Economic Principles and Problems: The Foundations of Social Capital

Part IIB (Papers 1 and 2)

Lent 2004: Tu 11 and W 12 (weeks 1-3)

(Professor Sir Partha Dasgupta)

Summary

Over the past dozen years or so, the idea of social capital has enjoyed wide and cumulative engagement among sociologists and political scientists. It is now one of the most popular subjects of research in the social sciences. Although the name suggests that the object in question is to be viewed as a durable commodity - a staple category in economics - professional economists as a group have been ambivalent about the notion. I have colleagues who regard the research programme to be an overblown piece of public relations. Some would run a mile if you mention "social capital" in their presence. But I also have colleagues who feel the programme has unearthed something of great significance to our reading of the social world. Some among them even use "social capital" as a peg on which to hang all those informal engagements we like, care for, and approve of. So it should not be surprising that the literature is something of a mess. (In order to give you an indication, I have included two articles in the Reading List that display the extent of the mess. But I leave it to you to identify them.)

In these lectures I shall approach the concerns of the literature on social capital, *not* by offering a catalogue of who wrote what, nor by asking what various writers may have meant by the term, but by developing a general formulation of the problem of resource allocation facing an arbitrary group of people. We will ask what mechanisms there might be for ensuring that agreements among one another in the group are kept. A distinction will be drawn between mechanisms involving external enforcement of agreements and those involving mutual enforcement of agreements. This distinction will enable us to develop a sharp notion of "social capital", one that is devoid of ambiguities, and is also operational. Specifically, I shall show that mechanisms involving mutual enforcement of agreements are at the heart of the concept of social capital, in the sense that social capital helps to create such mechanisms. I shall use the theory of repeated games and of games involving the maintenance of "reputation" to explain the way such mechanisms work. Once the microfoundations are developed, we will inquire how alternative resource allocation mechanisms would reflect macroeconomic performance. I shall demonstrate how "social capital" can be decomposed into constituents of (a) "human capital" and (b) "total factor productivity". The idea will be to reduce social capital to an economic category, which was very much the intention of early writers on the subject (see Reading (5)).

In developing the microfoundations, I shall be anxious to remove the warm glow that surrounds the topic in most current writings. To be sure, both theory and empirics have identified circumstances in which all members of the group who have helped to create their social capital benefit from that creation. However, I shall show that theory and empirics have also identified circumstances in which the accumulation of social capital is bad news *for some of the very members who have helped to accumulated it*. In short, the context matters: there is a gulf between the productivities of social capital in poor agrarian societies and in rich industrial ones.

Readings

The core reading for this lecture course is Reading (8). The paper can also be found on my web page in the Faculty's website. But as my own understanding of the subject has improved since I wrote the piece, I shall be providing lecture handouts containing additional technical material.

Collections

There are several collections of essays on social capital. Of particular relevance to this course of lectures:

(1) Dasgupta, P. and I. Serageldin, eds. (2000), *Social Capital: A Multifaceted Perspective* (Washington DC: World Bank).

(2) Grootaert, C. and T. van Bastelaer, eds. (2002), *The Role of Social Capital in Development: An Empirical Assessment* (Cambridge, UK: Cambridge University Press).

(3) Ostrom, E. and T.K. Ahn, eds. (2003), *Foundations of Social Capital* (Cheltenham, UK: Edward Elgar).

Thematic Readings

A. *Trust: Why are Agreements Kept*?

(4) P. Dasgupta (1988), "Trust as a Commodity", in D. Gambetta, ed., *Trust: Making and Breaking Cooperative Relations* (Oxford: Basil Blackwell).

(5) J.S. Coleman (1988), "Social Capital in the Creation of Human Capital", *American Journal of Sociology*, 94 (Supplement): S95-S120. Reprinted in Reading (3).

(6) P. Seabright (1997), "Is Cooperation Habit-Forming?", in P. Dasgupta and K.-G. Mäler, eds., *The Environment and Emerging Development Issues*, Vol. II (Oxford: Clarendon Press).

(7) R. La Porta, F. Lopez-de-Silanes, A. Schleifer, and R. Vishny (1997), "Trust in Large Organizations, *American Economic Review*, 87 (Papers & Proceedings): 333-338. Reprinted in Reading (1).

(8) P. Dasgupta (2003), "Social Capital and Economic Performance: Analytics", in Reading (3).

B. *Critiques of the Notion of Social Capital*

(9) K.J. Arrow (2000), "Observations on Social Capital", in Reading (1).

(10) R.M. Solow (2000), Notes on Social Capital and Economic Performance", in Reading (1).

C. *Social Capital and Economic Development*

(11) R.D Putnam, with R. Leonardi and R.Y. Nanetti (1993), *Making Democracy Work: Civic Traditions in Modern Italy* (Princeton, NJ: Princeton University Press).

(12) J.-M. Baland and J.-P. Platteau (1996), *Halting Degradation of Natural Resources: Is There a Role for Rural Communities*? (Oxford: Clarendon Press). Choose a chapter that interests you. The book has excellent case studies on the management of common property resources.

(13) M. Woolcock (1998), "Social Capital and Economic Development: Toward a Theoretical Synthesis and Policy Framework", *Theory and Society*, 27: 151-208. Reprinted in Reading (3).

(14) P. Collier (2002), "Social Capital and Poverty: A Microeconomic Perspective", in Reading (2).

(15) M. Woolcock and D. Narayan (2000), "Social Capital: Implications for Development Theory, Research, and Policy", *The World Bank Research Observer*, 15: 225-249. Reprinted in Reading (3).

(16) D. Narayan and L. Pritchett (1999), "Cents and Sociability: Household Income and Social Capital in Rural Tanzania", *Economic Development and Cultural Change*, 47: 871-889.

(17) Reading (8).

D. *The Dark Side of Social Capital: Exploitation*

(18) S. Ogilvie (2003), *A Bitter Living: Women, Markets, and Social Capital in Early Modern Germany* (Oxford: Oxford University Press). (Especially the final Chapter. This offers a historical case study.)

(19) Reading (8). Lecture Notes to be distributed on the underlying theory of exploitation *within* a group.

E. *Social Capital and Macro Performance*

(20) Reading (8). Lecture Notes to be distributed.

(21) S. Knack (2002), "Social Capital, Growth, and Poverty: A Survey of Cross-Country Evidence", in Reading (2).

(22) E.L. Glaeser, D. Laibson, and B. Sacerdote (2002), "An Economic Approach to Social Capital", *Economic Journal*, 112: F437-F458.

Lecture Notes on Social Capital, 1: Part IIB Economics, Lent 2004

Professor Partha Dasgupta

I want to offer you a few examples of situations where cooperation is desired by the parties. My choice has been motivated by the kinds of empirical studies that have been undertaken in poor countries. But if you think about them for a while, you will discover that the examples are canonical:

1. Mutual Insurance: Communities vs Markets

You will have studied the advantages of risk pooling. Here is a model that illustrates why communitarian insurance schemes are unlikely to be satisfactory.

In a certain village there are N households (i,j = 1,2,...,N). If x_i ($\geq$ 0) is household i's income, its utility is $u(x_i)$, where $u'(x_i) > 0$ for all x_i. However, incomes are uncertain. We want to show formally that by insuring one another, every household can reduce its risks. Mutual insurance amounts to *risk-sharing*. In the insurance literature risk-sharing is widely referred to as *risk-pooling*. I follow that convention here.

Households are expected-utility maximizers, which means that $u(x_i)$ is unique upto a positive affine transformation. It will be useful first to rehearse a well-known result on the cost of bearing risk. This is done in Section 1. In Section 2 I show that risk-averse households would want to pool their risks. We also confirm that it is not possible for households to obtain complete insurance coverage by pooling their risks if, as would typically be the case in a village setting, incomes are correlated. This is an inherent limitation of insurance schemes that are confined to a community's members.

Markets for insurance are able to cast their nets a lot wider. They are not confined to a village. Markets can pool the risks of households living far away from one another. Governments too can pool risks widely. They can thereby provide health care for citizens, prevent famines, and compensate flood victims. As I am interested here in the formal character of insurance, I do not distinguish between competitive insurance markets and government insurance schemes.

In order to study competitive insurance markets, I construct a model in which large numbers of households face independent risks. This is done in Section 3. We confirm that in such markets households are able to divest themselves entirely of risk. This suggests that markets are better placed than communities to provide insurance. However, insurance does not invariably amount to a pure sharing of risks: the expected values of household risks depend upon the extent to which households take precautions against bad outcomes. If households take less precautions against bad outcomes because they have taken out insurance, the expected income of the insured, taken as a whole, would be lower. Now markets could be presumed to be subject to greater *moral hazard* than communities, because "neighbours" are better placed than insurance firms to observe household behaviour.[1] One can argue, in short, that households are able to reduce risk more in insurance markets than in community insurance schemes; whereas, expected incomes are higher in community insurance schemes, because households work harder there. There are then two forces at work: one works in favour of markets, while

[1] The phenomenon of moral hazard was defined in Chapter 1.

the other works in favour of communities. In Section 4 I present a quantitative model that captures the combined effect of the two forces.

The question arises whether, by clever design of contracts, insurance firms could overcome their moral hazard problem. In Section 5 I study an example where the contracts can be so designed that households would wish to take precautions against bad outcomes at a cost to themselves even though firms are unable to observe their behaviour. Markets are unambiguously superior to communities as a provider of insurance in the kinds circumstances reflected in the example.

1.1 The Cost of Risk Bearing for an Individual Household

In facing risk, what does a household lose? As households will be assumed to have identical utility functions, I drop the subscript i from x_i when superfluous.

The model is timeless. Let   ($\geq$ 0) be a risky income with mean μ (> 0). Taylor's theorem says that for all x in the support of the distribution that defines the risky income,

$$u(x) = u(\mu) + (x\text{-}\mu)u'(\mu) + (x\text{-}\mu)^2u''(\mu)/2 + \ldots \qquad (1)$$

Let E be the expectation operator. Assume that the risk is sufficiently small, so that we may ignore terms involving the third and higher powers of $(x\text{-}\mu)$ in the Taylor expansion (1). This implies that

$$E(u(\ )) \approx E(u(\mu)) + E((\ \text{-}\mu)u'(\mu)) + E((\ \text{-}\mu)^2u''(\mu))/2,$$

or, $$E(u(\ )) \approx E(u(\mu)) + u'(\mu)E(\ \text{-}\mu) + u''(\mu)E((\ \text{-}\mu)^2)/2,$$

or, $$E(u(\ )) \approx u(\mu) + u''(\mu)\sigma^2/2, \qquad (2)$$

where σ^2 denotes the variance of .

Re-express equation (2) as

$$u(\mu) - E(u(\ )) \approx -u''(\mu)\sigma^2/2. \qquad (3)$$

I now suppose that $u''(x) < 0$ for all x ($\geq$ 0), which, from equation (3) implies that $u(\mu) - E(u(\ )) > 0$. This means that the condition $u''(x) < 0$ can be used to define *risk-aversion*: *the household prefers a guaranteed income* μ *to a risky income whose mean is* μ. We would like to develop an index of risk-aversion. We would also like to obtain a measure of the cost that a risk-averse household incurs in facing an uncertain income.

Toward this, let δ be the solution of the equation

$$u(\mu\text{-}\delta) = E(u(\ )). \qquad (4)$$

From equations (3)-(4) we know that $\delta > 0$. Equation (4) says that the household is indifferent between a guaranteed income $(\mu\text{-}\delta)$ and a risky income   with mean μ. Therefore, δ is the maximum the household would be willing to pay out of a sure income μ in order to avoid the risky income with mean μ. In the economics literature δ is called the *cost of risk-bearing*.[2]

Since the risk is assumed to be "small", we know δ is "small". Hence, ignoring all but the first two terms in the Taylor expansion of $u(\mu\text{-}\delta)$, we have

$$u(\mu\text{-}\delta) \approx u(\mu) - \delta u'(\mu). \qquad (5)$$

From (3)-(5) we conclude that

[2] Pratt (1964) and Arrow (1965) are the original sources for the model being discussed in this section.

$\delta \approx \sigma^2\eta(\mu)/2\mu$, (6)

where η (= $-u''(\mu)\mu/u'(\mu)$) is the *elasticity of marginal utility* at μ.[3] Since $u'(\mu) > 0$ and $u''(\mu) < 0$, we know that $\eta > 0$. In decision theory η is also called the *coefficient of relative risk-aversion*. It is a measure of the degree to which the household is risk-averse. To confirm this, note that equation (6) implies

$\delta/\mu \approx (\sigma/\mu)^2\eta/2$. (7)

So, other things being equal, the larger is η, the greater is the proportion of mean income the household would be willing to give up in order to avoid risk. To obtain a feel for the numbers that could be involved, suppose $\sigma/\mu = 0.2$ (so that $(\sigma/\mu)^2 = 0.04$) and $\eta = 4$. Then $\delta/\mu \approx 0.08$. In other words, the household would be willing to forego upto 8 percent of its expected income in order to avoid risk.

1.2 Mutual Insurance Among Households

We now return to the case of N households, whose incomes are uncertain. For vividness, imagine that household income is based on agriculture. To focus on the advantages of risk-pooling, I assume to begin with that production involves no costs. In Sections 4-5 we correct that empirical error and assume that household effort is a determinant of agricultural income and that effort is costly.

Since agricultural outputs are spatially correlated, the risks borne by village households are not independent of one another. Suppose then that household i's income is

$_i = \mu + \ _i$, $\mu > 0$, (8)

where, the $_i$'s are identical random variables, with zero mean, variance σ^2, and cov($_i$, $_j$) = ρ ($\geq$ 0) for all i and j.

Each household's income is assumed to be observable by all. This means that income cannot be hidden. Imagine now that there is a community insurance scheme in which the N households agree to pool their risks fully. Every household then faces the risky income ($_1$+ $_2$+...+ $_N$)/N. Since E(($_1$+ $_2$+...+ $_N$)/N) = (E($_1$)+E($_2$)+...+E($_N$))/N = $N\mu/N = \mu$, the mean income for each household remains μ. But what about the variance of household incomes?

Write = ($_1$+ $_2$+...+ $_N$)/N and let σ^2( ) denote the variance of . By definition,

$\sigma^2(\ ) = E(\Sigma_i(\ _i-\mu)^2)/N^2$. (9)

Let ${}^N C_2$ denote the number of pairwise combinations in a set containing N objects. We know that ${}^N C_2 = N!/(N-2)!2!$. Expanding the right hand side of equation (9) yields

$\sigma^2(\ ) = \sigma^2/N + 2({}^N C_2)\rho/N^2 = \sigma^2/N + (N-1)\rho/N$. (10)

In a village community, income risks would be expected to be correlated ($\rho > 0$), but not perfectly correlated ($\rho < \sigma^2$). From equation (10) we conclude that if $0 < \rho < \sigma^2$,

$\sigma^2/N < \sigma^2(\ ) < \sigma^2$. (11)

Consider the latter inequality in (11): $\sigma^2(\ ) < \sigma^2$. It says that as long as household risks are not perfectly correlated, pooling reduces each household's risk. We may put matters another way. The cost

[3] For notational simplicity I have dropped the functional dependence of η on μ. If U is a homogeneous function of x, the η is a constant.

each household would bear if they remained uninsured is $\sigma^2\eta/2\mu$ (equation (6)). By pooling risks fully, the cost of risk bearing for each household becomes $\sigma^2(\ )\eta/2\mu$, which, by the latter inequality of (11), is less. Therein lies the advantage of mutual insurance.

Note, though, that households are unable to insure themselves completely even if N is large. The reason is that the law of large numbers does not apply when $\rho > 0$. To confirm, equation (10) says that when N is large, $\sigma^2(\ ) \approx \rho > 0$. If, in the extreme case, the N income risks are perfectly correlated ($\rho = \sigma^2$), equation (10) reduces to

$$\sigma^2(\ ) = \sigma^2,$$

which means that pooling would not reduce individual household risks at all.

1.3 Independent Risks Among Large Numbers

Across large geographical terrains, correlations in agricultural income would be expected to be small, possibly even zero. In order to prepare ourselves for a comparative study of insurance markets and community insurance schemes, we construct a very stylised model, where the circumstances facing the N village households are replicated M times.

Imagine then M villages, each consisting of N households. Household incomes within each village are correlated (covariance between any pair is ρ (> 0)), but across villages they are independent. To see how the law of large numbers can be invoked to reduce individual risks to negligible values when independent risks are pooled, let M be large in comparison with N. To motivate the latter assumption, it may be noted that in India approximately 700 million people live in some 500,000 villages; meaning that, on average, a village is inhabited by about 1,400 people. If the typical household size is 7, the number of households per village is 200. In our notation, this means $M = 500{,}000$ and $N = 200$. To be sure, agricultural risks in neighbouring villages are unlikely to be independent; what we are trying to capture in the model is an environment in which the number of households facing independent risks is large when compared to the number whose risks are correlated with one another.

In the previous section we studied the extent to which individual risks can be reduced by pooling within a village (equation (10)). We now imagine that the the market (or the State - for our purposes it doesn't matter which) is able costlessly to pool risks across villages. The tidiest way to formalise the way risks can be pooled across villages in the market for insurance would be to number households in each village from 1 to N and imagine that one firm insures the risks of all households that are numbered 1, that a second firm insures the risks of all households that are numbered 2, ..., that an ith firm insures the risks of all that are numbered i, ..., and that an nth firm insures the risks of all that are numbered N. In other words, we are to imagine that there are N groups of households, and that the independent risks of the M households in each group are pooled. Because of competition, insurance firms earn no profit.

Consider the ith firm, that is, the firm that offers insurance protection to every household in group i. Assume that a household's realized income can be *verified*, meaning that insurance contracts can be enforced by the courts of law (the external enforcer). An *insurance contract* is a promise on the part of the household to pay the firm its entire income (whatever that may prove to be) and be guaranteed in return the average income of all households that have taken out insurance with the firm. We take it that there are M risky incomes, $_{ik}$ (k = 1,2,...,M), the mean and variance of each being μ and σ^2, respectively. As the distributions are independent of i and k, we may drop the subscripts. By pooling, every household's income is $= ({}_1 + {}_2 + ... + {}_M)/M$. Replacing N by M in equation (10) we have

$$\sigma^2(\;) = \sigma^2/M + 2({}^M C_2)\rho/M^2 = \sigma^2/M + (M\text{-}1)\rho/M. \tag{12}$$

As the risks are independent, $\rho = 0$. Equation (12) therefore says that if M is large,

$$\sigma^2(\;) \approx 0, \tag{13}$$

which means that individual households can divest themselves almost entirely of their risks by pooling.

1.4 Moral Hazard

So far we have assumed that the uncertain income of an uninsured household is exogenously given (equation (8)). But effort is a determinant of agricultural income, and the effort a household puts into work is a matter of choice. We therefore introduce effort in the production of income. Consider household i in an arbitrary village. Let

$$_i = \mu + e_i + {}_i, \tag{14}$$

where e_i ($\geq$ 0) is household i's level of effort. The disutility of effort is $v(e_i)$, where $v'(e_i) > 0$ and $v''(e_i) > 0$. The household's expected utility from exerting effort e_i is therefore $E(u({}_i)) - v(e_i)$, where $_i$ is given by (14). For simplicity, imagine that e_i can be either 1 ("high" effort) or 0 ("low" effort), so that $v(1) > v(0)$. We normalise by setting $v(0) = 0$.

In order to have a moral hazard problem, let ε_{max} be the maximum of the range of values that $_i$ can take. Formally,

$$\varepsilon_{max} = \max \operatorname{supp}\{{}_i\}, \tag{15}$$

where supp{ $_i$} denotes the support of the distribution of $_i$. Let us now suppose that

$$u(\mu+1+\varepsilon_{max}) - v(1) > u(\mu+\varepsilon_{max}). \tag{16}$$

Because $u''(x) < 0$, inequality (16) implies

$$E(u(\mu+1+{}_i)) - v(1) > E(u(\mu+{}_i)). \tag{17}$$

Inequality (17) says that uninsured households would choose to work hard: each such household would choose $e_i = 1$.

1.5 Community Insurance

We now extend the analysis of Section 2 to include effort in the generation of income under a community insurance scheme. Consider an arbitrary village k. Assume that villagers are able to observe one another's effort levels costlessly. In other words, not only are villagers able to observe one another's income, they can also observe whether someone has worked hard. Given (17), any community insurance scheme would be based on the understanding that each household, i (i = 1,2,...,N) in the village should choose $e_i = 1$.

As before, the ideal scheme involves complete pooling. Writing $_i^c$ for household i's uncertain income,[4] we know from equation (14) that

[4] The index "c" denotes communitarian insurance schemes.

$${}_i^{c} = \Sigma_j({}_j^{c})/N = (\Sigma_j(\mu+1+{}_j))/N. \qquad (18)$$

But $E({}_i^{c}) = \mu+1$. Let σ_c^2 be the variance in household income when it participates in the community insurance scheme. From equations (2) and (18) it follows that

$$E(u({}_i^{c})) - v(1) \approx u(\mu+1) + u''(\mu+1)\sigma_c^2/2 - v(1). \qquad (19)$$

However, we know from equation (12) that

$$\sigma_c^2 = \sigma^2/N + (N\text{-}1)\rho/N. \qquad (20)$$

This means

$$E(u({}_i^{c})) - v(1) \approx u(\mu+1) + u''(\mu+1)(\sigma^2/N+(N\text{-}1)\rho/N)/2 - v(1). \qquad (21)$$

1.6 Market Insurance

We now extend the analysis of Section 3 to include effort in the generation of income when villagers purchase insurance in a competitive market. We imagine that there is no community insurance scheme: villagers can either buy insurance in the market or remain uninsured.

Consider group i. As there are M villages in the group, there are M households in the group (k,p = 1,2,...,M). Using equation (14) we know that household k's uncertain income is given by

$${}_k = \mu + e_k + {}_k.$$

Assume that insurance firms can costlessly verify the income of every household that is insured, but are unable to observe their effort. Thus, when verifying that an insured household has low income, firms cannot tell whether its income is low despite having worked hard (that is, it had experienced bad luck), or because it had slacked.

Competition among firms in this exchange economy ensures that firms earn no profits in equilibrium. This is the natural interpretation of risk-sharing in a world with no moral hazard. So there is a case for exploring the implications of such contracts even in the presence of moral hazard.[5]

In order to have an interesting problem, assume next that

$$u(\mu) > E(u(\mu+1+{}_k)) - v(1). \qquad (22)$$

This means that if a household purchases insurance in the market, it has the incentive to free-ride and choose $e_k = 0$, implying that

$${}_k = \mu + {}_k. \qquad (23)$$

Let ${}_k^{m}$ be household k's uncertain income if it purchases insurance.[6] Then, on using equation (23), we have

$${}_k^{m} = \Sigma_p({}_p^{m})/M = \Sigma_p(\mu+{}_p)/M. \qquad (24)$$

From equation (24), $E({}_k^{m}) = \mu$ and var(${}_k^{m}$) = σ^2/M. Furthermore, (22) ensures that the insurance market would be active if M were large. And finally, from equations (2) and (24), we have

$$E(u({}_k^{m})) = u(\mu) + u''(\mu)\sigma^2/2M. \qquad (25)$$

1.7 Comparing Communities and Markets

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[5] In Section 5 we will discover that firms are able to reduce moral hazard even without monitoring effort.

[6] The index "m" denotes markets.

Equations (21) and (25) tell us that communities are better than markets at providing insurance if

$$u(\mu+1) + u''(\mu+1)(\sigma^2/N+(N\text{-}1)\rho/N)/2 - v(1) > u(\mu) + u''(\mu)\sigma^2/2M,$$

or $$[u(\mu+1) - v(1)] - u(\mu) > -u''(\mu+1)(\sigma^2+(N\text{-}1)\rho)/2N + u''(\mu)\sigma^2/2M, \quad (26a)$$

and are worse than markets in providing insurance if

$$u(\mu+1) + u''(\mu+1)(\sigma^2/N+(N\text{-}1)\rho/N)/2 - v(1) < u(\mu) + u''(\mu)\sigma^2/2M,$$

or $$[u(\mu+1) - v(1)] - u(\mu) < -u''(\mu+1)(\sigma^2+(N\text{-}1)\rho)/2N + u''(\mu)\sigma^2/2M. \quad (26b)$$

The sharpest way to see the contrast between markets and communities as providers of insurance is to consider the case where M is very large (the market enables households to eliminate risks entirely) and $\rho = \sigma^2$ (within village risks are perfectly correlated). In that case (26a,b) reduce to

$$[u(\mu+1) - v(1)] - u(\mu) > -\sigma^2 u''(\mu+1)/2, \quad (27a)$$

and $$[u(\mu+1) - v(1)] - u(\mu) < -\sigma^2 u''(\mu+1)/2, \quad (27b)$$

respectively.

Conditions (27a-b) are congenial to intuition. Since $u''(x) < 0$ for all x, we know from (16) that the left hand side of (27a-b) is positive. I conclude that, other things being equal, *the community is a better provider of insurance than the market if work is not too arduous, or the expected gains in income from hard work are large* (equation (27a)). However, other things being equal, *the market is a better provider of insurance than the community if work is arduous, or the expected gains in income from hard work are small* (equation (27b)).

1.8 Avoiding Moral Hazard Without Monitoring Effort

In fact, insurance markets can do better than we have allowed them to do. Firms can devise contracts in such ways as to reduce moral hazard. In extreme cases they can even eliminate moral hazard. To see how, imagine that $u(x) \to -\infty$ as $x \to 0$, which is to say that acute hunger is intolerable. Now let ε_{min} (< 0) be the minimum of the range of values that ${}_i$ can take.[7]. Define

$$= \mu + 1 + \varepsilon_{min}. \quad (28)$$

Consider a contract which stipulates that the household (say, k) is to pay the insurance firm its realized income, whatever that may happen to be, and that it will receive from the firm μ+1 if $x_k \geq (\mu+1+\varepsilon_{min})$, but will receive *nothing* if $x_k < (\mu+1+\varepsilon_{min})$. Notice that if the household were to purchase the contract *and* work hard, it would guarantee for itself income (μ+1) and utility $[u(\mu+1) - v(1)]$. If however it purchased the contract and then slacked, it would face a positive chance of going without any income. But the latter is too horrible to contemplate (remember, $u(x) \to -\infty$ as $x \to 0$). From equation (17) we know that if the household does not purchase any insurance, expected utility is $[E(u(\mu+1+{}_i)) - v(1)]$. Inequality (22) then tells us that it would be in the household's interest to purchase the contract and work hard. Since all households would reach the same conclusion, the insurance firm would be able to balance its budget by offering the contract in question. As the contract eliminates moral hazard entirely,

[7] Since ≥ 0, we know that ε_{min} exists.

the market would be able to provide better insurance than the community.[8]

2. Common Property Resources.

Reading (12) contains large number of examples of cooperative behaviour on the local commons. In Lecture 2 I presented a simple model of the commons. Here it is in typed form:

There are N herders (i = 1, 2, ..., N). They graze their cattle on a pasture land that is neither private property, nor state property, but is communally owned. Outsiders are not permitted to graze their cattle in the pasture, which means that there is no free access to the land either. (Note: You should ask what mechanism the herders can have invented to provide community members with the right incentives to keep outsiders out. Collective action problems are like an onion: you peel one layer and you find another layer underneath it that supports it.) The pasture is a common property resource (CPR). However, cattle are private property.

The model is timeless. Cattle intermingle in the pasture, so that on average the cows consume the same amount of grass. If X is the total number of cattle in the pasture, total output - say, of beef - is F(X), where $F'(X) > 0$ and $F''(X) < 0$; the latter assumption reflecting the fact that there is fixed factor in the production of beef, namely, the pasture land. Herders are interested in the profits they are able to earn from their cattle. A cow costs p (> 0) in the market. We normalise by choosing the market price of beef to be one.

Let us first study the extent to which the CPR is used if the community has instituted no grazing charges, nor any restriction on the number of cattle herdsmen can graze in the commons. Let x_i be the size of i's herd. Since cattle intermingle, $x_iF(X)/X$ is i's output of beef. This means that his net profit, π_i, is,

$$\pi_i = x_iF(X)/X - px_i. \qquad (1)$$

We are interested in computing the non-cooperative outcome.

Since the game is symmetric, we wish to compute the symmetric Nash equilibrium. Without loss of generality, consider herdsman i. If each of the other herdsmen introduce   number of cows into the pasture, we may write equation (1) as,

$$\pi_i = x_iF(x_i+(N-1)\ )/[x_i+(N-1)\ ] - px_i. \qquad (2)$$

Clearly then,   is the number of cattle each herdsman would introduce into the pasture at a symmetric Nash equilibrium if   is the value of x_i that maximizes π_i in equation (2).

In order to compute the equilibrium number of cattle, we differentiate π_i with respect to x_i and set the differential coefficient equal to zero (which is the first order condition of i's maximization problem). This yields,

$$F(x_i+(N-1)\ )/[x_i+(N-1)\ ] + x_iF'(x_i+(N-1)\ )/[x_i+(N-1)\ ] - x_iF(x_i+(N-1)\ )/[x_i+(N-1)\ ]^2 = p. \qquad (3)$$

At the symmetric Nash equilibrium (it is, of course, unique in this game), x_i in equation (3) equals . Re-arranging terms, the equilibrium number of cattle in the CPR, X, is the solution of,

[8] This is highly simplified version of a proposition, due originally to Mirrlees (1974), that non-linear contracts can be designed to force people to behave in accordance with their promises even when that behaviour cannot be observed.

$$[(N-1)/N]F(X)/X + F'(X)/N = p. \tag{4}$$

Equation (4) is a rather beautiful condition. It says that at the (symmetric) Nash equilibrium, the weighted average of the average product of cattle and the marginal product of cattle equals the price of cattle, where the weights are $(N-1)/N$ and $1/N$, respectively.

What would be the natural cooperative solution? It would be the value of X that maximizes $[F(X) - pX]$. Being symmetric, the agreement would be to permit each member to introduce *upto* X/N cows into the pasture. This yields the condition,

$$F'(X) = p. \tag{5}$$

It says that the socially optimum number of cattle is that at which the marginal product of cattle equals its price.

Note that if $N = 1$, equation (4) reduces to equation (3).

3. A Public Goods Problem

Consider the following N-person Prisoners' Dilemma game, involving the production of a public good (e.g. terracing, building flood barriers). Each of the parties can either behave opportunistically (by withholding her contribution to the production of the public good) or cooperate. To cooperate involves a cost k (> 0), but it confers benefit b (> 0) on each party, including the one who has incurred the cost. An opportunist incurs no cost, but enjoys the benefits confered by all who cooperate. This is the source of a free-rider problem. In particular, it means that each player's payoff is a linear and increasing function of the number of players who cooperate. To see this, note that if the fraction of people who cooperate is x, the net benefit enjoyed by each cooperator is $(Nxb - k)$, while each opportunist enjoys Nxb.

For this public goods game to be a Prisoners' Dilemma, it must be (i) that all parties are better off if all cooperate than if all act opportunistically, and (ii) that irrespective how others behave, each party enjoys greater benefit by behaving opportunistically than by cooperating. Now, if all behave opportunistically, then the payoff to each party is zero. It follows that (i) is satisfied if and only if $Nb > k$. Furthermore, by cooperating, a party adds b to her own payoff at a cost k. Therefore, condition (ii) is satisfied if and only if $b < k$. We conclude that the (linear) public goods game is an N-person Prisoners' Dilemma if and only if $b < k < Nb$.

4. Rotating Savings and Credit Associations (ROSCAS)

ROSCAS are communitarian saving schemes, organised for the purchase of an indivisible, durable commodity that each member desires as a private good. The scheme is of use in a world where people are unable to borrow from the market. It is designed to avoid the waste that would occur if funds remained idle.

There are N (> 1) people in the community. For simplicity, we assume that the economy is in a stationary state. Let P be the (spot) market price of the good. Time is continuous. Suppose to begin with that people do not cooperate, that is, they do not form the ROSCA. Each person would now have to save until his privately accumulated fund reaches P. Imagine that each member is able to save at most at each moment. The fund would reach that figure at date , where

$$= P/ . \tag{6}$$

Suppose now that people form a ROSCA. Let T be the solution of the equation,

$NTx = P.$ (7)

Each member of the ROSCA is obliged to contribut   to the pot at each moment, starting at t = 0 and ending at t = NT. At T, when the fund reaches the level P, a fair lottery is drawn to choose the winner of the pot, who spends P on the private good. At date 2T, when the fund again reaches the level P, a fair lottery is drawn again, but among the (N-1) who lost in the first round. The winner receives the pot, P. At date 3T, when the fund again reaches the level P, a fair lottery is drawn again, but among the (N-2) who lost in the first two rounds. The winner receives the pot, P. And so on.

Under these conditions a member wins the pot (and therefore the indivisible durable good) at date T with probability 1/N; at date 2T with probability [(N-1)/N]/(N-1), or 1/N; at date 3T with probability [(N-1)/N][(N-2)/(N-1)]/(N-2), or 1/N; and, so on, with probability 1/N at each remaining lottery date, until NT. The expected date of win is therefore,

$E(T) = (T + 2T + 3T + ... + NT)/N = N(N+1)T/2N = (N+1)T/2.$ (8)

Using (7) in (8), we have,

$E(T) = (N+1)P/2N .$ (9)

Notice that the most unfortunate member of the ROSCA gets to purchase the indivisible good at T = P/ . He will have neither lost nor gained by joining the ROSCA, while all others will have gained. So, the ROSCA is unambiguously a good thing for the members. Obviously, we confirm that,

$E(T) <$. (10)

Joining the ROSCA brings forward the date someone can expect to purchase the desired object. Moreover, nobody loses.

5. Information sharing

Reading (2) has a case study on this. In Lectures I shall recount to you the way academics share information, even while competing! Research and development activities involve much communitarian behaviour.

Lecture Notes on Social Capital, 2: Part IIB Economics, Lent 2004

Under what contexts is it possible for agreements to be kept?

(1) Mutual affection

(2) Pro-Social disposition

(3) Repeated interactions

(4) Reputation

(5) External enforcement.

In Lecture 1 I suggested that either (3) or (4) would have to be invoked when offering (5) as an appropriate context. The reason is that we should ask what incentives the external enforcer has to enforce the agreement. In Lecture 2 I sketched the nice model of Sethi and Somanathan that illustrated the evolution of pro-social disposition, (2) (Sethi, R. and E. Somanathan (1996), "The Evolution of Social Norms in Common Property Resource Use", *American Economic Review*, 86, 766-788). In Lectures 3 and 4 I shall develop the arguments involved in (3)-(5). Of these, it is likely you will not have come across (4). So I have constructed a model for you. (Notice that it does *not* assume repeated interchanges among the same group of people. It contrasts from (3), even though it looks somewhat similar.)

Model of Reputation

Brand name is an example of reputation as a form of capital asset. Imagine then that Acme is a firm that produces a commodity for sale. The owner of Acme can produce either a bad product or a good product. Customers can tell whether the product is good only after purchasing it. If the product sold is bad, the owner's profit is Π_b, if it is good, the owner's profit is Π_g, where, to have an interesting problem, we must have $\Pi_b > \Pi_g > 0$. Each potential owner lasts one period. At the end of the period she sells Acme in an auction and retires.

The story begins at t = 0. Imagine that Acme has so far an unblemished record for the quality of its product. We now imagine that customers have the following purchasing strategy: purchase from Acme if and only if it has had an unblemished record to date; cease purchasing from Acme the priod following the first transgression on the firm's part. (Notice that customers are following the Grim norm.)

We want to track a rational expectations equilibrium over time. Let p_t be the spot price of Acme and r (> 0) the rate of interest. Then, if there is competition among buyers at t, the price path along repeated good behaviour on Acme's part will produce zero NPV of profits. On the other hand, if the owner produces a bad product, customers will never again purchase from it. The price at t+1 will then be zero. And we want to find conditions such that under rational expectations, producing a bad product will result in negative profits for the owner. In short, we want to identify conditions in which it is in every owner's interest to keep Acme's reputation intact.

It pays now to start at an arbitrary date t. We imagine that Acme has an unvarnished reputation so far. Consider now an indefinite future during which Acme maintains its reputation for good-quality product. The PDV of profits enjoyed by buyer t along such a path is $(-p_t + \Pi_g + p_{t+1}/(1+r))$. However, because she has had to bid for Acme in an auction, profits are whittled down to zero. Hence,

$$-p_t + \Pi_g + p_{t+1}/(1+r) = 0. \qquad (1)$$

(1) is the zero NPV profit condition.

However, in order that it is in buyer t's interest *not* to produce a bad product,

$$-p_t + \Pi_b \leq 0. \qquad (2)$$

(2) is the constraint that bad behaviour is unprofitable, the point being that if she were to produce a bad product, no customer would ever purchase from Acme, and so price of Acme at t+1 would be zero.

Begin by assuming a steady state, along which Acme's reputation is maintained. This means, $p_t = p_{t+1}$. From (1) we have

$$p = \Pi_g(1+r)/r, \qquad (3)$$

and from (2), that

$$p \geq \Pi_b. \qquad (4)$$

From (3) and (4), it follows that, we must have

$$\Pi_g(1+r)/r \geq \Pi_b. \qquad (5)$$

Condition (5) offers a nice interplay between r and Π_b/Π_g. You should interpret it. If condition (5) does not hold, there is no steady state in the price of Acme along which its reputation is maintained.

Is the steady state the unique equilibrium? Answer is "no". To see this, suppose

$$p_t = \Pi_g(1+r)/r + \delta, \qquad \text{where } \delta > 0. \qquad (6)$$

Then (1) says that

$$p_{t+1} = (1+r)[\Pi_g/r + \delta] = p_t + \delta(1+r) > p_t.$$

This means that if $p_0 > \Pi_g(1+r)/r > \Pi_b$, then a "good" equilibrium exists under rational expectations, with p_t tending to infinity. If $p_0 < \Pi_g(1+r)/r$, then $p_{t+1} < p_t$ and the system collapses in finite time to the point where $p_t < \Pi_b$. Backward induction means that good equilibrium will collapse. I conclude that the steady state analysis gave us all the insights we needed.

Lecture Notes on Social Capital, 3: Part IIB Economics, Lent 2004

Professor Partha Dasgupta

I have avoided mentioning social capital in the first three lectures. I have done so for a good reason. I wanted to keep separate two notions: (1) there is a group of people (a *network*) who observe that there is scope for cooperation, and (2) they proceed to find ways in which cooperation is viable. The point is this: there is a difference between *being* a network and *getting* the network to do some work (e.g., coordinating strategies, enabling cooperation, and so forth). But writers on social capital haven't felt the need to distinguish between the two very different "objects". Here are four definitions of social capital:

(i) In an early definition, social capital was identified with those "... features of social organization, such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Reading (11): Putnam, 1993, p. 167).

(ii) Putnam (2000: 19) writes: "... social capital refers to connections among individuals - social networks and the norms of reciprocity and trustworthiness that arise from them."

(iii) Fukuyama (1999: 16) writes: "Social capital can be defined simply as an instantiated set of informed values or norms shared among members of a group that permits them to cooperate with one another. If members of the group come to expect that others will behave reliably and honestly, then they will come to *trust* one another. Trust acts like a lubricant that makes any group or organization run more efficiently." (Fukuyama, F. (1999), *The Great Disruption* (New York: Simon and Schuster).

(iv) Bowles and Gintis (2002: F419) write: "Social capital generally refers to trust, concern for one's associates, a willingness to live by the norms of one's community and to punish those who do not." (Bowles, S. and H. Gintis (2002), "Social Capital and Community Governance", *Economic Journal*, 112(Features), F419-436.)

Note a common weakness in these: the definition encourages us to amalgamate incommensurable objects For example, in the first of the Putnam definitions, he conflates, in that order, beliefs, behavioural rules, and such forms of capital assets as interpersonal networks, without offering a hint as to how they are to be amalgamated. More importantly, "trust" and "social norms", as we have seen, *enable* resources to be allocated in ways that they wouldn't have been if there were no trust or the force of social norms. [It will be noted that connections refer to interpersonal networks, norms of reciprocity to rules of conduct, and trustworthiness to behaviour itself.]

In what follows, we shall think of social capital only as a system of interpersonal *networks*. What a network manages to do is a component of the *resource allocation mechanism*. In the above quotes, the authors unthinkingly amalgamated two distinct notions into one overarching category, *social capital*, and thought that with such a definition, they were adding to the list of capital assets.

Resource Allocation Mechanisms: Some Macroeconomics

We should now define a resource allocation mechanism in formal terms:

The state of an economy is represented by the vector $\mathbf{K}$, where $\mathbf{K}$ is a comprehensive list of capital assets (viz. manufactured capital, knowledge, human capital, and natural capital assets). Let C denote aggregate consumption and **R** a vector of input flows (e.g., ecosystem services, labour, intermediate goods, and so forth). Let $\{C(\tau), \mathbf{R}(\tau), \mathbf{K}(\tau)\}_t^\infty$ be an economic programme from t to ∞. Given technological possibilities, resource availabilities, and the dynamics of the ecological-economic system, the decisions made by individual agents and consecutive governments from t onwards will determine $C(\tau)$, $\mathbf{R}(\tau)$, and $\mathbf{K}(\tau)$ - for $\tau \geq t$ - as functions of $\mathbf{K}(t)$, τ, and t. Thus let $f(\mathbf{K}(t), \tau, t)$, $\mathbf{g}(\mathbf{K}(t), \tau, t)$, and $\mathbf{h}(\mathbf{K}(t), \tau, t)$, respectively, be consumption, the vector of resource flows, and the vector of capital assets at date τ ($\geq$ t) if $\mathbf{K}(t)$ is the vector of capital assets at t. Now write

$$(\xi(\tau))_t^\infty \equiv \{C(\tau), \mathbf{R}(\tau), \mathbf{K}(\tau)\}_t^\infty, \text{ for } t \geq 0.$$

Let $\{t, \mathbf{K}(t)\}$ denote the set of possible t and $\mathbf{K}(t)$ pairs, and $\{(\xi(\tau))_t^\infty\}$ the set of economic programmes from t to infinity.

Definition: A "resource allocation mechanism", α, is a (many-one) mapping

$$\alpha: \{t, \mathbf{K}(t)\} \rightarrow \{(\xi(\tau))_t^\infty\}.$$

Example 1: Consider the famous single-good, Solow growth model, where, in the obvious notation,

$$dK(t)/dt = sF(K(t), L(t)), \tag{1}$$

where s ($0 < s < 1$) is the constant saving ratio, L(t) is the labour force at time t (assumed to be exogenously given) and F is the production function of output. The accumulation equation defines a resource allocation mechanism.

Example 2: A competitive equilibrium allocation.

Example 3: A Ramsey optimum allocation.

Lecture Notes on Social Capital, 4: Part IIB Economics, Lent 2004

Professor Partha Dasgupta

It has proved useful in economics to distinguish **capital assets** from **resource allocation mechanisms**. Definitions of social capital in regular use, however, conflate the two, which is why so much of the empirics on the subject is free of theoretical foundation. A typical empirical exercise reports quantitative indices of the level of trust in different societies, obtained from cross-country surveys; it then proceeds to run a cross-country regression of growth in GNP per head on the average level of trust and such other variables as the saving rate. The exercise is motivated by the thought that "trust" is a capital asset. But is it? As I suggested to you in Lecture 1 (see Reading (8)), trust in someone amounts to harbouring *expectations* about that person. It would be odd to regard "expectations" as capital assets. Expectations should be *endogenous* to the analysis.

Consider also the following pair of examples. I trust they will convince you that such notions as "trust", "reciprocity", "trustworthiness", and "cooperation" are not capital assets, but are ingredients of resource allocation mechanisms:

Suppose the government in a market economy has made it a practice in the past to impose wildly distortionary taxes, subsidies, and commodity controls. Using standard welfare economics, you would conclude that the economy has functioned very *inefficiently* to date. Imagine now that government policies change, in that the distortionary policies are reduced. Output expands, because resources now get allocated more efficiently. Would you explain this improvement in the economy's performance by claiming that the economy has experienced an increase in "policy capital"? I don't believe you would. What you probably would say is that reductions in distortionary policies have amounted to a change in the prevailing resource allocation mechanism, that is, the economic mechanism that *guides* the allocation of resources, such as capital assets.

Consider another example. Imagine that an ineffectual government has been in power, one that has turned a blind eye to public corruption, perhaps it has even taken part in illegal transactions. The economy's wealth has declined. At the insistence of international agencies, the government is now forced to set in place measures that reduce corruption. The economy is then observed to grow. Would you explain this improvement in the economy's performance by claiming that there has been an increase in "governance capital"? Again, I don't believe you would.

Social Capital in Macroeconomic Accounting

In what follows, I construct the simplest possible model in which network members obtain credit from one another. We then explore the connection between network-based microeconomic activity and macroeconomic performance. The background empirical material is Banerjee and Munshi (2004).

There are two people in the network. We begin by assuming that the network has formed. Later we will endogenise network formation. There is a single manufactured capital asset, whose quantity is denoted as K. Person *i* owns K units of the asset, while Person *j* does not own any. What person *j* does own is a technology for producing output by means of that asset. Person *i*, however, does not have access to the technology. *j*'s technology is characterised by the production function

$$Y = AK^{\alpha}, \qquad A > 0 \text{ and } 1 \geq \alpha > 0, \tag{1}$$

where Y is output, and K is the quantity of the capital asset in production. We are to imagine that the asset has no other use.

Imagine first that there is a perfect rental market for capital. Contracts are enforced by the state. In *competitive equilibrium*, the rental on the asset equals its marginal product. This means that equilibrium rental is $\alpha A^{(\alpha-1)}$. Suppose now that a person *m* appears in the economy with a superior technology, characterised by the production function

$$Y = BK_{\alpha}, \qquad B > 0 \text{ and } 1 \geq \alpha > 0, \tag{2}$$

where B > A. Assume that *m*, like *j*, does not own any capital. In the new competitive equilibrium, *i* will rent to *m* at the rental rate $\alpha B^{(\alpha-1)}$. As is well known, a competitive equilibrium sustains an efficient allocation of resources: the asset *K* is employed in its most efficient use. *j* cannot put his technology to use because, relative to *m*'s technology, his is inefficient.

Now imagine that there is no external enforcer of contracts. Specifically, assume that there is no rental market. We want to study what can be achieved by non-market exchanges. If the agents don't trust one another at all, *i* will not lend his capital to either *j* or *m*, and nothing will be produced. To have an interesting problem, imagine that *i* knows *j*, but does not know *m*, nor does she know anyone who knows *m*. To *i*, *m* is a stranger and not to be trusted with her capital stock. However, she trusts *j* to some extent. I model the extent of trust between *i* and *j* as the fraction of her asset that *i* would be willing to lend *j*, with the understanding that they will share their outputs according to some agreed upon proportion (say γ for *i* and $1-\gamma$ for *j*). This means that output is,

$$Y = A(\beta K)^{\alpha}. \tag{2}$$

Notice that the quantity of capital, $(1-\beta)$ remains idle. Clearly, Y is maximized when $\beta = 1$, which is attained in the market.

Since $dY/d\beta > 0$, we have

Proposition 1. Communities where people trust one another more, produce more, other things being equal.

For reasons that will become clear presently, imagine that the output has no domestic use, but can be sold in an external market - perhaps abroad - and that the producers can import food with the proceeds. If p is the price of the product in the external market, the value of GNP in the two-person economy is pY. Equation (2) defines a resource allocation mechanism in this atemporal economy.

We now introduce time and extend the resource allocation mechanism. Assume (a-la Solow, 1956) that each party saves a constant fraction of his/her income. In order to retain symmetry, imagine that the two save at the same rate, s. Therefore, their capital assets accumulate at the same rate. We can now use equation (2) to obtain the capital accumulation equation. Assuming that capital does not deteriorate,

$$(dK_t/dt)/K_t = spA\beta^{1/2}(1-\beta)^{1/2}, \tag{3}$$

which is at its maximum when $\beta = 1/2$, a result that should now be obvious to you. Equation (3) yields

Proposition 2. The rate of economic growth is an increasing function of the level of trust.

Proposition 2 explains recent empirical findings on differences in national economic growth rates (see the cross-country study in R. La Porta, F. Lopez-de-Silanes, A. Schleifer, and R. Vishny (1997), "Trust in Large Organizations", *American Economic Review*, 87 (Papers & Proceedings), 333-8; reprinted in Reading (1); and S. Knack and P. Keefer (1997), "Does Social Capital Have an Economic Payoff: A Cross Country Investigation", *Quarterly Journal of Economics*, 112, 1251-1288; reprinted in Reading (3)).

Imagine now that the level of trust between the two parties changes exogenously over time. Using equation (3), we conclude that each party consumes $(1\text{-}s)pAK_t(\beta_t)^{1/2}(1\text{-}\beta_t)^{1/2}$, and saves $spAK_t(\beta_t)^{1/2}(1\text{-}\beta_t)^{1/2}$. Writing by $g(X_t)$ the percentage rate of change in the variable X_t, the accumulation equation (4) becomes

$$g(K_t) = spA\beta_t^{1/2}(1\text{-}\beta_t)^{1/2}. \qquad (5)$$

Equation (5) yields

Proposition 3. If the level of trust increases over time, the growth rate of wealth also increases, other things being equal.

In order to study growth accounting more fully, assume next that p is also an exogenous function of time. Equation (3) can then be made to yield the growth accounting equation:

$$g(p_tY_t) = g(p_t) + [(1\text{-}2\beta_t)/2(1\text{-}\beta_t)]g(\beta_t) + g(K_t). \qquad (6)$$

We obtain a number of insights from equation (6):

Proposition 4. The (percentage) rate of growth of GNP can be decomposed into three parts: (i) the rate of change in the export price, (ii) the contribution of changes in the level of trust in society, and (iii) the rate of capital accumulation.

Note that (i) and (iii) in Proposition 4 are observable, but unless we have a theory of how trust is built, (ii) is unobtainable from macroeconomic data. Hence (ii) would be seen to be the *residual* in the accounting equation. (In contrast, the paper by La Porta, Lopez-de-Silanes, Schleifer, and Vishny (cited earlier) based their regressions on numerical estimates of the degree of trust from the University of Michigan's World Values Survey, where randomly chosen people in a large number of countries were asked if they trusted strangers.)

Proposition 5 (equivalent to Proposition 3). Suppose $g(p_t) = 0$. Suppose also that $s = 0$, which means that $g(K_t) = 0$ (equation (5)). Then $g(pY_t)$ increases, if $g(\beta_t) > 0$; that is, if "trust" increases, GNP increases at an increasing rate. The increase will be recorded as a *residual*.

Proposition 6. Suppose $s = 0$ (implying that $g(K_t) = 0$) and $g(\beta_t) = 0$ and $\beta > 0$. Then $g(p_tY) > 0$, if $g(p_t) > 0$.

Here is why we should find Proposition 6 interesting. Imagine that until recently there has been no external demand for the product. This means that in the past, $p_t = 0$. So, even though people trusted one another in the domestic economy ($\beta > 0$), they had no reason to produce the output. However, imagine that, because of changing demand conditions in the world, there is now a growing international market for the output (i.e., $g(p_t) > 0$). Then, from equation (6), we conclude that $g(p_tY) > 0$. This means that trust had until recently remained dormant as an engine of growth because it had nothing to work on, but it is now a potent force. The example illustrates how communities that have had dense networks for centuries, but have not had much to show for it economically, can blossom when external circumstances change favourably.

The assumption s = 0 is artificial, and I have made it only because the resulting analysis was simple to follow. We could imagine, though, that s is an increasing function of β. One reason why the saving rate could respond to β is that the shadow rate of return on investment in capital is an increasing function of β (equation (3)). From equation (6) we then obtain a variation on Proposition 2:

Proposition 7. Economies where people trust one another more, grow faster, other things being equal.

Endogenising Trust

I now endogenise β_t, by regarding it to be a function of the time each of the two parties invests in their relationship. Social capital, defined here as interpersonal networks, will accumulate if the parties invest in the relationship, getting to know each other better, creating more and more opportunities for mutual gains, and so forth.

It is tempting to consider the timeless economy of equations (2a,b) and capture the phenomena in the form $\beta = \beta(L_1, L_2)$, where L_1 and L_2 are the time spent on the relationship by persons 1 and 2, respectively. A recent paper (Reading (18)) does precisely that, without explaining in which ways investment in relationships is economically productive.

It is natural to imagine that $\beta(L_1,L_2)$ is a symmetric function. It is tempting to assume that β is an increasing function of L_1 and L_2. But I rather doubt that it is: one sided relationships go sour. If one party makes no investment, I doubt if a relationship is a relationship even if the other does invests. We would certainly wish to assume though that $\beta(,) > \beta(,)$ if > .

Assume next that investment in the relationship has no direct consumption value to either party. Let V(L) be the disutility to a party from investing L units of labour time, where V is increasing and strictly convex. Then net payoffs (Π_1 and Π_2) to the two parties are:

$$\Pi_1 = (A/2)[(1-\beta(L_1,L_2)K]^{1/2}[\beta(L_1,L_2)K]^{1/2} - V(L_1), \tag{7a}$$

and $$\Pi_2 = (A/2)[\beta(L_1,L_2)K]^{1/2}[(1-\beta(L_1,L_2)K]^{1/2} - V(L_2). \tag{7b}$$

We look for a Nash equilibrium of this symmetric game.

The individual first order conditions are:

$$AK(\partial\beta/\partial L_1)[1 - 2\beta(L_1,L_2)]/[\beta(L_1,L_2)(1-\beta(L_1,L_2))]^{1/2} = 4\partial V/\partial L_1, \tag{8a}$$

and $$AK(\partial\beta/\partial L_2)[1 - 2\beta(L_1,L_2)]/[\beta(L_1,L_2)(1-\beta(L_1,L_2))]^{1/2} = 4\partial V/\partial L_2. \tag{8b}$$

At a symmetric equilibrium $L_1 = L_2 = L$ (say). This means equations (8a) and (8b) reduce to

$$AK(\partial\beta/\partial L)[1 - 2\beta(L,L)]/[\beta(L,L)(1-\beta(L,L))]^{1/2} = 4\partial V/\partial L. \tag{9}$$

Since $\partial V/\partial L, \partial\beta/\partial L > 0$, we have $\beta(L,L) < 1/2$, and so,

Proposition 8. People invest less than is necessary to build complete trust.

Note: I haven't yet confirmed this, but I believe that the conditions we have imposed on β are so general, that equation (9) can possess multiple solutions. If this were to be true, people face a coordination problem in social relationships.

What would be the socially optimum investment in the relationship? If $[\Pi_1(L_1,L_2) + \Pi_2(L_1,L_2)]$ is to be maximised by choice of L_1 and L_2, then the first order conditions are:

$$AK(\partial\beta/\partial L_1)[1 - 2\beta(L_1,L_2)]/[\beta(L_1,L_2)(1-\beta(L_1,L_2))]^{1/2} = 2\partial V/\partial L_1, \qquad (10a)$$

and

$$AK(\partial\beta/\partial L_2)[1 - 2\beta(L_1,L_2)]/[\beta(L_1,L_2)(1-\beta(L_1,L_2))]^{1/2} = 2\partial V/\partial L_2. \qquad (10b)$$

Using symmetry, equations (10a,b) reduce to,

$$AK(\partial\beta/\partial L)[1 - 2\beta(L,L)]/[\beta(L,L)(1-\beta(L,L))]^{1/2} = 2\partial V/\partial L. \qquad (11)$$

Comparing equations (9) and (11), we have

Proposition 9. People would invest more in their relationship if they were to arrive at their investment levels through cooperation.

When I first wrote down Proposition 9, I thought it looked odd. But on reflection it seems reasonable to me. People *do* discuss how best to build their relationship (time spent with one another, tasks to be performed, and so forth). Why? Because there are blatant externalities in relation-building: $\beta(L_1,L_2)$ is the source of the externality. "Non-cooperative" choices in investments in networks are going to be sub-optimal. What Proposition 9 says is that there is a bias in the suboptimality: non-cooperation leads to underinvestment in relationships.

Lecture Notes on Social Capital, 5: Part IIB Economics, Lent 2004

Professor Partha Dasgupta

Thus far I have set up models where cooperation is inevitably a good thing. Mechanisms 3 and 4, based on repeated interactions and reputation, respectively, are built on the practice of social norms of behaviour. I want now to consider the down-side of social capital, viewed as interpersonal networks.

Two potential weaknesses of resource allocation mechanisms built on social capital are easy enough to identify:

1. Exclusivity. Networks are by their very nature exclusive, not inclusive. This means that "anonymity", the hallmark of competitive markets, is absent from the operations of networks. When market enthusiasts proclaim that one person's money is as good as any other person's in the marketplace, it is anonymity that is invoked as a virtue. In resource allocation mechanisms governed by networks, however, "names" matter. Transactions are personalised. This implies inefficiencies: resources are unable to move to their most productive uses. When farmers in a village insure one another against calamities, they are able to pool risks only partially, because their risks are not independent. Formal insurance markets pool risks better because they span a far wider area.

Names matter so much that, in the extreme, rival gangs prey on each other. Members of a gang cooperate, they even trust one another. Their destructive behaviour is directed at the rival gang. "They" are not "us".

2. Inequalities. The benefits of cooperation can be captured by the more powerful within the network. It has been documented by such political scientists as Margaret McKean that the local elite (usually wealthier households) capture a disproportionate share of the benefits of common property resources, such as coastal fisheries and forest products. Recall that in developing the theory of cooperative behaviour in repeated games, we took the sharing of the collective gains from cooperation to be given; what we tried to uncover were the social norms that would implement the "agreement". Thus, the spoils that are being shared along a cooperative equilibrium can be highly skewed in favour of the local elite.

However, empirical work has for the most part uncovered inequalities in the distribution of benefits of cooperative behaviour. Such findings are consistent with the possibility that all who cooperate benefit. I now want to explore the idea that long term relationships can be *bad* for some members of a community; or, in other words, that it is possible that the benefits of cooperation are not merely unequally shared, some members may even be worse off being part of the lon-term relationship than they would have been if there had been no long-term relationship.

Social Norms Once Again

Recall from your Part I notes that I gave you two years back, a strategy is a set of conditional actions ("do this if that happens", or "do that she does this", and so on). In those notes, and here too, I am interested in (Nash) equilibrium strategies. We define a *social norm* to be an equilibrium strategy in a repeated game when the equilibrium supports a cooperative outcome.

It is usual to differentiate *conventions* from social norms. The English language would place less weight to conventions than it would to social norms. But conventions can be important economically. One way of thinking about conventions is that they solve coordination problems in timeless games of coordination. Recall from your Part I lecture notes that there are simple (symmetric), timeless games containing multiple Nash equilibria that can be Pareto ranked. Then there are games that contain multiple equilibria that are equally good (possible example: driving on the right vs. driving on the left). I have urged you to think about social norms as being equilibrium strategies in games that reflect economic interactions over the indefinite future. So far, though, I have emphasized the bright side of social norms: those that enable everyone to improve their lot. This has been a reasonable thing to do in the context of games that are repetitions of the Prisoners' Dilemma. Indeed, as far as I can tell, the writings of social capital enthusiasts have been exclusively about coordinations games and the Prisoners' Dilemma.

That there can be exploitation in long-term relationships should not be doubted. Anthropoligists such as Andre Beteille, for example, have reminded us that in Indian villages access to local common-property resources is often restricted to the privileged (e.g., caste Hindus), who are also among the more prosperous landowners. The outcasts (euphemistically called members of "schedule castes") are often among the poorest of the poor. Rampant inequities exist too in patron-client relationships. Inequity *per se* is, of course, not evidence of exploitation, but inequities in patron-client relationships are known to take such forms as to make it all too likely that the "client" is worse off in consequence of the relationship than he would have been in its absence. My colleague Sheilagh Ogilvie (Reading (18)) has observed striking differences between the life chances of women in 17th century Germany (rich in social capital) and the life chances in 17th century England (not so rich in social capital). To take another class of examples that are suggestive of exploitative relationships, poor women in all too many societies continue to remain socially inferior beings, prevented from inheriting assets, obtaining education, and entering choice occupations, all of which excludes them from credit, savings, and insurance markets. But such people would appear to accept the restrictions in their lives as a matter of course, without visible or audible complaint. Why?

Exploitation within Networks

I now want to show you how it is possible for some member of a network to exploit others. In order to do so, it will prove necessary to define new terms:

Let S_1 and S_2 be the set of strategies available to individuals 1 and 2, respectively, in the *stage game* of a repeated game. Strategies themselves are denoted by s_1 and s_2 for the two individuals. The payoff function for 1 is denoted by $U_1(s_1, s_2)$, for 2 it is denoted by $U_2(s_1, s_2)$. Recall that a pair of strategies $(\ _1,\ _2)$ is an equilibrium of the stage game if:

$U_1(\ _1,\ _2) \geq U_1(s_1,\ _2)$ for all $s_1 \in S_1$

and $U_2(\ _1,\ _2) \geq U_2(\ _1, s_2)$ for all $s_2 \in S_2$.

The min-max values for individuals 1 and 2, which we write as U_1* and U_2*, respectively, are defined as:

$U_1^* =$ [min max $U_1(s_1, s_2)$]

$$U_2^* = \left[\min_{\substack{s_2 \in S_2 \\ s_1 \in S_1}} \max_{\substack{s_1 \in S_1 \\ s_2 \in S_2}} U_2(s_1, s_2)\right]$$

It will become plain presently why we should be interested in min-max values of stage games.

In what follows I restrict attention to pure strategies. The accompanying Table is the payoff matrix of a symmetric, two-person (stage) game in which each of the parties has three available strategies. The min-max value for individual 1 is 1 (strategies supporting it are the pair (β_1, γ_2)), and the min-max value for individual 2 is 1 (strategies supporting it are the pair (γ_1, β_2)). The payoff pair in the former case is (1, 0), while the payoff pair in the latter case is (0, 1). (β_1, β_2) is the unique equilibrium of the stage game, yielding the payoff pair (3, 3). However, both parties would be better off choosing (α_1, α_2): the payoffs would be (4, 4).

It will be noticed that the above is not a Prisoners' Dilemma. The hallmark of a Prisoners' Dilemma is that each player has a dominant strategy, which means that playing one's dominant strategy ensures the min-max payoff. In a Prisoners' Dilemma, Nash equilibrium payoffs are min-max payoffs. In the game being considered here, min-max values (1 for each player) are less than payoffs at the Nash equilirbium (3 for each player).

Suppose the game is to be repeated indefinitely. We turn to an illustration of the possibility of a long-term relationship in which 1 exploits 2. As we will see, the stage-game has been so constructued that there is scope for exploitation. Imagine that each parties discounts future payoffs at arbitrarily low rates. Suppose the "agreement" between the two is that every even period they will play for the payoff pair (3, 3) - that is, they will select (β_1, β_2) - and every odd period they will play for the payoff pair (7, 0) - that is, they will select (γ_1, α_2). If they play accordingly, player 1 would receive on average (7+3)/2 = 5, while player 2 would receive on average (3+0)/2 = 1.5. But in the absence of a long term relationship, each would enjoy the Nash equilibrium payoff of the stage game, namely, 3. Thus, if they play according to the "agreement", 2 would be worse off under the relationship than she would have been had she been outside the relationship.

The question arises as to how it would be possible for the "agreement" to be supported as an equilibrium outcome of repeated play. The point is to choose the social norm cunningly. Here is how this can be done:

You are by now familiar with the idea that in order to support the agreement credible sanctions have to be imposed on anyone who breaks the agreement. Let us see how the idea can be put into practice here.

Call someone a *conformist* if and only if he/she cooperates with all who are conformists. This sounds circular, but it isn't, because we now suppose that the norm requires both parties to begin the process of repeated interactions by keeping to their agreement. By recursion, it is possible for either party in any period to determine who is a conformist and who is not. If someone's actions in any period made her a non-conformist, the norm would enjoin each of the parties to impose a sanction on her *by pushing her to her min-max value for a sufficiently large number of periods*. Putting it more elaborately, the norm requires not only that sanctions be imposed upon those in violation of an agreement; but also that sanctions be imposed upon those who fail to impose sanctions upon those in violation of the agreement; upon those who fail to impose sanctions upon those who fail to impose sanctions upon those in violation of the agreement; ... and so on, indefinitely. This indefinite chain of "meta-norms" makes the threat of sanctions against deviant behaviour credible, because, if the other party were to conform to the norm, it would not be worth one's while to violate the norm. Abiding by the agreement would be mutually-enforcing.

I find this argument wholly convincing. It offers a definition of exploitation that has content. It describes a case where social capital is bad news for one of the parties within the network.

Stage Game

2 1	α_2	β_2	γ_2
α_1	4,4	2,2	0,7
β_1	2,2	3,3	1,0
γ_1	7,0	0,1	0,0