Chapter 1

Conceptual Framework

Introduction

Portfolio performance relies on upon many elements, for example, stock picking capacity, planning ideal portfolio portion, and market timing. Be that as it may, as of late literature begin tending to the significance of transaction cost analysis in measuring portfolio performance. Perold (1988) initially distinguished these bits of knowledge of transaction cost saying that transaction cost that can influence portfolio performance depends on cost of trading as well as on not having the capacity to trade (known as opportunity cost). It is later extended by different researchers giving it considerably more extensive meaning of extended implementation shortfall. This favor name is basically only transaction cost yet that incorporates all settled and variable obvious charges as well as every single imperceptible charge that were not taken a gander at precisely by traders previously. In this segment, all these unmistakable and imperceptible parts of transaction costs and appraisals significant to this examination are addressed.

Transaction and transaction cost

Transactions are recently the exchange protest's future possession between two people, and the substance of transaction is simply the proprietorship exchange, not the question moves starting with one then onto the next. It is for the most part expressed that,

transaction is quite recently the trading of products or administration by the medium of currency. In summery it can be stated that transaction is a movement of purchasing or offering s or interests among individuals; and to a widespread definition, every one of the exercises among endeavors, people, venture and individual can be named as transaction.

Transaction costs are those costs that emerge amid the implementation of any investment choice. In financial terms, they are the costs paid by purchasers yet not got by dealers, as well as the costs paid by merchants however not got by purchasers. Ordinarily, the brokerage house (who assumes the part of go-between in budgetary market) gets the measure of the transaction cost from both purchaser and vender to encourage the trade between the gatherings. Nonetheless, as a general rule it is much intricate and points of interest are characterized underneath as execution costs.

Directly observable transaction costs

The execution costs that are specifically detectable and settled are broker commission, exchange fees, taxes and rebates. These are clarified next.

Broker fee and commissions

Brokers charge fees and commissions from both purchaser and merchant of budgetary security to cover the costs of their organizations, which give network to various trades and between dealer networks. Broker commissions can have both settled and variable segments. The settled segment can be a level commission for every month or a level charge for each trade, regularly with a for each trade least charge.

Exchange Fees

Stock trade likewise assumes a part in the monetary market to easily encourage the trades in the market. It capacities to match orders from various broker-dealers or electronic communication networks (ECNs) and charges fees for the administration it gives. The center results of each trade is the stock of open purchase and offer intrigue that traders are hoping to execute on the trade. To pull in liquidity, trades charge higher fees for orders devouring liquidity than for orders providing liquidity. With an end goal to pull in liquidity, a few trades go similarly as paying traders that supply liquidity, while charging just the traders that expend liquidity. Like broker commissions, exchange fees are consulted ahead of time of execution.

Taxes

According to Benjamin Franklin, “In this world nothing can be said to be certain, except death and taxes.” taxes are charged from the net benefits of the trading operation by the fitting ward in which the operation is domiciled. High-recurrence trading creates here and now benefits that are generally subject to the full tax rate, not at all like investments of one year or more, which fall under the diminished tax capital increases umbrella in many locales. A nearby guaranteed or contracted bookkeeper ought to have the capacity to give an abundance of information relating to legitimate taxation rates. Suitable tax rates can be resolved ahead of time of trading movement.

Rebates

The rebate part is another transaction cost segment that is the side effect of the new market condition. Trading settings charge a utilization fee utilizing a straight

commission fee structure, a creator taker display, or a taker-producer (upset) show. In a straight commission demonstrate, both sides are charged a fee for use of the framework. In the producer taker demonstrate, the speculator who posts liquidity is furnished with a rebate and the financial specialist who takes liquidity is charged a fee. In an upset or taker-creator display, the speculator posting liquidity is charged a fee and the financial specialist who brings liquidity is given a rebate. In both cases the fee charged will be higher than the rebate given to guarantee that the trading scene will procure a benefit. Brokers might pass this part onto their customers. In the situations when it doesn't go through the part the broker will pay the fee or gather the rebate for their own benefit pool. The commission rate charged to financial specialists in these cases is probably going to as of now have this fee and additionally rebate installed in its sum.

Invisible/indirect components of transaction costs

There are different costs in executing trades that are not evident and concealed likewise is similarly vital and is considered as a major aspect of the transaction costs, for example, bid-ask spread, investment delay cost, price thankfulness cost, market impact cost, market timing hazard costs, and opportunity cost. The following are the meanings of these parts.

Bid-ask spreads

The spread cost is the difference between best offer (ask) and best bid price. It is intended to compensate market makers for the risks associated with acquiring and holding an inventory while waiting to offset the position in the market. This cost

component is also intended to compensate for the risk potential of adverse selections or transactions with an informed investor (i.e., acquirement of toxic order flow). Spreads represent the round-trip cost of transacting for small orders (e.g., 100 share lots) but do not accurately represent the round-trip cost of transacting blocks (e.g., 10,000 shares).

Investment Delay costs

Delay cost refers to the cost of investment delay, which is also referred to as the *latency cost*. It is the adverse change in the market price of the traded security that occurs from the time an investment decision is made until the time the trade is executed. For example, consider a trader who decides to buy a stock at 10 a.m. Eastern time when that stock was trading at $90.25 per share. It took 10 seconds from the time the order was placed for the broker to execute, at which time the price improved (or decreased) to $90.30 (or $90.20) and the order was executed at this price. Delay cost is then calculated as the difference between these two prices ($90.30 – $90.25 = $0.05 per share). This additional cost adversely affects the trader. However, a trader may save some cost if the price decreases ($90.25 – $90.20 = $0.05 per share). Whether the share price would go up or down is beyond the control of the trader. It is simply a result of the time delay in executing an order.

Price Appreciation costs

The price thankfulness cost alludes to the loss of investment incentive amid the execution of an extensive position. A place of impressive size may not be promptly consumed by the market and may should be “sliced” into littler squares. The littler pieces are then executed one square at once over a specific day and age. Amid execution,

the price of the traded security may acknowledge or devalue thus of regular market movements, conceivably creating an incremental misfortune in esteem. Such misfortune in esteem is known as price gratefulness cost and can be assessed utilizing data on past trades. The price thankfulness cost is unique in relation to the market impact cost, or the antagonistic change in price produced by the trading movement itself, examined accordingly.

Market impact costs

Market impact cost measures the adverse change in the market price due to the execution of a market order. More precisely, the cost of market impact is the loss of investment value caused by the reduction in liquidity following market order–driven trades. When a trader places a market order, it usually is executed at the ask price; based on the size of the trade, the ask price may quickly jump higher, adversely affecting the trader. Typically, in a buy order, a large buy order at the market may signal to the market that good news will be revealed, or it may be an indication of an informed trading. As a result, market makers quickly increase the spread upward to avoid any potential loss to the informed trader. A sell order at market price may cause a further downward shift in the bid price, which is an indication to market makers that the informed trader may have some negative information about the stock. Accordingly, the spread of the bid and ask would increase, further lowering the bid price from its current level.

The market impact cost can be divided into two parts: (1) temporary market impact and (2) permanent market impact. That is, Market impact cost = Temporary market impact cost + Permanent market impact cost. A temporary market impact is a sudden movement

of the price in response to news, which can shoot the price up or down; after a few minutes, it settles back to the original price or near the original price before the news hit the market. Traders may be affected by such sudden but temporary movement of the stock price in a short period of time. Permanent market impact is a case in which the price shoots up or down and remains near the new changed price, causing the sudden effect to remain permanent during the rest of the trading hours.

Timing Risk costs

Timing hazard costs are because of arbitrary, un-estimated price developments of the traded security that happen while the execution strategy is holding up to pinpoint or "hit" the ideal execution price. The cost of timing danger portrays by how much, by and large, the price of the traded security can haphazardly acknowledge or devalue inside 1 second, 10 seconds, 1 moment et cetera from the time an investment choice is made until the market order is executed.

Opportunity costs

The opportunity cost is the cost related with failure to finish an order. Regularly, opportunity cost goes with point of confinement order–based strategies, yet it can likewise be available in market-arrange execution.

The failure to satisfy an order can be because of one of a few variables: (i) the market price never crossed the farthest point price; (ii) The market did not have the liquidity (order or supply) adequate to satisfy the order at the coveted price; (iii) The price moved away so rapidly that satisfying the order would render the transaction unbeneficial, and

the transaction was wiped out subsequently; (iv) The opportunity cost is measured as the benefit anticipated that would be produced had the order been executed.

Implementation shortfall

The implementation shortfall (IS) contains both immediate and aberrant cost of trade and the opportunity cost of not having the capacity to trade as initially proposed by Perold (1988). It gauges the effectiveness of executing investment choices. It is figured as the distinction between the acknowledged trades and the trades recorded in paper trading. The paper trading process typically keeps running in parallel with the live procedure and records all the trades as though they were executed at attractive price at ideal circumstances.

1.06 S & P 500*:*

It remains for Standard and Poor 500. It is a blend of 500 securities, where some are vast capitalization and some are little capitalization firms recorded in the NASDAQ and NYSE. Utilizing market capitalization as weight the estimation of S&P 500 (which speaks to the aggregate market portfolio) is produced. The total number of symbol in S & P 500 are 505 on November 2016. The symbol list of the 505 stocks are mention in the Appendix.

Performance measurement

Relative Performance Measurement (RPM)

The relative execution measure evaluates at what rate of volume or trades all through the predefined time frame the trade could have been executed on far and away superior terms than it was really executed. In the current literature, RPM is assessed against a

few benchmarks, for example, VWAP, TWAP, and OHLC to gauge the portfolio performance of a trader or portfolio administrator.

VWAP and TWAP:

The most mainstream benchmarks are the volume-weighted normal price (VWAP, articulated “vee-wop”) and the time-weighted normal price (TWAP, articulated "tee-wop"). Different benchmarks incorporate midpoints of the open, high, low, and close prices (OHLC) inside the given trading interim that are intended to intermediary for the intra-period scope of price development and measure the calculation's ability to explore instability. Both the VWAP and the TWAP benchmarks can be founded on day by day, hourly, or considerably higher-recurrence price information encompassing the trade. VWAP is frequently thought to be a decent pointer of market price all through the period under thought (a moment, 60 minutes, a day, and so forth.). Execution equipped to beat VWAP commonly prevails at limiting market impact, and VWAP-based execution measures mirror the accomplishment of cost minimization strategies. Then again, VWAP-based execution measurements don't evaluate the execution of strategies attempting to limit chance or different factors other than market cost. TWAP benchmarking measures the capacity of the execution calculation to time the market. TWAP benchmark price registers the price that would be gotten if the order were part into equivalent measured packages and traded one bundle at any given moment at similarly dispersed time interims inside the assigned trading day and age.

OHLC (Open, High, Low, Close)

OHLC benchmark is a basic normal of the open, high, low, and close prices recorded amid the trading time of premium: (i) The OHLC benchmark fuses the intra-period price unpredictability by including the high and low price values; (ii) The OHLC benchmark does not, in any case, represent volume or liquidity accessible on the market.

Best execution

The observation that best execution is a tricky idea has turned out to be extremely exaggerated in the business. Truly, “best execution” is an extremely basic and direct idea: Best execution (as expressed in optimal trading strategies) is the way toward deciding the strategy that gives the most elevated probability of accomplishing the investment goal of the reserve. The strategy comprises overseeing transaction costs amid all periods of the investment cycle, and deciding when it is proper to exploit steadily changing market conditions.

Wayne Wagner portrayed best execution in considerably less complex terms:

It is the process of maximizing the investment idea.

Best execution does not rely on upon how shut the execution price strikes a discretionary benchmark price, (for example, the open, close, high, low, VWAP, and so forth.). Or maybe, it depends on the financial specialist's capacity to settle on appropriate trading choices by consolidating all market vulnerabilities and the current market conditions. A definitive objective of best execution is to guarantee that the trading choices are predictable with the general investment goals of the store. (See Kissell and Malamut

(2007) for an examination on guaranteeing consistency amongst contributing and trading consistency.)

To decide if best execution has been met requires the execution assessment to be made in view of the "information set" that was accessible toward the start of trading consolidated with the investment goal of the store. In the event that either the data set or the hidden investment goal is not known or is not accessible it is just unrealistic to decide whether best execution was accomplished—paying little heed to how close the transaction prices were to any benchmark price.

Goal of implementation

Implementation is the way toward deciding reasonable proper trading strategies and adjustment strategies that will bring about best execution. Lamentably, it is impractical for financial specialists to pre-assess and decide the most ideal approach to execute a position under every single conceivable situation, yet speculators can create standards and rules to make these undertakings faster, simpler, and more productive amid trading. In Wayne Wagner's terminology, *Implementation is the Journey to Best execution.*

Benchmark price Performance

Benchmark price execution measures are the easiest of the TCA execution assessment procedures. These are expected to look at particular measures, for example, net contrast and following blunder, or to recognize impermanent and perpetual impact. A portion of the all the more generally utilized benchmark prices include:

_ Open—as an intermediary for entry price.

_ Close—knowledge into end-of-day following mistake and is all the more ordinarily utilized by list finances that utilization the end price in valuation of the store.

_ Next Day Open—as an approach to recognize brief and perpetual market impact.

_ Next Day Close or Future Day Close—likewise to recognize transitory and lasting impact.

Benchmark

VWAP benchmark

The VWAP benchmark is utilized as an intermediary for reasonable market price. It helps speculators decide whether their execution prices were in line and steady with reasonable market prices.

The calculation is:

$$VWAP_{t_k}^{m} = \frac{\sum_{j=1}^{\Pi} P_j \times V_j}{\sum_{j=1}^{\Pi} V_j}$$

Where VWAP is the volume weighted normal price over the trading time frame. A positive esteem shows better execution and a negative esteem demonstrates underperformance.

Interim VWAP examination fills in as a decent measure of execution quality and makes a pleasant showing with regard to representing genuine market conditions, trading action, and market development. The interim VWAP, notwithstanding, suffers from three issues. In the first place, the bigger the order the nearer the outcomes will be to the VWAP price, as the order price will turn into the VWAP price. Second, genuine execution can wind up noticeably skewed if there are huge square trades that happen at

outrageous prices (highs or lows) in intersection scenes, particularly in situations where financial specialists have constrained chance to take an interest with those trades. Third, the VWAP measure does not permit simple examination crosswise over stocks or over the same stock on various days. For instance, it is impractical to decide whether missing VWAP by 3 bps in one stock is preferable execution over missing VWAP by 10 bps in another stock. On the off chance that the primary stock has low instability and the second stock has high unpredictability, missing VWAP by 10 bps in the second name may in truth be preferable execution over missing VWAP by 3 bps in the principal name. There are three diverse VWAP execution measurements utilized: entire day, interim, and VWAP to end of day.

Entire Day VWAP: Used for financial specialists who traded over the whole trading day from open to close. There is right now no “official” VWAP price on the day yet various suppliers, for example, Bloomberg, Reuters, and so on. do offer one. These sellers decide precisely what trades will be incorporated into the VWAP figuring’s yet they may not utilize all the market trades. For instance, a few suppliers may channel trades that were postponed or arranged in light of the fact that they don't feel these prices are characteristic of what all market members had reasonable access to.

Interim VWAP: Used as an intermediary for the reasonable market price amid the time the financial specialist was in the market trading. The interim VWAP is a particular VWAP price for the financial specialist over their particular trading skyline and should be figured from tic information. This is in contrast with an entire day VWAP price that is distributed by numerous merchants.

VWAP to End of Day: Used to assess those orders that were finished before the finish of the day. In these cases, the broker or trader settled on a cognizant choice to complete the trade before the finish of the day. This VWAP to End of Day gives some knowledge into what the reasonable market price was including even after the order was finished. It decides whether the choice to complete the order early was proper. This is an extremely valuable metric to assess after some time to decide whether the trader or broker is gifted at market timing. Be that as it may, it requires an adequate number of perceptions and a vast tic informational index.

It is significant that some B/Ds and sellers allude to the VWAP examination as a cost as opposed to a pickup/misfortune or execution sign. For those gatherings, a positive esteem demonstrates a higher cost (therefore underperformance) and a negative esteem shows a lower cost (subsequently better execution) and is the direct inverse of the importance in the recipe above. Shockingly, portrayal of costs, P/L, or G/L as a metric is not steady crosswise over industry members and financial specialists should know about these distinctions.

Participation Weighted price (PWP) benchmark

Support weighted price (PWP) is a variety of the VWAP analysis. It is proposed to give a correlation of the normal execution price to the imaginable acknowledged price had they took an interest with a predefined rate of volume amid the length of the order.

The PWP benchmark likewise has some natural impediments like the VWAP metric. To begin with, while PWP provides knowledge into reasonable and sensible prices amid a predefined time skyline it doesn't permit simple examination crosswise over stocks or

crosswise over days because of various stock price unpredictability and day by day price development. Besides, financial specialists could conceivably control the PWP by trading at a more forceful rate to push the price up for purchase arranges or down for offer orders, and give the market the feeling that despite everything they have more to trade. Since transitory impact does not disseminate momentarily, the PWP price processed over a somewhat longer skyline could remain misleadingly high (purchase orders) or falsely low (offer orders) because of brief impact cost. Members may hold prices at these falsely higher or bring down levels sitting tight for the non-existent orders to arrive. The final product is a PWP price that is more worthwhile to the financial specialist than what might have happened in the market if the order had really traded over that skyline.

Relative Performance Measure (RPM)

The relative execution measure (RPM) is a percentile positioning of trading action. It gives a sign of the rate of aggregate movement that the financial specialist beat in the market. For a purchase arrange, it speaks to the rate of market action that executed at a higher price and for an offer order it speaks to the rate of market movement that executed at a lower price. The RPM is designed according to the percentile positioning utilized as a part of institutionalized scholarly tests and gives an expressive measurement that is more reliable and powerful than different measures.

The RPM was initially introduced in Optimal trading strategies (2003) and Kissell (2007) and depended on a volume and trade metric. That unique plan, notwithstanding, had now and again little example size and expansive trade rate impediments

predisposition. For instance, the first detailing considered the greater part of the financial specialist's trades at the normal transaction price as outperformance. In this way, in circumstances where the financial specialist executed an extensive size at a solitary price every one of the shares were considered as outperformance and the final product would exaggerate the real execution. Leslie Boni (2009) additionally explains on this point in her "Grading Broker Algorithms," Journal of trading, Fall 2009, and gives some critical understanding and enhancements. To help address these limitations, The RPM formulation is revised as follows:

$$\text{RPM} = \frac{1}{2}[RPM_{trade} + RPM_{vol}]$$

The RPM is computed based on trading volume as follows:

$$RPM_{trade} = \frac{\sum trades^{\,p_i \geq p^*}}{\sum trades}$$

$$RPM_{vol} = \frac{\sum vol^{\,p_i \geq p^*}}{\sum vol}$$

This plan of RPM is presently the normal of the rate of volume that traded at our execution price or better and 1 short the normal of the rate of volume that traded at our price or more regrettable. In this way, in effect, it treats half of the financial specialist's orders as better execution and a large portion of the order as more regrettable execution.

As expressed, the first definition treated the greater part of the financial specialist's shares as better execution and expanded the measure.

The RPM is in numerous effects a favored measure to the VWAP metric since it can be utilized to analyze execution crosswise over stocks, days, and unpredictability conditions. What's more, it is not affected to an indistinguishable degree from VWAP when expansive squares trade at extraordinary prices.

The RPM will join to half as the speculator represents all market volume in the stock on the day like how the VWAP meets to the normal execution price for expansive orders. Brokers accomplishing reasonable and sensible prices for their speculators ought to accomplish a RPM score around half. RPM scores reliably more prominent than half are an indication of predominant execution and scores reliably under half are an indication of substandard execution. The RPM measure can likewise be mapped to a subjective score, for instance:

Table: 1.07.05.03.01 Meaning of RPM scores

RPM	**Quality**
0% - 20%	Poor
20% - 40%	Fair
40% - 60%	Average
60% - 80%	Good
80% - 100%	Excellent