Why trust in firms is unavoidable

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Secular Trust

'In God we trust - all others pay cash.'

This seemingly innocent little bon mot of shop-owners who express their dislike of credit card payments hides an important divide between different interpretations of the concept 'trust'. On the one hand, there is trust understood as unconditional believe in something (like God), on the other hand trust is motivated by an expectation in the enduring validity of a social relationship (like the functioning of exchange via cash money). Only the latter will be treated in what follows, and it will be called secular trust. Secular trust clearly needs at least two social entities, able to form expectations on each other's behavior. Furthermore the behavior of each entity must allow for a choice of action that can be characterized as 'trustful' as opposed to 'not trustful'. Since the actions of entities are linked to each other - secular trust is based on a social relationship - behavior that is 'not trustful' will be characterized as control of one entity over the behavior of the other entity. Although there might be the special case of equilibrating reciprocal control, the general case of social relationships in organizations is the one of an accentuated difference between the entity controlling and the entity controlled - thus defining the power structure of the organization. Control therefore will be viewed as the mirror image of secular trust. Unlike the unconditional believe in something, which is only a qualitative category, secular trust can be developed into a qualitative and quantitative concept reflecting the extent to which control is absent.

From a modeling perspective the appropriate formal tool to gain some insight into the concept secular trust evidently is the theory of strategic games. Consider the following example.

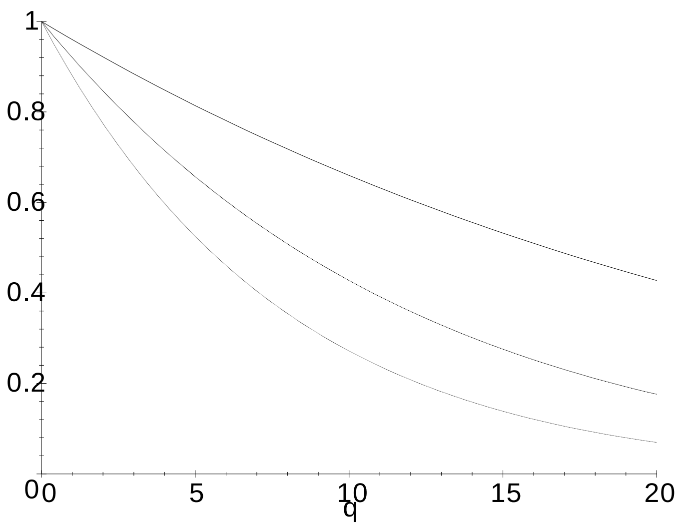
Assume that there exists an organization where an entity called W (worker) is controlled by an entity B (boss). The organization produces an output of q units in a production period of y (year) days. Furthermore each day W can choose between low labor intensity i_L or high labor intensity i_H. She clearly prefers low labor intensity, but the problem is that B will control her labor intensity on n of the y days of the production period. In case she is caught performing with low labor intensity the boss B will be able to initiate sanctions of a given level s. A typical utility function of W would be

$$u(y,q,n,s) = p(y,q,n)\cdot\left(\frac{q}{y}\right)^{\frac{1}{2}} - (1 - p(y,q,n))\cdot s$$

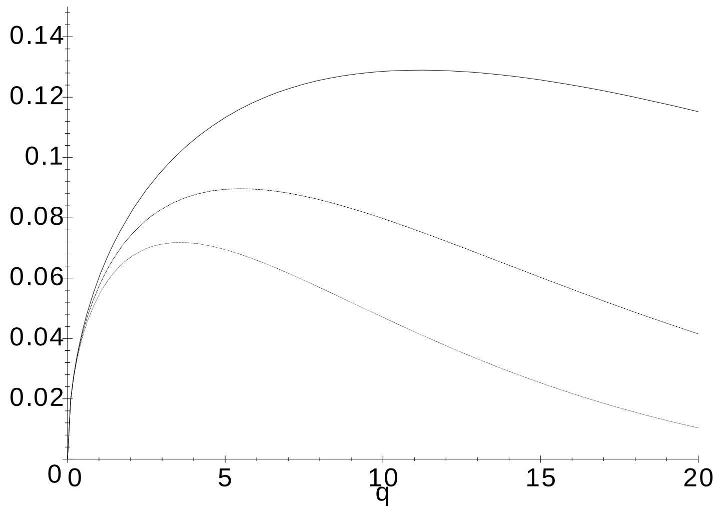
Expected utility u consists of two terms. The first term describes the case where W is not caught with iL. The probability of this case, p , is multiplied by the utility of choosing iL on q of the y days of the production period. The square root of the share of iL days is taken to normalize total utility to unity if q equals y, and to describe falling marginal utility - i.e. the gain from the first days of low labor intensity is larger than the one from additional ones. Simple combinatorics show that the probability p (not to be discovered with low labor intensity) is

$$p(y,q,n)=\frac{(y-q)!\cdot(y-n)!}{(y-q-n)!\cdot y!}$$

To get an idea of this utility function assume that the production function is 250 days (y=250) and that the boss B controls worker W on 10, 20 and 30 of these days (n=10, n=20, n=30). The sanction level s is set rather low (s=0.001). The following graphs show the three corresponding probabilities p (graph 1) and utility functions u (graph 2) as a function of q.



Graph 1



Graph 2

The optimal choice of the number of days with low labor intensity, q*, and the correspondent utility, u*, for different, exogenously given numbers of control days n and for two different given sanction levels (only s=0.01 is shown in graph 2) is summarized in table 1.

Table 1

n/s	s=0.01	s=0.01
n=10		
n=20		
n=30		

As can be seen the optimal choice of q* falls as the number of control days n and as the sanction level rises. With falling q* also maximum utility u* falls. This is what common sense would expect. Expressing q* as a function of n for given values y and s shows the best replies of entity W if entity B chooses a certain n, in game theoretic terms it is the reaction function of entity W.

Now consider the controlling entity B. On the one hand its utility must be linked to, more precisely, must rise due to higher labor intensity of the controlled unit W. Be it that B owns the firm, which W works for, or be it that B is a manager whose next career step depends on the performance of W. Since W only can choose between two states, iL and iH, what has to be considered is only B's absolute utility increase if W changes from working all days with iL to working all days with iH. Call this utility increase variability of labor intensity, r, and note that it crucially depends on the technical and organizational nature of the specific labor performed. Since q out of y days are performed with iL the gain from control can be described as a function of the share (y-q)/y. Furthermore, analogous to economic production functions, it is assumed that the gain from the first day worked at high labor intensity is greater than that from the second, and so on. Marginal utility gains are falling. On the other hand controlling implies the disutility of performing this control (e.g. its cost), which has to be subtracted from its gross benefit to get the net benefit. This disutility is assumed to consist of one part, which is independent of the extent of control (e.g. fixed cost), f, and one part which is proportional to the number of control days (e.g. variable cost), c. Taken together these arguments and assumptions can be expressed in a utility function, v, of the controlling entity

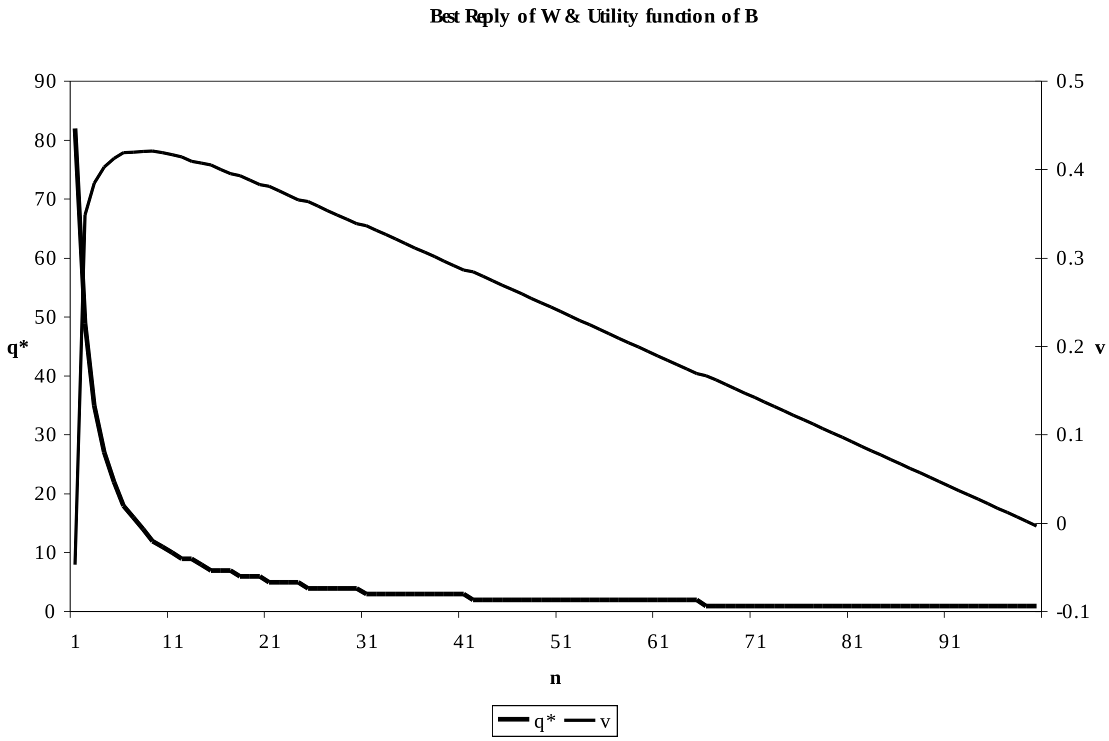
$$v(y,q,n,r,f,c,\alpha) = r \cdot \left(\frac{y-q}{y}\right)^{\alpha} - f - c \cdot n$$

The elasticity α describes how strong marginal utility gains fall with extended control. Note also that f and c must have been normalized to describe utility loss on the same scale as the first term of the right-hand side.

To find B's best reply to a choice of q made by W, entity B clearly has to consider that entity W's optimal q* will be based on an assumption about B's instrument variable n. As a consequence, the assumption that both entities are fully informed about the strategic possibilities involved, implies that B will maximize its utility by a choice of n*, *which also appears in the optimization of W*. In game theoretic terms the pair (n*, q*), where best replies coincide, is a *Nash equilibrium* - a point that will be voluntarily chosen by both entities, if the assumptions on this sequential move game hold. B moves first and sets n* in anticipation of W's optimal choice of q* in the second move. The unequal power of the players in this game thus is incorporated in the structure of the game tree (*first mover advantage*). The equilibrium (or set of equilibria) is described by

$$\max_{n} (\bar{y}, q^{*}, n, \bar{r}, \bar{f}, \bar{c}, \bar{\alpha}) = (\bar{r} \cdot \frac{\bar{y} - q^{*}(\bar{y}, n, \bar{s})}{\bar{y}})^{\bar{\alpha}} - \bar{f} - \bar{c} \cdot n$$

The following graph 3 shows entity W's reaction function q* (y, n, s) using the left vertical scale and B's utility function v(y, q*, n, r, f, c, α) using the right vertical scale. Both functions use the same parameter values as above: y=250, s=0.01, r=1, α=0.7, f=0.5, and c=0.005 .



It can easily be checked that n*=9 and q*=12 is the unique Nash equilibrium in this example. In this point B's utility reaches its maximum v*=0.4211 and so does entity W's utility (for given n*=9, u*=0.13605).

Now define secular trust of entity B in entity W as the product of a trust range and the actual equilibrium range - both terms to be explained immediately. The trust range is the maximum share of the total utility B can derive from its social relationship with W that can be lost if no control is exerted. In the example it could be assumed that the total utility B extracts from W is 10 utility units and with r=1 this would imply that the trust range is 10%. Evidently a trust range of zero is equivalent to the absence of the necessity of control - and thus of the absence of possible trust. The actual equilibrium range turning out in the example is the share of days with no control in the total number of days with possible control, that is (y-n*)/y = 241/250 = 96%. Since a quantified secular trust as defined above is the product of the two ratios, our example would exhibit a secular trust of 9.6 %.

It is interesting to investigate how shifts of the exogenous variables can be interpreted and how they influence secular trust.

A narrowing down of the trust range r, e.g. due to the normalizing effects of automatization, will decrease secular trust. On the other hand, increasing emancipation of labor that turns into labor laws will make it more difficult to maintain high sanction levels s, and this should lead to an increase of the actual equilibrium range and as a sequel to more secular trust. The same would be true if for some types of social relationships fixed control cost f would be too high for any positive value of v. But again decreasing variable control cost c, e.g. due to new information technologies, could work against an increase in secular trust.

Finally observe that information policies, which were explicitly excluded in the example, could play a major role in determining the Nash equilibrium and thus the actual equilibrium range. If B can convince W that the sanction level s is double as high as it actually is, and W optimizes according to this distorted information, then the resulting equilibrium is $n^*=8$ and $q^*=13$, with $v^*=0.42331$ and $u^*=0.14079$. Surprisingly pretended greater sanctions induce a lower propensity to choose low labor intensity for given n, which in turn motivates B to fewer control n^* resulting in more actual days with iL - and an increase of utility for both entities! Secular trust rises due to pretended sanction potential. This simple experiment should make us cautious when arguing about information policies without the use of a well-specified model.