

Mathematical Appendix: A Metaeconomics Look at Social Capital¹

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Mathematically, with the purpose of adding precision to the description of the role of social capital in economic development and economy generally, and as a companion and support piece for Authors (in review), we propose to think of an overall, symbiotically balanced outcome V arising from the simultaneous, joint pursuit of two (or more) interests represented in the egoistic self-interest (I_G) and an empathetic and perhaps sympathetic, leading to potentially an altruistic other-interest (I_M) in:

$$(1) \quad V = V(I_G, I_M) + \lambda(y - AOG - pq)$$

where

$$(2) \quad I_G = I_G(AOG, q)$$

$$(3) \quad I_M = I_M(AOG, q)$$

and a constraint:

$$(4) \quad y = AOG + pq$$

AOG is a numeraire, all other, including other capital, goods, with a price of 1; q is social capital, wanted for both egoistic and empathetic reasons, and thus carrying both of these dimensions. We presume in this formulation that the individual has complete freedom to choose; there is no control over the decision by some outside source, and, in fact, the individual, too, is able to act with a disciplined self-control in the balancing of the two interests. In effect, the mix of I_G and I_M is self-selected.

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Viewing these relations in Fig. 1, the product of pursuing mainly the egoistic, self-interest may be I_G' and the higher income represented in the level of the numeraire, all-other-goods AOG' and purchases of small amounts of the social capital good q' having price p . This may be someone who scores high on a selfism scale (for example, see Phares and Erskine, 1984) and is also well-fitted to a particular kind of work or business in the community, and staying has little to do with others who live in the community, per se. Note, too, there is some empathic, others-interest I_M curve through point A (not illustrated), with the individual gaining substantively less I_M at point A than, say, on I_M' . Alternatively, an individual who stays without much caring about the nature of the job might be at some point C, i.e., the outcome of pursuing mainly empathic others-interest may be I_M''' and far more of the social capital good q''' . This individual has suppressed the egoistic interest in favor of balancing toward the empathic, and perhaps even sympathy driven altruistic interest, although some I_G curve also passes through point C; both egoistic and empathic interests are also served at point C.

A more balanced, we might say, symbiotically balanced, outcome with egoistic pursuits affecting the purchase of social capital reciprocally affecting AOG may be at point B (Fig. 1). This individual has found a mix of (I_G'', I_M'') that gives good balance in the two kinds of goods being enjoyed in the community, perhaps working at a “good enough” job while enjoying the larger quantity of the social capital good q'' at the relatively low price p . As we will see in detail more later, it may also be possible that the total outcome is potentially greater than the sum of the parts at point B, if the individual has indeed found the symbiotically complementary (in contrast to competitive, or

independent) balance between the material and the emotional side of these goods. The first order conditions are:

$$(5) \quad \frac{\partial \Phi}{\partial AOG} = \frac{\partial V}{\partial I_G} \frac{\partial I_G}{\partial AOG} + \frac{\partial V}{\partial I_M} \frac{\partial I_M}{\partial AOG} - \lambda \underline{\underline{set}} 0$$

$$(6) \quad \frac{\partial \Phi}{\partial q} = \frac{\partial V}{\partial I_G} \frac{\partial I_G}{\partial q} + \frac{\partial V}{\partial I_M} \frac{\partial I_M}{\partial q} - \lambda p \underline{\underline{set}} 0$$

$$(7) \quad \frac{\partial \Phi}{\partial \lambda} = y - AOG - pq \underline{\underline{set}} 0$$

The economically efficient, balanced with empathy, path OZ in Fig. 1 for satisfying the two interests is represented in

$$(8) \quad \frac{\frac{\partial V}{\partial I_G} \frac{\partial I_G}{\partial q} + \frac{\partial V}{\partial I_M} \frac{\partial I_M}{\partial q}}{\frac{\partial V}{\partial I_G} \frac{\partial I_G}{\partial AOG} + \frac{\partial V}{\partial I_M} \frac{\partial I_M}{\partial AOG}} = \frac{p}{1}$$

The expansion path equation from (8) is:

$$(9) \quad AOG = AOG(p, q, I_G, I_M)$$

Note how the subjective, others-interest element I_M also affects the location of the expansion path; this is to say, an empathy conditioned (relative) price is revealed, and the emotions and feelings in the community affect the economically efficient mix of the two goods. The demand function for q (also including these social emotional elements) is

$$(10) \quad q = q(p, I_G, I_M, y)$$

representing the demand for the social capital along the path OZ in Fig. 1, where the disciplined individual has found a balance in the egoistic and empathic forces. The emotional demand is also economically efficient.

We can derive the ego-empathy frontier in Fig. 2 associated with moving along RR' by solving equation (3) for q, obtaining

$$(11) q = (y - AOG) / p$$

We then substitute Equation (11) into $V(I_G, I_M)$,

$$(12) V = V\{I_G[AOG, (y - AOG) / p], I_M[AOG, (y - AOG) / p]\}$$

Next, we substitute the economically efficient path equation (9) into (12),

$$(13) V = V(I_G, I_M, p, y)$$

This is the ego-empathy, balanced interests frontier of Fig. 2. Notice that,

$$(14) dV = \frac{\partial V}{\partial I_G} dI_G + \frac{\partial V}{\partial I_M} dI_M + \frac{\partial V}{\partial p} dp + \frac{\partial V}{\partial y} dy$$

such that the case of $dp = dy = dV = 0$ gives

$$(15) dI_G / dI_M = TB_{MG} = - \frac{\partial V}{\partial I_M} / \frac{\partial V}{\partial I_G}$$

which represents the slope and the “trade-off balance, TB” of a frontier curve in Fig. 2

where $dV = 0$. We can also examine the shape of the resulting three dimensional surface

(envision several ego-empathy curves in Fig. 2 and the distances between them of

interest) with D_{GM} , which indicates the kind of symbiotic interdependence and the nature

of the symbiotic balancing, where D_{GM} is calculated from:

$$(16) \frac{\partial^2 V}{\partial I_G \partial I_M} = SB_{GM}$$

where the “symbiotic balance, SB” refers to changes in V through the space. We can

now consider an empirical case to help illustrate the general outcomes above.

Consider a plausible, empirical V function of the form:

$$(17) V = \iota(I_G)^2 + \tau(I_M)^2 + \gamma(I_G)(I_M) + \eta p + \kappa y$$

We choose this particular form to illustrate in the simplest possible manner the metaeconomics concept of a modular brain (after Cory, 1999; Lynne, 1999; 2002) with semi-autonomous yet still highly interdependent egoistic self-interest I_G ; empathic others-interest I_M ; and a symbiotic balancing through the interaction $I_G I_M$ (reasoning and rational) part. We also see parallels here with the notion of autonomy; homonomy; and heteronomy in Angyal (1967). Autonomy is a more fundamental trend associated with the pursuit of the self-interest, reflecting mastery and an attempt at control of the natural and social environment in which the individual operates. Homonomy is a more fundamental trend associated with the pursuit of the other-interest, reflecting the pursuit of unity; relatedness with others. Heteronomy is also at work and associated with freedom of choice and actual control one is able to bring over the environment, recognizing that at least some outside-governance may be the reality, and perhaps even necessary when self-control/self-governance fails.

Assume for sake of discussion that $\iota, \tau > 0$. For this simple case, and for any given levels of p and y , we would posit that a relatively large ι indicates an individual operating primarily with egoistic self-interest, reflecting the deeper autonomous trend. A relatively high τ can be taken to mean a more substantive empathic others-interest in social emotional goods associated with building social capital, and representing the deeper homonomous (relatedness) trend, i.e., building networks with others based on common norms leading to trust.

A substantive γ would indicate symbiotic interdependence; the possibility of symbiotic outcomes; and jointness (or symbiotic independence if it is zero) as between the two interests and psychological trends. Using the specific form in equation (17) we

could find when $\iota, \tau > 0$ and $SB_{MG} < 0$, which is the case of symbiotic complementarity in the balancing, as illustrated in Fig. 2. That is, $(\partial V / \partial I_G)$ decreases, indicating more value is being obtained due to I_G increasing as I_M increases (the iso-curves in Fig. 2 get further apart as we move along some path OZ), suggesting that egoistic I_G (material outcomes) are enhanced by the pursuit of social capital related goods, in this case the social emotional good q . Similarly, pursuing the self-interest with material goods also enhances the social emotional outcomes. So, in effect, the total arising from the balancing is greater than the sum of the parts, due to the symbiotic complementarity between I_G and I_M .

Again referring to Equation (17), if $SB_{MG} > 0$, only the rational region AC will exist in Fig. 2 (assuming $\iota, \tau > 0$), indicating balancing of the symbiotically competitive type: The ego-empathy curves in Fig. 2 will become closer as we move along some path OZ . That is, $(\partial V / \partial I_G)$ increases as more I_M is pursued, implying that I_G is decreasing, i.e., I_G and I_M are competitive, essentially vying for expression within self. If one goes up, the other declines: More material goods means less social emotional outcome, and more social emotional goods means less material goods.

With $SB_{MG} = 0$, indicating symbiotic independence (no symbiosis) balancing, again, only AC will appear and the total is exactly the sum of the parts (rather than somewhat more with symbiotic complementarity and somewhat less with symbiotic competitiveness), with the ego-empathy curves equally spaced as we move out on OZ . The pursuit of self-interest does not lead to more or less other-interest focused mainly on the social emotional goods; pursuing the other-interest does not lead to more or less material goods. This is to say, egoistic pursuits do not affect empathy and empathy (i.e.,

emotion) does not affect egoistic pursuits for this case. It might be expected that this kind of independence will not occur very often in the real world, although it is presumed to apply to all cases in standard microeconomics, by default, in that empathy is left out of the model.

We also need to focus attention on the TB_{MG} , as also illustrated in Fig. 2 and reflecting the nature of the disciplined kind of choosing at work, with discipline defined as choosing between egoistic (largely material and pleasure seeking) and empathic (largely moral and doing-the-right-thing, social emotional) pursuits. Again using the quadratic form in Equation (17) to illustrate, we obtain,

$$(18) \quad dI_G / dI_m = TB_{MG} = - \frac{2\tau I_M + \gamma I_G}{2I_G + \gamma I_M}$$

Notice that when $\lambda = 0$, the $TB_{MG} = - (2\tau I_M / 2I_G)$: Material aspects are simple trade-offs (due to no interactions), resolved through the pricing/marketing system, as standard microeconomics suggests.

When $\lambda > 0$ (and, still assuming $\iota, \tau > 0$), we have symbiotic competitiveness, and $TB_{MG} < 0$ throughout the range; regions RA and CR' cannot occur for this case. When $\lambda < 0$, another kind of complementarity can occur, wherein $TB_{MG} > 0$, giving the irrational zones RA and CR' (in both Figs. 1 and 2), irrational because both interests are served by moving out of these zones. More of both kinds of outcomes are possible in these zones. In Fig. 1, the rational zone is between (and including) the paths 0G and 0M, giving the rational zone AC in Fig. 2.

An intriguing alternative set of relationships is given by the situation where $\iota, \tau < 0$. It is now possible to have RA and R'C as well as AC regions when $\lambda > 0$, but if $\lambda < 0$,

then $dI_G/dI_M = TB_{MG} > 0$ (we have only RA and CR' regions) throughout the whole range of the function.

Intriguingly, mainstream applications of microeconomic theory presume (generally without empirical test) that $\iota = 1$, $\tau = 0$, $\gamma = 0$, so $TB_{MG} = 0$, and we are at point A in Fig. 2 (and in Fig. 1). That is, the egoistic, self(ish)-interested, autonomy oriented, individual acts as though community (and the homonomous, relatedness side of a choice) does not matter, and social capital is nonexistent (or, irrelevant) in selecting Path OG, and social emotional goods do not exist. Also notice that the microeconomic result is the default case if we fail to reject the null hypotheses of no empathic influence

At the other extreme, which seems to be the view taken in mainstream sociology, a socially and community oriented individual would, usually through outside community and social control (in that it is generally doubted that the individual has sufficient self-discipline and self-control to do this on one's own), completely subdue the self(ish)-interest. This individual purchases goods on the others-interest path OM acting as if $TB_{MG} = -\infty$ (i.e., presuming that $\tau = 0$ and $\gamma = 0$) at Point C in Fig. 2 (maybe even $TB_{MG} > 0$ in CR' in irrational pursuit of social capital). This perhaps sociological result is the default if we fail to reject the null hypothesis of no egoistic interest.

We posit a less drastic outcome, one seeing that a disciplined and balanced person, a disciplined person in self-control, one who has balanced the autonomous and homonomous trends (after Angyal, 1965) and the self-interests with the other-interests (after Cory, 1999; Lynne, 1999), will operate in the region where $-\infty \leq (TB_{MG}) \leq 0$ while recognizing nature of the heteronomy in place... the control... is such that the individual has substantive control and power over her or his own destiny. We would also

expect that $SB_{MG} < 0$, that empathy and ego, the two interests, are symbiotically complementary: Increasing either one tends to enhance the other.

By explicitly recognizing empathy, and both natural trends in humans, the solution is also shown less deterministic with the individual perhaps even vacillating along the symbiotically complementary frontier (and on this surface) between points like A and C as conditions and the (heteronomic) context change: "It is the person's relatedness to the world through mastery and through love which alone makes life worthwhile and which cannot be achieved in isolation (Angyal, 1965, p. 89)." That is, autonomy and homonomy are symbiotically complementary, and we find the balance in the two trends, in some region AC on the symbiotically complementary surface of our life, assuming a substantive degree of freedom to choose... the heteronomy is not overly tilted to outside government (in contrast to internal government). As a result, we would see emergence of conditioned economic (and community) choice, wherein a more satisfactory mix of interests on Path OZ is achieved, where selfishness is conditioned by the need for relatedness, and efficiency conditioning the relationships, perhaps at a point B in both Figs. 1 and 2.

This is to say, we might also reasonably expect an effect relating to the freedom to choose... the extent to which power and control influence the choice within the environment, the heteronomy of the situation will be an important phenomenon, as represented in this variant on V:

$$(19) \quad V = \iota(I_G)^2 + \tau(I_M)^2 + \gamma(I_G)(I_M) + \alpha(N) + \eta p + \kappa y$$

where N = a measure of the freedom to choose... in effect a measure of the power and influence, the degree of control, that others have on this individual's choice of V, and

balance in the material v. social emotional goods. Leaving N out of the equation will lead to inappropriate estimates for ι , τ , λ in that the manner in which an individual interacts with the environment... how much control the person can bring to bear to offset the natural tendency for control from outside the individual... clearly affects the autonomous trend. It also influences the homonomous trend, in that some may allow control if it fits with the homonomy of the group the individual chooses to interact with.

Finally, it is perhaps important to note that this kind of a model leads to describing economic processes along expansion paths rather than along iso-curves: Trade-offs and options are really quite limited. This is to say, the consumer is quite limited in choices, leading to the economics of limitative processes, much like Frisch (1965) developed in early versions of production economics. Unfortunately, the economics of limitative processes never made a substantive showing in the mainstream of economics, the latter always favoring independence of free choices (like Friedmans' "freedom to choose" notion), and generally assuming away all technically and symbiotically interdependent cases.

This fact is fascinating enough, and perhaps needs to be pursued by an economic historian, as to why only the autonomous pursuit of the self-interest made its way into both modern consumption and production economics, and the theory of markets. One might ask if some political ideology is at work, here, subtlety hidden in the equations and mathematics of allocable inputs, single utility, and presumed independence of all kinds in economic analysis. A politically neutral economics would not only recognize the need for autonomy represented in the pursuit of self-interest but would also at least ask about homonomy... the need for unity with others and ideas... and about heteronomy... the

extent to which outside control is at work... and the associated symbiotic and other kinds of limitations arising in choice, in both consumption and production in a market economy.

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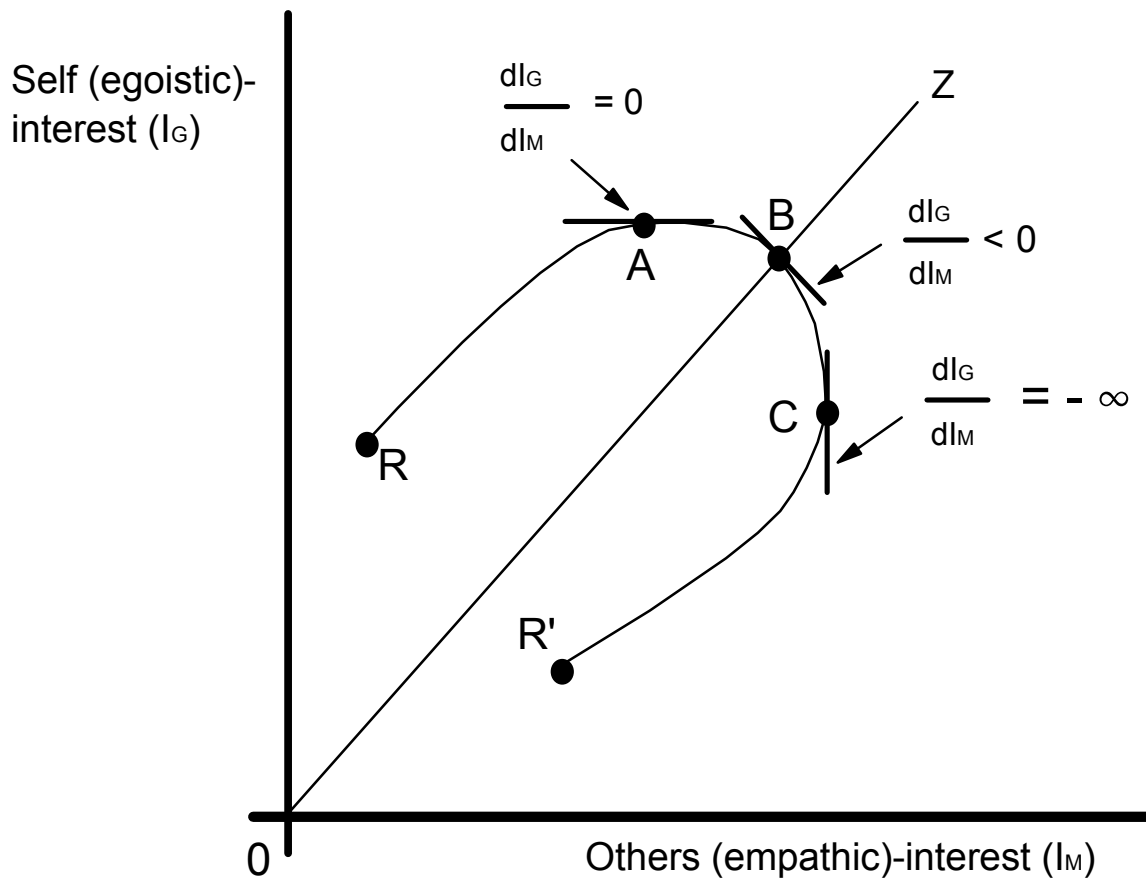


Figure 2. Ego-empathy frontier representing symbiotic balancing in the pursuit of the egoistic self(ish)-interest (I_G) in a job and the empathic others-interest (I_M).