TRUST AND CO-OPERATION IN BUYER-SELLER RELATIONSHIPS AND NETWORKS.

THE CO-EVOLUTION OF STRUCTURAL BALANCE AND TRUST IN ITERATED PRISONER'S DILEMMA GAMES[1]

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ABSTRACT

Our study has two aims: (1) to elaborate theoretical frameworks and introduce social mechanisms of spontaneous co-operation in repeated buyer-seller relationships and (2) to formulate hypotheses which can be empirically tested. The basis of our chain of ideas is the simple two-person Prisoner's Dilemma game. On the one hand, its repeated variation can be applicable for the distinction of the analytical types of trust (iteration trust, strategy trust) in co-operations. On the other hand, it provides a chance to reveal those dyadic sympathy-antipathy relations, which make us understand the evolution of trust. Then we introduce the analysis of the more complicated (more than two-person) buyer-seller relationship. Firstly, we outline the possible role of the structural balancing mechanisms in forming trust in three-person buyer-seller relationships. Secondly, we put forward hypotheses to explain complex buyer-seller networks. In our research project we try to theoretically combine some of the simple concepts of game theory with certain ideas of the social-structural balance theory. Finally, it is followed by a short summary.

1 CO-OPERATION IN BUYER-SELLER RELATIONSHIP AS A TWO-PERSON ONE-SHOT PRISONER'S DILEMMA GAME

Let's take the following simple example. A buyer and a seller interact on the market. (Opp 1987). Let's start out from the standard postulates of the rational choice theory (Osborne 2004): suppose that the buyer and the seller (A_1 and A_2) are instrumentally rational (utility maximizer) and selfish, moreover, the game is played only once (and the players know it). Make the traditional assumptions complete with the analysis of sociomatrix: there is no social

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[1] The basic ideas of our paper were presented on two conferences: on the conference of the Hungarian social network analysts (SUNBELT) in 2005 and on the conference of *Values and Norms from a Multidisciplinary Aspect* organised by the Department of Sociology and Communication of the Budapest University of Technology and Economics in 2006. We highly appreciate and thank for the valuable suggestions of Lengyel György, Tardos Róbert and Vedres Balázs. Our study was financed by the *Collective Action, Social Control and Social Network Stability* Research Project of OTKA (T/16 046380). The project was supported by MKIK-GVI. We thank the participation of the research project for Janky Béla, Orbán Annamária and Takács Károly.

relation between them, so it is a null-dyad (see sociomatrix 1)[2]. In the simplified model situation the buyer and the seller can choose whether they co-operate (behave according to the rules) or defect (behave opportunistically). The payoff matrix 1 shows the possible outcomes of the simplified strategic interaction and the players' utilities and the order of their preferences.

Payoff matrix 1

A_1 \ A_2	C	D
C	2,2	0,3
D	3,0	1,1

Sociomatrix 1

	A_1	A_2
A_1	-	0
A_2	0	-

C: Co-operate (behave according to the rules)
D: Defect (behave opportunistically)

Preference order of A_1: DC>CC>DD>CD
Preference order of A_2: DC>CC>DD>CD

We can see that the buyer and the seller find themselves in the Prisoner's Dilemma situation. The natural outcome of the game is mutual defection, as both players' dominant strategy is to behave opportunistically. The solution is optimal from the point of the individual interest but suboptimal from the point of the common interest: though none of the participants can improve their own situation with a biased step, but the CC outcome of the game provides a better result for both players. In another way: the solution of the game is Nash-equilibrium and Pareto-suboptimum. Consequently, the buyer and the seller fell into such a social trap where significant strain arose between the individual and collective interests. Will the situation change if they are *continuously* interacting on the market?

2.1 CO-OPERATION IN BUYER-SELLER RELATIONSHIP AS A TWO-PERSON ITERATED PRISONER'S DILEMMA GAME: TRUST AND CO-OPERATION

Let's modify the first example. The buyer and the seller are continuously interacting on the market on the long run (Opp 1987). Henceforward the players play the game several times and do not know which game will be the last interaction (assumption of "infinite iteration"). In iterated Prisoner's Dilemma situations – known from scientific literature – it may be worth trying new strategies (Axelrod 1989). Suppose that from now on the players can choose between the *always defect* (AD) and the *Tit for tat* (TFT) strategies. TFT: in the first game the player co-operates (behave according to the rules), then in the rest of the games the player always does what his partner did in the previous game (if his partner behaved according to the rules, he behaves according to the rules too, if his partner behaved opportunistically, he does so). Let's introduce into the model the W probability parameter which refers to the players' subjective expectation while considering the iteration of the game. Its value can change

[2] The main diagonal of the sociomatrix is empty as we examine social relations and exclude reflexive relations.

between 0 and 1: if the players know that they will play the game only once (*model 1*), then W=0, but if they are completely sure of the iteration of the game, the value of the probability parameter is 1. (Simply, the value of W is the same for both players.) *Payoff matrix 2* provides information about the possible outcomes of the game and the players' payoffs under the above conditions (Miller 1994) .

Payoff matrix 2

		A_2	
		TFT	AD
A_1	TFT	$2/(1-W)$, $2/(1-W)$	$-1+1/(1-W)$, $2+1/(1-W)$
	AD	$2+1/(1-W)$, $-1+1/(1-W)$	$1/(1-W)$, $1/(1-W)$

As we can see, the players' payoffs will be 2-2 units in the first game if they both choose TFT strategy (*Payoff matrix 1).* Then in every turn of the game the payoffs will be the value of the original payoff weighted with W:

TFT/TFT

	1.turn	2.turn	3.turn	…
A_1.player	2 (C)	2W (C)	$2W^2$ (C)	…
A_2.player	2 (C)	2W (C)	$2W^2$ (C)	…

If we modify this infinite sequence – with the help of well-known mathematical operations - , then we get the payoff matrix value seen in the left hand cell on the top of *Payoff matrix 2:*

$$2+2W+2W^2+\ldots=2(W^0+W^1+W^2+\ldots) =2(1/(1-W))=2/(1-W)$$

In those cases when one of the players chooses AD, and the other chooses TFT strategy (see *Payoff matrix 2*) both of them will defect from the second turn of the game, and their payoff will be the one-shot game's 1-1 unit weighted with W in every turn. The player playing AD strategy gets 3 payoff units, while the other one playing TFT strategy gets 0 payoff unit in the first run:

TFT/AD

	1.turn	2.turn	3.turn	…
A_1.player	0 (C)	W (D)	W^2 (D)	…
A_2.player	3 (D)	W (D)	W^2 (D)	…

After the mathematical modifications of this infinite sequence, we get the following payoff values:

$$0+W+W^2+\ldots=-1+1+W+ W^2+\ldots=-1+1/(1-W)$$
$$3+W+W^2+\ldots= 2+1+W+ W^2+\ldots= 2+1/(1-W)$$

Finally, if AD strategy plays against AD strategy, the players get 1-1 payoff unit in the first run (*Payoff matrix 1*), then they get the value of the original payoff unit weighted with W:

AD/AD

	1.turn	2.turn	3.turn	…
A_1.player	1 (D)	W (D)	W^2 (D)	…
A_2.player	1 (D)	W (D)	W^2 (D)	…

Thus we can count the payoff values seen in the right hand cell at the bottom of *Payoff matrix 2:*

$1+W+W^2+\ldots=1/(1-W)$

The natural outcome of the game *(Payoff matrix 2)* depends primarily on the W value.[3] If W value is low, namely the players see very little chance of the iteration of the game, the natural outcome is mutual AD, as AD is the further dominant strategy for both players. In another way: if the players don't trust in the continuation of the interaction in a longer term, they will go slow. For example, if we substitute W=1/3 value into *Payoff matrix 2,* the result will be:

Payoff matrix 2.1

A_2

A_1		TFT	AD
	TFT	3,3	0.5,3.5
	AD	3.5,0.5	1.5,1.5

Payoff matrix 2.1 clearly shows that AD is the dominant strategy for both players and the natural outcome of the game is mutual AD. This solution further ensures the success of individual interest (Nash-equilibrium), but does not guarantee collective optimum (Pareto-suboptimum). In another way: if the players don't trust in the iteration of the game, they will remain the prisoners of the social trap. If W value is low, defection pays its way for the individual in the long term.
Let's have a look at the changes, if we substitute W=2/3 value into *Payoff matrix 2:*

Payoff matrix 2.2

A_2

A_1		TFT	AD
	TFT	6,6	2,5
	AD	5,2	3,3

[3] Of course it also depends on the utility values of the original payoff matrix. These values become particular values in particular analyses. In our example the given (abstract) value has a more technical rather than an essential significance.

Payoff matrix 2.2 shows - if the players see a high probability of the iterated interactions -, that the players have no dominant strategy at all. The game has two Nash-equilibria: mutual AD and mutual TFT. Both players' best reply is AD for AD strategy and TFT for TFT strategy. If A_1 expects A_2 to always defect, his best reply will be to defect as well. In reverse order: if A_2 expects A_1 to always defect, his best reply will be to defect as well. This solution is Pareto-suboptimum too. If A_1 expects A_2 to play TFT strategy, his best reply will be to choose TFT strategy. In reverse order: if A_2 expects A_1 to play TFT strategy, his best reply will be to choose TFT strategy. But this solution is already Pareto-optimum: it ensures the success of individual and collective optimum interests.

As we have seen above, if W value is high, AD is not the dominant strategy of the players in the two-person iterated Prisoner's Dilemma game. It means, if the players trust in the continuation of the interaction, and they contribute W a relatively high subjective probability value, then there is a chance of reaching the Pareto-optimum equilibrium. From now on this this kind of subjective expectation is called *iteration-trust*. In our experiment if *iteration-trust* is high, the outcome of the game depends on the players' mutual expectation.[4] The condition of the evolution of the spontaneous cooperation is that both persons must expect their partner to play TFT strategy. This mutual subjective expectation is called *strategy-trust* from now on. The low level of strategy-trust means that both players expect that his partner will play AD strategy, whereas its high value means that the partners mutually expect each other to play TFT strategy. Thus we may have reason to expect the evolution of spontaneous co-operation in iterated Prisoner's Dilemma games, if the level of *iteration-trust* and *strategy-trust* is high. Consequently, if the players both trust in the iteration of the interaction and the partner's TFT behaviour, then they have a chance of escaping from the social trap.

So we can go further and develop a hypothesis on the basis of the iterated Prisoner's Dilemma model.

Hypthesis1: If in two-person buyer-seller relationship as iterated Prisoner's Dilemma games the level of iteration-trust and strategy-trust is high, then – on the basis of the mechanisms of rational strategic choices and expectations – mutual co-operation will spontaneously evolve (which ensures the success of individual and collective interests at the same time).

The following questions can arise: When can we expect the formation of high level iteration-trust and high level strategy-trust? In another way: what kind of two-person (dyadic) mechanisms can contribute to the evolution and continuation of the high level iteration-trust and high level strategy-trust?

2.2 CO-OPERATION IN BUYER-SELLER RELATIONSHIP AS A TWO-PERSON ITERATED PRISONER'S DILEMMA GAME: BALANCED DYAD AND TRUST

[4] We don't consider how our recommended trust-concepts relate to the different trust-theories of different social sciences. Valuable information is available in the Hungarian scientific literature concerning the different trust concepts: Szabó, 2004.

The iteration of the two-person Prisoner's Dilemma provides the possibility of the formation of a certain social relation, between the buyer and the seller during the long run interaction on the market. There is a bigger probability, that during the continuous interaction - on the basis of social learning mechanisms – the players get acquainted with each other, gain mutual experiences about each other rather than they would further remain socially isolated. Thus the probability of creating either a positive (sympathy, friendship, intimacy) or a negative (antipathy, hostile or distrustful) relation between the buyer and the seller is much bigger, rather than no social relation would develop between them at all (Khanafiah-Situngkir 2004). We consider these relations directed-signed-graphs. The chance of the cessation of the interpersonal lack of relation (null-dyad), in the form of either sympathy (+) or antipathy (-), is bigger than the continuation of the lack of relation.

$$Pr\ (A_{12}=0 \rightarrow A_{12}=+) > Pr\ (A_{12}=0 \rightarrow A_{12}=0)$$
$$Pr\ (A_{12}=0 \rightarrow A_{12}=-) > Pr\ (A_{12}=0 \rightarrow A_{12}=0)$$
$$Pr\ (A_{21}=0 \rightarrow A_{21}=+) > Pr\ (A_{21}=0 \rightarrow A_{21}=0)$$
$$Pr\ (A_{21}=0 \rightarrow A_{12}=-) > Pr\ (A_{21}=0 \rightarrow A_{21}=0)$$

Let's assume in the model, that the probability of the formation of sympathy and antipathy relations is equal. On its basis four logically possible dyad-configurations can develop. The first two ones are unbalanced, and the last two ones are balanced configurations (Taylor 1967). If sympathy and antipathy are present at the same time in the dyad (*sociomatrix 2.1*), then this relation will not remain for long, whereas mutual sympathy and mutual antipathy (*sociomatrix 2.2*) can be regarded as stable relations.

*Sociomatrices 2.*1: unbalanced dyads

	A_1	A_2
A_1	-	–
A_2	+	-

	A_1	A_2
A_1	-	+
A_2	–	-

Sociomatrices 2.2: balanced dyads

	A_1	A_2
A_1	-	+
A_2	+	-

	A_1	A_2
A_1	-	–
A_2	–	-

In the players of the unbalanced and instable relations mental discomfort and psychical strain can arose. In order to reduce strain the players try to achieve balanced and stable relations: with the help of certain dissonance-reduction mechanisms they form their relations so as to develop mutual sympathy or mutual antipathy (Zajonc 1960, Taylor 1967, Hummon-Doreian 2003). Mutual sympathy can remain for a long time. Experiencing long term mutual antipathy is even better for the players – as they can handle strain somehow – than an unbalanced relation. (At the same time mutual antipathy can get even worse and finally the relation breaks up.)

Let's consider our example again: if the buyer and seller are continuously interacting on the market, they get acquainted with each other from time to time. It is very likely that mutual sympathy-antipathy relations will evolve between them. It is probable too, that these relations will become balanced in the form of mutual sympathy or mutual antipathy.

As we have seen above the iteration of buyer-seller relation will probably lead to the cessation of the original null-dyad situation. In another way: there is a big chance of the formation of relatively stable and balanced social relations between the players as a by-product of the iterated market interaction. Mutual sympathy positively and mutual antipathy negatively influences the evolution of high level iteration-trust and high level strategy-trust. Our next hypotheses are the following:

Hypthesis$_2$:
If the two-person buyer-seller relationship as Prisoner's Dilemma game is repeated, then – as a result of social learning and dissonance-reduction mechanisms – stable and balanced interpersonal relations (mutual sympathy, mutual antipathy) will evolve between the players.

Hypthesis$_3$:
If mutual sympathy evolves between the buyer and the seller, then high level iteration-trust and high level strategy-trust will be formed.

Hypthesis$_4$:
If mutual antipathy evolves between the buyer and the seller, then low level iteration-trust and low level strategy-trust will be formed.

Next, we try to answer the following questions: what kinds of social network mechanisms can contribute to the formation of social relations – which are the bases of trust - in three- and multi-person iterated buyer-seller relationships? When can we count with the evolution of the high level iterated-trust and high level strategy-trust - which are the bases of co-operation - if there are more than two players in the game?

3 CO-OPERATION IN BUYER-SELLER NETWORK AS A MULTI-PERSON ITERATED PRISONER'S DILEMMA GAME

Let's modify our example again. This time *many* buyers and sellers are continuously interacting on the market on the long run. The postulates of the game are unchanged: the players are instrumentally rational (utility maximizer) and selfish, and the game is supposed to be played "infinitly iterated". *Profit matrix 3* shows the possible outcomes of the quasi-N-person variation of the game.

Payoff matrix 3

Everybody else: $A_2 \ldots . A_n$

A_1

	TFT	AD
TFT	P	Q
AD	R	S

In harmony with the earlier results, in the multi-person games we also accept that AD will not be the dominant strategy of the players if the iteration- trust is high. Furthermore, if high level iteration-trust always comes with high level strategy-trust, then there is a chance of stabilizing the co-operation, namely, the players will mutually choose TFT strategy. In our multi-person model we also expect that the original lack of relation (sociomatrix 3.1) will be replaced by social networks consisting of positive or negative interpersonal relations (sociomatrix 3.2).

Sociomatrix 3.1

	A_1	A_2	…	A_n
A_1	-	0	…	0
A_2	0	-	…	0
…	…	…	…	…
A_n	0	0	…	-

Sociomatrix 3.2

	A_1	A_2	…	A_n
A_1	-	–	…	+
A_2	+	-	…	–
…	…	…	…	…
A_n	+	–	…	-

On the basis of our earlier two-person model the interpersonal relations move into the direction of balance, furthermore mutual sympathy positively influences the evolution of trust-forms which are fundamental for the co-operation. That is why we should examine at first the mechanisms of structural balance in the multi-person situations too. The matrices of multi-person groups also contain interpersonal sympathy-antipathy relations: the structural balancing characteristics of complex networks can be attributed to the balancing characteristics of dyads or triads. In another way: in social networks the microfoundations of global balancing mechanisms is constructed from two- and three-person balancing mechanisms (Khanafiah-Situngkhir 2004, Park 2004). After a while the unbalanced dyads become balanced dyads as we have seen earlier. That is why, from now on we consider the two-person relations as *undirected signed graphs* (+,–).[5] On the basis of all these, at first we analyse the three-person relations.

3. 1 CO-OPERATION IN BUYER-SELLER NETWORK AS A THREE-PERSON ITERATED PRISONER'S DILEMMA GAME: BALANCED TRIAD AND TRUST

During the repetition of the three-person iterated buyer-seller interaction – similarly to the two-person iterated Prisoner's Dilemma – the players get acquainted with each other, and it is very likely that mutual sympathy-antipathy relations will evolve between them. The same mechanisms operate as earlier: social learning and gaining experiences. In the three-person situations on the basis of the classical structural balancing theories (Heider 1946, 1958, Newcomb 1961, Cartwright–Harary 1956, Harary–Norman–Cartwright 2004) eight configurations can develop: four of them are unbalanced and unstable configurations, and four are balanced and stable configurations. Let's assume that the probability of their evolution is equal.

[5] In another way: we exclude the unbalanced relations in sociomatrix 2.1 and consider only the balanced relations in sociomatrix 2.2. These symmetrical relations we consider undirected signed graphs. In the sociomatrix it means that Aij has always the same sign as Aji.

Sociomatrices 3. 1. 1: unbalanced triads

	A_1	A_2	A_3
A_1	-	+	–
A_2	+	-	+
A_3	–	+	-

A) My friend’s friend is my enemy.

	A_1	A_2	A_3
A_1	-	+	+
A_2	+	-	–
A_3	+	–	-

B) My friend’s enemy is my friend.

	A_1	A_2	A_3
A_1	-	–	+
A_2	–	-	+
A_3	+	+	-

C) My enemy’s friend is my friend.

	A_1	A_2	A_3
A_1	-	–	–
A_2	–	-	–
A_3	–	–	-

D) My enemy’s enemy is my enemy.

Sociomatrices 3. 1. 2: balanced triads

	A_1	A_2	A_3
A_1	-	+	+
A_2	+	-	+
A_3	+	+	-

E) My friend’s friend is my friend.

	A_1	A_2	A_3
A_1	-	+	–
A_2	+	-	–
A_3	–	–	-

F) My friend’s enemy is my enemy.

	A_1	A_2	A_3
A_1	-	–	–
A_2	–	-	+
A_3	–	+	-

G) My enemy’s friend is my enemy.

	A_1	A_2	A_3
A_1	-	–	+
A_2	–	-	–
A_3	+	–	-

H) My enemy’s enemy is my friend.

In the unbalanced and unstable triads similarly to the two-person unbalanced situations, strain arises in the players. To reduce mental discomfort, here the players also try to achieve balanced and stable relations: with the help of certain dissonance-reduction mechanisms they try to form their relations so as to get into a balanced and stable triad (Zajonc 1960, Hummon-Doreian 2003). As a result, the evolution of an A type complex sympathy-triad ("sympathy-clique"), or a B), C), D) type one sympathy-two antipathy triad-configuration is probable to be evolved. The common characteristic of the latter types is, that the two players' common enemy is the third player ("common-enemy-triad"). It is likely that sympathy-clique positively influences the evolution of high level iteration-trust and high level strategy-trust on the level of the complete triad. In the case of common-enemy-triads we expect that a high level iteration-trust and a high level strategy-trust will evolve between the players, whereas towards the common enemy the level of strategy-trust is very low from both directions (at least the level of iterated trust is high because of the relatively stable situation).

Going back to our example, if three market agents (for example two buyers and one seller) are continuously interacting on the market, they will get acquainted with each other. It is probable that sympathy-antipathy relations will evolve between them and soon the relations will become balanced. If sympathy-clique is formed, then the three players are expected to choose TFT strategy and they will behave according to the rules, whereas in the common-enemy-triad the two friends will behave according to the rules and their common enemy will behave opportunistically. (Of course the long term continuation of the latter status can be doubtful, because the situation may get worse.)
Concerning the three-person buyer-seller situations our new hypotheses are the following.

Hypothesis$_5$: If the three-person buyer-seller relationship as Prisoner's Dilemma game is iterated, then – as a result of social learning and dissonance-reduction mechanisms – stable and balanced interpersonal relation-configurations (sympathy-clique, common-enemy-triads) will evolve among the market players.
Hypothesis $_6$: If sympathy-clique is formed among the market players, then high level iteration- trust and high level strategy-trust will evolve.
Hypothesis $_7$: If common-enemy-triad is formed among the market players, then high level iteration- trust and high level strategy-trust will evolve among the friends, whereas low level strategy trust will evolve among the friends and the common enemy.

Finally, let's examine how structural balance and trust are formed in the more than three-person buyer-seller relations, and how they influence the chances of the evolution of co-operation on the market.

3. 2 CO-OPERATION IN BUYER-SELLER NETWORKS AS A MULTI-PERSON ITERATED PRISONER'S DILEMMA GAME: BALANCING SOCIAL NETWORK AND CO-OPERATION POTENTIAL

In our last model we wonder how three-person structural balancing mechanisms contribute to the balance of complex buyer-seller networks, and what kind of trustful relations and co-operational forms can be evolved on the level of complex market networks. On the basis of the fundamental hypothesis of structural balance (Doreian 2004: 282), sympathy-antipathy networks will alter towards structural balance: the degree of balance will increase. This fundamental hypothesis – in spite of the fact that some latest empirical researches have (at least partially) confirmed – is regarded too general by the scientific literature (Szántó 2006:

132). It is worth dividing it into partial hypotheses: for example, we examine separately the decrease of the degree of different type unbalanced triads, or we examine separately the increase of different type balanced triads. These fine analyses can give a better result of the operational dynamism of mechanisms on complex network level. In our approach it is worth separately developing our hypotheses, which concern the degree of the increase of sympathy-clique, or common-enemy-triads. But at first, let's see how we can measure the level of the multi-person networks' structural balance.

Khanafiah és Situngkir (2004) suggest two indexes for explaining the balance of multi-person sympathy-antipathy networks. The global balance index relates the number of all balanced triads to the number of all possible triads, whereas the local balance index relates the number of all the balanced triads to the number of all existing triads in the given network. In our approach it is expedient to use the local balance index, because for us, primarily the actually forming triads are important. Moreover, to develop a proper hypothesis, it is practical to define local balance index as sympathy-clique and common-enemy-triads. In the first case we relate the number of sympathy-clique, and in the second case we relate the number of common-enemy-triads to the number of all existing triads.

Our hypotheses concerning the multi-person situations are the following.

Hipothesis$_8$: If the multi-person buyer-seller relationship as Prisoner's Dilemma game is iterated, then – as a result of social learning and dyadic/triadic balance mechanisms – the balance of complex market networks increases: the proportion of sympathy-clique and/or common-enemy-triads will increase in all the triads.
Hipothesis $_9$: If the proportion of sympathy-clique increases, then the proportion of the players choosing TFT strategy will increase in the complex market networks (the co-operational potential of the complex market networks will improve).
Hipothesis $_{10}$: If the proportion of common-enemy-triads increases, then the proportion of the players choosing TFT and AD strategy will increase *at the same time:* the proportion of players choosing TFT increases in a rapid pace, whereas the proportion of AD strategy increases in a slow pace (the co-operational potential of the complex market networks will partially improve).

SUMMARY

In our study we introduced models and formulated hypotheses (which can be empirically tested) about the possible relations of trust and co-operation in different kind of buyer-seller relationships. We defined trust-forms which are the conditions of the evolution of spontaneous co-operation in iterated buyer-seller interactions as Prisoner's Dilemma situations. In our hypothesis we state, that the high level iterated-trust is necessary (but not sufficient) condition for the evolution of co-operation and it can contribute to the formation of co-operation only together with high level strategy-trust. Then we outlined those two- and three-person social balancing mechanisms which contribute to the evolution of trust on the one hand, and comprise the basis of structural balancing dynamism in the sympathy-antipathy network on the other hand. Our expectation is that mutual sympathy- and sympathy-clique (and partially the common-enemy- triad) contribute to the evolution of trust-forms which provide the bases of co-operation in multi-person market situations.

References

Axelrod, R. 1984. *The Evolution of Cooperation*. New York: Basic Books.

Cartwright, D.C. – F. Harary 1956. Structural Balance: A Generalization of Heider's Theory. *Psychological Review* 63: 277-292.

Doreian, P. 2004. Evolution of Human Signed Networks. *Metodološki Zvezki* 1: 277-293.

Hummon, N. P. – Doreian, P. 2003. Dynamics of Social Balance Processes. *Social Networks* 25: 17-49.

Harary, F. – R.Z. Norman – D.C. Cartwright 1965. *Structural Models: An Introduction to the Theory of Directed Graphs*. New York: Wiley.

Heider, F. 1946. Attitudes and Cognitive Organization. *Journal of Psychology* 45: 107-112.

Heider, F. 1958. *The Psychology of Interpersonal Relations*. New York: Wiley.

Khanafiah, D. – H. Situngkir 2004. Social Balance Theory. Revisiting Heider's Balance Theory for Many Agents. *http://www.cogprints.org*

Miller, G. 1993. *Managerial Dilemmas. The Political Economy of Hierarchy*. Cambridge: CUP, 1993.

Newcomb, T.M. 1961. *The Acquaintance Process*. New York: Holt, Rinehart and Winston.

Opp, K.D. Markstrukturen, Soziale Strukturen und Kooperation im Markt. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 28: 280-299.

Osborne, M. J. 2004. *An Introduction to Game Theory*. Oxford: Oxford University Press.

Park, H.S. 2004. Multi-Agent Models of Generative Structural Balance Processes. *http://www.casos.cs.cmu.edu*

Szabó K. 2004. Az ezerarcú bizalom: a bizalom formáinak fejezetei. (Multiface Trust: Chapters on the Forms of Trust.) *Szociológiai Szemle* 2004/3: 128-144.

Szántó Z. 2006. Egy kettős évforduló kapcsán: a strukturális kiegyensúlyozottság elméletének újrafelfedszése. (A Double Anniversary: Rediscovering of Structural Balance Theory) *Szociológiai Szemle* 2006/3: 126-135.

Taylor, H.F. 1967. Balance and Change in the Two Person Group. *Sociometry* 30: 262-279.

Zajonc, R. B. 1960. The Concept of Balance, Congruity and Dissonance. *Public Opinion Quarterly* 24(2): 280-296.