A Matter of Trust: Social Capital and Economic Development*

by

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Contents

Abstract

In recent years a great many scholars have argued that the formation of social capital is the engine of economic progress. Many others have noted, however, that the evidence is mixed. In this paper I argue that the deep requirement for economic progress is the development of trust among people. Defining social capital in lean terms, namely, as "interpersonal networks", I show that when suitably directed, social capital can build and sustain trust; but if it is misdirected or if it operates in the wrong sphere, it can hamper economic development and even cause economies to regress. I argue, moreover, that if the idea of social capital is to serve a useful purpose in economics, it should be interpreted as interpersonal networks whose members develop and maintain trust in one another to keep their promises by the device of "mutual enforcement" of agreements. But trust is the key to cooperation; "social capital" when suitably applied, is only a means to creating trust. I also show that a natural place to look for the worth of social capital in macroeconomic statistics in "total factor productivity" (TFP). But that implies that TFP is an amalgam of technology and institutions. The paper concludes (Appendix) by demonstrating how an increase in trust among people would result in an increase in total factor productivity, which is another way of saying that an increase in trust among people would lead to an increase in the economy's wealth.

1 Definitions?

The idea of social capital sits awkwardly in contemporary economic thinking. Although it has a powerful, intuitive appeal, social capital has proven hard to track as an economic good. Among other things, it is fiendishly difficult to measure; not because of a recognised paucity of data, but because we don't quite know what we should be measuring. Comprising different types of relationships and engagements, the components of social capital are many and varied and, in many instances, intangible.

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" (Putnam, 1993: 167). As a characterization this appears beguiling, but it suffers from a weakness: it encourages us to amalgamate strikingly different objects, namely (and in that order), beliefs, behavioural rules, and such forms of capital assets as interpersonal links (or "networks"), without offering reasons why such an inclusive definition would prove useful for our understanding of the social world.[1] A number of authors have subsequently defined social capital even more inclusively, where even attitudes toward others make their appearance: "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 and Gintis, 2002: F419.)

In developing the economics of what we today allude to as social capital, some authors focused on a more primitive concept, "trust" (Dasgupta, 1988, 2000, 2007). Others have studied those components of social organization (e.g., rotating savings and credit associations, irrigation management systems, credit arrangements, civic associations, and mutual insurance arrangements) that make "social capital" a productive asset (Levi, 1988; Udry, 1990; Besley et al., 1992; Ostrom, 1996; Grootaert and van Bastelaer, 2002). Case studies of the management of local common-property resources in poor countries (e.g., fisheries, ponds and tanks, forests, grazing lands, and threshing grounds) have offered further insights into the character of those communitarian institutions that enable mutually beneficial courses of action to be undertaken by interested parties (Jodha, 1986; Ostrom, 1990; Dasgupta and Mäler, 1991; Bromley et al., 1992; Baland and Platteau, 1996). Yet others have considered a broader sense of the notion, by

[1] See also Putnam (2000: 19), who writes: "... social capital refers to connections among individuals - social networks and the norms of reciprocity and trustworthiness that arise from them."

including extended kinship, lobbying organizations, and such hierarchical relationships as those associated with patronage (e.g., the Hindu jajmani system and the Sicilian Mafia) and street gangs, so that dense networks don't inevitably result in overall economic betterment, at least not in the long run (Gambetta, 1993). Moreover, both theory and evidence caution us that communitarian relationships can involve allocations where some of the parties are worse off than they would have been if they had not been locked into the relationships, meaning that even though no overt coercion would be visible, such relationships may be exploitative (Dasgupta, 2000, 2008). One can even argue that the theory in question makes precise the sense in which a relationship can be exploitative. In all those accounts, the engagements that rely on social capital occur somewhere between the individual and the State: they are conducted within communities. Indeed, social capital is frequently identified with the workings of civil society (Putnam, 1993, 2000).

For some time now it has seemed to me that in tracking social capital, the most fruitful first step isn't to ask what that object might be, but to ask instead a question that is faced by any group of people who have agreed on a joint course of action: under what contexts can they be sanguine that the promises they have made to one another are credible? The question suggests that the fundamental problem facing people who would like to transact with one another is one of trust. The question also points to a lean and useable notion of social capital, one that is shorn of the warm glow that surrounds the notion in the contemporary literature. In what follows, social capital will be taken to mean interpersonal networks. I will argue, however, that if the idea of social capital is to serve a useful purpose in economics, it should be interpreted as interpersonal networks where members develop and maintain trust in one another to keep their promises by the device of "mutual enforcement" of agreements (Section 5).

The advantage of such a lean notion of social capital is that it does not pre-judge the asset's quality. Just as a building can remain unused and a wetland can be misused, so can a network remain inactive or be put to use in socially destructive ways. There is nothing good or bad about interpersonal networks: other things being equal, it is the use to which a network is put by members that determines its quality. But the prior question is one concerning "trust".

2. The Problem of Trust

Imagine that a group of people have discovered a mutually advantageous course of actions. At the grandest level, it could be that citizens see the benefits of adopting a Constitution

for their country. At a more local level, the undertaking could be to share the costs and benefits of maintaining a communal resource (irrigation system, grazing field, coastal fishery); construct a jointly useable asset (drainage channel in a watershed); collaborate in political activity (civic engagement, lobbying); do business when the purchase and delivery of goods can't be synchronized (credit, insurance, wage labour); enter marriage; create a rotating saving and credit association (as in the institution of iddir in Ethiopia); initiate a reciprocal arrangement (I help you, now that you are in need, with the understanding that you will help me when I am in need); adopt a convention (send one another Christmas cards); create a partnership to produce goods for the market; conduct an instantaneous transaction (purchase something across the counter); and so on. Then there are mutually advantageous courses of action that involve being civil to one another. They range from such forms of civic behaviour as not disfiguring public spaces and obeying the law more generally, to respecting the rights of others.

Imagine next that the parties have agreed to share the benefits and costs in a certain way. The agreement could involve some members making side-payments to others. Again, at the grandest level the agreement could be a social contract among citizens to observe their Constitution. Or it could be a tacit agreement to be civil to one another, such as respecting the rights of others to be heard, to get on with their lives, and so forth. Here we will be thinking of agreements over transactions in goods and services. There would be situations where the agreement was based on a take-it-or-leave-it offer one party makes another (as when a purchaser accepts the terms and conditions in a supermarket). In other contexts, bargaining may have been involved (as in a Middle-Eastern bazaar). Here we will not ask how agreements have been reached, nor look for principles of equity that might have been invoked during negotiation, but rather, ask the question with which we began: under what circumstances would the parties who have reached agreement trust one another to keep their word?

Because one's word must be credible if it is to be believed, mere promises wouldn't be enough. (Witness that we caution others, and ourselves too, not to trust people "blindly".) If the parties are to trust one another to keep their promise, matters must be so arranged that: (1) at every stage of the agreed course of actions, it would be in the interest of each party to plan to keep his or her word if all others were to plan to keep their word, a condition that ensures that the promises are self-enforcing; and (2) at every stage of the agreed course of actions, each party would believe that all others would keep their word. If the two conditions are met, a system of

beliefs that the agreement will be kept would be self-confirming.

Notice that condition (2) on its own wouldn't do. Beliefs need to be justified. Condition (1) provides the justification. It offers the basis on which everyone could in principle believe that the agreement will be kept. A course of actions, one per party, satisfying condition (1) is a Nash equilibrium (formally, a subgame-perfect equilibrium).

Notice that condition (1) on its own wouldn't do either. It could be that it is in each agent's interest to behave opportunistically if everyone believed that everyone else would behave opportunistically. In that case non-cooperation is also a Nash equilibrium, meaning that a set of mutual beliefs that the agreement will not be kept would also be self-confirming; implying that opportunistic behaviour would be self-enforcing. Stated formally, a Nash equilibrium is a set of strategies, one per agent, such that no agent would have any reason to deviate from his or her course of actions if all other agents were to pursue their courses of actions. The famous Prisoners' Dilemma is a game that has a unique Nash equilibrium in which all parties are worse off than they would have been if only they were able to trust one another to cooperate.

Generally speaking, though, societies harbour more than one Nash equilibrium. Some yield desirable outcomes, others do not. In order to probe the question of which Nash equilibrium can be expected to be reached, if a Nash equilibrium is expected to be reached at all, economists have studied human behaviour that are not Nash equilibria. The idea is to model the way people form beliefs about the way the world works, the way people behave, and the way they revise their beliefs on the basis of what they observe. The idea is to track the consequences of those patterns of belief formation so as to check whether the model economy moves toward a Nash equilibrium over time, or whether it moves about in some fashion or other but not toward an equilibrium (Evans and Honkapohja, 2001).

This research enterprise has yielded a general conclusion: Suppose the economic environment in a certain place harbours more than one Nash equilibrium. Which equilibrium should be expected to be approached, if the economy approaches an equilibrium at all, will depend on the beliefs that people held at some point in the past. It also depends on the way people have revised their beliefs on the basis of observations since that past date. This is another way of saying that history matters. Unfortunately, the study of disequilibrium behaviour would lengthen this paper greatly. We shall see though that a study of equilibrium behaviour takes us a long way.

We began by observing that mutual trust is the basis of cooperation, and that for people to cooperate conditions (1) and (2) have to be met. So we look for social environments in which conditions (1) and (2) can be met. To do that it proves useful to classify the social environments in which the promises people make to one another are credible. Four come to mind (Dasgupta, 2000, 2007). In this section we discuss are the first two on my list, which are mutual affection and pro-social disposition. We discuss the latter two social environments in two separate sections (Sections 4 and 5) because each relies on a distinct form of social infrastructure, namely, external enforcement (e.g. an appeal to the rule of law), and mutual enforcement (e.g. abiding by social norms). It will be seen though that, of the two means of attaining cooperation, mutual enforcement is the more fundamental, in that societies need mutual enforcement mechanisms if they are to rely on external enforcement. I shall argue that mutual enforcement is at the heart of "social capital".

3 Affection and Pro-social Dispositions

We begin with two social environments where people would trust one another to keep their promises.

3.1 Mutual Affection

Promises would be credible if the parties care about one another sufficiently. Innumerable transactions take place only because the people involved care about one another and rationally believe that they care about one another (i.e., each knows that the others know that they care about one another, each knows that the others know that each knows that they care about one another, and so on) and thus trust one another to carry out their obligations. Economists model the situation as one where group members have interdependent utilities. The household best exemplifies institutions based on care and affection. As monitoring costs within the household are low (a group of people who cohabit are able to observe and to get to know one another), the institution harbours fewer problems of moral hazard and adverse selection than many other institutions. On the other hand, being few in number, members of a household, as a group, are unable to engage in those enterprises that require large numbers of people of varied talents and locations.

3.2 Pro-social Disposition

Promises would be credible if it was common knowledge that those making the promises were trustworthy, or that they reciprocated by keeping their promise if others displayed trust in

them. Evolutionary psychologists have argued that, because of selection pressures that operated among our hunter-gatherer Pleistocene ancestors, we are adapted to have a general disposition to reciprocate. Others have argued that such a disposition is to a greater or lesser extent formed through communal living, role modelling, education, and receiving rewards and punishments, and that the process begins at the earliest stages of our lives.[2]

For our purposes here, we don't have to choose between the two theories: either would do. In any event, they are not mutually exclusive. Thus, evolutionary psychologists have argued that our capacity to have such feelings as shame, affection, anger, elation, reciprocity, benevolence, and jealousy has emerged under selection pressure (Ehrlich, 2000). No doubt culture helps to shape preferences and expectations (thus, behaviour), which are known to differ widely across societies. But cultural coordinates enable us to identify the locus of points upon which shame, affection, anger, elation, reciprocity, benevolence, and jealousy are put to work; they don't displace the centrality of those feelings in the human makeup. The thought I am exploring here is that, as adults, we not only have a disposition for such behaviour as paying our dues, helping others at some cost to ourselves, and returning a favour, we also practise such norms as those which prescribe that we punish people who have hurt us intentionally; and even such higher-order-norms as shunning people who break agreements, on occasion frowning on those who socialise with people who have broken agreements; and so forth. By internalizing specific norms, a person enables the springs of her actions to include them. She therefore feels shame or guilt in violating the norm, and this prevents her from doing so, or at the very least it puts a break on her, unless other considerations are found by her to be overriding. In short, her upbringing ensures that she has a disposition to obey the norm, be it moral or social. When she does violate it, neither guilt nor shame would typically be absent, but frequently the act will have been rationalized by her. For such a person, making a promise is a commitment, and it is essential for her that others recognise it to be so.

Often enough, the disposition to be honest would be toward members of some particular group (clan, or neighbours, or ethnic group), not others. This amounts to group loyalty. One may have been raised to be suspicious of people from other groups, one may have even been encouraged to dupe such others if and when the occasion arose. Society as a whole wastes

[2] See, for example, Hinde and Groebel (1991), which contains accounts of what is currently known of the development processes through which people from their infancy acquire prosocial dispositions; for example, by learning to distinguish accidental effects from intentional effects of others' actions.

resources when the disposition for honesty is restricted to particular groups.

The disposition to be trustworthy at both the personal and impersonal spheres exists in varying degrees. When we refrain from breaking the law, it isn't always because of a fear of being caught. When an employee in an unorganised sector works overtime, it may simply be a gesture of benevolence, helping out an employer in unexpected need. Recent work in behavioural economics has re-affirmed that benevolence - more generally, pro-social disposition - isn't alien to human nature (see e.g., Rabin, 1993; Fehr and Fischbacher, 2002). The problem is that no society could rely exclusively on it, for how is one to tell to what extent someone is trustworthy? So we look elsewhere.

4. External Enforcement

The promises the parties have made to one another to keep to their agreement would be credible if they could devise an institution, or what one may call a cooperative infrastructure (Binmore and Dasgupta, 1986), in which keeping promises would be in the interest of each party if everyone else were to keep them. The problem therefore is to devise an institution in which keeping to the agreement satisfies conditions (1) and (2), identified earlier. Societies everywhere have constructed solutions to the credibility problem, but in different ways. What all solutions have in common, however, is the feature that those failing to comply with agreements without cause suffer punishment. Let us study them.

It could be that the agreement is translated into an explicit contract and enforced by an established structure of power and authority; that is, an external enforcer. However, for an external enforcer to enforce the agreement, it is necessary that breaches are verifiable. We now imagine that they are verifiable.

By an external enforcer I imagine here, for simplicity, the State (although, it could be the tribal chieftain, the head priest, the warlord, and so forth). The rules governing transactions in the formal market-place are embodied in the law, meaning that formal markets are supported by a legal structure. The law is enforced by the coercive power of the State. Transactions involve legal contracts backed by an external enforcer, namely, the State.

Why should the parties in question trust the State to carry out its task? After all, the contemporary world has shown that there are States and there are States. The apparatus of the State is controlled by people, so we are faced with an agency problem even there. Simply to invoke an external enforcer for solving the credibility problem won't do; for why should the

parties trust the State to carry out its tasks in an honest manner? In democracies a possible answer is that the government worries about its reputation. A free and inquisitive press in a democracy helps to sober the government into believing that incompetence or malfeasance would mean an end to its rule, come the next election. Knowing that they worry, the parties trust them to enforce agreements.

The above argument involves a system of interlocking beliefs about one another's abilities and intentions. Consider that millions of households in many parts of the world trust their government (more or less!) to enforce contracts, because they know that government leaders know that not to enforce contracts efficiently would mean being thrown out of office. In their turn, each side of a contract trusts the other not to renege (again, more or less!), because each knows that the other knows that the government can be trusted to enforce contracts. And so on. Trust among the parties to the agreement is maintained by the threat of punishment (a fine, a jail term, dismissal, or whatever) for anyone who breaks a contract. And the parties are confident that the State will honour its agreement to enforce contracts because citizens have coordinated their voting plans. We are in the realm of equilibrium beliefs, held together by their own bootstraps.

Of course, cooperation isn't the only possible outcome. Non-cooperation can also be held together by its own bootstrap. Each party believes that the others will not keep their agreement, and so finds it in his self-interest to break the agreement. At that particular equilibrium the parties don't trust one another to keep their promises, because the external enforcer cannot be trusted to enforce agreements. To ask whether cooperation or non-cooperation would prevail is to ask which system of beliefs is adopted by the parties about one another's intentions. Social systems have multiple equilibria.

Putnam (1993) famously offered evidence from Italy to show that if citizens were to invest in social capital (in the sense I am using the term here), they could further their projects and purposes by getting State officials to do their job honestly and efficiently. The underlying mechanism he alluded to, however, involves mutual enforcement. I believe Putnam was right in thinking that social environments involving "mutual enforcement" of agreements are a requirement for those involving "external enforcement". So we turn to the idea of mutual enforcement.

5. Mutual Enforcement as a Feature of Social Capital

Let us begin by imagining that the group of people in question don't have access to an

external enforcer. Suppose, however, that they expect to face similar transaction opportunities in each period over an indefinite future. We assume also that breach of agreement is observable by all in the group. In such a situation the parties could be sanguine that their agreement would be kept if it were to be mutually enforced. The basic idea is this: a credible threat by members of the group that stiff sanctions would be imposed on anyone who broke an agreement would deter everyone from breaking it. The problem then is to make the sanctions sufficiently stiff and the threat credible. The solution to the credibility problem in this case is achieved by recourse to social norms of behaviour.

Recall that by a strategy one means a set of conditional actions. Strategies take the form, "Do P if Q happens", "I will do M if she does N", and so forth. By a social norm we mean a strategy that is followed by members of a community. So a social norm is what one may call a "rule of behaviour". But for a rule of behaviour to be a social norm, it must be in the interest of everyone to act in accordance with the rule if all others were to act in accordance with it. Social norms are (Nash) equilibrium rules of behaviour.

I now show how a reliance on social norms can be the basis of mutual trust among people. To do that it will pay to study a numerical example:

5.1 Long-Term Relationships

Imagine that person A has access to some working capital (raw material, say), worth $4,000. To keep things simple we imagine that A is able to borrow the $4,000 from a source that can be guaranteed to recover the debt (e.g., because there is a credible external enforcer). I want to avoid having to discuss A's incentives to repay any debt he may incur to the external source because I want to study A's relationship with B, who has the skills to use the working capital worth $4,000 to produce goods worth $8,000 in the market. A doesn't have those skills. However, A has access to the market, which B doesn't. A proposes to advance the capital to her, with the understanding that he will sell the goods once B produces them and share the proceeds with her. If B was not to work for A, she would use her time to produce goods for her home, worth $2,000 to her. In order to get her to accept his offer, A proposes a sharing rule that is hallowed by their tradition: The $8,000 would be used first to compensate both parties fully ($4,000 for A and $2,000 for B) and the remaining $2,000 would then be divided equally between the two. A would receive $5,000 and B, $3,000. Each would gain $1,000 from the arrangement.

B regards the proposal as fair, but is worried about one thing: Why should she trust A not

to renege on the agreement by keeping the entire $8,000 for himself?

Imagine that the opportunity for A and B to do business with each other is expected to arise over and over again; say, annually. The time taken for B to produce her output is assumed to be well within a year. Let *t* denote time (*t* = 0, 1, 2, ...). Although the future benefits from cooperation are important to both A and B, they will typically be less important than present benefits because, among other things, there is always the chance that one of the parties will not be around in the future to continue the relationship, or that circumstances may change in such ways that A does not have access to his capital flow. So we suppose that the two parties discounts the future benefits from cooperation at the rate *r*. (We will see that in the present example it doesn't matter what B's discount rate is.) I now show that, provided *r* is small, the pair could in principle enter a successful long-term relationship, where each year A advances $4,000 to B, sells the goods B has produced for $8,000, and pays her $3,000.

Consider the following rule of behaviour that A might adopt: (i) begin by advancing $4,000 to B, (ii) sell the goods if she produces them during the year, (iii) share the proceeds according to the agreement, and (iv) continue doing so every year so long as neither party has broken the agreement; but (v) end the relationship permanently the year following the first defection by either party. Similarly, consider the following rule of behaviour that B might adopt: so long as neither party has reneged on the agreement, work faithfully for A each year; but refuse ever to work for him the year following the first violation of the agreement by either party.

The two rules embody a common idea: begin by cooperating and continue to cooperate so long as neither party has broken their word, but withdraw cooperation permanently following the first defection from the agreement by either party. Withdrawal of cooperation is the sanction. This most unforgiving of rules has been christened the "grim strategy", or simply grim. We show next that grim is capable of supporting the long-term relationship if *r* is not too large.

First consider B. Suppose A has adopted grim and B believes that he has. He will advance her the capital at the beginning of year 0. B's best course of actions is clear: keep to the agreement. For suppose she reneges on the agreement. She would lose $1,000 (her share of $3,000 minus the $2,000 she would earn producing home goods), but gain nothing in any future year (remember, A has adopted grim). This means that no matter what B's discount rate is, she couldn't do better than to adopt grim if A has adopted grim.

The harder piece of reasoning is A's. Suppose B has adopted grim and A believes she has.

If he has advanced the working capital to her, she will have worked faithfully for him in year 0. A now wonders what to do. If he reneges on the agreement, he would make a $4,000 profit ($8,000 minus the $4,000 he could have earned with his capital even if he had not entered into the relationship with B). But since he believes B to have adopted grim; he must also believe that B will retaliate by never working for him again. So, set against a single year's gain of $4,000 is a net loss of $1,000 (the foregone profit from the partnership) every year, starting year 0. That loss, calculated in year 0, is the sum, $(1,000 + 1,000/(1+$r$) + 1,000/(1+$r$)^2 + 1,000/(1+$r$)^3 + ... ad infinitum), which adds up to $1,000(1+$r$)/$r$. If $1,000(1+$r$)/$r$ exceeds $4,000, it isn't in A's interest to break the agreement, which means that he can't do better than to adopt grim himself. But $1,000(1+$r$)/$r$ exceeds $4,000 if and only if r is less than 1/3 per year (or approximately 33.3% per year). We have therefore proved that if r is less than 25%, it is in each party's interest to adopt grim if the other party adopts grim. But if both adopt grim, neither would be the first to defect, which implies that the agreement would be kept. We have therefore proved that grim can serve as a social norm to maintain a long-term relationship between the patron (A) and the client (B).

Economists have found evidence of grim in social interchanges, but it would appear to be in force mostly where people also have access to formal markets. In the poor world, though, grim is not in evidence. Sanctions are graduated, the first misdemeanor being met by a small punishment, subsequent ones by a stiffer punishment, persistent ones by a punishment that is stiffer still, and so forth. How are we to explain this?

Where formal markets and long-term relationships co-exist, grim could be expected to be in operation. Grim involves permanent sanctions, which is a needed device for preventing people from engaging in opportunistic behaviour when good, short-term opportunities appear nearby from time to time. But if, as in villages in poor countries, there are few alternatives to long-term relationships, communitarian arrangements would be of high value to all. Adopting grim would be an overkill in a world where people discount the future benefits from cooperation at a low rate. For that reason, the norms that are adopted involve less draconian sanctions than grim. A single misdemeanor is interpreted as an error on the part of the defector, or as "testing the water" (to check if others were watching). This is why graduated sanctions are frequently observed.

Here then is our general finding: social norms of behaviour are able to sustain cooperation

if people care sufficiently about the future benefits of cooperation. The precise terms and conditions will be expected to vary across time and place; what is common to them all is that cooperation is mutually enforced, it isn't based on external enforcement.

There is, however, a piece of bad news: people could end up not cooperating even if they care a lot about the future benefits of cooperation. To see how, imagine that each party believes that all others will renege on the agreement. It would then be in each one's interest to renege at once, meaning that there would be no cooperation. Even if *r* is less than 1/3 per year in our numerical example, behaviour amounting to non-cooperation is also a Nash equilibrium: A doesn't advance the $4,000 worth of raw material to B, because he knows that B won't work for him; she would refuse because of the fear that A won't keep his promise to share the proceeds; a fear that is justified, given that A intends not to share the $8,000 with her once she has produced those goods; and so on. Failure to cooperate could be due simply to an unfortunate pair of self-confirming beliefs, nothing else. No doubt it is mutual suspicion that ruins their chance to cooperate, but the suspicions are internally self-consistent. In short, even when appropriate institutions are in place to enable people to cooperate, they may not do so. Whether they cooperate depends on mutual beliefs, nothing more. I have known this result for many years, but still find it a surprising and disturbing fact about social life.

Could the pair form a partnership if *r* exceeds 1/3 per year? The answer is "no". As grim is totally unforgiving, no other rule could inflict a heavier sanction for a single misdemeaner. The temptation A faces to defect is less if B adopts grim than if she were to adopt any other rule of behaviour; which implies that no rule of behaviour could support a partnership if *r* exceeds 1/3 per year. Studying grim is useful, because it allows us in many examples, such as the present one, to determine the largest value of *r* for which cooperation is possible.

We now have in hand a tool to explain how a community can skid from cooperation to non-cooperation. Ecological stress - caused, for example, by increasing population and prolonged droughts - often results in people fighting over land and natural resources. Political instability - in the extreme, civil war - could in turn be a reason why both A and B become concerned that A's source of capital will be destroyed or confiscated. A would now discount the future benefits of cooperation with B at a higher rate. Similarly, if the two fear that their government is now more than ever bent on destroying communitarian institutions in order to strengthen its own authority, *r* would rise. For whatever reason, if *r* were to rise beyond 1/3 a year, the relationship

would break down. Mathematicians call the points at which those switches occur, bifurcations. Sociologists call them tipping points. Social norms work only when people have reasons to value the future benefits of cooperation.

Contemporary examples illustrate this. Local institutions have been observed to deteriorate in the unsettled regions of sub-Saharan Africa. Communal management systems that once protected Sahelian forests from unsustainable use were destroyed by governments keen to establish their authority over rural people. But Sahelian officials had no expertise at forestry, nor did they have the resources to observe who took what from the forests. Many were corrupt. Rural communities were unable to switch from communal governance to governance based on the law: the former was destroyed and the latter didn't really get going. The collective vacuum has had a terrible impact on people whose lives had been built round their forests and woodlands.

Ominously, there are subtler pathways by which societies can tip from a state of mutual trust to one of mutual distrust. Our model of the partnership between A and B has shown that when *r* is less than 1/3 per year, both cooperation and non-cooperation are equilibrium outcomes. The example therefore tells us that a society could tip over from cooperation to non-cooperation owing merely to a change in beliefs. The tipping may have nothing to do with any discernable change in circumstances; the entire shift in behaviour could be triggered in people's minds. The switch could occur quickly and unexpectedly, which is why it would be impossible to predict and why it would cause surprise and dismay. People who woke up in the morning as friends would discover at noon that they are at war with one another. Of course, in practice there are usually cues to be found. False rumours and propaganda create pathways by which people's beliefs can so alter that they tip a society where people trust one another to one where they don't.

The reverse can happen too, but it takes a lot longer. Rebuilding a community that was previously racked by civil strife involves building trust. Non-cooperation doesn't require as much coordination as cooperation does. Not to cooperate usually means to withdraw. To cooperate, people must not only trust one another to do so, they also have to coordinate on a social norm that everyone understands. That is why it's a lot easier to destroy a society than to build it.

5.2 Tying Long-Term Relationships

Cooperation can be made more robust if the parties were to tie their agreements. To see how, suppose that in the patron-client relationship we have just studied, the discount rate A (the patron) uses to value the future benefits of cooperation with B (the client) exceeds 1/3 per year.

We know that for want of trust, the pair would be unable to form a partnership. But now imagine that, in addition to the annual flow of $4,000 worth of working capital, A has access to an annual flow of a different type of working capital, worth $3,000 to him. B doesn't have the skills to work with that capital, but someone named C does. The time C would need to work A's capital into a marketable product is worth $1,000 to her. Like B, C doesn't have access to the market for products. The product can fetch $6,000 in the market and A is in a position to procure it. A considers approaching C with a proposal to form a partnership: the $6,000 would be used first to compensate the pair; the surplus would then be divided equally between them. Each would enjoy a profit of $1,000 annually. For what values of *r* is a partnership between them viable?

As C's motivations in the potential relationship are similar to B's in the previous example, we needn't study them again. But we do need to work through A's reasoning, because the numbers matter. So let us start in year 0. Suppose C has adopted grim. If A advances his capital to her but reneges on the agreement once she has produced the output, he gains $3,000 ($6,000 minus $3,000) that year. Set against it is the $1,000 he would lose every year, starting year 0. That loss, calculated in year 0, is $1,000(1+*r*)/*r*. If 1,000(1+*r*)/*r* is less than 3,000, A will renege. If, on the other hand, 1,000(1+*r*)/*r* exceeds 3,000, A can do no better than to adopt grim himself. Since 1,000(1+*r*)/*r* exceeds 3,000 if and only if *r* is less than 1/2 per year (50% a year), the pair are able to form a long-term relationship if A's discount rate is less than 50% per year. So suppose *r is* less than 50%. Then A is able to form a relationship with C, but not with B (*r* exceeds 1/3).

We are now able to show that so long as *r* is less than 40% (or 2/5) a year, A could form a relationship with B if the three were to tie the pair of undertakings. Let the proposal be to create both partnerships, but with the understanding that if any party in any year was to act opportunistically, both relationships would be terminated. In order to formalise this, let the rule of behaviour adopted by B (respectively, C) now read: Begin by cooperating with A and C (respectively, B) and continue to cooperate so long as no one has broken their agreement, but cease cooperating with everyone following the first defection by any one in either relationship. Similarly, let the rule of behaviour adopted by A now read: Begin by cooperating with B and C and continue to cooperate so long as no one has broken their agreement, but cease cooperating with everyone following the first defection by any one in either relationship. Each of the parties has adopted grim once again, but grim here comes with an added sting.

It's easy enough to confirm that B would adopt grim if A and C adopt grim and that C would adopt grim if A and B adopt grim. The interesting exercise is to determine A's incentives to cooperate if B and C adopt grim. As both clients would terminate their relationship with him if he behaved opportunistically with either, A would defect from both relationships if he defects at all. What remains is to calculate A's gains and losses if he defects from both relationships in year 0. If he does, he gains $7,000 now ($4,000 from his partnership with B; $3,000 from his partnership with C). Set against that is the value of all the future benefits from cooperation he will have to forego. That loss is $2,000(1+*r*)/*r*. It follows that A can't do better than to adopt grim himself if $7,000 is less than $2,000(1+*r*)/*r*; which is to say, if *r* is less than 40%. As we are supposing that $1/3 < r < 2/5$, we conclude that by tying the relationships, both can be created; whereas, if they are kept separate, only the one between A and C can form. The intuition behind the finding is clear. A faces greater temptation to defect from his agreement with B than the one with C, which is why the circumstances under which a relationship could form with B are more restricted than they are with C. By tying the two relationships, A's temptation to break his relationship with B is reduced.

While C doesn't lose from the move to tie the partnerships, she doesn't gain either. Only A and B gain. So B has every reason to offer solidarity to C, whom she now regards as a professional comrade. B may even offer a small compensation to C, so as to give her a positive incentive to agree to having the two partnerships tied. In return, C promises to stick by B should A mistreat her. He doesn't do that, of course, but only because he is smart enough to know that C would break up their relationship if he did.

Further refinements are needed when people who wish to trade with one another are separated by distance. Community responsibility systems in Italy during the 12th and 13th centuries helped people to obtain credit and insurance (Greif, 1994). Transgressions by a party were met in a collective way: the group to which the injured party belonged imposed sanctions on the group of which the transgressor was a member. In such arrangements it is communities, not individuals, that acquire a reputation for honesty. Tying relationships in this manner also creates incentives for members of a peer group to keep an eye on one another. The institution reduces the costs people incur in keeping an eye on one another.

The drawback of tied relationships among people having different interests is that they require further coordination. If B possessed not only her own skills but those of C as well, and

if she had the time to work for A in both ventures, it would be simpler for A to offer both partnerships to B, with the proposal that they be tied. The relationship would involve only A and B, requiring less coordination.

6 Culture as Beliefs

Agreements are kept only because parties expect agreements to be kept. Mutual expectations about "reputation" and "rules of behaviour" would seem to require an underlying "thing", something that would permit the coordination of those optimistic beliefs. But what is that "thing"? Today we use the term "social capital" to signify that thing. In earlier days it used to be culture. But pointing to culture as an explanatory device won't do, because culture itself should be explained.

6.1 Basics

We have seen that where incentives are required for cooperation, non-cooperation is also a possible outcome.[3] Which state of affairs prevails depends upon mutual beliefs. The theory I am using here doesn't explain those beliefs; what it does is to identify those that can be rationally held. Rational beliefs are not belied by the unfolding of evidence. As they are self-confirming, rational beliefs offer an anchor for our analysis. Because rational beliefs are not unique, they offer just the kind of flexible anchor we need in order to make sense of societal differences.

In his famous work on the influence of culture on economic development, Weber (1930) took a community's culture to be its shared values and dispositions, not just beliefs. Studies as widely cast as Weber's can't easily be summarized, but the causal mechanism Weber himself would seem to have favoured in his work on Protestant ethic and the spirit of capitalism leads from religion, through political culture, to institutions and, so, to economic performance.

Using culture to explain economics has not been popular among social scientists in the post-War period. But there has been a recent revival. The most ambitious appeal to culture to understand differences in economic performance since Weber has been Landes (1998), who asked why it is that since the middle of the sixteenth century, countries in northern Europe managed to race ahead of those several others elsewhere seemingly better placed at the time. No doubt technological progress and its rapid diffusion among populations was the key to that success, but the progress itself needs explaining. The one Landes offers is distinctive, because

[3] There can be many more equilibria, characterised by partial compliance. For expositional ease I mostly restrict the discussion to two extreme equilibria, those that are characterised by non-compliance and full compliance, respectively.

it gives importance to the evolution (or a lack of it) of different types of attitudes and beliefs in various regions of the world. Landes argued that these differences gave rise to institutional differences (with feedback to attitudes and beliefs), which help to explain why some countries became winners, while others enjoyed a brief period of success before losing to the winners, while yet others merely suffered from atrophy.

Landes offered a historical narrative. An alternative strand of enquiry makes use, when available, of statistical evidence. The two strands complement each other. Putnam (1993), Knack and Keefer (1997), and La Porta et al. (1997) have studied cross-section data and discovered positive links between civic culture (civic engagements, trust) and economic growth, while Granato, Inglehart, and Leblang (1996) have studied cross-section data and found positive links between personal motivation (the desire to advance oneself economically) and economic growth.

The statistical findings shouldn't be given a causal interpretation. The motivation to advance oneself would be expected to depend upon one's expectations (i.e., beliefs) regarding the chance that hard work pays off. Parents would be expected to instil personal ambition in their children only if they were sanguine that such ambition would not be thwarted by the social order. And women would not rise beyond their station if they (rationally!) feared retaliation against them for their temerity. Thus, even an attitude can be a determined rather than determining factor. When it is the former, an observed statistical link between culture and economic progress should be interpreted at most as an equilibrium relationship between two endogenous variables. I am using "culture" to denote differences in the beliefs people hold about one another. Culture in this view is a coordinating device.[4] The above line of thinking has been used to explain to two contemporary phenomena: the presence of cultural stereotypes (Arrow, 1973; Starrett, 1976; Coate and Loury, 1993) and the extent of tax compliance in a society (Levi, 1988; Lindbeck et al., 1999).

6.2 Culture as a Coordinating Mechanism

Equilibrium beliefs could be the consequence of historical accidents, rather than deliberate agreement. So it can be that societies that are identical in their innate characteristics (i.e. fundamentals) display very different civic behaviour. Similarly, it can be that people in one society harbour cultural stereotypes even though people in another society possessing the same fundamentals don't harbour them. Culture is not an explanatory variable in either example - it is

[4] Greif (1994) has pursued this line of enquiry.

endogenous in both. Moreover, as our four-way classification of social environments in which people could trust one another to keep their promises suggested, you don't need to know someone, even at some steps removed, to form beliefs (even rational beliefs) about his or her intended behaviour. Interpersonal networks are certainly necessary if mutually beneficial outcomes are to be identified and the associated agreements reached, but you don't need to know each and every fellow citizen to arrive at rational beliefs, at a statistical level, about their intended behaviour. Trust is the key to cooperation, what scholars have meant by "social capital" is merely one of the means to creating trust.

Earlier we alluded to disequilibrium beliefs and the way social scientists have modelled the way beliefs change over time. We may use those models to explain contemporary cultural differences (differences in rational beliefs) in terms of differences in primitives, such as our material needs, the large-scale ecological landscape, the shared knowledge base, and historical accidents. In such analyses cultural differences would be correlated with differences in economic performance, they would not be the cause of them.

Different types of variables should be expected to change at different speeds - some slow, some others not-so-slow, yet others fast. Imagine now that certain types of (cultural) beliefs are slow to adapt to changing external circumstances. Since slow variables are to all intents and purposes fixed in the short run, it would not be unreasonable to regard them as parameters for short-run analyses. This is the approximation social scientists make when they offer cultural explanations for economic performance, for example, the success of Japan in the post-War era (Hayami, 1997).

Matters are different in the long run. Individual motivation and beliefs are influenced by values and the practice of norms, and they in turn are influenced by the products of society, such as institutions, artifacts, and technologies (Wildavsky, 1987). Moreover, any process that ties individual motivations and beliefs to values and norms and thereby to the choices made, and back again, would be expected to be path-dependent. There is little evidence though that trade and imitation may not lead to convergence in those spheres of culture that have a sizeable effect on economic performance. It is also possible that the effect of a particular component of a people's culture changes over time even when the culture itself isn't changing. The various components of culture are in different degrees complementary to other factors of production. So it is possible for a particular component to lie dormant for decades, even centuries, only to become a potent

force when external circumstances are "right". By the same token, this same component could become ineffective, even dysfunctional, when external circumstances change again. This is why there is no logical flaw in such claims as that Japan's remarkable economic success in the post-War period has been due in part to some aspects of the nation's culture, even though those same aspects did not have potency in earlier centuries and may in future even prove to be dysfunctional.

7. Networks

So far we have assumed that interpersonal networks (networks for short) are in place.[5] But networks have to be created. Moreover, searching for others with whom to form networks involves resources (e.g., time). So we need to study pathways by which networks get formed and the reasons why they get formed.

7.1 Creating Ties

One may think of networks (social capital, in our classification) as systems of communication channels for protecting and promoting interpersonal relationships. Interpersonal relationships are a more complex notion than networks, as they are the outcomes of a system of mutual beliefs. But networks cover a wide terrain. They include as tightly-woven a unit as a nuclear family and one as extensive as a voluntary organization. We are born into certain networks and enter new ones. So networks are themselves connected to one another. Network connections can also be expressed in terms of channels, although a decision to establish channels which link networks could be a collective one.

An elementary channel connects a pair of individuals directly. However, one can establish indirect links. Person A builds an elementary channel, connecting him to person B, person B builds an elementary channel connecting her to C, and so forth. A is then connected to C, albeit once removed. Indeed C's motive for establishing an elementary channel with C could be because of her desire to be linked to A. And so on.

The clause "personal relationships" in the notion of networks is central. There is also the suggestion that engaging in civic cooperation leads to a heightened disposition to cooperate (Seabright, 1993). It amounts to forming personal beliefs about others and one's own tastes through sampling experiences. But if social engagement fosters trust and cooperation, there

[5] Goyal (2006) is an excellent treatise on the structure of a network and its implied connections among the network's members.

would be positive feedback between civic engagement and a disposition to be so engaged. The synergy would be tempered by the fact that the private cost of additional engagements (time) would rise with increasing engagements.[6]

7.2 Network Externalities

Installing channels is a way to create trust. Plausibly, someone's knowledge of someone else' character declines with the number of elementary channels separating them, as in perhaps knowing very little personally about a friend of a friend of a friend, knowing rather more about a friend of a friend, and knowing even more about a friend.[7] This creates the necessary tension between the benefits and costs of establishing elementary channels.

But one can be misled by this chain-postulate into thinking that weak ties are not valuable. In fact they can be very valuable. In a famous study based on interviews with professional and technical workers in a town outside Cambridge, Massachusetts, Granovetter (1973, 1974) revealed that more than half had found their jobs through a personal connection. Surprisingly, the majority of personal connections weren't close friends, they were mere acquaintances.

Granovetter himself noted that the latter finding should have been expected. The reason weak ties are especially useful in the search for jobs is that they cover a greater range of links than strong ties. Weak ties connect one to a variety of people and so to a wide information base. However, among rural populations in poor countries there are not so many weak ties, ties are mostly intense. This narrows possibilities. But it creates an avenue for migration. One enterprising member of the community moves to the city, perhaps supported by those with whom he has strong ties at home while he searches for work. He is followed by others in a chain-like fashion, as information is sent home of job prospects. Migrant workers may even recommend village relations to their bosses, because employing them would reduce moral hazard and adverse selection problems for the bosses. This would explain the still largely anecdotal evidence that city mills often employ disproportionate numbers of workers from the same village. The emotional

[6] Putnam (1993: 86-91) discusses this influence. He even suggests (p.90) that "taking part in a choral society or a bird-watching club can teach self-discipline and an appreciation for the joys of successful collaboration." Seabright (1997) reports empirical evidence of cooperation begetting further cooperation. Recall the observation by Hirschman (1984) that trust is a moral good (it grows with use and decays if unused).

[7] Compare this account with Putnam (1993: 168-9): "Mutual trust is lent. Social networks allow trust to become transitive and spread: I trust you, because I trust her and she assures me that she trusts you."

costs of adaptation to new surroundings would also be lower for later migrants, with the implication that migration in response to new opportunities in the city should be expected to be slow to begin with but would pick up strength as costs decline (Carrington et al., 1996). Formal evidence of chain migration, though sparse, does exist. Caldwell (1969) has confirmed its occurence in sub-Saharan Africa and Banerjee (1983) has provided evidence from an Indian sample. Chain migration from village to town has been observed among children in Karnataka, India, by Iversen (2002) in his study of peer-group emulation as a determining factor in the supply of child labour.

There can also be negative externalities in the creation of channels, such as those within groups that are hostile to one another. One would expect an oversupply of them (they are often neighbourhood "arms" races; Gambetta, 1993). Be they positive or negative, externalities give rise to collective inefficiency. Positive externalities point to an argument for public subsidy, negative ones for investment in such institutions as those whose presence would lower the externalities ("taxing" the corresponding activities would be another possibility). Local authorities frequently apply this argument when establishing youth centres, social clubs, and the like.

7.3 The Strength of Inherited Networks

Wintrobe (1995) asked why social networks frequently operate along ethnic lines and why they are multi-purpose and dense, unlike specialized "professional" networks; that is, why narrow identities are assumed so frequently along ethnic lines. In answer he observes that exit from, and entry into, ethnic networks are impossible and suggests that the threat of sanctions by the group prevents children from reneging on their tacit agreement to work within them.

But there are additional forces at work. It should not be surprising that the social channels people bequeath their children in traditional societies frequently amount to ethnic networks (who else is there with whom one can form connections?). Posner (1980) observes in the African context that, because monitoring one another's activities is not costly within the village and kin-group, confining networks to them are a means of reducing moral hazard and adverse selection. But even while it is true that exit from one's ethnicity is literally impossible, children do have a choice of not using the ethnic channels they have inherited. So Wintrobe's thesis needs to be extended if we are to explain why those particular networks are so active - their mere denseness would probably not suffice. The way to extend the account is to observe first that investment in

networks is irreversible. One cannot costlessly re-direct channels once they have been established, because such investments are inevitably specific to the relationships in question. Moreover, if trust among people begets trust (Seabright, 1993), the cost of maintaining a channel would decline with repeated use (witness that we often take our closest friends and relatives for granted). So, using a channel gives rise to an externality over time, much as in "learning by doing" in the field of technology-use. The benefits from creating new channels are therefore low if one has inherited a rich network of relationships; which is another way of saying that the cost of not using inherited channels is high. Outside opportunities have to be especially good before one severs inherited links. It explains why we maintain so many of the channels we have inherited from our family and kinship, and why norms of conduct pass down the generations. We are, so to speak, locked-in from birth.

8. Sundry Features of Social Capital

Three features of social capital (i.e., networks whose members enter into engagements under the discipline of mutual enforcement) deserve special attention. I turn to them.

8.1 Narrow Identities

There is a close link between "social capital" and "social identities". Activities in networks creates bonds, sometimes even affection, among members. Trust develops on the basis of the first two contexts we identified under the headings, "mutual affection" and "pro-social disposition". Here I want to think of a person's social identity as being defined by the networks she belongs to.

How many networks would a person be able to join? It is a truism today that a person's identity is multi-dimensional and that people share many of the allegiances associated with them. Social psychologists have noted too that aspects of a person's identity are fluid and built on the deliberative choices of the person himself and of others (Tajfel and Turner, 1986). Advocates of Liberal Cosmopolitanism tell us to recognize humanity whenever and wherever it occurs, while assuring us that it is deserving of our first allegiance and respect (Nussbaum, 1996; Maalouf, 2000; Barry, 2001; Appiah, 2005; Sen 2006). Sen (2006) in particular argues that individuals have multiple identities, so that claims for special and narrow identities are unwarranted, even delusionary. And yet, all over the world we see individuals and groups defining themselves in narrow, exclusive terms and defending them vigorously. Why?

Population heterogeneity is a reason: some like one network, others feel more at home

in other networks, and so on. Religious groupings are a prime example. Then there is the "lock-in effect" in inherited networks mentioned in Section 7.3, which makes it costly for someone to leave the networks into which he was born.

There is a third reason. The advantages of tied relationships suggest that size is an advantage to networks. But that means that if a member of a network were to join another network in order to further some of his purposes, the former would incur a loss by being less robust (Section 5.2). We should conclude that an increase in any given network's size inflicts a negative externality on other networks. So networks vie with one another for membership. Dasgupta and Goyal (2009) have developed a simple model of individual incentives and network interests to identify circumstances where individuals desire multiple identities, but are required by networks to assume narrow identities.[8]

8.2 Networks and Human Capital

In his pioneering work Coleman (1988) saw social capital as an input in the production of human capital. Establishing networks involves time and effort. Much of the effort is pleasurable, some not. Even so, just as academics are paid for what they mostly like doing anyway (as a return on investment in their education), networking would be expected to pay dividends even when maintaining networks is a pleasurable activity.

Burt (1992) has found among business firms in the United States that, controlling for age, education and experience, employees enjoying strategic positions in networks are more highly compensated than those who are not. His findings confirm that some of the returns from investment in network creation are captured by the investor. However, because of network externalities, not all the returns can be captured by the investor: when A and B establish a channel linking them, the investment improves both A's and B's earnings, but it also improves the earnings of C, who was already linked to B.

Burt's findings suggest that memberships in networks are a component of "human capital". If firms pay employees on the basis of what they contribute to profitability, they would look not only at the conventional human capital employees bring with them (e.g., health, education, experience, personality), but also the personal contacts they possess. It would be informative to untangle networks from the rest of human capital. This could reveal the extent to

[8] Large networks can experience communication problems of course. I am supposing here that those problems become significant only when network sizes are very large.

which returns from network investment are captured by the investor. But measurement problems abound. They may be insurmountable because of the pervasive externalities to which they give rise. We will see, moreover, that the way aggregate production functions are specified affects the way social capital manifests itself in macroeconomic statistics. In the Appendix, for example, I show that even when there are no network externalities, growth in a trust among members of a group of people will display itself in growth in total factor productivity (not growth in human capital) if the aggregate production function is suitably formulated.

8.3 Horizontal vs. Vertical Networks

Putnam (1993: 174) observes a critical difference between horizontal and vertical networks:

"A vertical network, no matter how dense and no matter how important to its participants, cannot sustain social trust and cooperation. Vertical flows of information are often less reliable than horizontal flows, in part because the subordinate husbands information as a hedge against exploitation. More important, sanctions that support norms of reciprocity against the threat of opportunism are less likely to be imposed upwards and less likely to be acceded to, if imposed. Only a bold or foolhardy subordinate lacking ties of solidarity with peers, would seek to punish a superior."

There is a third reason:

Imagine a network of people engaged in long-term economic relationships, where relationships are maintained by observing social norms (e.g., norms of reciprocity; Section 5). Suppose new economic opportunities arise outside the enclave, say, because markets have developed. Horizontal networks are more likely to consist of members who are similarly placed. If one of the parties discovers better economic opportunities outside the enclave, it is likely that others too will discover better economic opportunities. Both parties would then wish to re-negotiate their relationship.

Vertical (or hierarchical) networks are different. Even if the subordinate (e.g., the landless labourer) finds a better economic opportunity in the emerging markets, it is possible that the superior (i.e., the landlord-creditor) does not; in which case the former would wish to re-negotiate, but the latter would not. It is no doubt tempting to invoke the Coase-argument (Coase, 1960), that the subordinate would be able to compensate the superior and thus break the traditional arrangement. But this would require the subordinate to be able to capitalise his future

earnings, something typically not possible for such people as those who are subordinates in rural economies in poor countries. Nor is a promise to pay by instalments an appealing avenue open to a subordinate. He would have to provide collateral. As this could mean his family left behind, the worker could understandably find it too costly to move.

9 Networks and Markets

Networks are personal. Members of networks must have names, personalities, and attributes. Networks are exclusive, not inclusive, otherwise they would not be networks. The terms of trade within a network would be expected to differ from those which prevail across them. An outsider's word would not be as good as an insider's word: names matter.

Networks give rise to "communitarian" institutions. In contrast, markets (at least in their ideal form) involve "anonymous" exchanges (witness the oft-used phrase: "my money is as good as yours"). To be sure, the distinction between named and anonymous exchanges is not sharp, and even in a sophisticated market (modern banking), reputation matters (credit rating of the borrower). But the distinction is real. The key point that follows is that the links between markets and communitarian institutions are riddled with externalities. Transactions in one institution have effects that spill over to the other without being accounted for. Externalities introduce a wedge between private and social costs, and between private and social benefits. We observe below that some externalities are of a kind that reflects synergism between the two institutions, while others reflect antagonism between them.

All societies rely on a mix of impersonal markets and communitarian institutions. The mix shifts through changing circumstances, as people find ways to circumvent difficulties in realizing mutually beneficial transactions. It pays to study those features of goods and services that influence the mix in question and the hazards that lie in wait while the mix changes as a consequence of the individual and collective choices that are made.

9.1 Complementarities

Networks and markets often complement one another. Production and exchange via networks in one commodity can be of vital importance to the functioning of the market in another. As has been long noted by economists, for example, exchanges within the firm are based on a different type of relationship from those in the market place between firms.

But complementarities between networks and markets can be a good deal more subtle. Powell (1990) and Powell and Brantley (1992) have found that researchers in rival firms in such

a competitive environment as the one that prevails in the bio-technology industry share certain kinds of information among themselves, even while the scientists maintain secrecy over other matters. The balance between disclosure and secrecy is a delicate one, but in any given state of play a common understanding would seem to prevail on the kinds of information members of a network of scientists are expected to disclose, if asked, and the kinds one is expected not even to seek from others. In such an environment non-cooperation would be costly to the individual scientist: if he refused to share information, or was discovered to have misled others by giving false information about his own findings, he would be denied access to information others share. There is also evidence that sharing research findings among scientists in rival firms is not clandestine practice. Management not only are aware of the practice, they positively encourage their scientists to join the prevailing network. Well-connected scientists are especially valued. The geographical clustering of firms in research-based industries (e.g., Silicon Valley, California; the Golden Triangle in North Carolina; Silicon Fen around Cambridge, England) is a consequence of the need for such networks. Networks can even be the means by which markets get established (long distance trade in earlier times). In some cases they are necessary if markets are to function at all.[9]

9.2 Crowding Out

Where networks and markets are substitutes, they are antagonistic. In an oft-quoted passage, Arrow (1974: 33) expressed the view that organizations are a means of achieving the benefits of collective action in situations where the price system fails. This formulation, if interpreted literally, gets the historical chronology backward, but it has an important contemporary resonance: when markets displace communitarian institutions in the production of goods and services, there are people who suffer unless counter-measures are undertaken by collective means.

Arrow's observation also has a converse: certain kinds of network can prevent markets from functioning well (Arnott and Stiglitz, 1991). Networks can even prevent markets from coming into existence. In such situations networks are a hindrance, not a help to economic development. They may have served a purpose once, but they are now dysfunctional.

To illustrate, consider the strong kinship ties that are prevalent in traditional societies.

[9] Even here the role of networks can be expected to diminish as it becomes easier and easier to transmit and access information in the market place.

Such ties reflect a communal spirit absent from modern urban life and strike an emotional chord among Occidental scholars (Apfell Marglin and Marglin, 1990). But there is a functional side to kinship ties: the obligation of members of a kinship to share their good fortune with others in the group offers a way to pool individual risks. The lowlands of sub-Saharan Africa, for example, are in large measure semi-arid, where people face large climatic risks. In contrast, people in the highlands enjoy more reliable rainfall. Lineage groups are powerful in the lowlands. They are less powerful in the highlands, where even private ownership of land is not uncommon (e.g., the Kikuyu in Kenya; Bates, 1990).

However, there is a bad side to the coin in kinship obligations. They dilute personal incentives to invest for prosperity. Even if the social return on investment in an activity is high, the private return can be low: because of kinship obligations, the investor would not be able to appropriate the returns.[10] Insurance markets are superior to communitarian insurance systems because the former, covering a wider terrain of people, are able to pool more risks. On the other hand, mutual insurance among members of a community (e.g., household, kinship, village) can be expected to be less fraught with problems of moral hazard and adverse selection than markets. This means that if we view kinship obligations over insurance and credit, respectively, as risk-sharing arrangements and intertemporal consumption-smoothing devices, they are to the good; but they are not all to the good, because their presence renders as low the private benefits people would enjoy from transacting in insurance and credit markets even when the collective benefits are high.

It is possible also to show that the more dissimilar are transactors, the greater are the potential gains from transaction. This means that, to the extent communitarian institutions are a dense network of engagements, they are like economic enclaves. But if the institutions act as enclaves, they retard economic development. For example, social impediments to the mobility of labour imply that "talents" aren't able to find their ideal locations. This can act as a drag on economic development. The same point can be made about credit, if credit is based on kinship. More generally, resources that should ideally flow across enclaves don't do so. Society then suffers from an inefficient allocation of resources.

10 Micro-Behaviour and Macro-Performance

[10] Platteau and Hayami (1998) have stressed this feature of life in the lowlands of sub-Saharan Africa. They were concerned to account for differences between its economic performance and that of East Asia since the 1960s.

We should now ask how network activities translate into the macro-performance of economies. Interestingly, we will discover that they depend on the way aggregate production functions are specified.

Consider a simple formulation of economy-wide production possibilities. Let individuals be indexed by j (j = 1, 2, ...). Let $\underline{K}$ denote the economy's stock of physical capital and $\underline{L}_j$ the labour-hours put in by person j. I do not specify the prevailing system of property rights to physical capital, nor do I describe labour relations, because, to do so would be to beg the questions being discussed here. But it is as well to keep in mind that in a well-developed market economy $\underline{K}$ would be dispersed private property, in others $\underline{K}$ would be in great measure publicly owned, in yet others much would be communally owned, and so forth. It is also worth remembering that in market economies labour is wage based, that in subsistence economies "family labour" best approximates the character of labour relations, and that labour cooperatives are not unknown in certain parts of the world; and so on.

Let $\underline{h}_j$ be the human capital of person j (years of schooling, health). His effective labour input is then $\underline{h}_j\underline{L}_j$. $\underline{h}_j$ is what one may call "traditional human capital"; that is, for the moment we leave aside the networks to which j belongs. For notational ease, it helps to interpret physical capital as "manufactured" capital, comprising such items as factories and buildings, roads and bridges, machines and cables, and so on. In short, I ignore natural capital here.

Human capital is embodied in workers. Given the economy's knowledge base and institutions (the latter I take here to be the engagements brought about by the interpersonal networks), human capital in conjunction with physical capital produces an all-purpose output, $\underline{Y}$.

10.1 Scale vs. Change

Write $H = \Sigma_j(\underline{h}_j\underline{L}_j)$. $\underline{H}$ is aggregate human capital. Now suppose that output possibilities are given by the relationship,

$$\underline{Y} = \underline{A}F(\underline{K},\underline{H}), \qquad (\underline{A} > 0), \qquad (1)$$

where F is the economy's aggregate production function. F is non-negative and is assumed to be an increasing function of both $\underline{K}$ and $\underline{H}$.

In equation (1) $\underline{A}$ is total factor productivity. It is a combined index of institutional capabilities (including the prevailing system of property rights) and publicly-shared knowledge. A macro-economy characterized by the production function F would produce more if, other

things the same, A were larger (that is, if publicly-shared knowledge were greater or institutional capabilities higher). Of course, the economy would produce more also if, other things the same, K or h_j or L_j were larger. In short, technological possibilities for transforming the services of physical and human capital into output, when embedded in the prevailing institutional structure of the economy, account for equation (1).

Consider now a scenario where civic cooperation increases in the community: the economy moves from a bad equilibrium system of mutual beliefs to a good one. The increase would make possible a more efficient allocation of resources in production. The question arises: would the increase in cooperation appear as a heightened value of A, or would it appear as an increase in H, or as increases in both?[11]

The answer could seem a priori to depend on the extent to which network externalities are like public goods. It may be thought that if the externalities are confined to small groups (that is, small groups are capable of undertaking cooperative actions on their own - with little effect on others - and do take such actions in the good equilibrium), the improvements in question would be reflected mainly through the h_js of those in the groups engaged in increased cooperation. Moreover, if the externalities are economy wide (as in the case of an increase in quasi-voluntary compliance in the economy as a whole owing to an altered set of beliefs, even about members of society one does not personally know), the improvements would be reflected mainly through A. Either way, the directional changes in macro-performance (though not the magnitude of the changes) would be the same. Other things the same, an increase in A or in some of the h_js - brought about by whichever of the mechanisms we have considered - would mean an increase in Y, an increase in wages, salaries, and profits, and possibly an increase in investment in both physical and human capital. The latter would result in faster rate of growth in output and consumption, and, if a constant proportion of income were spent on health, a more rapid improvement in health as well.[12]

10.2 Interpreting Cross-Section Findings

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[11] As is well known, it would not be possible to separate the two influences if the production function has the Cobb-Douglas form, $AF(K, H) = AK^aH^b$, where $a, b > 0$. In the text I assume that the production function is not "Cobb-Douglas".

[12] In the text I am assuming implicitly that wage rates, salary rates, and profit rates are monotonically increasing functions of the marginal products of L_j, h_j, and K, respectively. In a perfectly competitive world, the former three quantities would equal the latter three, respectively.

In his analysis of statistics from the 20 administrative regions of Italy, Putnam (1993) found civic tradition to be a strong predictor of contemporary economic indicators. He showed that indices of civic engagement in the early years of this century were highly correlated with employment, income, and infant survival in the early 1970s. Putnam also found that regional differences in civic engagement can be traced back several centuries and that, controlling for civic traditions, indices of industrialization and public health have no impact on current civic engagement. As he put it, the causal link appears to be from civics to economics, not the other way round. How do his findings square with the formulation in equation (1)?[13]

The same sort of question can be asked of even less aggregated data. For example, Narayan and Pritchett (1999) have analysed statistics on household expenditure and social engagements in a sample of some 50 villages in Tanzania, to discover that households in villages where there is greater participation in village-level social organizations on average enjoy greater income per head. The authors have also provided statistical reasons for concluding that greater communitarian engagements result in higher household expenditure rather than the other way round.

To analyse these findings in terms of our macroeconomic formulation, consider two autarkic communities, labelled by i (= 1, 2). I simplify by assuming that members of a community are identical.[14] Denote the human capital per person in community i by $\underline{h}_i$. By $\underline{h}_i$ I now mean not only the traditional forms of human capital (health and education), but also network capital. I denote by $\underline{L}_i$ the number of hours worked by someone in i, by $\underline{N}$ the size of i's population, and by $\underline{K}_i$ the total stock of physical assets in i. Aggregate output, $\underline{Y}_i$, is,

$$\underline{Y}_i = \underline{A}_i F(\underline{K}_i, \underline{N}_i \underline{h}_i \underline{L}_i). \qquad (2)$$

Improvements in civic cooperation are reflected in increases in $\underline{A}$, or $\underline{h}$, or both. It follows that if civic cooperation were greater among people in community 1 than in community 2, we would have $A_1 > A_2$, or, $h_1 > h_2$, or both. Imagine now that the two communities have the same population size, possess identical amounts of physical capital, and work the same number of hours. GNP in community 1 would be greater than GNP in community 2 (i.e., $Y_1 > Y_2$). More

[13] Putnam stressed the importance of civic engagement for making government accountable and responsible.

[14] This is a privilege theorists are able to enjoy to good advantage. By assuming that potentially different entities are identical, we are able to avoid having to "control for differences" in those same entities. The assumption permits us to better understand statistical correlations within multivariate relationships.

generally, an observer would discover that, controlling for differences in K and L, there is a positive association between a community's cooperative culture (be it total factor productivity, A_i, or human capital, h_i) and its mean household income (Y_i/N). This is one way to interpret the finding reported in Narayan and Pritchett (1999).

Consider now a different thought-experiment. Imagine that in year 1900 the two communities had been identical in all respects but for their cooperative culture, of which community 1 had more (i.e., in 1900, $A_1 > A_2$, or $h_1 > h_2$, or both). Imagine next that, since 1900, both A_i and h_i have remained constant. Suppose next that people in both places have followed a simple saving rule: a constant fraction s_K (> 0) of aggregate output have been invested each year in accumulating physical capital. (For the moment I imagine that net investment in human capital in both communities is nil.)[15] In order to make the comparison between the communities simple, imagine finally that the communities have remained identical in their demographic features. It is then obvious that in year 1970 community 1 would be richer than community 2 in terms of output, wages and salaries, profits, consumption, and wealth.

Notice that we have not had to invoke possible increases in total factor productivity (A_i) or human capital (h_i) to explain why a cooperative culture is beneficial. In fact, I have deliberately assumed that neither A_i nor h_i changes. It is the scale of total factor productivity and human capital that has done all the work in our analysis of the empirical finding, we haven't had to invoke secular improvements in them to explain why a more cooperative society would be expected to perform better economically.[16]

The problem with the above interpretation of the empirical findings is that it doesn't tell us how an increase in trust (as discussed formally in Section 5) translates into changes in the variables that make up macroeconomic statistics. I merely assumed that an increase in trust translates either into an increase in human capital or into an increase in TFP or both. In the Appendix I present a simple model in which I am able to present an exact capital model (i.e., shorn of index number problems) in which an increase in trust translates into increases in total

[15] It can be argued that the extent to which people save for their future is itself an influence of social capital: people would save more if they trusted their institutions to protect their savings. I abstract from such effects because to include them would merely re-inforce the argument I am about to offer in the text.

[16] For a different perspective from the one I am advocating here, see Solow (1995), who suggested that if social capital is a potent force in economic development, it should find itself reflected in growth in total factor productivity. In the text I have shown that there needs be no growth in the A_is for social capital to influence economic performance.

factor productivity (TFP), and thereby wages and salaries.

10.3 Network Inefficiencies

As the communities in the thought-experiment we have just conducted are both autarkic, there is no flow of physical capital from one to the other. This is an economic distortion for the combined communities: the rates of return on investment in physical capital in the two places remain unequal. The source of the distortion is the enclave nature of the two communities, occasioned in our example by an absence of markets linking them. There would be gains to be enjoyed if physical capital could flow from community 2 to community 1.

Autarky is an extreme assumption, but it isn't a misleading assumption. What the model points to is that, to the extent social capital is exclusive, it inhibits the flow of resources, in this case it impedes a movement of physical capital from one place to the other.[17] Put another way, if markets don't function well, capital does not move from community 2 to community 1 to the extent it ideally should. When social networks within each community block the growth of markets, their presence inhibits economic progress.

11 Microbehaviour Again: Dark Matters

In this paper social capital has been defined as interpersonal networks where trust is maintained by the mutual enforcement of agreements (Section 5). There is however a dark side of social capital. Two potential weaknesses of resource allocation mechanisms built on mutual enforcement are easy enough to identify:

11.1 Exclusivity. Networks are 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 market place, it is anonymity they invoke. In allocation mechanisms governed by networks, however, "names" matter. Transactions are personalised. This, as has been noted, implies inefficiencies: resources are unable to move to their most productive uses.

11.2. Inequalities. The benefits of cooperation are frequently captured by the more powerful within the network. McKean (1992), for example, has discovered 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. However, empirical work has for the most part only uncovered inequalities in the distribution of benefits of cooperative behaviour.

[17] A similar argument can be advanced as regards labour mobility and credit.

Such findings are consistent with the possibility that all who cooperate benefit. The reason why social capital continues to radiate a warm glow in the literature is that the examples that have motivated thinking on the subject have been coordination games and the Prisoners' Dilemma.

The problem is that the Prisoners' Dilemma is an uncommon economic game. Dasgupta and Heal (1979: Ch. 3) showed that when properly formulated, neither the production of public goods nor the management of local common property resources gives rise to the Prisoners' Dilemma (see also Dasgupta, 2008). Even the famous Cournot duopoly game does not conform to the Prisoners' Dilemma.

11.3 Exploitation

I began this paper by considering a group of people who have discovered a mutually beneficial course of actions and have agreed to cooperate by following that course. Our premise has been that the agreement benefits all members of the network. I now want to explore the idea that long-term relationships can be bad for some members. I want to explore circumstances where some members of a network are worse off being part of the long-term relationship than they would have been if there had been no long-term relationship.

That there can be exploitation in long-term relationships should not be doubted. 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 among the poorest of the poor. Rampant inequities exist too in patron-client relationships in agrarian societies.

Inequity per se is not evidence of exploitation. But inequities in, say, patron-client relationships are known to take such forms as to make it likely that the "client" is worse off in consequence of the relationship than he would have been in its absence. Among contemporary societies there are many where women remain socially inferior beings, prevented from inheriting assets, obtaining education, and entering choice occupations, all of which excludes them from credit, saving, 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.

Dasgupta and Heal (1979: Ch. 3) found that in the production of public goods and the management of local common property resources a player's min-max value is smaller than the payoff she receives in a non-cooperative equilibrium. (In the Prisoners' Dilemma the two coincide, which is what makes the game so very special.) That gap (between the equilibrium

payoff and the min-max value) can be so exploited that some members of a network are worse off in a long-term relationship than they would be if the relationship had not been entered into (Dasgupta, 2000, 2008). The basic idea is this:

Consider a one-shot game possessing a unique non-cooperative equilibrium, but where the min-max value of every member is smaller than his equilibrium payoff. (So the game is not a Prisoners' Dilemma.) Let us now imagine that the game is to be repeated indefinitely. Let the agreement among the parties read as saying that one of the members is to receive a per period payoff less than her payoff in equilibrium in the one-shot game.

Call someone a conformist if she cooperates with those who are conformists but punishes those who are non-conformists. This sounds circular, but it isn't, because the social norm we want to study requires all parties in the network to start the process by keeping their agreement. It would then be possible for anyone in any period to determine who is a conformist and who is not. For example, if ever someone was to break the original agreement, she would be judged to be a non-conformist; so, the norm would require all parties to punish the non-conformist by forcing her to her min-max value. Moreover, the norm would require that such a dire punishment be inflicted not only upon those in violation of the original agreement (first-order violation); but also upon those who fail to punish those in violation of the agreement (second-order violation); upon those who fail to punish those who fail to punish those in violation of the agreement (third-order violation); ... and so on, indefinitely. This infinite chain makes the threat of punishment for errant behaviour credible because, if all others were to conform to the norm, it would not be worth anyone's while to violate the norm. So long as people don't discount future costs and benefits at too high a rate, keeping one's agreement would then be mutually-enforcing.

12 Conclusions

Writings on social capital have a warm glow about the concept. That relationships matter for a person's well-being is no doubt a trite observation; but people writing on social capital have claimed more. They have claimed that social capital is an economically productive asset, a source of much that is good about economic and political relationships.

The original literature claimed less though. Some regarded social capital as an input in the production of human capital (Coleman, 1988), while others regarded it as the sort of civic engagement that helps to discipline public officials (Putnam, 1993). The subsequent literature has gone far beyond those modest claims. Among development economists social capital has

been interpreted as communitarian relationships. In countries where the law does not function well, where officials regard the public sphere to be their private domain, where impersonal markets are often absent, communitarian relationships are what keep people alive, if not well; hence their attraction for many contemporary development economists. But we need to bear counterfactuals in mind. It could be that communitarian relationships prevent impersonal transactions from taking place. Moreover, personal obligations inherited from the past can prevent public officials from acting dispassionately. What appears as corruption in the North could well be social obligation in the South. Similarly, one man's civic association in the North is another man's special interest group.

In this paper I have suggested that social capital is best seen as interpersonal networks and that if the concept is to be useful, attention should be paid to engagements within networks that are subject to mutual enforcement (Section 5). We should assess the worth of social capital by studying what networks are engaged in. Some would be found to be progressive, others reactionary, yet others violent. That said, the deep underlying feature of an economy whose presence is necessary if it is to progress is not the economy's social capital, but rather the extent to which individuals trust one another. In this paper we have also studied how social capital is a means to creating trust. It is a commonplace to say today that an economy's performance depends on its institutions. True enough, but institutions don't grow in vaccuum, their functioning depends on trust. In any given historical situation which institutions should be run on external enforcement of agreements and which on mutual enforcement is a problem to which we still have no firm answer. Determining the right interplay between interpersonal networks and impersonal public institutions remains the central problem of the social sciences. Mutual trust is the elusive bird all societies would like to capture.

Appendix

How does an increase or decrease in trust translate into macroeconomic statistics? Our numerical example in Section 5 captured a salient point, that an increase in trust raises incomes by permitting a more efficient allocation of resources: A's working capital was put to better use under cooperation, as was B's labour. Consider now two communities that are identical in all respects, excepting that in one people have coordinated at an equilibrium where they trust one another, while people in the other have coordinated at an equilibrium where they don't trust one another. I show below that the difference between the two economies would be reflected in their total factor productivity, which would be higher in the community where people trust one another than in the one where they don't. Enjoying greater income, individuals in the former economy are able to put aside more of their income to accumulate capital assets, other things being equal. So the economy's wealth would grow faster. Mutual trust would be interpreted from the statistics as a driver of economic growth.

Consider a timeless, subsistence economy of N households ($i,j = 1,2,...,N$). There is a single perishable capital good, which, in combination with labour, can produce a perishable consumption good. You could imagine that the capital we are considering is a form of "working capital" (it doesn't last beyond one period) and that output is consumed entirely. Labour is supplied inelastically. If household i works with K_i units of a capital, it can produce $F(K_i)$ units of output. Note that this means that households have the same technology of production at their disposal.

I assume that $F(0) = 0$, $F'(K_i) > 0$, and because labour is also a factor of production, $F''(K_i) < 0$. This means that F is *strictly concave*. Let Y_i be household i's output. Aggregate output would then be

$$Y = \Sigma Y_i. \tag{A.1}$$

Let us being by imagining that households don't trust one another at all, meaning that they are *autarkic*. Suppose i owns $\bar{K}_i$ units of capital. Under autarky, household i's output is $F(\bar{K}_i)$, which means that aggregate output of the economy, Y, is

$$Y = \Sigma Y_i = \Sigma F(\bar{K}_i). \tag{A.2}$$

Now suppose that households i and j form a long term relationship, while all others remain autarkic. We may imagine that each year i and j have access to $\bar{K}_i$ and $\bar{K}_j$ units, respectively, of the capital asset. Suppose $\bar{K}_i > \bar{K}_j$. Then the two households would maximise their

joint output if each were to work with $(\bar{K}_i+\bar{K}_j)/2$ units of capital. (Hint for proof: F is the same for all households and is a strictly concave function.) This would involve i giving $(\bar{K}_i-\bar{K}_j)/2$ units of capital to j, with the understanding that j would, say, repay by sharing j's extra produce in some agreed upon manner. (Recall the sharing rule we investigated in the example of the "putting out" system of cooperation.) Household i's (resp. j's) output would be,

$F(\bar{K}_i-(\bar{K}_i-\bar{K}_j)/2) = F((\bar{K}_i+\bar{K}_j)/2)$

(resp. $F(\bar{K}_j+(\bar{K}_i-\bar{K}_j)/2) = F((\bar{K}_i+\bar{K}_j)/2)$).

By the strict concavity of F, we have

$$2F((\bar{K}_i+\bar{K}_j)/2) > F(\bar{K}_i) + F(\bar{K}_j), \qquad \text{(A.3)}$$

which is why it pays i and j to enter into an agreement. The incomes i and j are larger because of that agreement. One is then tempted to say that the human capital of both i and j has increased. The output of all other households remain the same (implying that the agreement between i and j creates no externalities), but because the aggregate output of i and j increases, economy wide output increases. And so on for all other possible networks that may form: <u>every possible network would gain by sharing their initial endowments of capital equally and splitting the increased output in some agreed upon manner</u>. If the grand coalition of all households were able to form as a giant network, each household would, under such an agreement, work with $\Sigma(\bar{K}_i)/\text{N}$ units of capital.

Interestingly, it is simplest to study the effect on aggregate output of network formation if we (i) imagine that households are autarkic and (ii) vary the distribution of initial endowments. Cooperation within networks of households can then be studied by tracking the effect of the *re*-distribution of initial endowments on aggregate output in a world where households are autarkic.

Formally, write $\bar{K} = \Sigma\bar{K}_i$. Notice that aggregate output, Y, would be lowest if households were autarkic and the entire capital asset of the economy was owned by one household. By the same token, Y would be at its highest possible level if households were autarkic and each household had inherited $\Sigma(\bar{K}_i)/\text{N}$ units of capital. Write $\alpha_i = \bar{K}_i/\bar{K}$. Thus, a distribution of inital endowments can be expressed as a vector on the unit simplex of N dimensions, that is,

$$\underline{\alpha} = (\alpha_1, ..., \alpha_i, ..., \alpha_N), \qquad \text{where } \alpha_i \geq 0 \text{ for all } i \text{ and } \Sigma\alpha_i = 1. \qquad \text{(A.4)}$$

If $\underline{\alpha}$ is the vector of endowment shares, household i's endowment is $\bar{K}_i = \alpha_i\bar{K}$.

Because F is strictly concave, we know that for all $\underline{\alpha}$ satisfying (A.4),

$$\Sigma F(\bar{K}/\text{N}) \geq \Sigma F(\alpha_i\bar{K}) \geq F(\bar{K}). \qquad \text{(A.5)}$$

Define

$$A(\underline{\alpha}) \equiv \Sigma F(\bar{K}_i)/F(\bar{K}) \equiv \Sigma F(\alpha_i \bar{K})/F(\bar{K}), \qquad \text{where } \underline{\alpha} \text{ satisfies (A.4).} \qquad \text{(A.6)}$$

Notice that A is a symmetric function. Notice also that A's minimum values is 1 (when $\bar{K}_i = \bar{K}$ for some i) and its maximum value is attained when $\bar{K}_i = \bar{K}/\mathrm{N}$ for all i.

It helps to simplify some more and assume that $F(K_i) = K_i^{\beta}$, where $0<\beta<1$. (That is, the production function is Cobb-Douglas.) In this case, (A.6) reduces to the form

$$A(\underline{\alpha}) = \Sigma \bar{K}_i^{\beta}/\bar{K}^{\beta} = \Sigma \alpha_i^{\beta}, \qquad \text{where } \underline{\alpha} \text{ satisfies (A.4).}$$

Because every equality-enhancing redistribution of initial endowments raises aggregate income when households are autarkic, we may conclude that when networks form, the A that results from the re-allocation of capital in production rises. We now have a direct connection between the extent of trust among people in an economy and total factor productivity. An increase in trust among a group of people will raise total factor productivity and simultaneously raise implicit wages in the economy in question.

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