The challenge of decentralized marketplaces

Bas van IJzendoorn, 4024850

ABSTRACT

Categories and Subject Descriptors
1 [**A**]: B

; 2 [**C**]: D

Keywords
e-mails, demographic data, languages

1. INTRO
Commodities are traded on decentralized markets (Miao, J., 2005).

http://www.uniba.it/ricerca/dipartimenti/dse/seminari/seminari-2011/Schiraldi-al2011.pdf Rapson, D. (2011) Proof that transaction costs are less in decentralized markets and that

2. PROBLEM DESCRIPTION
Decentralized markets are hard to create. Buyers and sellers need to be matched to each other according to their preferences. A price should be negotiated and a trade deal should be made. The requirements vary among markets. Brunner, E. et al divides the economic requirements into four categories of parameters: basic, composed, complex and comments. Basic and composed parameters are simple values like price, volume and quantity. Composed parameters are more complex economic measurements that needs to be computed from more values like Return of Investment (ROI) and Price-earnings ratio. The last parameters are comments like quality or expert reviews. Policies on how these parameters should be created, altered and read needs to be specified for each market. Other research introduces the concept of contracts between peers called P2P contracts or smart contracts. These contracts allow to transfer user specified amounts against user specified conditions. For instance, ABN AMRO bank uses smart contracts in a case in which it only transfers money after a quality check has been done successfully (BRON). These conditions allow great flexibility in the economic parameters. Namely, all transactions conditions and requirements can be programmed as a smart contract. This allows to maintain money on the Internet without the need of an intermediate party (Fairfield, J., 2014). Brunner, E. *et al* also specifies time sensitive and historic information that should be made public to the user. Also privacy information of the public and private market and personal data of the user are considered parameters by Brunner, E. *et al.*

MEER info over preferences, tot nu toe alleen requirements.

3. SYSTEM MODEL AND ARCHITECTURE
There are a wide range of possibilities to architect the decentral market systems in which a lot of decisions have to be made. The most important problems are:

1) Trust and reputations In order to understand the problems with in computer markets the underlying economic mechanisms have to be studied. In particular the mechanisms that provide new problems when computerized. When actors go online to do business they don't necessarily have a social relation with the persons they are doing business with. The lack of social relations with other actors in the economies creates problems in communication and trust. Communication issues can be solved by providing well enough information about products, vendors, buyers etc. to actors in the markets. However, questions arise as to how much of the information should be made available to actors and to what extent should information be anonymous. For instance, a buyer in grain trading markets might be reluctant in sharing how much grain it wants to buy because this gives valuable information about the trading position of this actor. When other actors know the trading position of the buyer they can play economic games like only selling grain for a higher price to this buyer. What and how information should be presented to users depend on the structure and information demand in each market.

Trust among actors is another problem in computerized markets. In traditional economic theory of a perfect market their is no discussion for trust and the concept is kept outside the domain of economics. In the traditional market anonymous buyers and sellers come together to exchange standardized

goods. It is assumed that buyers and sellers try to maximise their welfare. Because of the transparent nature of the perfect market their are no opportunities to be dishonest and so there is a natural trust among buyers and sellers. In recent research the concept of trust has become a part of economic theory and is evaluated in a number of economic theories. A new consensus among economic theorists is growing among economic theorists that emphasises the importance of social relations among economic transactions. In transaction theory literature it is suggested that more trust between actors lowers the transaction costs. Broader social relations among actors lowers the costs of transactions between actors and at the same time minimizes risk from opportunistic behavior in the marketplace. The insight that trust can lower the costs of exchange has pushed the concept of trust in the economic debate.

There is also other research that describe relationships between economic activity and trust that suggest it is hard for computers to generate trust and determine trust of agents. Williamson (1993) distinguishes six types of trust contexts that are important for economic activity: societal trust, political trust, regulatory trust, professional trust, network trust and trust in the corporates themselves. Agents take all these contexts into consideration before making an economic decision. These contexts are largely outside of the digital world an play a large role inside the social world. Other researchers argue that agents who operate economically have a bounded rationality. The number of possibilities to take into consideration before an economic decision is made are simply to large for an agent to rationally process. Therefore not all rules of thumb that an agent follows for economic decision making can be described as a rational process of cost minimization. Because it is hard for an agent to make a calculative rational economic decision it is also hard to calculate whether another agent is trustworthy or not (Furlong, D., 1996). As computers are purely rational decision makers, determining trust is hard for a computer.

However, there are a large number of positive examples where computer systems are trusted for economic activity. In these computer systems are alternative trust mechanisms in place like reputation systems for agents, anonymization systems and brand usage. There are a lot of successful examples of trust build on the internet in business to consumer electronic commerce. For instance: Amazone.com, bol.com and alibaba.com (BRON). Analysis have been done to measure the trust in these online business to consumer marketplaces. The amount of trust plays a central role in the technology acceptance model proposed by Corbitt et al (2003). Trust is solved in the Silk Road and other anonymous markets with vendor repuation systems and anonymization (SILK ROAD PAPERS, MEER UITLEG, DARKNET). In P2P file sharing are reputation systems in place to prevent users from freeriding behavior where users only download and not upload. Each user has a reputation, which in fact is a trust metric to test whether a user will upload data or not. EXAMPLES VAN DERGELIJKE SYSTEMEN GEVEN. Trust is solved in Uber. Airbnb with professional photography (BRON GEVEN).

There are also designs for trust systems for decentralized markets live BEAVER (BRON EN UITGEBREIDERE OMSCHRIJVING), P2P file sharing systems and payment for anonymous routing (BRON EN OMSCHRIJVING GEVEN).

3.1 Trust in P2P filesharing

We will go into further detail of these systems. In P2P file sharing research there are a number of systems proposed with systems to prevent free riding. According to Moreton, T. (year) the major problem in P2P systems is the mutual distrust between peers. There are many pseudonyms or Sybil nodes that take up resources without providing resources to the network. These Sybils are run by agents which have a bad trust relationship with the other agents of the network. The behaviour of these agents is in P2P filesharing also denoted as freeriding. The problem was first described by Wilcox O'Hearn after his experiences with the deployment of the Mojo Nation file sharing system. O'Hearn describes as the biggest problem the distrust among nodes. The motivation between nodes to cooperate was not there. Nodes did not upload data to the network which made data availability a problem. There were even attacks on the network by which users altered their clients to gain more advantage for himself.

The main question in free-riding research in P2P file systems research is how to prevent nodes to free-ride and to architect a system that allows nodes to determine the trustworthiness of other nodes in the network. I will discuss some of the system proposals and their relation with decentralized markets. Vishnumurthy, V. (year) introduces a design of a P2P file sharing system that gives incentives to nodes to contribute resources to the global pool in the network. A currency is introduced in where a single value called KARMA represents the amount of resources a peer has contributed and consumed. This represents a users trustworthiness with regard to upload/download ration within the system. There are groups of k nodes called bank-sets that keep track of the KARMA of each user. There are mechanisms in place to make the KARMA system work. distributed hash tables (DHT's) that map nodes towards a bank set.

TRUST in electronic commerce (Ratnashingham, 1999).

SCREENSHOTS MAKEN VAN VERSCHILLENDE TYPEN MARKTEN.

https://www.ids.ac.uk/files/Wp35.pdf

https://pdfs.semanticscholar.org/d490/3a683c7b60a27a0c19c28d0a77
http://www.emeraldinsight.com/doi/pdfplus/10.1108/1066224981023
Trust in electronic commerce.

ONDERZOEK DOEN NAAR PROBLEMS IN ELECTRONIC MARKETS.

Importance of trust in electronic commerce: http://www.emeraldinsigl
Importance of perceived trust, security and privacy in online trading systems. https://www.researchgate.net/profile/Juan$_{G}arcia95$
$shoppinghttp : //download.springer.com/static/pdf/565/art$

http://dspace.unive.it/bitstream/handle/10579/7203/830275-1190055.pdf?sequence=2 2) Market structure Impact on market according to Bichler with broker services. However, time has proven that the market still requires the broker. Exam-

ple van Olsthorn et al, just buy out the bid prices.

In economic theory the market structures are elaborated around the research to "two-sided markets".

As markets can obtain a variety of characteristics it is important to notice that for each market a different market mechanism is required. To reason easier about markets the following concepts are described in the paper by Hatfield and Kominers for market mechanism design. 1) Stability: There is no blocking pair for a match. A blocking pair is a match with a higher utility function than the original match. e.a. the blocking pair match is a better match than the original match. Thus a stable match is the best match available. If a match is stable this implies a future match offer will never be better (Niederle, Yariv, 2008, Gale and Shapley, 1962). Gale and Shapley (1962) showed that any market has a stable matching and provided an algorithm that identifies one in the deferred acceptance algorithm. 2) Strategy-Proofness: When a matching mechanism is implemented there might be strategies that disrupt the market. For instance, a person might BETER OPZOEKEN in two sided matching literature (Niederle, Yariv, 2008). Roth and Sotomayer have an example of a market where agents have an incentive to misstate its preferences even tough the optimal match is chosen by the implemented mechanism. 3) Substitutability: The definition of substitutability is as follows. Lets assume two group of agents G and H that are matched. An agent $a \in G$ chooses $b \in H$ as its optimal match. If b is also chosen as the optimal match from $H' \cup w$ where subset $H' \subset H$ than the preferences of a are substitutable. When b is chosen from a set, it is also chosen from a smaller set. (Echenique, F, Oviedo, J., 2006). SO a CAN ALSO CHOOSE ANOTHER WORKER. http://people.hss.caltech.edu/ fede/published/echen-oviedo-TE.pdf STRONG SUBSTITUTABILITY OOK NOG ERBIJ DOEN. 4) The Law of Aggregate demand: (Condition) If the choice set of contracts for an agent increases, the agent chooses a bit more contracts.

A contract language is developed to describe the effects of varying contract language on stability and substitutability.

Verschillen tussen many-to-many and many to one markets.

CONCLUSIONS VERY USEFUL OF PAPER.

3) Matching engine The matching engine needs to be strategy proof. No obvious strategies to fool people should be in the market. (GIVE EXAMPLE OF POSSIBLE STRATEGIES). Olsthorn counterexampelen. TOR anonymity can be used as a tool to provide a better matching engine. A manual matching is also an option.

The markets are called matching markets. We have many-to-many markets. Meaning that they have substitutable contracts. Strategy Proofness in Harvard Paper.

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.359.3617rep=rep1type=pdf
Contract design and stability in markets (Harvard, Hatfield, 2011).

4) Price discovery mechanism Is fixed in matching engine. According to Bichler, M. dynamic pricing mechanisms can be implemented such that market prices match the market conditions and therefore creating an optimal outcome for both buyer and seller. In physical markets, the high transaction costs of auctions have made it impossible to implement these price mechanisms. With information technology it might be possible to implement auctions and change the way how the markets are operated. Ebay has already proven itself to be successful in online auctions. An example of an auction is where buyers send their bid prices to suppliers. The suppliers can then accept the bid prices as a contract. Electronic exchanges can focus on the buyer side or the seller side. The actor that has the least market power usually takes the initiative. There are also auction techniques on which over multiple attributes of the contract are negotiated to allow complex products (Bichler, 2001). In other markets there is also a need for dynamic pricing models. There is research done in multiple markets to find suitable price discovery mechanisms that suits each market. For instance, in the cloud computing market Anandasivam, A. and Prem, M. (2009) introduce a dynamic pricing model for price determination in the cloud computing market In cloud computing systems, sometimes the demand is high and sometimes the demand is low. The price is changed when the demand level changes. This price change is calculated in a mathematical model. Another example of the need for a dynamic pricing mechanism is in modern electric power grids. ELECTRONIC POWER GRID UITWERKEN.

Methods: Auction from Bichler, Auction from Lee,

Various possibilities on matching engine and price discovery mechanism

http://link.springer.com/article/10.1007/s12599-009-0071-2/fulltext.h
Current cloud computing solutions lack pricing mechanisms, but there are movements to bring this into the business world (Weinhardt, C.)

https://pdfs.semanticscholar.org/85e2/69c8b6a9d791424e16747a6d39
Auction as a dynamic price mechanism in e-commerce (Lee, J.)

https://books.google.nl/books?hl=nllr=id=-lhLmmSM–4Coi=fndpg=
Book on matching (Bichler, M.)
file:///C:/Users/Lenovo/Pictures/wilson-market-architecture.pdf
Economisch paper over markets (Wilson, R.) http://www.emeraldinsig
Importance of trust in economic commerce (Pauline Ratnasingham) http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.5
Commodity trading using an auction (Preist, C.). http://people.bu.edu
Search model centralized and decentralized trade (Miao, J.).

http://scholarlycommons.law.wlu.edu/wlulr-online/vol71/iss2/3/?utm
$scholarlycommons.law.wlu.eduSmartcontracts(Fairfield)$

http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4536461
Requirements and architecture decentralized information system (Brunner)
http://www.sciencedirect.com/science/article/pii/S002205318471074X
Equilibrium mechanisms in decentralized market (Peters, M.)

ToDo:

Solutions: SOA, Blockchain, microservices.

4) Sybil attack resilience

4. REFERENCES