Title: Justification for Linear Modeling of the Temporary Impact Function g□(x)

In modeling the temporary market impact function gt(x)g_t(x), we opted for a linear approach, motivated by both empirical observations and practical considerations.

1. Empirical Evidence from the Plot

The plot of gt(x)g_t(x) at different timestamps (2025-04-03 13:30 and 17:30), as generated and saved using code in `modeling.ipynb`, shows a nearly straight-line relationship between order size xx and impact gt(x)g_t(x). The image `gt_graph_at_1330_1730.png` visualizes this trend, with both curves exhibiting proportional growth. Deviations are minimal, and the curves align closely, especially for moderate order sizes (up to x≈650x \approx 650).

2. Interpretability and Simplicity

A linear model gt(x)=βtxg_t(x) = \beta_t x is easily interpretable. The parameter βt\beta_t captures the cost per unit order size, allowing us to compare market impact across different times. This simplicity aids in communication with stakeholders and in deploying the model into larger trading strategies.

3. Sufficiency Given the Data

The data range (up to x=1000x = 1000) and the observed patterns do not suggest strong non-linearities. More complex models (e.g., power laws or piecewise functions) might overfit and require additional data to calibrate effectively. In contrast, the linear model fits well within the data-supported regime.

4. Computational Efficiency

Linear models require fewer resources to train and evaluate. This is beneficial for real-time systems where speed is crucial.

5. Robustness Across Time

The similarity between curves at 13:30 and 17:30 demonstrates that βt\beta_t changes slowly and remains stable over time, further validating the use of a linear function with a time-varying slope.

Conclusion

A linear model for gt(x)g_t(x) balances empirical fit, interpretability, and efficiency. While future data might motivate more complex forms, current evidence strongly supports the linear approach for modeling temporary market impact.