To perform the CAPM test, we will check if the residual value, the excess return calculated using CAPM, deviates significantly from zero. Any positive or negative alpha represents if an asset is overperforming or underperforming, respectively. As the amount of assets present for analysis is huge, we will use Excel formulas of slope, intercept and RSQ for regression on individual assets. Our null hypothesis states that alpha values will equal or near zero. If the intercept value (alpha α) deviates significantly from zero, we will consider it evidence that CAPM does not hold. To check the significance of the deviation of alpha from zero, we will use the T-statistic with a level of significance set to 5%.

Measures – Beta and alpha

Beta helps define the volatility of a portfolio return compared to the market return movement.

β > 1	Portfolio is more volatile than market
β < 1	Portfolio is less volatile than market
β = 1	Portfolio is equally volatile as the market

Alpha helps in defining the residual or excess return that a portfolio makes based on its beta.

Residual (alpha) = Actual Return – CAPM Return

| α > 0	portfolio is overperforming and holder should keep it
α < 0	portfolio is underperforming and holder should sell it

PART A
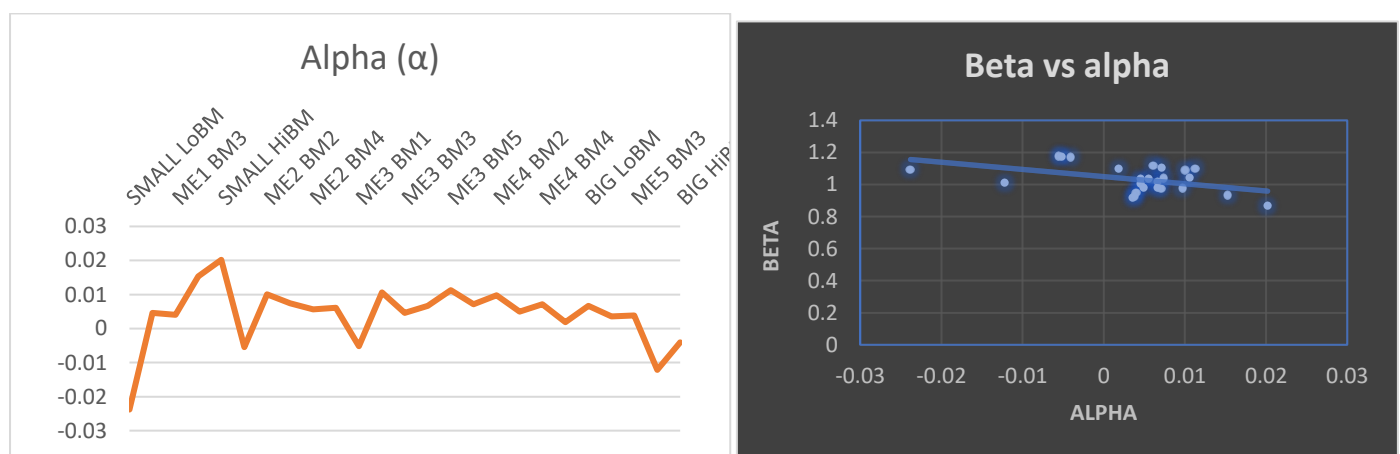
From the graph plotted for Alpha (α), we can see clear deviations in the value of Alpha. However, the value of the deviations is not statistically significant as the deviations are not huge. In the Excel Calculations, I have used t-statistic to check the significance of Alpha. From the calculations, we can see that if we use 1% as the level of significance, then portfolios like SMALL LoBM, ME1 BM4, SMALL HiBM, ME3 BM2, ME4 BM2, BIG LoBM and

ME5 BM4 fail to pass the CAPM test. If we use a standard significance level of 5%, then CAPM holds, and every portfolio passes the CAPM test as the Residual value is insignificant.

PART B
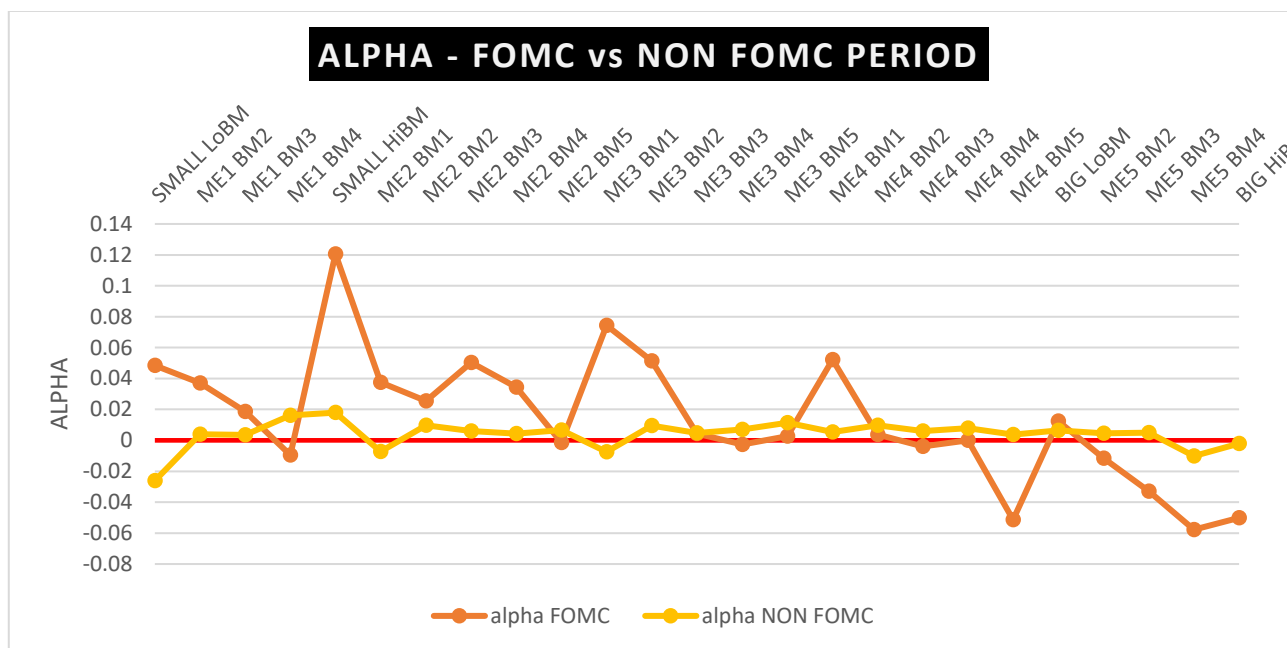
From the line graph, we can see that during the FOMC period the absolute value of the residual (alpha) is higher than the non FOMC period. To check the statistical significance of the calculated alpha, we will use the t-statistic calculated in Excel with a level of significance of 5%. For the FOMC period we can see that the portfolio SMALL LoBM (5%), SMALL HiBM (8%), ME2 BM3 (7%), ME3 BM1 (10%), ME3 BM2 (9%), ME4 BM1 (9%), ME4 BM5 (5%), ME5 BM3 (6%), ME5 BM4 (5%) and BIG HiBM (5%) have failed to perform during the CAPM test. On the other hand, all the portfolios during the NON FOMC period holds the CAPM test because of near to zero alpha values and having a level of significance under 5%. During the FOMC period, we also saw that beta didn't remain consistent between the two periods.

This means that CAPM did not hold during the FOCM announcement and the period surrounding it.

PART C

The FOMC announcements determine US monetary policies. These policies affect various aspects, such as interest rates on assets, asset valuation, and overall growth. People wait for these announcements, trying to predict policy changes and shifts. Because of such predictions and plans to mitigate the effect of these new policies, investors use various methods to overcome the adverse effects of these monetary policies. Such plans cause a residual, an excess return to be created. The CAPM works on the assumption of a linear relationship between risk and return. It employs a beta created using historical data.

$$E(R_i) = R_f + \beta \times (E(R_m) - R_f)$$

⇨ $E(R_i) = R_f + \beta \times (E(R_m) - R_f)$

⇨ $E(R_i) - R_f = \beta \times (E(R_m) - R_f)$

⇨ $B = (E(R_i) - R_f) / (E(R_m) - R_f)$

⇨ Beta Calculated using historical data is the slope

$E(R_i)$ = Represents the expected return

R_f = Represents the Market Risk

$E(R_m)$ = Represents the Market Return

$(E(R_m) - R_f)$ = represents the Market Risk premium

This beta, calculated using historical data, will not consider the volatile pricing returns that investors create for a short period during FOMC announcements to get ahead of the curve, allowing them to gain an edge in the market. The results of the analysis done in PART B, where CAPM fails to hold during the FOMC announcements, can be explained by various factors –

- **Increased Market Volatility –** FOMC announcements come with high uncertainty about policy changes and shifts. These uncertainties manifest themselves in the form of volatile changes in the asset's market price. CAPM helps make predictions by assuming a linear relationship between the risk and the return. Such volatilities add noise to the system, which may affect the Beta, which assumes this linear relationship. These volatilities occurring for short periods around the FOMC announcement may cause issues in the expected returns, which are maintained and calculated using a running historical Beta. During periods of such high volatility, the Beta might not accurately represent an asset's risk. Thus, making CAPM ineffective for these short periods. In a paper proposed by (Bodilsen et al., 2021), the author shows an analysis that predicts the relationship between a portfolio's Beta and the excess return (residual). The author shows that this relationship is strong on the period surrounding the announcement and is weak during the NON FOMC announcement days. They also added that cross-sectional beta dispersion, which is beta values across different stocks, reduces on announcement days, suggesting that an increase in the value of the market's volatility results in the unreliability of the Beta.

Speculation and Bias – Investors may react poorly to the announcements of the FOMC, which might trigger herd behavior or overreaction from the investors. Such views can cause the new price to differ significantly from the expected price. Because of this, we can see residuals being produced, which can cause an asset to either overperform or underperform. For example, a fear of rising interest rates can cause people to sell interest-rate-sensitive assets. Such things cannot be predicted and handled by CAPM. A study identified a pre-FOMC drift where excess residuals are received in anticipation of these announcements

(LUCCA, 2015). The Author attributed these excess returns to the reallocation, news announcements and volatility

- **Systematic Risk –** ·Investor sentiment affects market risk. Such risks cannot be reduced. If an FOMC decision appears to cause changes to growth and inflation, the beta values of assets can change because of the insight into the future incoming risk. This makes CAPM, which uses beta calculated using historical data, less accurate in predicting expected return. This can cause residual excess return because of the difference between the actual return and the return calculated using CAPM. ("Investor sentiment and the pre-FOMC announcement drift," n.d.) describes how investor sentiment about the perception of future risk and pre-FOMC announcement can show a fall image of the asset valuation or price. This distortion will affect the beta calculated, which is used by CAPM, making it less effective. The study states that the positive sentiment toward the FOMC announcement shows a flaw in CAPM's accuracy.

- **Asset Rebalance –** Investors anticipating new monetary policies can trigger a rebalance of their portfolios where they can take out money from one portfolio and put it into a different one. This rebalancing can cause a dynamic that can cause issues like sell-off or hold to short the market. During FOMC periods, investors closely monitor FOMC announcements and adjust their expectations accordingly. These expectations and prior beliefs may cause volatility, which plays a hand in the deviations that we see in the CAPM expected return. CAPM works on the assumption of trends that are formed over a long period of time. CAPM is a straightforward framework that works on assumptions like rational investors, distributed returns, and portfolios yielding maximum return for a given risk. These simple assumptions may not represent the real-life dynamics as investors do not follow such practices.
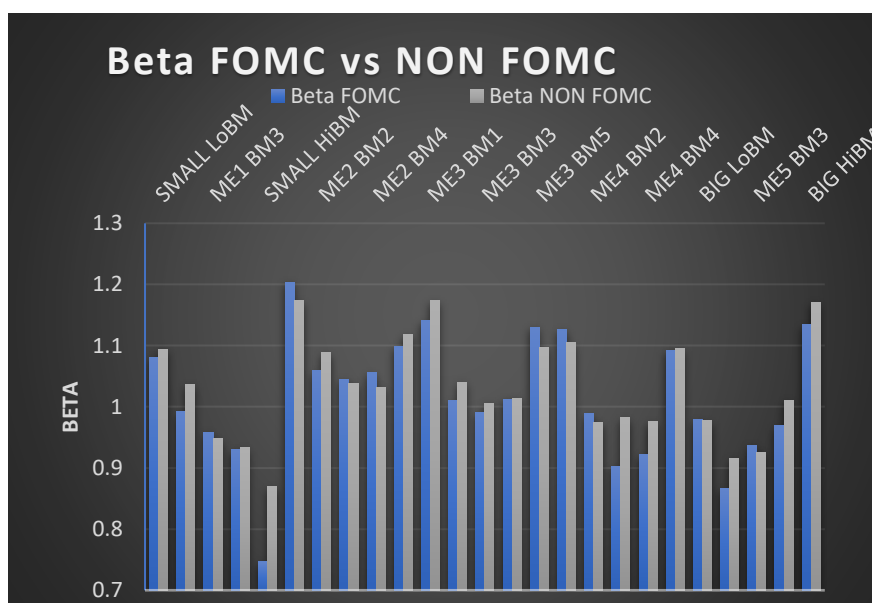
We cannot see any discernable pattern for the Beta in the bar graph. Most of the asset's Beta lies close to Market volatility. There is no clear pattern of how the FOMC period affects the Beta. We can see that Beta is increasing for some portfolios and decreasing for others. This can happen due to investors rebalancing their portfolios based on the new monetary policies, which can lead to short-term gain/drop in valuation, which may influence Beta. These short-term changes affect the Beta, which CAPM does not handle well. Hence, there is a difference between the two periods. There is also no correlation between the size and Beta of the portfolio. Some smaller portfolios have a higher beta than bigger portfolios. Most of the Beta changes for smaller portfolios are small in the two periods, while the beta difference for larger portfolios is larger. In the paper (Baker & Wurgler, 2004, p. xx), the author states that when sentiment is low, returns are high for small stocks. When sentiment is high, the returns are small. Larger portfolios of bigger valuation respond more actively to monetary policies, while small portfolios face less tinkering.

PART D
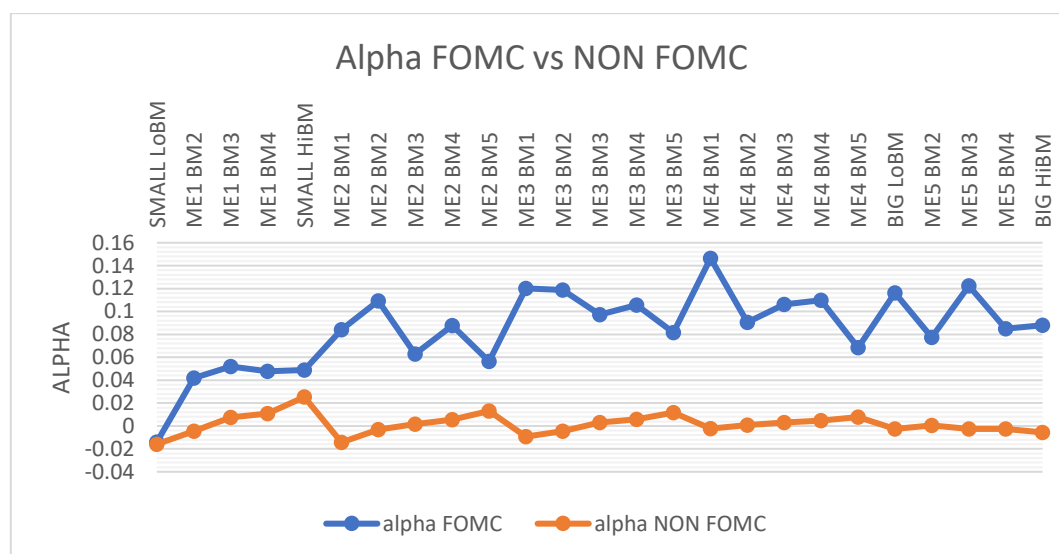
The line graph of alpha shows that the residual value is high during the FOMC period. To check the statistical significance of the calculated alpha, we will use the t-statistic calculated in Excel with a significance level of 5%. Only one of the 25 universal portfolios present for analysis is insignificant. The rest of the 24 portfolios lie above the level of significance. During the NON-FOMC period, the alpha of the portfolios remains close to zero. When we check the significance level of the alphas calculated, we can see that the t-statistic values lie under the 5% mark. From this, we can conclude that CAPM holds during the NON-FOMC period and fails to do so during the FOMC announcement period.

The Excel calculations show that the deviation for the alphas from zero when calculating the intercept for international portfolios is higher than for the US portfolios. This is also evident from the fact that the t-statistic, used to calculate the significance of the mentioned

coefficients from the regression model, of the international portfolios lie well above the US portfolios. Even though the strength of deviation is stronger in international portfolios, our results remain consistent with the fact that the CAPM holds during the NON-FOCM period but fails to do so during the FOCM period.

There are several reasons why Alpha (residual) in international portfolios experiences a deviation from zero during the FOMC period –

- **Market Volatility and Risk** – FOMC announcements play a major part in the excess return being calculated for international portfolios because of the US economy's interconnectedness with the global market. This is because a change in monetary policies will affect investors globally. For example, an increase in interest rates can prompt a herd mentality where investors can move away from risky assets with higher returns to less risky assets in US securities, which will give a higher return. A Paper (Trung Hoang Bao & Cesario Mateus, 2017) that studies the impact of FOMC announcements on Asian countries states that the interconnectedness of US and global markets influences foreign markets.

- **Liquidity** – Liquidity refers to how easily a transaction of the same monetary value can be made without affecting the asset's price. When the FOMC makes announcements about interest rates, it can affect the investor to safe US government bonds. The increase or decrease of funds available to the investor after investing in safe US government bonds may affect international assets. CAPM will not handle this movement of capital allocation as it works on the principle of long-term asset holding. This issue will result in a large increase in the value of Alpha. In the paper (Tadle & Cruz, 2022), The study finds that a strong or cautious outlook of FOMC has a high influence on the valuation of the US dollar against several foreign currencies. This shows that the FOMC period can affect international capital flows.

- **Currency** – FOMC announcements usually have an impact on the US dollar. The US dollar, for the moment, serves as the global reserve currency. The impact of global currencies on international portfolios can be because of the exchange rate of currencies against the dollar. For example, an increase in the interest rates will increase the dollar's value against other currencies. Hence, these exchange rates greatly impact the sensitivity of the international market, which can show as high residual values because of abnormal returns.

- **Cash Flow Adjustment** – When the FOMC announcements affect US monetary policies, such as a higher interest rate, US assets become much more attractive to investors. Because of this, a large movement of cash flow can be seen from risky assets to assets with a lower risk and a potentially higher return. These movements may not be handled

by the CAPM model, and we, in turn, see a higher residual in the period surrounding the FOMC.
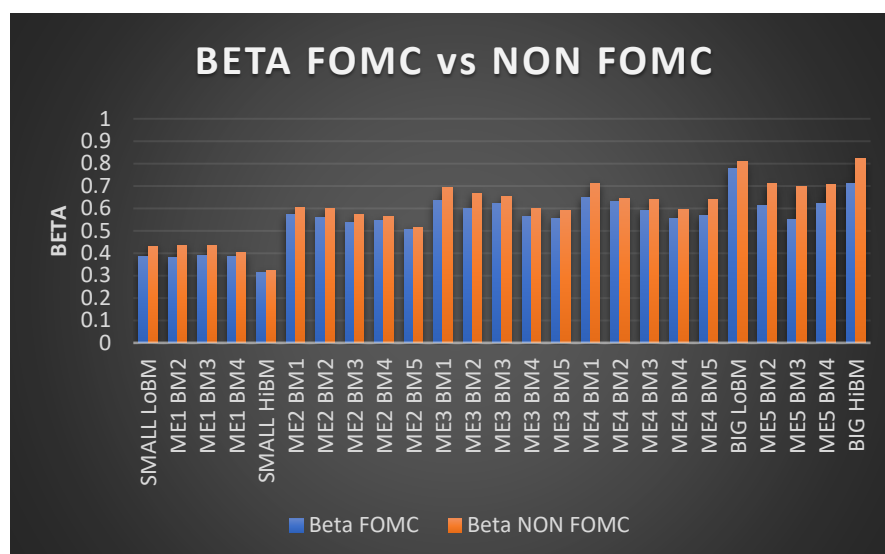
The bar graph shows a very subtle change in the value of Beta between the FOCM and NON-FOCM periods. We always see a slight decrease in the value of Beta when going from NON-FOCM to FOCM period. This is inconsistent compared to US portfolios as it does not share a similar pattern where its Beta increase in some portfolios and a decrease in others. We can also see that smaller portfolios have a smaller beta value while bigger portfolios have a higher beta value. This does not follow the US portfolios as it shows no pattern in deciding how the value of the Beta is affected based on its size.

A paper (Hausman et al., 2011) provides evidence that states the case of a decrease in Beta for international assets during Federal Open Market Committee (FOMC) announcements. The paper analyzed data from 49 countries and stated that exchange rates and long-term interest rates are sensitive to the stance of US monetary policies. This helps understand the shift that international markets face when merging and collaborating it with the US market. All this leads to a small decrease in the value of the Beta of international portfolios during the FOCM period.

References

Baker, M., & Wurgler, J. (2004). Investor sentiment and the cross-section of stock returns. https://doi.org/10.3386/w10449

Bodilsen, Eriksen, S. &., & Jonas N. & Grønborg, Niels S. (2021, February 2). *Asset pricing and FOMC press conferences*. Economics and Finance Research | IDEAS/RePEc. https://ideas.repec.org/a/eee/jbfina/v128y2021ics0378426621001229.html

Hausman, Wongswan, J. &., & Jon. (2011, February 2). *Global asset prices and FOMC announcements*. Economics and Finance Research | IDEAS/RePEc. https://ideas.repec.org/a/eee/jimfin/v30y2011i3p547-571.html

Investor sentiment and the pre-FOMC announcement drift. (n.d.). Welcome to Enlighten Publications - Enlighten Publications. https://eprints.gla.ac.uk/209237/

LUCCA, D. O., & MOENCH, E. (2015). The Pre-FOMC Announcement Drift. The Journal of Finance, 70(1), 329–371. http://www.jstor.org/stable/43611030

Tadle, & Cruz, R. (2022, February 2). *FOMC minutes sentiments and their impact on financial market*. Economics and Finance Research | IDEAS/RePEc. https://ideas.repec.org/a/eee/jebusi/v118y2022ics0148619521000394.html

Trung Hoang Bao & Cesario Mateus. (2017, February 2). *Impact of FOMC announcement on stock price index in Southeas*. Economics and Finance Research | IDEAS/RePEc. https://ideas.repec.org/a/eme/cfripp/cfri-06-2016-0051.html