Supply and Demand Levels Forecasting Based on Returns Volatility

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Abstract- Supply and demand levels, which are also named resistance and support, are important drivers for investment and trading decisions in any kind of market. For retail trading in the stock market, identifying these zones is very popular. However, these techniques have an issue which is they are subject to personal interpretation of the current scenario pointed out by a chart or indicators that are calculated from past price data. This article proposes a method for identification and the forecasting of supply and demand zones that are not arbitrarily or subjectively defined on a chart, based on the volatility calculation for each stock/security, and can be generalized for different types of markets.

Index Terms- supply, demand, trading, volatility, quantitative finance, forecasting

I. Introduction and Literature Review

Supply and demand, mainly known as resistance and support, are the main driver for market price formation for any kind of market, financial or not. In the special case of trading in the stock market, trading based on identifying these levels is very popular among retail investors (Achelis, 2001). They would seek for these areas to understand where the market could react with some relevant price action, being able to pursue profit out of it. The breakout technique, for example, is a widely used method in which the price breaks under or above a particular price zone – the one from the supply or demand – the trader opens a position in the same direction of the breakout. Alternatively, based on other indicators such as the trading volume, investors could make an interpretation that the breakout would be false or weak and, therefore, the price would revert to the main trend (AS, 2013). The issue with these techniques is that the determination of the supply and demand levels is subjected to personal interpretation of the current scenario pointed to by a chart or indicators that are calculated simply from past price data (Osler, 2000). And there is no pragmatic determination of what these conditions are since they could be many. Nevertheless, the profitability of these techniques has never been fully proven, and there is a lack of consensus and several pitfalls when evaluating them (Park, 2007).

However, investors could think about returns volatility to address this issue. Here there is a relevant point, that is to use returns and not prices to calculate the volatility. The main reason for this approach is that since volatility is a measure of dispersion if prices are used, the scale of the price value will erroneously point out higher or lower measurements as the price change over time. And prices are naturally different on their scales from one security to another. It is also known that returns of an asset are scale-free and return series are easier to handle than price series. That is important because the first have more attractive statistical properties, as being stationary most of the time, and time series that are stationary has several convenient properties for analysis (Campbell, 1997).

Hence, if volatility measures based on price are applied, it is not possible to compare different time frames for the same security nor how much one security has more volatility in comparison to another. Since returns are of the same scale regardless of the type of security, it enables the solution for the listed issues. This article guides a stepwise walkthrough of a proposed method for identification and the forecast of supply and demand zones that are not arbitrarily or subjectively defined on a chart. It suggests a method based on the volatility calculation for each stock/security and can be generalized for different types of markets.

II. Methodology

It's from well know and public domain that volatility is calculated using variance and standard deviation. As volatility measures the dispersion over a specific period, it can be calculated with the formula from equation 1.

$$vol = \sigma\sqrt{T} \quad (1)$$

where:

vol = volatility for an interval of time

σ = standard deviation of returns
T = number of periods in the time horizon

At first, in this paper, the daily volatility is calculated with a moving window of 20 days, since it represents a satisfactory proxy for the average number of trading days in a business month. Multiplying daily volatility by the square root of 252 gives the annualized volatility. If that value is divided by the square root of 12, it is given the monthly volatility value. Likewise, if the annualized volatility value is divided by the square root of 52, the weekly volatility is obtained. When the volatility value of returns is then multiplied by 100, it gives the dispersion value in percentual points (%). Data has been collected from Yahoo Finance from 01/01/2012 to 10/11/2022 using Python as a programing language.

As a baseline to interpret the volatility and what it represents, it is assumed that returns follow a normal distribution, even if is known that for several cases it maybe not be the case. To simplify the approach, that assumption is made, and future work can be used to improve it. With that in place, an example of how to interpret volatility is as follows. Suppose that a value of 15% is obtained. It represents a change, with a 68.27% probability, of a +-15% movement for the security in 1 year time, assuming the annualized volatility. Following the above-cited description for the weekly volatility, for the same annual volatility of 15% and dividing it by the square root of 52, a value of 2.08% is obtained, which represents a change, with a 68.27% probability, of a +-2.08% movement in the security in 1 week time.

Once the volatility calculation method is defined, there is a need to define the criteria for the supply and demand zones. And it is proposed as the following cases A and B:

A. **Annual supply and demand zones**: to derivate the annual expected supply and demand zones for 1 year time, a reference day is chosen, the annual volatility is calculated, and the projected supply and demand bands are given by equations 2 and 3:

$$Supply\ Band\ 1y = (Annual\ Volatility + 1) * Reference\ Price \quad (2)$$
$$Demand\ Band\ 1y = Reference\ Price * (1 - Annual\ Volatility) \quad (3)$$

B. **Weekly supply and demand zones**: to derivate the weekly expected supply and demand zones for 1 year time, a reference day is chosen, the weekly volatility is calculated, and the projected supply and demand bands are given by equations 4 and 5:

$$Supply\ Band\ 1w = (Weekly\ Volatility + 1) * Reference\ Price \quad (4)$$
$$Demand\ Band\ 1w = Reference\ Price * (1 - Weekly\ Volatility) \quad (5)$$

For example, in a case where there is the need to estimate the supply and demand for case A, the last trading day of the year, for instance, 2021, is taken as a reference with its respective annual volatility and closing price values (it will be the Reference Price). Using these values in equations 2 and 3, the trader or investor will have the annual supply and demand zones for the following year, 2022. The same rationale can be used and adapted for case B or any other period that is required – with its required adaptions in the formula. The same is valid if needed to add another standard deviation to the equation, summing up to a 95.45% of probability that the prices will be in the range of minus or plus 2 standard deviations from the mean. Equations 6 and 7 demonstrate that calculation for case B, which is one of the cases more detailed discussed in the results of this paper.

$$Supply\ Band\ 1w\ 2d = (2 * Weekly\ Volatility + 1) * Reference\ Price \quad (4)$$
$$Demand\ Band\ 1w\ 2d = Reference\ Price * (1 - Weekly\ Volatility * 2) \quad (5)$$

The need of using annual or weekly calculations, as well as 1 or 2 standard deviations is to be decided by the investor according to the risk profile and investment strategy that will be applied.

III. Results

Beginning with the results for the annualized volatility calculation, figure 1 illustrates the annualized volatility for the S&P500 (ticker ^GSPC) and figure 2 is for the Ibovespa (ticker ^BVSP), the main Brazilian stock index.

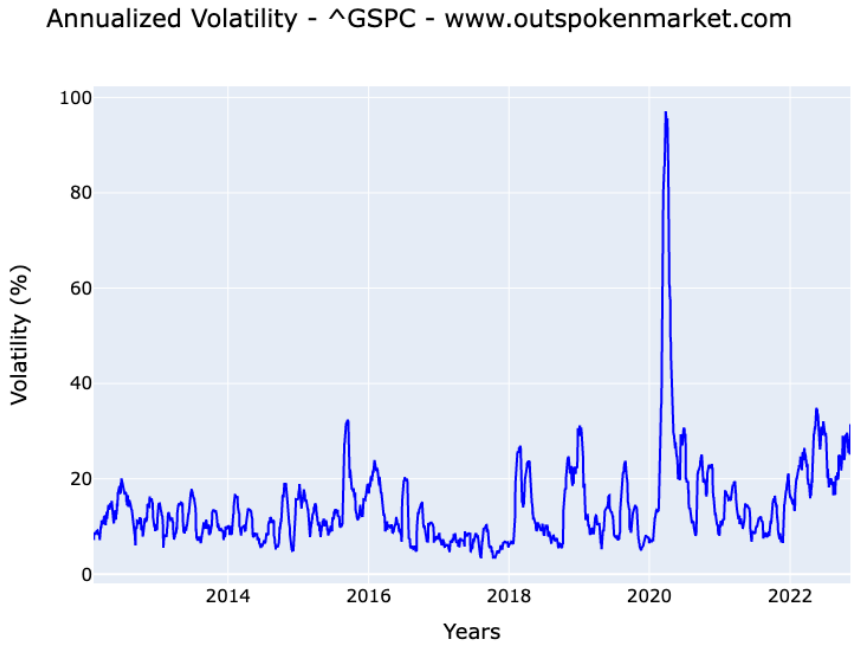

Figure 1 - Annualized volatility for S&P500

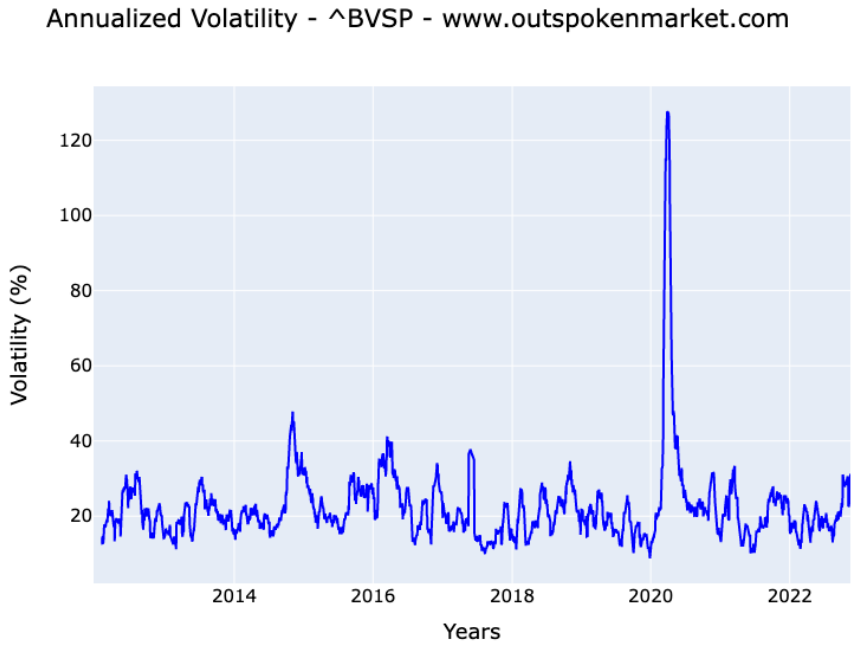

Figure 2 - Annualized volatility for Ibovespa

The most important observation, in this case, is that the volatility values are equivalent in scale, meaning, for example, that during the beginning of the COVID-19 pandemic in the early 2020s, the Ibovespa index reached a volatility level of over 120%, while the S&P500 index was close, but not above, to 100%.

As next, figures 3 and 4 illustrate, respectively the S&P500 and Ibovespa, an example of case A (annual supply and demand zone).

Figure 3 – 2022's annual supply and demand volatility zone for S&P500

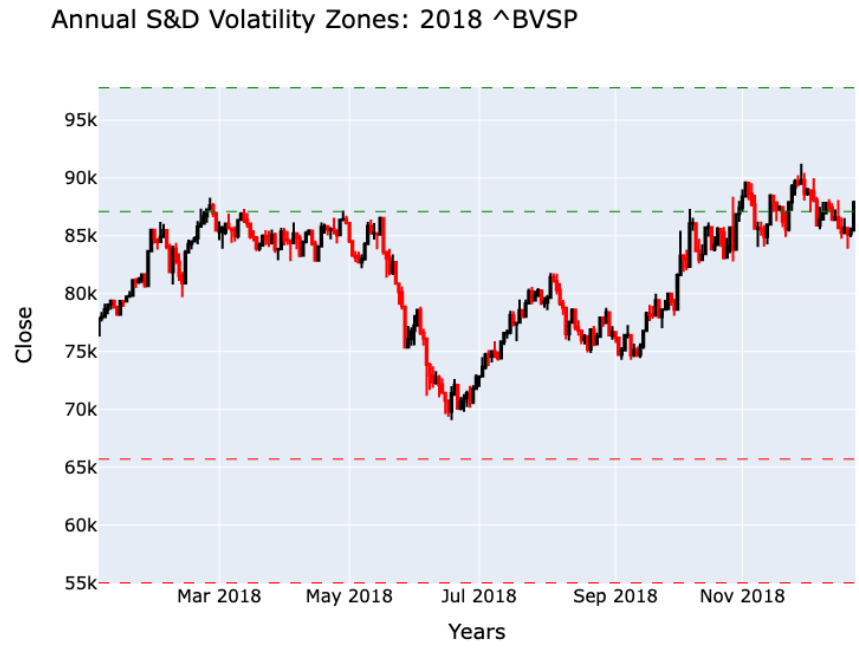

Figure 4 – 2018's annual supply and demand volatility zone for Ibovespa

The periods chosen for the charts above are the ones to best illustrate the example of the proposed method as well as to be used as proof of work of the forecasting methodology. That is because is it possible to notice the price action around the bands that were calculated way before they happened.

Finally, yet importantly, figures 5 and 6 illustrate, respectively for the S&P500 and Ibovespa, an example of case B (weekly supply and demand zone) with emphasis on 2022 for better visualization given the granularity of the information from a weekly basis.

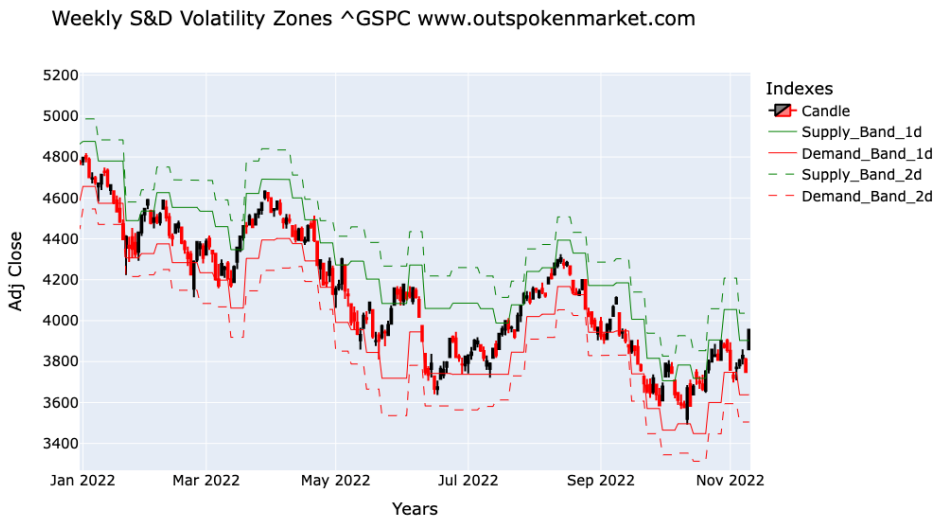

Figure 5 – 2022's weekly supply and demand volatility zones for S&P500

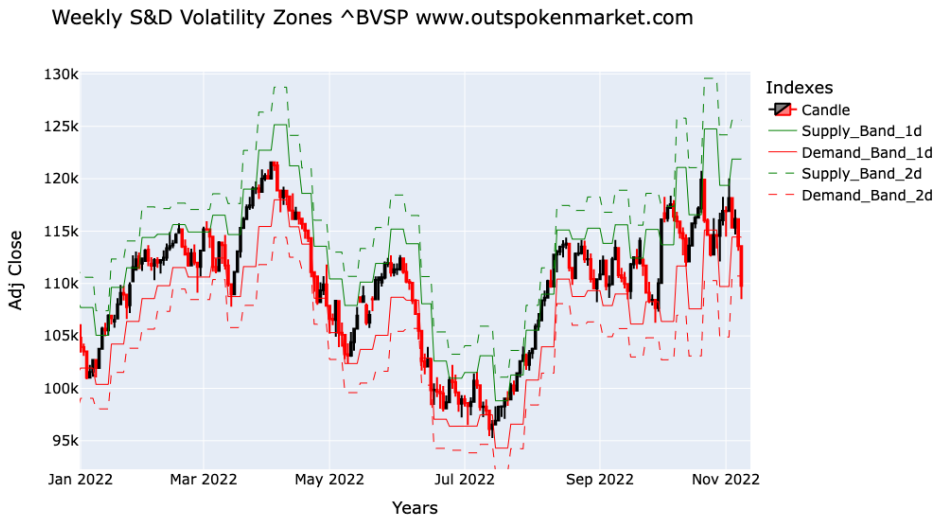

Figure 6 – 2022's weekly supply and demand volatility zones for Ibovespa

Both charts demonstrate also the 2 standard deviation levels.

IV. Conclusion and Discussion

This paper proposed a quantitative and pragmatic methodology to forecast supply and demand zones, projecting the levels based on the returns' volatility calculation and its application in a looking-forward approach. Naturally, this approach is open for utilization by any player in the financial market. However, the main objective is to reduce the level of subjectivity of this kind of analysis and help investors, mainly from the retail side that do not have the same amount of technical and monetary resources as the institutional investors, to acquire quality data for their investment and trading decisions.

There are several trading approaches that can benefit from this method, such as the traditional breakout strategies as well as machine learning model techniques that could use these levels as attributes for the modeling process. That opens space for future work to analyze the contribution in incremental performance it may bring to such methodologies, as well as its utilization on a standalone basis.

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