

Three simple models of social capital and economic growth

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Abstract

This paper proposes three models of social capital and growth that incorporate different perspectives on the concept of social capital and the empirical evidence gathered to date. In these models, social capital impacts growth by assisting in the accumulation of human capital, by affecting financial development through its effects on collective trust and social norms, and by facilitating networking between firms that result in the creation and diffusion of business and technological innovations. We solve for the optimal allocation of resources channelled into the building of social capital, examine the models' comparative statics and dynamics, and demonstrate how a tax and subsidy scheme may correct the resource under-allocation that results from the public good aspect of social capital creation. Observed differences in social capital across countries are explained by differences in government policies and the possibility of multiple equilibria and social capital poverty traps.

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1. Introduction

The concept of social capital, which refers to features of social organizations, such as networks, norms and trust, that facilitate coordination and cooperation for mutual benefit, has found rising albeit grudging acceptance within the economics profession in recent years. Like other sociological concepts, its amorphous nature initially elicited deep skepticism from mainstream economists, who questioned the validity of classifying social interactions as a form of capital.¹

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¹ See, for example Arrow (2000) and Solow (2000).

An increasing number of economists now acknowledge that social capital shares at least some similarities with physical and human capital in its intertemporal dimension and its ability to generate a stream of future benefits. These benefits include information sharing and the matching of people to economic opportunities, mutual aid and insurance, as well as effective collective action.

More importantly, different facets of social capital have been demonstrated to have a profound impact on economic development and growth. Indicators of social capital has been shown to affect local financial development as well as general economic growth in Italy (Guiso et al., 2000; Helliwell and Putnam, 1995). Many cross-country studies have shown the importance of trust in determining an economy's growth prospects. For example, Knack and Keefer (1997) find that a one-standard deviation increase in a survey-based measure of country-level trust increases economic growth by more than half a standard deviation. Easterly and Levine (1997) and others have highlighted ethnic divisions and inequality as sources of slower growth through their effects on trust, social cohesion, economic policy-making, and violent conflict. In addition, social capital has been shown to be correlated with superior outcomes in watershed conservation in Rajasthan, India (Krishna and Uphoff, 2002), in agricultural trading in Madagascar (Fafchamps and Minten, 2002), in community-based water projects in Central Java, Indonesia (Isham and Kahkonen, 2002), and in voluntary solid waste management in Dhaka, Bangladesh (Pargal et al., 2002). Further evidence of the impact of social capital on development emerge from studies in Burkina Faso, Paraguay, Thailand, Bolivia, and Mexico that are compiled in Isham et al. (2002).

The question we seek to answer in this paper is: can a sociological concept be modelled satisfactorily using conventional tools of economic analysis? We argue that not only can social capital be legitimately classified as a form of capital, we can demonstrate its economic effects by carefully building on and extending traditional models of economic growth. We propose three parsimonious models where social capital impacts macroeconomic performance by: (i) assisting in the accumulation of human capital, (ii) affecting financial development through its effects on collective trust and social norms, and (iii) facilitating collaboration and networking between firms that result in the creation and diffusion of technological and business innovations. Because of the multifaceted nature of social capital, instead of formulating a “grand theory” of social capital and economic growth, each model seeks to build a theoretical basis for the observed empirical relationship between one particular aspect of social capital and growth. The approach we adopt is a logical development of the representative agent endogenous growth framework, building on models of learning-by-doing, human capital, and R&D by Romer (1986), Lucas (1988), Romer (1990), and Jones (1995). For example, our first model is an extension of the Lucas (1988) human capital model that captures the interdependence between human capital and social capital accumulation. Our approach allows us to solve for the optimal allocation of human resources (whether human capital or labor time) to each activity, and consequently to determine the extent of under-allocation of resources to social capital-creating activities arising from the public goods aspect of social capital. We also examine the comparative statics and/or dynamics of each model.

The paper is organized as follows: Section 2 examines the concept of social capital—its definition(s), attributes and classifications. Sections 3–5 are devoted to expositions of theoretical models in which social capital impacts growth through the channels of human capital accumulation, financial development, and technological innovation. Section 6 uses the models to explain observed differences in social capital across countries. Section 7 discusses the implications for public policy derived from these models, while Section 8 concludes.

2. The concept of social capital

2.1. Defining social capital

Like many sociological concepts, social capital encompasses many different meanings. While some researchers define social capital in terms of trust and norms of civic cooperation, others characterize it in terms of cultural values such as compassion, altruism and tolerance, while still others emphasize institutions and the quality and quantity of “associational” life. Some researchers find it practical to separate the *sources* of social capital (primarily, social networks) from their *consequences* (which can be positive or negative, depending on the circumstances), such as trust, tolerance and cooperation. Below we present several definitions that relate to particular aspects of social capital that we wish to capture in our models.

According to Coleman (1990), “What I mean by social capital in the raising of children is the norms, the social networks and the relationships between adults and children that are of value for the child growing up. Social capital exists within the family, but also outside the family, in the community, etc. in the interest, even the intrusiveness, of one adult in the activities of someone else’s child.” Education, for Coleman, is the strongest expression of the resources generated by the relationships, values, and trust that constitute social capital. These resources include obligations and expectations, information channels, norms and effective sanctions that constrain or encourage certain types of behavior in children.

Putnam’s (1996) concept of social capital focuses on features of social life that enable participants to act together more effectively to pursue shared objectives. While Coleman examines the application of social capital to facilitating the accumulation of human capital by particular individuals, Putnam applies the concept at a broader sociological and geographical scale—at the regional level. Networks of civic engagement (neighborhood associations, choral societies, cooperatives, sports clubs, mass-based parties, etc.) are an essential form of social capital that foster robust norms of reciprocity that in turn fuels social trust.

Maskell (2000) argues that social capital refers to the values and beliefs that citizens share in their everyday dealings and which give meaning and provide design for all sorts of rules. However, he believes that the formation of social capital is often not a *deliberate* action: social capital is accumulated within the community through processes of interaction and learning. Social capital is in part accumulated as an unintended and even unanticipated consequence of economic activity as people interact with workplace colleagues rather than with their family and friends. Social capital, then, may arise in the commercial workplace, indeed even in a multinational corporation, as much as it does in civil society.

2.2. Key attributes of social capital

Social capital has several key attributes that form a common thread running through each of our models. Firstly, social capital is capital because it is an *accumulated stock* from which a stream of benefits flows. Social capital is therefore more than simply a set of social organizations or social values.² Social capital often enhances output by raising the productivity of other resources, such as human and physical capital.

² However, like Arrow (2000), Solow (2000) is skeptical about the “capital” aspect of social capital. He argues that “behavior patterns” is a more appropriate term.

However, as Grootaert (2002) points out, social capital exhibits several characteristics that distinguish it from other forms of capital. For example, like human capital but unlike physical capital, social capital may accumulate as a result of its use. That is, social capital is both an input and an output of collective action. To the extent that social interactions are drawn upon to produce mutually beneficial output, the quality or quantity of these interactions is likely to rise.

In addition, although every other form of capital has a potential productive impact in a typical Robinson Crusoe economy, social capital does not—creating and activating social capital requires at least *two* people. Social capital therefore has public good characteristics, so it is likely to be underproduced because of incomplete collective internalization of the positive externalities inherent in its formation. Coleman (1988) argues that the kinds of social structures that enable social norms and the sanctions that enforce them do not benefit primarily the person or persons whose efforts are necessary to bring them about, but benefit all those who are part of such a structure.³

On the other hand, social capital, like other forms of capital, is not costless to produce and requires a significant amount of time and effort, if not always money. It is, according to Bourdieu (1986), ‘the product of investment strategies, individual or collective, consciously or unconsciously aimed at establishing or reproducing social relationships that are directly usable in the short or long term.’ (p. 251) Trusting relationships among members of a sports club, professional organization, or civic association often take a very long time to build. Moreover, since trust is more easily destroyed than rebuilt, there is a maintenance expense to social capital.

2.3. *Classifying social capital*

2.3.1. *The scope and sources of social capital*

Social capital may exist at three levels. *Micro*-level social capital exists within networks of individuals or households. It has come to be accepted that the externalities from these interpersonal interactions may either be positive or negative. For example, interactions between individuals in a network which create social capital may benefit these individuals at the expense of those excluded from the network. Micro-level social capital consists of ‘bonding’ and ‘bridging’ social capital. The former refers to relations between family members, close friends and neighbors, the latter to more distant associates and colleagues who may have different demographic characteristics. In our first model, we will argue that micro-level bonding social capital plays a key role in human capital accumulation. In our second model, bridging social capital builds collective trust which aids financial development.

The analysis of social capital at the *meso* level expands the concept of social capital to include vertical as well as horizontal associations and behavior within and among other entities, such as firms. While bonding or integrating relationships take place within a group and facilitate interaction and collective action within it, linking relationships strengthen linkages between the group and other organizations. The capacity to leverage resources, ideas and information from formal institutions beyond the community, most notably the state, is a key function of linking or

³ Coleman gives the example of a dense set of associations among some parents in certain schools. These are the results of a small number of persons, ordinarily mothers who do not hold full-time jobs outside the home. However, these mothers themselves experience only a subset of the benefits of this social capital surrounding the school. Should one of them choose to abandon these activities to take a full-time job, the withdrawal of these activities constitutes a loss to all those other parents whose associations and contacts are dependent on them.

meso-level social capital (Woolcock, 2002). It is meso-level social capital that facilitates R&D networks in our third model.

The last and most encompassing view of social capital includes the social and political environment that shapes social structure and enable norms to develop. This *macro* view includes the most formalized institutional relationships and structures, such as the political regime, the rule of law, the court system, and civil and political liberties. However, in this paper, we will not attempt to model the relationship between macro-level social capital (also known as ‘government social capital’ or ‘social infrastructure’) and growth, as this has been done elsewhere, such as Chin and Chou (2004), and Gradstein (2003).

2.3.2. *The forms of social capital*

At each of the three levels explained above, social capital affects economic growth as a result of interactions between two distinct types of social capital—*structural* and *cognitive*. As noted in Grootaert and Van-Bastelaer (2002), structural social capital facilitates information sharing and collective action and decision-making through established roles and social networks supplemented by rules, procedures and precedents. Cognitive social capital, on the other hand, refers to shared norms, values, trust, attitudes and beliefs, and is a more subjective and intangible concept. Krishna (2000) terms the first type of social capital as ‘institutional capital’ and the second as ‘relational capital’. The two forms of social capital are often complementary. For example, cooperation between parents who are neighbors are based on a cognitive bond, and may also be reflected in a formal structural arrangement if they are both deeply involved in the parents–teachers association of the local school.

3. Social capital and human capital

The impact of civil society, the way individuals in a society work together for common purposes, on the education and raising of children has long been recognized. This is perhaps best encapsulated in the old African proverb, “It takes a village to raise a child”. Among social scientists, James S. Coleman was one of the first to make explicit reference to the concept of social capital in evaluating society’s impact on human capital accumulation. Coleman (1994) argues that “social capital is the set of resources that inhere in family relations and in community social organization and that are useful for the cognitive or social development of a child or young person.” (p. 300) It is interesting to note that the great pioneer in the study of the economics of human capital, Gary Becker, recognized the importance of family relations on human capital accumulation. Becker (1993) acknowledges that “(n)o discussion of human capital can omit the influence of families on the knowledge, skills, values, and habits of children 1/4 Therefore, even small differences among children in the preparation provided by their families are frequently multiplied over time into large differences” (p. 21).

In Coleman’s view, the family background of a student affects his accumulation of skills and knowledge in three ways. Financial capital, approximated by the family’s wealth or income, provides physical resources that can aid achievement: a fixed place in the home for studying, materials to aid learning, and financial resources that smooth family problems. Human capital, approximately measured by parents’ education, provides the potential for a cognitive environment for the child that aids learning.⁴ Coleman cautions that this parental human capital, if not

⁴ This argument supports the inclusion of positive spillover effects from the existing stock of human capital on new human capital creation in the Lucas (1988) model.

complemented by social capital embodied in family relations, will contribute little to their child's educational growth. Similarly, Woolcock (2002) argues that the most innovative ideas in the mind of the brightest person will amount to little unless that person also has access to others to inform, correct, assist with and disseminate their work. These observations form the basis of our first model of social capital and growth.

3.1. *Empirical evidence*

Coleman (1988) provides empirical evidence that the presence of social capital within the family is important in determining whether a child drops out of school. He uses the number of siblings, which measures the dilution of adult attention to a child, as a proxy for social capital. In addition, Coleman also finds that social capital outside the family has a significant impact on the dropping out decision. Students who have changed schools because their parents moved are more likely to drop out than their peers. For families that have moved often, the social relations that constitute social capital are broken at each move. Moreover, Coleman finds that dropout rates are lower in religiously based private schools than in public or secular private schools. Whether parents devote time to religious activities, it appears, affects human capital accumulation in their offspring.

Grootaert et al. (2002) present evidence that community participation in parent teacher associations in Burkina Faso is associated with substantially higher rates of school attendance. Other important empirical findings pertaining to our first model may be found in Costa and Kahn (2001), where the rise in women's labor force participation rates explains the observed decline in social capital produced within the home, and in Gleaser et al. (2000), who find that people who invest in human capital also invest in social capital. Moreover, social capital appears to have interpersonal complementarities: people who belong to groups with more social capital tend to invest more in social capital themselves.

3.2. *A formal model of bonding social capital*

In each of our three models, there are many identical infinitely lived agents.⁵ Here, each agent faces a trade-off between devoting resources (human capital, specifically) to final goods production (which enables current consumption), to human capital accumulation, and to the building of bonding social capital. The last activity produces no income by itself but increases the effectiveness of human capital accumulation. In an overlapping generations framework, this activity would include involvement in parent teacher associations and "quality time" spent with one's offspring.

The formal model we propose incorporates the following elements: (1) the building or accumulation of social capital requires resources to be diverted from other productive uses; (2) social capital decays over time without new "investment" in social capital; (3) the existing stock of social capital has spillover effects on the building of new social capital; (4) social capital has a positive impact of human capital accumulation but no direct effect on final goods production; (5) human capital has positive intertemporal spillovers in its accumulation; and (6) human capital is an important input in final goods production.

⁵ One weakness of the representative agent framework is that it is unable to model heterogeneity in the accumulation of social capital by different groups in a population.

Mathematically, the model may be summarized as follows:

$$\dot{K} = Y - C - \delta_K K, \quad (1)$$

$$\dot{H} = E(u_H H)^{1-\psi} S^\psi - \delta_H H, \quad (2)$$

$$\dot{S} = P(u_S H)^{1-\sigma} S^\sigma - \delta_S S, \quad (3)$$

$$Y = AK^\alpha (u_Y H)^{1-\alpha}, \quad (4)$$

where K is the aggregate physical capital stock, Y the aggregate output, C the aggregate consumption, H the stock of human capital, S the stock of social capital, δ_K the physical capital depreciation rate, δ_H the human capital depreciation rate, and δ_S is the social capital depreciation rate. u_H , u_S and u_Y denote the share of the human capital stock that is allocated to accumulating new human capital, building social capital, and producing goods, respectively. A , E and P are productivity parameters, while α , σ and ψ are elasticity parameters constrained to lie on the (0,1) interval. While ψ measures the extent of social capital spillovers on human capital formation, σ measures the externalities in social capital building, that is the extent to which community-wide stocks of social capital influences an individual's social capital formation. The above equations describe in turn the evolution of the physical, human, and social capital stocks. For example, Eq. (1) states that the change in the physical capital stock per unit time, \dot{K} , is equal to new investment (which is equal to savings, $Y - C$) minus depreciated old capital. Eq. (4) is the production function for the consumption good. The model collapses to the Lucas (1988) model of human capital and growth if $\psi = 0$ since S and the \dot{S} equation then become irrelevant.

3.2.1. The decentralized, competitive model

We now flesh out the microeconomic foundations of our model of human and social capital. In the final goods sector, firms seek to maximize profits, π_Y , by choosing the optimal allocation of labor, u_Y , and the optimal amount of physical capital, K :

$$\max K^\alpha (u_Y H)^{1-\alpha} - w_Y u_Y H - r_K K,$$

where w_Y is the wage rate in the final goods sector and r_K is the rental price of capital.

Profit-oriented firms equate the marginal products of labor and capital to the wage rate and the rental price of capital, respectively:

$$w_Y = (1 - \alpha) A k^\alpha u_Y^{-\alpha}, \quad r_K = \alpha A k^{\alpha-1} u_Y^{1-\alpha},$$

where $k \equiv K/H$ denotes the physical–human capital ratio.

Individuals seek to maximize discounted lifetime utility (with instantaneous utility taking the constant relative risk aversion form). Specifically, they choose c , u_Y and u_τ to

$$\max \int_0^\infty e^{-\rho t} \frac{C^{1-\theta} - 1}{1-\theta} dt$$

subject to

$$\begin{aligned} \dot{K} &= r_K K + w_Y u_Y H + w_H u_H H - P_H \dot{H} - C, & \dot{H} &= E(u_H H)^{1-\psi} S^\psi - \delta_H H, \\ \dot{S} &= \tilde{P}(u_S H)^{1-\sigma} - \delta_S S, & 1 &= u_Y + u_H + u_S, \end{aligned}$$

where ρ is the rate of time preference, θ the measure of the desire for consumption smoothing, w_H the prevailing wage in the human capital sector, $r_K K$ the individual's asset income, P_H the price of each unit of new human capital, and $\tilde{P} \equiv PS^s$. That is, individuals do not internalize the externalities that their formation of social capital confer on the accumulation of social capital by others. This is the public good aspect of social capital that we discussed earlier. Note, however, that individuals fully recognize the impact of social capital accumulation on human capital accumulation. (Indeed, this may be their sole motive for building social capital.) In addition, we assume that educational services are priced so that they exactly cover the costs of providing such services, that is $P_H \dot{H} = w_H u_H H$.

Note that the production functions for new human capital and social capital both exhibit constant returns to scale. This restriction is required in order for all forms of capital to grow at the same rate on the balanced growth path. Lastly, for tractability's sake, we assume that social capital by itself does not give pleasure to the individual and is thus excluded from the utility function.

3.2.2. Solving the model

In the steady state (or balanced growth path), all variables including K and H grow at constant rates. We define the following ratios to be constant in the steady state: $k \equiv K/H$ (the physical capital–human capital ratio), $s \equiv S/H$ (the social capital–human capital ratio), $c \equiv C/H$ (the consumption–human capital ratio), and $y \equiv Y/H$ (the output–human capital ratio).

In the steady state, the optimal allocation of human capital to human capital accumulation and social capital accumulation, as well as the optimal social capital–human capital ratio are given by

$$u_H^* = \frac{(1-\psi)(\gamma_H^* + \delta_H)}{\rho + \theta\gamma_H^* + \delta_H}, \quad u_S^* = \frac{\psi(1-\sigma)(\gamma_H^* + \delta_S)}{(1-\psi)(\rho + \theta\gamma_H^* + \delta_S)} u_H^*,$$

$$s^* = \left(\frac{\rho}{\gamma_H^* + \delta_S} \right)^{1/(1-\sigma)} u_S^*,$$

where γ_H^* is the steady-state growth rate of the economy.

Defining the implicit function $f(\gamma_H^*) = 0$, where $f(\gamma_H^*) \equiv \gamma_H^* + \delta_H - E u_H^{*1-\psi} s^{*\psi}$, we solve numerically for γ_H^* after substituting the above expressions for u_H^* , u_S^* , and s^* .⁶ Once γ_H^* is found, it can be substituted back into these same expressions to obtain u_H^* , u_S^* , and s^* . Furthermore,

$$k^* = \left(\frac{A\alpha}{\rho + \theta\gamma_H^*} \right)^{1/(1-\alpha)} (1 - u_H^* - u_S^*), \quad c^* = \frac{\rho + \theta\gamma_H^* - \alpha\gamma_H^* k^*}{\alpha},$$

$$y^* = A k^{*\alpha} (1 - u_H^* - u_S^*)^{1-\alpha}.$$

3.2.3. Divergence between the competitive and planner solutions

It can be shown via simulations that the competitive solution results in an under-allocation of human capital to the accumulation of social capital. That is, u_S^* is smaller in the competitive solution than in the hypothetical social planner's solution. Simulations also show that the economy's growth rate and output–capital ratio are higher in the social planner's solution. Figs. 1–3 show that the divergence between the planner and competitive solutions for the steady state

⁶ Closed-form solutions cannot be obtained in this three-sector growth model.

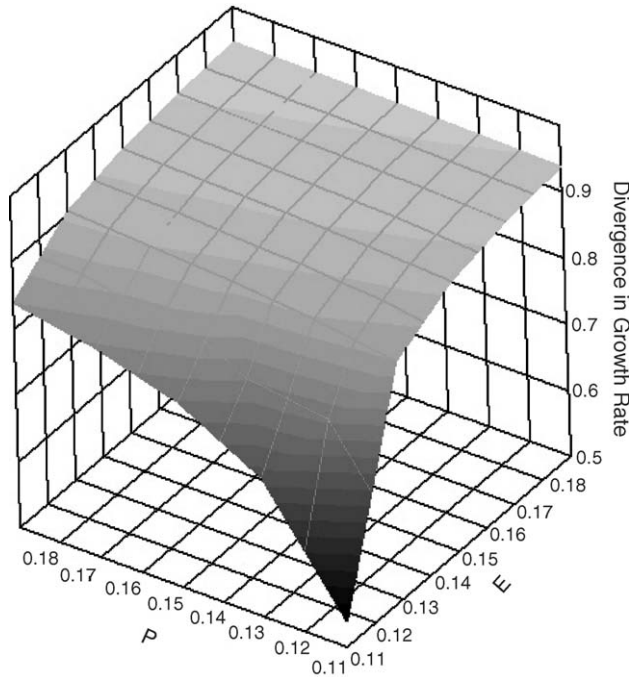


Fig. 1. The impact of productivity parameters on the divergence of the planner and competitive solutions for the economy's growth rate.

growth rate (γ_H^*), allocation of human capital to social capital creation (u_S^*), and output–physical capital ratio (y^*/k^*) are decreasing in the productivity parameters E and P . (The vertical axis in each of the figures shows the ratio of the competitive solution to the planner's solution. Larger values on the vertical axis therefore indicate a smaller degree of divergence between the two solutions.) In other words, the poorer an economy is at creating human and social capital, the more harmful the inability of individuals to internalize the externalities associated with social capital accumulation.

3.3. Comparative statics

In this section, we examine the impact of changes in the various parameters of the model on the steady-state growth rate. Fig. 4 shows that the steady-state growth rate is increasing in θ , the risk aversion parameter, and ρ , the rate of time preference. Since social capital and human capital accumulation create long run growth but requires a short run sacrifice of consumption, a higher discount rate results in lower investment in social and human capital, and therefore lower long run growth. The steady-state growth rate is increasing in the productivity parameters of the human capital and social capital accumulation equations, E and P , as well as the social capital spillover parameter in the social capital accumulation equation, σ . The stronger the public good aspect of social capital, the larger its impact on economic growth. Interestingly, there is a U-shaped relationship between the steady-state growth rate and the social capital elasticity parameter in the human capital accumulation equation, ψ . Because of the constant returns to scale production

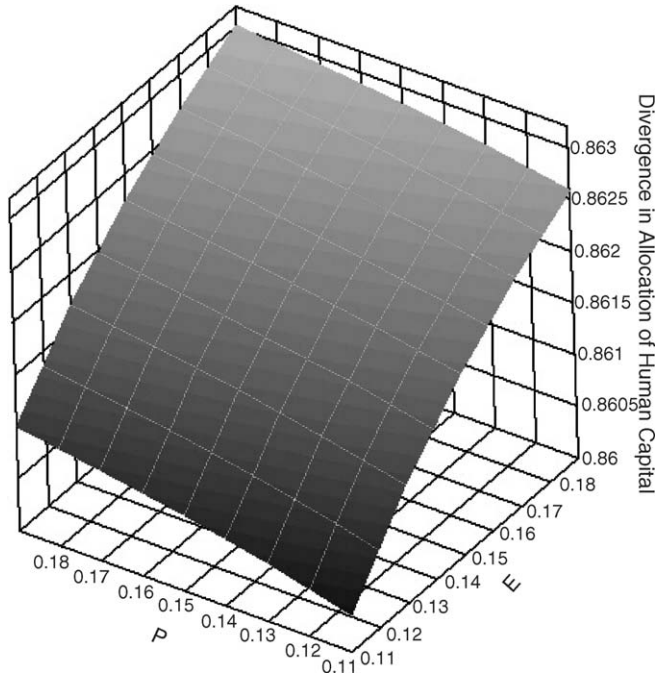


Fig. 2. The impact of productivity parameters on the divergence of the planner and competitive solutions for the optimal allocation of human capital.

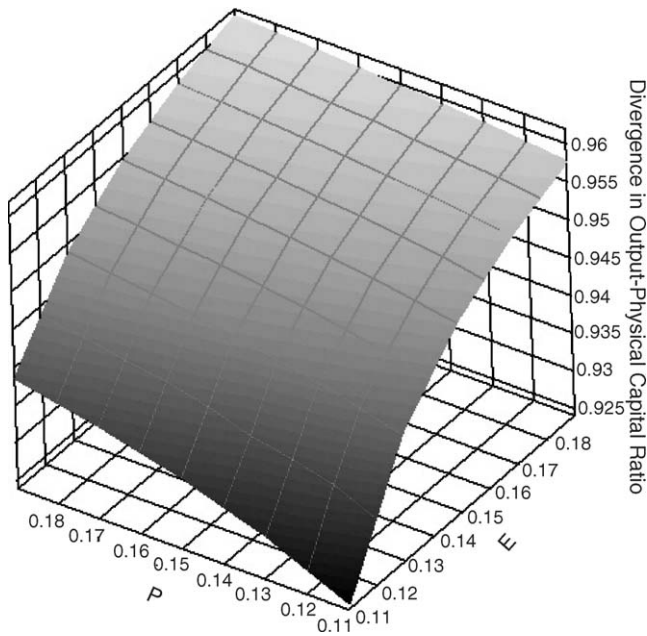


Fig. 3. The impact of productivity parameters on the divergence of the planner and competitive solutions for the steady-state output-capital ratio.

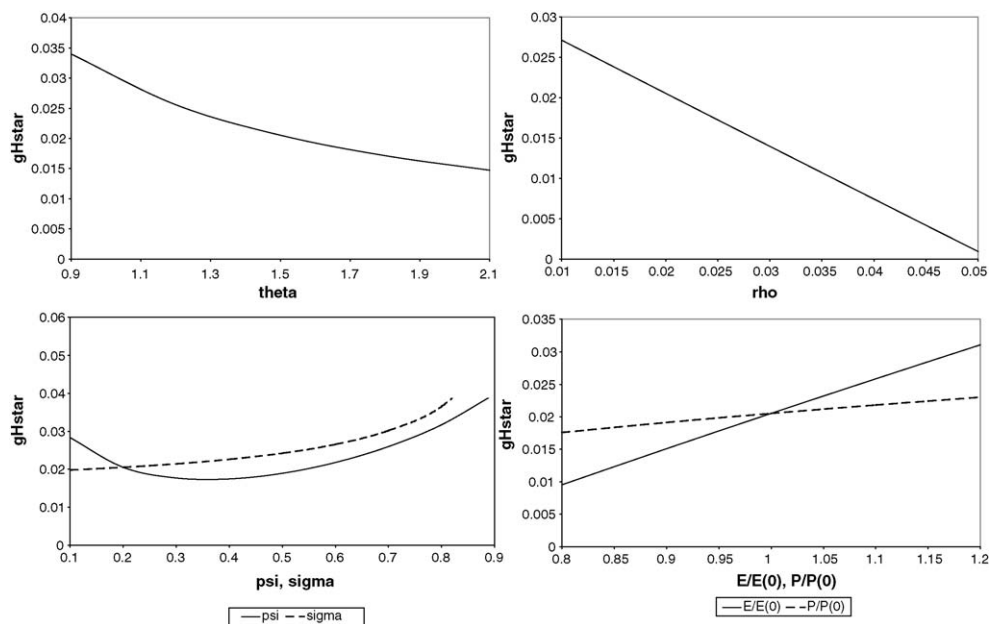


Fig. 4. Effect of various parameters on the steady-state growth rate.

functions for \dot{H} and \dot{S} , the steady-state growth rate of the economy is higher at very low and very high values of ψ than at intermediate values.

3.4. Transitional dynamics

We next examine the effect of raising the productivity parameters governing the production of human and social capital. In order to present the transitional dynamics of the model graphically, it is necessary to reduce the complexity and dimensionality of the model by assuming a constant saving rate and an exogenous allocation of human capital across the three sectors. That is, we assume u_S and u_H are exogenously given. The dynamics of the model then reduce to equations characterizing the $\dot{s} = 0$ and $\dot{k} = 0$ conditions, respectively:

$$s = \left(\frac{P u_S^{1-\sigma}}{E u_H^{1-\psi}} \right)^{1/(1+\psi-\sigma)}, \quad (5)$$

$$k = \left[\frac{A}{E} \left(\frac{s}{u_H} \right)^{1-\psi} \phi \right]^{1/(1-\alpha)} u_Y. \quad (6)$$

The phase diagram of the simplified model in k, s space is depicted in the upper panels of Fig. 5. The shape of the $\dot{k} = 0$ schedule depends on the relative magnitudes of the parameters α and ψ . The lower left panel in Fig. 5 shows the impact of an increase in the productivity parameter of the human capital accumulation equation, E , while the lower right panel shows the impact of an increase in the productivity parameter of the social capital accumulation equation, P .

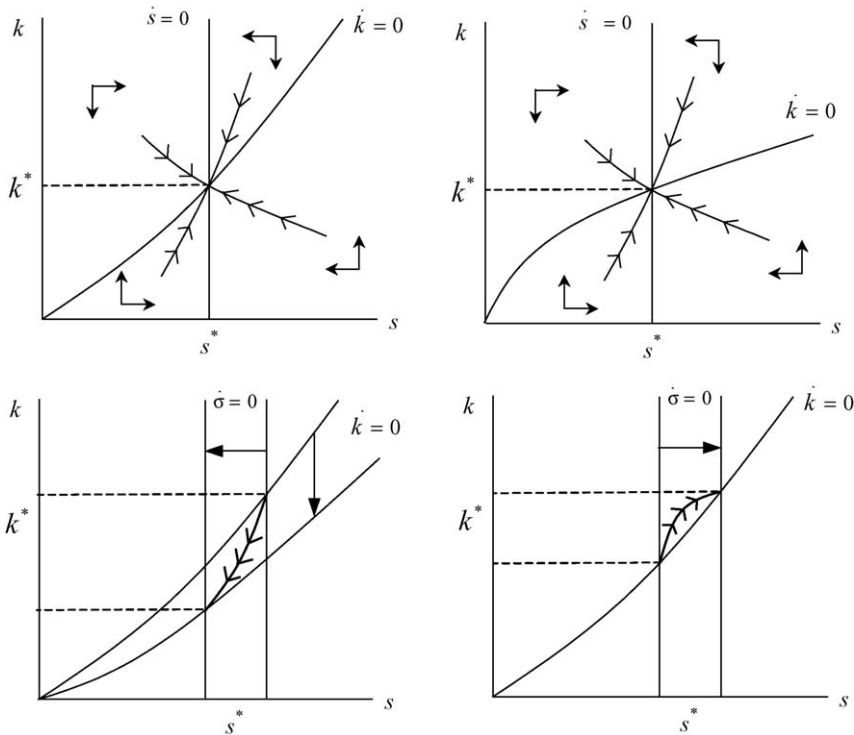


Fig. 5. Transitional dynamics of the model.

An increase in E causes both the physical capital–human capital ratio, k , and the social capital–human capital ratio, s , to decrease. This is caused by human capital increasing proportionately more than the other two forms of capital. On the other hand, an increase in P causes both k and s to increase. That is, physical capital and social capital increase by proportionately more than human capital. Therefore, government policies that increase the efficiency of human capital accumulation have quite different effects from policies that increase the efficiency of social capital accumulation.

4. Social capital and financial development

A second channel through which social capital may impact economic growth is financial development. Guiso et al. (2000) produce evidence of this channel by using microeconomic data on households and firms and exploiting well-known differences in social capital and trust across different regions of Italy.⁷ Controlling for a large set of household characteristics and other environmental variables such as the quality of legal enforcement and GDP per capita, they find that in areas of the country with high social trust, people invest less in cash and more in stocks, use more checks, have greater access to institutional credit, and make less use of informal credit. In these areas, firms also have more access to credit and are more likely to have multiple shareholders.

⁷ Putnam (1993) had earlier investigated various aspects of social capital in Italy.

4.1. A model of micro-level bridging social capital

In our proposed model of social capital and financial development, social capital affects growth by increasing the efficiency of the financial sector in transforming individual or household savings into productive investments by firms in the final goods sector. The accumulation process for social capital is similar to that in our first model except that raw labor replaces human capital as an input in production. Individuals may devote time to non-market activities such as participating in community clubs, associations and other networks of civic engagement. These interactions between individuals create bridging social capital of the Putnam variety that raise the level of generalized trust in the community. This in turn spurs the development of financial institutions, resulting in financial intermediation that better reconciles the needs of savers with those of borrowers.

Specifically, the quantity of social capital per person, S/L , determines the fraction of savings that is transformed into productive new capital. The relationship is allowed to be a non-linear one through the inclusion of the parameter $\iota > 0$:

$$\dot{K} = \left(\frac{S}{L}\right)^\iota (Y - C) - \delta_K K, \quad (7)$$

$$\dot{S} = P(u_S L)^{1-\sigma} S^\sigma - \delta_S S, \quad (8)$$

$$Y = AK^\alpha (u_Y L)^{1-\alpha}, \quad (9)$$

$$1 = u_Y + u_S, \quad (10)$$

where L denotes the number of working adults, u_Y and u_S the allocation of time to final goods production and social capital creation, respectively, and A and P the productivity parameters, and $(\alpha, \sigma) \in (0, 1)$ are parameters. Our physical capital accumulation equation builds on Pagano (1993). In Pagano (1993), $I = \phi S$, where ϕ is an exogenous parameter and a proxy for the level of financial development, and S and I refer to saving and investment, respectively. The production function for social capital, \dot{S} , must exhibit constant returns to scale since S and L both grow at rate n in the steady state.⁸ This equation, (8), mirrors (3) except for L replacing H .

4.1.1. Solutions

Analogous to the first model, we define the following variables to be constant in the steady state: $k \equiv K/L$ (physical capital per person), $s \equiv S/L$ (social capital per person), $c \equiv C/L$ (consumption per person), and $y \equiv Y/L$ (output per person). The efficiency of financial intermediation is therefore given by s^ι .

The steady-state solutions are

$$u_S^* = \frac{\Gamma}{\Gamma + \Phi}, \quad \Gamma = \alpha\iota(1 - \sigma)(n + \delta_S)(n + \delta_K),$$

$$\Phi = (1 - \alpha)(\rho + \delta_K)[\rho + \delta_S - \sigma(n + \delta_S)], \quad (11)$$

$$u_Y^* = 1 - u_S^*, \quad (12)$$

⁸ $(S/L)^\iota$ is constant in the steady state and cannot exceed 1 in a closed economy.

$$s^* = \left(\frac{P}{n + \delta_S} \right)^{1/(1-\sigma)} u_S^*, \quad (13)$$

$$k^* = \left(\frac{s^{*l} A \alpha}{\rho + \delta_K} \right)^{1/(1-\alpha)} u_Y^*, \quad (14)$$

$$c^* = \frac{\rho + \delta_K - \alpha(n + \delta_K)}{\alpha} \frac{k^*}{s^{*l}}. \quad (15)$$

4.1.2. Implications

Proposition 1. We can show that the steady-state allocation of labor time to social capital accumulation is decreasing in the discount rate but increasing in the elasticity parameter in the transformation of savings into investment, and is independent of the productivity parameter in the social capital equation. That is, $\partial u_S^*/\partial \rho < 0$, $\partial u_S^*/\partial \iota > 0$, and $\partial u_S^*/\partial P = 0$.

Proof. Using Eq. (11),

$$\frac{\partial u_S^*}{\partial \rho} = \frac{(\Gamma + \Phi) \partial \Gamma / \partial \rho - \Gamma \partial \Phi / \partial \rho}{(\Gamma + \Phi)^2} < 0,$$

since $\partial \Gamma / \partial \rho = 0$, $\partial \Phi / \partial \rho > 0$ and $\Gamma > 0$. In addition,

$$\frac{\partial u_S^*}{\partial \iota} = \frac{(\Gamma + \Phi) \partial \Gamma / \partial \iota - \Gamma \partial \Phi / \partial \iota}{(\Gamma + \Phi)^2} < 0,$$

since $\partial \Gamma / \partial \iota > 0$, $\partial \Phi / \partial \iota = 0$, and $\Phi > 0$. Finally,

$$\frac{\partial u_S^*}{\partial P} = \frac{(\Gamma + \Phi) \partial \Gamma / \partial P - \Gamma \partial \Phi / \partial P}{(\Gamma + \Phi)^2} = 0.$$

since $\partial \Gamma / \partial P = 0$ and $\partial \Phi / \partial P = 0$. \square

Proposition 2. In the steady state, social capital per person, s , and the efficiency of financial intermediation, s^l , are decreasing in the discount rate, ρ , and increasing in the productivity parameter in the social capital creation equation, P .

Proof. From Eq. (13) and using Proposition 1,

$$\frac{\partial s^*}{\partial \rho} = \left(\frac{P}{n + \delta_S} \right)^{1/(1-\sigma)} \frac{\partial u_S^*}{\partial \rho} < 0.$$

Similarly,

$$\frac{\partial s^*}{\partial P} = \frac{1}{1-\sigma} \left(\frac{P}{n + \delta_S} \right)^{\sigma/(1-\sigma)} > 0. \quad \square$$

Proposition 3. Physical capital per person, k , and output per person, y , are increasing in the productivity parameter in the social capital creation equation, P , in the steady state.

Proof. From Eq. (14), k^* is increasing in s^* . Since we showed previously that $\partial s^* / \partial P > 0$, it follows that $\partial k^* / \partial P > 0$. Note that u_Y^* is independent of P since $u_Y^* = 1 - u_S^*$ and $\partial u_S^* / \partial P = 0$. From the production function, $y^* = A k^{*\alpha} u_Y^{1-\alpha}$. Therefore, $\partial y^* / \partial P > 0$. \square

Propositions 1–3 indicate that a higher discount rate is associated with a decrease in time allocated to social capital creation, which reduces the amount of social capital per person in the steady state. On the other hand, an increase in the productivity of social capital creation raises social capital per person, physical capital per person, and output per person in the steady state. This suggests that public policies that facilitate the efficient formation of social capital may benefit the macroeconomy in addition to their positive social ramifications.

5. Social capital and innovation

5.1. *Social capital and high-technology firms*

In developed countries, the “New Economy” of the 1990s and the new millennia has witnessed a distinct gravitation towards inter-organizational linkages in the form of partnerships and consortia. Firms in many industries have formed productive collaborative relationships with other firms, laboratories and universities, as well as local and national governments to leverage the benefits of cooperation.⁹ The reason for this trend is that the investments required to sustain technology development and deployment have increased to such an extent that single firms are often unable to undertake the level of risk necessary for innovation.

Fountain (1998) argues that gains in economic performance and innovative capacity depend on the institutional effectiveness of these relationships as measured by the available stock of linking or meso-level social capital. Social capital is created when a group of organizations develops the ability to work together for mutually productive gain. Cooperation paradoxically enhances competitiveness, information sharing leads to joint gains, while the importance of reputation and trust ensures reciprocity and fair play within a given network. Social capital is located both in the sharable resources held by individual institutions in a network as well as in the overall structure of the network. Social capital is preserved through careful selection of network players and strict sanctioning of inappropriate network-destroying behavior.

5.2. *Social capital and traditional firms*

According to Maskell (2000), social capital also facilitates the ‘low-tech’ learning and innovation that takes place when firms in traditional industries are innovative in how they handle and develop resource management, logistics, production, organization, marketing, sales, distribution, industrial relations, and other tasks and activities. He argues that much of this is due to inter-firm learning. Pure market interactions by themselves are often incapable of facilitating this due to the problem of asymmetric information. For example, potential buyers of information want to ascertain the merit of knowledge offered for sale. But when fully informed of the content of the knowledge offered, they have in effect acquired it for free.¹⁰

Maskell argues that these market failures in the exchange of knowledge between firms can only be overcome when open market relations are superseded by stable and reciprocal exchange arrangements based on trust. Trust will characterize a relation between firms when each is confident that the other’s present value of all foreseeable future exchanges exceeds the possible benefits

⁹ These relationships involve shared resources, group problem-solving, multiple sources of learning, collaborative development, and diffusion of innovation.

¹⁰ This problem was recognized in Arrow (1970).

of breaking the relation. The key argument is that the time and resources needed to build a relationship varies with the stock of social capital that the firms in question might attain through membership in a community. However, according to Maskell, “(w)e still know very little about the actual process by which social capital is produced and accumulated, beyond suspecting that it might be a mainly unanticipated consequence of doing something else - just like, for instance, learning by doing.” (p. 114)

5.3. The model incorporating ‘learning-by-doing’

In this model, innovation or the creation of new technology follows a process similar to [Romer \(1990\)](#), and [Jones \(1995\)](#). The rate of innovation depends on the allocation of labor to the R&D sector as well as the economy. In turn, social capital (unlike in our first two models) is created partly through ‘learning-by-doing’ as an unintended consequence of firms simply enfeebling of spillovers from past innovation activities. However, here the rate of innovation also depends on the stock of ‘linking’ social capital in the engaging in productive activities. But in order to leverage the social capital that is embodied in the types of networks described previously, firms have to invest at least some labor resources towards seeking suitable network partners and identifying productive collaborative activities. The equations of motion describing the evolution of physical capital, technology and social capital in this model are:

$$\dot{K} = Y - C - \delta_K K, \quad (16)$$

$$\dot{A} = B(u_A L)^\eta S^\beta A^\psi, \quad (17)$$

$$\dot{S} = P(u_S L)^\sigma S^\phi \hat{K}^\lambda - \delta_S S, \quad (18)$$

$$Y = K^\alpha (u_Y A L)^{1-\alpha}, \quad (19)$$

where A denotes technology, \hat{K} denotes the aggregate physical capital stock that each firm takes as exogenously given, B and P are productivity constants, and α , β , η , ψ , σ , ϕ , and λ are elasticity parameters that lie on the (0,1) interval. Eq. (17) is the [Romer \(1990\)/Jones \(1995\)](#) R&D equation augmented with the social capital spillover described above. A^ψ represents the “standing on the shoulders of giants” effect where previous research positively impacts current R&D. Labor exhibits diminishing returns in R&D as a result of the “stepping on toes” (wasteful duplication) effect. The \hat{K}^λ term in Eq. (18) is the ‘learning-by-doing’ effect in social capital creation.

5.3.1. The solution

The growth rates of technology and social capital on the balanced growth path are

$$\gamma_A^* = \frac{\eta(1-\phi) + \beta(\sigma + \lambda)}{(1-\psi)(1-\phi) - \beta\lambda} n, \quad (20)$$

$$\gamma_S^* = \frac{(\sigma + \lambda)n + \lambda\gamma_A^*}{1-\phi}. \quad (21)$$

We can show algebraically that both γ_A^* and γ_S^* are increasing in the elasticity parameters of the \dot{A} and \dot{S} equations: β , λ , σ , ψ , and ϕ . Moreover, consumption per worker, capital per worker and output per worker will all grow at the rate of technological progress γ_A^* in the steady state.

Defining the following variables that are constant in the steady state, $\hat{k} \equiv K/AL$ (physical capital per effective unit of labor), $s \equiv S/L$ (social capital per worker), $\hat{c} \equiv C/AL$ (consumption

per effective unit of labor), and $\hat{y} \equiv Y/AL$ (output per effective unit of labor), the solution to the model is as follows:

$$u_S^* = \frac{1}{1 + (1 + \Gamma)\Phi}, \quad (22)$$

$$u_A^* = \frac{\Phi}{1 + (1 + \Gamma)\Phi}, \quad (23)$$

$$u_Y^* = \frac{\Gamma\Phi}{1 + (1 + \Gamma)\Phi}, \quad (24)$$

where

$$\Gamma \equiv \frac{\rho + (\eta - 1)n + \beta}{\eta\gamma_A^*}, \quad \Phi \equiv \frac{\eta[\rho + (1 - \phi)\delta_S + (\sigma + \lambda - 1)n + (\theta + \lambda - 1)\gamma_A^*]}{\sigma\beta(\gamma_S^* + \delta_S)},$$

$$\hat{k}^* = \left(\frac{\alpha}{\rho + \theta\gamma_A^* + \delta_K} \right)^{1/(1-\alpha)} u_Y^*, \quad (25)$$

$$\hat{c}^* = \frac{\rho + \theta\gamma_A^* + \delta_K - \alpha(n + \gamma_A^* + \delta_K)}{\alpha} \hat{k}^*, \quad (26)$$

$$\hat{y}^* = \hat{k}^{*\alpha} u_Y^{*1-\alpha}. \quad (27)$$

5.3.2. Comparative statics

We now examine the impact of changes in various parameters of the model on the steady-state allocation of labor to the production of final goods, the creation of innovations, and the accumulation of social capital. The top panels in Fig. 6 show that a larger risk aversion parameter, θ , and a larger discount rate, ρ , are associated with a greater allocation of labor to the final goods sector, and correspondingly smaller allocations to the other sectors. This is because final goods production brings instant gratification through current consumption, while social capital accumulation and R&D activities only increase future consumption.

The middle left panel in Fig. 6 shows that the social capital elasticity parameter in the \dot{A} equation has a negative relationship with the allocation of labor to final goods production, u_Y , a positive relationship with the allocation of labor to social capital accumulation, u_S , and hump-shaped relationship with the fraction of the labor force allocated to innovative activities, u_A . The middle right panel in Fig. 6 shows that the intertemporal spillover parameter in the \dot{A} equation has a negative relationship with u_Y , a hump-shaped relationship with u_S , and a positive relationship with u_A . When current R&D has a large spillover effect on future R&D, the optimal response is to re-allocate resources to this activity at the expense of the other sectors of the economy.

The bottom panels in Fig. 6 show that a larger social capital spillover parameter (ϕ) or a larger physical capital learning-by-doing effect (λ) in the social capital accumulation equation results in a greater steady-state allocation of labor to *both* innovation creation and social capital accumulation, at the expense of labor allocated to final goods production.

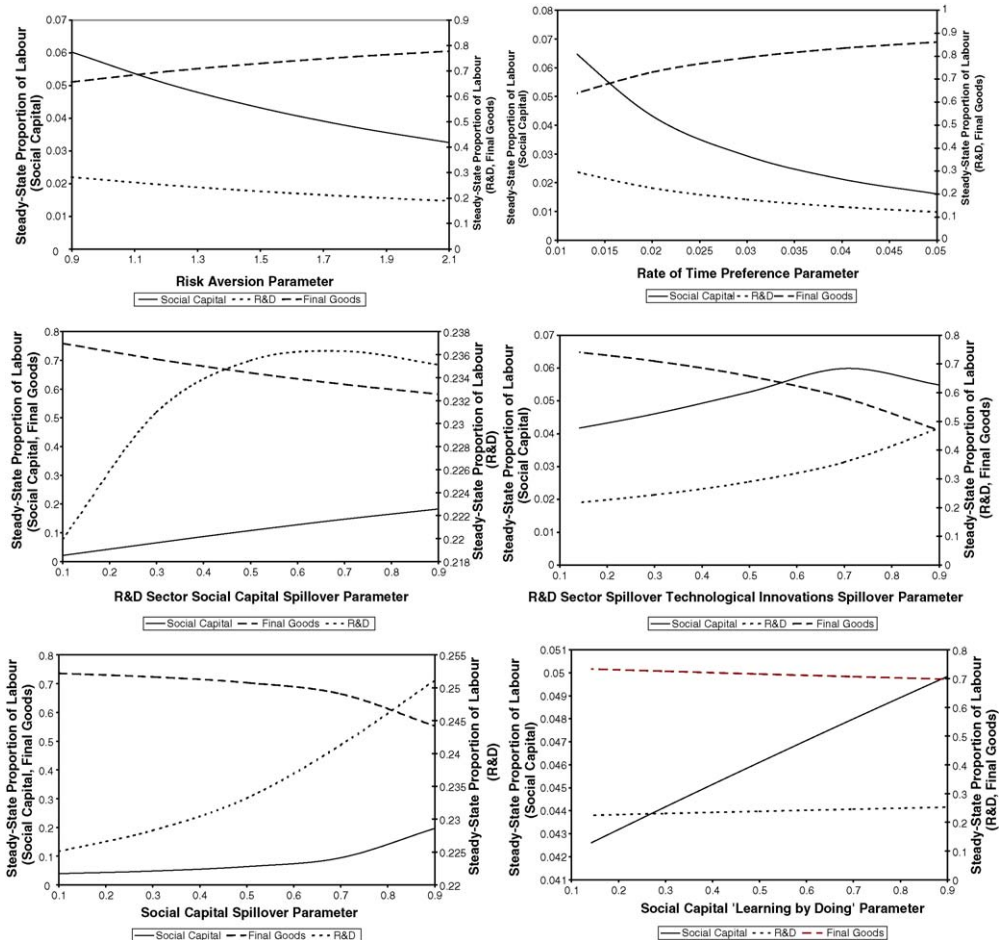


Fig. 6. Effect of parameters on steady-state labor allocation.

6. Explaining cross-country differences in social capital

Why do countries differ so dramatically in social capital? For example, why do 61% of Norwegians think that most people can be trusted while only 7% of Brazilians think so?¹¹ Why do the citizens of certain countries participate so actively in clubs and associational or civic activities while those in other countries do not? That is, why is u_S persistently higher in some countries than others? Our models provide two explanations.

6.1. Differences in cultural homogeneity and government policies

The first reason for cross-country differences in the stocks of social capital is that the productivity of social capital building differs among countries. In our model, this implies differences in

¹¹ Knack and Zak (2001).

the productivity parameter P in the social capital accumulation equation, $\dot{S} = P(u_S L)^\beta S^\gamma - \delta_S S$. Factors that determine the magnitude of P include the degree of ethnic, linguistic and religious fractionalization in the country. For example, social interactions are more fruitful when all participants speak the same language fluently. When communication requires less effort, the gains obtained from economic cooperation will be larger. Similarly, trust is higher where there is ethnic homogeneity since people are more likely to deal dishonestly with members of other ethnic groups than with members of their own. Evidence of this trust along ethnic lines may be seen in the organization of international merchantile networks, such as Chinese merchants in Southeast Asia and Indians in East Africa. Moreover, Ahuja (1998) found that in Cote d'Ivoire, the extent of environmental degradation of the land was lower in ethnically homogeneous than ethnically heterogeneous villages, suggesting that people have an easier time cooperating for the common good with others of the same ethnicity.

Secondly, governments in different countries have responded differently to the perceived decline in social capital over recent decades in terms of the policies enacted and actions taken to address the externality/spillover effect inherent in social capital formation. (The magnitude of this effect is captured in our third model by ϕ .) For example, policymakers in Scandinavian countries have probably done more to correct this market failure than their US counterparts. In our third model, simulations demonstrate that u_S^* is increasing in ϕ (see the bottom left panel in Fig. 6).

6.2. Multiple equilibria and social capital poverty traps

A modification to the models presented offers a third explanation for the disparities in social capital between countries. Let the population be constant for simplicity. Then we can express the \dot{S} equation given above in graphical form, as shown in the upper left panel of Fig. 7. The curve represents the creation of new social capital while the straight line represents the amount of “depreciated” old social capital. The dynamic equilibria or steady state (where social capital per person is constant) occurs at the unique intersection of the curve and the straight line. The upper right panel represents the same \dot{S} equation except in terms of growth rates. The growth rate of social capital is the vertical distance between the curve and the straight line.

Suppose the spillover parameter is now larger at higher levels of aggregate social capital or suppose the production function for new social capital takes a cubic polynomial form. Intuitively, the spillover effect on one person's decision to accumulate social capital now varies with the level of social capital in the community. For example, the effectiveness of a parent teacher association may be extremely low when very few parents are involved so that a newcomer to the neighborhood may find participating in the PTA a very inefficient use of her time. If this is the case, then the formation of new social capital may be represented by the curve in the lower left panel of Fig. 7. (The lower right panel represents the same \dot{S} equation in terms of growth rates.) Notice that we now have two possible equilibria: one in which the community is social capital-poor and the other in which it is richer in aggregate social capital. The first equilibrium may be viewed as an undesirable social capital poverty trap. In the given example, the social capital-poor equilibrium is a stable one while the social capital-rich equilibrium is unstable. Obviously, a more complex production function for social capital may generate three or more possible equilibria, of which more than one may be stable.

The potential existence of social capital poverty traps suggests that government action may be required to ameliorate the coordination problem between private agents in the economy. We discuss this in the next section of the paper.

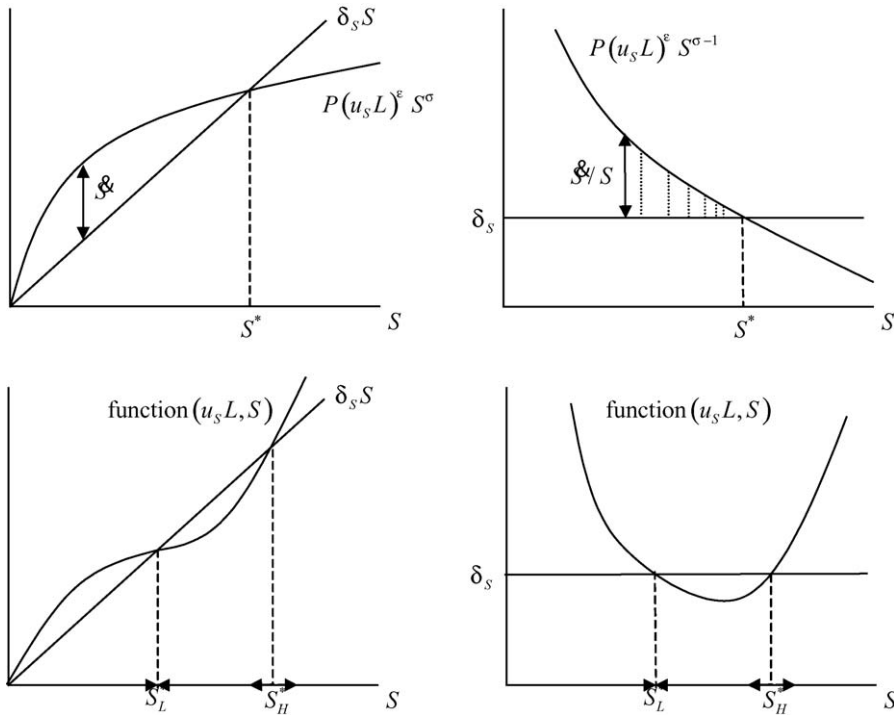


Fig. 7. Multiple equilibria and social capital poverty trap.

7. Implications for public policy

In this section, we explore the policy implications that follow from the analyses of our models. We demonstrate that the failure of private economic agents to internalize the positive spillovers in social capital creation may be addressed via a subsidy to individuals engaging in social capital creation that is financed by a wage tax on the final goods sector. We then discuss the practicalities of implementing such a policy.

7.1. Internalizing the spillovers in social capital creation: a tax and subsidy scheme

We showed previously that, as individuals do not internalize the positive externalities that their accumulation of social capital confers on the accumulation of social capital by other individuals, there is an under-allocation of time or human capital towards activities that create social capital. Specifically, in each of the three models, u_S^* is larger in the social planner's solution than in the decentralized, competitive solution. For example, in the model of social capital and financial development:

$$u_S^{*DC} = \frac{\alpha n(1 - \sigma)(n + \delta_S)}{\rho(1 - \alpha)(\rho + \delta_S) + \alpha n(1 - \sigma)(n + \delta_S)},$$

$$u_S^{*SP} = \frac{\alpha n(1 - \sigma)(n + \delta_S)}{\rho(1 - \alpha)(\rho + \delta_S - \sigma(n + \delta_S)) + \alpha n(1 - \sigma)(n + \delta_S)}.$$

Clearly, $u_S^{*DC} < u_S^{*SP}$ since $\sigma(n + \delta_S) > 0$ and $\rho > n$. This under-allocation may, however, be corrected by an appropriate tax and subsidy scheme.

Suppose the government imposes a proportional tax on the wage bill of the final goods sector to finance a subsidy to social capital creation. The tax rate on the final goods sector is τ_Y while an individual is awarded ξ for every unit of labor time devoted to activities that create social capital. The balanced budget equation for the tax and subsidy scheme is

$$\xi u_S L = \tau_Y w_Y u_Y L. \quad (28)$$

Incorporating this scheme in our model of social capital and financial development, we can show that the optimal tax rate that causes the planner's and competitive solutions for u_S^* to coincide is

$$\begin{aligned} \tau_Y^* &= \frac{\Gamma(\Psi - \Phi)}{\Psi\Phi} > 0, \quad \Gamma = \alpha n(1 - \sigma)(n + \delta_S), \\ \Phi &= \rho(1 - \alpha)(\rho + \delta_S - \sigma(n + \delta_S)), \quad \Psi = \rho(1 - \alpha)(\rho + \delta_S). \end{aligned} \quad (29)$$

The optimal tax rate is increasing in the magnitude of the social capital spillover effect as captured by σ . That is, $\partial \tau_Y^* / \partial \sigma > 0$.

7.2. Practical policy-making

What policies can a government put in place to encourage the creation of more social capital? How do we raise the productivity of social capital creation, that is, produce more social capital given a fixed amount of resources such as the time commitment of individuals?

If social capital is critical to the development of children and the accumulation of human capital, then policies should be targeted at parents to induce them to spend more time with their children and play a more active part in their formal education. For example, it may make sense to offer financial rewards and other incentives for parents to join parents–teachers associations. In some developed countries, experts have advocated the establishment of charter schools, where the government provides school resources but school management is devolved to self-governing groups of parents, teachers and citizens. When parents are empowered with a real voice in the running of their children's schools, they are likely to be more enthusiastic about contributing time to parents–teachers activities.

The tax system (such as tax credits and deductions) may also have to be revised to encourage parents to spend time at home with their offspring. Just several decades ago, many mothers would regularly bring their children to their neighbors' and relatives' homes so that they could socialize with other kids or their cousins under adult supervision. Child development experts believe that the lack of such parental oversight today has resulted in a progressive rise in juvenile crime and other social problems in industrialized nations. However, such a policy is in conflict with welfare reform undertaken in the US and other countries since the mid-1990s that seek to encourage single mothers to return to the labor force. There is obviously a moral hazard problem in trying to identify whether an individual's time away from market activities is spent productively in producing social capital or not.

The accumulation of human capital is increasingly an extended and continuous process in today's information age. In recognition of this, governments should promote and fund lifelong learning, so that the education system will emerge as society's most prominent forum for public interaction. Adult education, learning circles, public libraries and universities for mature students

are places where citizens can learn and practise the habits of social trust. They should therefore be positioned at the center of civic life.

We have also shown the social capital affects economic performance through the building of trust when individuals spend time in associational leisure activities. To encourage participation in such activities, there should be adequate government funding (and possibly tax incentives) for sports clubs and other associations. The government must play a leading role in building leisure centers, sports grounds, parks and community centers. In addition to the physical infrastructure, there should be better designed community-based programs and activities to foster stronger ties within local communities.

Communal trust may also be raised when community organizations are allowed to take over the role of providing social services from the government. An example is President Bush's controversial faith-based initiatives to federally fund religious groups to provide such services. In this case, bonding and bridging social capital may increase within the religious community, but the policy may damage the bridging social capital that exists between religious groups and other civic organizations.

In recognition of the importance of social capital within innovation networks, government policies should focus on inducing firms to collaborate more intensively with other firms, research labs, universities and government agencies in order to increase the number, size and efficacy of networks. Governments should lay the physical infrastructure that encourage networking such as building research and development hubs, industrial parks and clusters for high-technology firms. There could conceivably be tax incentives for private expenditures on network-building activities.

8. Conclusion

This paper represents an addition to the relatively sparse theoretical literature on social capital and economic growth. The approach we adopt is a logical development of the representative agent endogenous growth model, building on models of learning-by-doing, human capital, and R&D by Lucas (1988), Romer (1986), [Romer \(1990\)](#), and [Jones \(1995\)](#).

By way of introduction, we reviewed the multifaceted relationship between social capital and economic growth that has been uncovered in the growing empirical literature. Following a discussion on the concept of social capital, we proposed three theoretical growth models built upon different perspectives on the meaning of social capital that are consistent with the available empirical evidence.

In the first model, micro-level bonding social capital impacts growth by assisting in the accumulation of human capital. Building social capital in this model corresponds in the real world to parents taking time off from work or staying at home with their children, and involving themselves in parent teacher associations. In the second model, bridging social capital impacts growth by affecting financial development through its effects on collective trust and social norms. Social capital accumulation in this model corresponds to participation in community clubs or engagement in other forms of associational activities. In our last model, meso-level linking social capital arises from the networking and collaborative activities of firms, which then results in the efficient creation and diffusion of business and technological innovations. In each of these models, we solved for the optimal steady-state allocation of human resources to the creation and maintenance of social capital, and examined the models' comparative statics and transitional dynamics.

We argued that cross-country differences in social capital stocks may be explained by differences in governments' commitment to the facilitation of social capital building and by the possibility of multiple equilibria that create poverty traps in social capital formation. We then

demonstrated that the failure of private economic agents to internalize the positive externalities in social capital creation may be addressed by a tax and subsidy scheme. The proposed scheme consists of a wage tax on the final goods sector where the tax receipts are used to reward individuals for time spent engaging in activities that build social capital. We then discussed the practicalities of implementing such a policy as well as viable ways of raising the productivity of social capital creation. Our future research will focus on the development on an overlapping generations model to study the impact of social capital on fertility choice and human capital accumulation, and the resulting implications for growth and development.

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