

Embedded Trust: Theoretical and Empirical Sociological Approaches

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Overview

- Field of application
 - Trust in embedded settings
- Theoretical approaches
 - Rational choice theory
 - (Behavioral) game theory
 - Learning
- Empirical approaches
 - Laboratory experiments
 - Surveys
 - Vignette experiments
- Conclusion



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Trust in Words

- Placing trust means that a buyer (trustor) decides to hand over some resources at the disposal of a seller (trustee)
- If the seller handles these resources well and is trustworthy, they both profit compared to the no trust situation
- The seller cannot guarantee to act trustworthy and has an incentive to act untrustworthy
- The buyer has to decide first

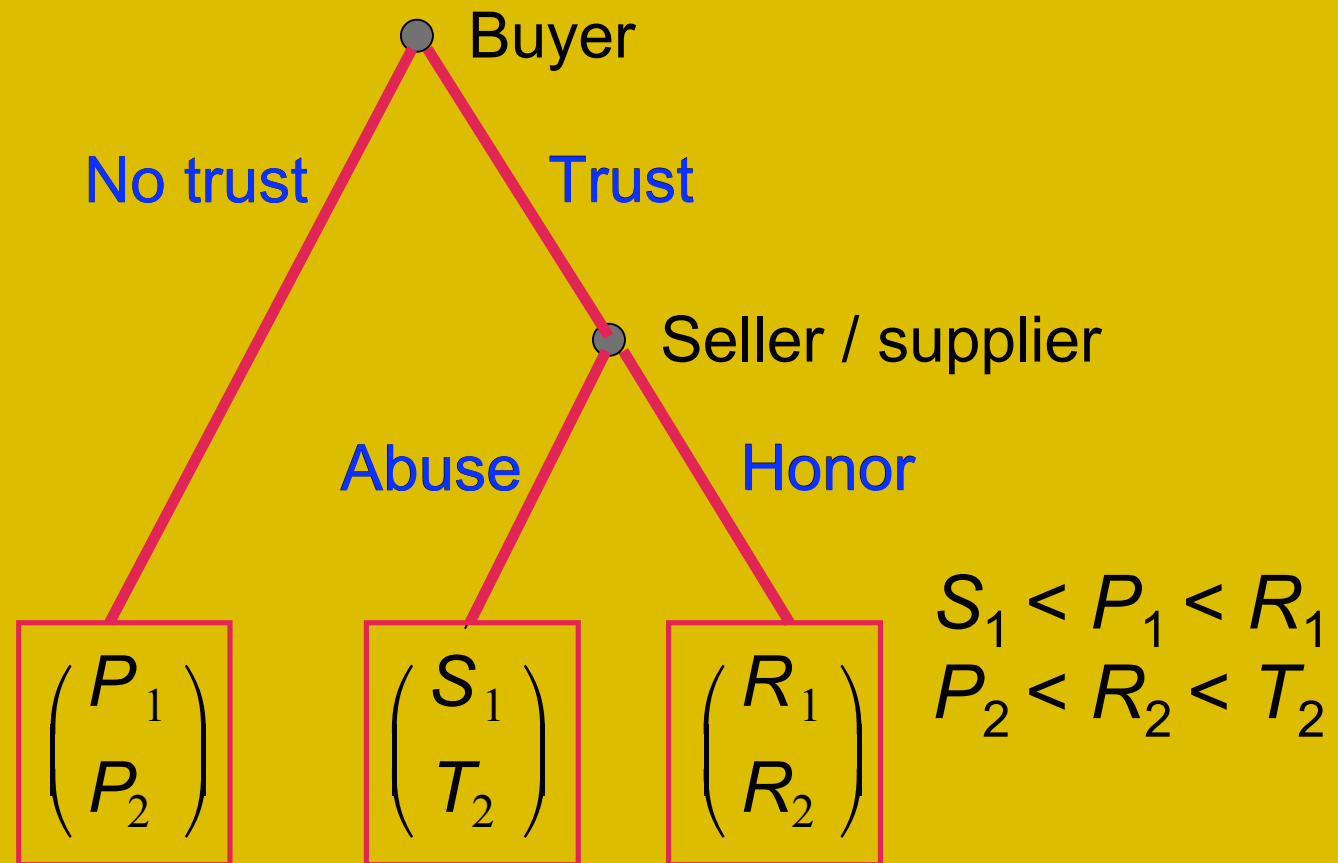


Trust by Example

- A buyer of a rare first edition offered at eBay has to decide whether to buy this edition from a seller and to send the money
- The seller (after receiving the money) has to decide whether or not to send this rare first edition to the buyer
- If the seller ships the first edition and this edition is in correspondence with the claimed specifications, both buyer and seller are happier after the deal than before the deal
- If the seller does not ship the book, he can try to sell it again, while the buyer lost the money



The Trust Game



Embedded Trust

- Many trust situations (and other social and economic interactions) do not occur in isolated encounters but are embedded in a larger context of interactions (Granovetter 1985)
- Actors deal with each other repeatedly
- Actors deal with partners of other actors
- Therefore, we need to extend the predictions for trust situations to embedded settings



Two Levels and Two Mechanisms

- Two levels of embeddedness
 - Dyadic embeddedness
 - Network embeddedness
- Two mechanisms
 - Learning
 - Buyers obtain information about past behavior of sellers
 - Control
 - Buyers can inform other buyers about past behavior of sellers and subsequent decisions can be based on this information



Summary Research Problem

- Distinguish between different embeddedness effects on trust
 - theoretically
 - empirically

	Dyadic Embeddedness	Network Embeddedness
Learning	Prior own experiences	Prior third-party experiences
Control	Own sanction opportunities	Sanction opportunities w.r.t. third parties

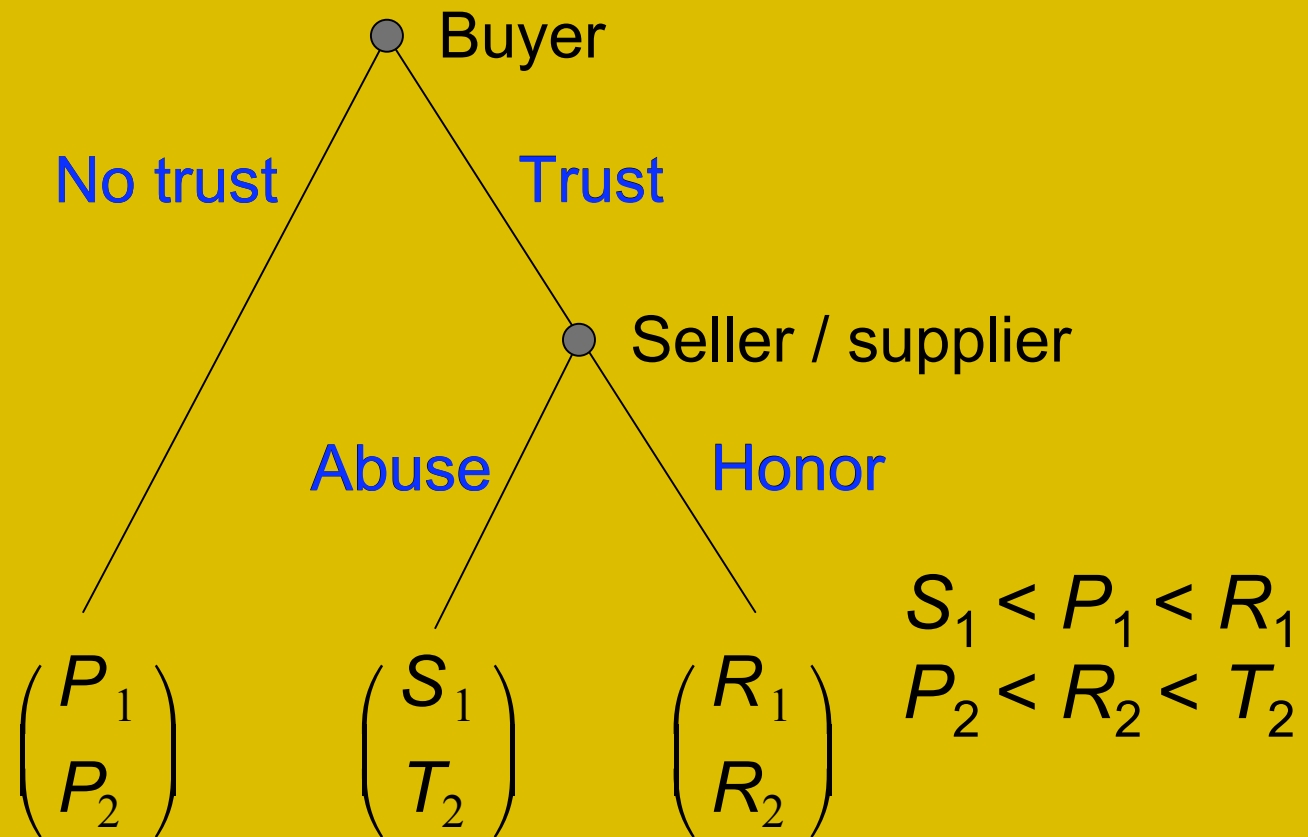


Existing Formal Theories

	Dyadic Embeddedness	Network Embeddedness
Learning	Adaptive learning models Information diffusion models	
Learning and control	Game-theoretic models with incomplete information (hardly in networks)	
Control	Repeated games with complete information	



Remember the Trust Game



Repeated Games

- Buyer and seller are involved in a series (rounds) of Trust Games
- After each round, the same Trust Game is played again with probability w
- If w is large enough, there are equilibria in which trust is possible, because a buyer can threaten the seller with not trusting anymore in the future. If the loss of this threat is larger than the short-term gain of abusing trust, the seller will honor trust.



Trigger Strategies

- Buyers trust as long as trust is honored, but never again after trust has been abused once. Sellers honor trust as long as trust has always been placed and never after trust is not placed once.
- It can be derived that these strategies are an equilibrium if and only if

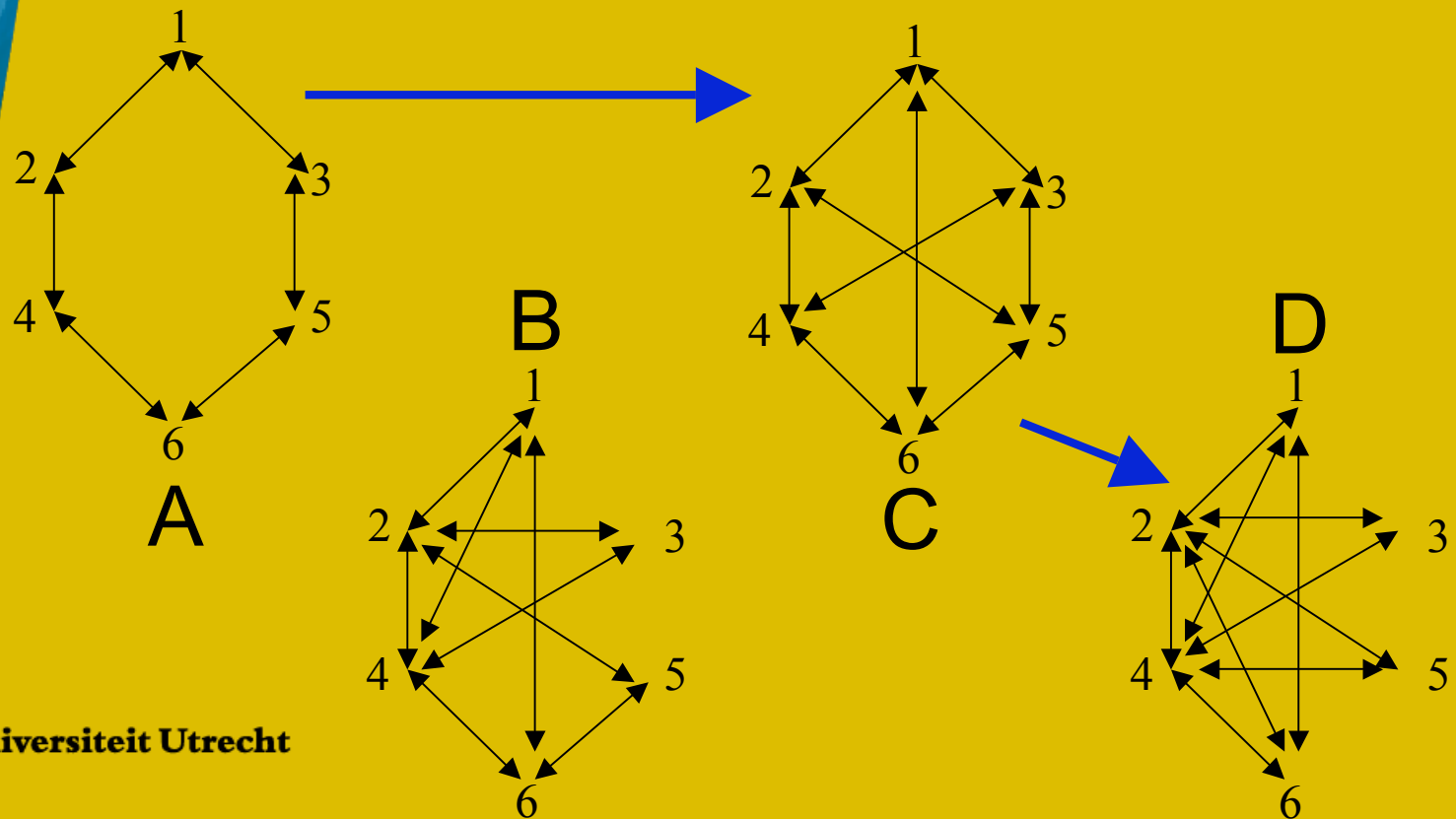
$$w \geq \frac{T_2 - R_2}{T_2 - P_2}$$

- Interpretation: the more restrictive this inequality, the less likely a buyer will trust
- Hypotheses:
 - the larger R_2 , the more likely the buyer trusts
 - the larger w , the more likely the buyer trusts



Repeated Games in Networks

- Networks of buyers play repeated Trust Games with the same seller
- Networks represent information exchange possibilities



Related Hypotheses

- Again using a model based on trigger strategies (buyers always trust as long as they have no information that the seller ever abused trust), we derive the following hypotheses
- The denser the network, the more buyers will trust
- The more relations a buyer has, the more this buyer will trust
- We focus here on hypotheses about placing trust, but similar hypotheses can be derived for honoring trust



Incomplete Information

- Imagine some sellers exist who never abuse trust
 - For one-shot games, there is quite some evidence that actors not only care about their own money, but also in some way about other people's money (e.g., fairness preferences)
- Different tools
 - Game-theoretic models with incomplete information using e.g., Bayesian updating
 - Learning models that use boundedly rational approaches to actors' decision making processes



New Hypotheses

- Trust increases if a buyer has less to lose in the Trust Game (e.g., S_1 is larger)
- Trust increases with positive own experiences and decreases with negative own experiences (*dyadic learning*)
- Trust increases with positive information from third parties and decreases with negative information from third parties (*network learning*)



Hypotheses Summary

	Dyadic Embeddedness	Network Embeddedness
Learning	Trust decreases with the buyer's risk and increases with positive experiences with a seller	Trust increase with the density of the buyer's network and the amount of positive information received through the network
Control	Trust decreases with the temptation to abuse trust and increases with the likelihood of future interactions	Trust increases with the density of the buyer's network and the number of relations of a buyer



Overview of Our Data

	Laboratory experiments	Survey of IT transactions	Vignette experiments
Dyadic learning	Yes	Yes	Yes
Dyadic control	Yes	Yes	Yes
Network learning	Yes	- Learning and control hard to disentangle	Yes
Network control	Yes		Yes



Laboratory Experiment

- Subjects (mostly students) play repeated Trust Games in the laboratory
- Interactions are with actual other participants in the laboratory
- Interactions are anonymous
- Complete game structure is provided in the instruction
- Points that can be earned in the games represent actual money for the subjects

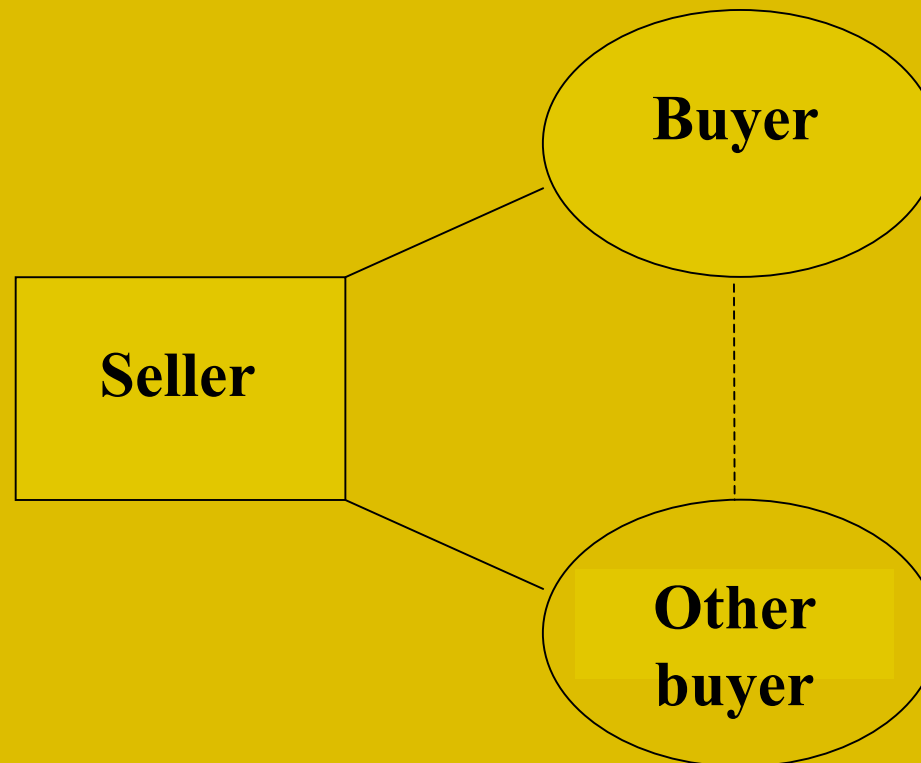


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Interaction Structure

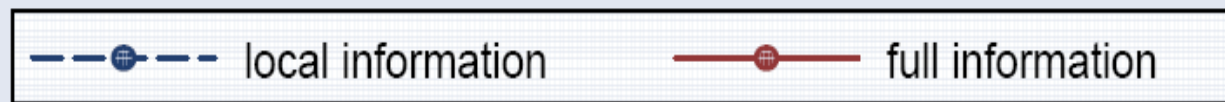
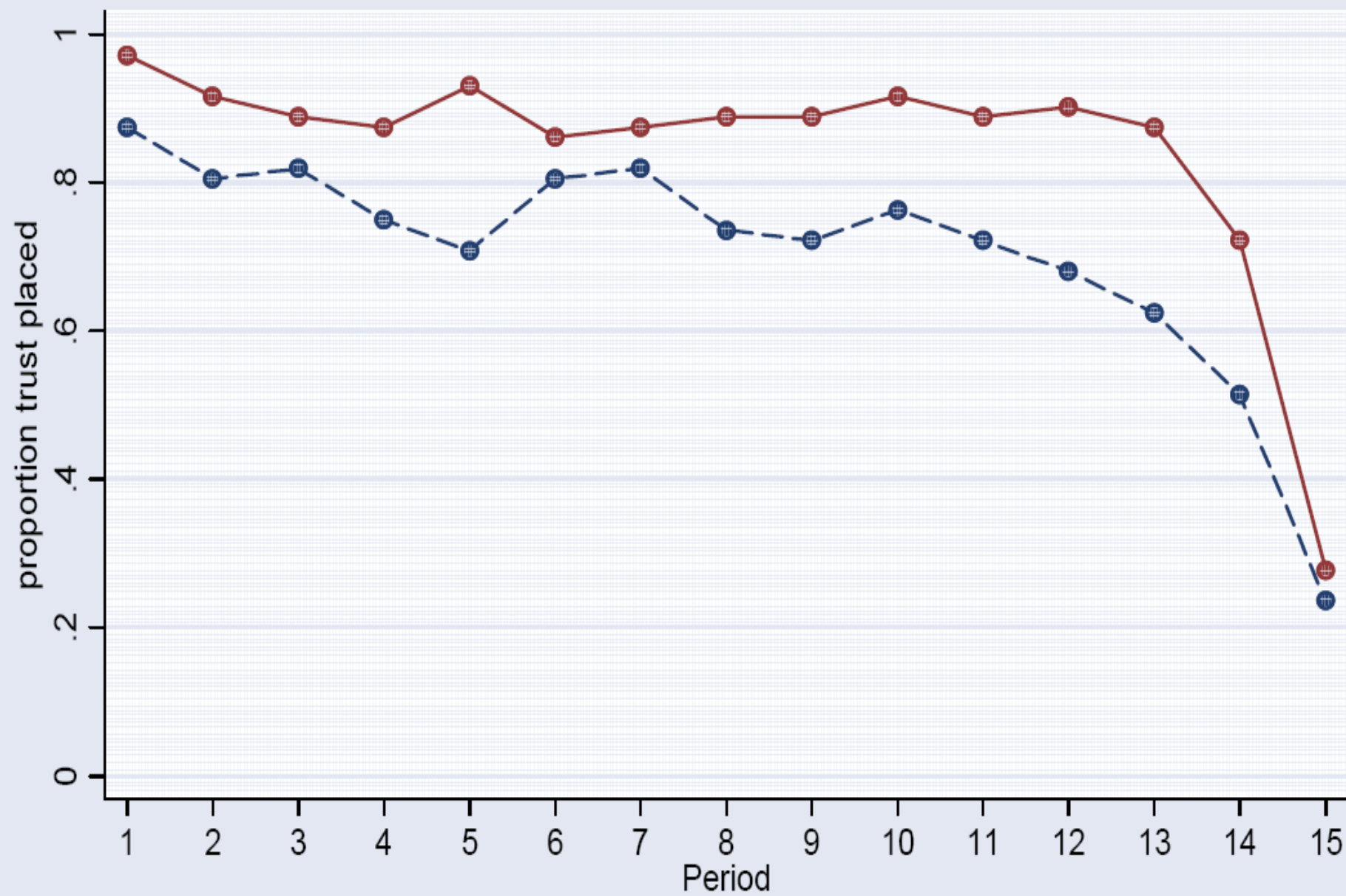
- Two buyers play with the same seller for 15 rounds
- Information about past might be distributed



Laboratory Experiment

- Six sessions with 6 times 18 = 148 subjects
- In total 2160 games played
- Two conditions
 - Local information: buyers only have information about their own interactions with the seller
 - Full information: buyers also have information about transactions of another buyer with the same seller





Random-Effects Logistic Regression

- Predict trusting behavior
 - Information condition
 - Own last experience
 - Other buyers last experience (if applicable)
 - Number of the round
 - Additional dummies for two last rounds
 - Interactions of last round dummies with information condition
- Random effects for clustering within sellers



Results Logistic Regression

- Effects of embeddedness variables on trust

Information condition	No net effect
Previous own: abuse	–
Previous own: honor	+
Previous other: abuse	–
Previous other: honor	+
Rounds to go	+
Round 14	–
Round 15	–
Information × round 14	0
Information × round 15	–



Evidence Experiment in Words

- Own experience (dyadic learning) is very important
- Third-party information (network learning) is also taken into account although effects are a bit smaller
- Number of rounds to go has a positive effect on trustfulness (dyadic control)
- Trust decreases dramatically in last round (dyadic control)
- Effects of number of rounds is hardly effect by the condition (no evidence for network control)
- Experimental condition does not have an effect on top of this explanatory model



Overview of Results Sofar

	Laboratory experiment	Survey	Vignette experiment
Dyadic learning	Confirmed		
Dyadic control	Confirmed		
Network learning	Confirmed		
Network control	No effect		



Survey of IT Transactions

- We obtain completed questionnaires from 788 buyers of IT products (SMEs)
- Some buyers complete the questionnaire for two transactions which resulted in 1252 transactions
- Data on
 - transaction management (search, contracting)
 - transaction characteristics (price, risks)
 - dyadic embeddedness (learning and control)
 - (network embeddedness)
 - characteristics of buyer and supplier



Trust and Embeddedness Variables

- “Lack of trust” measured by time and money spent for searching, negotiating, and contracting (ex ante management)
- Dyadic embeddedness variables
 - Information on prior transactions
 - Expectation for future transactions at the time of the focal transaction
- Network embeddedness variables
 - Information on other buyers of the same supplier and their relations
 - Geographic distance between buyer and supplier



Operationalizations

- Factor score for ex ante management
- Dummy for past transactions
 - Variation in amount of past / satisfaction did not matter
 - Hardly any negative evaluations of suppliers
- Five-point scale for future expectations
- Interaction between past and future
- Number of other buyers known of the same supplier
- Density of the network of other buyers
- Geographic distance
- We control also for other transaction characteristics



Interaction Past and Future

- Ex ante management is expected to be smaller for transactions with a longer future because of arguments given above
- However, ex ante management can also be expected to be larger if you think that you start a long-term relationship (rather than a one-time transaction)
- Therefore, especially in first transactions their will be also a positive effect of future transactions on ex ante investments, but in particular in later transactions, the negative effect of future should be visible



Results Linear Regression

- Effects of embeddedness variables on ex ante management

Past	—
Future	0
Future × past	—
Number other buyers	0
Density buyer network	0
Geographical distance	—



Evidence Survey in Words

- Own positive experiences (dyadic learning) induces trust
- Expected future transactions also induce more trust as can be seen from the effect of future in later transactions (dyadic control)
- Trust is not affected by the information we have about other buyers of the same supplier (these data seemed not that reliable) so we cannot conclude from this whether there is no effect or the data is not good enough to find an effect
- Trust is affected by geographical distance. Network embeddedness (learning or control) might be part of the mechanisms



Overview of Results Sofar

	Laboratory experiment	Survey	Vignette experiment
Dyadic learning	Confirmed	Confirmed	
Dyadic control	Confirmed	Confirmed	
Network learning	Confirmed	Serious measurement problems	
Network control	No effect		



Buying-a-Used-Car Vignettes

- 125 Dutch and US students
- 1249 comparisons of used-car dealers
- Data on
 - choice of a dealer
 - (transaction characteristics)
 - dyadic embeddedness (learning and control disentangled)
 - network embeddedness (learning and control disentangled)
 - characteristics of subjects



Trust and Embeddedness Variables

- Choice between two dealers
- Dyadic embeddedness variables
 - Past experiences (learning)
 - Expected future transactions: moving buyer (control)
- Network embeddedness variables
 - Density: dealer well-known garage
 - Positive information from other buyers (learning)
 - Close social tie with dealer (control)



A Pair of Vignettes

- You can buy a car for \$4000.
- You never bought a car from The Autoshop before.
- You will move to the other side of the country in a few weeks.
- The Autoshop is an unknown garage in your neighborhood.
- As far as you know, none of your friends have bought a car from The Autoshop before.
- You do not have a close social link with the owner of The Autoshop.

- You can buy a car for \$4000.
- You bought a car from The Autoshop before and you were satisfied.
- You do not expect to move out of town soon.
- The Autoshop is a well-known garage and has many customers in your neighborhood.
- You have friends who bought a car from The Autoshop before and they were satisfied.
- The owner of the garage and you are members of the same football team.



Statistical Model

- Random utility model.
- Probit model on choices for vignettes.
- Coefficients are interpretable as indicators for the increase in utility assigned to a vignette related to the given variables.
- Standard errors modified for clustering.



Results Vignette Experiment

	All	Chicago	Utrecht	Tilburg
Dyadic learning	1.09**	0.99**	1.11**	1.39**
Dyadic control	0.57**	0.61**	0.61**	0.30
Density	0.71**	0.67**	0.73**	0.73**
Network learning	0.83**	0.77**	0.89**	0.86**
Network control	0.26**	0.18	0.28*	0.51*
Number of pairs	1249	400	720	129

** and * represent two -sided significance at $p < 0.01$ and $p < 0.05$ respectively.



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Results Vignettes in Words

- Probability of dealer to be chosen increases with
 - positive past experiences (*dyadic learning*)
 - expected future transactions (*dyadic control*)
 - density (*network learning or control*)
 - positive third-party information (*network learning*)
 - the presence of a close social tie with the dealer (*network control*)



Overview of Results

	Laboratory experiment	Survey	Vignette experiment
Dyadic learning	Confirmed	Confirmed	Confirmed
Dyadic control	Confirmed	Confirmed	Confirmed
Network learning	Confirmed	Serious measurement problems	Confirmed
Network control	No effect		Confirmed



Discussion

- Hardly dependence of effects on uncertainty just as in the vignette experiment
- Is there a trade-off between complexity and rationality?
- What about “learning” to play the game?
- Are network effects stronger in interactions with strangers?



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