AI in the Investment Office

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CLIENT

DUMAC - Duke Management Company

Formed in 1989 by approval of the Duke's Board of Trustees as a separate nonprofit support corporation.

Duke’s Long Term Pool (LTP) is managed by DUMAC Inc., an investment organization of 55 employees controlled by Duke University.

In addition to Duke’s endowment of $8.6 billion, DUMAC also manages the employee’s retirement pool and Duke University Health System’s investments leading to a cumulative $19 billion in assets under management.

We used artificial intelligence tools and data visualizations to support DUMAC's venture investment analysis and cost optimization.
Background

DUMAC
- DUMAC has 4 investors:
  - Duke University
  - Duke Health
  - Duke Retirement Plan
  - Duke Endowment
- DUMAC created an SMA platform to combine funds of these investors (~6 billion dollars)
- Each investor owns interest in the platform
- Their managers invest directly in the securities

Prime Broker
- Prime brokers offer a bundle of services to hedge funds
- DUMAC’s prime brokers earn fees on stock borrow costs and financing charges
- When cash < total market value of short positions at a prime broker, DUMAC pays a fee to the prime broker
  - Our goal is to reduce financing charges
1. Cost Optimization
Preview of Data

Actual Cash Information
- Available Tradable Cash
- PB Equity and Excess Margin
- Un-reinvested Proceeds
- Imputed Cost
- Annualized Cost (Local/Base)

Pro Forma
- Takes proposed transfer and changes the prior day information to calculate cost savings
- Relates to Cost Optimization portion of the project

Proposed Transfers
- Framework for proposing margin/cost-optimization transfers
- The part of the process we are automating

Margin Requirements
- One of the basic rules for cash allocation
- Maintain a certain percentage of cash at each Prime Broker
Cost Optimization Flowchart

Load Excel data into Python

Check margin percentages for each prime broker (>5%)

Under 5%/negative cash

Rank banks in terms of debit and credit rates

Select top bank and check if trade can be completed

Keep proposing trades until margin/cash requirements are satisfied

Create report with best transfers

Over 5% and positive cash

Rank banks in terms of debit and credit rates

Assess greatest credit/debit rate spread

Check if trade can be completed
Margin vs. Savings Transfers

**Margin Transfer**
- DUMAC is required to have at least 5% of the prime broker equity in cash at all times.
- If cash under a prime broker falls below margin, a transfer from another broker must be made:
  - A transfer can’t make the margin of another PB <10%
  - If the margin of a PB is between 5-10%, a transfer cannot be made to make the margins <10%
- Additionally, if the net tradable cash at a PB is negative, a transfer is proposed.
- **Mandatory**

**Savings Transfer**
- Financing charges occur when cash < short position.
- Every prime broker has different rates that they charge.
- Savings transfers shift cash towards high-rate brokers from lower-rate ones.
- Do not cause margins to fall under 10% and follow a set of rules.
- **Optional**
Rules for making a savings transfer:

- Savings resulting from the transfer are greater than $10K
- Margins do not fall below 10%
- Savings must be 5 basis points of the transferred money
  - Basis points are a measure of financing charges
Data Input

**Xlrd/PIP**
- Able to use xlrd to read in new Spreadsheet every day
- Accesses specific Actual tab and pulls information

**Data Storage**
- Currently using dictionaries with the keys as Prime Brokers (margins) and as the individual deals (info)
- Easily accessible and manipulatable

**Running the Code**
- Uses the computer’s built-in command line
- Navigate to the file location
- Run the code and input the file name

**Commands Used**
- `cd file_location`
- `python3 script.py`
- `excel_name.xlsm`
**Sample Output**

**Necessary Transfers** (margin and negative cash issues)

**Suggested Scenarios** (cost optimization)

**Note:** Dependent on each other. Meant to be done sequentially. Occur after the necessary margin transfers.

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### Suggested Transfers for 2020-07-09:

#### Necessary Margin and Net Trade Cash Transfers:

1. Should give $100000 USD.
2. Should give $81000 USD.
3. Should give $208000 USD.

Total Margin Savings: $4030 USD

#### Suggested Cost Optimization Transfers:

**Scenario 1.**

1. Should give $32670000 AUD to save $159573 USD.
2. Should give $6853000 CHF to save $390381 USD.
3. Should give $4888000 USD to save $341067 USD.
4. Should give $4167000 EUR to save $148436 USD.

Total Cost Savings: $1030458 USD

Total Margin and Cost Savings: $1043489 USD

**Scenario 2.**

1. Should give $3235000 CHF to save $138115 USD.
2. Should give $6853000 CHF to save $390381 USD.
3. Should give $3871000 USD to save $285588 USD.
4. Should give $3267000 AUD to save $159573 USD.

Total Cost Savings: $973658 USD

Total Margin and Cost Savings: $977689 USD

**Scenario 3.**

1. Should give $6853000 CHF to save $390381 USD.
2. Should give $3421000 USD to save $242677 USD.
3. Should give $3267000 AUD to save $159573 USD.
4. Should give $4167000 EUR to save $148436 USD.

Total Cost Savings: $941068 USD

Total Margin and Cost Savings: $945099 USD
Sample Output

**Last Scenario**
(Dependent transfers)

**One-Off Transfers** (cost optimization)

**Note:** Must be done independently of each other. Avoid making transfers with the same Prime Broker.

**Total Cost Savings:** $892386 USD
**Total Margin and Cost Savings:** $896417 USD

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**Scenario 5.**

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<tr>
<td>1</td>
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<td>3</td>
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<td>$242677 USD</td>
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<tr>
<td>4</td>
<td>$32670000 AUD</td>
<td>$159573 USD</td>
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</tbody>
</table>

**Top 15 One-Off Transfers:**

1. should give $68530000 CHF to save $390381 USD.
2. should give $34210000 USD to save $242677 USD.
3. should give $32670000 AUD to save $159573 USD.
4. should give $11670000 EUR to save $148436 USD.
5. should give $32350000 CHF to save $130115 USD.
6. should give $17800000 GBP to save $104008 USD.
7. should give $10220000 USD to save $99754 USD.
8. should give $17490000 USD to save $64069 USD.
9. should give $7750000 USD to save $55063 USD.
10. should give $10670000 GBP to save $54497 USD.
11. should give $6100000 USD to save $50186 USD.
12. should give $3610000 CHF to save $47248 USD.
13. should give $8230000 GBP to save $42881 USD.
14. should give $47990000 HKD to save $41389 USD.
15. should give $21360000 CHF to save $40740 USD.
2. Venture Analysis
Venture Analysis

**Burgiss**
- Provides investors with information on private investments (~70,000 holdings), benchmarks, risk models, and other cash flow and performance data on companies

**Pitchbook**
- Provides private market data on 3 million companies, 308,000 investors, 1.2 million deals, and 55,000 funds

**Venture Financing Stages**

- **Seed**
  - The first official money that a venture raises (typically through support from friends, family, founders, and incubators)

- **Stage A**
  - Further optimizing user base and product offerings to scale the product (raise $2-15 million)

- **Stage B**
  - Focus on business development and increasing market reach

- **Stage C**
  - Focus on expanding into more markets, developing new products, and potential acquisitions
Venture Analysis

THE GOAL:

Use Burgiss and Pitchbook data to calculate the length of investments that DUMAC has made in the past 20 years based on the initial investment date and the dollar-weighted realizations of a company over time.

Create data visualizations that provide DUMAC analysts with another historical data point in their venture investment analysis.
Venture Analysis

How?

- Web-scraping (extraction of data from websites) for age and investment series
  - Pitchbook
  - Assessing founding date and initial investment date to calculate company age
  - Pulling all available series data to find investment round

- Use Tableau to consolidate the Burgiss data with the data scraped off the internet and then create appropriate visualisations
- Calculate length of investments using weighted averages
- Calculate return on investments
- Consolidate data using Python scripts and Excel functions
Average Length of Investment by Industry (Incl. Write Offs)
Length of Investment by Industry (Incl. Write Offs, Max. and Min. Labeled)
Length of Investment by Region and Status
Length of Investment Frequency (Ex. Filtered for Age 2 and 3)
<table>
<thead>
<tr>
<th>Series</th>
<th>Avg. Length (Years)</th>
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<tbody>
<tr>
<td>Series A VC</td>
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Intralinks

**THE GOAL:**

Intralinks provides a database for partners to upload files that DUMAC manually downloads. The goal is to use their provided API to automate the downloads into a folder structure for DUMAC to access in a more efficient and time-effective manner. A secondary goal would be to then organize these files into the existing DUMAC file database.

**Going Forward:**

We are currently planning an extended relationship with DUMAC to continue to help with projects similar to this. Need to get familiar with the API and existing DUMAC code and file base. Create mapping for file names to create more organized and clear database.
Thank you for listening!