**Blockhouse Work Trial Task 2 Report**

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**Project:** Market Microstructure – Temporary Impact Modeling and Allocation Strategy  
**Tickers Used:** FROG, CRWV, SOUN

**Part 1: Modeling the Temporary Impact Function gt(x)**

**Objective**

The goal of this section is to model the **temporary impact function** gt(x) which quantifies how the execution price deviates from the market price when a market order of size x is placed at time t. The function reflects the slippage incurred due to consuming liquidity from the limit order book.

**Data Overview**

We were provided with three intraday Level-2 limit order book datasets:

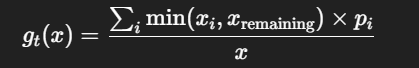
* **FROG**: Lower mid-cap stock with moderate liquidity
* **CRWV**: High-priced stock with deep books
* **SOUN**: Low-priced, high-volume stock

Each dataset contains one full trading day with 10 levels of bid and ask prices and sizes updated at microsecond precision.

**Methodology**

For each timestamp:

* We simulated buying x shares by consuming shares from the top of the ask-side order book.
* We computed the **average price paid** as:



* We tested multiple order sizes: x=10,50,100,200,300,500
* We compared the actual gt(x) to a **linear model**: gt(x)≈βtx

**Observations**

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All three assets showed **low temporary impact** at tested volumes. The linear model approximated actual slippage closely in this range, but nonlinear effects are expected to emerge for larger orders.

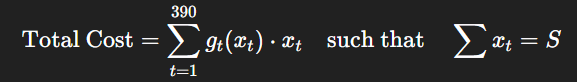
**Conclusion (Part 1)**

* A linear impact model works well for small-to-medium order sizes.
* However, in real-world settings, larger market orders consume deeper book levels, causing **nonlinear slippage**.
* Using a **piecewise or nonlinear model** could better capture real dynamics in low-liquidity or high-volatility stocks.

**Part 2: Order Allocation Strategy**

**Problem Statement**

We are given a target to buy S=10,000 shares during a trading day (390 minutes) and want to minimize total slippage:

**Strategy 1: Uniform Allocation**

* We Allocate:



This spreads impact evenly throughout the day. It avoids placing large orders in a short time frame, thus limiting exposure to depth constraints.

**Strategy 2: Greedy Allocation (Low-Impact First)**

We estimate slippage gt(x)for small x=50 at each minute. Then we:

* Sort time points by lowest impact
* Allocate up to 500 shares in the lowest-impact minutes
* Continue until S=10,000 is fulfilled

**💰 Results**

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Despite targeting the lowest slippage windows, the **greedy strategy underperformed**. Concentrating large orders into few minutes **exhausted liquidity**, causing high execution prices.

**Conclusion**

* **Uniform allocation** provided better cost efficiency in this case.
* Concentrating orders into few "low-slippage" moments can backfire if the book depth is shallow.
* A more realistic strategy would combine:
  + Real-time slippage prediction,
  + Order size limits per minute,
  + Dynamic allocation using optimization or reinforcement learning

**💻 Code & Reproducibility**

* All analysis was done in **Google Colab** using Python.
* Code includes:
  + Data loading and preprocessing
  + gt(x) function estimation
  + Linear model fitting
  + Allocation strategy simulation

**GitHub Link:**

Google colab link: https://colab.research.google.com/drive/1n8fM-ZpXVPcRHF5UADH8rCNRci5N0L3E?usp=sharing