



Growing apart: The division of labor and the breakdown of informal institutions

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In this paper, we model the co-evolution of the division of labor and informal institutions based on three assumptions. First, informal institutions lower coordination costs among specialists, which increases the equilibrium division of labor. Second, advances in the division of labor increase the size of interpersonal trading groups and thereby undermine the game theoretic basis of informal institutions. Finally, the collective nature of informal institutions implies that they are undervalued in private decision making. Together these assumptions imply that the equilibrium division of labor is too high from a social perspective. Consequently, the economy has greater than optimal complexity and grows at a higher than optimal rate of growth. *Journal of Comparative Economics* 34 (1) (2006) 75–91. Pierce Hall 107, Smith College, Northampton, MA 01063, USA.

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1. Introduction

Although growth leads to improvements in the material standard of living, psychic costs may accompany these benefits. Putnam (2000) and Tam (1998) focus on the complexity of modern life and the resulting breakdown of community. However, these conjectures have not been subject to formal analysis. Any attempt to investigate these concerns must provide a link between

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economic complexity and economic development and explain why the actual and optimal levels of economic complexity differ. In this paper, we consider one such link by analyzing the relationship between the division of labor and informal institutions.

In growth models, the division of labor is endogenized by assuming that agents face a trade-off between gains to specialization and interpersonal coordination costs, as in Yang and Borland (1991), Tamura (1992, 1996), Becker and Murphy (1992) and Davis (2001, 2003a, 2003b). Gains to specialization may offset diminishing returns to capital, establishing the basis for a virtuous cycle of growth driven by accumulation and the evolution of the division of labor. With the division of labor dependent on a web of interpersonal exchange, this literature provides a link between economic growth and increases in the complexity of economic life. The complexity of economic organization depends on individual labor specialization decisions and the resulting degree of interpersonal economic interdependence.

We extend this literature in two directions. First, informal institutions are given an explicit role to play in facilitating the division of labor. Informal institutions consist of a set of conventions regarding behavior among members of a society and are crucial for establishing a stable social order. In the economic sphere, these institutions reduce contract enforcement costs and facilitate the coordination of productive activity. Hence, they allow greater exploitation of gains from the division of labor. Second, we incorporate North's (1990) insight that advances in the division of labor lead to the deterioration of informal institutions. Lacking the threat of official force, informal institutions arise from spontaneous cooperation among members of a group. However, as we show, advances in the division of labor undermine those group characteristics on which informal coordination and enforcement mechanisms depend.

Previous models of the division of labor assume that the costs and benefits to labor specialization are borne entirely by the optimizing individual. As a result, the equilibrium and optimal levels of labor specialization do not differ and the resulting economies achieve an optimal degree of complexity. We deviate from this assumption by treating informal institutions as a public good. In making labor specialization decisions, individual agents take the quality of informal institutions as given. Intuitively, an agent's decision to move to a city in which specialized skills may be utilized more intensively does not depend on how this decision may affect the level of interpersonal trust and cooperation in the city. Hence, we introduce an external cost to specialization, which implies that labor is overspecialized from a social perspective. In equilibrium, the economy is overly complex.

Treating informal institutions as public goods generates rate effects as well as level effects. As Rosen (1983) and Young (1928) have pointed out, the return to a specialized capital good increases with its rate of utilization. In our model, more specialized workers utilize their skills more intensively so that greater-than-optimal specialization results in greater-than-optimal investment rates. Thus, in addition to being overly complex, the economy grows too fast and the onset of industrialization and commercialization, which marks the transition from a traditional to a market economy, occurs at a lower-than-optimal level of development. Our model is not intended to provide a comprehensive welfare analysis of labor specialization decisions. Rather, we focus on a single aspect of the relationship between labor specialization and informal institutions. We ignore the substitution of formal for informal institutions considered by North (1990) and negative aspects of informal arrangements, such as cronyism and discrimination, discussed in Bowles and Gintis (2004). The appropriate interpretation of our work is that the public nature of informal institutions provides a tendency toward over specialization but not that specialization is characterized by negative externalities on balance. Assessing the relative strengths of the negative and positive spillovers to labor specialization is beyond the scope of this paper.

In Section 2, we survey theoretical and empirical studies of informal institutions with an eye to highlighting two propositions regarding the relationship between informal institutions and the division of labor. These propositions capture the role of informal institutions and form the basis for the static model in Section 3. Section 4 contains a dynamic model that addresses the relationship between equilibrium and optimal growth. In Section 5, we conclude by presenting the implications of our model for development.

2. Informal institutions: a review of the literature

The best evidence that informal institutions reduce market transaction costs and, by implication, facilitate exchange comes from studies of long-distance exchange in the absence of legal contract enforcement. The work by Greif (1993) on the Maghribi traders in the Mediterranean, the analysis by Milgrom et al. (1990) of the Champagne fairs of medieval Europe, and the study by Clay (1997) of merchants in colonial California are prime examples. In each case, the transactions described involve principal-agent relationships with considerable latitude for opportunistic behavior. However, the written record suggests that traders developed a common code of behavior so that abuse was rare and, when it occurred, subject to collective punishment.

Although considering trade in the absence of law highlights the role of informal institutions, other work indicates that informal institutions remain important even in the presence of a well-developed commercial and legal system. At a theoretical level, Williamson (1979) argues that fully contingent contracts are prohibitively expensive in complex exchange relationships, leaving informal institutions an important role in reducing opportunistic behavior. Bowles and Gintis (2004) survey the large empirical literature considering the roles of ethnic trading groups and suggest that social ties continue to play a role in advanced economies. Hence, our first proposition that informal institutions facilitate exchange by reducing transaction costs is well documented in various literatures.

Our second proposition is that labor specialization generates negative social costs in the form of the non-optimal deterioration of informal institutions. Informal institutions are characterized as self-enforcing contracts that emerge in repeated multi-player prisoner's dilemma game. In these games, the threat of future sanctions serves to mitigate opportunistic behavior among trade partners. Changes in the division of labor alter the structure of these games in ways that undermine the incentives that support informal institutions. In particular, informal contract enforcement depends on the maintenance of a number of collective goods that individuals tend to undervalue or take as given in making their labor specialization decisions.

The division of labor increases the number of one's trade partners, which corresponds to an increase in the number of players in the game. As demonstrated by Kandori (1992), an increase in the number of players reduces the frequency of repeat pairings of trade partners. As a result, personal enforcement, i.e., retaliation by the victim, is undermined and reliance on community enforcement, i.e., retaliation by non-victims, is required. In community enforcement equilibria, an informational issue arises in that effective enforcement requires the players to know their current trade partner's reputation, which consists of information on their past behavior. The cost of transmitting information on a player's reputation rises with group size. Milgrom et al. (1990) suggest that information sharing accounts for the emergence of private commercial judges in medieval Europe. As private individuals, the judges lacked powers of coercion but served as reservoirs of information on the past behavior of merchants. Moreover, the information on merchants' reputations used in community enforcement is a public good. This public information becomes increasingly more difficult to maintain as the number of merchants increases because

individual merchants have an incentive to free-ride on the efforts of others to produce and transmit it.

In cases in which incentives are insufficient to eliminate cheating completely, community sanctions become necessary. As Taylor (1987) argues, sanctioning itself becomes a public good if it involves a loss to the sanctioning member. In detailed case studies of merchant interactions, Greif (1993) and Clay (1997) document that sanctions took the form of exclusion from trade and involved losses for both the cheater and the merchant implementing them. Clay (1997) reports that some merchants used minimal sanctions to reduce their private losses in colonial California. For our purposes, the key point is the public good nature of the mechanisms that underlie informal institutions.¹ A closely related point is that the expansion of trading opportunities may reduce the effectiveness of sanctions. With new opportunities for exchange, the threat of exclusion from future trades becomes less costly and leads to the breakdown of informal trade relations according to Greif (1993) and Clay (1997). Woodruff (1998) reports that reputation-based trade relations between Mexican footwear manufacturers and retailers collapsed after trade liberalization afforded retailers access to foreign suppliers. The loss to Mexican manufacturers, who had relied on informal enforcement mechanisms, exemplifies the external cost of market expansion.

An additional link between the division of labor and informal institutions involves the density of the social network in which trade takes place. In a review article, Granovetter (2005) argues that a dense social network tends to reduce information costs, which in turn facilitates the development and enforcement of social norms. Taylor (1987) points out that having a group in which relations are direct and many-sided increases the range of positive and negative sanctions. Hence, access to alternative sanctions should increase flexibility in punishment and reduce enforcement cost.

If occupational specialization decisions alter an individual's personal values or provide access to specialized sources of information, advances in the division of labor may weaken a social network by increasing interpersonal heterogeneity. Schofield (1985) argues that such heterogeneity tends to frustrate efforts at cooperation, which requires knowledge of others' beliefs and preferences. Regarding the impact of the division of labor on group size, Granovetter (2005) notes that social density tends to be less in larger groups because of the limits on how many social ties people can sustain. The same author also points out the public good nature of social networks in that individuals cannot pay for the trust and obligations that motivate friends and relatives to help one another. The importance of social ties in facilitating trade is supported by a large empirical literature on ethnic trading groups. In a seminal paper, Landa (1981) finds that transaction costs among Chinese rubber traders in Malaysia rise with social distance, which is defined hierarchically by ties of kinship, clanship, geographic origin and ethnicity. Making a complementary point, Knorringa (1996) finds that barriers to the formation of social ties, such as those that exist across Indian castes, may act to increase transaction costs and impede trade.

Thus, the argument that labor specialization exerts a negative spillover on the quality of informal institutions rests on two suppositions. First, spontaneous cooperation depends on the successful maintenance of several collective goods that are subject to free-rider problems. These include the creation and transmission of information regarding the past behavior of group members, the costly sanctioning of cheaters, and the maintenance of social networks. Second, the collective nature of these goods suggests that individuals do not consider the full social cost of

¹ The private cost aspect of sanctions introduces a second informational problem involving the knowledge of which group members have fulfilled their obligation to punish cheaters.

their labor specialization decisions. Either individuals free-ride consciously on the contributions of others or they simply disregard the impact of their specialization decisions on the equilibrium level of the division of labor. An agent who leaves home to pursue a specialized career in a city is unlikely to consider either the cost to members of the social network left behind or the social impact of this decision on information and enforcement costs in the destination city.

Our model is related closely to two others in the literature. Kranton (1996) analyzes the impact of access to markets on informal trade relations and supports the notion that the expansion of trade exerts a negative spillover on informal institutions. However, Kranton views personal and impersonal exchange as competing forms of economic organization, whereas in our framework social ties facilitate market exchange. Annen (2003) considers informal institutions in a model in which the division of labor is exogenous and static. In contrast, we model the interdependence and co-evolution of informal institutions and the division of labor. In a different literature examining the role of social capital in facilitating trade, Glaeser et al. (2002) consider social capital to be the result of costly private investments in personal relationships. Our approach is complementary to theirs in that we focus on the public good aspects of social ties that may lie beyond the influence of individual action.

3. The static model

To consider the interaction between informal institutions and the division of labor in a static context, we solve for both equilibrium and optimal levels of output in this section. We highlight the impact of an externality introduced by the public nature of informal institutions. In addition, we generate a reduced-form equation for per capita output to be used in the dynamic model in the next section. The model proceeds from a nano-economic foundation in which production is disaggregated to the level of individual productive tasks. We assume a continuum of productive tasks, which are arranged along the unit interval and indexed by a , and a one-to-one relationship between tasks and intermediate goods so that performing a task produces an intermediate good of the same index number. Intermediate goods are equally productive complementary inputs in final good production, but they are not used to produce other intermediate goods.

We consider N identical individuals. Each individual is endowed with h units of human capital and one unit of time, which are allocated uniformly across v tasks. Defining labor specialization as $s \equiv 1/v$, the time and human capital allocated to producing each intermediate good are given by $\ell_a = 1/v = s$ and $h_a = h/v = sh$. These two task-specific inputs are increasing in labor specialization and measure two separate sources of gains to specialization. Task-specific human capital, $h_a = sh$, captures the idea that specialization allows an agent to concentrate educational efforts, e.g., taking two courses in time series econometrics or panel data methods rather than one course in each. A second, and conceptually separate, gain is associated with a worker concentrating effort, which allows exploitation of task-specific capital more intensively. To extend the previous example, someone with specialized training in econometrics gains from spending two days per week, rather than one, running regressions. Such gains to utilization are highlighted in the analysis of Rosen (1983) and Young (1928).

Intermediate goods are produced according to a Cobb–Douglas production function with arguments ℓ_a and h_a so that $y_a(\ell_a, h_a) = A\ell_a^\alpha h_a^\beta$, where both α and β belong to the open unit interval and are uniform across tasks. Per capita output, denoted y , is measured as the value of the intermediate goods produced by an agent, which is computed by integrating y_a over the set

of productive task. Hence, we have:

$$y(s, h) = \int_0^1 y_a da = v y_a = A s^{(\alpha+\beta-1)} h^\beta = A s^\varepsilon h^\beta. \quad (1)$$

Per capita output exhibits gains to specialization so long as the exponent on s in Eq. (1) is positive, i.e., $\varepsilon = \alpha + \beta - 1 > 0$, which is assumed to be the case. In addition, Eq. (1) exhibits a positive cross-partial, $y_{sh}(s, h) > 0$, which captures the insight of Rosen (1983) that labor specialization increases the return to specialized human capital.

Intermediate goods are complements in the production of a composite good that may be used either for consumption or investment and is taken as the numeraire. One unit of the composite good is produced using a Leontief technology by combining one unit of each of the intermediate goods. A worker may produce the full range of intermediate goods, $s = 1$, and combine them to produce the composite good. Alternately, a worker may specialize in the production of a subset of intermediate goods, in which case this worker must coordinate production with other specialists. The strong complementarity embodied in the final good technology requires that every intermediate good be produced within the economy. Hence, an upper limit is placed on the level of labor specialization in that $v \geq 1/N$ implies $s \leq N$. At the lower end, labor specialization is restricted by the number of intermediate goods so that $v \leq 1$ implies $s \geq 1$.

Whether undertaken within a firm or through the market, the coordination of production is assumed to be costly.² Coordination costs may include transportation costs, as discussed by Smith (1776), principle-agent conflicts, as considered in Becker and Murphy (1992), information costs, as identified by Coase (1991) and Arrow (1974), and contracting costs, as highlighted by Williamson (1979). We assume that the coordination costs faced by an agent are increasing and convex in the number of specialists with whom production must be coordinated. A group of specialists who coordinate their production is designated as a team. Since team members constitute the market for an individual's output, the number of team members, m , corresponds to the extent of the market. Positive coordination costs imply that team members produce non-overlapping sets of intermediate goods, with $v \leq 1/m$. Leontief production of the final good implies a team must produce each intermediate good, $v \geq 1/m$, hence, team size is given by $m = 1/v = s$. Coordination costs depend on labor specialization and informal institutions as follows:

$$x(s) = q^{-1} s^{1+\gamma}, \quad (2)$$

where $\gamma > 0$ and q is a measure of the quality of informal institutions. Other determinants of coordination costs, e.g., geography, technology and the quality of formal institutions, are taken as given and normalized to unity. Equation (2) captures our first proposition that informal institutions reduce coordination costs.

Our second proposition holds that the quality of informal institutions depends negatively on the division of labor. In addition, the collective nature of reputation transmission, sanctioning, and social network maintenance suggests that individuals may disregard the impact of their specialization decisions on institutional quality. To model the second proposition, we assume that institutional quality varies inversely with average labor specialization \bar{s} , which individuals treat as independent in making their personal specialization decisions. Hence, we specify:

$$q(\bar{s}) = b \bar{s}^{-\phi}, \quad \text{where } b, \phi > 0. \quad (3)$$

² Davis (2003b) addresses the trade-off between organizing production within and between firms in a growth model.

To avoid the complications introduced by the exercise of monopoly power by specialists, we assume that the interpersonal exchange of intermediate goods proceeds according to contracts signed prior to specialization decisions. Since agents are ex ante identical, no agent may exercise market power at the time that contracts are signed. Hence, contracting in this manner is sufficient to ensure price-taking behavior by individual agents, as Yang and Borland (1991) demonstrate. This assumption allows us to focus our attention on the distortion introduced by the public nature of institutional quality.³

Agents choose the level of labor specialization to maximize net income, equal to per capita income less coordination costs. The level of human capital, assumed to be uniform across agents, is taken as given. Substituting (3) into (2), we write the agent’s problem as follows:

$$\max_{s \in [1, N]} z(s, h; \bar{s}) = y(s, h) - x(\bar{s}, s) = As^\varepsilon h^\beta - b^{-1} \bar{s}^\phi s^{1+\gamma}. \tag{4}$$

Initially ignoring the upper and lower bounds on the value of s , the first-order condition for (4) is

$$s^e = \left[\frac{\varepsilon Ab}{1 + \gamma} \right]^{\frac{1}{1+\gamma-\varepsilon}} \bar{s}^{\frac{-\phi}{1+\gamma-\varepsilon}} h^{\frac{\beta}{1+\gamma-\varepsilon}}.$$

Noting that $\bar{s} = s^e$ in equilibrium and that average specialization depends on the level of average, rather than individual, human capital, \bar{h} , we have

$$\bar{s} = \left[\frac{\varepsilon Ab}{1 + \gamma} \right]^{\frac{1}{1+\gamma+\phi-\varepsilon}} \bar{h}^{\frac{\beta}{1+\gamma+\phi-\varepsilon}}.$$

Substituting this expression into Eq. (4) and considering the Kuhn–Tucker conditions for constrained optimization, we have the following equation for equilibrium specialization as a function of individual and average human capital:

$$s^e(h, \bar{h}) = \begin{cases} 1 & h < h_0^e, \\ \left[\frac{\varepsilon bA}{1 + \gamma} \right]^{\frac{1}{1+\gamma+\phi-\varepsilon}} \bar{h}^{\frac{-\beta\phi}{(1+\gamma+\phi-\varepsilon)(1+\gamma-\varepsilon)}} h^{\frac{\beta}{1+\gamma-\varepsilon}} & h \in [h_0^e, h_1^e], \\ N & h > h_1^e, \end{cases} \tag{5}$$

where

$$h_0^e = \left[\frac{1 + \gamma}{\varepsilon bA} \right]^{\frac{1}{\beta}} \quad \text{and} \quad h_1^e = h_0^e N^{\frac{1+\gamma+\phi-\varepsilon}{\beta}}.$$

Figure 1 illustrates these solutions. For an interior solution, equilibrium specialization is increasing in the capital–labor ratio, which reflects the complementarity between human capital and labor specialization from the production technology specified in Eq. (1). For low levels of human capital, $h < h_0^e$, the gains to specialization are low and equilibrium specialization is constrained by its lower bound, $s^e = 1$. Similarly, for high levels of the capital–labor ratio, i.e., $h > h_1^e = h_0^e N^{(1+\gamma+\phi-\varepsilon)/\beta}$, the gains to specialization are high and specialization is limited by

³ In a similar model, Chu (1997) shows that free occupational entry is sufficient to generate a Pareto-optimal equilibrium. Ng and Yang (1997) consider the informational requirements necessary for a sequence of equilibria to converge to the efficient division of labor.

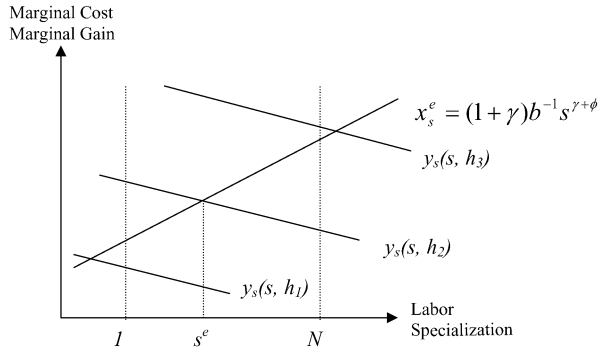


Fig. 1. Equilibrium specialization, $h_1 < h_2 < h_3$.

population size rather than coordination costs, i.e., $s^e = N$. Although $\bar{h} = h$ may be imposed as an equilibrium condition due to identical agents, we find it useful to maintain a distinction between these two variables because of their difference from the agent’s perspective. In the dynamic model, agents view h as evolving according to their individual investment decisions but take the time path of the average capital–labor ratio as given.

The equilibrium level of per capita net output is determined by substituting (5) into (4) to yield:

$$z^e(h, \bar{h}) = \begin{cases} Ah^\beta - b^{-1} & h < h_0^e, \\ B^e \bar{h}^{\frac{-\varepsilon\phi\beta}{(1+\gamma+\phi-\varepsilon)(1+\gamma-\varepsilon)}} h^{\frac{\beta(1+\gamma)}{1+\gamma-\varepsilon}} & h \in [h_0^e, h_1^e], \\ AN^\varepsilon h^\beta - b^{-1} N^{1+\gamma+\phi} & h > h_1^e, \end{cases} \quad (6)$$

where

$$B^e = \left[\frac{1 + \gamma - \varepsilon}{1 + \gamma} \right] A \left[\frac{\varepsilon b A}{1 + \gamma} \right]^{\frac{\varepsilon}{1+\gamma+\phi-\varepsilon}}.$$

Equations (5) and (6) indicate that endogenous specialization decisions result in three distinct stages of economic development, with h_0^e and h_1^e representing transitional values of human capital. The low levels of human capital, output and specialization reflected in the first lines of each equation may be taken as a stylized representation of a traditional economy, in which markets are underdeveloped and agents are relatively self-sufficient and isolated economically. The second lines correspond to an industrializing economy in which market size and the division of labor are increasing in the capital–labor ratio. The third lines characterize an organizationally mature economy, consisting of a single integrated market with an advanced division of labor. The following proposition summarizes these results.

Proposition 1. (A) *If $h < h_0^e$, the economy is a traditional economy with the following characteristics:*

- (a) *labor is not specialized, i.e., $s^e = 1$,*
- (b) *specialization is not affected by increments of capital, i.e., $ds^e/dh = 0$,*
- (c) *specialization and per capita income are unaffected by population size, i.e., $ds^e/dN = dz^e/dN = 0$, and*
- (d) *production exhibits diminishing marginal returns to capital, i.e., $d^2z^e/dh^2 < 0$.*

(B) If $h \in [h_0^e, h_1^e]$, the economy is an industrializing economy with the following characteristics:

- (a) labor is specialized and production is organized into multi-person teams, i.e., $s^e = m > 1$,
- (b) labor specialization and team size are increasing in the level of human capital, i.e., $ds^e/dh > 0$,
- (c) population size affects the number of teams in the economy but not team size, labor specialization, or per capita income, i.e., $ds^e/dN = dz^e/dN = 0$, and
- (d) the marginal product of capital may be either increasing, constant, or decreasing.

(C) If $h > h_1^e$, the economy is a mature economy with the following characteristics:

- (a) there is only one team and specialization equals population size,
- (b) specialization is not affected by increments of capital, i.e., $ds^e/dh = 0$,
- (c) specialization and per capita income are increasing in population size, i.e., $ds^e/dN = 1$, $dz^e/dN > 0$, and
- (d) production exhibits diminishing marginal returns to capital, i.e., $d^2z^e/dh^2 < 0$.

Because agents ignore the effect of their specialization decisions on institutional quality, equilibrium specialization is not optimal. To analyze the divergence of socially and privately optimal labor specialization, we determine per capita net output when specialization decisions are optimal. The problem faced by a benevolent social planner taking account of the impact of specialization on institutional quality is given by:

$$\max_{s \in [1, N]} z(s, h) = y(s, h) - x(s) = As^\varepsilon h^\beta - b^{-1}s^{1+\gamma+\phi}. \tag{7}$$

Optimal labor specialization and net per capita output are given by

$$s^*(h) = \begin{cases} 1 & h < h_0^*, \\ \left[\frac{\varepsilon b A}{1 + \gamma + \phi} \right]^{\frac{1}{1+\gamma+\phi-\varepsilon}} h^{\frac{\beta}{1+\gamma+\phi-\varepsilon}} & h \in [h_0^*, h_1^*], \\ N & h > h_1^*, \end{cases} \tag{8}$$

and

$$z^*(h) = \begin{cases} Ah^\beta - b^{-1} & h < h_0^*, \\ B^* h^{\frac{\beta(1+\gamma+\phi)}{1+\gamma+\phi-\varepsilon}} & h \in [h_0^*, h_1^*], \\ AN^\varepsilon h^\beta - b^{-1}N^{1+\gamma+\phi} & h > h_1^*, \end{cases} \tag{9}$$

where

$$h_0^* = \left[\frac{1 + \gamma + \phi}{\varepsilon b A} \right]^{\frac{1}{\beta}}, \quad h_1^* = h_0^* N^{\frac{1+\gamma+\phi-\varepsilon}{\beta}}, \quad \text{and}$$

$$B^* = \left[\frac{1 + \gamma + \phi - \varepsilon}{1 + \gamma + \phi} \right] A \left[\frac{\varepsilon b A}{1 + \gamma + \phi} \right]^{\frac{\varepsilon}{1+\gamma+\phi-\varepsilon}}.$$

Figure 2 illustrates that taken full account of the social costs of specialization results in lower labor specialization. By imposing the general equilibrium condition $\bar{h} = h$ in Eqs. (5) and (6) and comparing the solutions to those in Eqs. (8) and (9), we obtain the following proposition.

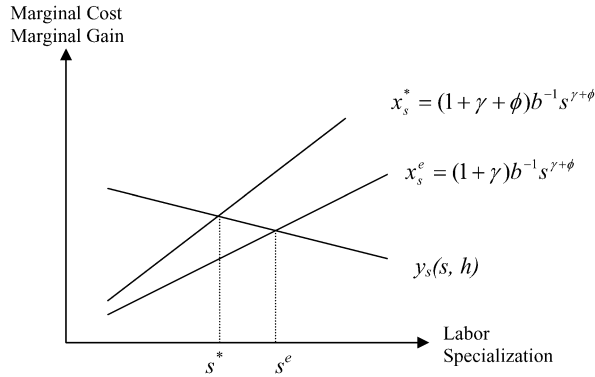


Fig. 2. Optimal and equilibrium specialization.

Proposition 2. *Relative to the social optimum, privately optimal specialization decisions yield the following results.*

- (A) *In an industrializing economy, for a given level of human capital, equilibrium labor specialization is greater than optimal and informal institutional quality is lower than optimal, i.e., $s^e(h) > s^*(h)$ and $q^e(h) < q^*(h)$.*
- (B) *Transitional values of human capital are lower than optimal, i.e., $h_0^e < h_0^*$ and $h_1^e < h_1^*$.*
- (C) *At the either very low levels of human capital, i.e., $h < h_0^e$, or at very high levels of human capital, i.e., $h > h_1^*$, labor specialization is unaffected by transaction cost. As a result, equilibrium and optimal specialization coincide.*

Part A of Proposition 2 provides the intuition for our model. For intermediate levels of human capital, labor specialization involves unconstrained private optimization decisions. Since individuals disregard the effect of these private decisions on the quality of informal institutions, equilibrium specialization is greater than the social optimum. Moreover, the implication of treating informal institutions as public goods is that the initiation of market exchange may occur at a lower-than-optimal level of development, which follows from part B of the proposition because $h_0^e < h_0^*$. Yellen (1990) argues that such was the case for the Kung of Botswana, for whom the transition to market exchange coincided with the breakdown of traditional social and economic relationships.

Part C of the proposition indicates that specialization is optimal at high and low levels of development, possibly because the external costs associated with the destruction of community are greatest during the period of rapid market expansion accompanying industrialization. However, we do not wish to stress this interpretation overly because the mechanism by which optimality is restored in advanced economies may not be realistic. Coordination costs, rather than population size, appear to constrain specialization decisions in real-world advanced economies. In any event, our main point concerns the impact of unconstrained specialization decisions occurring during the second stage of development.

4. The dynamic model

In this section, we develop a simple dynamic model to address the relationship between equilibrium and optimal growth. Defining output in a piece-wise fashion allows three dynamic

equilibria, one in each stage of development. We find that, because agents undervalue informal institutions and over-specialize, industrializing economies experience faster-than-optimal growth. The dynamic model uses a discrete time framework in which the variables of preceding section are treated as functions of time. We assume labor specialization is separable over time so that we may use the reduced-form equations for per capita net output in Eqs. (6) and (9). Population is assumed to grow at a constant exogenous rate n so that we have $N_{t+1} = (1 + n)N_t$. Households maximize an infinite horizon utility function with logarithmic instantaneous utility given by:

$$U = \sum_{t=0}^{\infty} \rho^{-t} \ln(c_t), \tag{10}$$

where $\rho > 0$ subject to an accumulation equation with full-depreciation of capital expressed as:

$$(1 + n)h_{t+1} = z^e(h_t) - c_t. \tag{11}$$

The use of a discrete time framework with full periodic depreciation of capital sharpens the analysis. Intuitively, each period may be considered to be a separate generation. The first-order condition for this maximization exercise is:

$$1 + g_t^e = c_{t+1}/c_t = \frac{r^e(h_{t+1})}{\rho(1 + n)}, \tag{12}$$

where $r^e(h_t)$ is the private marginal return to capital.

Equation (12) implies that an economy’s dynamic behavior depends on the position and shape of the function determining the return to capital. Differentiating Eq. (6) with respect to h , we have

$$r^e(h, \bar{h}) = \begin{cases} \beta A h^{\beta-1} & h < h_0^e, \\ \beta A \left[\frac{\varepsilon b A}{1 + \gamma} \right]^{\frac{\varepsilon}{1+\gamma+\phi-\varepsilon}} \bar{h}^{\frac{-\varepsilon\phi\beta}{(1+\gamma+\phi-\varepsilon)(1+\gamma-\varepsilon)}} h^{\frac{\beta(1+\gamma)}{1+\gamma-\varepsilon}-1} & h \in [h_0^e, h_1^e], \\ \beta A N^\varepsilon h^{\beta-1} & h > h_1^e, \end{cases} \tag{13}$$

by imposing $\bar{h} = h$, we obtain:

$$r^e(h) = \begin{cases} \beta A h^{\beta-1} & h < h_0^e, \\ \beta A \left[\frac{\varepsilon b A}{1 + \gamma} \right]^{\frac{\varepsilon}{1+\gamma+\phi-\varepsilon}} h^{\frac{\beta(1+\gamma+\phi)}{1+\gamma+\phi-\varepsilon}-1} & h \in [h_0^e, h_1^e], \\ \beta A N^\varepsilon h^{\beta-1} & h > h_1^e. \end{cases} \tag{14}$$

where

$$h_0^e = \left[\frac{1 + \gamma}{\varepsilon b A} \right]^{\frac{1}{\beta}} \quad \text{and} \quad h_1^e = h_0^e N_t^{\frac{1+\gamma+\phi-\varepsilon}{\beta}}.$$

Expression (14) indicates that $r^e(h)$ is continuous but not necessarily monotonic. For industrializing economies, the sign of the exponent on human capital is ambiguous. Capital accumulation induces a greater division of labor and the gains to specialization may partly, or fully, offset diminishing returns to capital in the production of intermediate goods in these economies.

Our interest in endogenous growth leads us to restrict the analysis to the knife’s edge case in which industrialization is characterized by constant marginal returns to capital, which results if and only if $\varepsilon = (1 - \beta)(1 + \gamma + \phi)$. In other words, the marginal return to capital is constant

provided the gains to specialization are just sufficient to offset the combined effects of diminishing returns to capital, i.e., $1 - \beta$, and rising marginal coordination costs, i.e., $1 + \gamma + \phi$.⁴ For notational convenience, we define the return to capital during industrialization as:

$$r_I^e \equiv \beta A \left[\frac{\varepsilon b A}{1 + \gamma} \right]^{\frac{\varepsilon}{1 + \gamma + \phi - \varepsilon}}$$

During the traditional and mature stages of development, equilibrium specialization is constrained and, thus, independent of incremental changes in the capital–labor ratio. This condition prohibits the mutually re-enforcing interaction between capital accumulation and the evolution of the division of labor that occurs during industrialization. As a result, these stages of organizational development are characterized by diminishing marginal returns to capital.

Expression (14) describes the transition from the industrializing to the mature stage of development. As in the static model, this transition occurs when the privately optimal level of labor specialization exceeds population size. With a growing population, the transition value of human capital is given by $h_1^e = h_0^e N_t^{(1 + \gamma + \phi - \varepsilon)/\beta}$, which grows at the rate $(1 + n)^{(1 + \gamma + \phi - \varepsilon)/\beta} - 1$. As a result, the third segment of the return to capital function shifts to the right in each period, as illustrated in Fig. 3. The dynamic model supports three equilibria with constant growth rates, one in each phase of development. The realization of a particular dynamic equilibrium depends on the relationship between the return to capital, population growth, and the discount rate. These equilibria are a stationary state for a traditional economy, endogenous growth during the industrialization phase, and population-constrained growth in a mature economy.

If the return to capital under industrialization is lower than the value required for a positive rate of growth, i.e., $r_I^e \leq \rho(1 + n)$, the economy converges to a stationary state in the traditional development stage. The equilibrium occurs at $h_L < h_0^e$, which is defined implicitly by $r(h_L) = \rho(1 + n)$. In this equilibrium, diminishing returns to capital bring accumulation and growth to a halt prior to reaching the industrialization stage so that its associated processes of market expansion and labor specialization are not achieved. However, if productivity, i.e., A , and

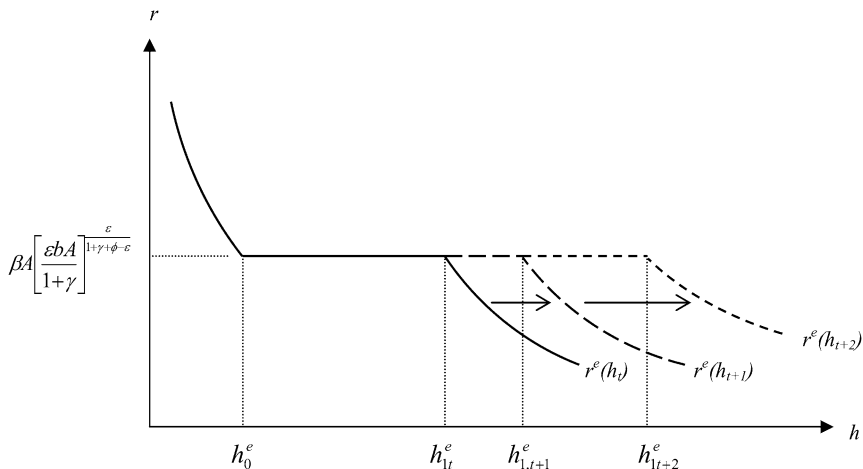


Fig. 3. Equilibrium return to capital.

⁴ Davis (2001) examines the implications of increasing and diminishing marginal returns during industrialization.

institutional efficiency, i.e., b , are sufficiently high to avoid this stationary state, human capital eventually exceeds h_0^e and industrialization begins. During this stage of development, growth is characterized by increases in both labor specialization and market size and deterioration in the quality of informal institutions. The gains to specialization are just sufficient to offset the effect of both rising coordination costs and diminishing returns to capital so that the economy grows at a constant rate given by

$$g_I = \frac{\beta A}{\rho(1+n)} \left[\frac{\varepsilon b A}{1+\gamma} \right]^{1+\gamma+\phi-\varepsilon} - 1.$$

During industrialization, the economy grows at an endogenously determined rate, which suggests that the strength of informal institutions, as captured by b , may influence the long run rate of growth. Although informal institutions are not usually considered to be affected by direct policy intervention, formal and informal institutions may be complements in the production of interpersonal trust. As an example, an increase in the rule of law may increase b and raise the equilibrium rate of growth. Moreover, endogenous growth occurs in the absence of technical progress, which highlights the potential for changes in economic organization to overcome the effects of diminishing returns and generate persistent growth.

If the economy grows sufficiently quickly during industrialization the level of labor specialization will eventually exceed the current population size, in which case the economy enters the mature phase of development. This transformation occurs if human capital grows more quickly than $h_1^e(N_t)$ or, equivalently, if $r_I^e > \rho(1+n)^{(1+\gamma+\phi+\beta-\varepsilon)/\beta}$.

Upon entering the mature stage of development, additional gains from the division of labor are limited to those available from population growth. Because the evolution of the division of labor is independent of accumulation decisions, the model exhibits diminishing marginal returns to capital so that the rate of growth slows as it approaches that of $h_1^e(N_t)$. On the balanced growth path, the return to capital is constant and per capita levels of consumption, net output, and capital all grow at the constant rate given by $g_M = (1+n)^{\varepsilon/(1-\beta)} - 1$.

Defining $r_L = \rho(1+n)$ and $r_H = \rho(1+n)^{(1+\gamma+\phi+\beta-\varepsilon)/\beta}$, we summarize the steady state outcomes in the following proposition.

Proposition 3.

- (A) If $r_I^e \leq r_L$, the economy converges to a stationary state during the traditional stage of development.
- (B) If $r_I^e \in (r_L, r_H]$, the economy industrializes and grows at an endogenously determined rate given by

$$g_I = \frac{\beta A}{\rho(1+n)} \left[\frac{\varepsilon b A}{1+\gamma} \right]^{1+\gamma+\phi-\varepsilon} - 1.$$

- (C) If $r_I^e > r_H$, the economy passes through both the traditional and industrializing stages and grows at a rate $g_M = (1+n)^{\varepsilon/(1-\beta)} - 1$ as a mature economy.

Proposition 3 indicates that, for an industrializing economy, the rate of growth is decreasing in the population growth rate, which is a familiar result from neoclassical growth theory and points out the need to equip labor force entrants. However, for a mature economy, the equilibrium growth rate is increasing in the rate of population growth, which is an outcome related to

scale effects and consistent with the endogenous growth literature. Thus, our model implies that the dynamic effects of population growth differ across economies depending on their level of development and, in particular, on their internal organization. For a mature economy having one integrated market, growth rates are increasing in the rate of population growth. For an industrializing economy consisting of many, economically independent markets, labor specialization are not constrained by population size. In this case, population growth increases the number of markets but does not affect labor specialization.

We turn to a consideration of the relationship between optimal and equilibrium growth rates to investigate whether the external nature of institutional quality distorts the trade-off between current and future consumption faced by private decision makers. We find that unconstrained specialization decisions lead to over-specialization and faster-than-optimal growth with the source of this distortion being the link between labor specialization and the return to capital. An increase in labor specialization increases the utilization rate of task-specific capital goods; the more intensively capital is utilized, the higher is its return.

The social return to capital is determined by differentiating $z^*(h)$ in Eq. (9) with respect to h to obtain:

$$r^*(h) = \begin{cases} \beta A h^{\beta-1} & h < h_0^*, \\ \beta A \left[\frac{\varepsilon b A}{1 + \gamma + \phi} \right]^{\frac{\varepsilon}{1 + \gamma + \phi - \varepsilon}} & h \in [h_0^*, h_1^*], \\ \beta A N^\varepsilon h^{\beta-1} & h > h_1^*, \end{cases} \tag{15}$$

where

$$h_0^* = \left[\frac{1 + \gamma + \phi}{\varepsilon b A} \right]^{\frac{1}{\beta}} \quad \text{and} \quad h_1^* = h_0^* N^{\frac{1 + \gamma + \phi - \varepsilon}{\beta}}.$$

Expression (15) indicates that $r^*(h)$ is continuous at the transitions between organizational structures. We define the social return to capital under industrialization to be

$$r_I^* \equiv \beta A \left[\frac{\varepsilon b A}{1 + \gamma + \phi} \right]^{\frac{\varepsilon}{1 + \gamma + \phi - \varepsilon}}.$$

During industrialization, the social return to capital is less than the private return, i.e., $r_I^* < r_I^e$, and the difference between them increases with ϕ , which measures the strength of the external effect of specialization on institutional quality. More generally, the relationship between the social and private returns to capital is illustrated in Fig. 4 and summarized in the following proposition.

Proposition 4.

- (A) If $h < h_0^e$ or $h > h_1^*$, both the optimal and equilibrium levels of labor specialization are independent of the level of human capital. As a result, the social and private returns to capital are identical and the equilibrium growth rate is optimal.
- (B) If $h \in (h_0^e, h_1^*)$, either the optimal or equilibrium specialization decision is unconstrained so that the social return to capital is less than the private return and equilibrium growth is greater than optimal.

Proposition 4 illustrates the dynamic implications of over-specialization. For intermediate levels of human capital, specialization decisions are unconstrained. Agents ignore the impact of

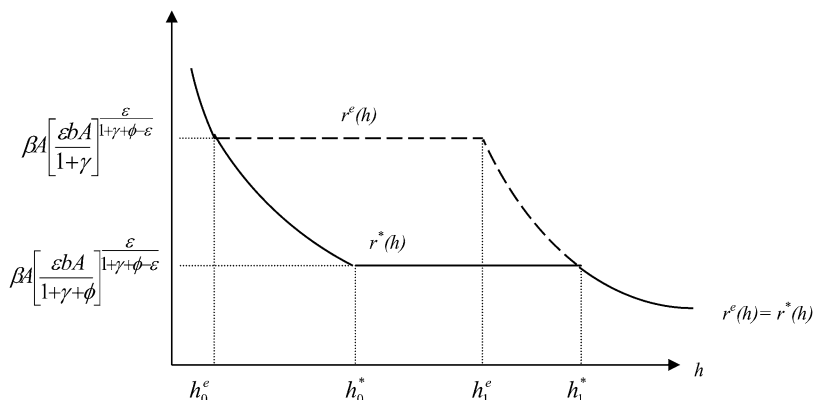


Fig. 4. Equilibrium and optimal returns to capital.

their accumulation decisions on average labor specialization and, thus, on institutional quality. As a result, the private return to capital exceeds the social return and the economy grows too fast. However, with constrained specialization outcomes, average labor specialization and institutional quality are unaffected by capital accumulation so that private and social returns coincide.

The re-establishment of optimal specialization and investment behavior in advanced economies does not diminish the importance of non-optimal outcomes at lower levels of income. Households discount utility starting at the pre-industrial time zero so that non-optimal outcomes during the industrialization phase are included. On a related point, the fact that inefficiencies are temporary does not justify attempts to hasten the growth process. Such a policy involves adjusting the trade-off between present and future gains, but equilibrium investment decisions reflect privately optimal behavior with respect to this trade-off, as Eq. (10) indicates. Furthermore, privately optimal growth is already dynamically inefficient because investment is over-valued relative to current consumption. Nonetheless, the implications of non-optimal industrialization should not be overstated. The fact that industrialization and market expansion start at a lower-than-optimal level of human capital, i.e., $h_0^e < h_0^*$, proceed at too rapid a rate, and result in the inadvertent destruction of informal institutions does not imply that agents would be better off in a perpetual traditional economy.

5. Conclusion

In this paper, we formalize the notion that development causes a systematic deterioration of informal institutions by developing a dynamic model in which the evolution of the division of labor both drives growth and undermines the group-theoretic basis of effective informal institutions. If individuals consider the quality of informal institutions to be independent of their specialization decisions, the equilibrium division of labor is too high from a social perspective and the economy may be characterized as too complex. In addition, since the return to capital is increasing in labor specialization, over-specialization results in a greater-than-optimal growth rate. Thus, we conclude that the development process undermines traditional social structures and does not account fully for the costs involved in weakening them.

We have avoided intentionally the value judgments inherent in much of the modernist versus traditionalist debate on development. Our results are generated under the assumption that the informal institutions enter the model only through their impact on the cost of exchange. In

particular, no subjective or intrinsic value is ascribed to existing institutions and they are not arguments of the agents' utility functions. The appeal of this approach is that the results do not rely on claims about individual preferences for a traditional society. Motivating this line of inquiry is our awareness that growth theorists tend to focus on possible sources of positive spillovers, in part for purely technical reason related to the presence of diminishing returns to capital, as discussed by Romer (1994). By implication, observed growth rates must be slower than optimal. Our formal argument that equilibrium growth may be faster than optimal provides some balance to this one-sided perspective.

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