# Cross-Impact Analysis of Stock Order Flows

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**Abstract**

This short write-up covers a quick analysis of order flow imbalance (OFI), principal component analysis (PCA), and cross-impact among selected stocks. This document contains the main steps I took to calculate OFI, visualize the relationships, the cross-impact analysis, and visualizations of my findings.

# 1 Methodology

## 1.1 OFI Calculation

First, I computed the Order Flow Imbalance (OFI) for each stock by comparing the size and direction of trades at the best bid and ask. Specifically, I used

$$\text{OFI} = (\text{AskVolumeTraded} - \text{BidVolumeTraded}),$$

The goal was to capture the pressure caused by buy vs. sell orders.

## 1.2 PCA

I used PCA to reduce dimensionality of the OFI data across multiple stocks. By extracting principal components, I aimed to see if a handful of components could represent most of the variance. This helped me visualize if some stocks exhibited stronger or weaker impact patterns.

## 1.3 Cross-Impact Analysis

Cross-impact analysis involves looking at how one stock's OFI might correlate with subsequent price or volume changes in other stocks. I calculated the coefficient that approximated the effect of one stock's OFI on another's price movement. A positive coefficient implied that upward (buy) pressure in one stock might lead to upward movement in another, while a negative coefficient implied an inverse relationship.

# 2 Results

Figure 1 shows a simple bar plot of cross-impact coefficients for five symbols (AAPL, AMGN, JPM, TSLA, and XOM).

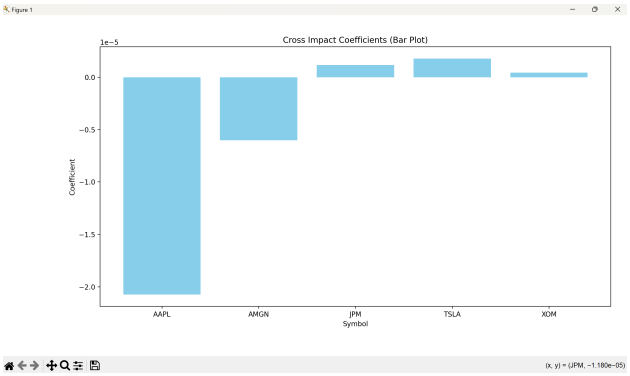


Figure 1: Cross Impact Coefficients

From the figure, AAPL had a relatively large negative coefficient, suggesting its OFI might move inversely with another symbol's price. Meanwhile, TSLA and XOM showed smaller (but still positive) impacts, indicating they might move somewhat together with other stocks.

## 3 Discussion

The main takeaway is that certain stocks show more pronounced cross-impact than others. A large negative coefficient could mean that heavy buying in one stock might correspond to selling pressure elsewhere. This could be used to design pairs-trading strategies or risk hedging techniques. For instance, if we notice AAPL and AMGN tend to move in opposite directions when there's big order flow, a trader could look for diversification between those two names.

## 4 Conclusion

These results highlight that order flow in one stock can indeed affect others, but the impact can be small. Still, in a high-frequency or short-term trading context, even tiny edges might be useful. Next steps could include testing more symbols, refining the OFI formula, or incorporating more sophisticated methods to predict cross-impact relationships.

## References

[1] Cont, R., Cucuringu, M., Zhang, C. (2023). *Cross-impact of order flow imbalance in equity markets*. Routledge, Taylor & Francis Group.