Behavioural factors and market makers activity

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Overview

Problem

A market maker:

- assumes the risk of holding a certain number of a particular security in order to facilitate the trading of that security
- displays buy and sell quotations for a guaranteed number of a particular security

Questions:

How behavioural traits influence market makers decisions?

How behavioural traits influence influence chances of success in a competitive behaviour?

Literature

Information models

- emphasize the role of the informational asymmetry between market maker and the informed traders, Glosten and Milgrom (1985)

Inventory models

- relate the market makers behaviour to the current status of inventories
- objective of the market maker is to avoid bankruptcy, Garman (1976)
- objective is only maintaining an inventory balance, Stoll (1978)

Behavioural models

- the mean of prior information (optimistic/pessimistic bias)
- variance of the noise in their private signal (overconfidence / underconfidence bias). Germain L., F. Rousseau, A. Vanhems, (2014)

Participants

- 88 students (63 managed to finish the experiment)
- undergraduate students (mean age around 21)
- financial engineering course (credit points)
- 7 games (each game has maximum of 25 rounds) with increasing difficulty

Game

Game
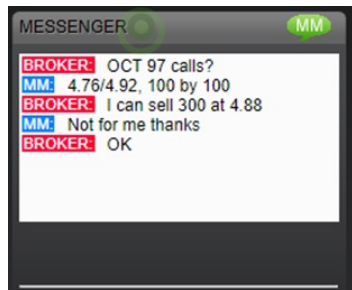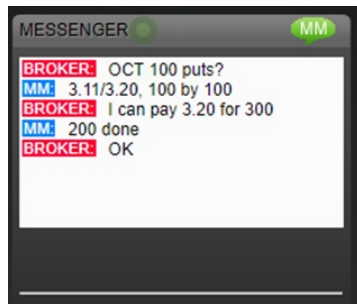
- **BROKER: APR 100 puts?**: broker asks for quotation of the European put option with a strike price 100 and maturity in April
- **MM: 3.14/3.16, 125 by 125**: market maker offers to buy 125 option contracts at a price 3.14 or to sell 125 option contracts at a price 3.16
- **BROKER: I can pay 3.16 for 300**: broker discloses her/his intention to buy 300 put option contracts at a price 3.16
- **MM: Sell the APR 125 puts at 3.16**: market maker sell 125 option contracts at a price 3.16

Behavioural traits

- BART (The Balloon Analogue Risk Task)
    - average pumps when collected — risk taking
- Jars
    - average number of beads — conservatism
- ultimatum game
    - average amount proposed — fairness
    - average amount when rejects — reaction to unfairness
    - amount earned — strategic thinking
- surveys
    - Objective numeracy skills (ONS)
    - Subjective numeracy skills (SNS)
    - UPPS: negative urgency, lack of premeditation, lack of perseverance, sensation seeking, and positive urgency

Behaviour

Quotes

1. spread — how wide is a spread
2. skewness — how asymmetric is the spread around value

Deals

1. acceptance — what is the probability of accepting worse trade conditions?
2. volume — what part of the additional volume will be accepted?

Econometric model

Spread - glmmTMB package: Generalized Linear Mixed Models using Template Model Builder.

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.415	0.909	0.457	0.648
max_risk	0.003	0.000	7.961	0.000
ONS	3.950	1.501	2.631	0.009
strategic_thinking	-2.544	0.730	-3.487	0.000
fairness	-2.274	1.265	-1.797	0.072
negative_urgency	5.135	1.216	4.222	0.000
positive_urgency	-2.487	0.813	-3.060	0.002

Machine learning CART model

Model
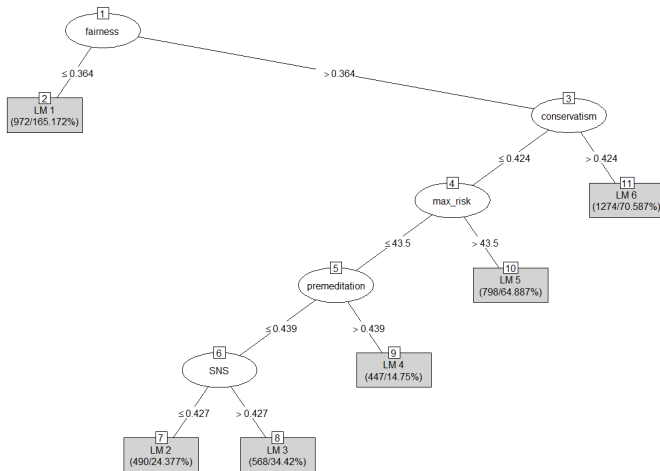
Agents

- N heterogeneous market makers
- 2000 brokers connected to n market makers
- 1000 simulation steps: brokers try to buy or sell option contracts

Simulation steps

- a broker collects offers from connected market makers and selects a best offer
- a broker and selected market maker deal together
- if a market maker exceeds a risk limit for k simulation steps, he leaves the market

Results

Chances of market maker survival (simulation step which market maker leaves the market at)

	Estimate	Std. Error	t value	Pr($>$|t|)
(Intercept)	934.1959	3.6351	256.99	0.0000
marketMakersMinimumSize	4.3385	0.1707	25.41	0.0000
objectiveNumeracySkills	298.7558	1.8832	158.64	0.0000
subjectiveNumeracySkills	7.0242	1.8880	3.72	0.0002
riskTaking	-112.2909	1.8781	-59.79	0.0000
strategic	18.1183	1.8939	9.57	0.0000
fairness	-36.3360	1.8902	-19.22	0.0000
negativeUrgency	-10.4585	1.8894	-5.54	0.0000
premeditation	-133.3661	1.8732	-71.20	0.0000
perseverence	12.1852	1.8859	6.46	0.0000
sensationSeeking	-70.5796	1.8947	-37.25	0.0000
positiveUrgency	-45.8056	1.8889	-24.25	0.0000

Results

Financial result per round (present on the market)

	Estimate	Std. Error	t value	Pr($>$|t|)
(Intercept)	29.1394	0.1509	193.07	0.0000
marketMakersMinimumSize	-0.8411	0.0076	-111.24	0.0000
maximumStepsRiskIncreased	-0.0469	0.0214	-2.19	0.0285
objectiveNumeracySkills	-25.8631	0.0834	-310.13	0.0000
riskTaking	-5.4074	0.0831	-65.05	0.0000
strategic	0.9129	0.0838	10.89	0.0000
fairness	18.7894	0.0837	224.57	0.0000
negativeUrgency	3.5667	0.0836	42.65	0.0000
premeditation	-8.6346	0.0829	-104.10	0.0000
sensationSeeking	-1.9446	0.0838	-23.21	0.0000
positiveUrgency	-1.3494	0.0836	-16.14	0.0000

Conclusions and further research

Conclusions

- in general behavioural traits decrease chances of market makers survival on the financial markets

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Further research

- other machine learning algorithms for marker makers
- benchmarking with professional market makers data

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Thank you