

Dec 3 Price Change (PC) vs No Price Change Simulations (NPC)

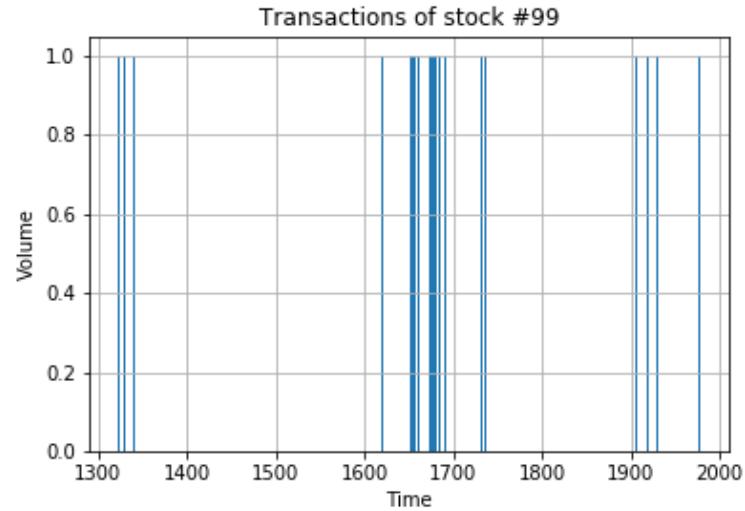
Braedyn Au

Definitions

- Price Change (PC): change in Hurst index of stock proportional to number of stocks moved
- No price change (NPC): constant Hurst index
- Individual Stock Cascades: temporally separated cascades of an individual stock, with all stock cascades compiled in these distributions
- Causal Cascades: algorithm that traces trading activity from one portfolio to another based on trading overlapping stocks

Individual Stock Cascades

- For each stock, find temporally separated cascades of activity
- Compile all the cascades of each stock for a total Cascades list



Causal Cascades

- 1) Take first portfolio as seed portfolio and add all seed portfolio activity that occurs at or after t0 and terminates after a set minimum down time of quiescence to the cascade
 - Add all traded stocks to the pool of stocks
 - Each stock has a set max time effect for which each trading event can impact future trades of the same stock and be considered part of the same causal cascade
- 2) Iterate over the order list to find orders that overlap with the pool of stocks and are within the time effect window
- 3) When matched, add the new portfolio and all their trading activity that occurs at or after the time the first overlapping stock is traded and terminates after the set minimum down time to the cascade
 - Add all new traded stocks to the pool of stocks
 - Any new stocks are assigned a new max time effect while preexisting stocks extend the time effect
- 4) Cascade terminates when no overlapping stocks are traded within their time effect window

Parameters

- Maximum time effect (Max Eff): maximum time a single trading event can impact other trades to be considered part of the same causal cascade
 - $\text{abs}(\text{order}) * \text{maxtimeeff}$
- Minimum down time: minimum amount of quiescence time for a causal and stock cascade to end

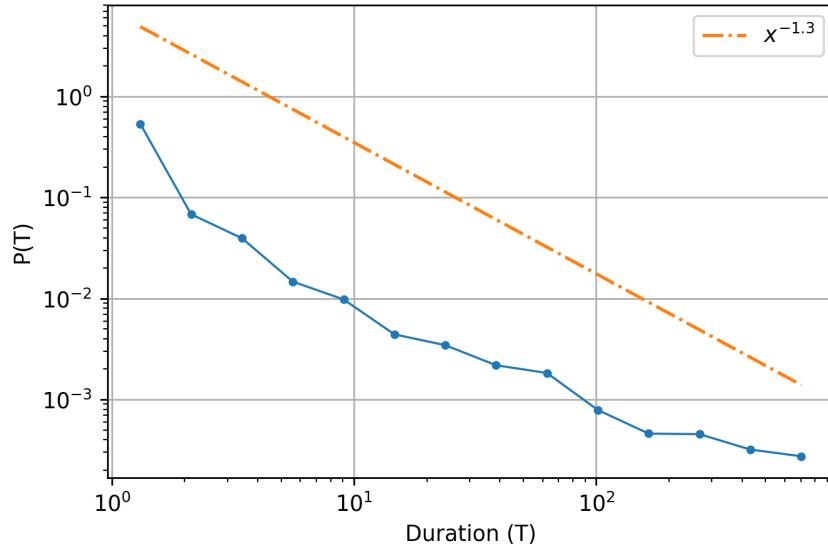
Results I: PC vs NPC

All simulated with 500 traders with 8-12 stocks,
100 stocks, for 1000 time steps

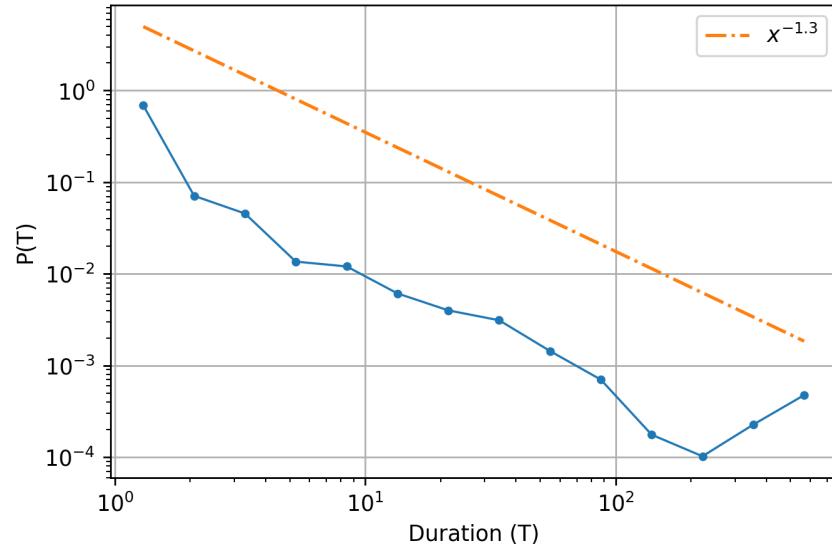
Looked at number of transactions, volume, and
duration of cascades while varying Max Eff and
Min down time thresholds

Causal Cascades

PC Causal Cascades (duration) | Max Eff: 1 | Min Down Time: 1

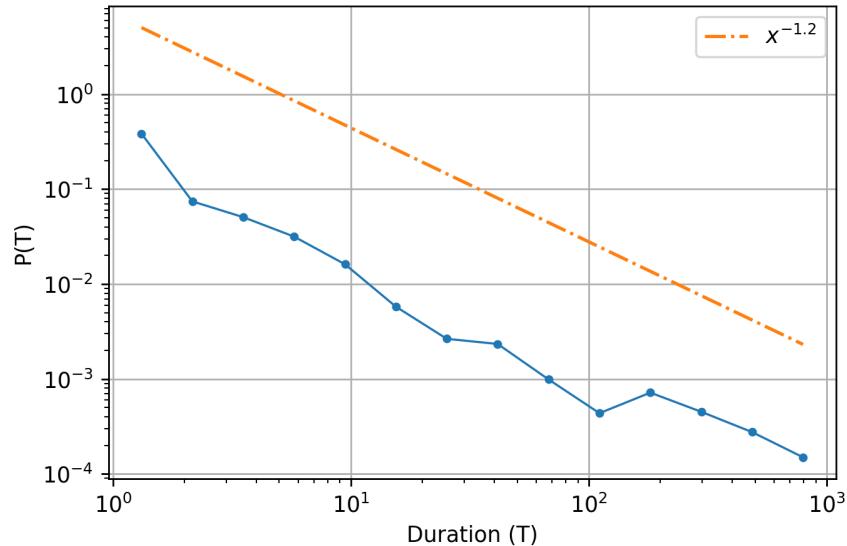


NPC Causal Cascades (duration) | Max Eff: 1 | Min Down Time: 1

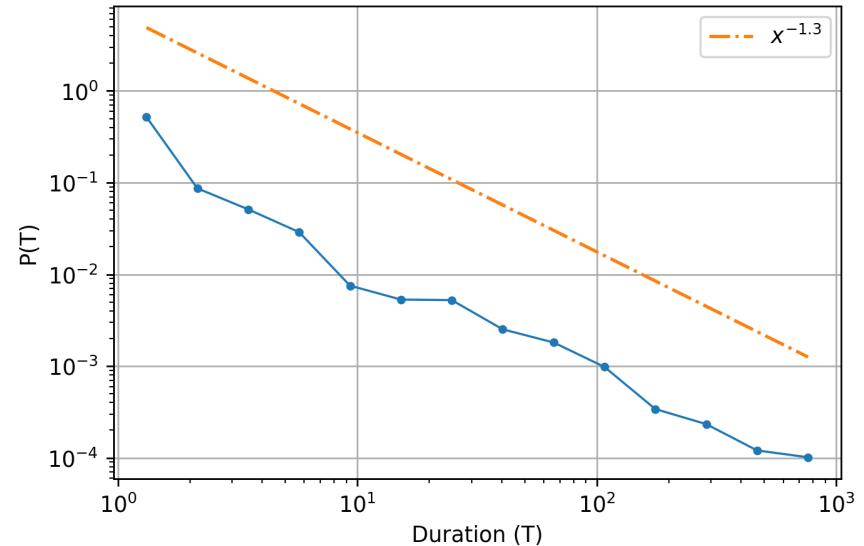


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

PC Causal Cascades (duration) | Max Eff: 1 | Min Down Time: 2

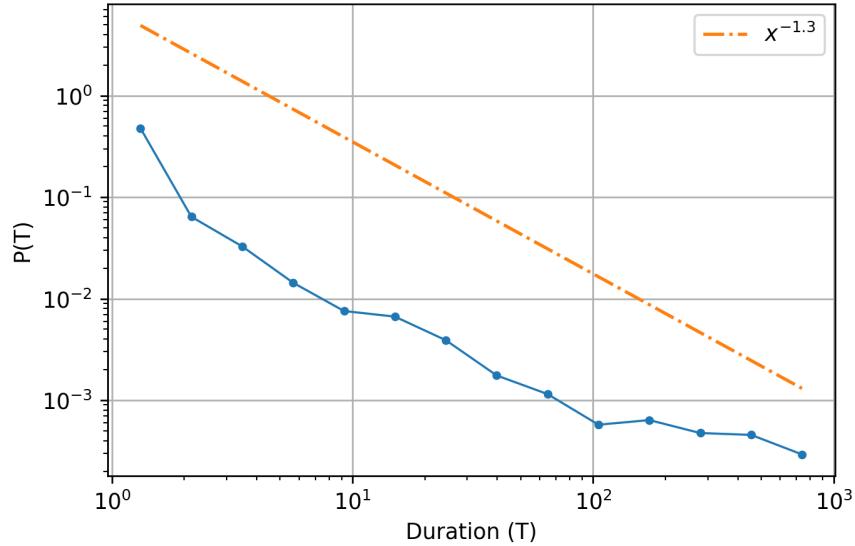


NPC Causal Cascades (duration) | Max Eff: 1 | Min Down Time: 2

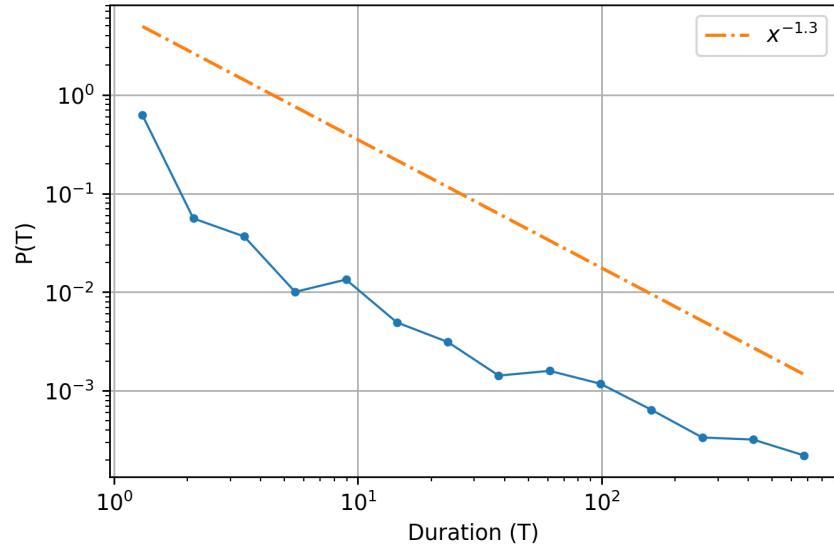


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

PC Causal Cascades (duration) | Max Eff: 2 | Min Down Time: 1

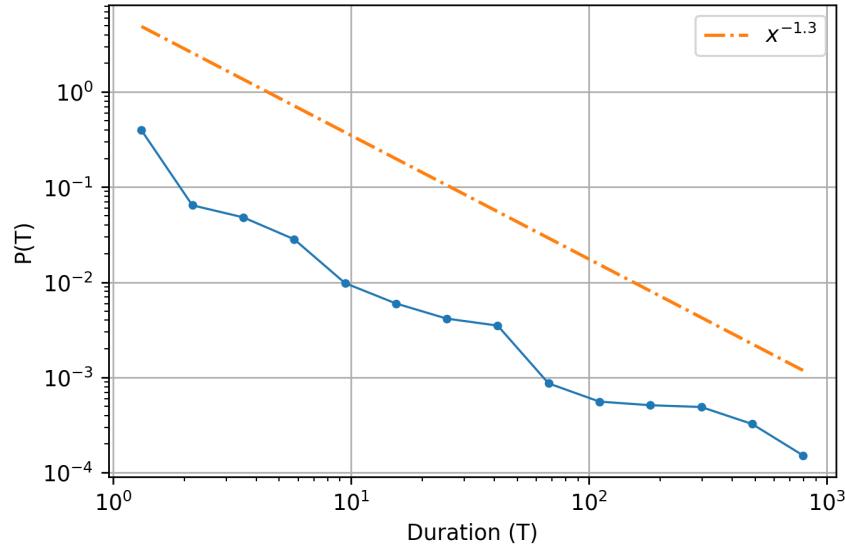


NPC Causal Cascades (duration) | Max Eff: 2 | Min Down Time: 1

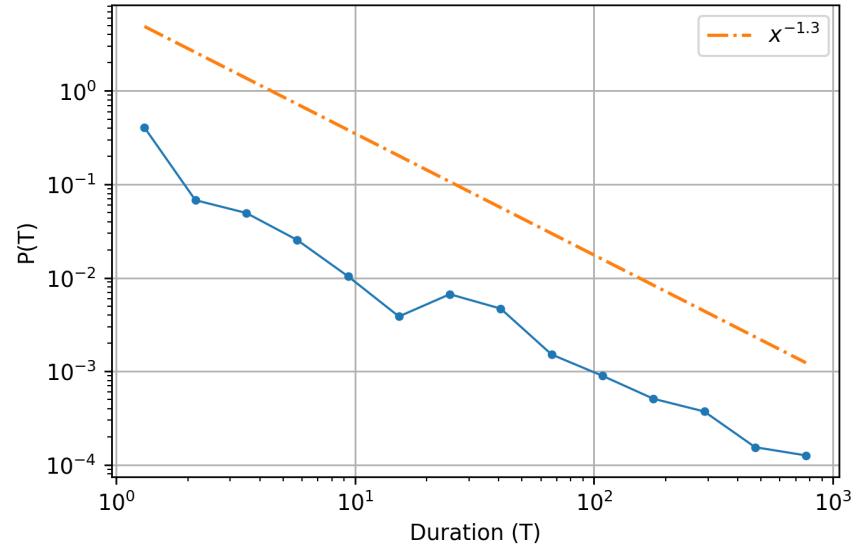


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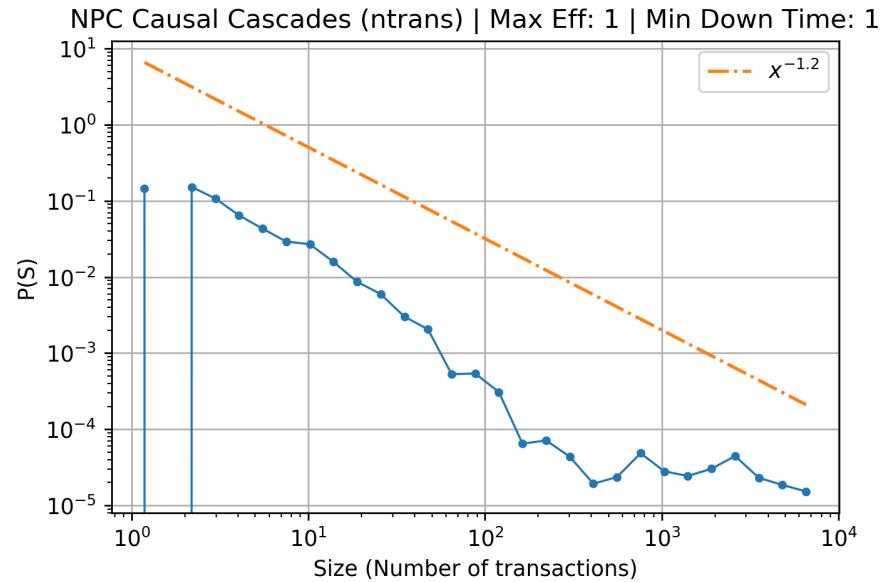
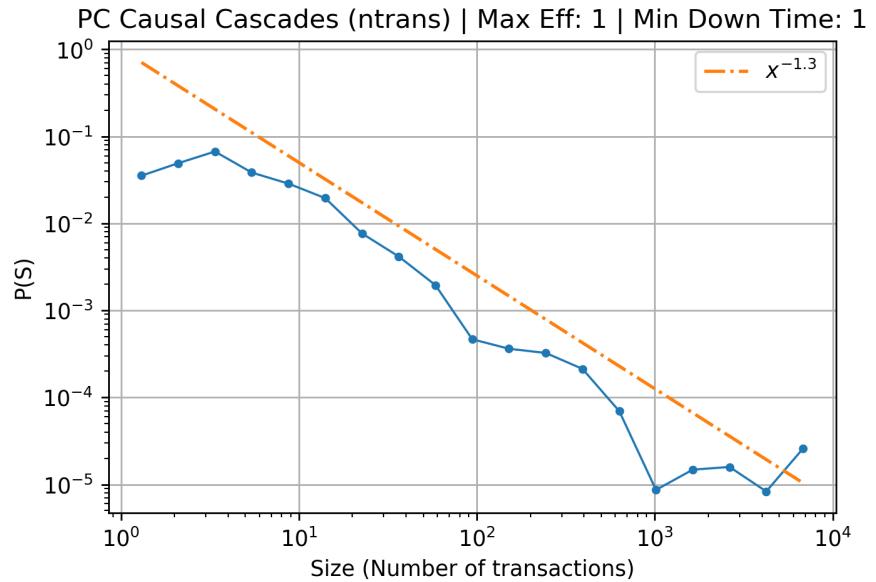
PC Causal Cascades (duration) | Max Eff: 2 | Min Down Time: 2



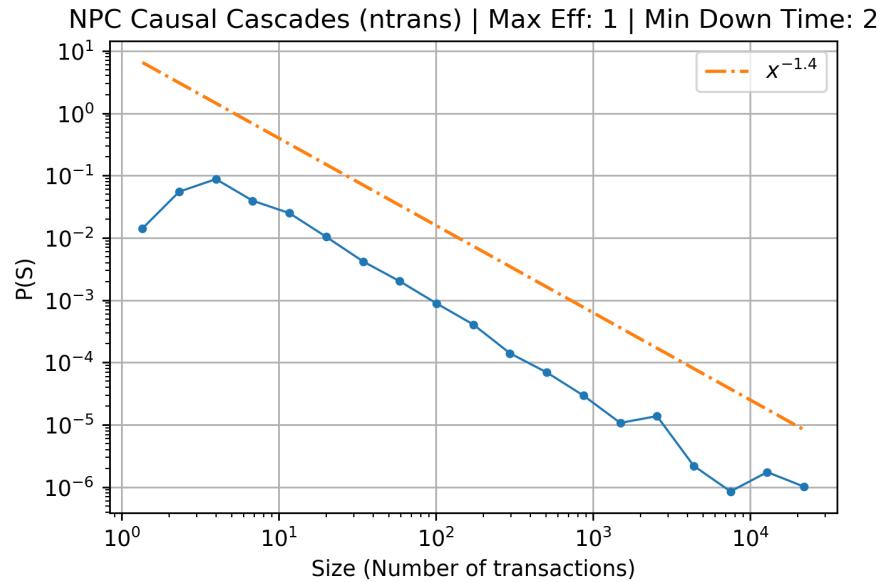
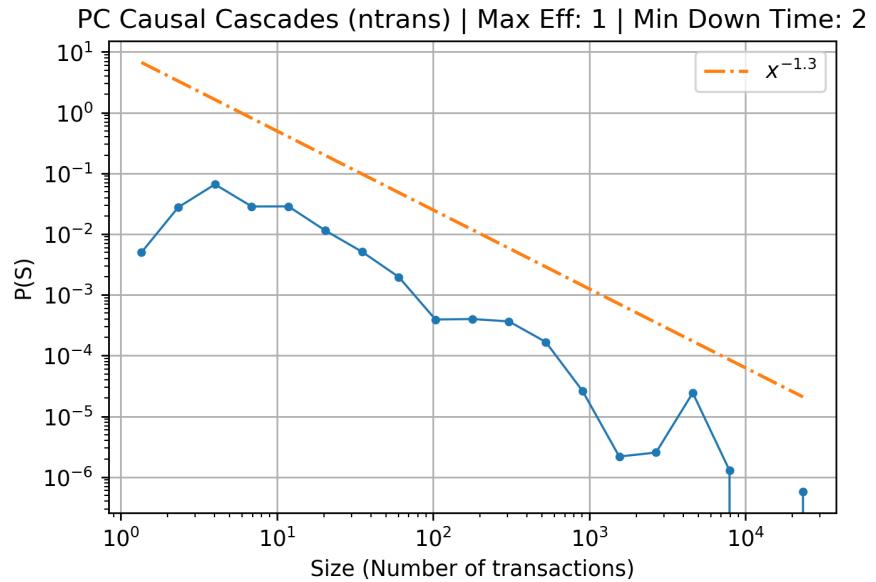
NPC Causal Cascades (duration) | Max Eff: 2 | Min Down Time: 2



500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

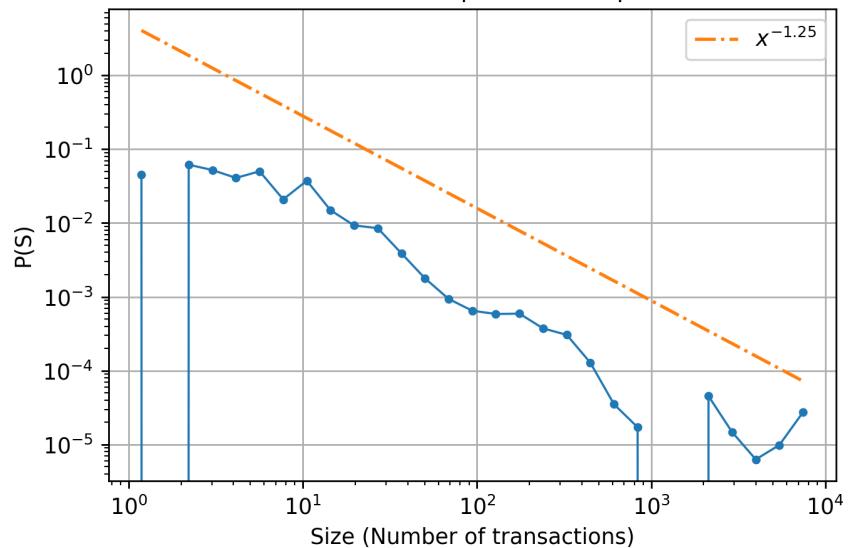


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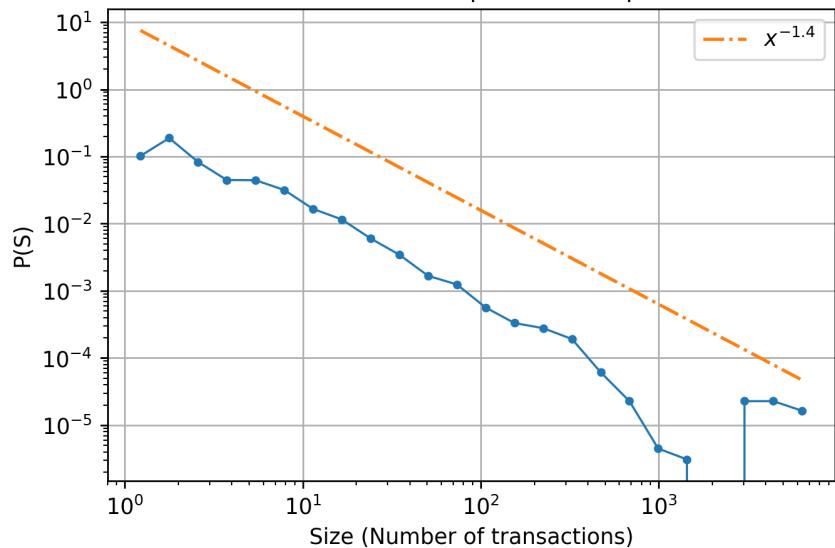


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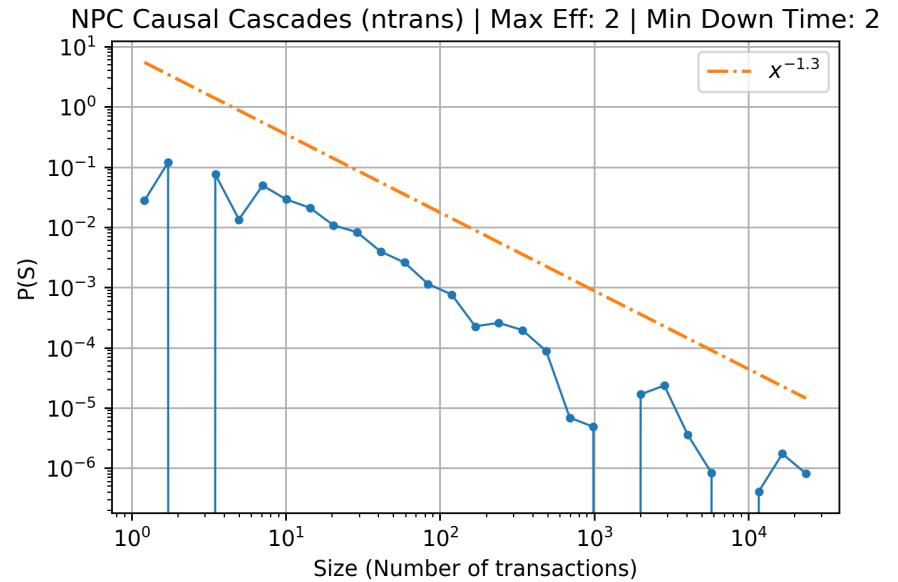
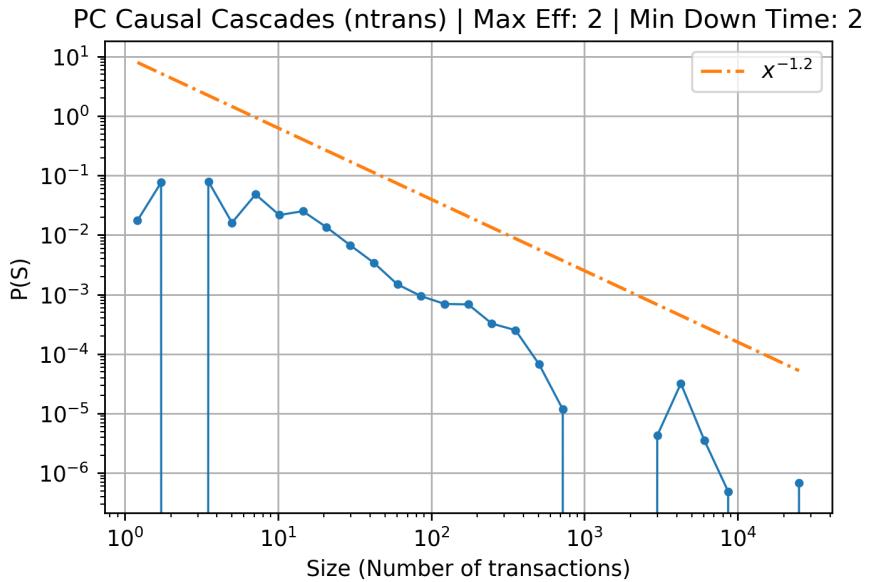
PC Causal Cascades (ntrans) | Max Eff: 2 | Min Down Time: 1



NPC Causal Cascades (ntrans) | Max Eff: 2 | Min Down Time: 1

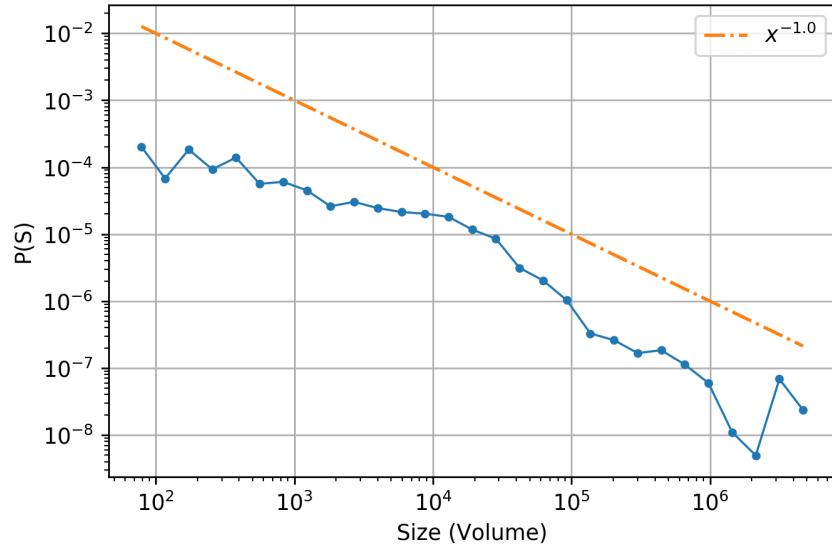


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

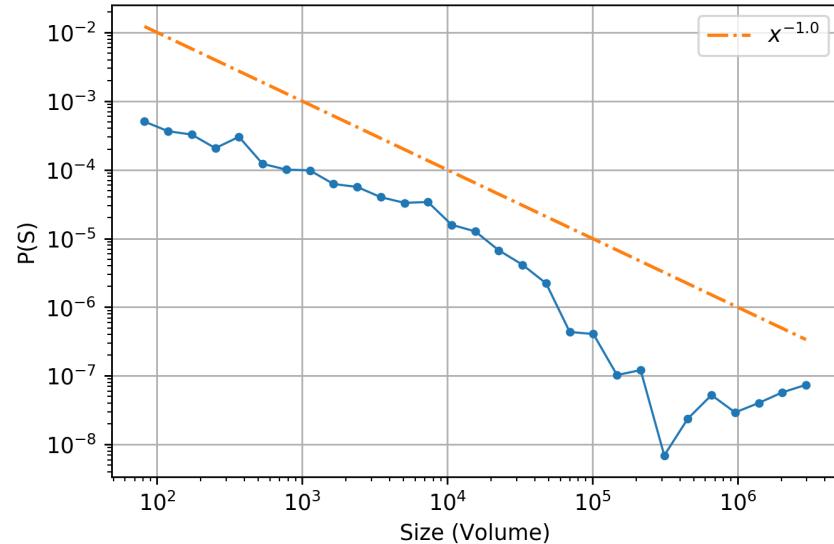


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

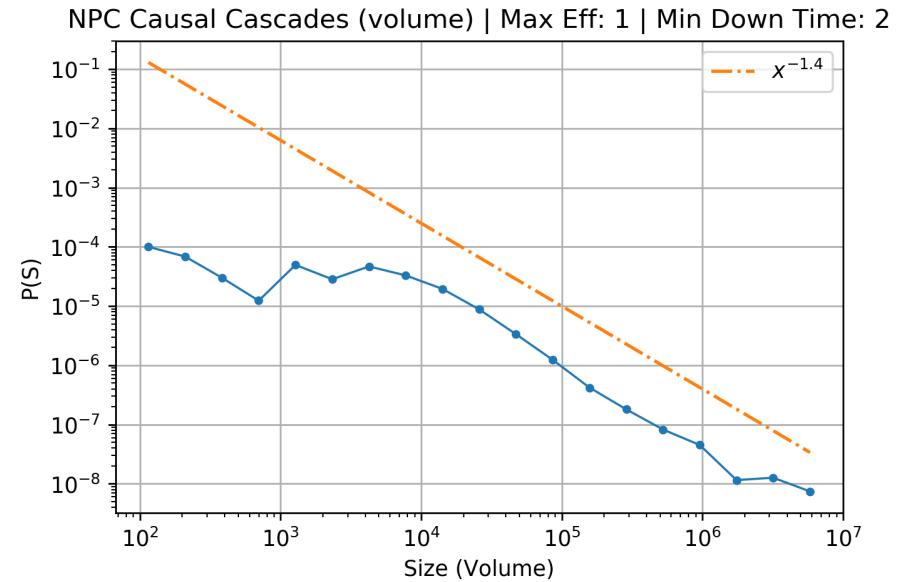
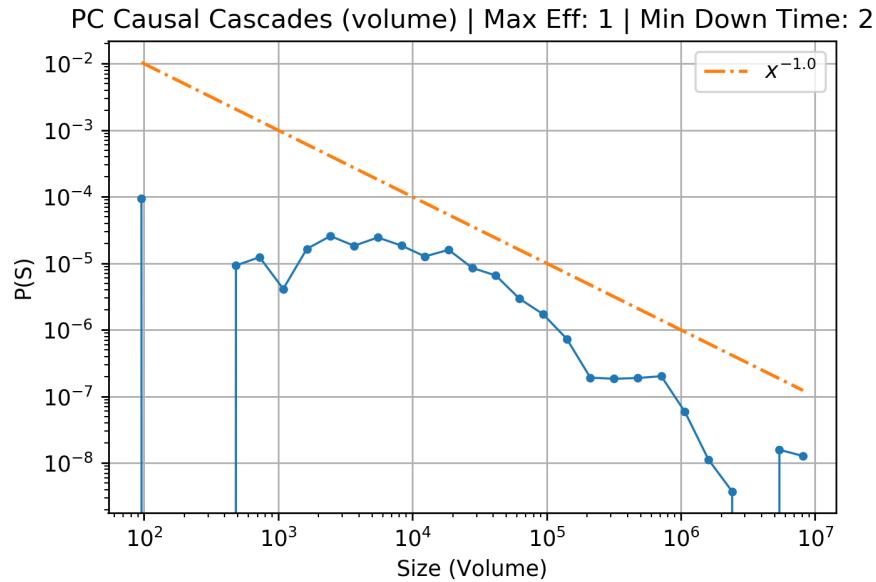
PC Causal Cascades (volume) | Max Eff: 1 | Min Down Time: 1



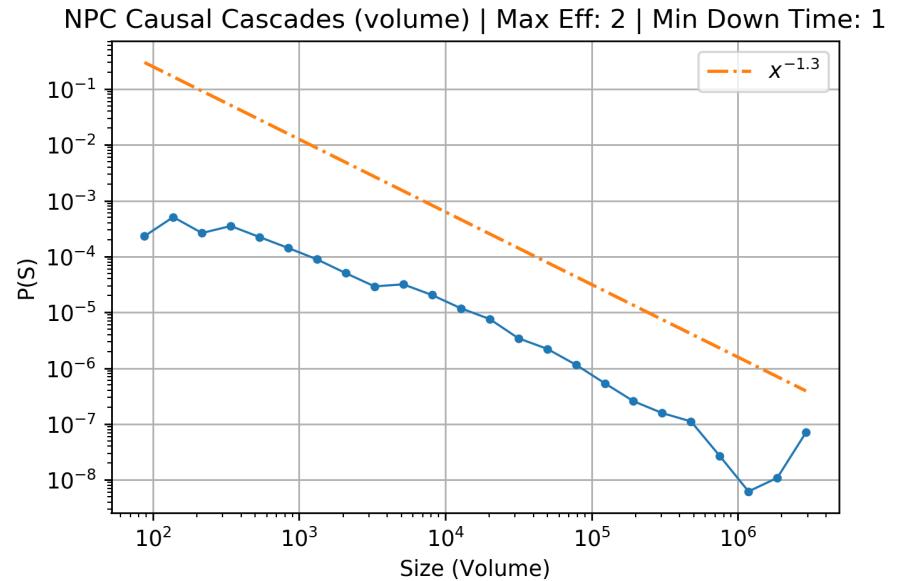
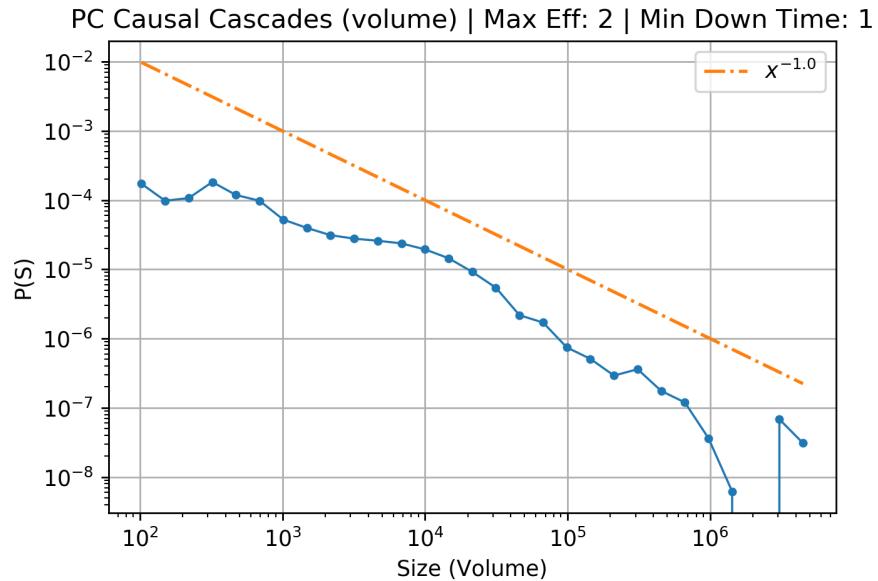
NPC Causal Cascades (volume) | Max Eff: 1 | Min Down Time: 1



500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

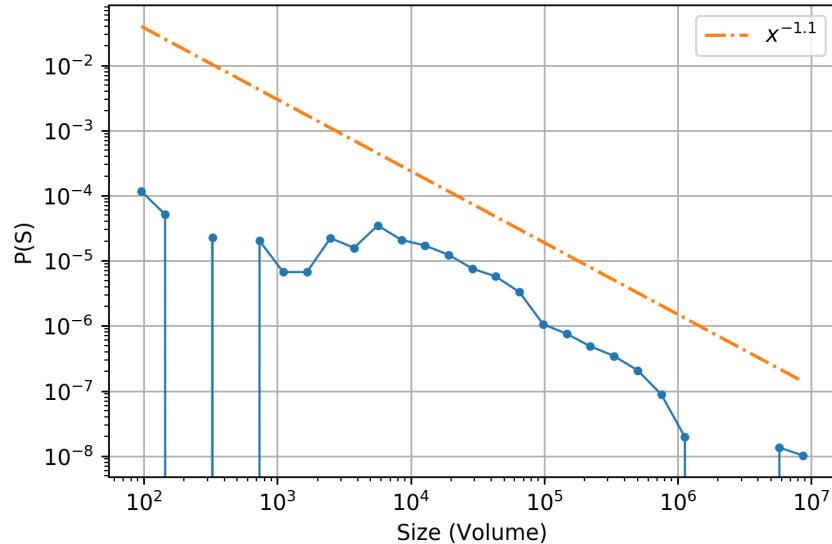


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

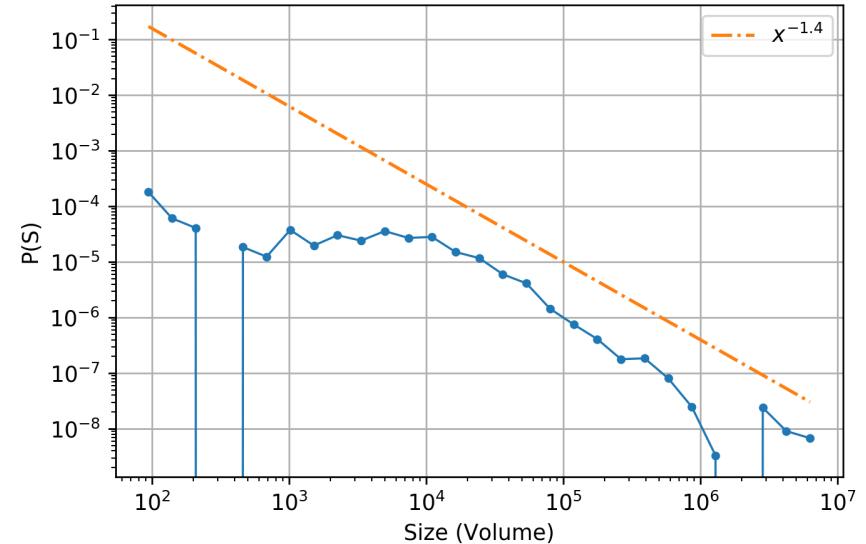


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

PC Causal Cascades (volume) | Max Eff: 2 | Min Down Time: 2

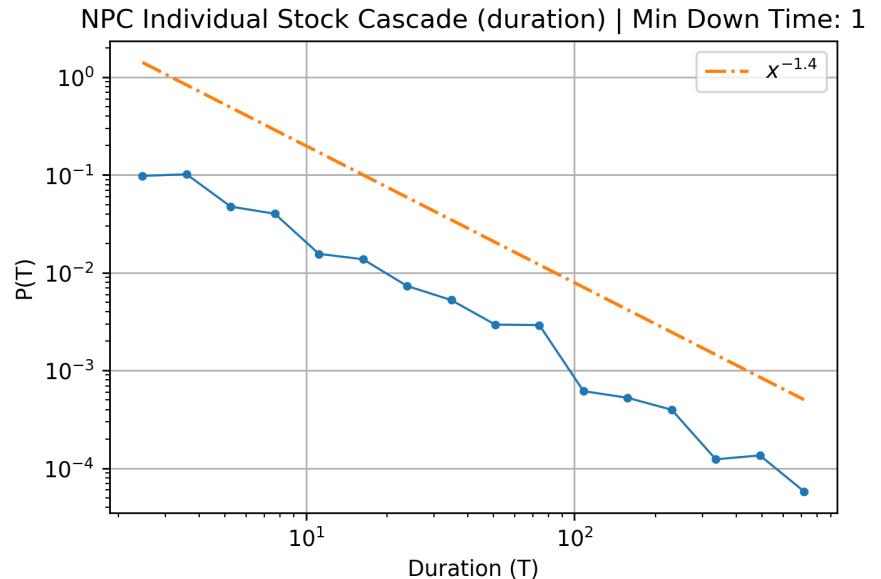
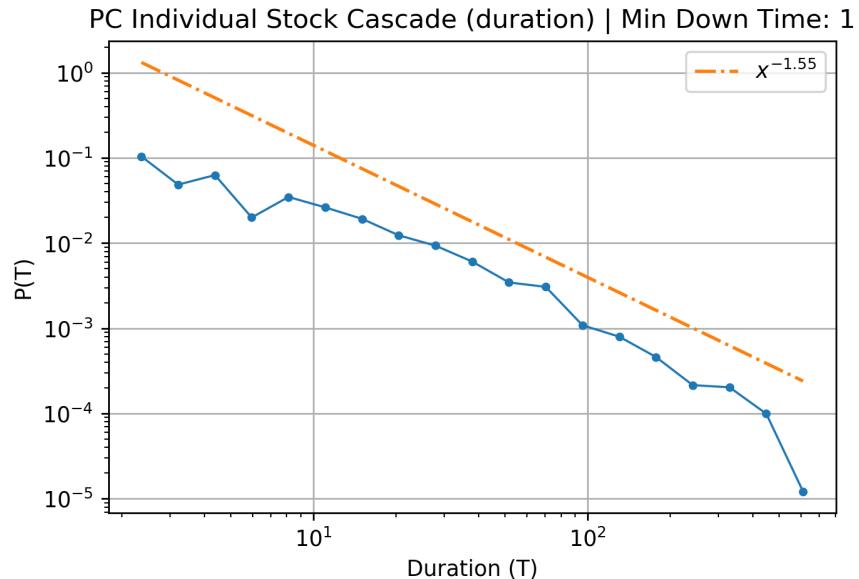


NPC Causal Cascades (volume) | Max Eff: 2 | Min Down Time: 2

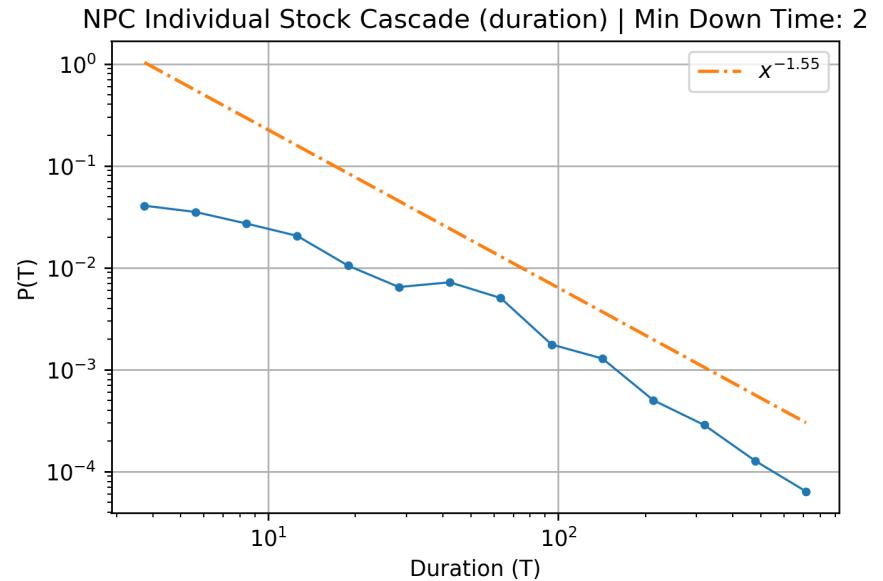
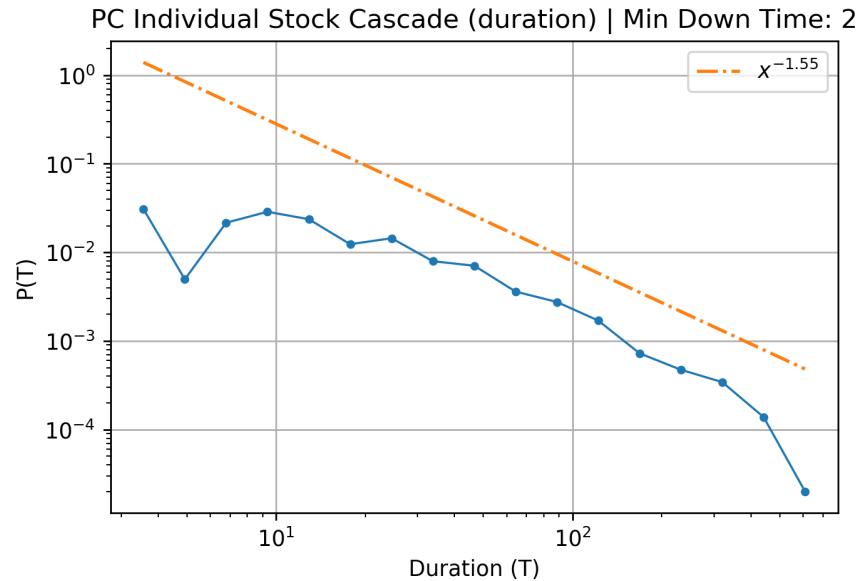


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

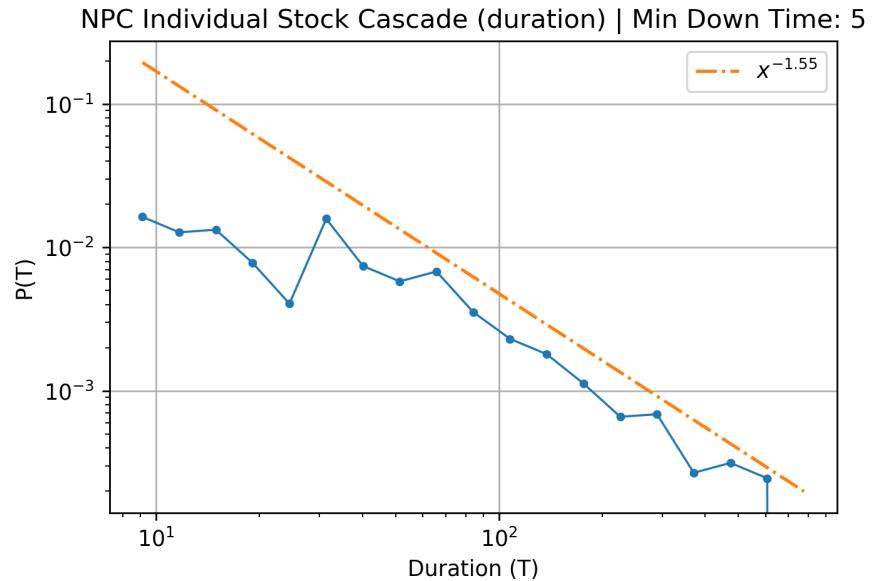
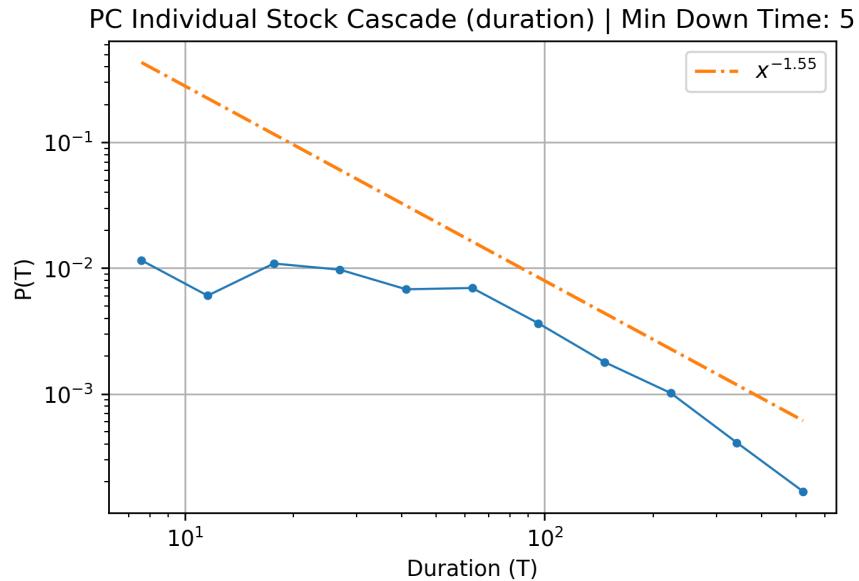
Stock Cascades



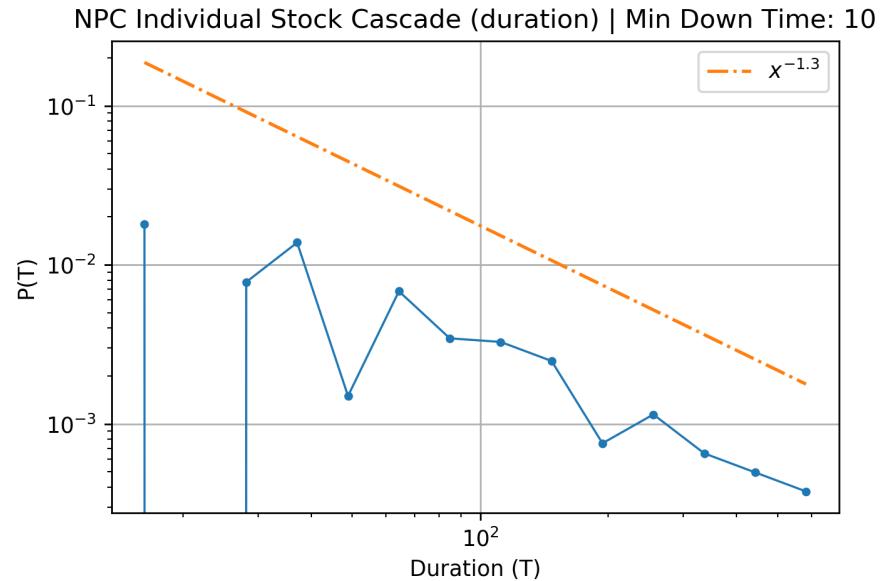
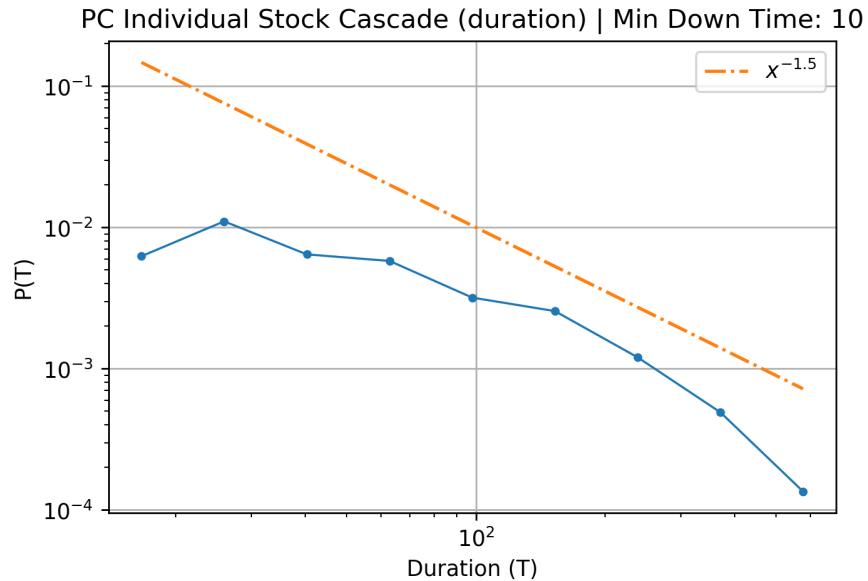
500 traders with 8-12 stocks, 100 stocks, for 1000 time steps



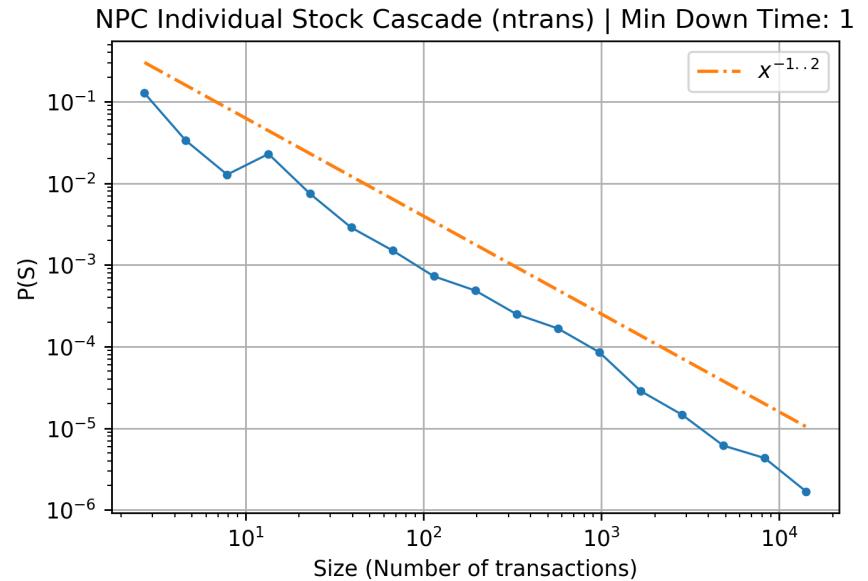
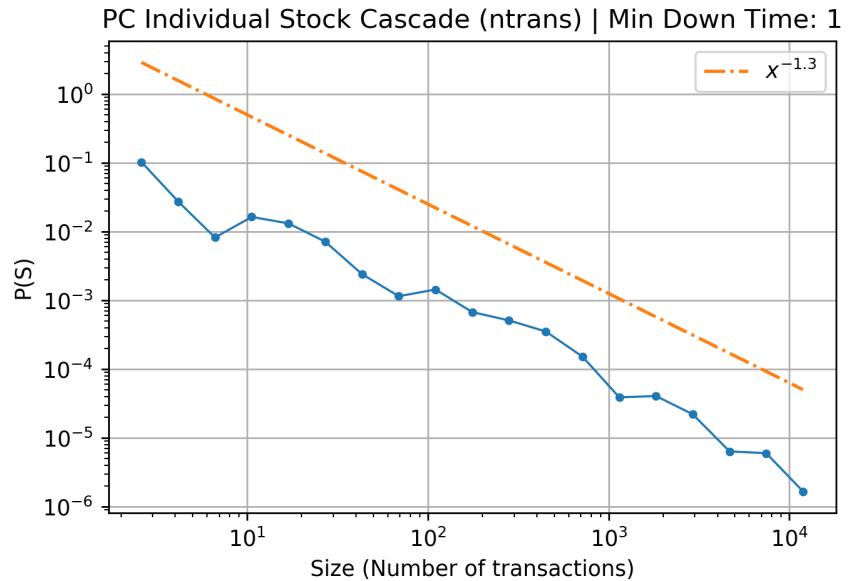
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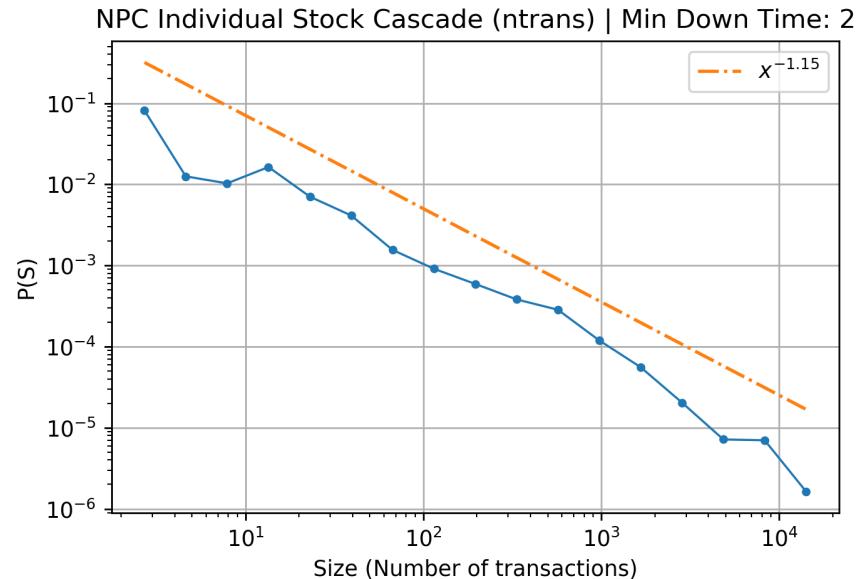
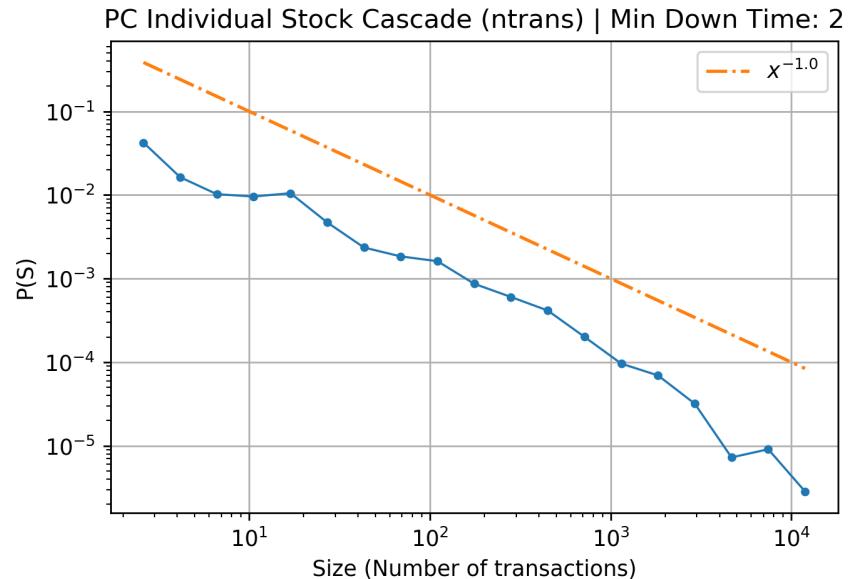
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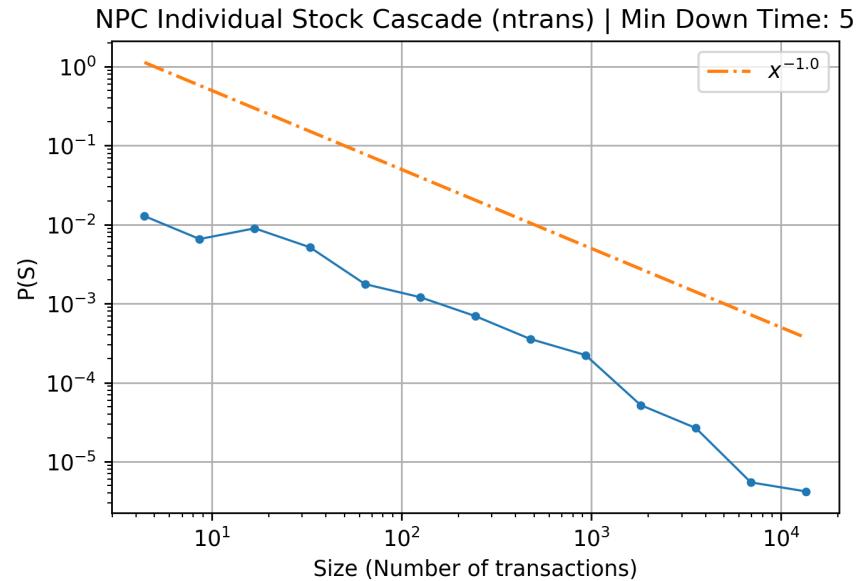
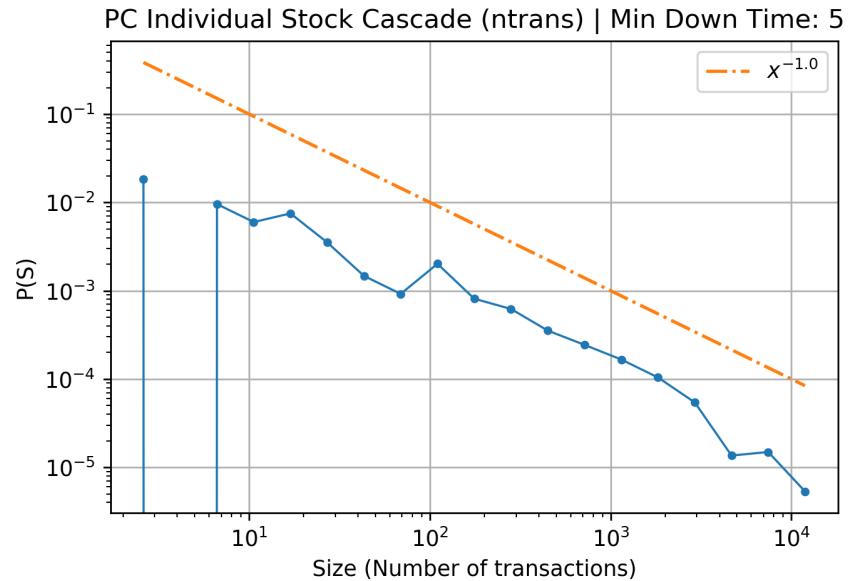
500 traders with 8-12 stocks, 100 stocks, for 1000 time steps



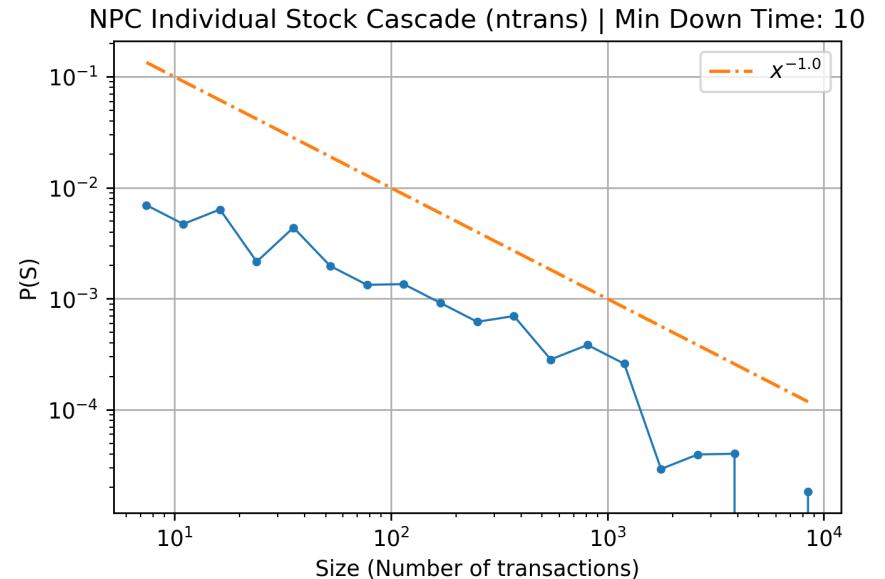
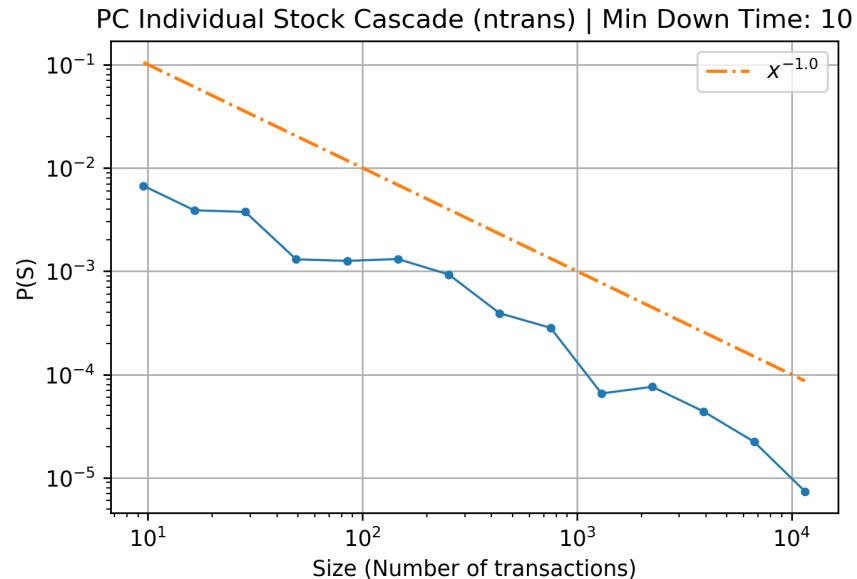
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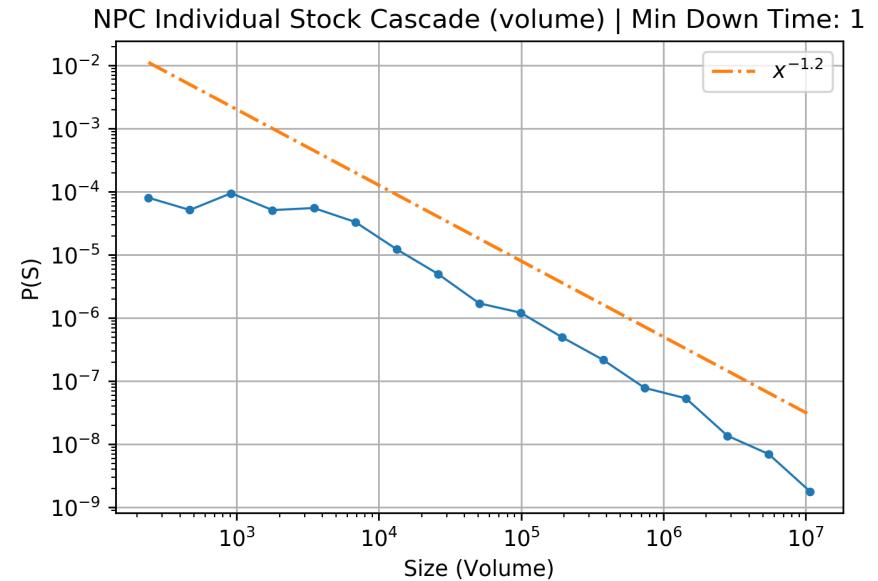
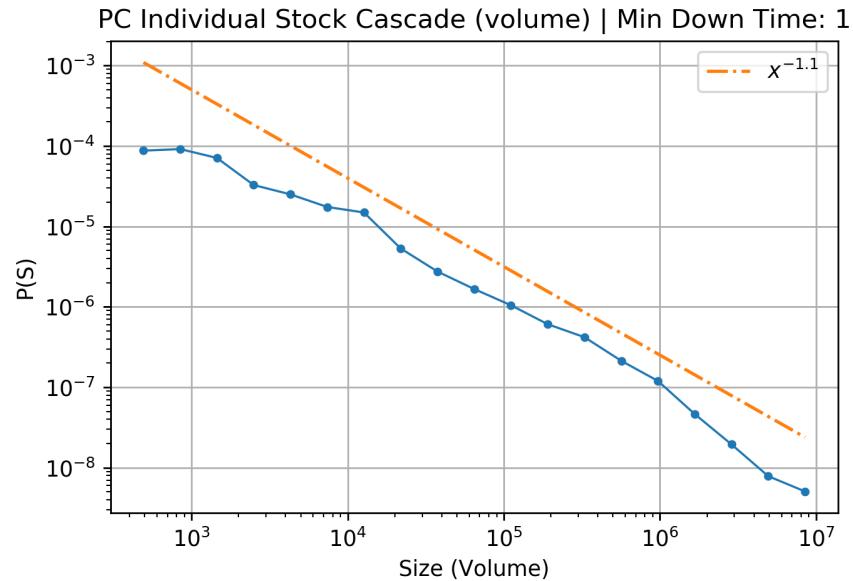
500 traders with 8-12 stocks, 100 stocks, for 1000 time steps



500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

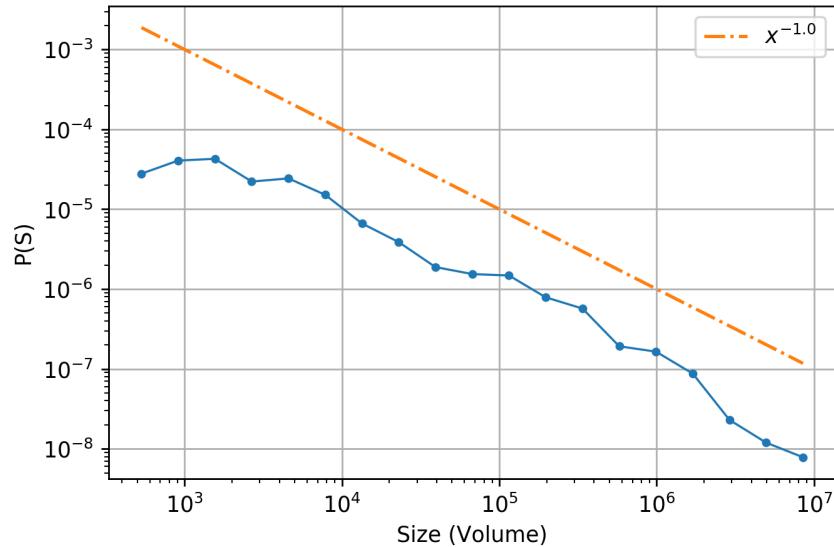


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

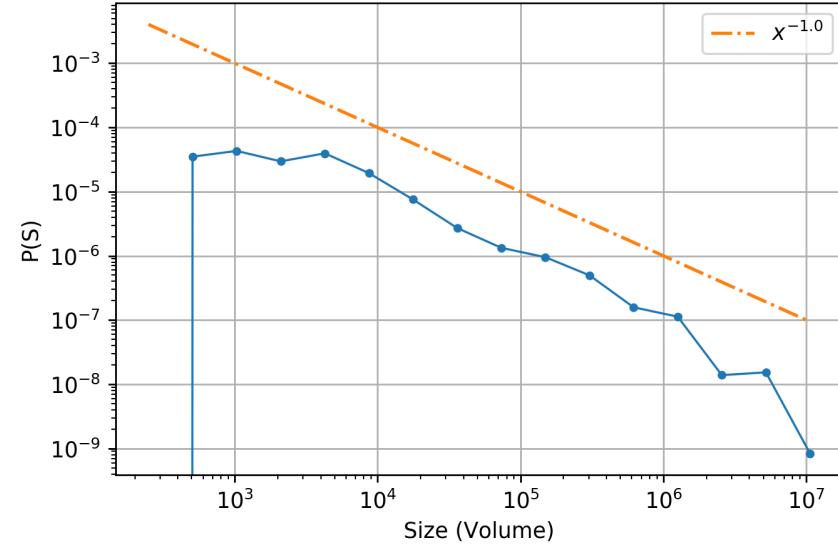


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

PC Individual Stock Cascade (volume) | Min Down Time: 2

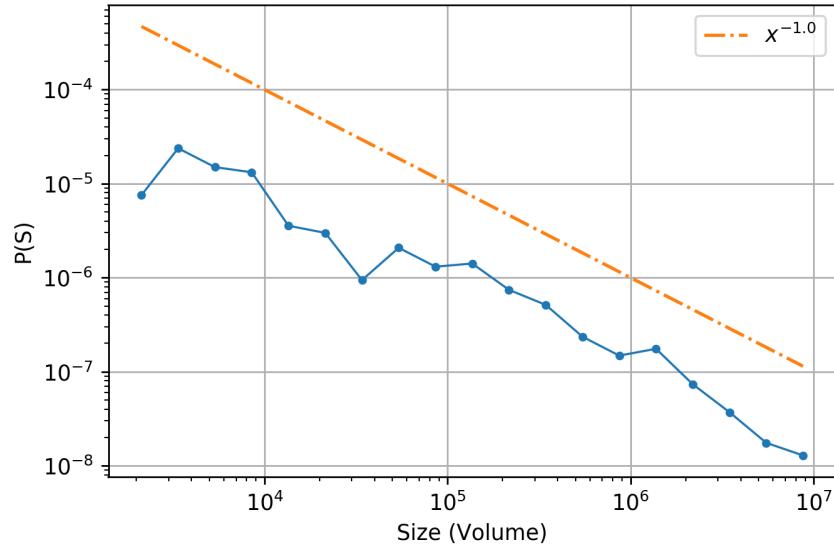


NPC Individual Stock Cascade (volume) | Min Down Time: 2

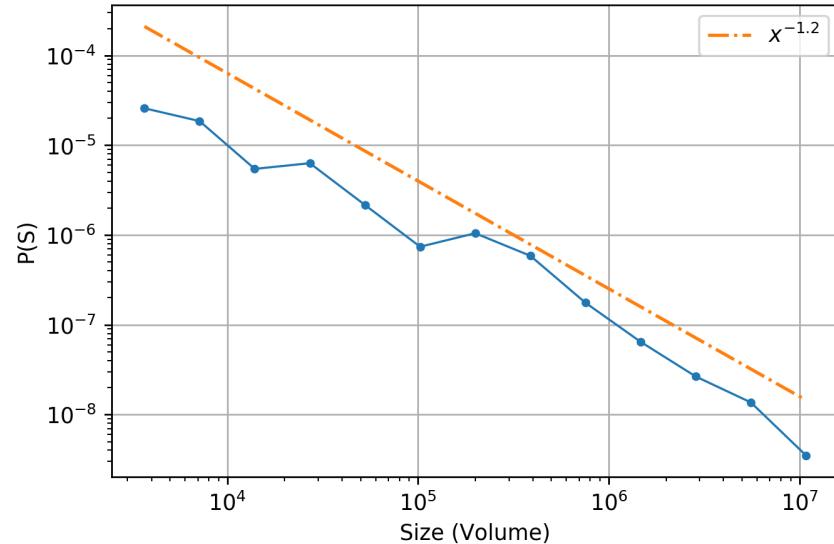


500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

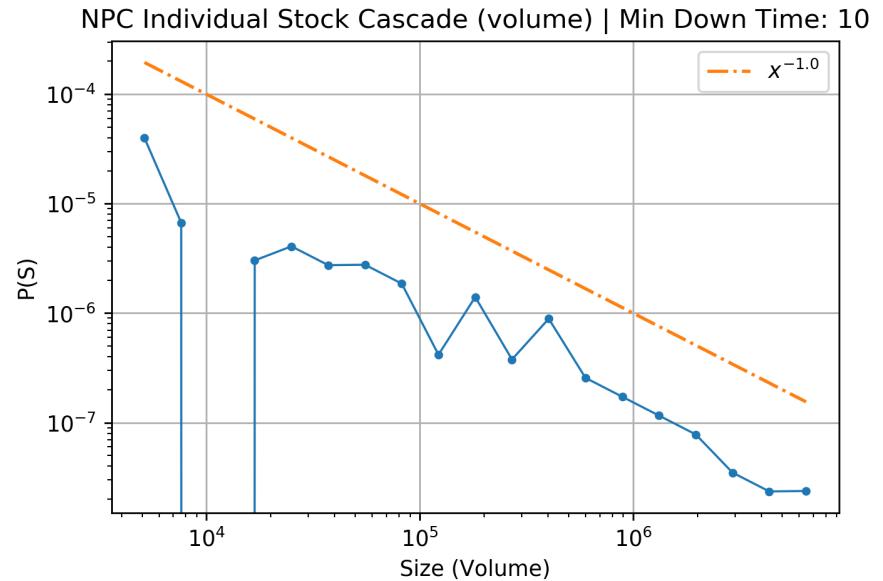
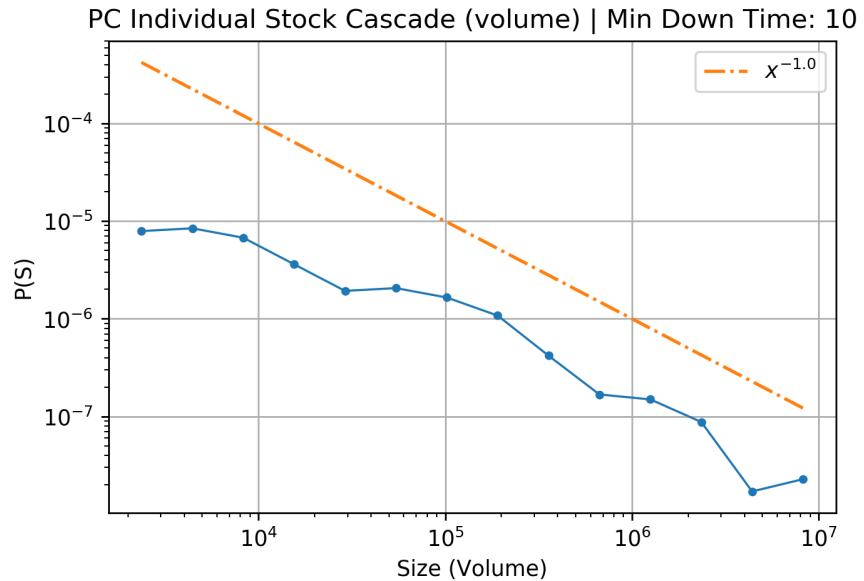
PC Individual Stock Cascade (volume) | Min Down Time: 5



NPC Individual Stock Cascade (volume) | Min Down Time: 5



500 traders with 8-12 stocks, 100 stocks, for 1000 time steps



500 traders with 8-12 stocks, 100 stocks, for 1000 time steps

Results I

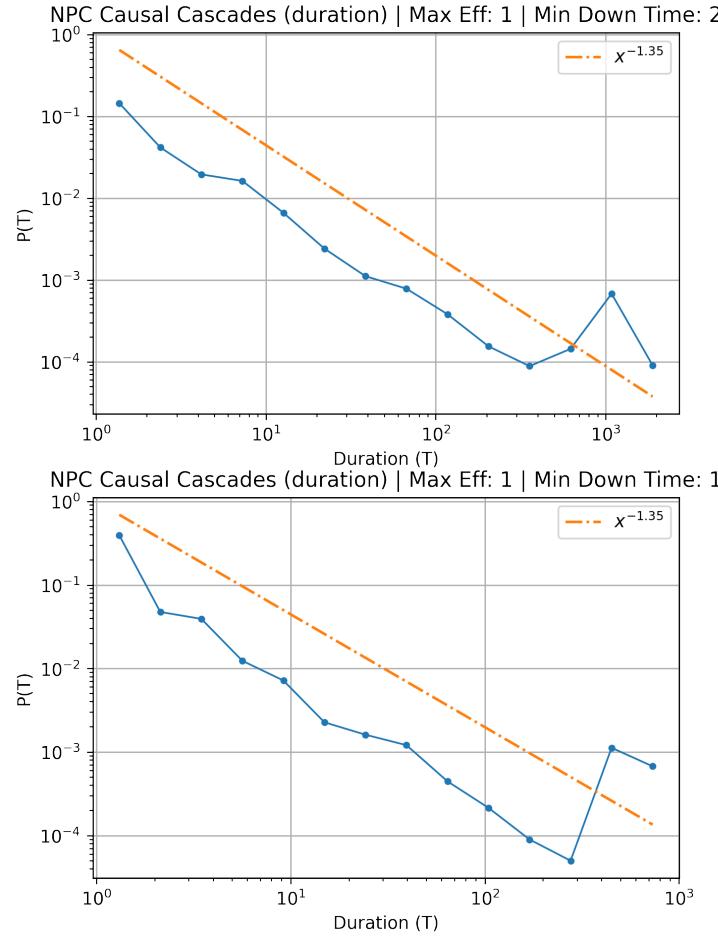
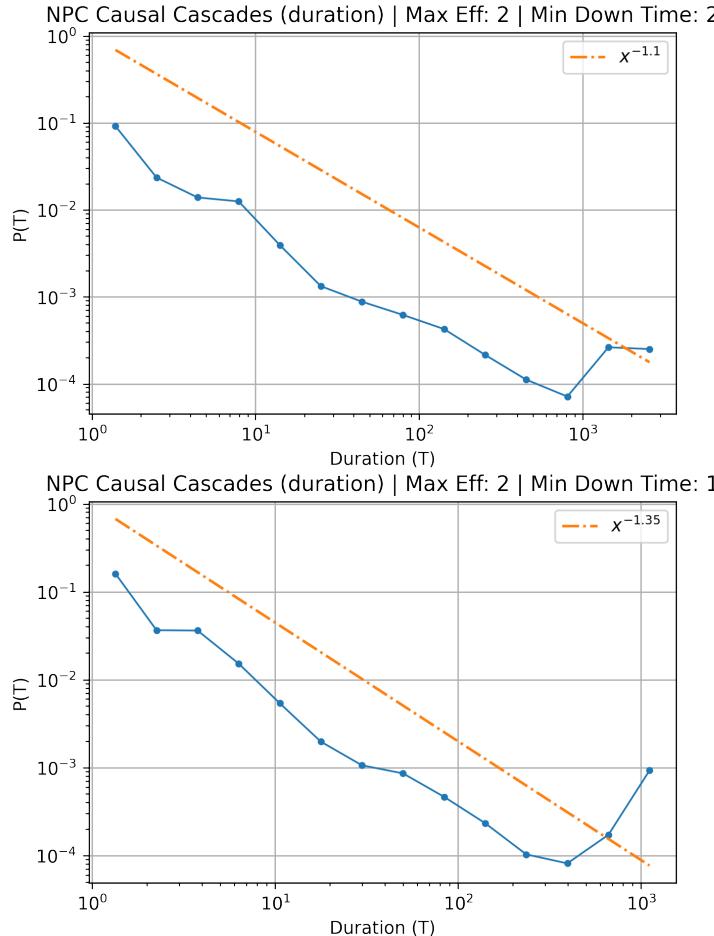
No outstanding differences between PC and NPC cases when simulating 500 traders, 100 stocks, for 1000 time steps

Results II

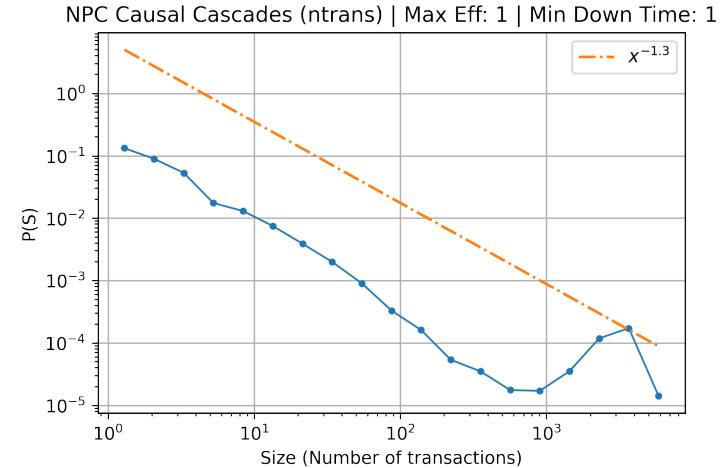
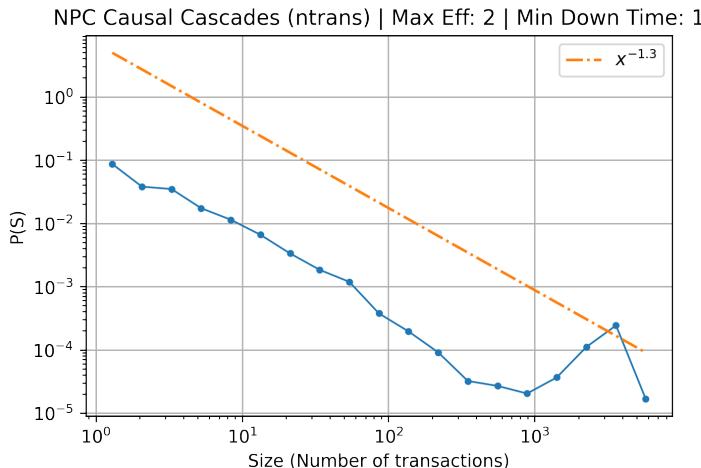
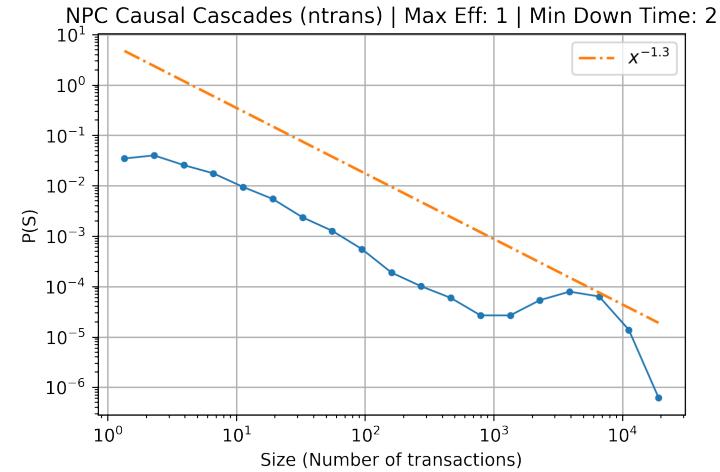
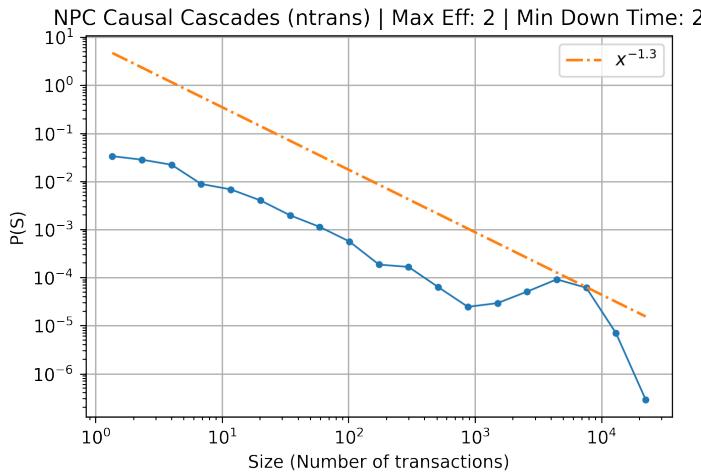
Since NPC had no outstanding differences from PC cases, I simulated 500 traders, 100 stocks, for 7200 time steps (trading week) with NPC to gather better statistics

500 traders with 8-12 stocks, 100 stocks, for 7200 time steps

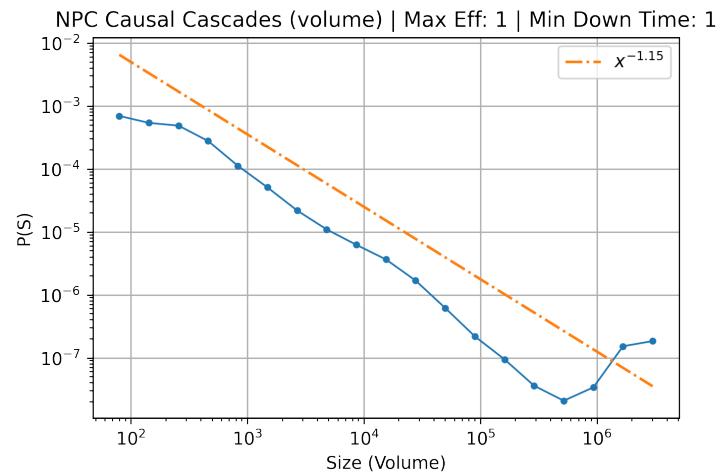
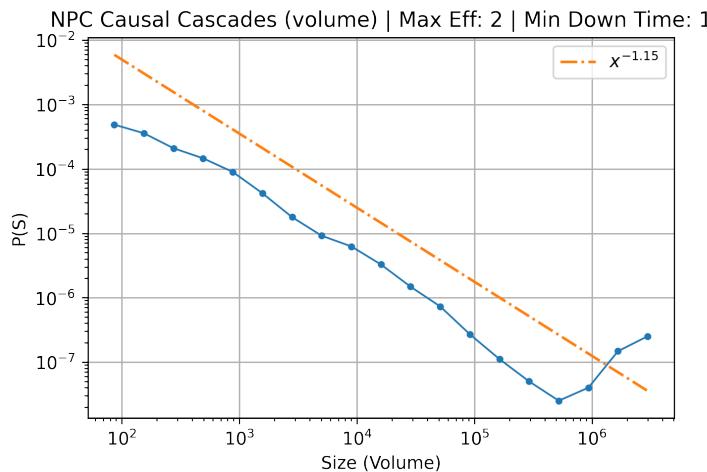
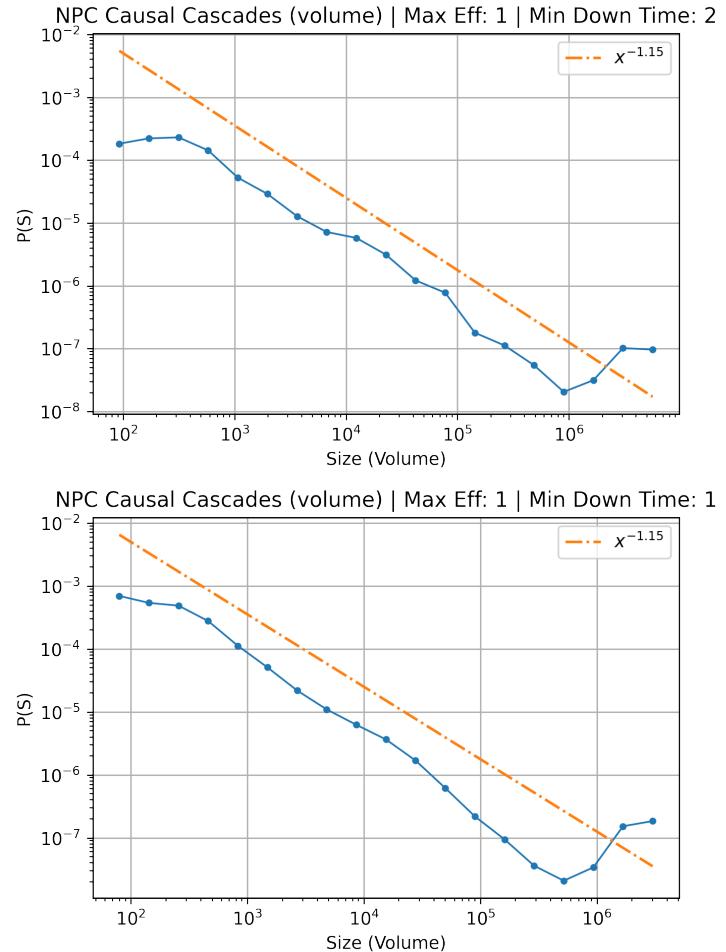
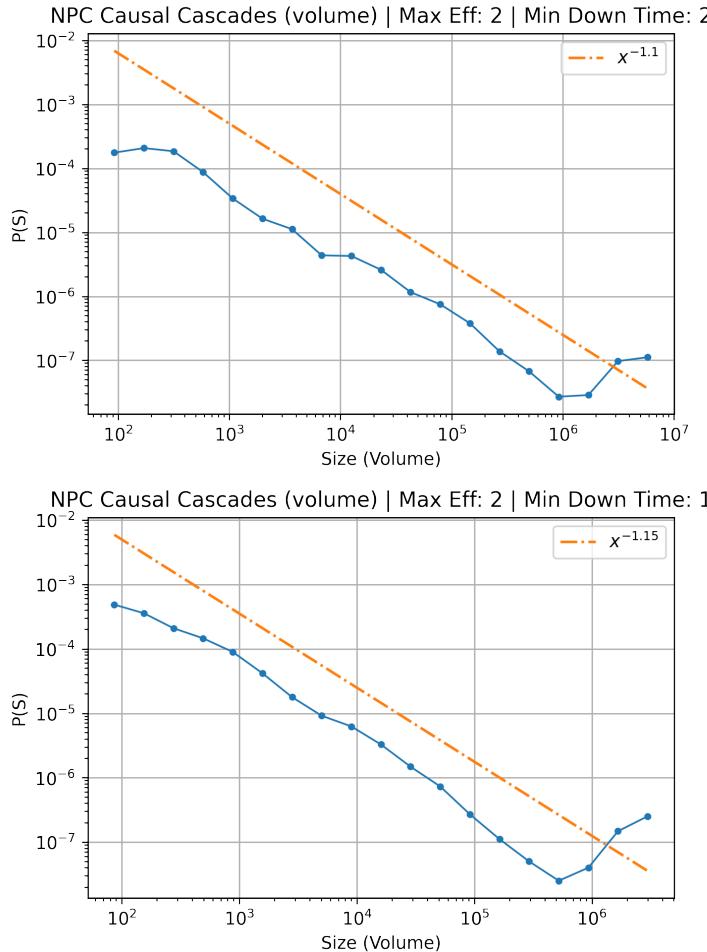
Causal Cascades



500 traders with 8-12 stocks, 100 stocks, for 7200 time steps

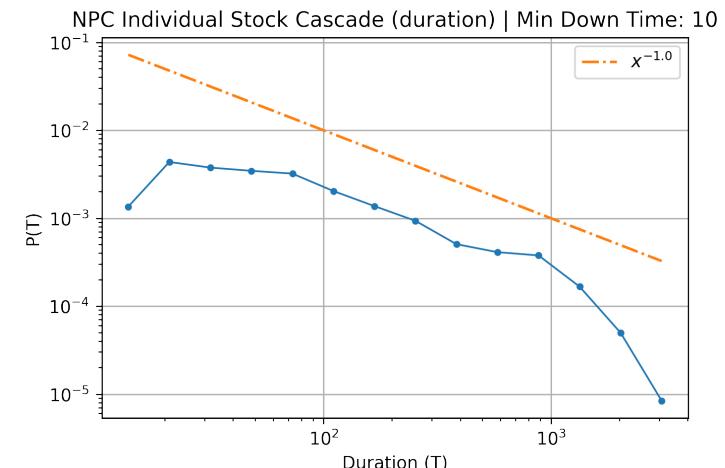
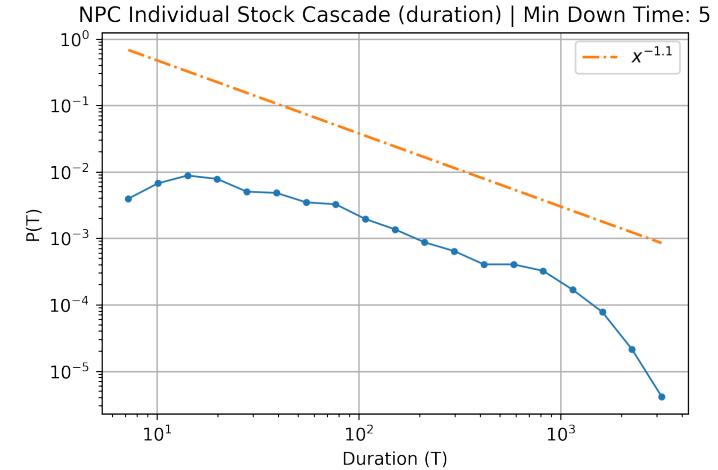
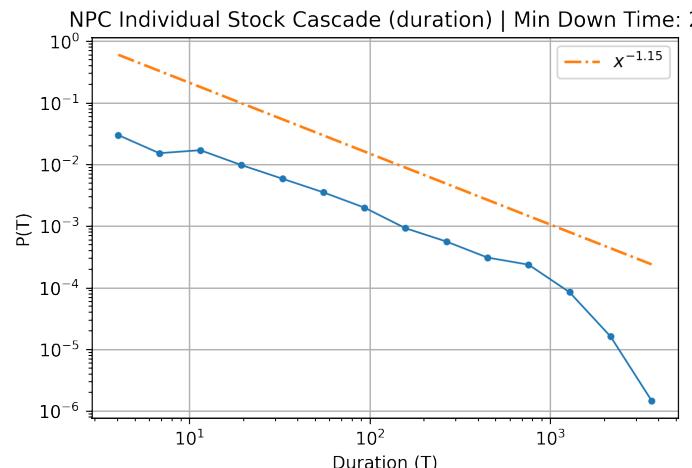
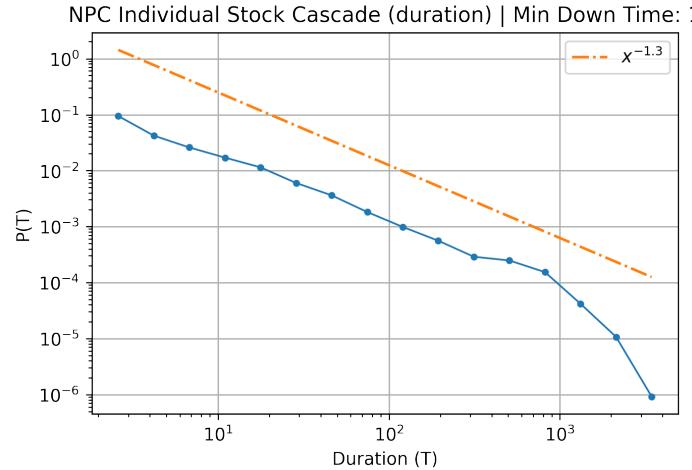


500 traders with 8-12 stocks, 100 stocks, for 7200 time steps

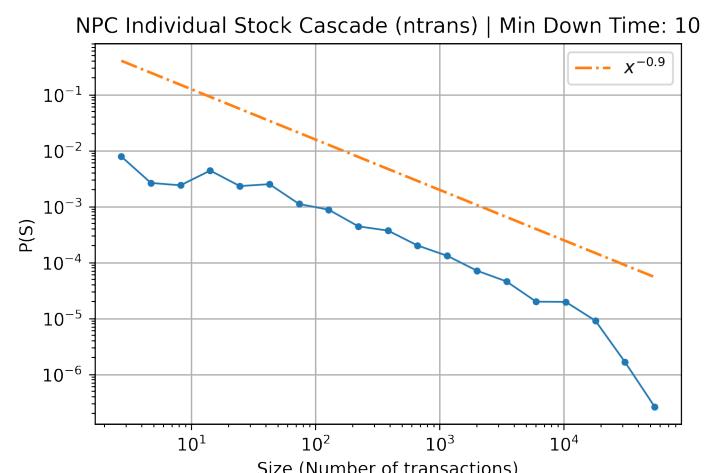
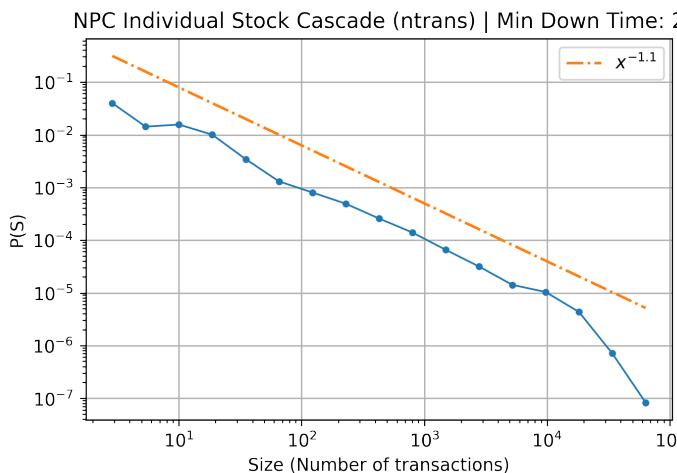
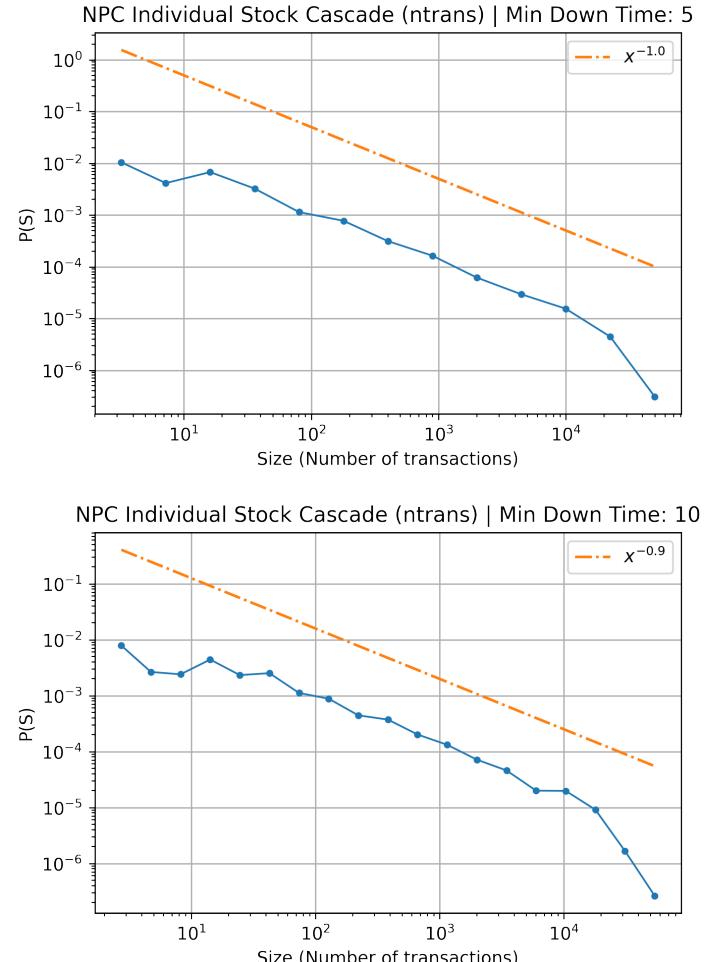
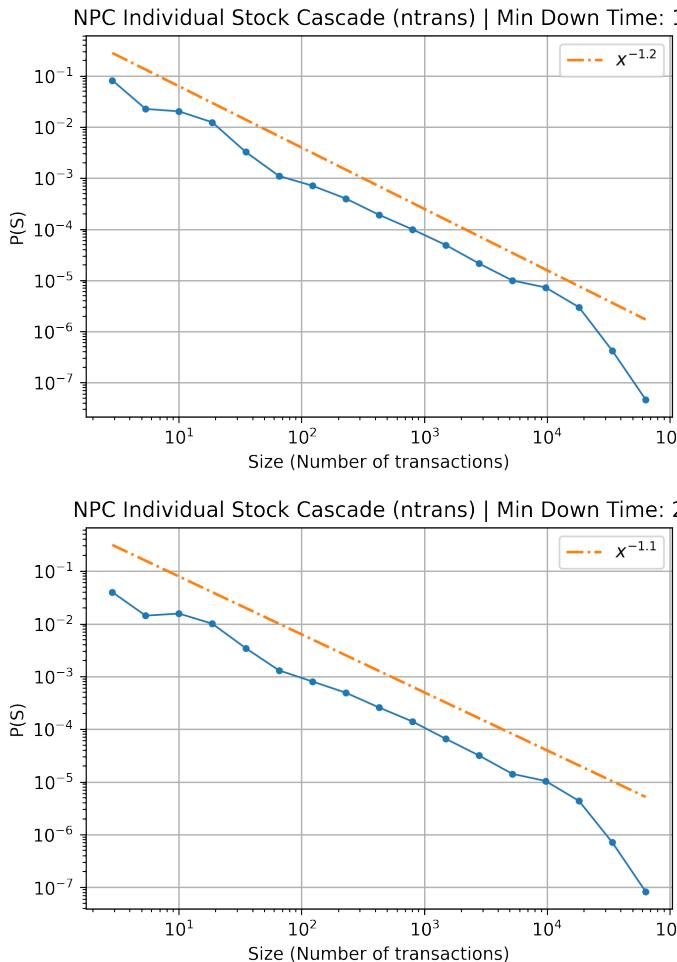


500 traders with 8-12 stocks, 100 stocks, for 7200 time steps

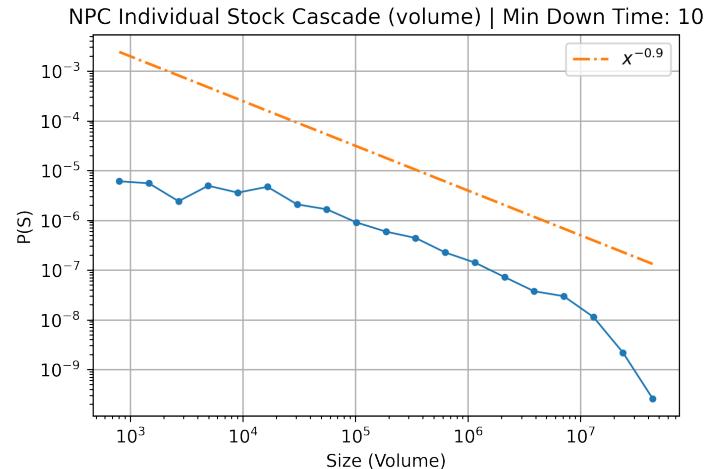
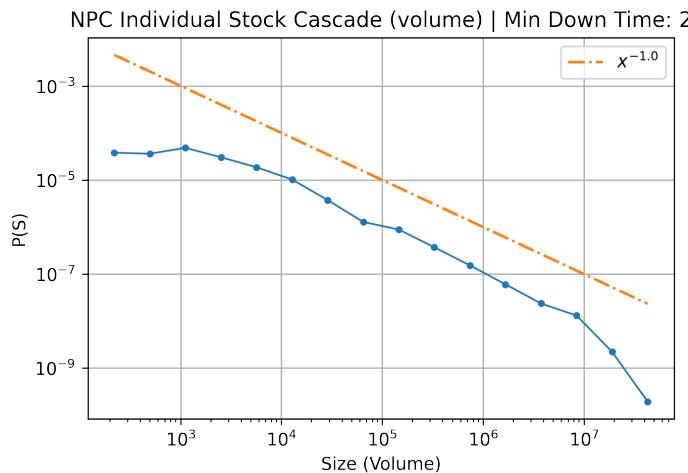
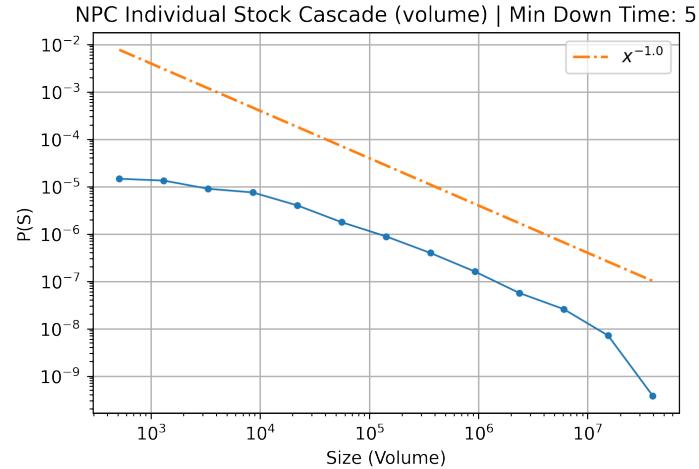
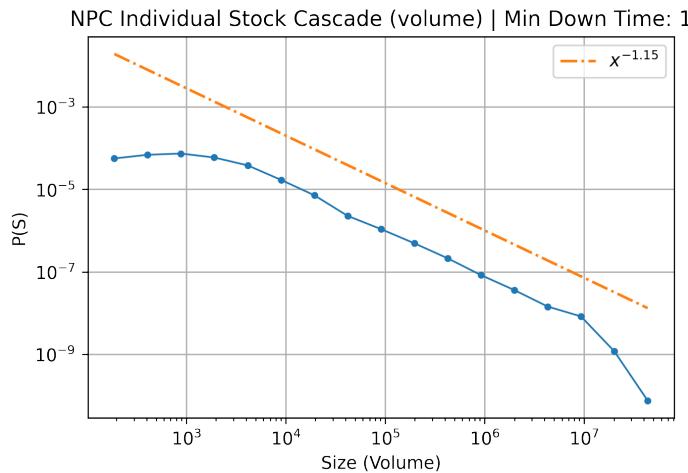
Stock Cascades



500 traders with 8-12 stocks, 100 stocks, for 7200 time steps



500 traders with 8-12 stocks, 100 stocks, for 7200 time steps



500 traders with 8-12 stocks, 100 stocks, for 7200 time steps

Results II

Running simulations of 500 traders, 100 stocks, for 7200 time steps with NPC showed a distinct bump at large cascade distributions, suggesting some finite size effects.

100 traders with 2-5 stocks, 100 stocks, for 7200 time steps

Results III

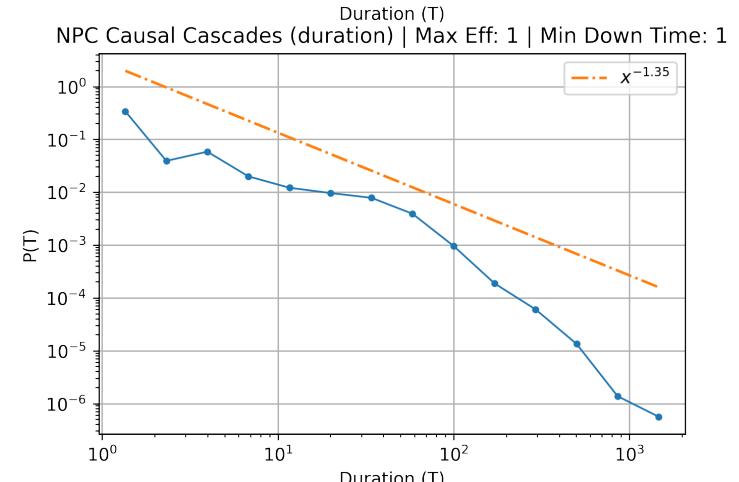
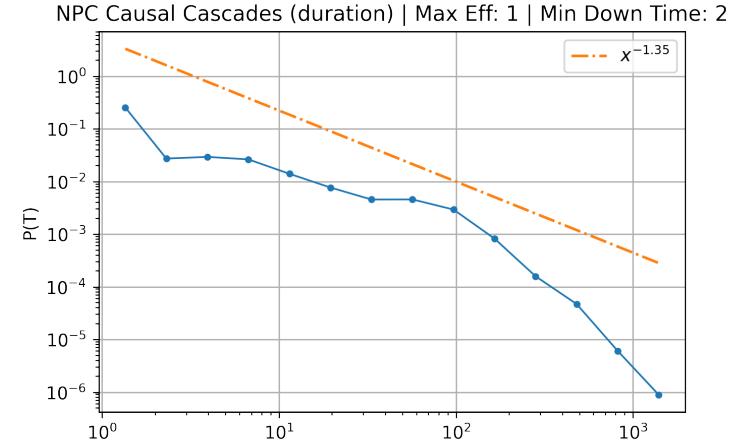
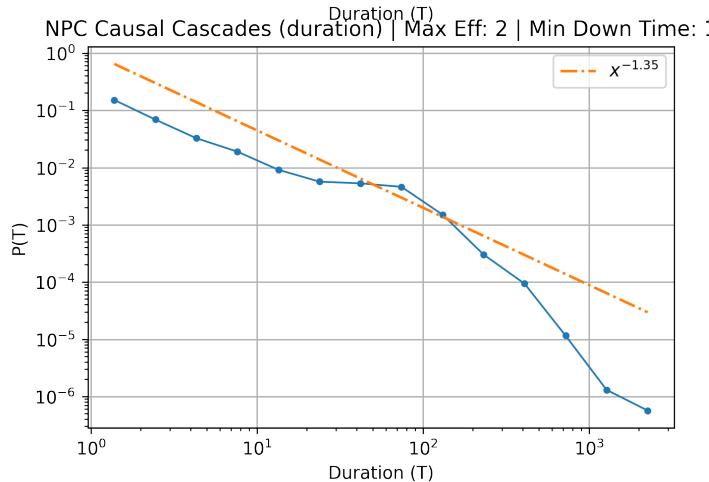
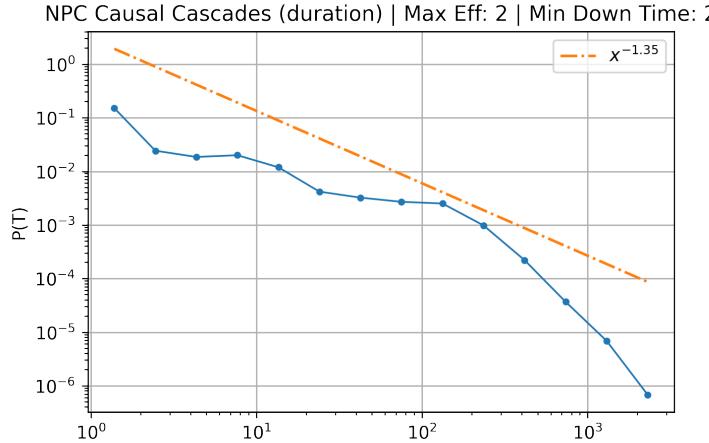
Running simulations of 100 and 200 traders, 100 stocks, for 7200 time steps with NPC to gauge finite-size effects

Portfolio sizes varied—these results are from portfolios of size 2-5 instead of the 8-12 seen previously.

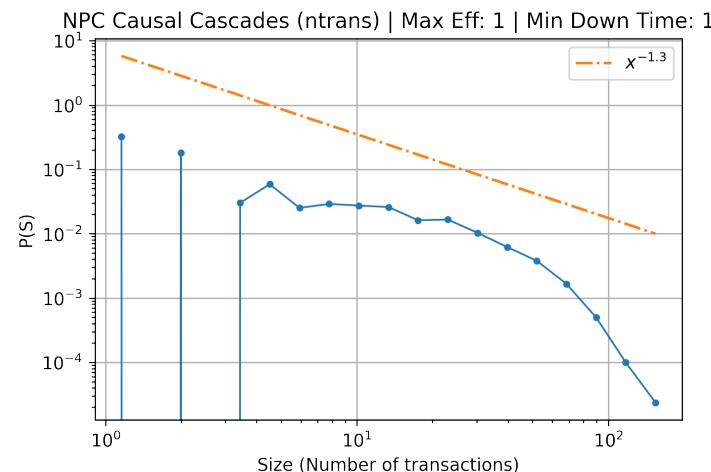
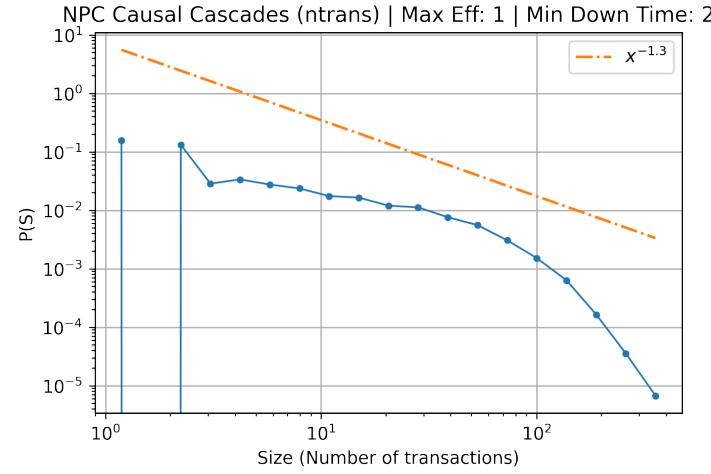
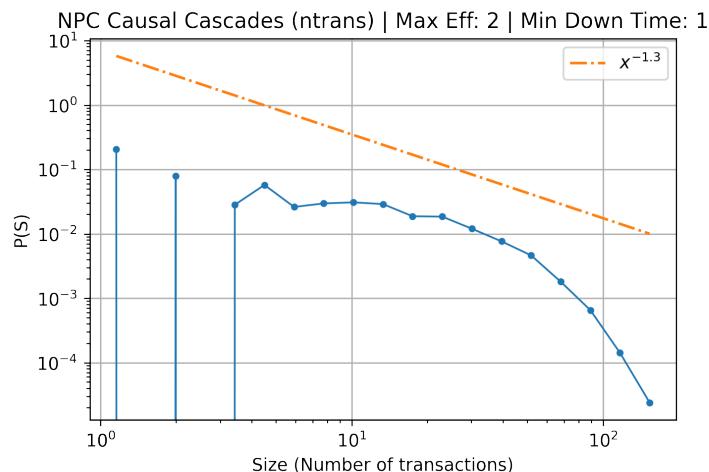
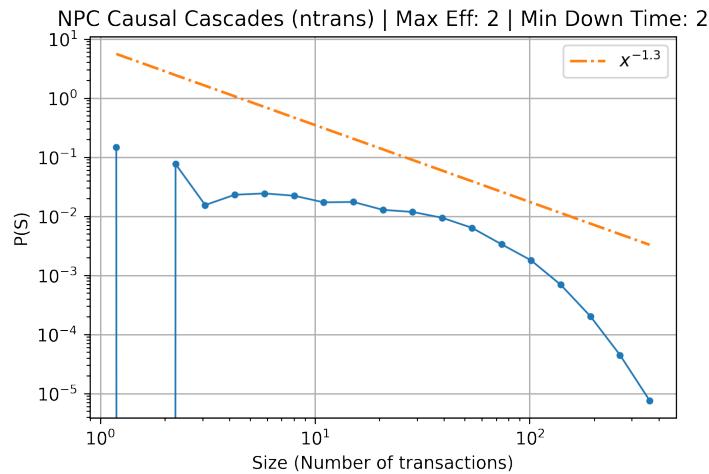
Other system sizes still simulating

100 traders with 2-5 stocks, 100 stocks, for 7200 time steps

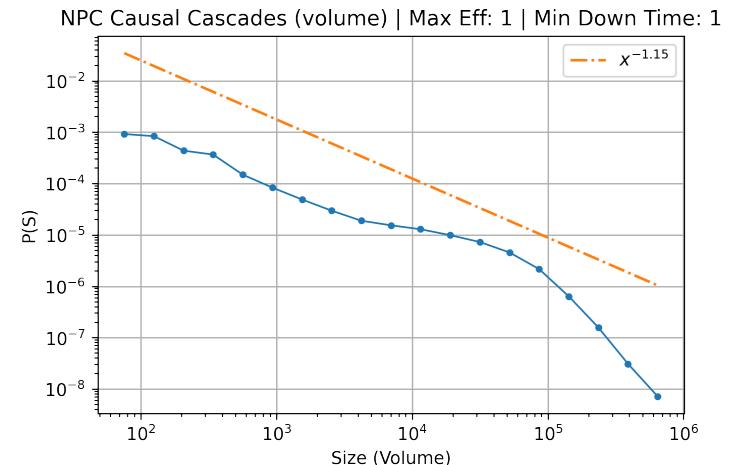
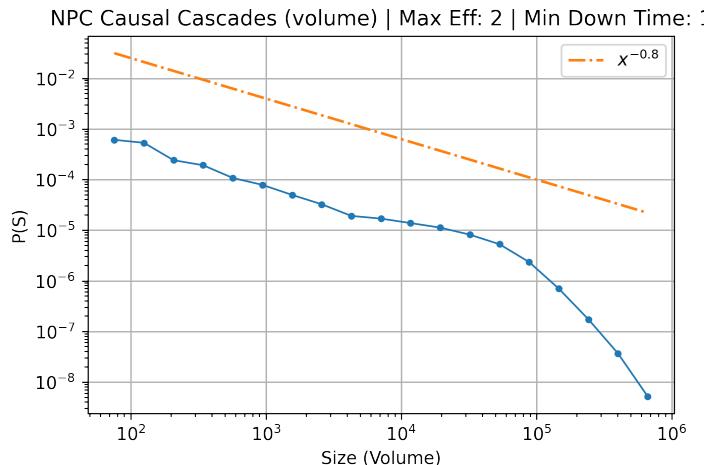
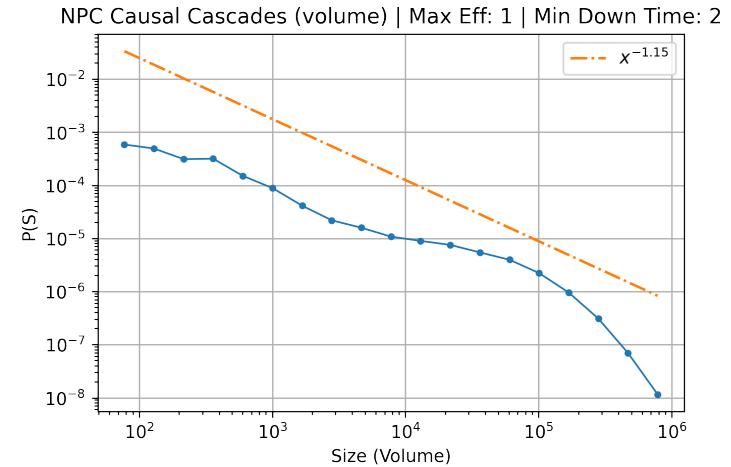
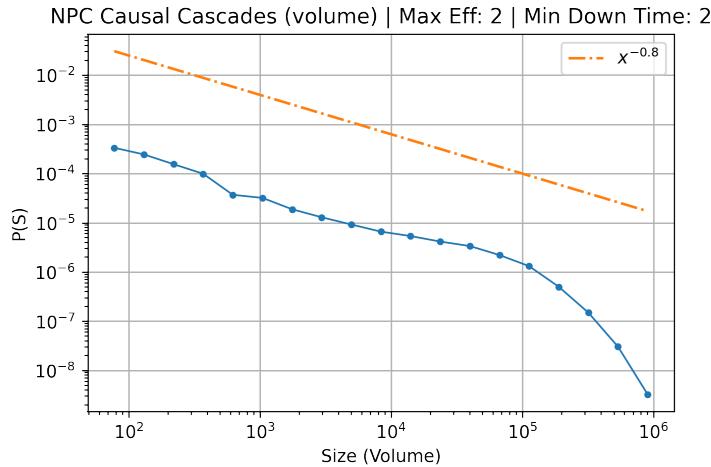
100 Portfolios Causal Cascades



100 traders with 2-5 stocks, 100 stocks, for 7200 time steps

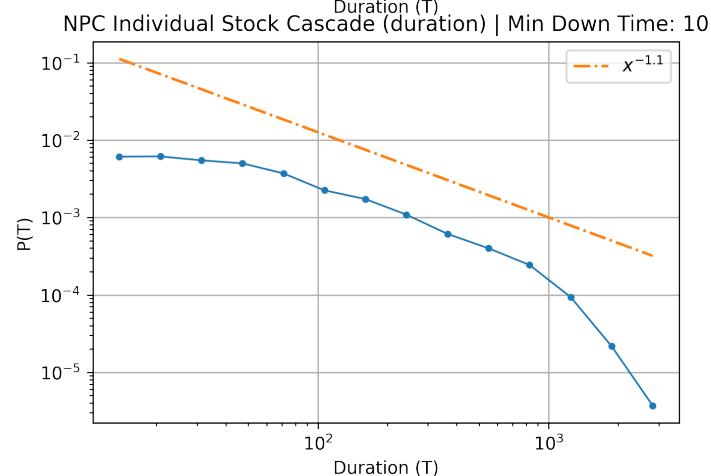
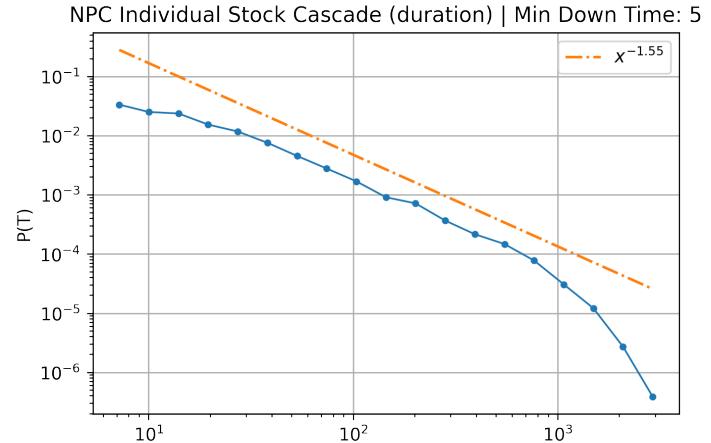
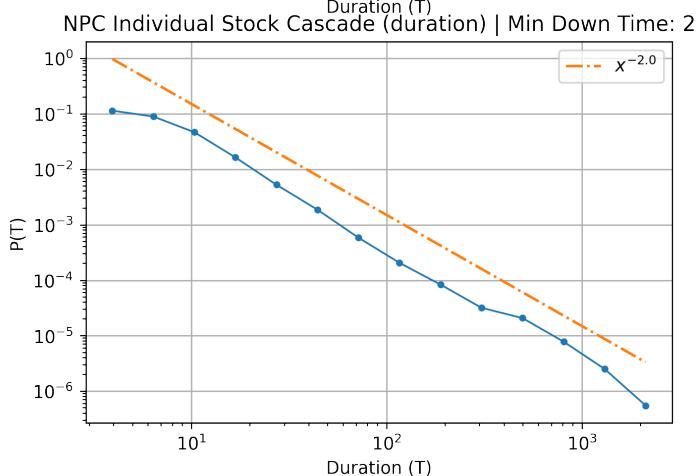
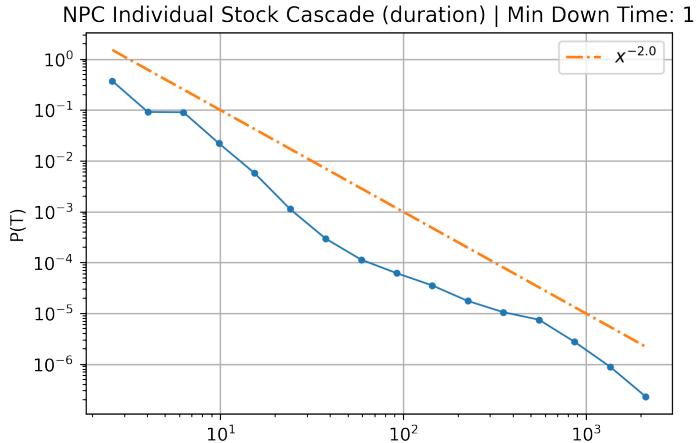


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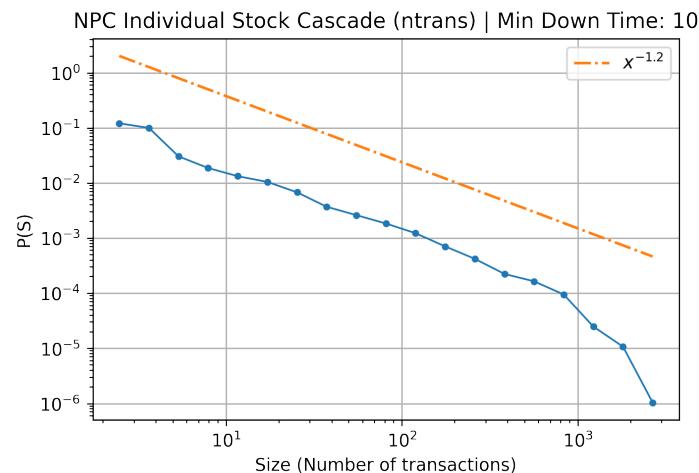
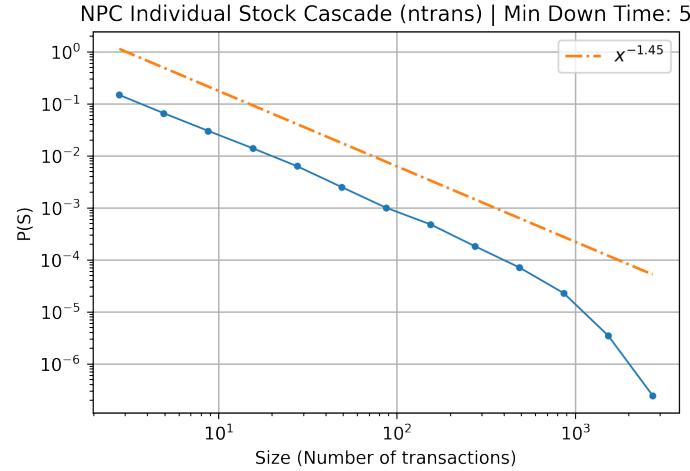
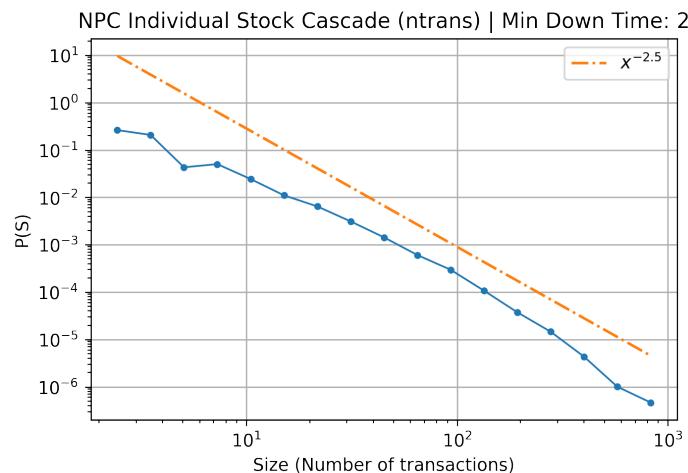
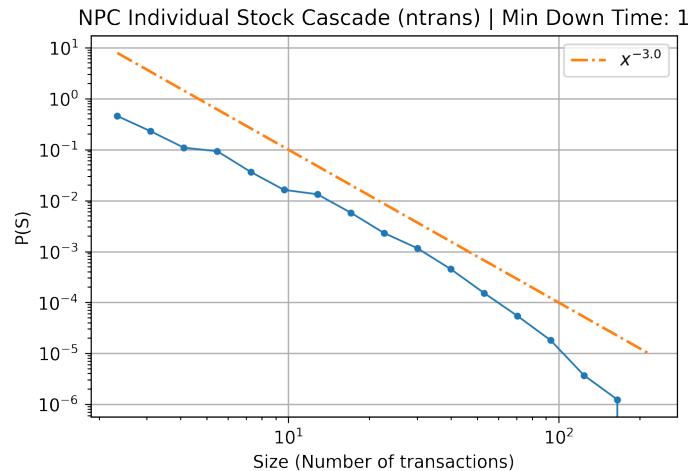


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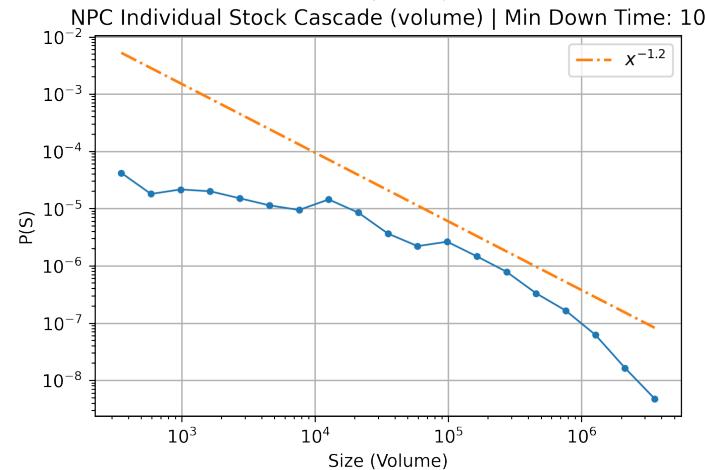
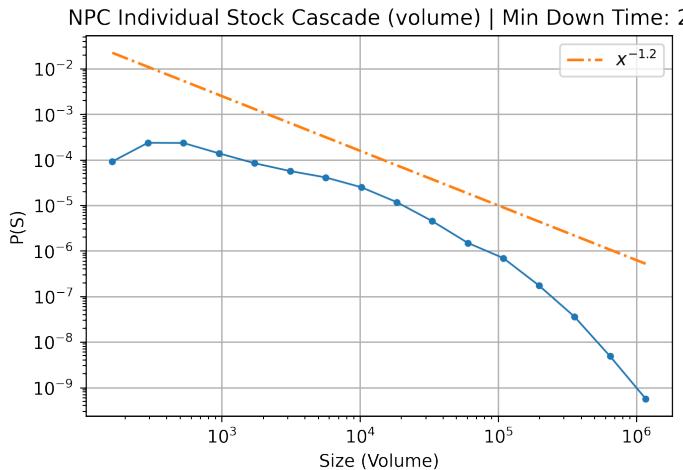
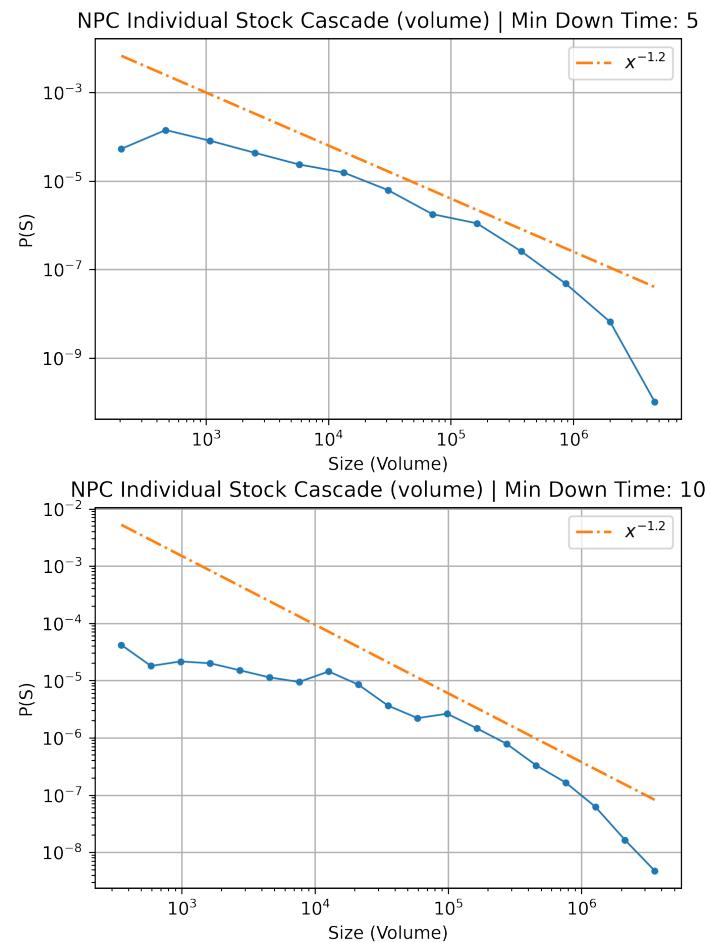
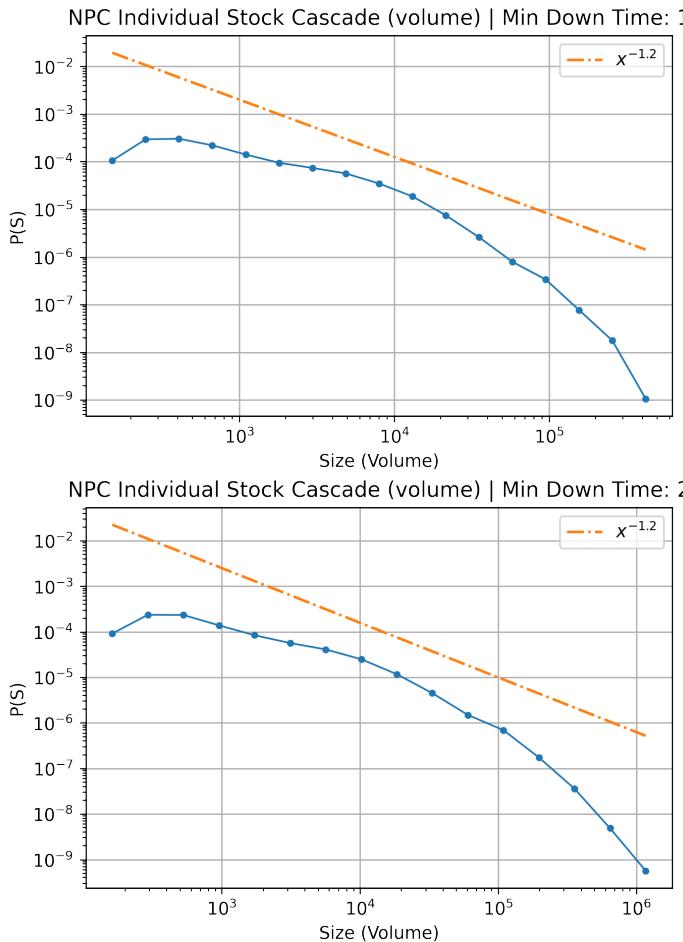
100 Portfolios Stock Cascades



100 traders with 2-5 stocks, 100 stocks, for 7200 time steps

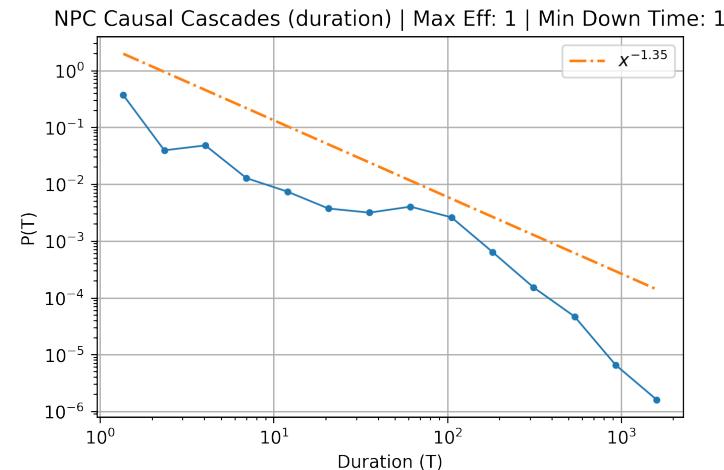
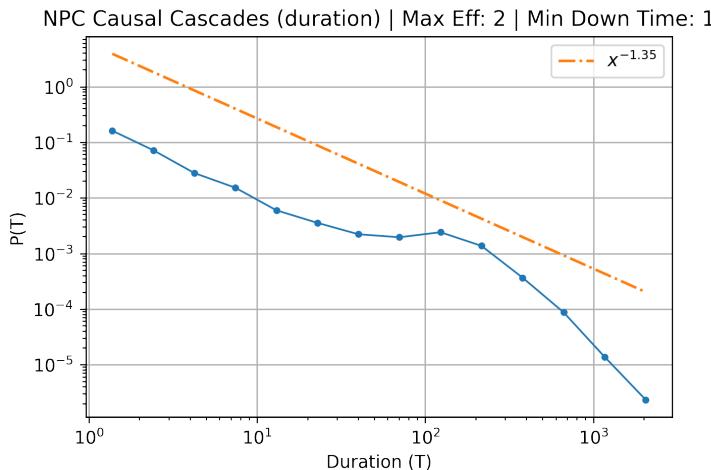
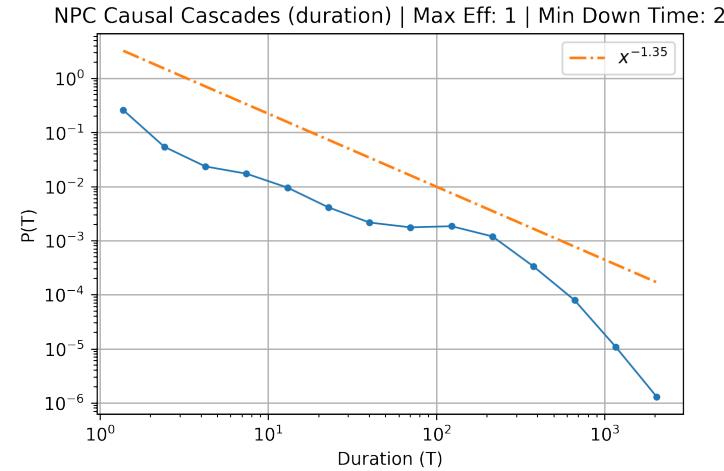
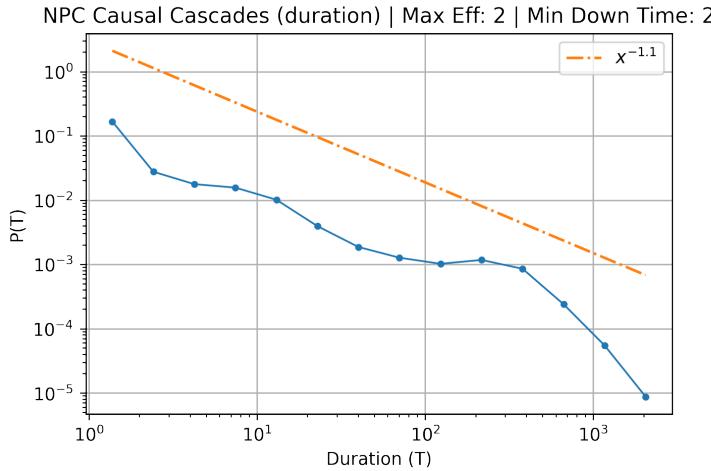


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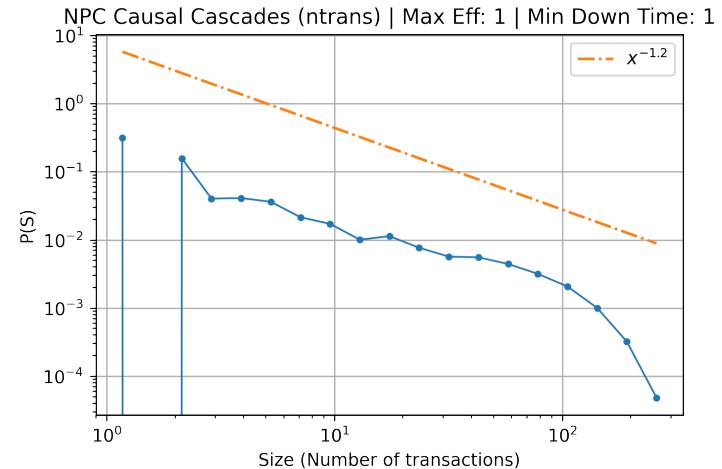
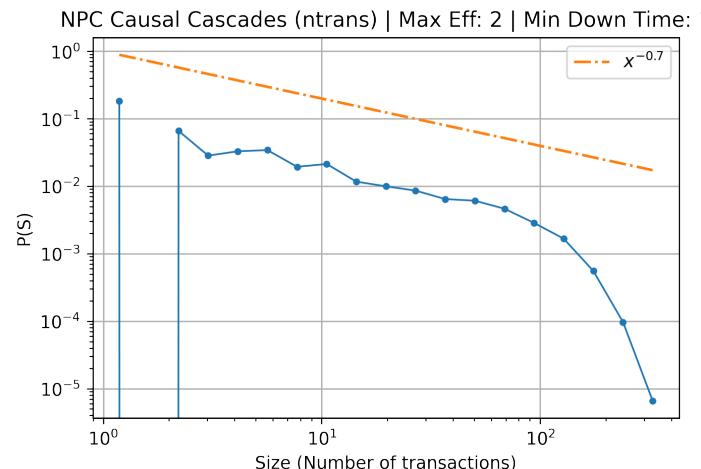
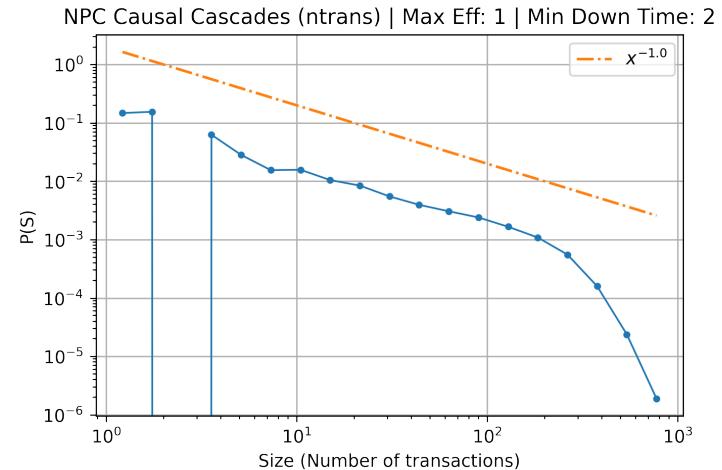
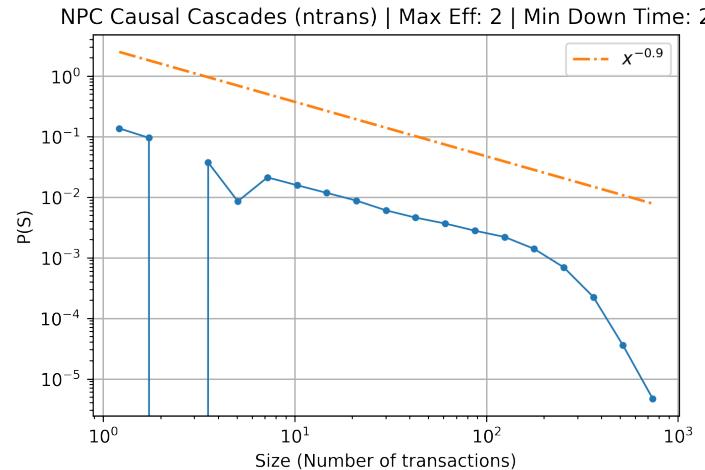


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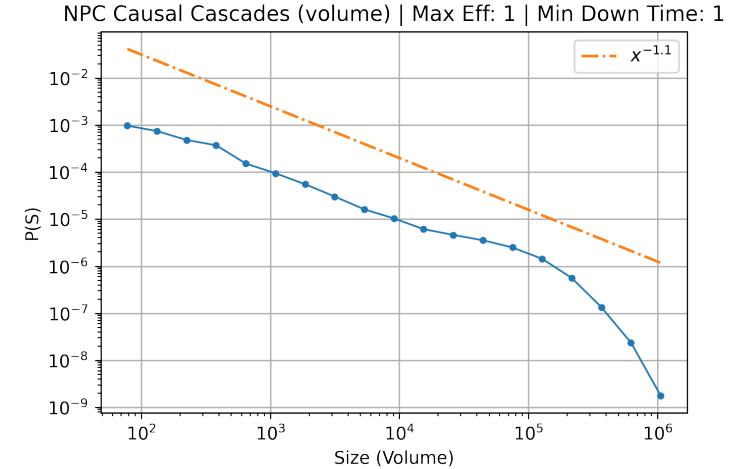
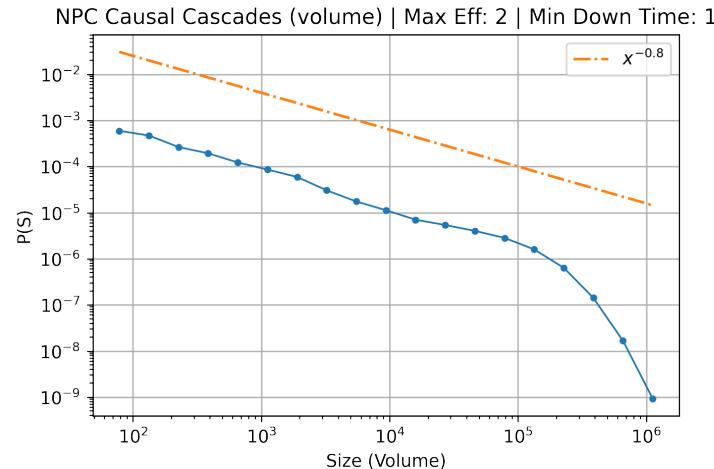
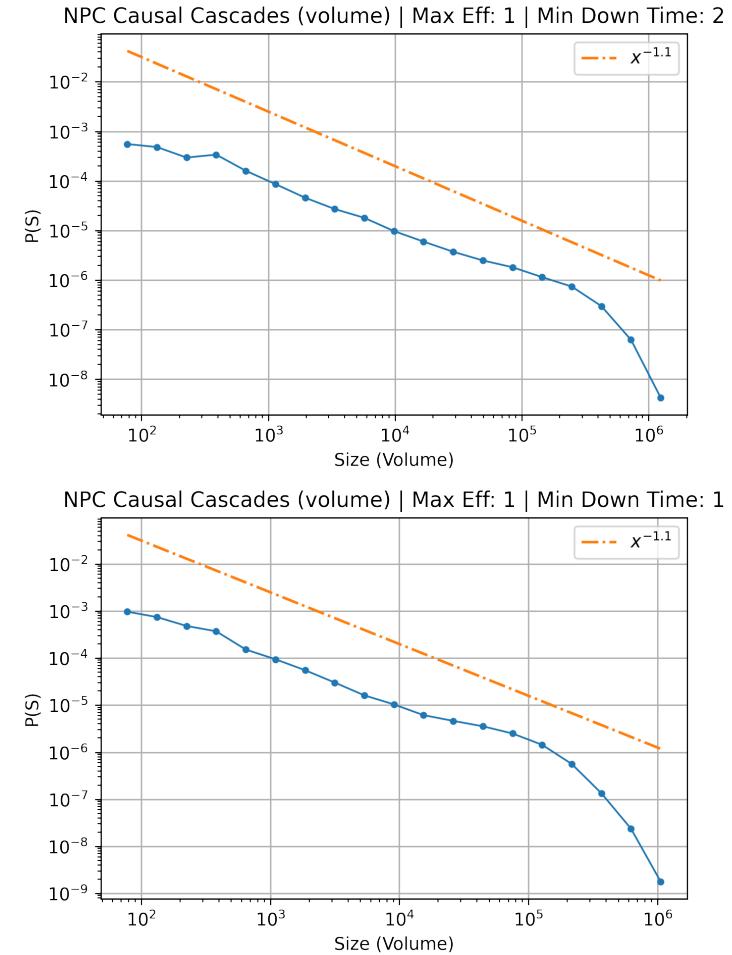
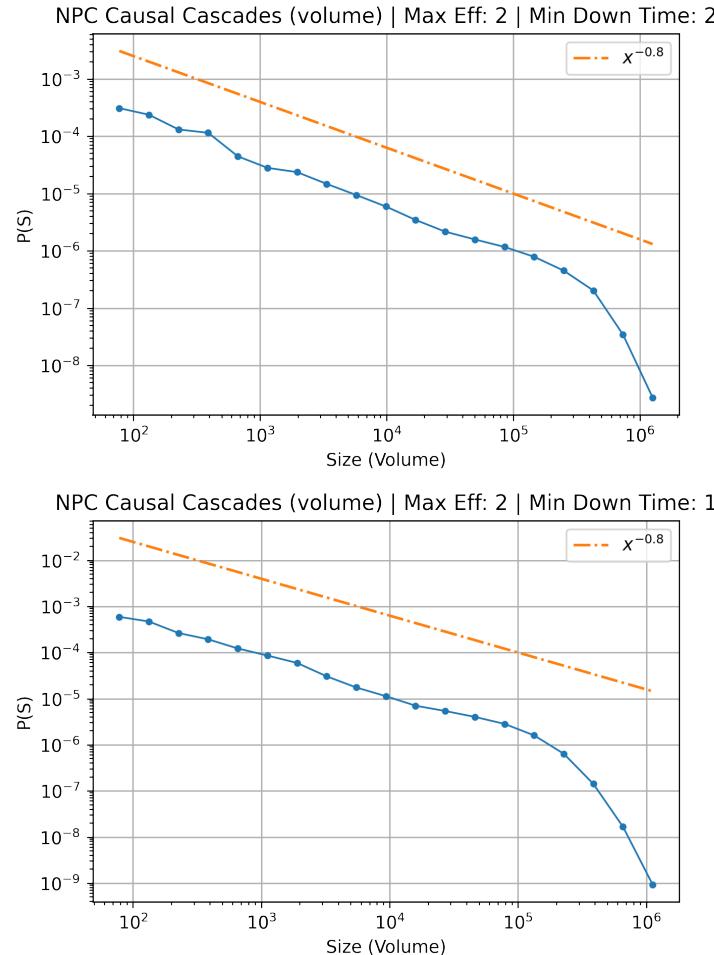
200 Portfolios Causal Cascades



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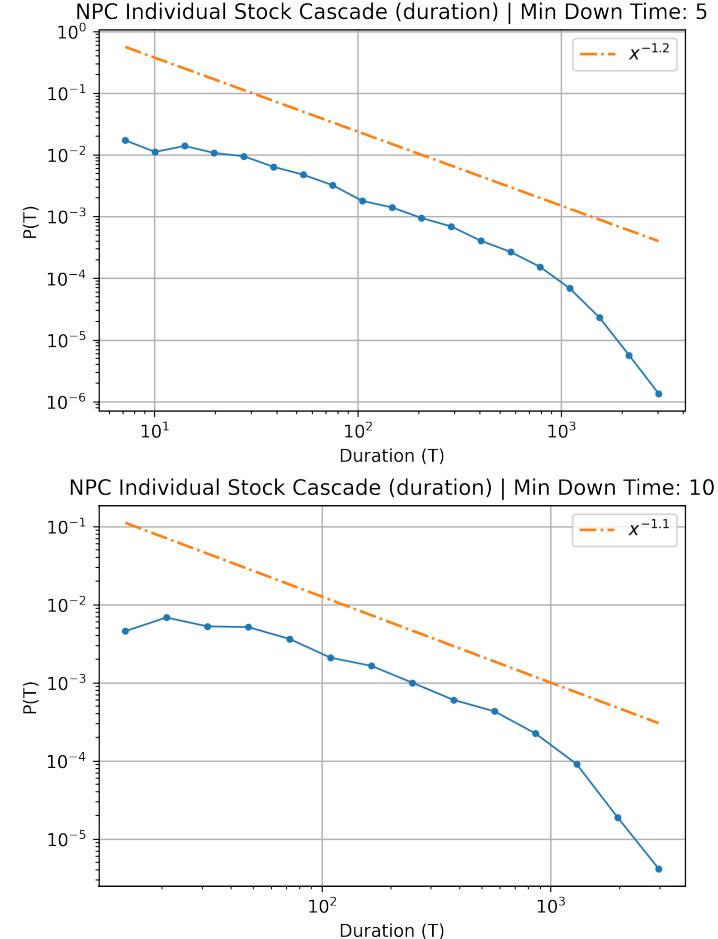
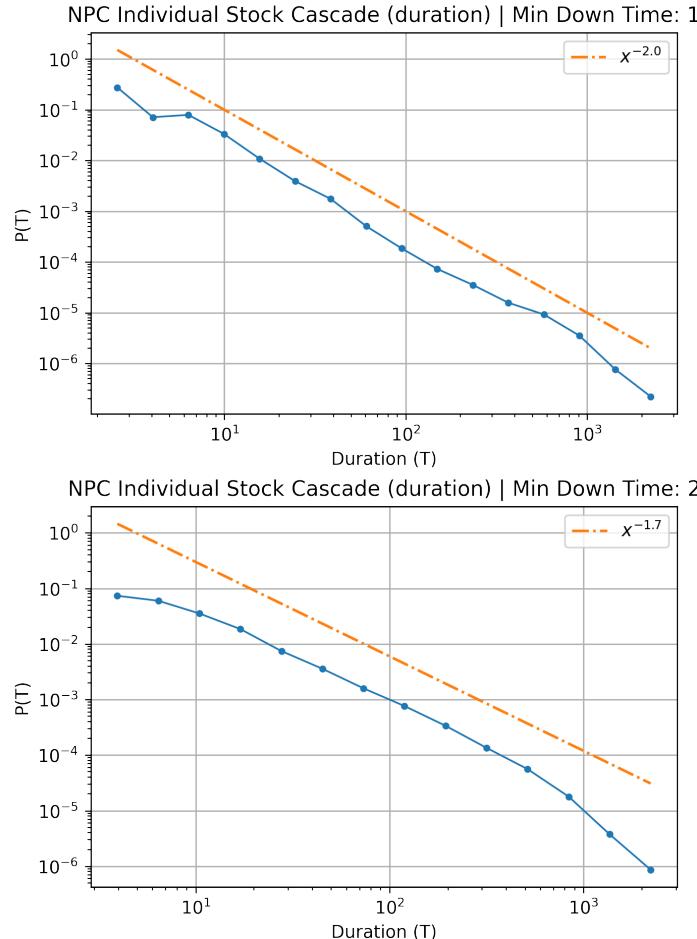


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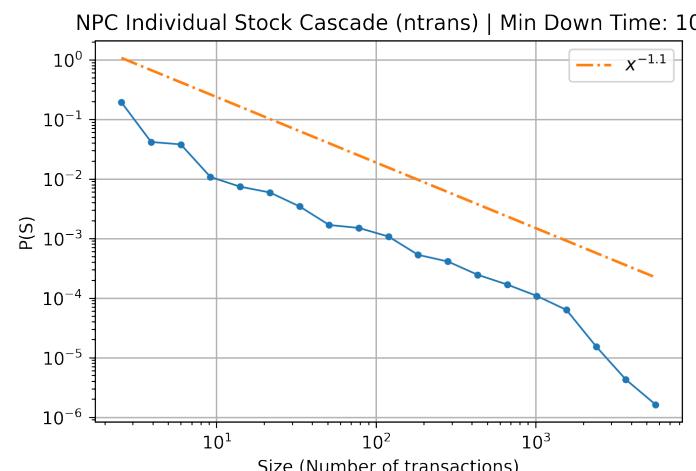
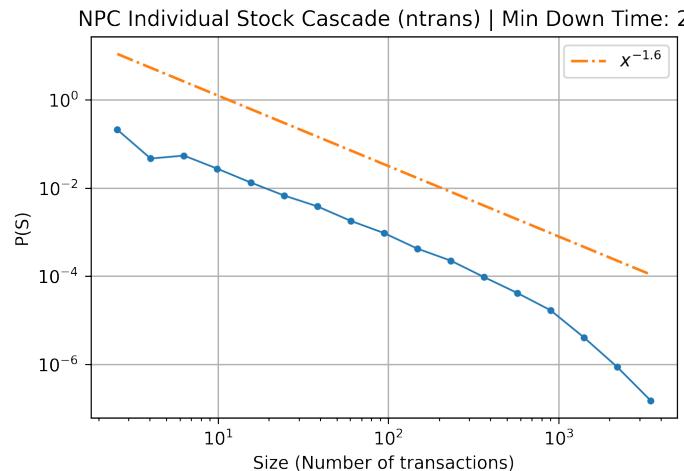
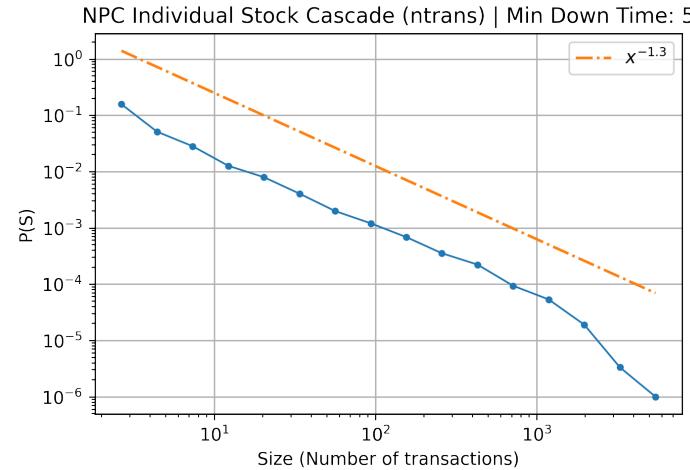
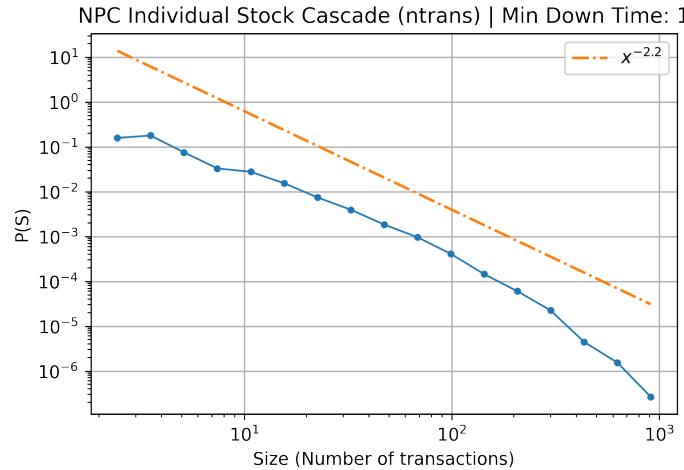


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200 Portfolios Stock Cascades



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