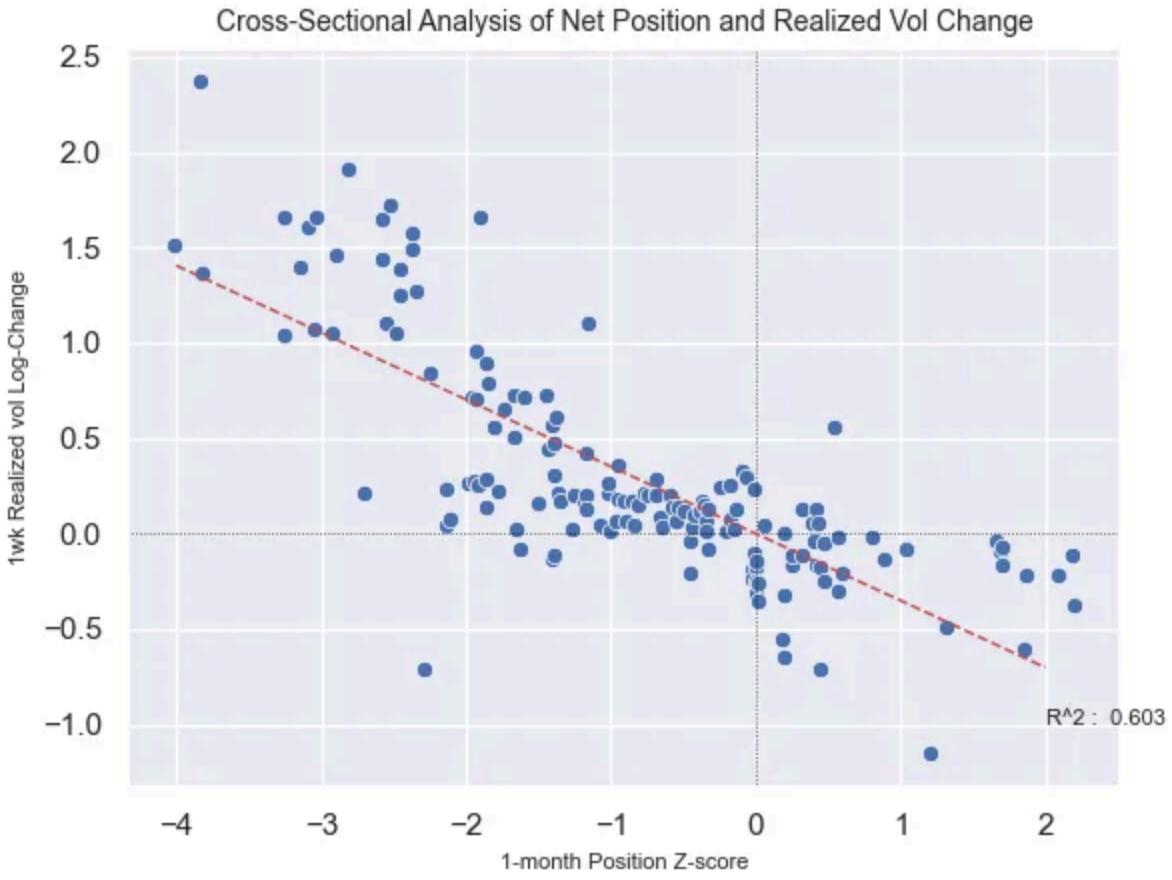
In theory, when dealers are **NET SHORT** gamma, they will "chase the market" when they hedge their options book's delta, so they will sell on the move down and buy on the move up. Assuming that, on average, dealers are in the same position, their forced selling/buying resulting from delta hedging should create heightened volatility in the short term; such volatility tends to drive up short-term implied volatility. As buy-side traders who see that the market is moving, they will buy more options, putting dealers in a larger "short gamma" position.

This reflexive behavior will continue until one (or more) of the following occurs:

1. Implied volatility will move high enough to allow dealers better room to maneuver with their delta hedging (the higher the vol, the more theta they get, and the lower the negative gamma) and widen their delta hedging "bands."
2. Options expire, and their gamma profile changes.
3. The underlying spot moves back to a zone where dealers are long gamma

(needless to say that when dealers are **NET LONG,** the exact opposite happens)

Analyzing historical positioning data and changes in realized vol (we assume 1-wk realized vol to be a good measure of short-term volatility) reveals some degree of negative correlation between gamma positioning Z-score (relative to 1-month lookback window) and the future week/week log-change of 1wk realized vol.



This analysis was conducted on various G10 and EM currency pairs (which is why both positioning data and realized volatility data were normalized). The study is based on data collected between August 2021 and September 2022.

As we can see, dealers' gamma positioning has some predictive power over future moves in 1-week realized vol.

Adding Exotic Flavour To The Mix

As we previously noted, exotic derivatives play a significant role in how FX volatility is modeled, evolved, and traded. Knowing dealers' position in the exotics space could give us a huge information advantage.

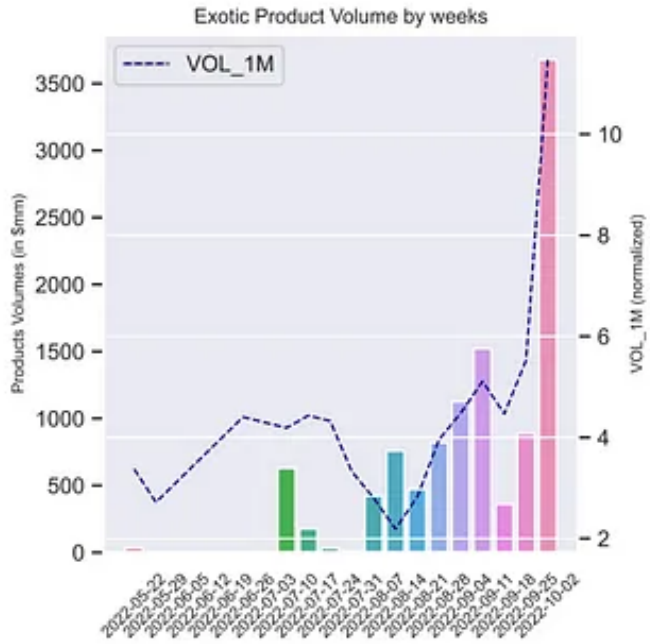
Let's imagine sitting on a sell-side trading desk, and we know that "the street" (the dealers) is highly exposed to a HUGE cluster of KO barriers (meaning

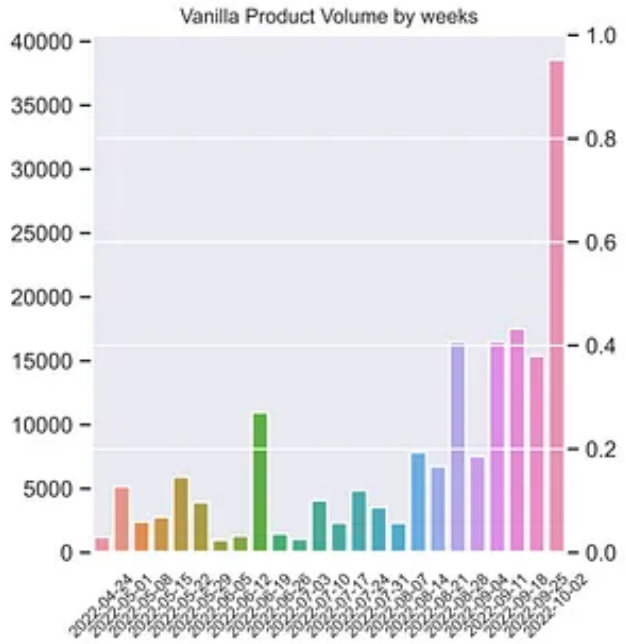
they are LONG the barrier) in EURUSD (let's say, at 1.00). Now, the spot is trading at 1.0050, but we know that if it touches that level, all these barriers will be knocked out, and all the dealers will have to unwind the hedges they hold against these options. What should we do? Should we front-run all others or wait? Having that information puts us at an advantage, as we can assess the likely scenario and the possibly critical levels in the market, which is why analyzing the flow of exotic products is as equally important as analyzing the flow of vanilla options.

The problem, however, is that trade reporting rules regarding exotic options don't require dealers to report anything regarding the "exotic features" of the product (for example, the kind of exotic product, exercise type, and, most importantly, barrier/trigger level). Now, you are probably thinking, "Well, we just hit a dead-end because the trades reporting tells us nothing." But, as you probably guessed, I wouldn't have spent so much time explaining exotic options and their dynamics if we couldn’t analyze them, right?

So, let's start with the very basic analysis of trading volumes. If we break down the total traded volume of a currency pair into exotic products and vanilla products, we can clearly see some correlation between the move of 1-month implied volatility and the cumulative weekly volume of exotic products traded.

(the below example is the most recent GBPUSD volume tracker)





This, to me, is super interesting. It seems like moves in implied volatility are correlated, to some degree, with volumes traded in exotic space. There is probably more than one reason why they are correlated, but let's consider a very popular type of exotic option — reverse knock-out. I'm examining this specific type of option because this year it has been the rising star of FX options and has been the absolute favorite weapon of choice (metaphorically speaking, of course) by macro traders to express their views (and narratives). A reverse knock-out is a vanilla-type option (call/put) with a knock-out barrier struck ITM, so as the option gains in intrinsic value, it also gets closer to the barrier (and is more likely to be knocked out). For that reason, it offers a significant discount over the equivalent vanilla. The "common" RKO structure is set with the KO barrier of about 4–5% ITM and usually costs around 10–20bp in premium, while the equivalent vanilla option costs 1.5%-2%.

The thing that is interesting in the context of positioning analysis is how these options behave. When an RKO option is traded (mostly bought by clients), dealers get short vega/gamma around the vanilla strike and get

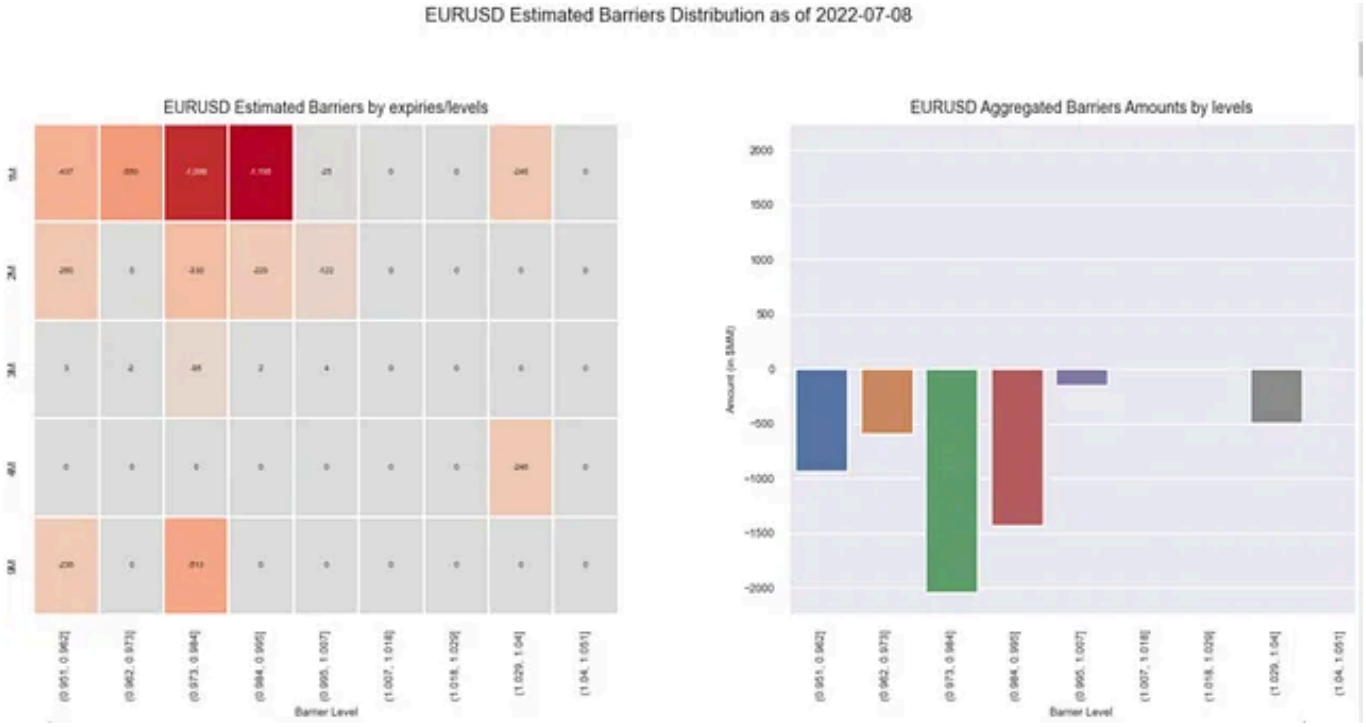
longer vega/gamma as the spot moves toward the barrier level. Because RKO buyers tend to take advantage of the "richness" of the skew, they will mostly "sell" the barrier at the expensive side of the smile. One dynamic that we observed this year (mostly in EURUSD as the spot went to parity and in USDCNH as the spot went to 7.00) was that high trading volumes in exotics and the distribution of barriers (which were implied by our model) had initially caused a significant increase in volatility, but as the market moved towards clusters of barriers it gradually had a depressing effect on realized (and implied) volatility, as well as implied skew (RR).

As previously noted, the spot/vol dynamic of the exotic option alternates near the barrier/trigger level. In the case of RKO options, if the underlying spot is found around 60–80% closer to the barrier than the strike (assuming the barrier is 5% ITM, that means the spot is 3–4% ITM), dealers will get very long gamma (and will have to take profit on the delta to be neutral) and get long vega (so, in theory, they will have to sell either RR or outright vol via ATM options).

But there is one caveat. As this dynamic is highly path-dependent, the option is highly dependent on the velocity of the underlying move. If the spot moves fast (or gaps through the barrier level in extreme cases), dealers will not have time to accumulate Greeks, and the options will be knocked out quickly, causing dealers to unwind their hedges (which will cause the underlying and implied volatility to "squeeze" as dealers rush to buy/sell back their delta/vega hedges)

To make things more realistic, let's examine the market dynamic in EURUSD around the beginning of July 2022 (during its 1st attempt to breach parity).

The below "estimated barrier distribution" was derived from the trade reports and describes all outstanding barriers at that point in time:



While the market was highly obsessed with the "magical" 1.00 level, in exotic space, most of the KO barriers struck around 0.99–0.97 (it would have been foolish to set a barrier at a level like 1.00 that the market is clearly targeting, right…). If we look at the underlying price action following the break of the 1.00 level, we can see a very shallow price action:

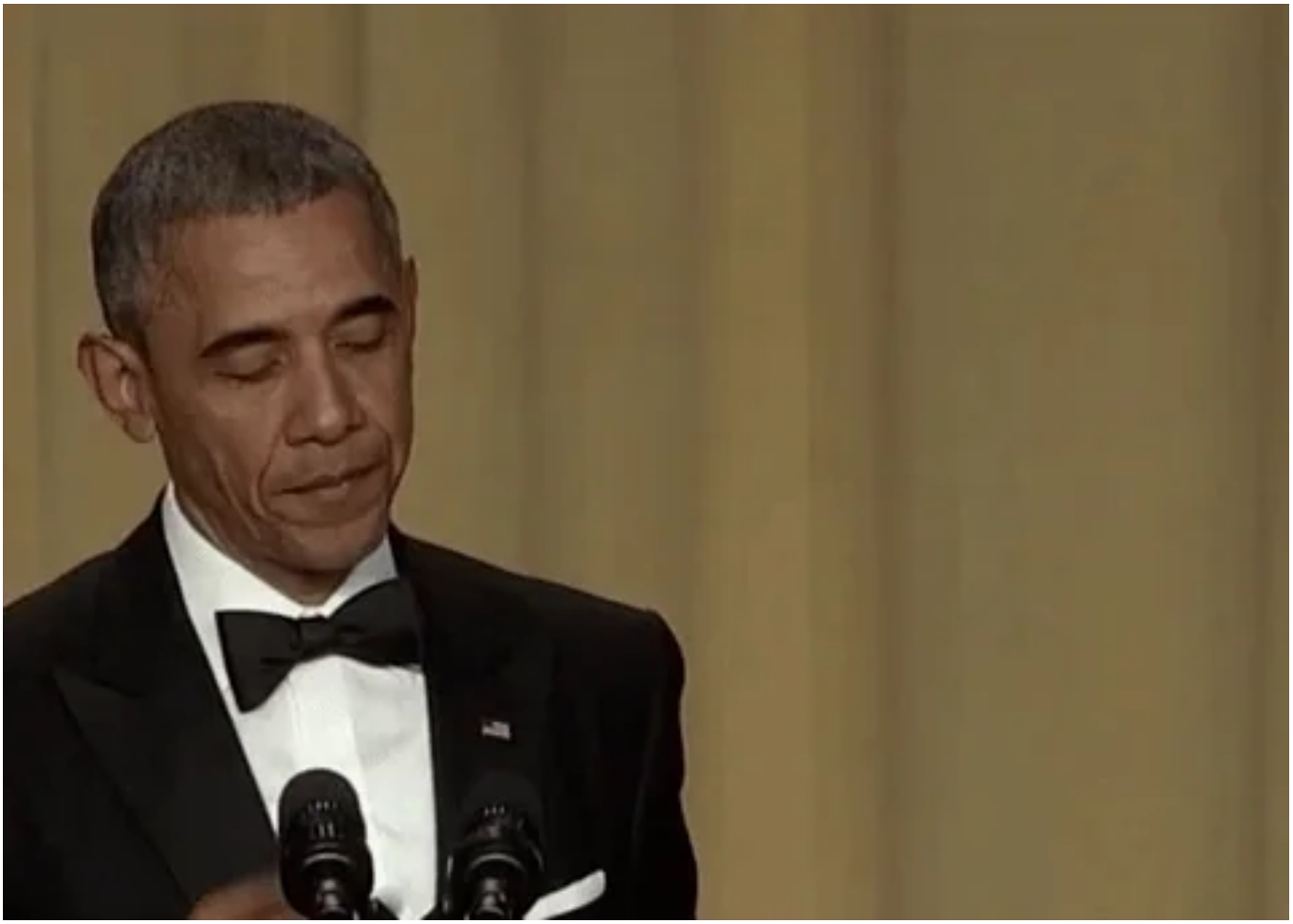
And if we examine how the fixed-strike volatility smile moved, it shows that the entire smile moved lower. Yet, low delta strikes (i.e., far-from-the-money) had a sharper move lower (probably as dealers rushed to sell their excess vega and flattened out their vega-related exposure).

All of the above insights gained from sourcing publically available data merely scratch the surface of why gauging positioning and flows in OTC

markets (like the FX market) is valuable for us as practitioners. Understanding the different agents' interactions and how their interactions affect the price dynamic (both in the underlying market and in the options market) can help in building better volatility models (yet less generalized) to match the market microstructure.

I hope that this write-up was enjoyable (and insightful) to read as it was for me to write and that it gave some food for thought with whatever data/modeling/trading problems you are working on.

Harel.



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Great article, finding niche domain knowledge like this is very rare - thanks for sharing!

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Great article, thanks for sharing all this info with us!

I was wondering which assumptions do you use in order to classify if a trade was bought or sold by the dealer.

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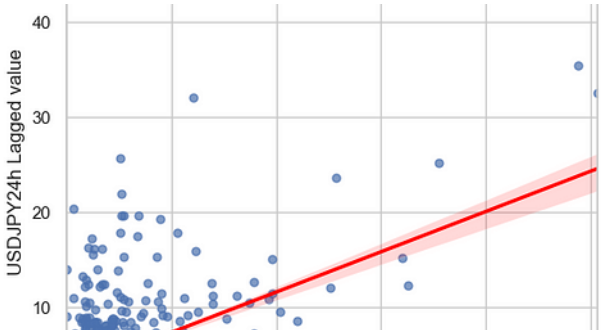

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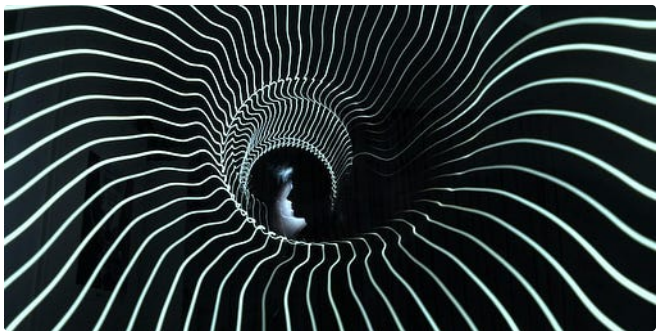

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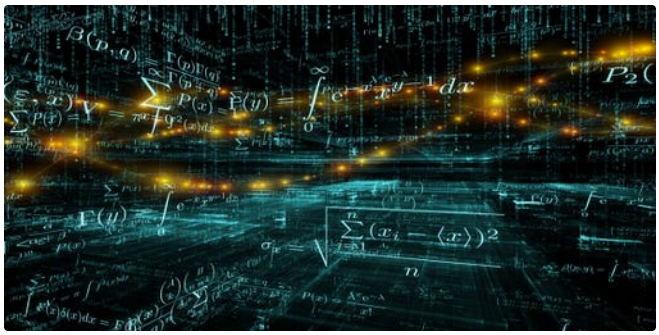

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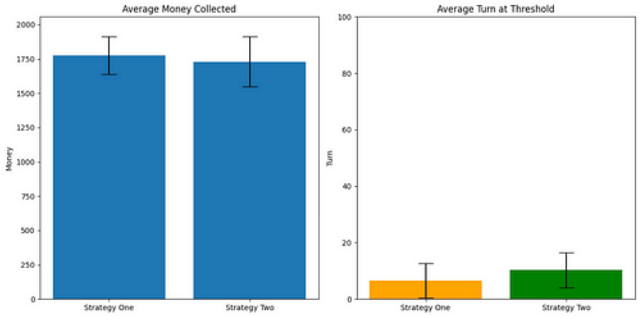

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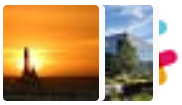

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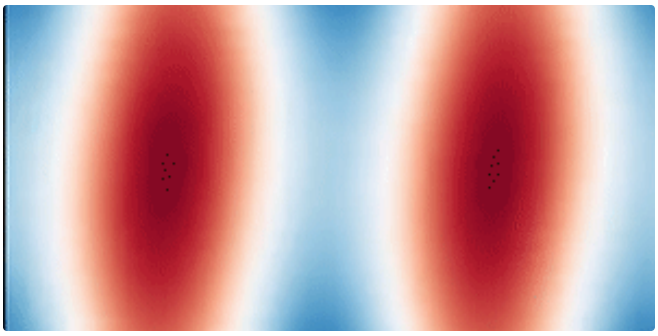

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