

## Adaptive hedging beta analysis for US stocks

Capstone Public Project Summary

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#### **1.** Basic terminology

This capstone project make research about stocks' beta. Beta is the coefficient from the CAPM model captures individual stock sensitivity to market returns. For example, a stock with beta 1.5 means that if market (usually S&P 500 in the US) moves by 1%, the stock would move by 1.5%, i.e. the stock is more sensitive.

Another important concept is the beta error.

#### Beta error = Next day return – Next day market return \* Calculated Beta.

During the project, I focused on finding patterns that can minimize this beta error. Lower beta errors would mean that we could predict the future beta better.

### 2. Summary of project

The purpose of this capstone project was to identify patterns in beta calculations/analysis of US stocks, that can help the Client to make better predictions for future beta. In other words, I searched for patterns that could minimize the beta error. The main benefit of this capability for Client is that it can make hedging more effectively during their trading activity.

The difficulties with beta calculation are that there are a lot of factors that affect beta's and beta errors' values, such as market volatility or turnover. Just an example, during the last one year, the beta error values increased significantly, ~2-3 times higher. This is due to the high market volatility.

As a result of this research, I found evidences that there is correlation between beta error and volatility/turnover, and these patterns can help us to make better prediction for beta. In addition, I created a simple algorithm that adaptively change its calculation of beta. I also found that with this simple algorithm, I could achieve better results compared to that if I would have used a non-adaptive beta calculation.

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#### 3. Approaching the problem & key outcomes

First, I prepared the suitable dataset for analysis. I used Reuters Eikon's database and downloaded with a script the 1,000 most traded US stocks, based on average 90-days traded volume as of March 2020.

Next, I analyzed the following aspects/questions:

- How beta error change if I use different time windows? The beta error change significantly on different time horizons. This dataset is the 'benchmark' data, which I can make further analysis on. The next important tasks were to find some factors that affect this beta errors. I focused on two factors: volatility and turnover.
- 2. How beta error change in relation with volatility? I found evidence that there is a correlation between beta error and volatility. Also, I found that there is a correlation between selecting the optimal beta time window and the volatility level. It means that I can select an optimal timeframe if the volatility increases/decreases.
- 3. **How beta error change in relation with turnover?** Similarly to volatility, I found significant relationship between turnover and the beta error. I also found a correlation between turnover change/turnover values and optimal beta time windows.
- 4. Could I get better results if we use an adaptive beta rather than a static beta? After I found clear patterns between beta error and turnover/volatility, it makes sense to check whether we could build a model that could give better predictions. I compared the results of adaptive beta and non-adaptive beta. My main finding was that I could get a better performance if I used an adaptive beta.

These findings helped my Client to get insights about how they can predict more effectively the and as a result, they can make better hedging strategies.

#### 4. Key learning outcomes

Overall, the whole Capstone Project was a great experience for me and I've improved many of my hard and soft skills. Just to mention a few hard skills:

- **Programming:** The whole analysis was prepared in Python, so my programming skills improved a lot.
- **Data analysis:** I had to apply a lot of data science-related techniques, such as cleaning/structuring data frames or using the appropriate charts. It definitely improved my data science knowledge
- **Financial knowledge:** As the capstone project focused on stocks' beta, I've learnt what characteristics of beta could have, such as they're not stable over time and affected by a lot of factors.

Regarding soft skills, I could highlight the following three:

- **Problem solving:** I had to solve a lot of problems during the capstone project, which required structured/logical thinking and a lot of efforts. It was also a great skill that I learnt in which situations/problems I had to consult with my supervisor.
- **Communication & consultation:** I also learnt a lot about how I should communicate/consult about a project for an external sponsor. It was a great experience to learn that during my research I always had to focus on what information/analysis would be useful for my project sponsor.
- **Project management:** As the whole Capstone Project took more than 1-2 months, I had to properly manage the timing and tasks.

#### 5. Further improvements/research ideas

One next step in this research would be to build more advanced models that can better predict the beta based on my findings relating to turnover and volatility. Another next step would be to find more factors that can affect the beta's values. As I really enjoyed the capstone project, I might continue researching on this topic.