

Based on research thesis at Georgia Institute of Technology

Master of Science in Quantitative and Computational Finance

Security Valuation

Jai Deshmukh

February 2025

Abstract

As an investor in the capital markets, one of the most critical decisions you face is whether to purchase a specific security, such as OST's (Made up Security) shares. To answer this question, we need to develop a robust framework for valuing securities that considers various factors, including risk, growth, and discounting.

1 Defining a Security

The fundamental premise of security valuation is that a security represents an agreement between two parties, where one party promises a non-negative benefit to the other at a future time or place (Brody et al., 2011).

The value of a security can be derived from the current internal shortcomings in self-assigned security to wealth, which is often referred to as "risk." (Hall, 2001)

Specifically, the attribution of risk, as measured by Repurposed Value at Risk, can provide insights into the ability to recoup the initial investment in the worst-case scenario.

Furthermore, the factors that influence the accumulation and distribution of wealth, such as changes in debt-to-equity ratios, can be used to quantify the impact at the time of investment. (Hall, 2001) (Montani et al., 2020)

The process of valuing a security involves discounting and appreciating the viewpoints of the debtor, the party who has agreed to provide the future benefit.

This includes considering the debtor's growth rate, which reflects the likelihood of the debtor "sticking to

their word", and the discount rate, which determines the level at which we can "discount" the debtor's views.

Finally, the valuation of a security involves analyzing the potential outcomes at the time of exercise, considering both the transaction ask and the impact of decisions to purchase the security.

Applying this framework to the basic question of whether to buy OST shares, we can consider the following:

- The security definition: Paying 144.16 now to receive a non-negative quantity on sale at $t+30$ days.
- The risk: How much of the 144.16 would an investor be able to retain during the 30-day holding period? (Higgins, 2008) (Hall, 2001)

Based on the basic survey, if the investor were to receive \$144.16 for 30 days, they would be able to retain \$44.16, or approximately 30.633% of the initial investment, in the worst-case scenario.

This analysis suggests that the decision to buy OST shares should consider the potential for the investor to recoup more than the initial 144.16 investment during the holding period. (Napitupulu et al., 2021) (Schuyler, 2005) (Hall, 2001) (Brody et al., 2011)

2 Value at Risk (Repurpose)

The value of a security can be derived from the current internal shortcomings in self-assigned security to wealth, which is often referred to as "opportunity cost." (Petruzzi, 1986)

This concept recognizes that securing wealth can also be seen as a form of self-assigned security.

Opportunity cost arises from the loss of adaptiveness that comes with wealth, as it can bind an individual to lower degrees of freedom. Additionally, the need to constantly guard against coercive or persuasive deviations, such as convincing someone through force or reasoning, can be a significant factor in the value of a security.

Quantifying the impact of these factors at the time of investment is essential for accurately valuing a security. Instead of retaining OST stock, you could move between security and cash in various ways keeping in mind your ability to fend off "coercive deviations" - the need to constantly guard against loss of your wealth.

By considering this alternative view of the 144.16, you can better appreciate the value of the OST investment. If the expected retention from OST after accounting for implicit time/regime-based attribution as we will see in the next sections exceeds the explicit retention from the security, then the investment might be worthwhile. However, if the opportunity cost is higher, then it might be prudent to forgo the OST purchase.

The quantification of the impact at time zero is crucial in this analysis, as it allows us to assess the potential risks and rewards of the investment.

The 30.633% retention rate I mentioned earlier does not stem from any calculations specific to OST, but rather reflects an internal confidence of the investor in retaining a portion of the \$144.16 without purchase of OST at time 0. This serves as a personal benchmark for comparison.

While this approach is subjective, it highlights the focus on capital preservation. To strengthen this analysis, you could consider defining the time horizon over which you are setting a personal benchmark for retaining the 69.367%, specifying the potential risks that could lead to losing up to 100%, and relating this baseline to the opportunity costs of the alternative uses you outlined.

Value at Risk is a statistical measure that quantifies the potential loss in value of a risky asset or portfolio over a defined time horizon. We can repurpose its definition to mean "the amount I might be

able to get back from that 144.16 spent on time 0 until end of the security agreement (t+30 days)".

In the context of the OST investment, we can use VaR to estimate the maximum expected loss over the 30-day holding period. With this logic, We would need to conduct a detailed analysis to estimate the Value at Risk, taking into account factors such as the volatility of OST's price, the holding period, and the investor's risk tolerance.

As noted, calculating Value at Risk for OST requires a few key pieces of information, some of which are subjective and based on your risk tolerance and investment timeframe. Since we cannot make those subjective judgements, we will outline the process and provide a simplified example.

Here's how we can approach calculating VaR for OST:

1. Define the Confidence Level: How certain do you want to be about your VaR estimate? Common confidence levels are 95 and 99. Let's assume a 95 confidence level for this example.
2. Determine the Time Horizon: Over what period are you assessing the risk? You've mentioned 30 days, so we'll use that.
3. Estimate Volatility: This is the most crucial step. Volatility measures how much the stock price fluctuates. There are several ways to estimate volatility:
 - Historical Volatility: Calculate the standard deviation of past price returns over a similar timeframe (e.g., the past 30 days, or annualize a shorter period's volatility).
 - Implied Volatility: Derived from options prices, this reflects the market's expectation of future volatility. This is generally considered a forward-looking measure.

Let's assume, for simplicity, that we've estimated the annualized volatility of OST to be 30. We need to convert this to a 30-day volatility:

$$30\text{-day Volatility} = (30/365) \times 30 = 5.09$$

Plugging these numbers into a standard VaR formula:

1. Calculate VaR: Once we have the volatility and confidence level, we can calculate VaR. For a 95 confidence level, the corresponding z-score is approximately 1.645 (you can find this using a standard normal distribution table or calculator).

$\text{VaR} = \text{Investment} \times \text{Volatility} \times \text{z-score}$

$\text{VaR} = 144.16 \times 5.09 \times 1.645 = \12.02

So based on this simplified example, the 95 30-day VaR for the OST investment is \$12.02.

This means that there is a 95 chance that the maximum expected loss on the 144.16 investment in OST over the next 30 days would be no more than \$12.02.

Important Considerations:

- **Volatility Estimation:** The accuracy of your VaR calculation heavily depends on the accuracy of your volatility estimate. Using different methods or timeframes for estimating volatility will yield different results.
- **Distribution Assumptions:** The standard VaR calculation assumes a normal distribution of returns, which may not always hold true, especially for shorter time horizons. For alternative investments (Chambers et al., 2013) with diverse return distributions, traditional VaR may be inadequate.
- **Limitations:** VaR is a helpful risk measure, but it does not provide information about the magnitude of losses beyond the specified confidence level.

Overall, this simplified VaR calculation provides a starting point for quantifying the potential downside risk of the OST investment, but further refinement may be necessary to account for the nuances of this specific security (Maxwell & van Vuuren, 2014) (Chambers et al., 2013).

While value at risk can provide insights into the potential downside of an investment, it has some limitations that warrant consideration. First, VaR is based on historical data and may not fully capture future risk, particularly in periods of market stress. Second, VaR does not provide information about the magnitude of losses beyond the specified confidence level.

To address these limitations, investors may want to consider complementary risk measures such as Conditional Value at Risk, which looks at the average expected loss in the tail of the distribution beyond the VaR level.

Additionally, the literature suggests that incorporating environmental, social, and governance factors can improve volatility forecasting and VaR estimation. The incorporation of ESG risks may be particularly relevant for evaluating the long-term sustainability of the OST venture.

Another key consideration is the role of estimation risk in VaR calculations. Estimation risk refers to the uncertainty in the parameters used to calculate VaR, such as volatility and correlation. This can be particularly challenging for alternative investments with less liquid or more complex return distributions. (“Forecasting volatility by integrating financial risk with environmental, social, and governance risk”, n.d.) (Lechner & Ovaert, 2010)

Ultimately, the assessment of risk and valuation for the OST investment requires a holistic approach that considers multiple factors, including but not limited to Value at Risk.

3 Factor Attribution

In addition to assessing the risk profile, it’s important to consider the factors that drive the accumulation and distribution of wealth associated with the OST investment.

The literature suggests several key factors that can influence wealth, including:

1. **Market Exposure:** The extent to which the investment’s returns are correlated with broad market movements.
2. **Liquidity Risk:** The ease with which the investment can be converted to cash without incurring significant losses.
3. **Idiosyncratic Risk:** Risks specific to the OST venture, such as technology risk, regulatory risk, and execution risk.

4. Environmental, Social and Governance Factors: Risks and opportunities related to sustainability, stakeholder management, and corporate governance.

By understanding the relative importance of these factors, investors can make more informed decisions about the overall risk and return profile of the OST investment.

Let us consider the idiosyncratic risk in particular as it is the factor that is reflective of purposeful action by firms. One crucial factor is the estimated change in OST's debt-to-equity ratio over similar investment periods.

The relationship between change in debt-to-equity (D/E) ratio in the context of financial or capital accumulation can be analyzed from multiple perspectives:

1. Leverage and Capital Accumulation

- (a) Increased Debt-to-Equity Ratio: If a company takes on more debt relative to equity, it suggests that it is using leverage to finance growth or asset accumulation. This can accelerate capital accumulation if the return on investment (ROI) from the borrowed funds exceeds the cost of debt.
- (b) Decreased Debt-to-Equity Ratio: A reduction in D/E ratio implies that the company is relying more on equity financing, which could indicate less aggressive accumulation but potentially greater financial stability.

Impact on Asset Accumulation

2. (a) When a firm accumulates assets (e.g., machinery, real estate, or financial instruments), the funding source matters:
- (b) Debt-Financed Accumulation: Faster accumulation but with increased financial risk due to interest obligations.
- (c) Equity-Financed Accumulation: More sustainable in the long run but often slower due to dilution effects and shareholder return expectations.

3. Debt-to-Equity Changes in Different Economic Phases

- (a) Expansion Phase: Companies may increase leverage (higher D/E) to accumulate assets quickly.
- (b) Recession Phase: Firms may reduce leverage (lower D/E) to maintain liquidity and avoid insolvency, slowing down accumulation.

4. Investor Perspective: Change in D/E and Wealth Accumulation

- (a) For Individual Investors: An increasing D/E ratio of a company could signal higher risk but potential for higher returns if the firm successfully reinvests the borrowed capital.
- (b) For Portfolio Allocation: Investors may adjust holdings based on the change in D/E ratio to balance risk and return in their accumulation strategy.

5. D/E Ratio and Long-Term Sustainability

- (a) A consistently rising D/E ratio without proportional asset accumulation or revenue growth could indicate financial distress.
- (b) A falling D/E ratio with steady asset accumulation suggests a company is growing while reducing reliance on debt, which may be a sign of strong financial management.

In summary, the change in a company's debt-to-equity ratio can provide valuable insights into its capital accumulation strategy, risk profile, and long-term sustainability. This factor attribution can help investors assess the specific risks and growth potential associated with the OST investment.

Ultimately, evaluating the OST investment requires a comprehensive analysis that considers multiple factors, including risk, return, and sustainability.

4 Discounting and Appreciating Viewpoints

It is essential to recognize the differing perspectives on debt utilization and its implications for

financial performance and risk. The way debt is perceived—both by the borrower and the investor—plays a crucial role in shaping growth expectations and discount rates applied to future cash flows.

From an investor’s standpoint, the appropriate discount rate for valuing expected future cash flows or dividends should not be determined solely by theoretical capital structure considerations but rather by the **credibility of the debtor**. A higher degree of credibility—built through financial discipline, repayment history, and stability—reduces the risk premium investors require, leading to lower discount rates and higher valuations. Conversely, a firm with uncertain repayment capacity or an increasing debt burden without a corresponding rise in productive assets will be subject to higher discounting, reducing its valuation.

The trade-off theory (Suitri & Monoarfa, 2021) suggests that there is an optimal level of debt where the tax benefits of debt are balanced against the increased probability of bankruptcy.

Traditional capital structure theories offer frameworks for understanding debt’s role in firm value but do not fully encapsulate the nuances of investor perception:

1. Trade-off Theory suggests an optimal capital structure where debt enhances firm value due to tax benefits up to a point, beyond which the risks of financial distress outweigh its advantages. However, this assumes a mechanistic balancing of debt benefits and costs without fully accounting for how markets perceive a firm’s ability to manage leverage. If investors question the debt holder’s credibility, they may impose a higher discount rate, eroding the supposed benefits of leverage. (Does Capital Structure Affect the Profitability of Listed Family and Non-Family Firms? Evidence from Bangladesh, n.d.)
2. Pecking Order Theory argues that firms prioritize internal financing, then debt, and only turn to equity as a last resort. An increase in leverage may therefore signal that a firm has exhausted its internal reserves and is forced to take on debt.

However, this interpretation is only valid if investors view the firm’s debt reliance as a sign of distress rather than strategic financial management. If the firm maintains high credibility, debt accumulation may instead be seen as a sign of strong future cash flow expectations, leading to lower discount rates.

Ultimately, growth rates and discount rates are not simply functions of capital structure mechanics—they are reflections of the credibility of the debtor and the confidence investors have in the firm’s ability to generate sustainable returns. A firm with a growing debt burden but strong investor trust will experience lower discount rates and an appreciation in valuation, while a firm with increasing debt but wavering credibility will see its growth projections discounted more aggressively.

5 Exercising Valuation

To determine whether to buy OST, we would need to compare the current market price of 144.16 to our estimate of the security’s intrinsic value.

Some key considerations in this process would be:

1. Transaction Bid/Ask: What is the current bid and ask price for OST shares in the market? How do these prices compare to your estimate of the security’s value?
2. Receipt of Right or Control: What specific rights or control does the OST security provide to the holder?

How do these rights factor into your valuation?

1. Decision Discremination: Based on your analysis, is OST a better investment than holding cash or alternative securities?
2. Which option provides the best risk-adjusted returns given your investment objectives and risk tolerance?
3. By carefully considering these factors, you can make a more informed decision on whether to invest in OST at the current market price.

In summary, the key considerations in valuing OST as a security are:

- Calculating the Value at Risk to quantify the potential downside risk
- Assessing the factors driving the accumulation and distribution of wealth, such as the debt-to-equity ratio and growth rate
- Balancing the perspectives of the investor and the issuer to determine an appropriate discount rate

Comparing the current market price to your estimate of the security’s intrinsic value to make a buy/sell decision (Brody et al., 2011) (Lilford et al., 2018) (Blake, 2016) (Pfeifer & Conroy, 2010)

6 Conclusion

In conclusion, the decision of whether to invest in OST at its current market price of 144.16 hinges on a comprehensive evaluation of several key factors. Our analysis began by framing the investment as a security, a promise of future benefit. We then explored the inherent risks, emphasizing the importance of quantifying potential downside through metrics like Value at Risk. This necessitates estimating volatility and defining an acceptable confidence level, both of which depend on individual investor preferences and time horizons.

Furthermore, we delved into the dynamics of wealth accumulation and distribution, highlighting the role of factors such as a company’s debt-to-equity ratio. Changes in this ratio offer valuable insights into a company’s financial strategy and risk profile, influencing investor perceptions and subsequent valuations. A nuanced understanding of these factors, beyond simplistic interpretations offered by traditional capital structure theories, is crucial.

The critical role of investor perception and debtor credibility in determining discount rates and growth expectations was also underscored. A firm’s ability to inspire confidence in its ability to generate sustainable returns significantly impacts its valuation,

irrespective of rigid adherence to theoretical capital structure models. This emphasizes the subjective nature of valuation, where investor outlook plays a defining role.

Finally, the decision to invest in OST requires a careful comparison of the current market price with an estimated intrinsic value. This involves considering transaction costs, the specific rights conferred by the security, and a comparison with alternative investment opportunities. Ultimately, the decision rests on a balance of risk, promised return, and alignment with individual investment objectives. While this analysis provides a framework for evaluating OST, the final investment decision requires a personalized assessment of these factors. (Alexandrov, 2004) (Lai, 2014)

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