Filling Open Price Gap on Intraday Timeframe: A Case Study for DJIA Index Stocks

Maged Abidou

(Department of Physics & MathematicsEngineering, Faculty of Engineering, Ain Shams University, Egypt)

Abstract: *Stock open price in a trading session is usually located within the trading range of previous day unless there is a good or a bad news about the stock. If it is good news, open price could be higher than the High price of previous day which causing "Up Open Gap". If there is bad news, then open price could lower than the Low price of previous day which causing "Down Open Gap".During the trading session which lasts for 390 minutes in US, stock trading will result in either closing the open gap or leave it opened.*
This research aims to quantify expected behavior and to find the time of filling the open gap, if it will be closed on the intraday timeframe. Research has used Dow Jones Industrial Average (DJIA) index stocks.
Keywords: *Algorithmic Trading, High Frequency Trading, Market Timing, Stock Market, Stock Open Gap.*

I.   Introduction

The first signal coming from the stock market is the open price for a stock as it gives the first impression on the trading session. The relative location of the open price with respect to the previous day trading range and the close price is what is being transmitted through the media which will influence the sentiments of majority. If there is no significant news about the stock or the economy, open price will be within the previous day price range. If there is good news about the stock before trading session open, open price will be located outside the previous day trading range creating "Up Open Gap".Down open gap will happen when open price is lower than previous day trading range as illustrated in Figure 1 that shows Open-High-Low-Close (OHLC) prices for previous day and for the first minute of trading.

Kaufman [1] introduced a comprehensive analysis for price gaps. He identified that gaps occur when important news influences the market at a time ofno trading astraders are accumulating their trading orders to be executed on the next open. If majority of investors are willing to buy the stock, it will push the open price to be higher than previous day trading range causing an up open gap. Down gap will happen when traders accumulate their sell orders before the trading start time causing the stock price to open at lower price than previous day trading range.
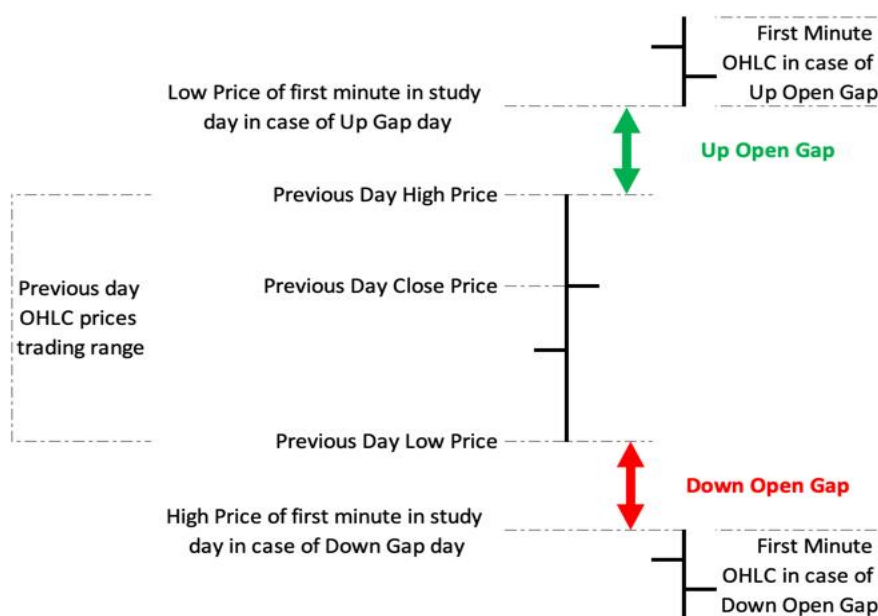

Figure 1: Open Gap Definition

Dahlquistand Bauer[2] studied when gaps will be closed on daily framework. They found that up gaps need 5 days on average to be closed compared to 6 days for down gaps to be closed. Their study was focused on daily timeframe but closing the gap during the same session on intraday framework was not considered.

Due to the increase of algorithmic trading in stock markets as found by Hendershottet al [3], stock price movement behaviors are changing due to the fast response of trading robots which could cause a behavior change of gap closing. Algorithmic trading footprint is not limited to some specific exchanges but it affects most stock exchanges as detailed by Boehmer et al [4].

ArqueTech[5] haslinked algorithmic trading strategy for the gap in Indian stock exchange. They studied the optimum trading strategy for Open gap in Indian exchangeon daily timeframe and an algorithmic trading strategy was introduced for BANKNIFTY in Indian exchange.

As most of the previous studies are focusing on daily timeframe, the current case study paper aims to focus on intraday timeframe by studying the behavior of stock price movement to close the open gap on the same trading session.It will quantify how many gaps are closed within the same session and how manyare left opened until end of the trading session. It aims also to find the average gap closing time for each gap size in US exchange.

II.   Research Methodology

Study sample is identified as the thirty stocks of Dow Jones Industrial Average [6] which traded under the following symbols: AAPL, AXP, BA, CAT, CSCO, CVX, DIS, DOW, GS, HD, IBM, INTC, JNJ, JPM, KO, MCD, MMM, MRK, MSFT, NKE, PFE, PG, TRV, UNH, UTX, V, VZ, WBA, WMT and XOM stocks. Study period is two years starting from 14th September 2017 to 13th September 2019. Stock price was monitored during the same trading session to check if open gap will be closed during the same session or it will be left open. Time of closing the gap was recorded for each price gap. Table 1 shows an overview about recorded open gaps for traded stocks.

Table 1: Recorded Open Gap Overview

Study Start Date	Study End Date	Monitored Stocks	Recorded Open Gaps
14th September 2017	13th September 2019	30 of DJIA	3,047

Recorded data (3,047 points) was grouped into 10 groups based on gap size and gap direction as shown in Figure 2.
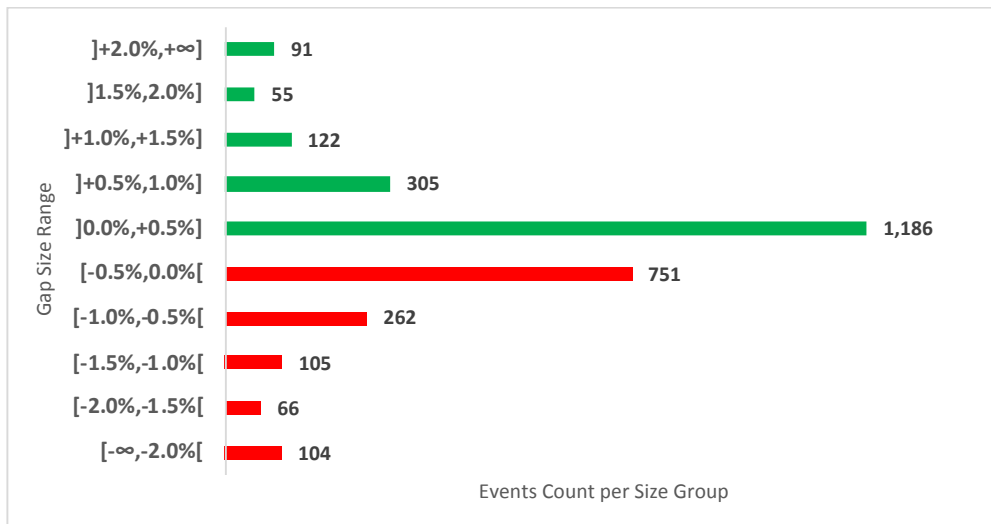

Figure 2: Open Gaps Distribution for DJIA stocks over the study Period

Gap size is defined as in the following equations.

$$\text{Up Open Gap}_{Day} = \frac{\text{Low Price}_{First\ Minute} - \text{High Price}_{Previous\ Day}}{\text{Close Price}_{Previous\ Day}}$$

$$\text{Down Open Gap}_{Day} = \frac{\text{High Price}_{First\ Minute} - \text{Low Price}_{Previous\ Day}}{\text{Close Price}_{Previous\ Day}}$$

For each gap size group, the gap closing time in US EST time stamp was recorded, if gap is filled during the same session. The accumulated percentage of gaps closed within same session was plotted over the session time for each gap size group.

III.   Findings

It was found that traders tend to close up open gap more quickly compared to down open gap as illustrated in Figure 3 that shows 50% of open up gaps are closed just after 22 minutes (9:52 EST) from session start time while 50% of down open gaps need 98 minutes (11:08 EST) to be closed. By session closing time (16:00 EST), 81.5% of up open gaps will be closed comparing to 60.2% of down open gaps.
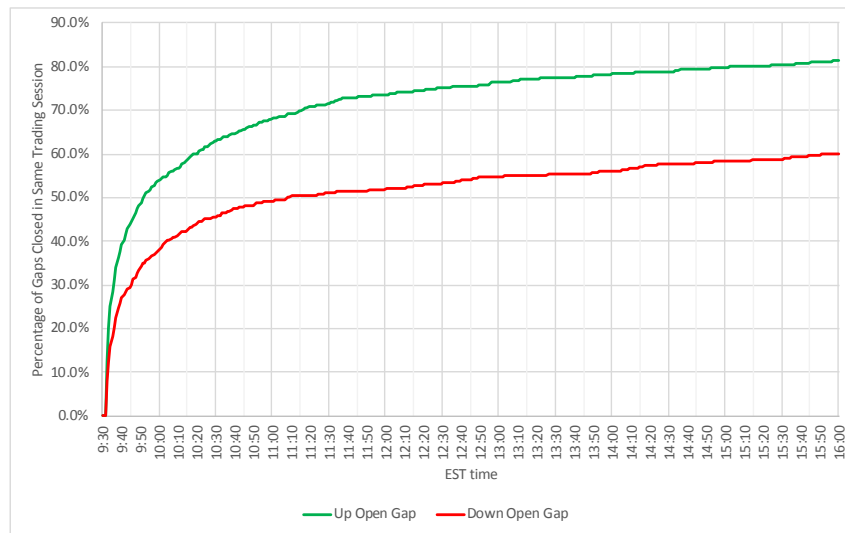

Figure3: Percentage of closed gaps in same trading session

Same study was made for each gap group to have better understanding for the impact of gap size. Results are shown in figures 4 and 5 for up gap groups and down gap groups respectively.
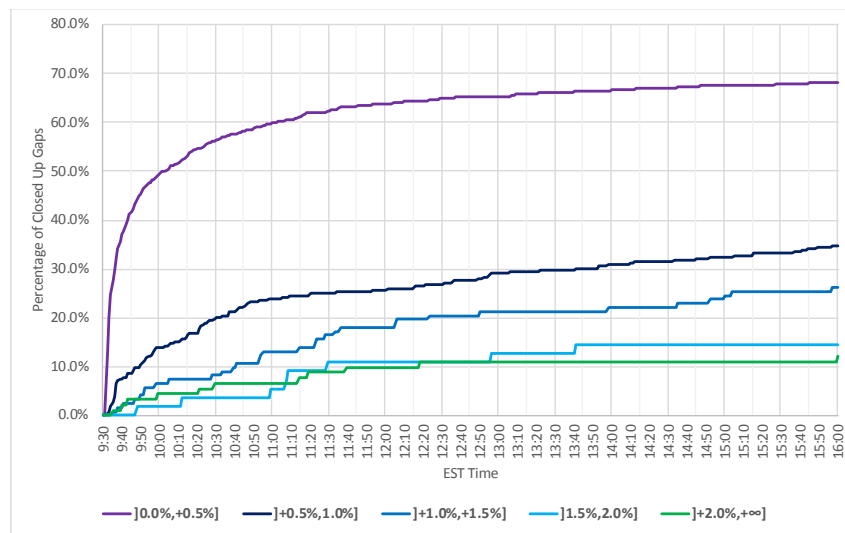

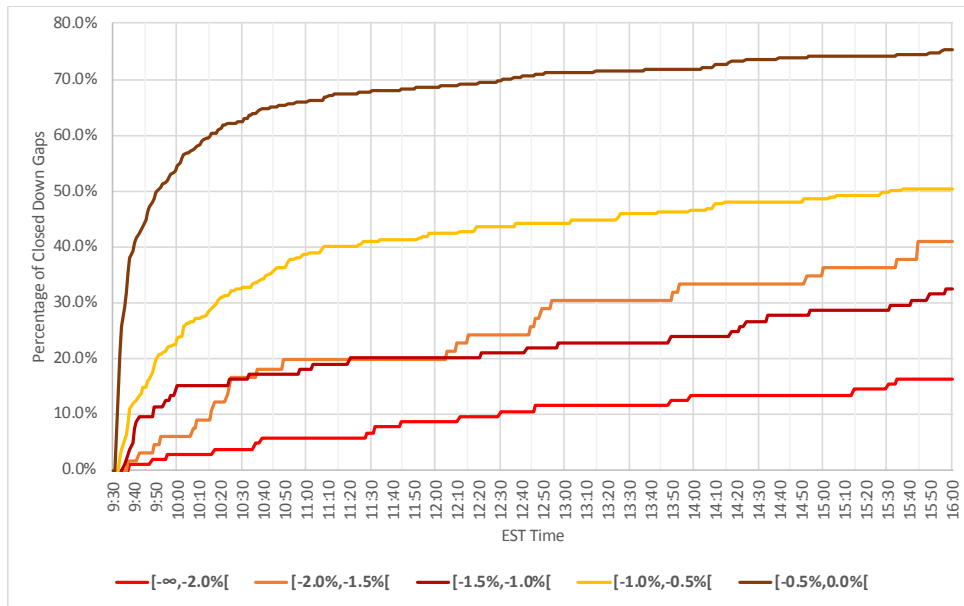**Figure 4:** Percentage of closed up open gaps per open size group

Figure 5: Percentage of closed down open gaps per open size group

It is very obvious that large gaps are hard to close at intraday trading as just 16.3% of down open gaps of size -2.0% or less are closed by end of the session while 83.7% of large down open gaps are left opened. Situation is clearer on the up open large gap side where just 12.1% of gaps sized +2.0% or higher are closed by end of the session leaving 87.9% of large gaps opened. Figure 6 shows the percentage of closed open gaps for each group by end of the session.
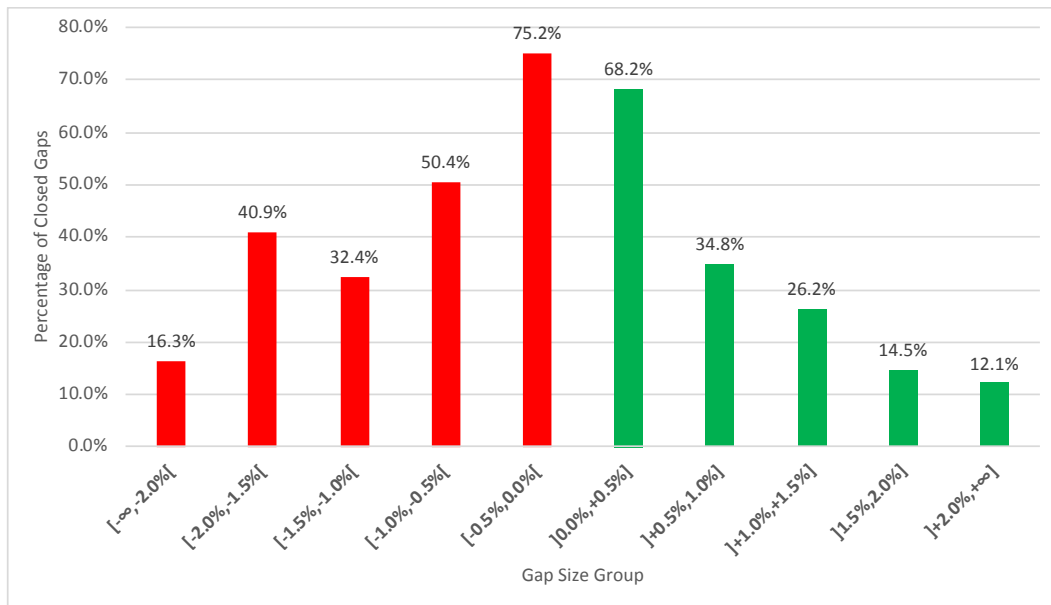

Figure 6: Percentage of closed gap per each size group

Small open gaps are most likely to be closed within same trading session as 68.2% of up open gaps and 75.2% of down open gaps are closed within same session.

IV.   Conclusion

It is risky to trade large open gap while it is advisable to build a high trading algorithm to trade small open gap. Trading small up gap could result in around 68.2% of successful short selling trades by short selling on open and cover at high price of previous day. Trading small down gap by buying the stock on session open targeting the low price of previous day where it is expected to end with 75.2% success rate.

References

[1].   P.J. Kaufman, New trading systems and methods (Library of Congress USA, 2013).
[2].   J.A. Dahlquist, and R.J. Bauer, Technical analysis of gaps (FT press, NJ, 2012).
[3].   T. Hendershott, C.M. Jones, and A.J. Menkveld, Does algorithmic trading improve liquidity?, The Journal of Finance, 66 (1), 2011, 1-33.
[4].   E. Boehmer, K. Fong, and J. Wu, International evidence on algorithmic trading, AFA San Diego meetings paper, 2012.
[5].   Arque tech, This is what happens when you flip the Gap Up/Gap Down strategy. https://www.arque.tech/post/backtesting-the-gap-up-down-strategy
[6].   S&P Dow Jones Indices, 2019, https://us.spindices.com/documents/commentary/djia-year-end-2018-in-review.pdf