

# **Agent-baseret modellering af finansielle markeder**

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# ‘Algorithmic Finance: Inquiring into the Reshaping of Financial Markets’ (AlgoFinance)

<http://info.cbs.dk/algofinance>

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**European Research Council**  
Established by the European Commission

# Oversigt

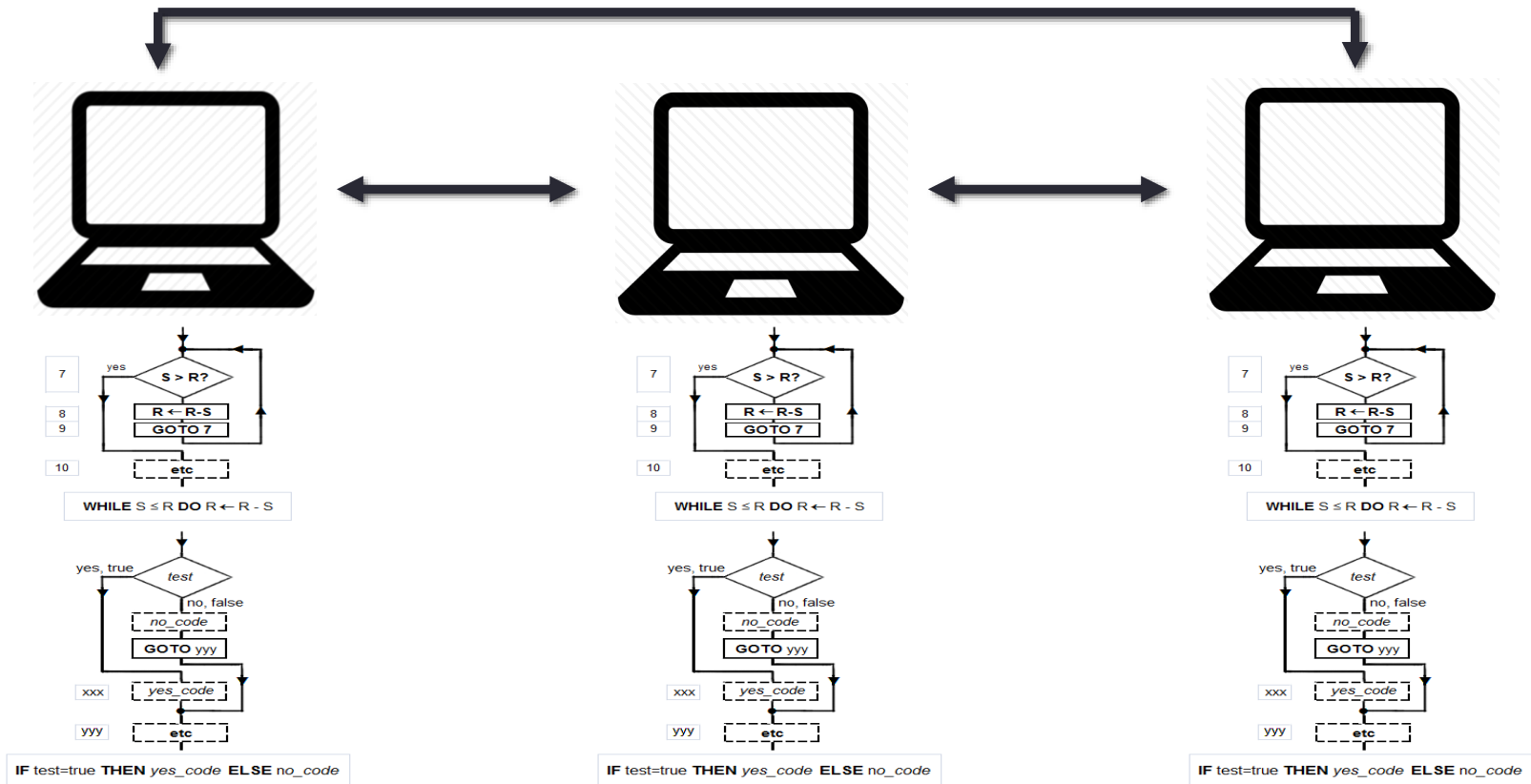
- Baggrund
- Tilgang
- Udfordringer

# Baggrund – I

Tidligere forskningsprojekt om massedynamikker i finansielle markeder:

- Fokus på automatiseret højfrekvenshandel, hvor man fx udnytter små markedsubalancer

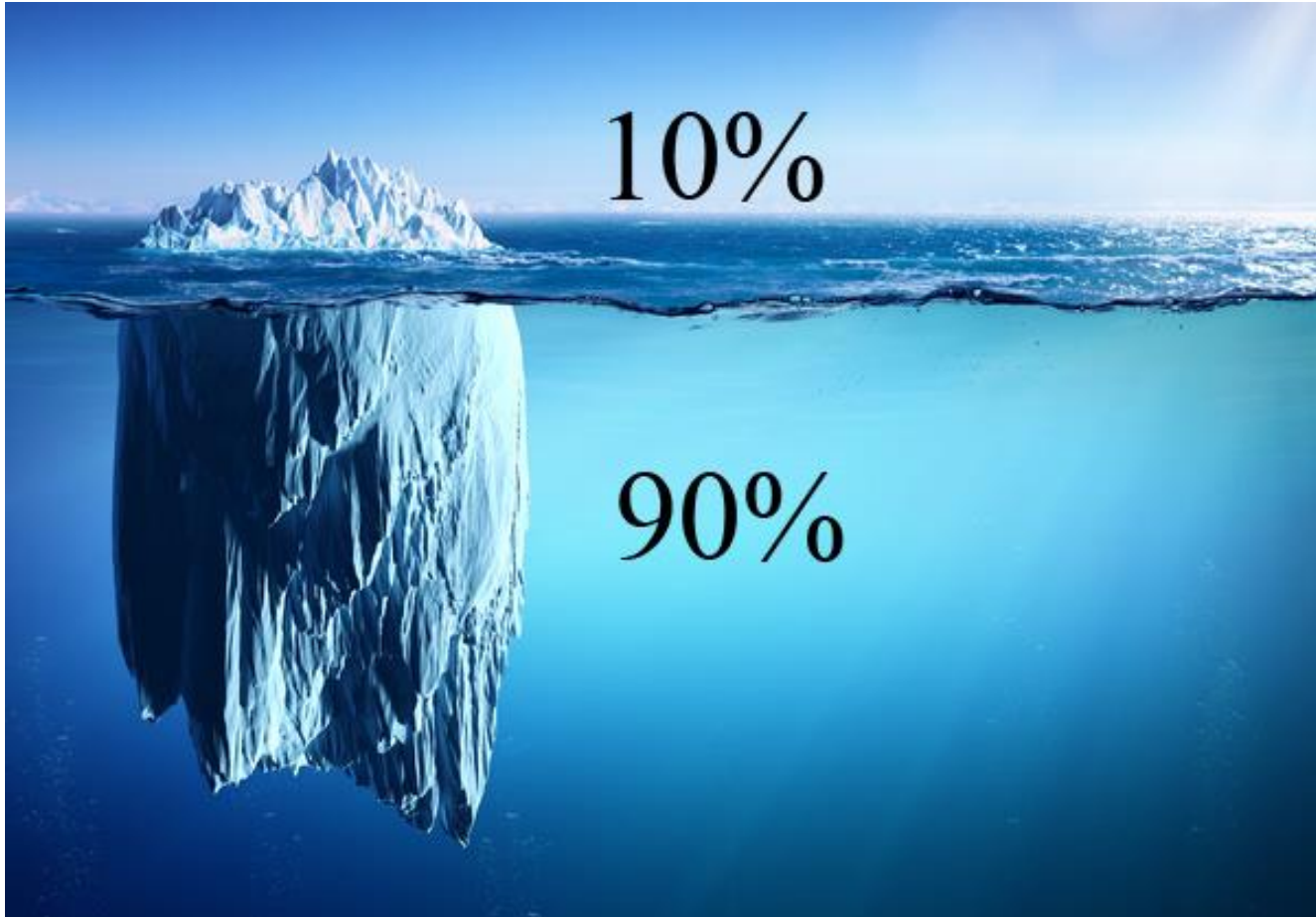
# Algoritmedrevne finansielle markeder



# Baggrund – II

Tidligere forskningsprojekt om massedynamikker i finansielle markeder:

- Feltarbejde pegede på, at algoritmer er designet til at indgå i særlige interaktionsdynamikker



10%

90%

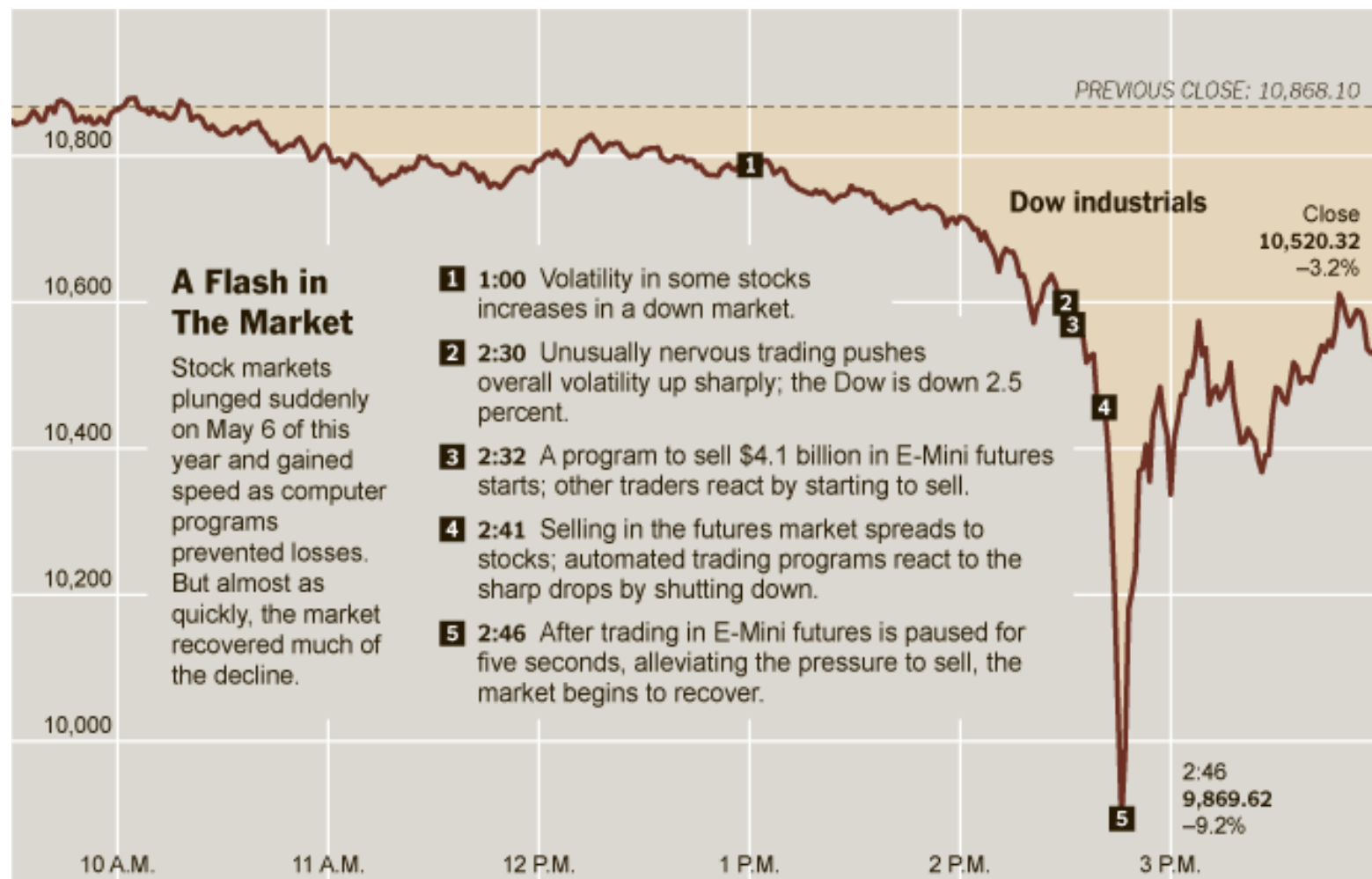
# Baggrund – III

Tidligere forskningsprojekt om massedynamikker i finansielle markeder:

- Flash Crash-events: interaktionsdynamikker kan skabe emergente effekter



# Flash Crash 6. maj 2010



Sources: Bloomberg (Dow industrials); Securities and Exchange Commission

THE NEW YORK TIMES

# Baggrund – IV

Spørgsmål: hvordan kan man studere interaktionen mellem fuldt automatiserede algoritmer?

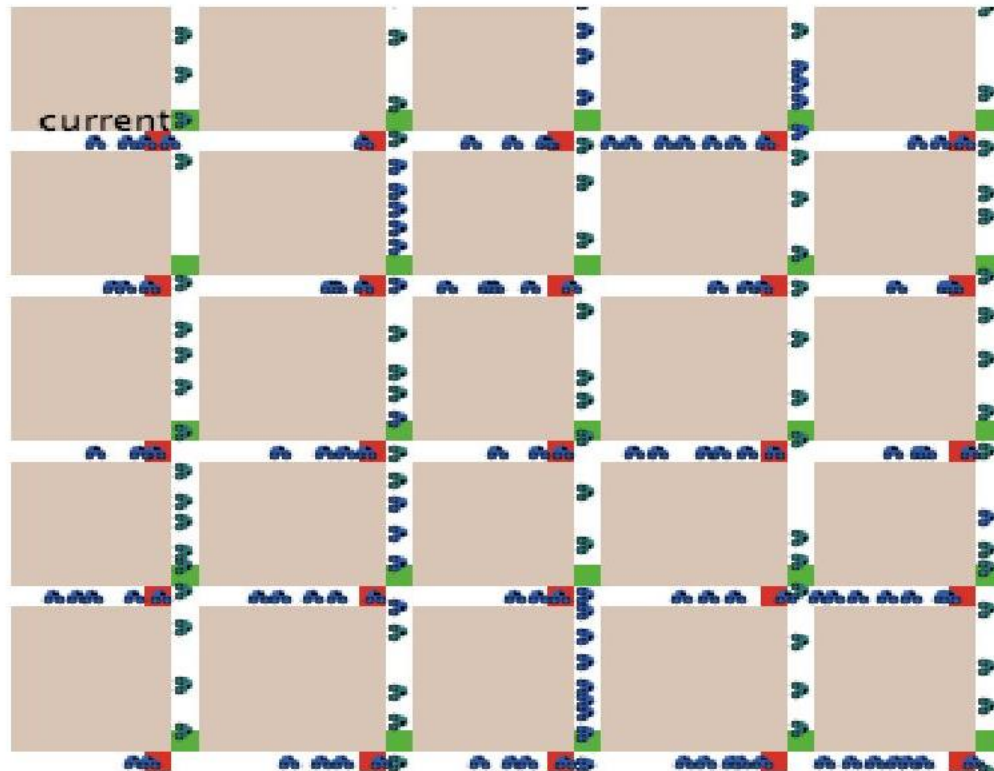
- Interviews?
- Adgang til børsers ordredata?
- Algoritmisk etnografi?
- Agent-baseret modellering (ABM)?

# Baggrund

Agent-baseret modellering: simulering af agenter, som interagerer i et bestemt miljø

- Specificere forskellige mikrodimensioner på agentniveau samt det miljø, de interagerer i, for så at modellere (emergente) makroresultater

# ABM Generic Example – Traffic Control



# Tilgang

ERC-projektet: AlgoFinance (2017-)

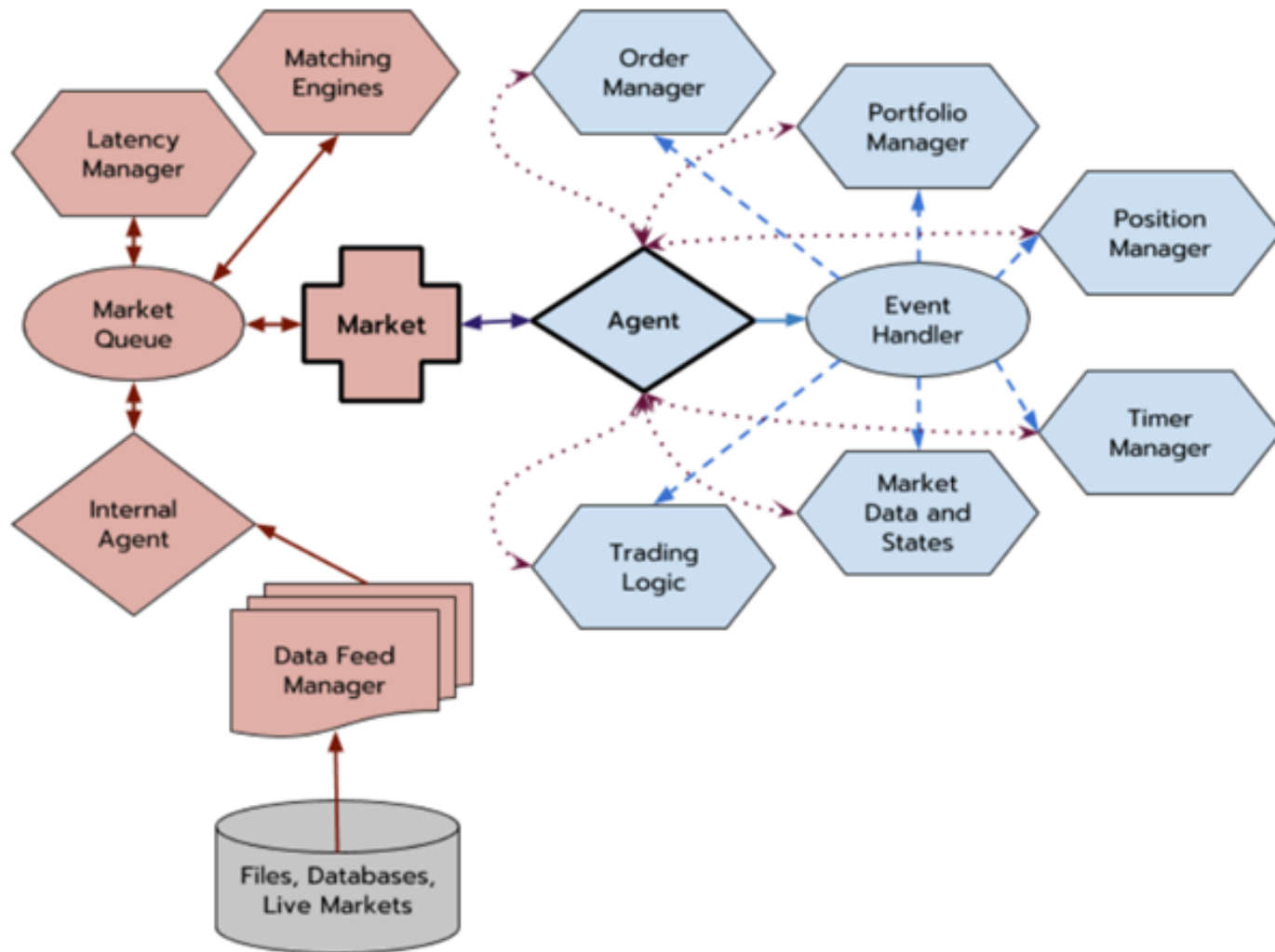
- Eksisterende finansielle ABMs: få agenter, grove antagelser, urealistisk miljø
- Vores tilgang: forsøger at skabe realistiske agenter (inkl. automatiserede algoritmer), som interagerer i et realistisk miljø (den måde, moderne børser faktisk opererer på)
- Tailor-made ABM

Sociological-  
anthropological  
work

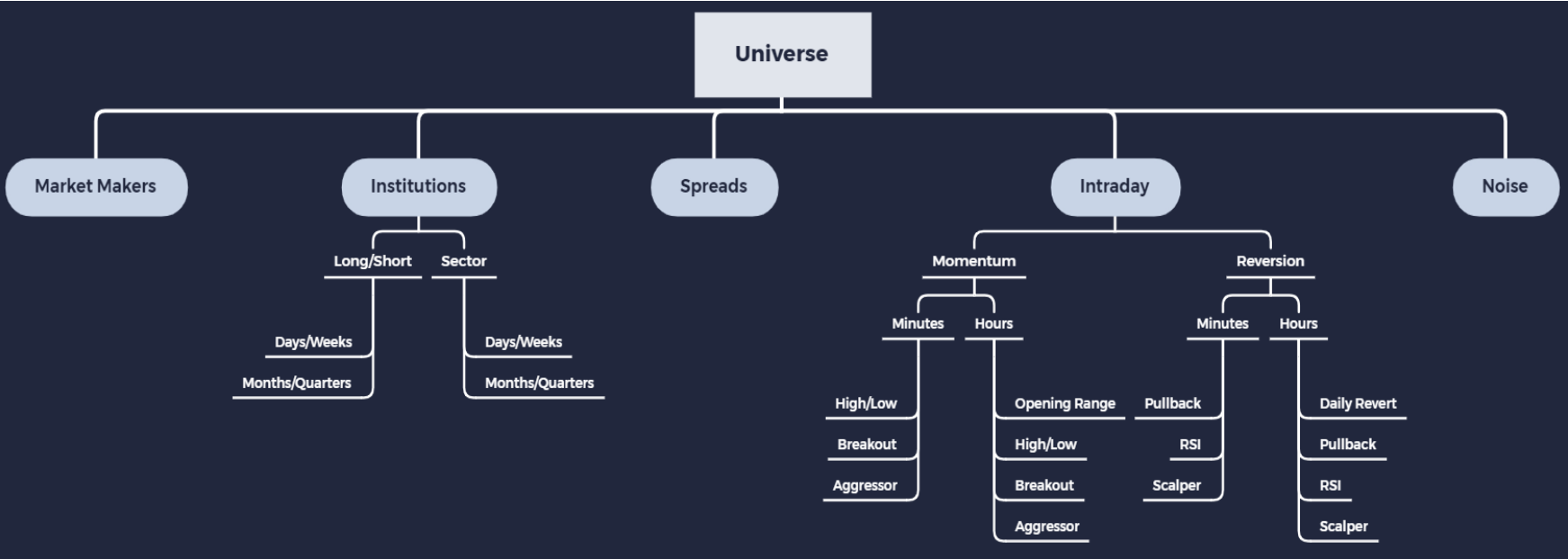
Agent-based  
modelling



## Overview: Agent↔Market Modeling Platform and Simulator



Universe





Only Random traders, institutional investors and momentum/mean-reversion

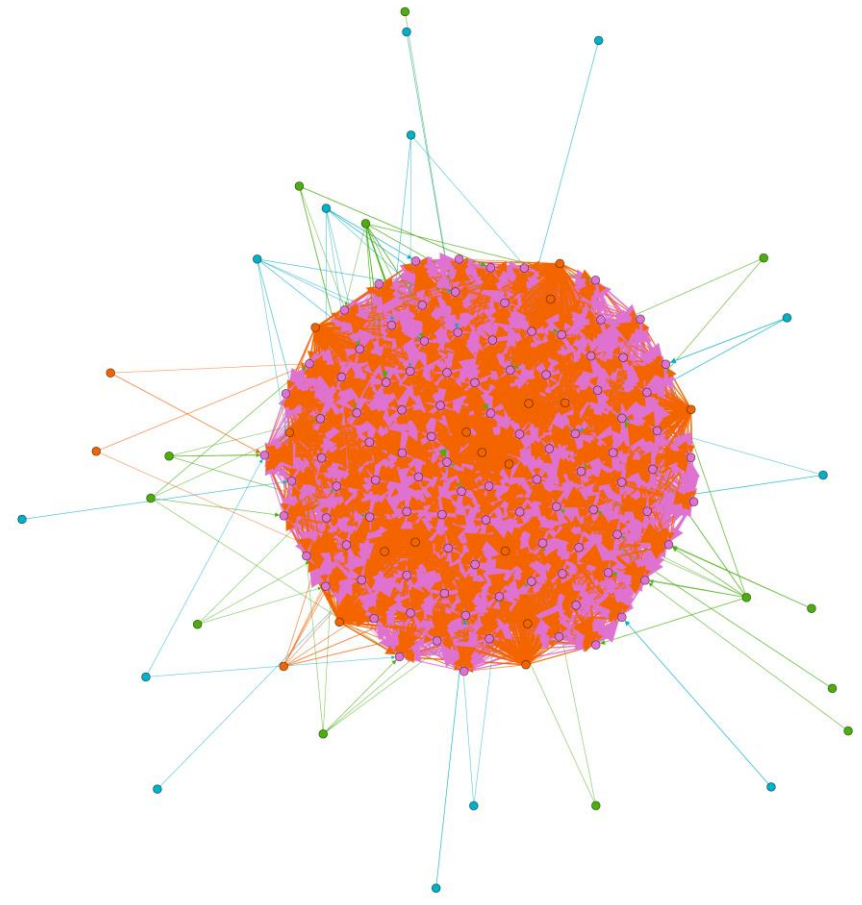
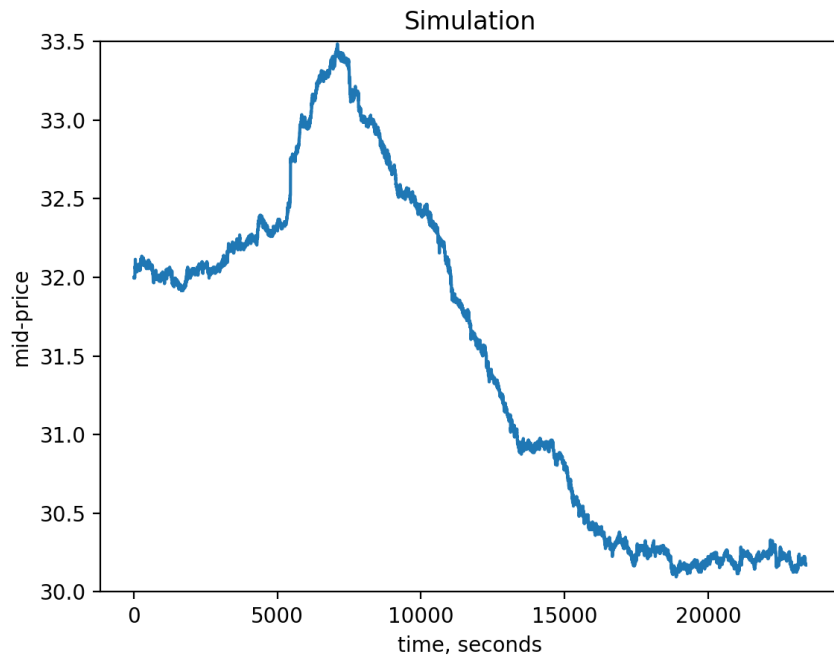
Random traders: 100

Institutional investors: 20

Momentum: 90

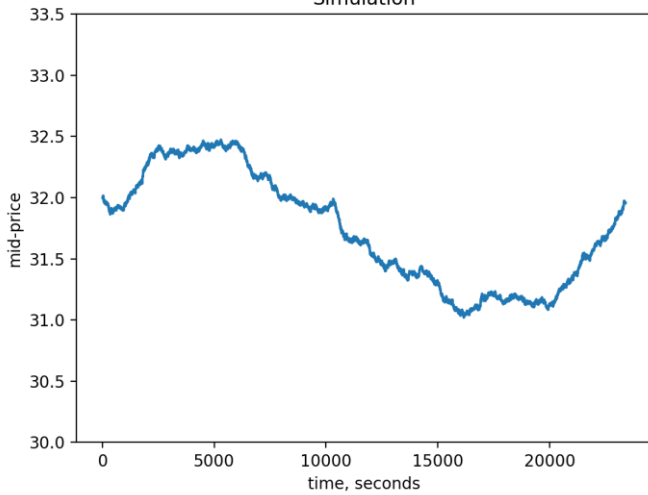
Mean-reverting: 90

Arrows indicate from whom agents take liquidity

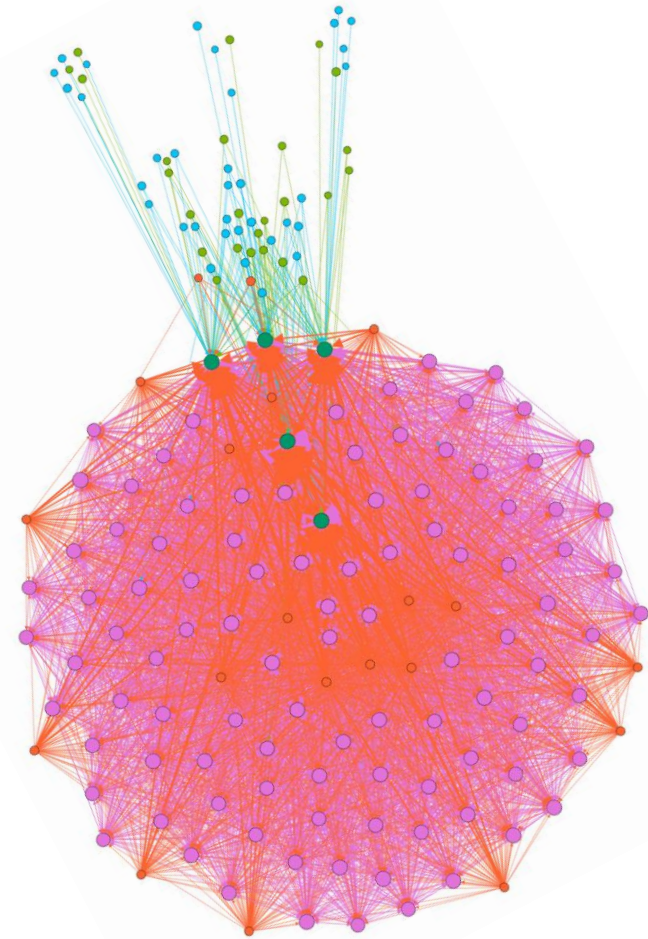
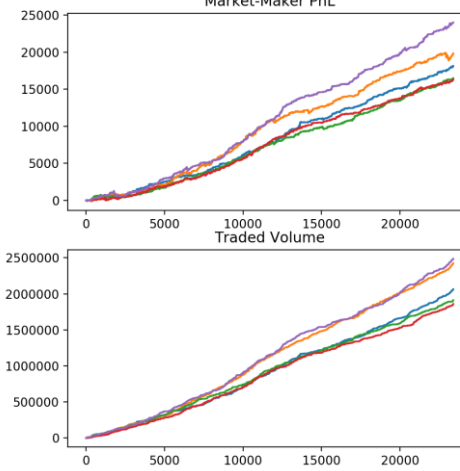


# 5 market makers with spread \$0.03

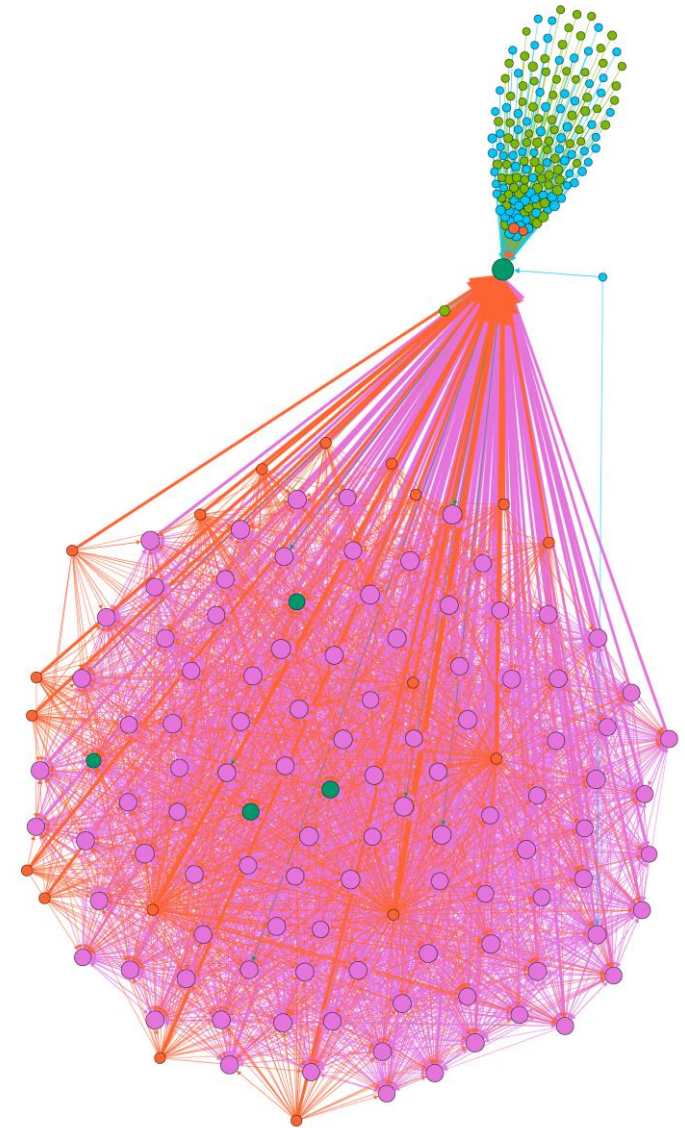
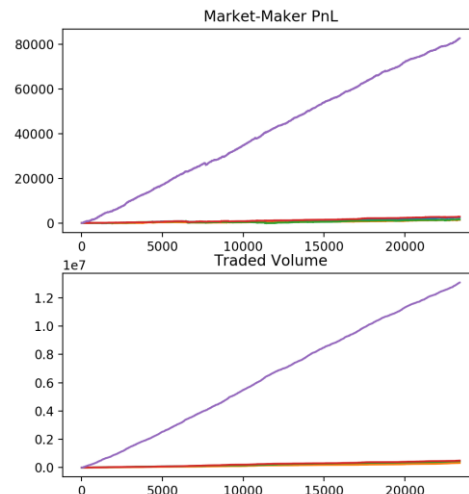
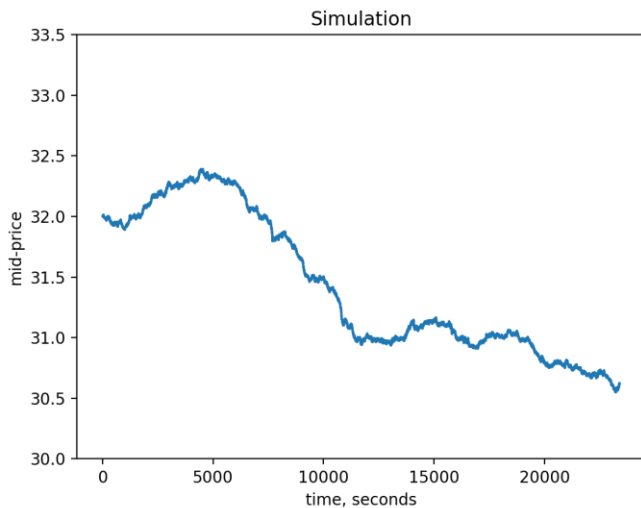
Simulation



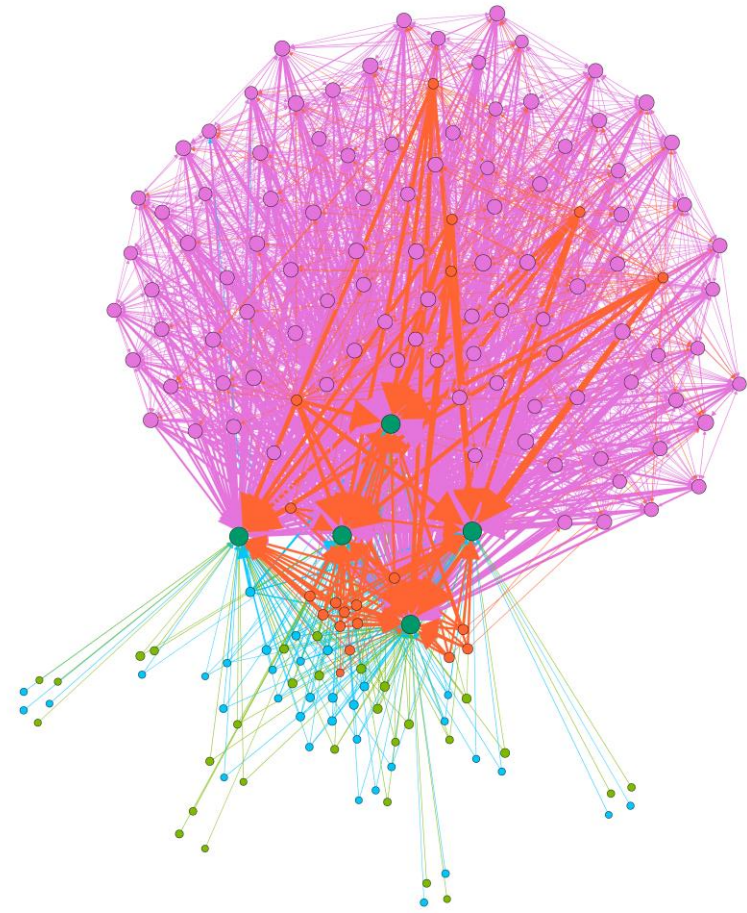
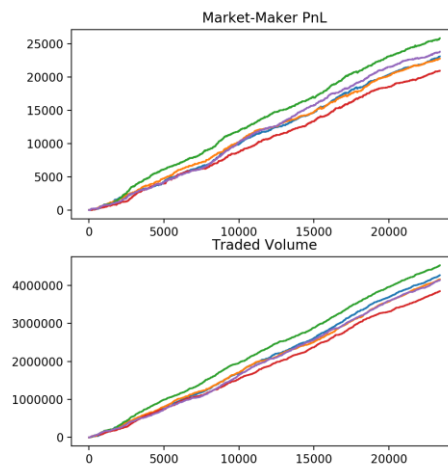
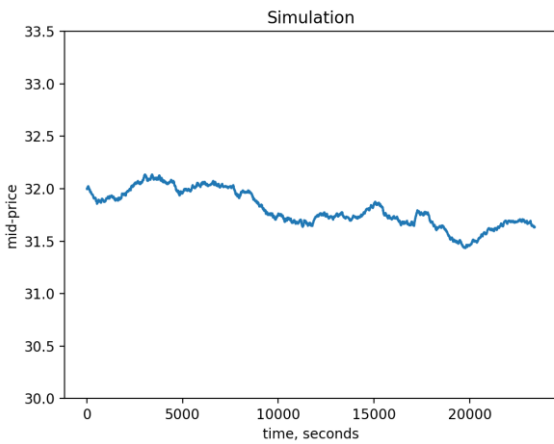
Market-Maker PnL



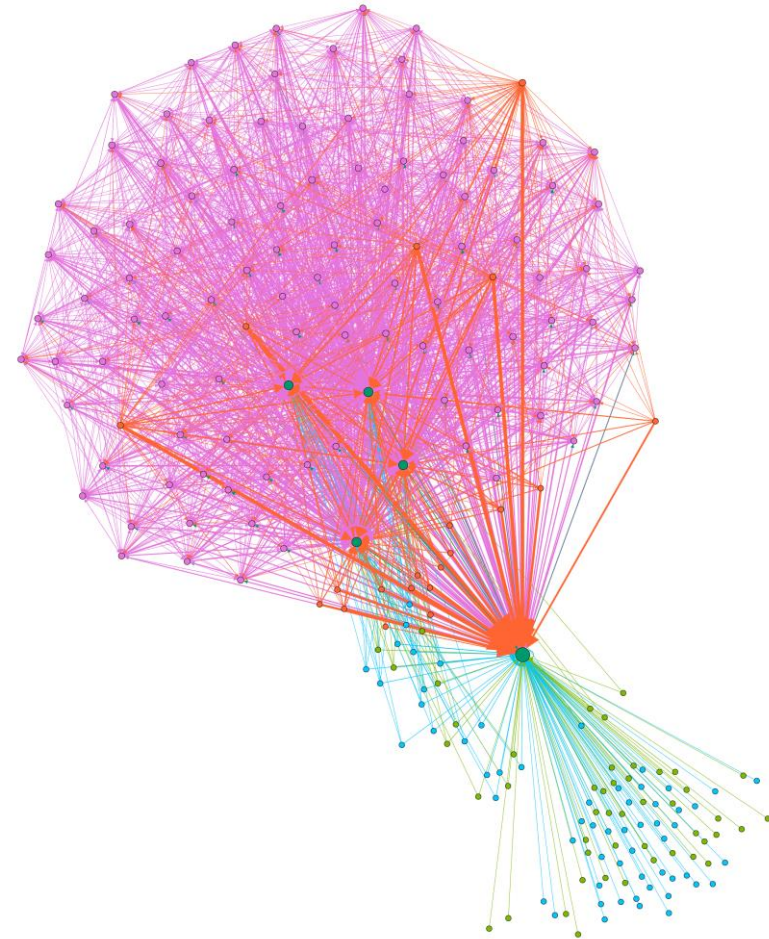
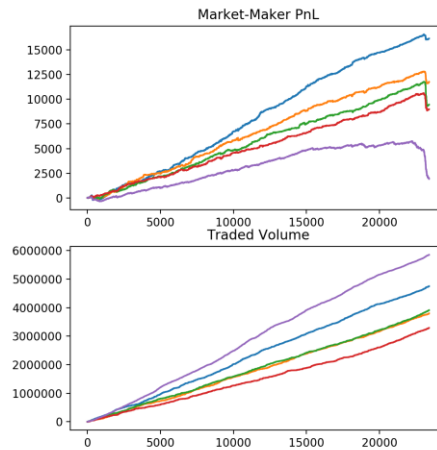
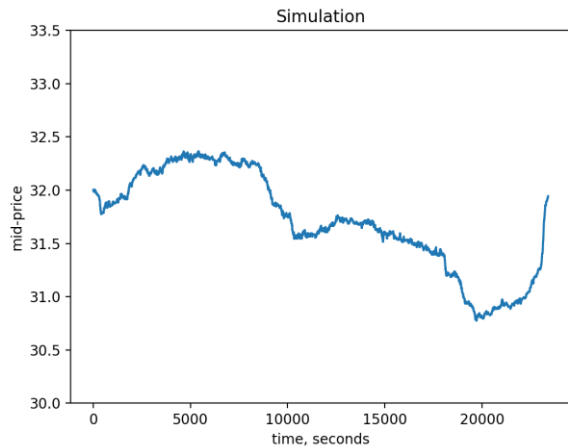
4 market makers with spread \$0.03  
1 market maker with spread \$0.02



# 5 market makers with spread \$0.02



4 market makers with spread \$0.02  
1 market maker with spread \$0.01

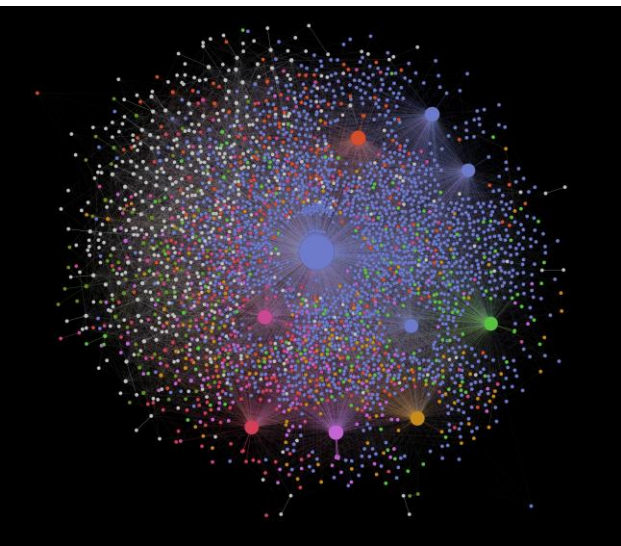


# Networks

## Case 1 (concentrated market):

On Average takes more than 5% liquidity from 5.4

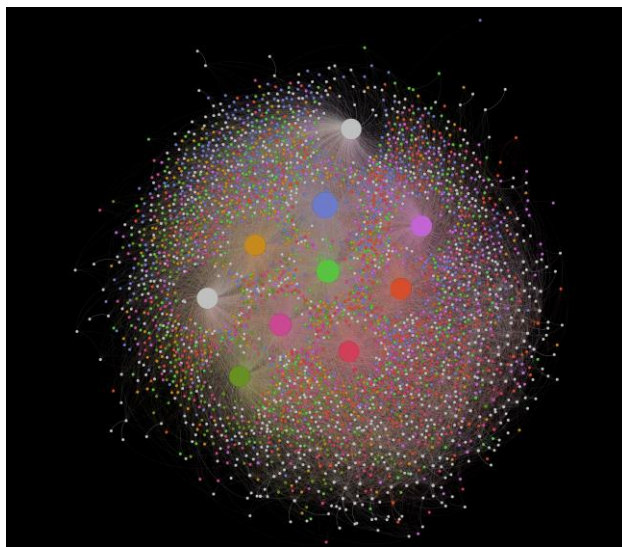
Largest community: 55%  
(followed by 7 in 3-4% range)



## Case 2 (dispersed market):

On Average takes more than 5% liquidity from 7.1

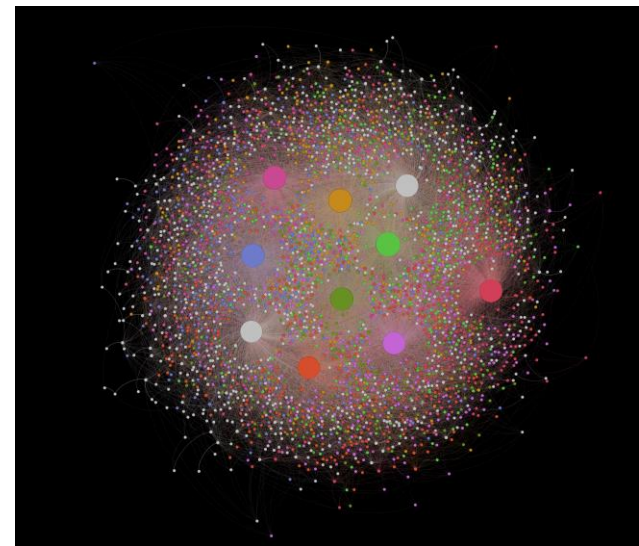
Largest community: 13%  
(followed by 9 in 8-10% range)



## Case 4 (dispersed market):

On Average takes more than 5% liquidity from 7.1

Largest community: 10%  
(followed by 9 in 8-10% range)



# Udfordringer

- Realisme er tidskrævende!
- Modellen er beregningskrævende
- Tror jeg på trods af det stadig på vores tilgang? Ja!

Tak for opmærksomheden!

<http://info.cbs.dk/algofinance>

<http://info.cbs.dk/borch>