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Index and an Inverted U-Shaped Utility-Wealth Theory

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Abstract

This paper explores a possible effect of social capital on the relationship between utility and wealth. Material status sensitivity is considered in constructing the individual social-capital index. The incorporation of the index into the individual's utility function leads to the proposition that if utility is directly increased by wealth but indirectly reduced by diminishing intensity and quality of sincere social interaction as the material-status-gape widens, there exists an inverted U-shaped relationship between utility and wealth. People located in the lower and upper tails of the wealth distribution are less content and hence more vulnerable to depression.

1. Introduction

Conventional economic theory suggests that the greater the individuals' stocks of physical and human capitals the greater their income and consumption possibilities and hence the higher their utility levels. Thus, individuals' utility levels can be expected to rise as society becomes more technologically advanced and affluent. However, this expectation is not compatible with the rise in the prevalence of mental depression and with its distribution during the last three decades. Consistently with Putnam's (1995, 2000) diagnosis of the changes in communities in the United States and the impact of these changes on people, there may be another type of capital affecting individuals' levels of utility.

This paper refers to the individual's combination of physical and human capitals as the individual's material wealth (wealth, shortly). The paper argues that social capital is adversely affected by material wealth disparities and its erosion, in

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turn, reduces its owners' utility level. The paper measures social capital in a manner that facilitates the exposition of this possible indirect effect of material wealth, hence the full effect of material wealth, on the individual utility.

Consistently with Bourdieu's (1986) definition,[1] the paper deals with the social capital of the individual members of the community. The use of the term is also compatible with Sobel's (2002) complementary interpretation.[2] However, the set of benefits associated with social capital includes those that are not stemming from strategic (market-return-oriented) social interactions: mutual respect, trust, solidarity, friendship, cultural nourishment and spiritual stimulation. Hence, throughout the paper the term social capital stands for individual sincere social capital. The individual strategic social capital is taken to be a component of the individual's human capital and is included in the individual's material wealth.

Social capital is likely to be affected by a wide range of personal characteristics and factors including, charisma, age, appearance, mobility, education, occupation, homeownership, time-preferences and value of time and also by the aggregate social, cultural, political and economic structures and conditions of the community. (Cf., Coleman, 1988; Di Passquale and Glaeser, 1999; Glaeser and Sacerdole,1999; Putnam, 2000; Glaeser, Laibson and Sacerdole, 2002). In view of the objective of the paper, and for simplicity, the analysis of social capital is focused on the effect of material-status disparities. The analysis reveals that, as long as people's social interaction is sensitive to material-status disparities, the incorporation of the non-pecuniary returns on social capital into the utility function generates an inverted U-shaped relationship between utility and material wealth. The underlying rationale is

[1] "An attribute of an individual in a social context". (Bourdieu, 1986, p. 241)
[2] An attribute describing the "circumstances in which individuals can use membership in groups and networks to secure benefits" to an extent that "depends on the person's connections, the strength of these connections, and the resources available to their connections." (Sobel, 2002, p. 139)

that in addition to generating utility from private consumption of goods and financial security, people derive utility from sincere social interaction. However, while their income, consumption possibilities and financial security increase with their material wealth, the intensity and quality of their association are eroded by the differences in their levels of material wealth. Up to a critical level of material wealth the former, direct effect of wealth is dominant. Beyond it, the latter, indirect effect of wealth is dominant.

The effect of wealth on its owner's social capital is outlined in a greater detail in section 2. An index that relates the individual's level of social capital to the individual's wealth and community size is constructed in section 3. A community (aggregate) social-capital index is also constructed. Section 4 incorporates the individual social-capital index into the individual's utility function, presents the inverted U-shape relationship between utility and material wealth, and identifies the utility-maximizing level of wealth. Section 5 indicates the possible contribution of a U-shaped utility-wealth relationship for explaining three phenomena—wealthy-people depression, wealthy people's publicized donations, and the individually non-optimality of wealth-equality. It also articulates the implied testable hypotheses.

2. Material-status sensitivity, community size and individual social-capital

Consider a community of N members where, for simplicity, the distribution of wealth-share is symmetric. The wealth-share difference between any two community-members i and j is not necessarily known to i and j initially, but is realized during their interaction. The community members are material-status-sensitive: each of them is aware of, uncomfortable with, and has an aversion toward, deviations from his level of material wealth. Hence, every member's level of sincere social association with

any other member is responsive to their wealth-share proximity. Recalling the assumption that wealth-share is symmetrically distributed, the greater the difference between a member's wealth-share and the mean of the wealth-share distribution the weaker the member's overall level of association with the rest of the members of the community. In other words, an index of the *i*-th member's overall intensity and quality of social interaction with the rest of the community-members is negatively related to the difference between his actual wealth-share (w_i) and the hypothetical equal-wealth share (*1/N*). Along the positive range of the personal material-status-disparity spectrum ($w_i - 1/N > 0$) people are subjected to intensified *tall-poppy* syndrome. The greater the individual's wealth-share-deviation from the equal share the more frequently he encounters jealousy, hatred, strategic and deceitful behaviors, peer-rivalry and media intrusion—emotions and actions that adversely affect the quality and, in turn, the intensity of his social interaction. Moreover, snobbism may be correlated with affluence. Thus, the greater the individual's wealth the higher the wall of his castle. Along the negative range of the personal material-status-disparity spectrum ($w_i - 1/N < 0$) people are subjected to intensified stigma and marginalization. The greater the individual's relative poverty the stronger the stigma and the higher the degree of his marginalization. In addition, pride may cause a self-imposed withdrawal from social interaction for concealing poverty and avoiding shame and clemency.

An ultimate materially poor person ($w_i = 0$) may receive expressions of solidarity from people in a similar condition and care from some compassionate members of the community. In contrast, an ultimate materially rich person ($w_i = 1$, a person controlling the entire material wealth of the community) is exposed to utmost expressions of hostility from the wealth-deprived *N-1* members of the community.

Hence, an ultimate poor person's stock of sincere social capital is likely to be larger than that of an ultimate rich person.

The size of the community is already introduced through the equal wealth-share term (*1/N*). Since this introduction is indirect it does not necessarily represent the full effect of the community size on the individual's social association. Hence, its consideration *per se* might render the construction of the individual social-capital index improper. Therefore, a possible direct effect of community size is taken into account. It is assumed that the intensity and quality of the individual's social interaction are also affected by the number of the people with whom the individual actively and passively interacts. Up to an individually critical number, $\tilde{N}_i$, a positive social agglomeration effect is dominant. Beyond $\tilde{N}_i$, crowding and congestion take over and the diminishing overall intimacy and trust (i.e., impersonalization) depreciate the individual's intensity and quality of social interaction. This individually optimal (and desired) community size $\tilde{N}_i$ may be larger (e.g., in small rural communities), or smaller (e.g., in large cities), than the actual community size *N*.

An individual social-capital index reflecting the aforementioned features is constructed in the next section. Although the individual social-capital index is explicitly related only to the deviations of individual's wealth and desired community-size from the average wealth and actual community-size, respectively, its sensitivities to these deviations are affected by the individual's other characteristics—rate of time preference, ideology, dynamism, age, gender, appearance, education, occupation, marital status, family structure, etc.

3. Social-capital index

We require the social capital index of person i (SCI_i) to satisfy the following conditions:

i. $\frac{dSCI_i}{d(w_i - 1/N)^2} < 0$ (monotonically decreasing in the individual's wealth-share-deviation from the equal share),

ii. $\frac{dSCI_i}{d(N - \tilde{N}_i)^2} < 0$ (monotonically decreasing in the distance between the actual size and the individually optimal size of the community),

iii. $SCI_i(w_i = 0) > SCI_i(w_i = 1)$ for every $N > 1$ (the social capital of an ultimate poor person is larger than that of an ultimate rich person),

iv. $0 \le SCI_i \le 1$,

v. $SCI_i(w_i = 1/N, N = \tilde{N}_i) = 1$,

vi. $SCI_i(N = 1) = 0$ (there is no social capital without a human company),[3] and

vii. $SCI_i(w_i = 1, N > 1) = SCI_N^1 > 0$ (even an ultimate rich person can have some social capital).

We commence the construction of the individual social-capital index by considering a convenient specification that satisfies conditions i, ii and v:

$$SCI_i = 1 - \delta_i(w_i - 1/N)^2 - \mu_i(N - \tilde{N}_i)^2 \qquad (1)$$

where δ_i and μ_i are positive scalars and indicating the marginal depreciation effects of the deviation of the wealth-share of member i from the equal share and the

[3] Note that $w_i = 1$ when $N = 1$.

deviation of the community size from his desired size $\tilde{N}_i$, respectively. The magnitudes of these marginal effects depend on personal characteristics.[4]

By imposing condition vi on this specification:

$$\mu_i = \frac{1}{(1-\tilde{N}_i)^2}. \tag{2}$$

By imposing this result and condition vii on (1):

$$\delta_i = \frac{1 - SCI_N^1 - \left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2}{(1-1/N)^2}. \tag{3}$$

For ensuring that δ_i and μ_i are positive, the following additional condition must be fulfilled:

viii. $1 < \tilde{N}_i < \frac{N}{\sqrt{1-SCI_N^1}} - 1$.

That is, person *i* neither remain in seclusion nor stay in a community whose size is larger than $\sqrt{1-SCI_N^1} + \left[1-\sqrt{1-SCI_N^1}\right]\tilde{N}_i$.

When this condition is obeyed, the individual social capital index is:

$$SCI_i = 1 - \left[1 - SCI_N^1 - \left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2\right]\left[\frac{w_i - 1/N}{1-1/N}\right]^2 - \left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2 \tag{4}$$

and also satisfies conditions iii and iv.

Let W_i denote the absolute level of the individual's material wealth and $\overline{W}$ the average material wealth in the community. Then $\frac{w_i - 1/N}{1-1/N} = [(N-1)\overline{W}]^{-1}(W_i - \overline{W})$ and SCI_i can be equivalently rendered as:

[4] For instance, an energetic, young, single, performing-art graduate may be less concerned with his current wealth disparity and more concerned with the deviation of the community size from his desired size.

$$SCI_i = 1 - \frac{\left[1 - SCI_N^1 - \left(\frac{N - \tilde{N}_i}{1 - \tilde{N}_i}\right)^2\right]}{[(N-1)\overline{W}]^2}(W_i - \overline{W})^2 - \left(\frac{N - \tilde{N}_i}{1 - \tilde{N}_i}\right)^2 \tag{5}$$

for every community with $1 < N < \sqrt{1 - SCI_N^1} + \left[1 - \sqrt{1 - SCI_N^1}\right]\tilde{N}_i$.

Though it is not an essential part of the paper, a community (aggregate) social-capital index (CSCI) is proposed. A meaningful CSCI is equally responsive to, and increasing in, the community-members' individual social-capital levels, but decreasing in their variation. We therefore based the construction of CSCI on the average and on the distribution-free measure of variation—the Gini coefficient—of SCI:

$$E_{SCI} = \frac{1}{N}\sum_{i=1}^{N} SCI_i \tag{6}$$

$$G_{SCI} = \frac{\sum_{i=1}^{N}\sum_{j=1}^{N}\left|SCI_i - SCI_j\right|}{2N(N-1)E_{SCI}} . \tag{7}$$

We require CSCI:

i. to rise monotonously with E_{SCI},

ii. to decline monotonously with G_{SCI}, and

iii. to lie within the (0,1) interval.

So long that $G_{SCI} > 0$, these conditions are satisfied by $1 - \exp(-E_{SCI} / G_{SCI})$. Recalling equations (6) and (7), our proposed index of the community social capital is:

$$CSCI = 1 - 1/\exp\{[2(1-1/N)(\sum_{i=1}^{N} SCI_i)^2] / \sum_{i=1}^{N}\sum_{j=1}^{N} \left| SCI_i - SCI_j \right| \}. \tag{8}$$

4. Inverted U-shaped utility-wealth relationship

We assume that the individual's utility is derived from the return on his portfolio of assets—material wealth and social capital. The return on material wealth indicates the individual's consumption and saving possibilities. The return on the individual's social capital is equal to the individual's monetary appreciation of (and maximum willingness to pay for) the level of mutual respect, trust, solidarity, friendship, cultural nourishment and spiritual stimulation received from his community. Let r_w and r_s denote the rates of return on material wealth and social capital, respectively. While r_w is market determined, r_s is individualistic and reflecting the effects of personal characteristics (e.g., charisma, age, gender, appearance, education, mental disposition, social awareness, ideology, dynamism, ethnicity, nativity, and family structure) and community characteristics (e.g., dominant doctrine, age structure, educational structure and ethnic-native composition) excluded from the construction of the SCI. The synthesis of these personal characteristics and community characteristics affects the individual's ability to appreciate and extract the aforementioned social benefits.

Recalling Eq. (5), the total return on the individual's portfolio of material and social assets can be concentrated on material wealth:

$$R_i = r_w W_i + r_s SCI_i = r_s(1-\phi_i \overline{W}^2) + (r_w + 2r_s\phi_i\overline{W})W_i - r_s\phi_i W_i^2 - r_s\left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2 \quad (9)$$

where,

$$\phi_i = \frac{\left[1 - SCI_N^1 - \left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2\right]}{[(N-1)\overline{W}]^2} \quad (10)$$

and is, by construction, positive. Eq. (9) reveals an inverted U-shaped relationship between the return on the individual's portfolio and the individual's material wealth. Assuming that the individual's utility (u_i) is increasing and concave in R_i (i.e., $u_i'(R_i) > 0$ and $u_i''(R_i) < 0$), there also exists an inverted U-shaped relationship between utility and material wealth. As displayed by Figure 1, this inverted U-shaped relationship reveals that becoming more affluent does not necessarily imply a higher level of satisfaction. By virtue of the necessary condition, $u_i'(R_i(W_i^*))R_i'(W_i^*) = 0$, the utility-maximizing wealth is:

$$W_i^* = \overline{W} + \frac{r_w}{2r_s}\left[\frac{(N-1)^2\overline{W}^2}{1 - SCI_N^1 - \left(\frac{N-\tilde{N}_i}{1-\tilde{N}_i}\right)^2}\right]. \quad (11)$$

The individual's utility-maximizing material wealth is larger than the average wealth in his community. The preferred extra material wealth is positively related to the ratio of the rates of return on material wealth and social capital. The novelty is that the effect of this ratio is compounded by the average material wealth in the community, by the actual size of the community, by the individual's desired size of community, and by the level of social capital associated with potentially becoming the ultimate

rich person. Up to W_i^*, material wealth complements social capital in generating utility. Beyond W_i^*, the negative indirect marginal effect of material wealth on utility (through the erosion of social capital) exceeds its positive direct marginal effect.

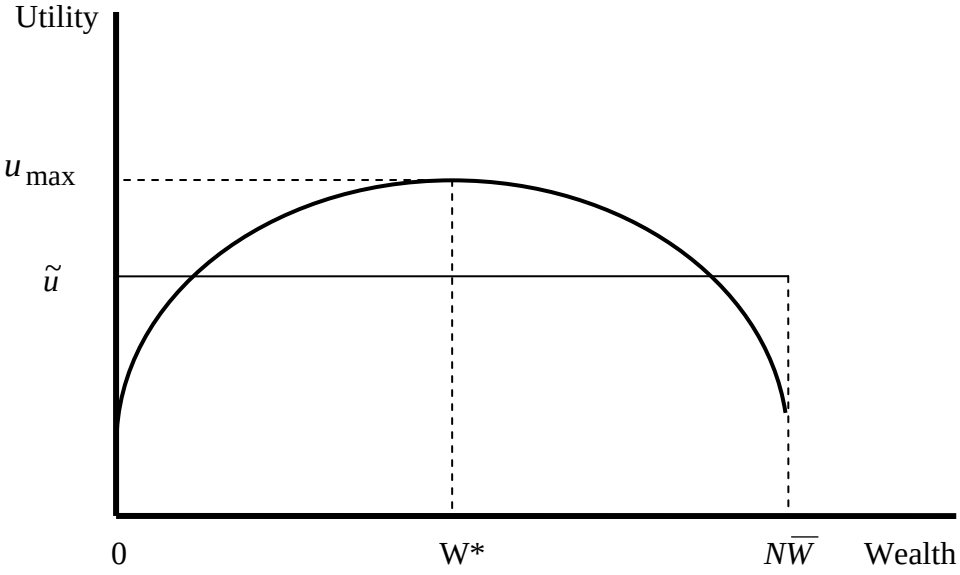

Figure 1. An inverted U-shaped utility-wealth relationship

The construction and analysis of the individual's optimal portfolio of material wealth and social capital can be extended to the case where the rates of return on these assets are random. Suppose that the individual's utility is $u = 1 - e^{-\beta R}$ (with the positive scalar β indicating the individual's degree of absolute risk aversion) and r_w and r_s are normally distributed with means μ_w, μ_s, variances σ_w^2, σ_s^2 and covariance σ_{ws}. Then, maximizing $E(u(R))$ is equivalent to maximizing $\mu_w W + \mu_s SCI - 0.5\beta(\sigma_w^2 W^2 + 2\sigma_{ws} WSCI + \sigma_s^2 SCI^2)$. The construction of the optimal portfolio for an expected-utility-maximizer along these lines implies that investment in social capital is relatively large (small) in communities in which the

mean of the rate of return on social capital (material wealth) is relatively large, the variance of the rate of return on social capital (material wealth) is small and the correlation between the rates of return on social capital and material wealth is not largely negative.

5. Conclusion

By focusing on the role of material wealth and assuming that sincere social interaction between any two individuals is adversely affected by their material-status differential, the paper constructs an index of individual social capital. By incorporating the return on individual social capital into the individual's utility function, an inverted U-shaped relationship between utility and material wealth emerges. This inverted U-shaped relationship may provide some explanation to three phenomena and implies several testable hypotheses.

A notable phenomenon is a prevalent, neither accidentally nor genetically caused, depression within the group of wealthy people. It can be argued that when the individual's utility level is lower than a mentally accommodating threshold (say $\tilde{u}$) the individual is discontent. In the case of wealthy people in particular, a low level of utility is due to a low frequency and quality of sincere social interaction. A prolonged discontent might lead to depression. As implied by the inverted U-shaped curve in Figure 1, people located in the lower and upper tails of the material-wealth spectrum are vulnerable to depression. The closer they are to the extremities of the poverty-affluence spectrum the higher the likelihood and intensity of their depression. An implied testable hypothesis is that depression is more prevalent within the group of people in the lower and upper tails of the material-wealth spectrum.

Another well-known phenomenon is non-anonymous, rather heavily publicized, donations of large shares of wealth to public projects. In contrast, true philanthropy is anonymous. An inverted U-shaped relationship between utility and material wealth implies that even a non-philanthropist *i* endowed with wealth $W_i > W^*$ can increase his utility by restructuring his portfolio of material and social assets. Recalling the individual social-capital-index equation (5), a non-anonymous donation is a wealthy person's investment in his (and in his family's) social capital. His optimal donation is his futile, harmful, excessive material wealth: $W_i - W^*$. In this respect Eq. (11) suggests the following testable hypotheses. The size of the donation decreases with the rate of return on material capital. Moreover, the larger the average material wealth and size of the community the greater the donation-moderating effect.

An ego complex of being above the average, but not provokingly so (i.e., not a tall-poppy), is also a notable phenomenon. Although the individual's social capital is eroded by material-wealth-disparities, the inverted U-shaped relationship reveals that wealth-equality is not desired by utility-maximizing people. Yet, the lower the ratio of the rate of return on material wealth to the rate of return on social capital the smaller the gape between the utility-maximizing wealth, W_i^*, and the equal, social-capital-maximizing wealth, $\overline{W}$. It is likely that this ratio is lower for a member (endowed with adequately matching characteristics) of a traditional, religious community than for a person (endowed with adequately matching characteristics) living in a modern, secular society. This, in turn, implies (if all people are utility-maximizers and suitable members of their communities) the following testable hypothesis: the degree of

material-wealth-inequality in traditional, religious communities is lower than in modern, secular ones.

Finally, the discrepancy indicated in the opening paragraph between the conventional economic theory proposition on the relationship between utility and wealth and the rise of depression in technologically advanced and materially affluent communities can be resolved by including sincere social capital in the definition of wealth.

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