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DISKUSSIONSBEITRÄGE

Friedrich L. Sell

More about economic and non-economic determinants of (mutual) trust and trustworthiness

19. Jg. (2007), Nr. 2

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by

Friedrich L. Sell [#]

[#] Institut für Volkswirtschaftslehre, insbesondere Makroökonomik und Wirtschaftspolitik, Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, 85577 Neubiberg, E-Mail: friedrich.sell@unibw.de.

Abstract

The aim of this paper is threefold: we first discuss the appropriateness of the traditional trust-game-tree for the analysis of trust relationships. Following the definition put forward by Lee et al. (2005) that "confident expectations and a willingness to be vulnerable are critical components of all definitions of trust", we relate these criteria to the subjective probabilities given by Coleman's inequality. Then, we develop the "trust-tree-game" further to a psychological trust game in the vein of Dufwenberg (2002). Here, we complement the concept of "trust responsiveness" with the idea of "honouring trust responsiveness" which enables us to consider the issue of mutuality in trust relationships. In a second step, we move on to the concept of mutual trust (which is more than some degree of mutuality in a trust relationship), where each individual can be both trustor and trustee. This aspect is visualized within the two-person optimal intertemporal consumption choice model. The corresponding "creditor-debtor-game" reproduces the well known "prisoner's dilemma". In a third step we analyse in depth how the intertemporal elasticity of substitution is related to trust and trustworthiness in (inter)national credit contracts. The fact that we observe multiple creditor-debtor-relationships in an economy seems to reflect not only the gains from cooperation in repeated games, but also the existence of "generalized" trust in the society.

JEL Classification: D23, D69, K12,

Key words: Trust, Psychological Game Theory, Intertemporal Consumption

I. Introduction

Following Dufwenberg (who quotes Rotter) trust is an "expectancy held by an individual that the word, promise, oral or written statement of another individual or group can be relied on." (ibid., 2002, p. 62). As Lee et al. (2005) add, "confident expectations and a willingness to be vulnerable are critical components of all definitions of trust" (ibid., p. 609). The vulnerability stems in the first place from the fact that a trustor offers some sort of goods/services to the trustee and can expect – if at all – an "equivalent" from the trustee only after some time delay (Haug 1997, p. 16). While the first component explains why a trustor is prepared to take the first step or action towards the trustee, the second gives a hint as to why he is willing to afford a, so to say, "first-mover-disadvantage". And, what is most crucial: the trustor accepts this "first-mover-disadvantage" not in addition to his confidence, but *because* he is confident, or, in other words, because he *expects reciprocity* (Bolle 2007, p. 2). Accepting a disadvantage from the beginning should be taken as a rational decision, perhaps even "super-rational" among rational agents, and not as the outcome of some sort of "bounded rationality". Hence, there is no reason to believe that confidence, which motivates this acceptance, is irrational. Quite the opposite is true. "Trust responsiveness" can tell us why.

The concept of "trust responsiveness" has (at least) two virtues: in a way it introduces in a rational way "emotions" and "norms" into the sober concept of the "trust game", more precisely it claims that trustworthiness-related emotions and acquired norms of the trustee have a significant impact on his actions. Notice that the trustor, when anticipating the existence of these emotions/norms among the trustee, is not irrational at all. The clue of "trust responsiveness" lies in the fact that it tends to reduce the implicit, so to say, "second-mover-advantage" of the trustee. A precondition for the functioning of this mechanism is, as is well known (Sell/Wiens 2006) that the trustee has to recognize or likewise realize the confidence which the trustor invests in the action towards the trustee and in the trustee himself. But the trustor, then, will in many cases notice in a face-to-face situation whether and, if, how much "trust responsiveness" is felt by the trustee from his observable reaction, unless the trustee is a good actor[1], i. e. a liar. As a result, we have here an individual-specific signalling in the trust process yet from the beginning.

When there is no face-to-face situation, there are widespread (either formal or informal) social norms which sanction an attitude in the case that someone does not honour trust put in him by somebody else: "If A does something for B and trusts B to reciprocate in the future, this establishes an expectation in A and an obligation on the part of B. This obligation can be conceived as a *credit slip* held by A for performance by B." (Coleman 2000, p. 20). This is common knowledge for the trustor and for the trustee and it can serve as a general signal, provided the trustee can credibly communicate his adhesion to the common rules of credit transactions. Generalizing, Lorenz (1999, p. 308) calls them "procedural rules (which contribute, the author) … to the build-up of trust". Both the individual-specific and the general signal are actions "taken by the better informed party in a setting of asymmetric information to communicate its true characteristics in a credible fashion to the less-informed party." (Lee et al., p. 610). Both the individual-specific and the general signal have the objective to signal trustworthiness (ibid., p. 621), but of course can never establish trustworthiness. For the trustee, gaining trustworthiness has benefits in any case: „How can

[1] „Studies in applied psychology have shown that empathy in many spheres is strongest when the interchange is face to face." (Dasgupta 2000, p. 371).

you cheat another person without having gained trustworthiness in his eyes before“ is a quote from a gangster movie. These benefits have to be weighted against the opportunity costs of building up the reputation of being trustworthy.

What can be, on this background, the motivation for *an other* (to cite Yusuf Islam's recent album) contribution to the trust puzzle? The aim of this note is threefold: we first discuss the appropriateness of the traditional trust-game-tree for the analysis of trust relationships. Following the above definition put forward by Lee et al. (2005), we relate his criteria to the subjective probabilities given by Coleman's inequality. In a second step, we develop the "trust-tree-game" further to a psychological trust game in the vein of Dufwenberg (2002). Here, we complement the concept of "trust responsiveness" with the idea of "rewarding reciprocity" which enables us to consider the issue of mutuality in trust relationships. Finally, we move on to the concept of mutual trust (which is more than mutuality in a trust relationship), where each individual can be both trustor and trustee. This aspect is visualized within the two-persons optimal intertemporal consumption choice model. In this model, the rationality of both extending and receiving a credit is founded and can be related to Coleman's credit slip. The corresponding "creditor-debtor-game" reproduces the well known "prisoner's dilemma". The fact that we though observe multiple creditor-debtor-relationships in an economy seems to reflect not only the gains from cooperation in repeated games, but also the existence of "generalized" trust in the society.

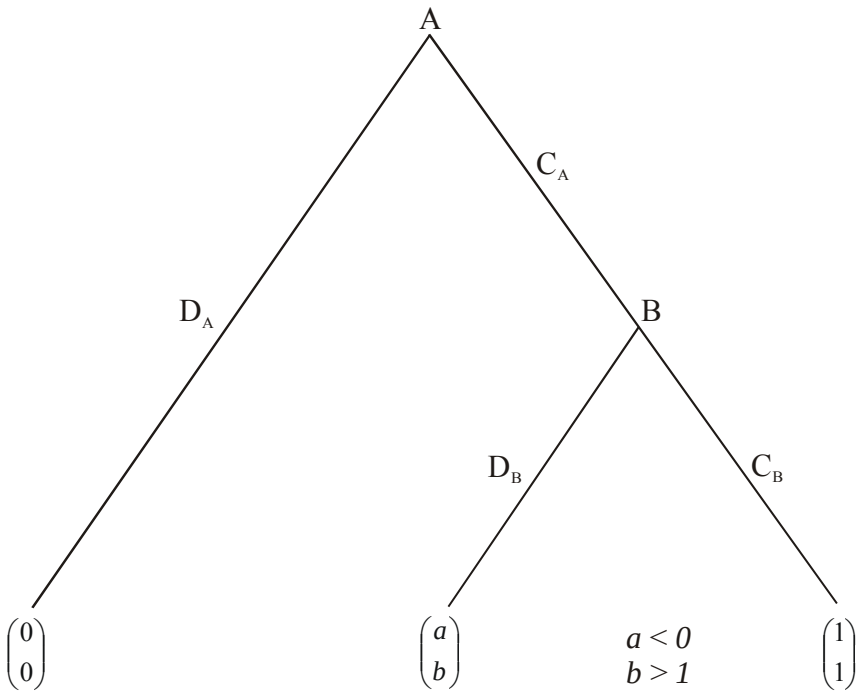
II. Mutuality in trust relationships

The original trust tree, trust responsiveness and Coleman's inequality

If the structure of the game used to exemplify trust does not put forward the vulnerability of the trustor, then it is inappropriate to model trust. Also, as Dasgupta puts it, the trustor's "action must be chosen before he or she can observe the actions of the others" (2000, p. 330). The following trust-game-tree seems to be "prima facie" a viable approximation to the relevant situation; we have two agents *A* and *B* who want to exchange goods (*B*) for money (*A*). If *A* makes himself vulnerable by delivering the money first (C_A), *B* has either the option to submit the goods (C_B) or to defect (D_B). In the first case, the respective utilities amount to say *1* and *1*. When *B* defects, (D_B), he stays with the money of *A* without giving away the goods. Now the corresponding utilities are a (< 0) and b (> 1). As the second option seems to be the more attractive one and can be anticipated by *A* (D_A), the outcome in this "traditional trust game" leads to the "no transaction case" with the respective utilities being (0, 0).

Following Lee (see above), Figure 1, however, can by no means be understood as a representation of a „trust(ing) situation"; because there is neither a room for confident expectations nor is agent *A* making himself truly vulnerable. Confidence has to do with „calculation", but also with emotions, morality and reputation (Lahno 2005, p. 95). The above traditional trust game suffers from a false reasoning: those aspects which seem to be constitutive for a trusting behaviour are simply faded out, namely the emotional, normative/ethical and reputational aspects and their corresponding utilities and costs. Subsequently, it is argued that rational agents do not have any incentives to trust each other. But: Can it be rational to omit important variables for the decision process in a strategic game?

Figure 1:



Source: Lahno 2005; author

From first glance, in Figure 1, Agent *A* is not really making himself *vulnerable*. As the unique (Kreps 1990, p. 101)[2] sub game perfect equilibrium outcome of the game is necessarily (0, 0) – „do no transaction"is a (non-cooperative) equilibrium strategy and agent A is always „safe" if he follows it. However, there could be room for *confident* expectations in Figure 1; even when these can obviously not be based on experience with the particular player B, they could, in principle, be based on experience with other players in similar situations. This sort of "general confidence" would then depend on the expectations people have about the subjects in a reference group, and in this sense would concern the reference group's reputation. Alternatively, one could argue with the existence of a behavioural norm of reciprocity, whose evolutionary stability has been shown by Güth and Kliemt (1994). But, as Bolle puts it, "a necessary condition of this result is, however, a large enough probability of detecting "exploiters" … (2001, p. 5). In light of this probability, different possible degrees of vulnerability come into play.

Something else could happen: Agent B may anticipate what is anticipated by Agent A (see above) and foresees that the outcome (0, 0) will be worse for him than transacting without defection (0 < 1). He may then want to *signal* to Agent A that he is inclined not to defect. If A anticipates what B anticipates about his own earlier anticipation, then this signal may be credible. But this mechanism goes far beyond the "manual description" of the simple one-shot trust game. Moreover, sending signals does not make everything easier: "while it is true that if a signal is sufficiently expensive and unfakeable cue, it entails that the sender possesses a

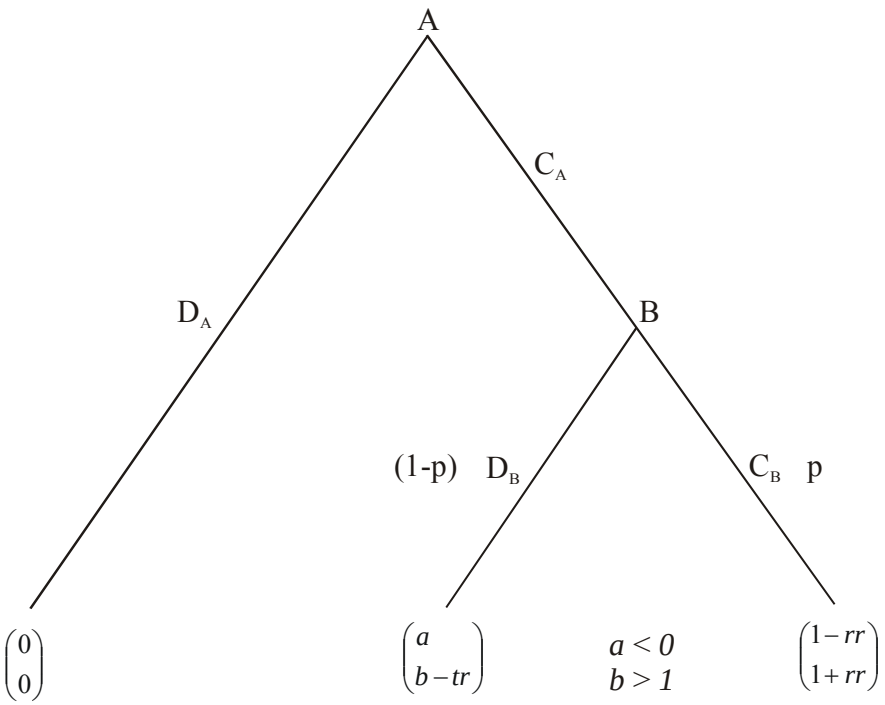
[2] "But it is the unique equilibrium outcome in this game, played once and played non-cooperatively (that is, if we assume that individuals are motivated only by the monetary payoffs involved - part of our qualification "absent other considerations" - and if we assume that they have no opportunity to sign a binding and enforceable contract - more of the qualification - then this outcome is the unique self-enforcing outcome of the game)."

particular quality, it is *not* true that the absence of a signal entails non-possession of the quality." (Braham/Bolle 2006, p. 230 and Bolle/Kaehler 2007).

In a one-shot game, confidence can be (better) taken into account, when it is feasible to assign (subjective) likelihoods/probabilities to possible outcomes of the game. Consider the following, modified trust game in Figure 2, in which player *A* assigns probabilities $(p,(1-p))$ to the expected behaviour of player *B*.

The discussion of the trust phenomenon has been enriched to a considerable extent by the introduction of "trust responsiveness"; the latter stands for a "player's aversion to letting others down" (Gueth/Dufwenberg 2004, p. 2) or likewise for a "tendency to fulfil trust because you believe that it has been placed on you" (Guerra/Zizzo 2004, p. 25) and it is said that this attitude "depends on the sympathy or respect the trustee feels for the trustor" (Bacharach/Guerra/Zizzo 2001, p. 6). The concept of „trust responsiveness" has made a first significant step towards the consideration of emotional und normative/ethical aspects when modelling trusting behaviour. So far, however, there seems to be missing the „opposite side", to say so, of „trust responsiveness". This opposite side should be an attitude of „rewarding reciprocity". Let us see why.

Figure 2:



Source: author

Not only the trustee, but also the trustor can feel emotions: given that he had to invest (so much) confidence to compensate his felt and at the same time very much objective vulnerability, he will be grateful to the trustee if the latter fulfils the expectations of reciprocity. A honours the fact that B has not disappointed trust put in him. When *B* in fact delivers the goods, he may be honoured by an attitude of "rewarding reciprocity" from agent *A*. It is (almost) irrelevant whether the reward is material or immaterial.

What implications does "rewarding reciprocity" have on the pay offs of the game tree? While „trust responsiveness" tends to lower b (*B*'s pay off in the non-cooperative case (D_B) to values above, but close to 1, „rewarding reciprocity" tends to raise *B*'s pay off in the cooperative case (C_B) to (again) values above, but close to 1, too. Notice that *B*'s pay off cannot become lower than 1, because then cooperation would be his dominant strategy and *A* could always pay in advance for the goods without the need to trust *B*. This is an obvious error in Lahno (2005, p. 97). If "rewarding reciprocity" (*rr*) comes along as an immaterial device, A's pay off will not be affected. If it comes along as a material premium, it will lower A's pay off to values below 1 in the cooperative solution.

The probability *p* is a proxy for *A's* confidence in *B*, more precisely the belief that

$$b^* = (b - tr) < (1 + rr)$$

(1) or

$$b < 1 + tr + rr$$

A's confidence is justified whenever expected income from a transaction exceeds the no activity alternative with a pay-off of zero:

(2) $E(A) = p + (1-p)\cdot a \geq 0$, where $(1-p)$ is a proxy for *A's* vulnerability (in likelihood equivalents). Considering *rr*,

(2a) $E(A) = p\cdot(1-rr) + (1-p)\cdot a \geq 0$

Hence,

(3) $p^* \geq \frac{-a}{(1-a)} = \frac{a}{(a-1)} > 0$ or

(3a) $p^* \geq \frac{-a}{(1-a-rr)} = \frac{a}{(a+rr-1)}$

Equation (3) or (3a), respectively, is also known in the literature as "*Coleman's inequality*", where the denominator of $\frac{a}{(a-1)}$, $(a-1)$ is a proxy for *A's* vulnerability (in money equivalents), as the sum of foregone benefits and actual payments. It is obvious that an increasing vulnerability makes a higher confidence necessary, if the trustor wants to justify entering a transaction with the trustee (notice that $(a-1)$ has a negative sign; therefore, we need to calculate the following derivative):

(4) $-\frac{\partial p^*}{\partial(a-1)} = \frac{1}{(a-1)^2} > 0$ or

(4a) $-\frac{\partial p^*}{\partial(a+rr-1)} = \frac{1}{(a+rr-1)^2} > 0$

A' s vulnerability in likelihood weighted money equivalents (*V*) amounts to

(5) $V = (1-p)(a-1)$ or

(5a) $V = (1-p)(a+rr-1)$

"Trust responsiveness" and "rewarding reciprocity" in the (broadened) "psychological trust game" (Dufwenberg)

In a second step, we may now develop the above "trust game tree" further to a "psychological trust game" in the vein of Dufwenberg's "marital investment game" (2002, pp. 57-69): As there is always the possibility to be cheated by the trustee *B*, we may assign probabilities to the principal choices of the trustor *A* (*transact*; *don't transact*):

$\sigma \in [0,1]$: The probability that the trustor *A* agrees to transact with trustee *B*

Both the trustor and the trustee prefer the strategy profile (*transact, cooperate*) to any profile where the trustor says *I don't transact*.

$\tau \in [0,1]$: The probability that the trustee *B* will cooperate with the trustor *A*

In order to bring "trust responsiveness" and "rewarding reciprocity" into the game, the following beliefs will be denoted:

$\tau' \in [0,1]$: The trustor's (*A's*) expectation of τ (his trust in *B*)

$\tau'' \in [0,1]$: The trustee's (*B's*) expectation of τ' (his degree of trust responsiveness)

$\tau''' \in [0,1]$: The trustor's (*A's*) expectation of τ'' (his ex-ante degree of willingness to honour reciprocity ex-post)

When *B* makes his choice, "the stronger he expects that (the trustor, the author) trusts him … the more disutility of guilt he experiences by choosing" (Dufwenberg 2002, p. 62) to defect. When A makes his choice, he will take into account or evaluate, how much he is in principle prepared to offer as a reward for reciprocity to agent *B*. Here, in this psychological context, we take it as an immaterial reward to B which accrues not to his attitude of cooperation itself, but to the motives of B, not to let down A (or, likewise, to enjoy the fact that someone puts trust into him). Assume that the guilt effect enters additively into the trustee's utility function and that the trustee's guilt sensitivity is constant at $\gamma \geq 0$ (ibid., p. 63). Furthermore, for reasons of simplicity, assume that $\gamma \geq 0$ can also serve as a proxy for the trustor's sensitivity with regard to the trustee's degree of reciprocity. Then, rearranging (1), the condition for cooperation now reads:

$$b^* = (b - \gamma\tau'') < (1 + \gamma\tau''')$$

or

(6) $$b < 1 + \gamma(\tau'' + \tau''')$$

or

$$b - \gamma(\tau'' + \tau''') < 1$$

Now, we can solve the game in the vein of Dufwenberg for different values of γ. There are three different cases:

(1) Let us assume for a moment *b* to be 4 in order to get things better tractable; if we reformulate (6) to the inverse condition (for non-cooperation) and assume in the first place $\gamma < 1.5$, we get the inequality $4 - \gamma(\tau" + \tau"') > 1$, which must hold since $\tau", \tau"' \in [0,1]$. Hence, in this case, the trustee will always choose to defect irrespective of his *and* the trustor's beliefs. Hence, here we have a – by the way sub game perfect – „no trust equilibrium". This equilibrium of course entails the implication:

(7) $\tau = \tau' = \tau" = \tau"' = 0$

(2) What happens for larger values of γ ($\gamma \geq 1.5$)? Consider the case where $\gamma = 3$; now, we get the inequality $4 - 3(\tau" + \tau"') > 1$. It holds, as long as $\tau" = \tau"' < 0.5$, but it does not hold for $\tau" = \tau"' \geq 0.5$. So there is an obvious range of values when $\gamma \in [1.5,\ 3]$ for which multiple equilibria exist. Which one is relevant, depends on the beliefs of the involved parties.

(3) In all of these cases, where $\gamma > 3$, there only trusting equilibria are viable. The reason for that is that if the trustor is"called upon to move" (ibid., p. 65), he must believe that $\tau' = \tau" = \tau"' \geq 0.5$. If, in turn, we introduce this condition into the inequality $4 - \gamma(\tau" + \tau"') > 1$, we arrive at:

(8) $4 - \gamma(0.5 + 0.5) > 1 \rightarrow \gamma > 3$

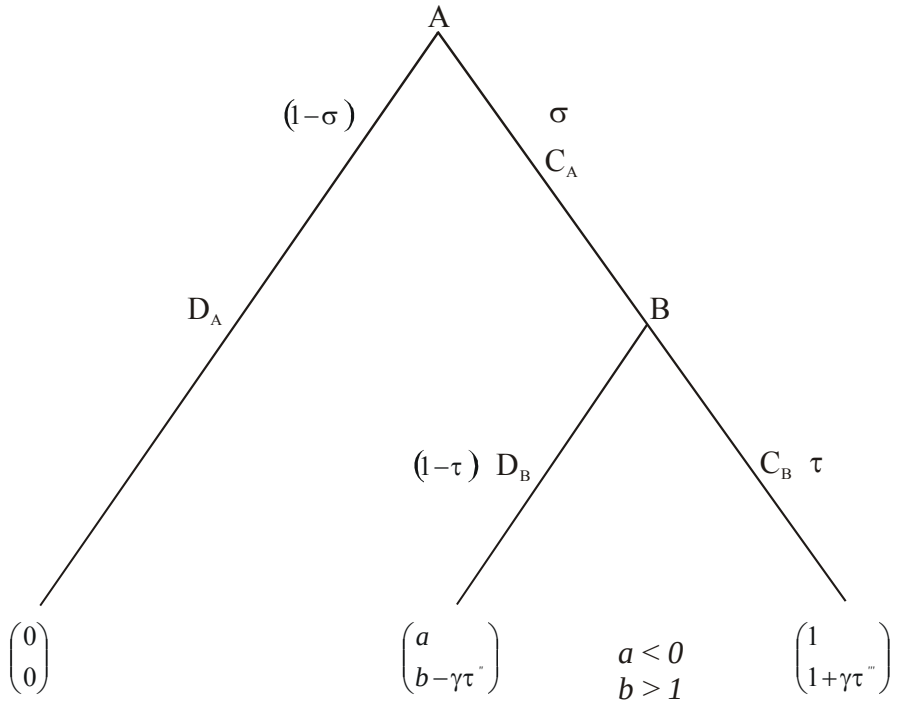
All of these equilibria of course entail the implication:

(9) $\tau = \tau' = \tau" = \tau"' = 1$

Consider finally the cases of $\gamma = 4$ and of $\gamma = 5$ from A's viewpoint. Suppose the trustor decides to *transact*; then he will maximise his expected pay-off only, if he expects to get at least a pay-off of 0 (see Figure 3). This means that his expectation of τ, or equivalently, that his trust, τ', is at least $0 < 1 \cdot \tau' + a(1 - \tau')$ or:

(10) $\tau' > \frac{-a}{1-a}$

Figure 3



Sources: Dufwenberg 2002; author

Condition (10) replicates Coleman's inequality (3) from above. With rational agents – "beliefs must be consistent with what is actually happening" (ibid., p. 64/65) –, this also implies,

$$(11) \qquad \tau' = \tau'' = \tau'''; \tau'' + \tau''' = 2\tau' > \frac{-2a}{1-a}$$

For this case, we now get the inequality $4 - 4(-2a/(1-a)) > 1$. This inequality is fulfilled for $a > -3/5$. In the case of $\gamma = 5$, the condition changes to $a > -3/7$.

The above explanation for a likely cooperation between *A* and *B* based on a trusting decision still has (at least) three shortcomings. *First*: we still are "captured" by the static categorisation of one person being the trustor, the other person being the trustee. Again, daily business and private life transactions show us that trust is seldom a one-directional relationship with one "active" and one "passive" economic agent. In many, perhaps most of the cases, cooperation can only be organized on the basis of *mutual trust*. Notice that mutual trust is much more than mutuality in a trust relationship. *Second*: So far, we have been dealing only with one-shot games. Suppose *A* decided to trust *B* in Figure 2 and *B* honoured *A's* trust. Then, it is much more likely that in future rounds "each side will cooperate as long as the other does and threatens, say never to again cooperate if the opponent takes advantage", as Kreps (1990, p. 107) puts it. *B* will build up a *reputation* of being trustworthy. *B* honours *A's* trust "because to abuse it would preclude or substantially limit (his, the author) opportunities to engage in future valuable transactions" (ibid., p. 116). This is something we can observe in day-to-day business and private transactions. However, "this story about reputations depends critically on there being no last round" (ibid., p. 108). Moreover, contrary to what some studies in the field of trust tend to claim – trust leads to *cooperation*, but the reverse does not hold always. If we think of cartels, we would agree that these could not function without a minimum level of cooperation among the members. I guess, however, that no serious person (not to speak of

economists) would assert that we will always find trust relationships among the members of a cartel. Quite the opposite, I suppose, will be normally the case.[3] And *third*: whether trust can be relevant for *new transactions* between individuals in a society has also to do with what has been termed "*generalized trust*". In how much is a society on average or in general prepared to give room to trusting relationships? Do we find a general atmosphere which is suitable to trust, or is that sometimes a mood of suspicion and envy hinders the innovative entrepreneurs to engage in promising new endeavours?

The intertemporal consumption choice model and Coleman's credit slip

The assumption to merely identify *one* trustor and *one* trustee in economic transactions is far too simple. Trust relationships are exchange relationships: either trust is exchanged against trust responsiveness/specific emotions (see above) or the exchange is directly related to goods/services and financial claims. The idea of exchange does not suffer any depreciation if one considers trusting activities to be some sort of advance on the future delivery of money/goods, hence as a provision of a credit, very much in the vein of Coleman's *credit slip* from above.

An appropriate setting to demonstrate the effects of a credit in a two-person environment is the well-known intertemporal consumption choice model. There are two households, each of them can choose between alternative bundles of homogenous consumption goods available in the present or in the future period. In the beginning, each household is provided with an initial endowment of future and present consumption goods. However, a household may depart from his initial endowment point by entering into an exchange with the other household. This is likely, for example, when one of the households has a high time preference and wants to exchange some of his future consumption goods against present consumption goods. This, in turn, is only viable, if he signs an obligation/a credit contract in which he promises to pay back the equivalent of the present consumption goods in the future to the other household. For an additive intertemporal utility function $U(C_t, C_{t+1})$ we have:

$$(12) \qquad U(C_t, C_{t+1}) = U\left[C_t\right] + U\left[\frac{C_{t+1}}{1+\rho}\right]$$

where $1/1+\rho$ equals the discount factor applied to future consumption and ρ is the symbol for the time preference. In our example, we assume household 1 to have a high time preference; he is willing to borrow present consumption goods from household 2 at a maximum interest rate of 10 percent. In other words: household 1 is willing to exchange (for example) 100 present consumption (to borrow) goods against 110 future consumption goods (to pay back):

$$(13) \qquad \left.\frac{dC_2}{dC_1}\right|_{\overline{U}^1} = MRS^1_{C_1,C_2} = -\frac{110}{100} = -(1+r) = -1{,}10.$$

For the second household we assume:

[3] A cartel can be best approximated by a collective monopoly, its members debating with jealousy the distribution of the quota. It is characterized by the anxiety about the possible outsider competition, as each member of the cartel has this outside option. In essence, it functions thanks to mutual threat equilibrium.

$$(14) \qquad \left.\frac{dC_2}{dC_1}\right|_{\overline{U}^2} = MRS^2_{C_1,C_2} = -\frac{105}{100} = -(1+r) = -1{,}05.$$

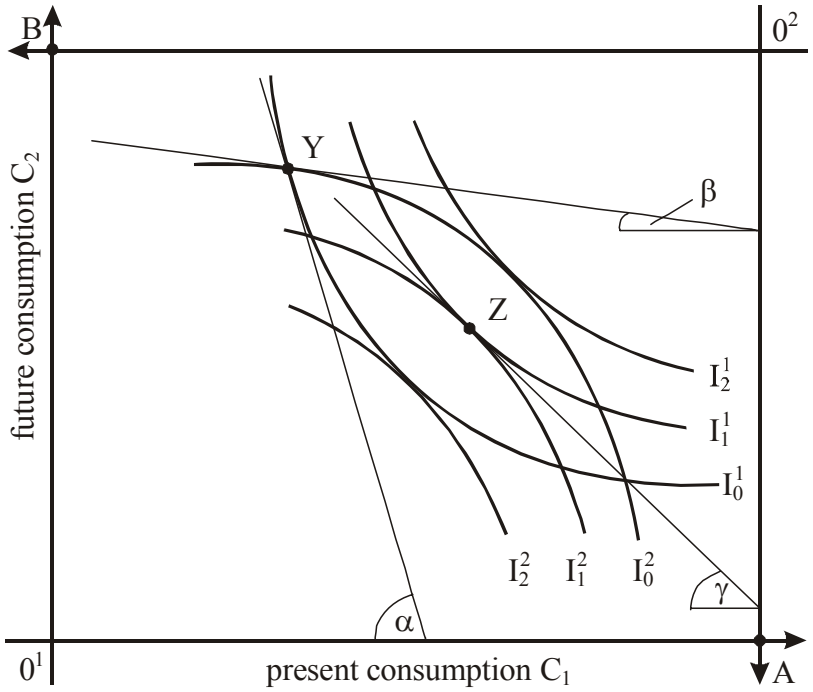
Household 2, hence, is willing to give up 100 units of present consumption goods in exchange for 105 units of future consumption goods. His implicit interest rate thus amounts to a minimum of 5 percent. How can both households get so seal a deal? This is obviously the case, whenever household two receives an implicit interest rate of or higher than 5 percent, and if, opposed to this, household 1 would pay an implicit interest rate of or lower than 10 percent. In this neoclassical equilibrium, an exchange of goods and hence an implicit credit contract will be agreed on by the two households at an unique real rate of interest (which, by the way, must equal the marginal productivity of capital) and at identical marginal rates of substitution between future and present consumption goods for the two households.

In Figure 4 below, we find the graphical solution to the problem well known from text books: Y stands for the arbitrarily chosen "endowment point" in the beginning. The corresponding intertemporal indifference curves build the famous "lens" known from any other Edgeworth box. At *Y*, the marginal rates of substitution (*MRS*) differ between the households. This is visualized in the figure by the different angles ($\tan\alpha > \tan\beta$) which the tangents have at the respective indifference curves. A possible equilibrium which enables an exchange of goods is at *Z*; here, the interest rate factor *(1+r)* and the marginal rates of substitution of the two households do harmonize ($\tan\gamma$). Compared to point *Y*, household 1 and household 2 achieve higher levels of utility. Household 1 (2) realizes a higher (lower) consumption in the present in exchange for a lower (higher) consumption in the future period. A possible numerical case for point *Z* could be:

$$(15) \qquad \left.\frac{dC_2}{dC_1}\right|_{\overline{U}^1} = \left.\frac{dC_2}{dC_1}\right|_{\overline{U}^2} = MRS^1_{C_1,C_2} = MRS^2_{C_1,C_2} = -\frac{107}{100} = -(1+r) = -1{,}07$$

Hence, the creditor and the debtor household sign a credit contract with a (real) interest rate of 7 percent, which is less than what initially household 1 was prepared to pay for, but more than household 2 was inclined to ask for. As we will make clear in the following, the optimal solution cannot be achieved without trust between the parties. And, as the optimal solution is superior for both households in comparison to the initial situation, trust is beneficial to both transactors. Moreover, trust has to be mutual and cannot be reduced to a one sided trustor-trustee-relationship as in the traditional trust game. Also, as the next section will demonstrate, our rational choice model can easily be "translated" into a simple simultaneous game structure. The game will be labelled here forth "creditor-debtor game".

Figure 4



Source: author

Mutual trust in the creditor-debtor game

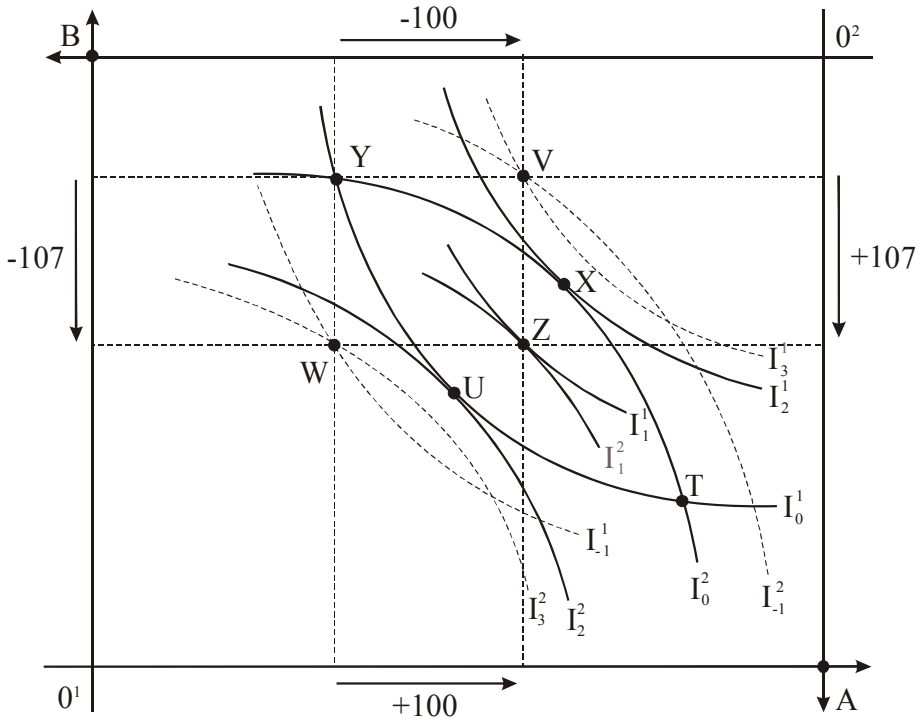
Mutual trust is in place when in principle *both* players can be trustor and trustee, hence when *each* player can be characterized by both *confident expectations* and a *willingness to be vulnerable* (see above). The probability for that economic exchange transactions occur in a single, totally simultaneous move is close to zero, no matter if we are dealing on an East-Asian bazaar or in an internet auction like EBay. Following the "principle of insufficient reason" (Sinn 1980), in 50 percent of the cases, household 1 will have a first mover disadvantage, in 50 percent of the cases household 2 will have a first mover disadvantage. This implies that, not knowing whether I will be actually the trustor or the trustee, I will be better prepared to be the trustor.

The following Figure 5 goes beyond the insights won in Figure 4; as is well known from traditional Edgeworth box analysis, *Z* is not the only possible exchange outcome between the two agents. If "market power" is not divided equally between the two involved parties, agent 1 (agent 2) may enforce an exploitation solution as depicted in point *X* (*U*). Inactivity (*Y*), however, is already an inferior solution, as agent 1 (agent 2) – at given utility level of agent 2 (agent 1) – cannot gain higher utility levels as opposed to the exploitation alternative. The latter solution, in turn, will not give rise to distrust in the economy, but rather to disappointment or to "innovation" in the sense of a motivation for searching ways to disentangle/destroy the obvious market power on the other side. Notice that the basic rules of goods exchange in a market economy are not at stake here, there is not yet a reason for that "*general trust*" might fade away. This is different, however, when we come to comment points such as *V* or *W*. In the first case (*V*), agent 1 would appropriate 100 units of present consumption goods for himself without handing out the obligation/security to agent 2 which, being an enforceable contract, promises the delivery of 107 units of future consumption goods

in the next period. In the second case (*W*), agent 2 would appropriate the mentioned security without delivering in exchange the promised amount of present consumption goods.

Realizations such as the points V or W not only represent the actions of perpetrator and victim in a (personal) fraud scenario, they should also shake the overall trust in market exchange transactions and, in so far, put into danger what has been called above "general trust". The utility levels achieved by either agent 2 in the case of *V* or agent 1 in case of *W* are far below those utility levels achievable by inactivity (*Y*) and, also, below those "produced" by expropriation (*U*, *X*). Hence, they give incentives to abstain from exchange transactions in the future and prevent agents from repeating successful bilateral exchange. The opportunity costs of *V* and *W* do not consist only of the utility levels associated with Z, but of the option to *repeat V* and *W*. Repeated cooperative behaviour can best be modelled by modern game theory. Therefore, in the following pay-off table, we have "translated", so to say, the main alternatives from Figure 5 into the language of simultaneous game theory.

Figure 5



Source: author

In the subsequent one-shot game, there are, as before, two players (one and two); their possible strategies are either to deliver (d) goods/services vs. a signed obligation/ contract or to keep back (k). The pay-off structure is a bit more complicated by the fact that there are two periods involved. In the northwest cell (kk), both players decide for inactivity; in the northeast cell (kd), player 2 delivers his goods/services in advance, while player 1 receives the goods, but keeps back the obligation and defects. In the southwest cell (dk), player 1 signs an obligation, but is not rewarded by player 2 who keeps back his goods and defects. Finally, in the southeast cell (dd), we find the cooperative case, where both players deliver. It is obvious that the social surplus has a maximum here. However, it is the combination (kk) which represents the Nash equilibrium of the game. The strategy of keeping back is strictly dominant for each of the players, just like in the classical "prisoner's dilemma": Even when player 1 (player 2) knows for sure that player 2 (player 1) will cooperate, defection is profitable. If he

knew for sure that the other player will defect (keep back), keeping back (defecting) is his best answer anyway.

Table 1: Pay off matrix in the creditor-debtor game

2 / 1	keep back (k)	deliver (d)
keep back (k)	0 / 0	**V** +100 /-100**
deliver (d)	**W** -107* / +107	+100 / -100 -107 /+107

* Player 1 signs an obligation
** Player 2 delivers goods/services in advance
V: Defection by player 1
W: Defection by player 2

Source: author

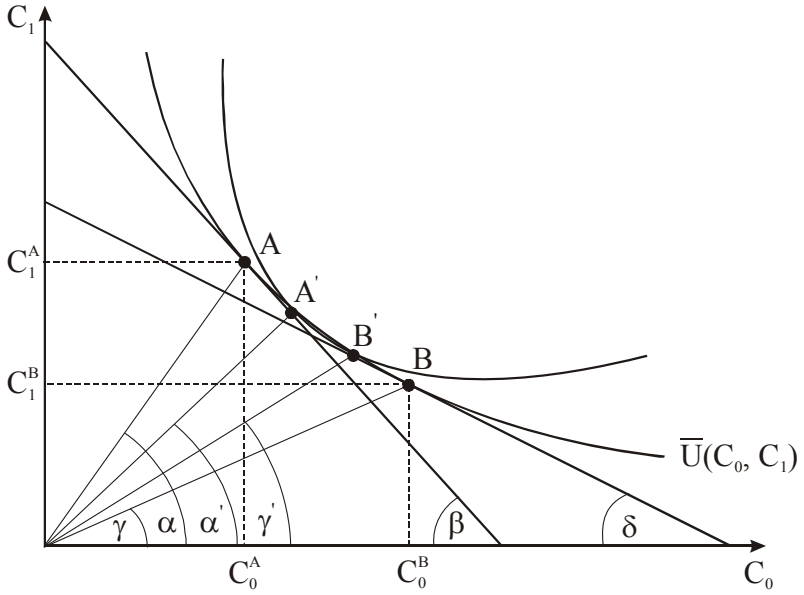
"Deep" economic determinants of a likely cooperation/default

Traditional Edgeworth box analysis is capable to provide additional insights into the trust puzzle: What economic forces determine the location of the default points *V* and *W*, and hence the size of pay-off *b* in the trust game tree of Figure 1 (see above)? As we will show in the following, their exact positioning, among other things, is a function of the curvature /degree of convexity of the agents' indifference curves. The latter, in turn, depends on a „deep"economic parameter of the "new" economic growth theory labeled the „intertemporal elasticity of substitution (σ) ".[4] As we know from several models, but also from empirical research, the per capita growth rate of an economy is the higher, the higher σ is. A number of empirical studies also reveal that the amount of "general trust" available in a society tends to contribute positively to economic growth (see, for example Zack and Knack 2001). These papers, however, add proxies of "general trust" and/or of "social capital" as factors of production rather ad hoc to quite common macroeconomic production functions. The microeconomic foundation of their reasoning would be fostered considerably if we could demonstrate that a higher „intertemporal elasticity of substitution" goes along - at a given set of norms and /or experiences with reciprocity in a society - with a higher likelihood for cooperation/a lower likelihood for default/defection in the traditional trust game.

4 $\sigma = -\frac{d(C_1/C_0)}{C_1/C_0} \div \frac{d(dC_1/dC_0)}{dC_1/dC_0}$

The following Figure 6 shows how a representative household distributes his earnings between bundles of consumption goods available in the present and in the future at given income streams and a given real rate of interest. The elasticity of substitution σ denotes how the distribution between the two bundles of goods is changed (from *A* to *B*) relatively or in percentages, when the real rate of interest is reduced from r^A to r^B . Households will change the proportion of their present consumption to their future consumption the less, the stronger the convexity of their indifference curves: The move from *A'* to *B'* is obviously much less pronounced than the move from *A* to *B*. The elasticity of substitution σ, in turn, is the lower, the stronger the convexity of the indifference curves.

Figure 6

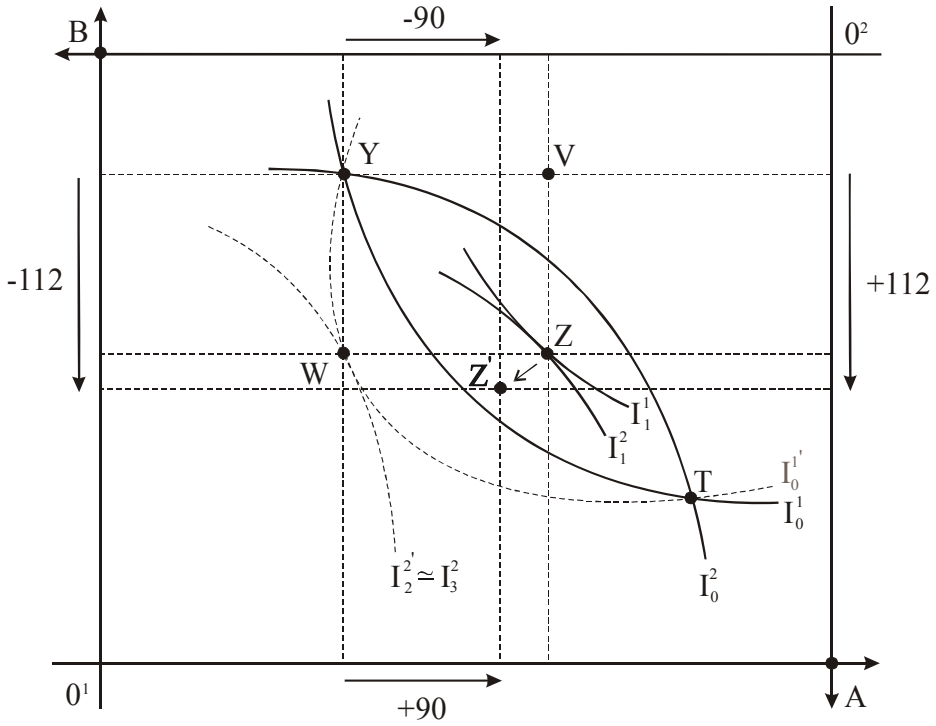


Source: author

Remember that σ is the inverse of η, the so-called elasticity of the marginal utility of (present) consumption. Impatient agents will usually be characterized by a low σ or a high η; they will, and here we come to grips, be more inclined to sign contracts which imply the delivery of future consumption goods at unfavorable terms in order to fulfill their desire for a high level of present consumption then agents with a higher σ and a lower η, ceteris paribus.

With the help of Figure 7, we can now discuss the implications of a higher σ and a lower η on the likelihood for cooperation or default. Assume that we assign, corresponding to the traditional trust game, the role of the trustor to agent 1 who is willing to sign a contract – which in exchange for the delivery of 90 units of present consumption goods promises the delivery of say 112 units of future consumption goods – and the role of the trustee to agent 2 who promises to deliver 90 units of present consumption goods today after having received the contract signed by agent 1. Agent 2 has the choice between fulfilling his obligations or to defect. As the obligation signed by agent 1 is an enforceable contract, it is pretty much like "money" in the traditional trust game. If agent 2 defaults (*W*), he appropriates the mentioned security worth 112 units of future consumption goods. That is obviously more than in the reference case (107). 112 (107) units of future consumption goods correspond to the pay-off "b" in the traditional trust game.

Figure 7



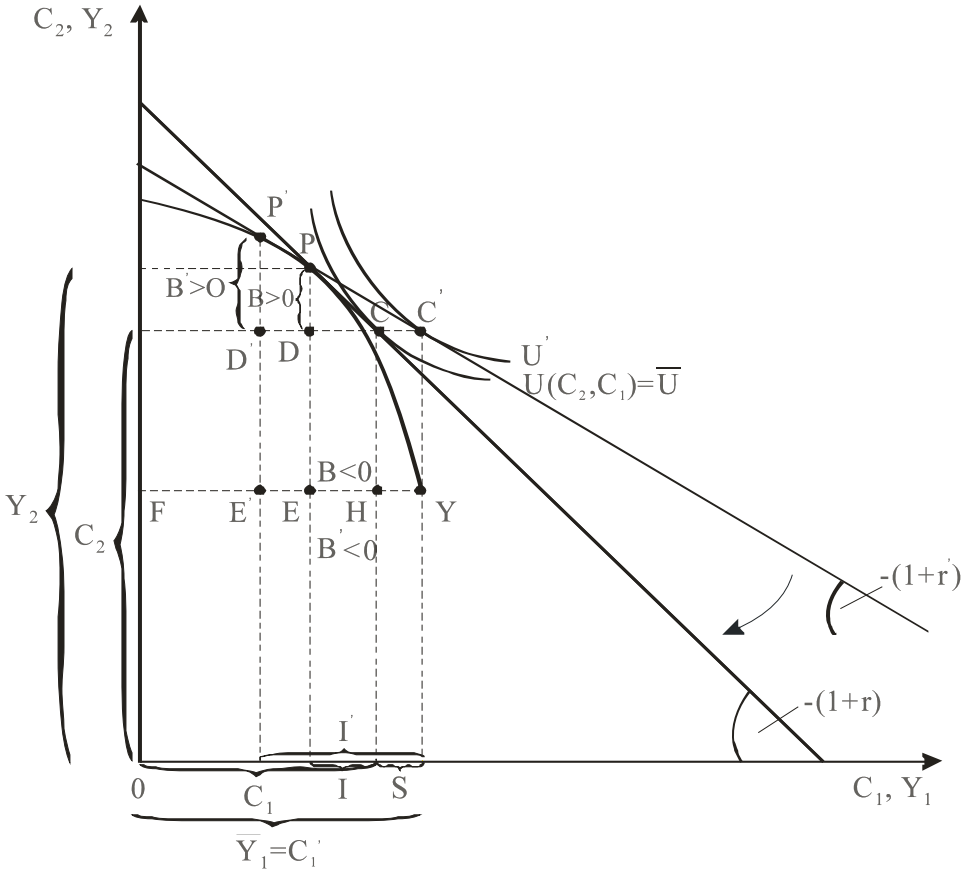
Source: author

The conclusion, then, is straightforward: our results, transferred into the traditional trust game tree, imply that the gains of default (*b*) are apparently higher (112 vs. 107), when the trustor is characterized by a lower σ and, hence a higher η in comparison to the reference case of Figure 5. Or, in other words, the "premium" for default is a (negative) function of the intertemporal elasticity of substitution among the trustor. Hence, cooperation is the more likely, the higher the intertemporal elasticity of the trustor involved. The reader may convince himself that this result is robust, i. e. that is it does not hang upon the assignments made above. So, if agent 2 becomes trustor (then, we would have to depict his alternative indifference curves) and agent 1 becomes trustee, the same outcome will apply.

Trust (worthiness) in international lending

The most suitable model for the analysis of the intertemporal elasticity of substitution and its role in international lending is the two-period small open economy setting offered by Frankel and Razin (1996, pp. 155-188). In particular, we have to deal here with the case of "investment opportunities, which tilt the time profile of income, augment the levels of consumption in each period without introducing variability to its time profile" (ibid., p. 166):

Figure 8



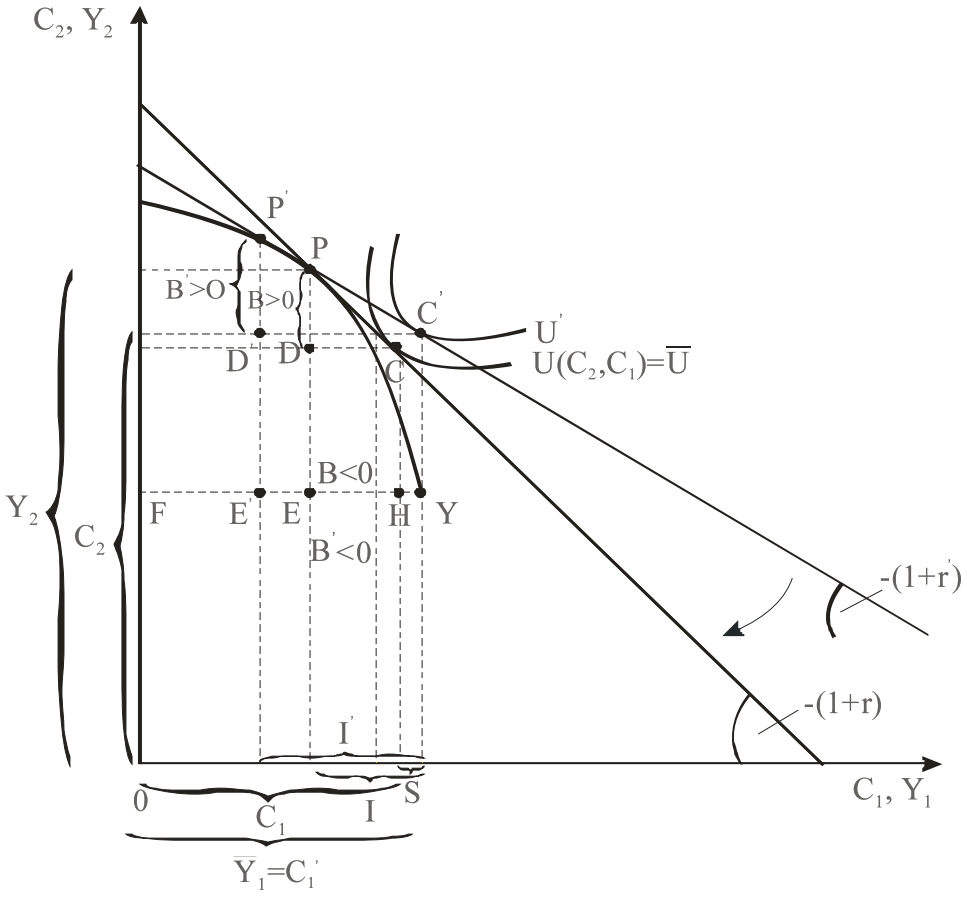
Source: author

Figure 8 illustrates a borrowing country's investment policy. In the absence of investment, the output sequence is $\overline{Y}_1$ and $\overline{Y}_2$. The schedule originating from point *Y* and passing through point *P* specifies the transformation schedule linking current period production that is allocated for consumption with future period production which is allocated for consumption. Diagrammatically, investment spending is measured in a leftward direction from *Y*. The profit maximizing debtor country will seek to reach the highest locus (*P*) on the investment return curve, given the intertemporal price and budget line with slope - *(1+r).* The maximized level of utility obtains at point *C* at the tangency of indifference curve $\overline{U} = U(C_1, C_2)$ with the budget line. The country in concern incurs a balance of trade deficit of size $\overline{EH}$ which leads to a necessary payment to the creditor country in the subsequent period in the amount of $\overline{PD}$ (including the debt service). Investment equals the distance $\overline{EY}$; domestic savings contribute to investment according to the distance $\overline{HY}$. As depicted in Figure 8, the country in concern is characterized by a normal or even high intertemporal elasticity of substitution. It will serve as our "reference case".

Suppose now that the country is confronted with a lower rate of interest and a corresponding slope of - (*1+r'*). How will the profit and utility maxima be affected? As Figure 8 demonstrates, at a lower interest rate, the country in concern will invest more ($I' = \overline{E'Y}$), incur a higher debt (or likewise a higher deficit in the balance of trade ($B' = \overline{E'Y}$), the production point will shift leftwards to *P'*, domestic consumption will rise and the consumption locus will shift downwards and to the right to *C'*, while domestic savings will

shrink to a zero level ($Y - C' = 0$). Consumers reach a higher utility level at U'. So far, all of these results are standard and correspond to conventional economic wisdom.

Figure 9



Source: author

Now we consider the case where the country in concern is characterized by a lower intertemporal elasticity of substitution - and hence much more bended indifference curves - in comparison to the case of reference in Figure 8. What changes, what is different? Let's put the reasoning (see Figure 9) as follows: increasing the interest rate from *r'* to *r*, which makes the budget line steeper (- *(1+r')* < - *(1+r)*), will now result in the same (lower) amount of investment and production as depicted in Figure 8 at the interest rate *r*. But now (see Figure 9), domestic consumption and the deficit in the balance of trade (*B*) will be higher and domestic savings (*S*) will be lower in comparison to the case of reference (at the interest rate *r*). This implies that such a country deserves less trustworthiness in the eyes of possible creditors: Default on a credit contract seems to be the more likely; the less (the more) capital inflows are directed into domestic investment opportunities (domestic consumption). This is so, because a debtor country has to produce (consume) comparatively many (few) tradeable goods in order to guarantee the debt service towards the creditor country. This problem was at the core of the famous Ohlin-Keynes-debate on the so-called "transfer problem" in the 1930s.

Cooperation, mutual trust and generalized trust

Notice that the implication of the Nash solution in Table 1 would be (or better: is) that "inactivity" is an equilibrium in an exchange economy. In repeated games, there is a way out offered by the tit-for-tat-strategy which makes cooperation profitable also in the case of finite games, when the number of rounds is uncertain and/or when agents act with "bounded rationality" (Pindyck/Rubinfeld 2003, p. 667). The iteration of cooperative action in a simultaneous game is more likely, the greater the uncertainty about the number of possible "rounds" is. If the number is finite and known by the players, defection has a greater likelihood. The problem with the tit-for-tat logic is that it explains why and when cooperation is profitable, but not that cooperation is chosen on the grounds of (mutual) trust. But mutual trust *can* itself become a prerequisite to overcome situations resembled by the prisoner's dilemma. Also, cooperative interactions in the past make a tit-for-tat strategy more likely (Haug 1997, p. 18) in the present. But it does not necessarily imply that past cooperation was based on a trust relationship. The key point is here perhaps that we have to understand how and why agents learn to trust in indefinitely repeated (Engle-Warnick/Slonim 2006) or, likewise in finite games with an unknown number of rounds and not how and why agents build up a reputation for being cooperative. This is so, because the latter *may* be, but *must* not be accompanied by trust as the above example of cartels nicely demonstrates. As opposed to Lorenz' view (1999, p. 305), members of a cartel do in fact cooperate, but without the need to "share the degree of trust necessary to cooperate". What makes the members of a cartel cooperate is the strong will to maintain prices (and so profits) high and the supply of goods low. This is in many cases a "mutually beneficial cooperation" (Gueth/Ockenfels/Wendel 1997, p. 15), but it is not based on mutual trust. Of course, Lorenz is right to find that "the build-up of trust (increases, the author) ... the likelihood of successful cooperation." (ibid., p. 314). However, as the notion of cooperation does not make sense in a unilateral sense and trust may be (but must not be) in some cases the reason for cooperation, the trust which is at stake here is necessarily a *mutual trust*. Or, as Lorenz puts it: "trust is (between cooperating partners, the author) earned and is reciprocally and mutually merited" (ibid., p. 309).

Can mutual trust on the personal level be supported by the existence of "generalized trust" in the society? Following the study of Pérez García et al. (2006) generalized trust or trust measured on a national level such as by the World Value Surveys (WVS) can also be proxied by the "amplitude of the credit the economy grants in relation to the volume of transactions within it" (ibid., p. 25), if we consider that situations in which agents deposit funds in the banking sector and trust "their investments to the banks, or in which other individuals receive credits" cannot occur without agents being somehow "connected by relationships of trust" (ibid.). When it comes to the issue of possible *new transactions* between individuals in a society, the existence of a phenomenon which has been termed "*generalized trust*" will be most important. In how much is a society on average or in general prepared to give room to trusting relationships? Do we find a general atmosphere which is suitable to trust, or is that a mood of suspicion and envy hinders the innovative entrepreneurs to engage in promising new endeavours?

Cooperative actions/activities lead to a social surplus. Social surplus can be calculated as the net "profit" from cooperative actions, say in the prisoner's dilemma: "A possible experimental method to measure social capital … is by studies revealing how often people cooperate in prisoner's dilemma games." (Paldam/Svendsen 2000, p. 349). This statement is ambiguous, though. Not only because there may be a confusion of the terms "social surplus" and "social capital". Again: if cooperation is not due to trust, but to other attitudes, measured gains in terms of units of social surplus cannot be solely attributed to trust. Given this insight,

one could try to estimate that unknown share by the information given in the World Value Surveys (WVS); the ratio of respondents who think that it is possible to trust the majority of people could in principle be the weight applied to the cooperative outcomes of experiments (experimental game theory). But, as Glaeser et al. (2000) find, this ratio may be a better proxy for "trustworthiness" than for "trust" in a society (ibid., p. 813). They prefer the answers of respondents to questions related to their effective "past trusting behaviour" in order to estimate the overall propensity to trust in a society (ibid., p. 819). Game theory based experiments – unless they are properly designed to capture cooperation based on trust (Gueth/Ockenfels/Wendel 1997) – tend to measure directly the "incentive to cooperate" (Glaeser et al. 2000, p. 822) and not, or less so, the propensity to trust. This is revealed indirectly by regression analysis which (in the end, only) connects "an index of past trusting behaviour and the amount sent in gift/trust experiments" (ibid., p. 827). In going further into that direction, one would have a means to even more "harmonize" the two major strands of research on the trust phenomenon: one rooted in experimental game theory, the other based on questionnaires and the subsequent application of statistical/econometric tools often used in empirical macroeconomics: "combining experimental and survey methods in order to allow heterogeneous participants to reveal rather than state their propensities to provide and sustain elements of social capital" (Bellemare/Kröger 2007, p. 200).

III. Conclusions

Trust responsiveness is a key starting point for the understanding of mutual trust. Introducing "honouring trust responsiveness" as an additional attitude of the trustor can possibly help to explain how mutuality enters into the trust relationship. To establish mutual trust, however, it seems that more aspects come into play. One is the uncertainty about one's own role in the exchange transactions of a market economy. Can I be sure to be the trustor (trustee)? The second is the likelihood of repeated transactions in the business field, such as in the credit sector. And the third is related to the existence of "generalised trust" in the society. The latter may give us hints as to the share of observed cooperation in experiments among agents which is due to trust. Beyond these rather psychological determinants of trust it seems worthwhile to search for essentially economic variables related to trust. The intertemporal elasticity of substitution could be an important one.

Acknowledgements

This paper benefited from the excellent and generous comments made by Matthias Sutter on an earlier version and also from the most valuable discussions I had with Marcus Wiens on the subjects of trust and social capital. It was also inspired by the contributions of Bart Nootebom, Hartmut Esser and Simon Gächter during the conference on "trust and reputation" held in Tutzing (March 10-12, 2004) and the comments the participants of the conference made on my paper "trust and the erosion of trust: economic functions and effects" .

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