Macroeconomic Dynamics, **24**, 2020, 860–881. Printed in the United States of America.
doi:10.1017/S1365100518000512

SOCIAL DISTANCE AND ECONOMIC DEVELOPMENT

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We show that path dependency in economic development can emerge in a model where social distance affects capital accumulation. This effect works through the impact of social interactions on individuals' incentives to invest. Social distance evolves intergenerationally, as the process of social interactions with people from different backgrounds generates familiarity and experiences that are bequeathed to the next generation, thus shaping their perceptions and opinions about "outsiders." A key result is the possibility of alienation among people who belong to different groups, if social distance is above a threshold. The initial conditions with respect to social distance and the capital stock can both be critical in determining the economy's long-term prospects.

Keywords: Social Distance, Cultural Externalities, Economic Development

1. INTRODUCTION

The view that the social, cultural, and economic dimensions of a nation are closely interlinked has received increased attention in recent years. This paper aims at contributing to the current understanding on the conditions that underpin the relation between social and economic phenomena, and their repercussions with respect to long-term economic performance. This is done by means of a dynamic model that focuses on the joint determination of capital accumulation and *social distance*, that is, the perceived degree of remoteness which characterizes the personal and social relations between people who belong to groups of different characteristics—racial, ethnic, linguistic, religious, cultural, or political/ideological—thus determining their willingness to interact with each other [Park (1924), Bogardus (1925), and Fiedler et al. (2011)].

The analysis is motivated by existing empirical evidence, advocating the view that social distance and the factors that fuel it, such as fractionalization

This study is a significant modification and reworking of material found in Chapter 1 of Guangyi Xin's PhD thesis "Essays on Social Capital and Economic Activity" (University of Leicester). We are grateful to two anonymous reviewers and to an Associate Editor for their very useful comments and suggestions. We would also like to thank Aris Boukouras, Jesse Matheson, Tania Oliveira, and Eugenia Vella for their comments on earlier drafts. Address correspondence to: Dimitrios Varvarigos, School of Business (Division of Economics), University of Leicester, University Road, LE1 7RH Leicester, United Kingdom, Tel. +44 (0) 116 252 2184; e-mail: dv33@le.ac.uk

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https://doi.org/10.1017/S1365100518000512 Published online by Cambridge University Press

and polarization, are impediments to investment, productivity, and growth.[1] For example, experimental evidence by D'Exelle and Verschoor (2015) shows that reduced social distance can increase investment expenditures, whereas Karachiwalla (2018) uses microeconomic evidence to show that reduced social distance increases educational attainment and improves learning outcomes. From a macroeconomic perspective, Alesina et al. (2003) show that measures of ethnolinguistic fractionalization and polarization are inversely related to economic growth. In a related vein, Montalvo and Reynal-Querol (2005) show that ethnic polarization is a significant explanatory variable for the incidence of conflicts. They also argue that such conflicts can be the underlying cause for the negative effect of polarization on investment and growth. Interestingly, the analysis of Alesina et al. (2003) shows that religious fractionalization has no adverse effect on economic growth. They argue that this is because more tolerant societies are actually those in which religious fractionalization is actually higher, due to the fact that people feel confident to declare their true religion (rather than hiding it if they belong to a religious minority within an intolerant society). For Alesina et al. (2003), this is an indication that it is the perceived distance among groups of different characteristics and, therefore, the lack of tolerance and cohesion—rather than the different characteristics *per se*—that are responsible for the negative effects on growth performance. Evidence presented by Bandyopadhyay and Tang (2018) corroborates this view, as they show that greater social cohesion among different groups of people promotes economic growth. They argue that this effect stems from the positive economic spillovers of increased social interactions in a more cohesive society.[2]

In our model, the decrease of social distance fosters capital accumulation because it promotes social interactions which—in addition to their direct utility benefit—reduce the effective cost of investment. This idea is based on empirical evidence showing that social interactions facilitate people in identifying more productive and more efficient investment opportunities, through factors such as word-of-mouth communication, direct observation of others, imitation, and learning spillovers [e.g. Ellison and Fudenberg (1995), Duflo and Saez (2003), Hong et al. (2005), and Macours and Vakis (2014)]. Social distance evolves by means of an intergenerational externality. Specifically, the current generation of adults engages in social interactions based on their inherited level of perceived social distance. These interactions generate familiarity, experiences, and form opinions that are bequeathed to the next generation, hence forming their perceived social distance.[3] We show that the initial condition regarding social distance plays a key role in the economy's convergence to the long-run equilibrium. Particularly, the equilibrium is path-dependent as—for given capital stock—the current conditions that determine social distance can be important in shaping the dynamic path of socioeconomic outcomes. We also analyze an extension where economic factors affect the dynamics of social distance. Our analysis shows that, in this case, the dynamic path of socioeconomic outcomes may also depend critically on the current stock of capital, thus highlighting circumstances where the feedback

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that imbues the joint evolution of social distance and economic development can transform current imbalances among economies into permanent fixtures of their long-term characteristics.

Our model is broadly related to other studies that have endeavored to elucidate the theoretical underpinning of the relation between economic activity and social distance. Akerlof (1997) introduced social distance into a variant of the gravity model as a means of discussing its implications on a variety of socioeconomic decisions, whereas Gradstein and Justman (2002) used a dynamic model to show that a centralized system of public education can foster economic growth by reducing the social distance between two distinct groups of individuals, hence increasing the probability of successful economic transactions among them. Our analysis is, to some extent, also related to research that has directed attention to the possibility of path dependencies on the relation between other cultural characteristics (such as social norms and trust) and economic development [e.g. Francois and Zabojink (2005), Growiec and Growiec (2014), and Varvarigos (2017)].

Before we proceed to our main analysis, we should note that, in principle, multiplicity in the relation between social distance and capital accumulation could also emerge in an alternative scenario where social distance—and its impact on social interactions—affects the degrees of coordination and commitment that are relevant to investment projects.[4] Indeed, an existing strand of literature have dealt with issues of coordination—under different contexts—in models of economic growth [e.g. Matsuyama (1995a), Redding (1996), and Palivos and Varvarigos (2013)]. Nevertheless, whenever multiple equilibria emerge under such circumstances, they are associated with some sort of indeterminacy, as initial conditions are irrelevant for the determination of the long-run equilibrium. Since our focus is on path-dependent equilibria, these issues go beyond the scope of our study.

The remaining analysis is organized as follows. In Section 2 we present the setup of our economy and show the mechanisms that govern capital accumulation and the evolution of social distance. Section 3 analyzes the dynamic equilibrium, discusses the main results, and offers some extensions to the original setup. We summarize and conclude in Section 4.

2. THE ECONOMY

Consider an economy that is populated by an infinite sequence of overlapping generations of three-period-lived individuals. The first period of each individual's lifetime is *childhood* while the two subsequent periods are *youth* (the first period of adulthood) and *maturity* (the second period of adulthood). Agents are active only during adulthood. Although they are largely inactive during childhood, it is the period where they form the set of personality traits (values, beliefs, attitudes, etc.) that determine their perceptions on the degree of detachment that separates them from people who belong to a group with different

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characteristics, hence determining their willingness to form ties and to interact socially with them.

The population mass of each age cohort is denoted by $N > 0$ and is assumed to be constant over time. Once she reaches the first period of adulthood (i.e. in period t), each person is endowed with a unit of labor which she inelastically supplies to final good-producing firms in exchange for a wage, denoted by w_t. She allocates her disposable income between consumption expenditures (denoted by c_t) and investment expenditures toward the formation of physical capital stock (denoted by κ_{t+1}), which she will sell to firms at a unit price of R_{t+1} next period. The individual uses the return of her investment in order to finance her consumption expenditures during maturity (consumption in the second period of adulthood is denoted by d_{t+1})—a period when she does not have any labor endowment, therefore no other source of income other than the one that accrues from investment.

2.1. Social Distance, Social Interactions, and Investment

In addition to the standard consumption–investment choice, individuals can also enjoy utility through social interactions with their peers. Particularly, young individuals build social ties with other members of their age group—ties that are retained over their lifetime and allow individuals to socialize. We are going to assume that the population is divided in two groups, denoted by A and B. The former group has a population mass of $X < N$ while the latter group has a population mass of $N - X$. This distinction may capture characteristics such as racial, cultural, ethnolinguistic, religious, or ideological ones. These differences have no bearing on any of the economic characteristics of agents, that is, their ability to perform labor, the rate at which they discount future outcomes, etc. It only affects their attitudes toward socialization.[5]

Consider a person belonging to group $i = \{A, B\}$. This person can interact costlessly with a fraction $\pi \in (0, 1)$ of individuals belonging to her own group, while each of these interactions yields $b > 0$ units of utility. She can also establish social ties with a maximum fraction $p \in (0, 1)$ of people belonging to the other group. In what follows, we shall be making use of the composite terms $\pi X \equiv \nu^A$, $\pi(N - X) \equiv \nu^B$, $p(N-X) \equiv n^A$, and $pX \equiv n^B$.

Interactions with "outsiders" are costly to initiate. Particularly, initiating a social tie with φ_t^i individuals from the other group entails an effort cost that is captured by the function $\Phi(\varphi_t^i, m_t, n^i)$. The variable $m_t \in [0, 1]$ is a measure of the social distance between individuals who do not belong to groups that share common characteristics; thus, they need to devote effort in order to approach and interact with each other. In this context, a higher value for the variable m_t is associated with narrower social distance. The effect of social distance on the effort function will be described shortly. With respect to the other arguments, this function satisfies $\Phi_{\varphi_t^i} > 0$, $\Phi_{\varphi_t^i \varphi_t^i} > 0$, $\Phi(0, m_t, n^i) = 0$, $\lim_{\varphi_t^i \to n^i} \Phi(\varphi_t^i, m_t, n^i) = +\infty$, and

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$\Phi_{n^i} < 0$ (the latter assumption capturing the idea that is relatively easier to establish a social tie when the number of people with whom one can potentially interact and socialize is higher).

The perceptions that determine social distance are generated during an individual's childhood; thus, they are taken as given once she reaches her adulthood. Furthermore, such perceptions affect the attitudes of individuals across different groups, hence we abscond from the issue of differentiated social distance. In other words, if m_t^{AB} is the distance that a person in group A feels toward a person in group B—and analogously, if m_t^{BA} is the distance that a person in group B feels toward a person in group A—then our previous discussion indicates that $m_t^{AB} = m_t^{BA} = m_t$.[6] This approach is consistent with other work on related issues. For example, in their influential work on polarization, Esteban and Ray (1994) consider cases where the perception of distance is symmetric across different groups.

Social distance affects the effort toward interactions with "outsiders" as follows: Once established, an interaction with any of the φ_t^i individuals from the other group yields the same units of utility that accrue from interactions with people who share common characteristics, that is, b.[7] Nevertheless, a reduced social distance mitigates the effort cost associated with initiating such ties. In other words, it is relatively easier to establish some type of relation with "outsiders" when social distance is narrower. These arguments may capture the idea that a narrower social distance reflects the willingness of individuals to approach people from different backgrounds, understand that their underlying differences should not be detrimental to their effort to communicate, and share common goals and interests, thus inhibiting prejudice and intolerance. Recalling that higher m_t is indicative of reduced social distance, we capture these ideas through $\Phi_{m_t} < 0$, $\Phi_{m_t m_t} > 0$, and $\lim_{m_t \to 0} \Phi(\varphi_t^i, m_t, n^i) = +\infty$, the latter implying that it is prohibitively costly to initiate social ties with "outsiders" if social distance is very high. A specific functional form that satisfies all the aforementioned properties for the effort function, and therefore it shall be employed in our subsequent analysis, is given by

$$\Phi(\varphi_t^i, m_t, n^i) = \frac{n^i \varphi_t^i}{(n^i - \varphi_t^i) z(m_t)}, \tag{1}$$

where the function $z(m_t) \in [0, 1]$ satisfies $z'(m_t) > 0$, $z''(m_t) > 0$, $z(0) = 0$, and $z(1) = 1$.

The benefit of social ties is not restricted to the utility that accrues from social interactions. These can also facilitate investment activities as follows: For a person belonging to group i, each unit of time-$t+1$ capital requires an investment of $q_t^i > 1$ units of time-t output. We assume that q_t^i is a function of the individual's social ties, denoted by s_t^i, according to

$$q_t^i = q(s_t^i), \quad q_{s_t^i} < 0, \tag{2}$$

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where, according to our previous discussion, the total number of social ties formed by an individual is

$$s_t^i = \nu^i + \varphi_t^i. \tag{3}$$

The idea is that social interactions facilitate individuals in reducing the cost of identifying and undertaking investment activities. As we argued previously, this may happen because of factors such as word-of-mouth communication, direct observation of others, imitation, or learning spillovers. Evidence in support of this idea is provided by Ellison and Fudenberg (1995), Duflo and Saez (2003), Hong et al. (2005), and Macours and Vakis (2014), among others.

2.2. The Individual's Problem

The objective of a young individual who belongs to group i is to choose her capital investment—which will also dictate her intertemporal consumption profile—as well as her effort toward social interactions, to maximize her lifetime utility

$$u_t^i = (1-\delta)\ln(c_t^i) + \delta \ln(d_{t+1}^i) + bs_t^i - \Phi(\varphi_t^i, m_t, n^i), \tag{4}$$

subject to $0 \leq \varphi_t^i \leq n^i$, (2), (3), and the budget constraints for youth and maturity that are given by

$$c_t^i = w_t - q_t^i \kappa_{t+1}^i \tag{5}$$

and

$$d_{t+1}^i = R_{t+1}\kappa_{t+1}^i, \tag{6}$$

respectively. The parameter $\delta \in (0, 1)$ quantifies the relative weight attached to the utility that accrues from consumption during the second period of the individual's adulthood. At this point, we should note the only reason behind the linear term for s_t^i in (4) is analytical simplicity. As it will become clear later, it ensures a closed-form solution for φ_t^i and, therefore, it ensures that the subsequent analysis is tractable. Qualitatively, while the results would be similar with an increasing and concave function of s_t^i, the added cost of intractability would undermine the clarity of the results as well as their intuition.

Substituting (1), (2), (3), (5), and (6) in (4), we can express the individual's problem as follows:

$$\max_{\kappa_{t+1}^i, \varphi_t^i} u_t^i = (1-\delta)\ln(w_t - q(\nu^i + \varphi_t^i)\kappa_{t+1}^i) + \delta \ln(R_{t+1}\kappa_{t+1}^i) + b(\nu^i + \varphi_t^i) - \frac{n^i \varphi_t^i}{(n^i - \varphi_t^i)z(m_t)}. \tag{7}$$

The first-order conditions are

$$\frac{(1-\delta)q(\nu^i + \varphi_t^i)}{w_t - q(\nu^i + \varphi_t^i)\kappa_{t+1}^i} = \frac{\delta}{\kappa_{t+1}^i} \tag{8}$$

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and

$$-\frac{(1-\delta)q_{s_t^i}\kappa_{t+1}^i}{w_t - q(v^i+\varphi_t^i)\kappa_{t+1}^i} + b = \left(\frac{n^i}{n^i-\varphi_t^i}\right)^2 \frac{1}{z(m_t)}. \tag{9}$$

In terms of optimal investment behavior, we can rearrange (8) to derive

$$\kappa_{t+1}^{*,i} = \frac{\delta}{q_t^i} w_t, \tag{10}$$

that is, each young individual's capital investment is a fraction of her disposable income. This fraction (i.e. the marginal propensity to save) is proportional to the preference weight that people attach to consumption during maturity. By virtue of (2) and (3), it is also increasing in the number of social interactions because such interactions reduce the effective cost of capital investment.

With regard to the optimal choice for φ_t^i, we shall adopt a specific functional form for $q(s_t^i)$, to ensure analytical solutions. Specifically, we adopt

$$q(s_t^i) = e^{\theta - s_t^i}, \quad \theta > v^i + n^i. \tag{11}$$

Substituting (2), (3), (10), and (11) in (9) and rearranging, it is straightforward to establish that the solution to the individual's problem results in

$$\varphi_t^{*,i} = \max\left\{0, \left[1 - \beta\left(\sqrt{z(m_t)}\right)^{-1}\right] n^i\right\}, \tag{12}$$

where $\beta \equiv (\sqrt{b+\delta})^{-1}$. For reasons that will be clarified at a later part (see Endnote 11), we assume that the composite term β satisfies $\beta < 1/2$. Note that this composite term is decreasing in the two preference factors that motivate individuals to expand their social connections, i.e., the direct utility benefit of social interactions, and the relative weight on the utility from old-age consumption (recall that social interactions facilitate investment activities, and that individuals need to invest in order to finance consumption expenditures during the final period of their lifetime).

According to the result in equation (12), individuals will try to establish social ties with a fraction $1 - \beta(\sqrt{z(m_t)})^{-1}$ of the total number n^i of "outsiders" with whom they can potentially interact. Given that $z'(\cdot) > 0$, it is obvious that this fraction is higher when social distance is narrower (i.e. it is increasing in m_t). In other words, reduced social distance will induce individuals to seek more social interactions with people who do not belong to their own group.

What is also important is the possibility of a corner solution that is embedded to the result in (12). With the purpose of illustrating this point and improving the clarity and analytical convenience of the subsequent analysis, without any significant loss of generality, henceforth we shall be making use of a functional form for $z(m_t)$ that satisfies all the properties that were outlined previously. Particularly, for the remaining analysis we shall specify[8]

$$z(m_t) = m_t^2. \tag{13}$$

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Combining (12) and (13), we can express the optimal decision regarding φ_t^i according to

$$\varphi_t^{*,i} = \varphi^i(m_t) = \begin{cases} 0 & \text{if} \quad m_t \leq \beta \\ \left(1 - \frac{\beta}{m_t}\right) n^i & \text{if} \quad m_t > \beta \end{cases}. \tag{14}$$

As it is obvious from this expression, individuals find it worthwhile to devote effort in engaging socially with "outsiders" only if social distance is below a threshold characterized by the composite parameter term β (i.e. if $m_t > \beta$). If social distance is above this threshold (i.e. if $m_t \leq \beta$), then the utility benefit of such social interactions falls short of the effort cost that is necessary in order to initiate and establish them. As a result, an individual will retain interactions only with people who are more akin to her specific attributes. Thus, the result in (14) indicates that unless social distance is below a critical threshold, there will be some form of alienation among groups, in the sense that people will not form social ties with individuals from different backgrounds. This is a result that will prove important for the economy's long-term prospects, as we shall see later. It should also be noted that the *total* number of interactions with "outsiders" by individuals who belong to the A group ($X\varphi_t^{*,A}$) equals the *total* number of interactions with "outsiders" by individuals who belong to the B group ($(N - X)\varphi_t^{*,B}$). This can be easily established by combining (14), $p(N - X) \equiv n^A$, and $pX \equiv n^B$.

2.3. Firms and Production

Young individuals are employed by perfectly competitive firms (whose mass we normalize to one) who combine units of labor (denoted by l_t) and capital (denoted by K_t) in order to produce Y_t units of the economy's single commodity, by utilizing a technology $F(K_t, l_t)$ such that $F_{K_t} > 0$, $F_{K_tK_t} < 0$, $F_{l_t} > 0$,$F_{l_tl_t} < 0$, and $F_{K_tl_t} > 0$. Furthermore, in line with the existing literature, we are assuming that the technology displays constant returns to scale, that is, $F(xK_t, xl_t) = xF(K_t, l_t)$ for all $x > 0$. For the purposes of our analysis, we shall be employing the familiar Cobb–Douglas technology:

$$Y_t = F(K_t, l_t) = HK_t^{\eta} l_t^{1-\eta}, \quad H > 0, \quad 0 < \eta < 1. \tag{15}$$

Using (15), together with the labor market clearing condition $l_t = N$, we can solve the firms' profit maximization problem according to which each input is paid its marginal product. Formally,

$$w_t = (1 - \eta)Hk_t^{\eta}, \tag{16}$$

$$R_t = \eta Hk_t^{\eta-1}, \tag{17}$$

where $k_t = K_t/N$ is the stock of capital per person. Note that we assume full depreciation of capital.

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2.4. The Dynamics of Social Distance

We consider a scenario whereby social interactions generate familiarity and affect the perceptions on the qualities of individuals from other groups. The next generation of individuals is inculcated with these perceptions while developing the personality traits that shall ultimately determine social distance. We view this as a mechanism of intergenerational transmission of the characteristics that determine social distance—a mechanism that encompasses the processes through which values and beliefs are passed on from parents to their offspring; or through the imitation of a role model; or through the instruction of a (political or religious) leader, etc. Particularly, the mechanism we propose works as follows: Individuals form their social ties with people from different backgrounds, based on the perceptions with which they were endowed. Once formed, these interactions will expose them to different characteristics, hence generating experiences that are conducive to increased tolerance. Such views and opinions are transmitted to the next generation of individuals when they form those attributes that shape their perceived social distance. Based on this, once the next generation reaches their adulthood, they will form their own social ties with people from different backgrounds, and so on.[9]

Taking account of the previous arguments, the social distance indicator for the next generation, captured by m_{t+1}, is formed by the current generation's experiences from social interactions. Since social distance is a society-wide characteristic, we shall assume that it is driven by the social activities of both groups A and B, with each group's impact being weighted by its relative size over the whole population. Hence

$$m_{t+1} = \frac{X}{N}\gamma(\varphi_t^{*,A}) + \frac{N-X}{N}\gamma(\varphi_t^{*,B}), \tag{18}$$

such that $\gamma_{\varphi_t^{*,i}} > 0$ for $i = \{A, B\}$.

For the remainder of our analysis, we are going to employ the following functional form:

$$\gamma(\varphi_t^{*,i}) = \frac{\varphi_t^{*,i}}{\bar{\varphi}^i}, \tag{19}$$

where $\bar{\varphi}^i$ gives the total number of social ties with "outsiders," initiated by a person of the current generation of young adults in group i, had social distance been the lowest possible, that is, $m_t = 1$.[10] Therefore, given (14), we have

$$\bar{\varphi}^i = (1-\beta)n^i. \tag{20}$$

Combining (18)–(20), it is evident that $0 \le m_{t+1} \le 1$, which is the permissible range of values for the social distance indicator. Now, let us substitute (14), (19), and (20) in (18) so as to derive a dynamic expression for social distance, that is,

$$m_{t+1} = M(m_t) = \begin{cases} 0 & \text{if} \quad m_t \le \beta \\ \frac{1-(\beta/m_t)}{1-\beta} & \text{if} \quad m_t > \beta \end{cases}. \tag{21}$$

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As we established previously, scenarios for which $m_t \leq \beta$ entail some form of alienation among different groups, in the sense that individuals will avoid establishing relations and ties with people from different backgrounds, given that social distance is excessively high. Individuals will seek to socialize and interact with people of different characteristics only if social distance is below a certain threshold (i.e. whenever $m_t > \beta$). In this case, the extent of social interactions is increasing in m_t. Nevertheless, as we indicated previously, such interactions increase the familiarity and improve the opinions on the qualities of people from different backgrounds—characteristics that are transmitted to the next generation of young individuals, thus forming the personality traits that ultimately determine their perceived social distance. In other words, if the current generation is more willing to engage socially with "outsiders," then the next generation will be endowed with perceptions that are conducive to reduced social distance, thus motivating them to establish more social ties with people from the other group, and so on. This is the intuition behind $M_{m_t} > 0$ in (21).

We can begin the formal analysis of the dynamics of social distance with the derivation of the steady-state solutions. This is done through the following.

LEMMA 1. *There are three steady-state equilibria $m_{t+1} = m_t = m$ for the social distance indicator. These are $m^* = 0$, $m^{**} = \frac{\beta}{1-\beta} \in (\beta, 1)$, and $m^{***} = 1$. The equilibria m^* and m^{***} are locally asymptotically stable whereas m^{**} is unstable.*

Proof. Given (21), we have $m_{t+1} = 0\ \forall t$ whenever $m_t \leq \beta$. Together with the non-negativity constraint for the social distance indicator, this implies that $m^* = 0$ is a stable steady-state solution. For $m_t > \beta$, there are two additional steady states, which we can obtain after solving (21) for $m_{t+1} = m_t = m$. In other words, we find the roots of the quadratic equation $(1-\beta)m^2 - m + \beta = 0$. These are $m^{**} = \frac{\beta}{1-\beta} \in (\beta, 1)$ (by virtue of $\beta < 1/2$) and $m^{***} = 1$. To examine the stability of these equilibria, we calculate the first derivative $M'(m_t) = \frac{\beta}{(1-\beta)m_t^2} > 0$ and evaluate at the steady state to establish that $M'(m^{**}) = \frac{1-\beta}{\beta} > 1$ and $M'(m^{***}) = \frac{\beta}{1-\beta} < 1$, since $\beta < 1/2$ by assumption.[11] ■

The next step is to present the dynamics of social distance. This is something we do in the following.

PROPOSITION 1. *The long-run equilibrium with regard to social distance is path-dependent. In other words, if m_0 is the initial condition, in the long run social distance will converge to a low-level $m^{***} = 1$ (high-level $m^* = 0$) as long as $m_0 > m^{**}$ ($m_0 < m^{**}$).*

Proof. It follows from Lemma 1. ■

The dynamics are illustrated on the phase diagram of Figure 1. The fact that individuals form social ties with "outsiders" only if social distance is sufficiently low [i.e. if $m_t > \beta$; see equation (14)] implies that the interior equilibrium m^{**}

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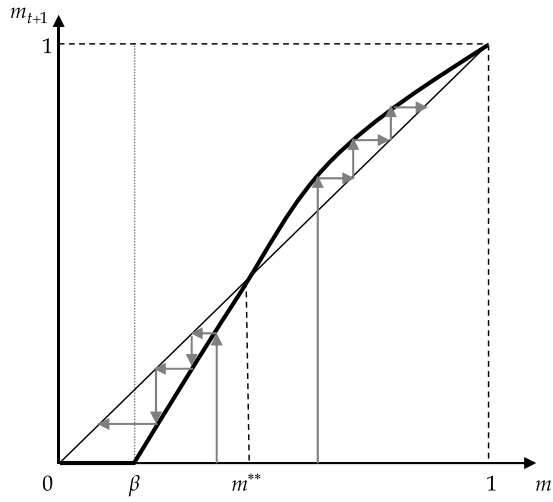


FIGURE 1. The dynamics of social distance.

acts like a threshold. If social distance is sufficiently high (i.e. if $m_t < m^{**}$), interactions among people from different groups will be so limited that social distance will be increasing over time due to the gradual alienation among people in the two groups.

2.5. The Dynamics of Capital Accumulation

The aggregate stock of capital available in period $t+1$ comprises the period-t capital investments of those belonging to group A (of whom there are X) and those belonging to group B (of whom there are $N-X$). That is,

$$K_{t+1} = X\kappa_{t+1}^{*,A} + (N-X)\kappa_{t+1}^{*,B}. \tag{22}$$

Defining $k_{t+1} = \frac{K_{t+1}}{N}$ as the average stock of capital per person and substituting (2), (3), (10), (11), (14), and (16) in (22) yield

$$\begin{aligned} k_{t+1} &= f(k_t, m_t) \\ &= \begin{cases} \frac{(1-\eta)Hk_t^{\eta}}{N}\left(\frac{X}{e^{\theta-\nu^A}} + \frac{N-X}{e^{\theta-\nu^B}}\right) & \text{if} \quad m_t \le \beta \\ \frac{(1-\eta)Hk_t^{\eta}}{N}\left(\frac{X}{e^{\theta-\nu^A-[1-(\beta/m_t)]n^A}} + \frac{N-X}{e^{\theta-\nu^B-[1-(\beta/m_t)]n^B}}\right) & \text{if} \quad m_t > \beta \end{cases}. \end{aligned} \tag{23}$$

The expression in (23) characterizes the dynamics of capital per person. It indicates that social distance may affect capital formation, as we show formally in the following.

LEMMA 2. *It is* $f_{m_t} > 0$, *as long as* $m_t > \beta$.

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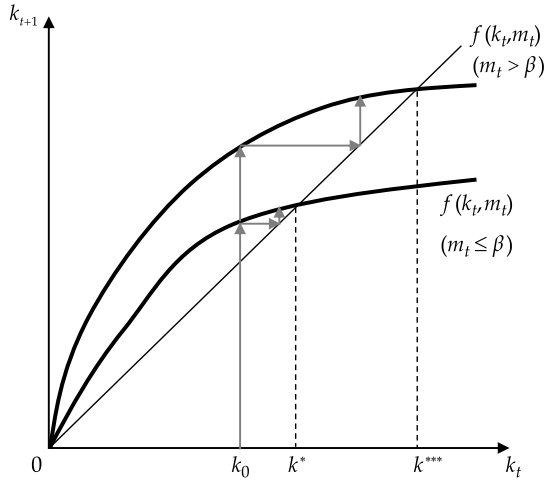


FIGURE 2. The dynamics of capital formation.

Proof. Through (14) and (23), it is straightforward to establish that $f_{m_t} > 0$. ■

The reason why lower social distance is a factor that promotes capital accumulation is because social ties encourage investment activities. Particularly, a higher m_t (i.e. lower social distance) increases the overall number of social interactions—as it promotes interactions among people who belong to different groups—thus reducing the effective cost of investment. This motivates individuals to invest a larger fraction of their resources, hence increasing the economy's rate of capital formation.

Note that the positive impact of social interactions on investment expenditures means that the threshold effect that determines social ties in (14) also permeates the process of capital accumulation. On the phase diagram of Figure 2, we illustrate the dynamics of capital formation, for a given indicator of social distance m_t. As we can see, despite the same initial condition k_0, the long-run equilibrium may differ depending on whether social distance is below or above the critical level that determines if people with different characteristics are willing to form social ties with each other.

3. THE DYNAMIC EQUILIBRIUM

As we have seen from the preceding analysis, the economy's equilibrium is characterized by the system of first-order difference equations with two state variables k_t and m_t, displayed in (21) and (23). This system of transition equations will facilitate us in tracing the economy's transitional dynamics, as well as deriving its long-run equilibrium. We shall begin the analysis with the derivation of the steady-state solutions. These are presented in the following.

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LEMMA 3. *There are three pairs of steady-state equilibria* (k^*, m^*), (k^{**}, m^{**}), *and* (k^{***}, m^{***}), *such that* $k^{***} > k^{**} > k^*$, *and* $m^{***} > m^{**} > m^*$. *The pairs* (k^*, m^*) *and* (k^{***}, m^{***}) *are locally asymptotically stable whereas the pair* (k^{**}, m^{**}) *is a saddle point.*

Proof. See the Appendix. ■

The implication from Lemma 3 is that we can establish the economy's long-run equilibrium for given initial conditions $0 < m_0 < 1$ and $k_0 > 0$. This analysis is formally presented in the following.

PROPOSITION 2. *The long-run equilibrium of the economy is path-dependent. Particularly, depending on the current social distance indicator* m_0, *the economy may converge to either an equilibrium characterized by high social distance and low capital stock (i.e.* m^* *and* k^**) or an equilibrium characterized by low social distance and high capital stock (i.e.* m^{***} *and* k^{***}*).*

Proof. It follows from Proposition 1 and Lemma 3. ■

The joint dynamics of capital formation and social distance are illustrated on the phase diagram of Figure 3. In order to get a better understanding of the intuition and the mechanisms leading to the result in Proposition 3, we need to recall two issues. Firstly, at the beginning of any time period t there are two predetermined variables—the stock of capital k_t and the social distance indicator m_t—implying that for a given stock of k_t (m_t), there is only one value for m_t (k_t), out of an infinite range of possible ones that will converge to the saddle point (k^{**}, m^{**}); all the other paths diverge away from it. In essence, the pair (k^{**}, m^{**}) is not a stable equilibrium. Secondly, the fact that individuals engage in social interactions with "outsiders" only if social distance is sufficiently low (see the expression in (14)) implies that the interior solution $m_{t+1} = m_t$ that one derives from (21) acts like a threshold. Given the impact of social distance on capital accumulation (see Lemma 2), the presence of this threshold also influences the economy's long-term prospects in terms of income per capita. So let us consider a scenario in which $m_t < m^{**}$: As social distance is above the threshold, it will be increasing over time (m_t will be declining), hence impeding capital accumulation due to the reduced social interactions which, in turn, alleviate the positive spillovers that could have lowered the effective cost of investment. When $m_t > m^{**}$ however, social distance is sufficiently low and, therefore, it declines over time (m_t is increasing). Consequently, it supports capital formation due to the beneficial effect of social interactions on individuals' incentives to invest.

As it is clear from the preceding analysis and discussion, the initial stock of capital does not have any role in determining the equilibrium to which the economy will converge in the long run. The reason behind this outcome is that the evolution of social distance—that is, the process that generates threshold effects in the first place—is independent of economic factors. In the section that follows, we shall enrich this aspect of our model.

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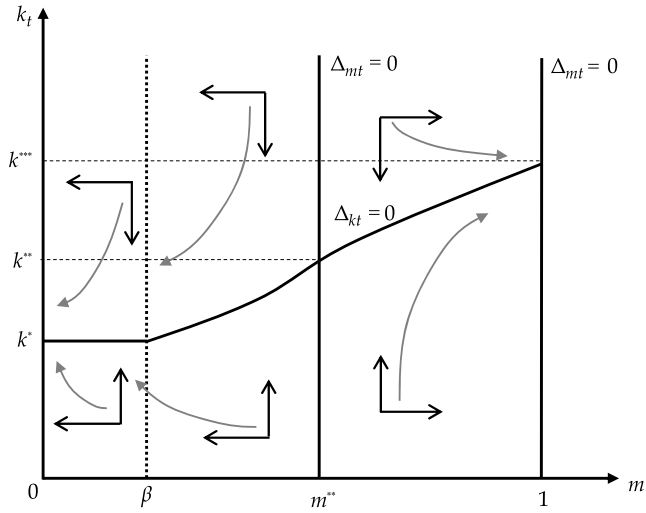


FIGURE 3. Phase diagram.

3.1. The Impact of Economic Factors on Social Distance

As we have just argued, the capital stock does not play any role in the emergence of multiple, path-dependent equilibria; multiple equilibria are attributed to the process of social interactions and their effect on the dynamics of social distance. Capital accumulation is in fact the transmission channel through which the path dependency of social distance can generate persistent differences in economic performance.[12] Nevertheless, it is possible to embed a scenario in which the capital stock can also be critical in generating path-dependent outcomes.

We shall modify our model to examine the implications that emerge when the dynamic process that governs social distance is affected directly by the economy's income. It should be noted that this scenario is not at odds with empirical observations and evidence. On the contrary, researchers have argued that economic conditions can affect social distance. For example, Bogardus (1967) cited the Great Depression as one of the main factors that did not allow social distance to narrow during the 1930s, whereas Butz and Yogeeswaran (2011) and Smith et al. (2014) have shown that social distance can be amplified as a result of adverse macroeconomic conditions. In a similar vein, a recent study by Funke et al. (2016) has traced the roots of rising polarization and of the gradual increase in the appeal of populist far-right movements, to incidences of financial crises. Other researchers have suggested a possible role for public goods and services in reducing social distance—an effect that they attribute to public education's contribution toward a sense of citizenship, and to the development of social and cognitive skills that promote acceptance among different segments of the population [e.g. Glaeser et al. (2000) and Delhey and Newton (2005)].[13]

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With the purpose of introducing these ideas into our model, we shall now assume that the average level of income per capita y_t has a positive external effect on the degree of tolerance among different groups, hence affecting the dynamics of social distance. Particularly, we replace equation (18) with

$$m_{t+1} = \frac{X}{N}\gamma(\varphi_t^{*,A}, y_t) + \frac{N-X}{N}\gamma(\varphi_t^{*,B}, y_t), \tag{24}$$

where

$$\gamma(\varphi_t^{*,i}, y_t) = \frac{(1+y_t)(\varphi_t^{*,i}/\bar{\varphi}^i)}{1+y_t(\varphi_t^{*,i}/\bar{\varphi}^i)}. \tag{25}$$

Combining (24) and (25) together with (14), (15), and (20), it follows that the social distance indicator evolves according to

$$m_{t+1} = M(k_t, m_t) = \begin{cases} 0 & \text{if} \quad m_t \leq \beta \\ \frac{(1+Hk_t^{\eta})[1-(\beta/m_t)]}{1-\beta+Hk_t^{\eta}[1-(\beta/m_t)]} & \text{if} \quad m_t > \beta \end{cases}. \tag{26}$$

Now let us apply the steady-state condition $m_{t+1} = m_t$ in (26). Doing so, it is straightforward to establish that, similarly to before, there are three steady-state equilibria—two stable ones (i.e. $m_t^* = 0$ and $m_t^{***} = 1$) and a third one $m_t^{**} = \frac{\beta(1+Hk_t^{\eta})}{1-\beta+Hk_t^{\eta}} \in (\beta, 1)$ which is unstable. In other words, the capital stock affects the threshold that determines whether social distance will increase or decrease over time, given the initial value m_0. Formally it is $\frac{\partial m_t^{**}}{\partial k_t} < 0$, meaning that a higher capital stock makes it more likely that social distance will decline over time. In terms of intuition, the higher capital stock leads to an increase of per capita income, thus cultivating the conditions that can reduce social distance among the two different groups of people in the economy.

Now consider the situation illustrated on the phase diagram of Figure 4. Here, we imagine two economies that are identical in their structural characteristics and current social distance indicator m_0; they only differ in their current capital stock k_0. Consistent with our previous result, the social distance dynamics of the economy with the lower capital stock are depicted by the dashed curve with the threshold level $m^{**,1}$; analogously, the social distance dynamics of the economy with the higher capital stock are depicted by the solid curve with the corresponding threshold level $m^{**,2}$. Let us also consider the case where $m^{**,2} < m_0 < m^{**,1}$. The economy with the low stock of capital will go through an increase of social distance as m_t converges to $m^* = 0$, whereas the economy with the high stock of capital will go through a decrease of social distance as m_t converges to $m^{***} = 1$. Furthermore, by virtue of (23) and Lemma 2, the narrower (wider) social distance in the currently richer (poorer) economy will perpetuate the existing differences in income per capita, through the process of capital accumulation.

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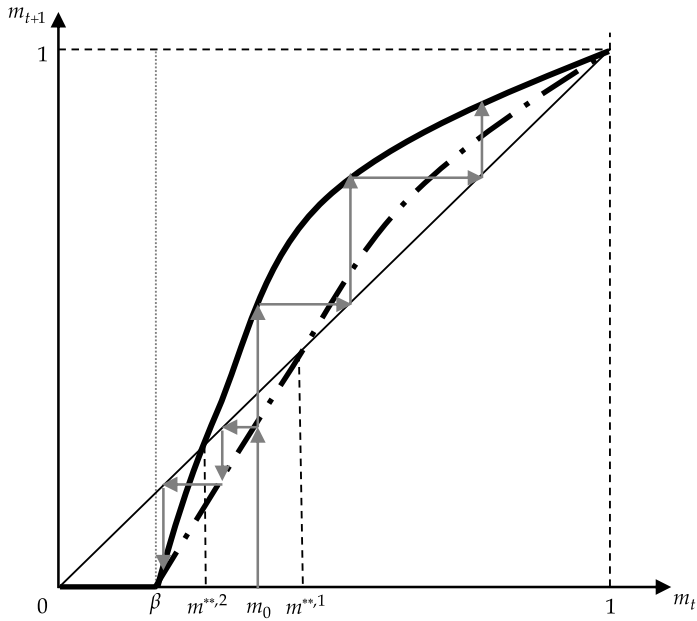


FIGURE 4. Dynamics of social distance with differences in the initial capital stock.

We can formalize the implications of the previous analysis through the following.

PROPOSITION 3. *As long as economic factors affect the evolution of social distance, the current stock of capital k_0 may also be critical in determining the long-term prospects in terms of socioeconomic outcomes.*

Proof. It follows from the preceding analysis. ■

In this example, economic development and the degree of social distance are complementary processes. Insofar as the reduction of social distance fuels, and at the same time is fuelled by, economic development, then such complementarities are conducive to the existence of persistent differences in which the current conditions with respect to both social distance and the capital stock are critical for an economy's long-term prospects.

3.2. A Version with a Unique Equilibrium

Our analysis has pinpointed the conditions under which path-dependent equilibria emerge in a growth model where social distance affects (and is affected by) capital accumulation. Of course, there are also circumstances where we can obtain a unique, rather a path-dependent equilibrium. Naturally, this depends on the choice of specific functional forms. For example, let us go back to the setup of the model

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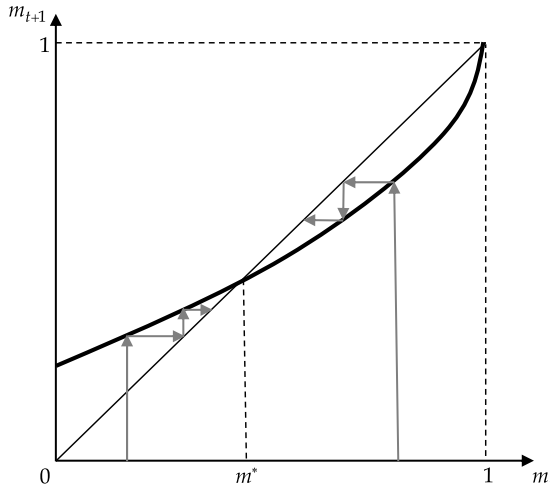


FIGURE 5. Unique equilibrium.

in Section 2 and replace the effort function in (1) with $(n^i)^{-1}\left(\frac{\varphi_t^i}{\zeta+m_t}\right)^2$, where $\zeta \in (0,1)$. Solving the maximization problem yields $\varphi_t^{*,i} = (b+\delta)(\zeta+m_t)^2 n^i$, where a different restriction on the composite term $b+\delta$ (i.e. $(b+\delta)(1+\zeta)^2 < 1$) is needed to ensure $\varphi_t^{*,i} < n^i$. Substitution of these solutions [together with equation (20)] in (18) and (19) yields the dynamic equation

$$m_{t+1} = M(m_t) = \left(\frac{\zeta+m_t}{\zeta+1}\right)^2, \tag{27}$$

which has two steady-state solutions $m^* = \zeta^2$ and $m^{**} = 1$. Given $M'(\zeta^2) = 2\zeta(1+\zeta)^{-1} \in (0,1)$ and $M'(1) = 2(1+\zeta)^{-1} > 1$, the only stable steady-state equilibrium is $m^* = \zeta^2$, toward which the indicator of social distance will convergence irrespective of the initial value m_0 (see the phase diagram in Figure 5).

With regard to the capital stock, its dynamics are characterized by the difference equation

$$k_{t+1} = \frac{(1-\eta)Hk_t^\eta}{N}\left(\frac{X}{e^{\theta-\nu^A-(b+\delta)(\zeta+m_t^2)n^A}} + \frac{N-X}{e^{\theta-\nu^B-(b+\delta)(\zeta+m_t^2)n^B}}\right). \tag{28}$$

Given that the social distance indicator converges to a unique, stable steady-state equilibrium, the capital stock will also converge to the unique equilibrium

$$k^* = \left[\frac{(1-\eta)H}{N}\left(\frac{X}{e^{\theta-\nu^A-(b+\delta)\zeta^2(1+\zeta^2)n^A}} + \frac{N-X}{e^{\theta-\nu^B-(b+\delta)\zeta^2(1+\zeta^2)n^B}}\right)\right]^{\frac{1}{1-\eta}}. \tag{29}$$

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4. CONCLUSION

In this paper, we constructed and analyzed a dynamic model where the evolution of social distance interacts with the formation of capital. The characteristics of the model's equilibrium suggest that current imbalances among nations can cast their shadow over their long-term socioeconomic prospects. In other words, the positive feedback in the coevolution of social distance and economic activity may perpetuate these imbalances and establish them as permanent fixtures. In this respect, both the current conditions that govern social distance and the current stage of economic development may be vital in perpetuating these differences. Economies at a similar stage of economic development, but different in terms of social distance, may experience strikingly different long-term prospects. Equally important, however, is the likelihood that countries which are similar in terms of social distance may yet experience drastically opposite socioeconomic paths if they differ in terms of their economic conditions.

Methodologically, our approach was to analyze these issues in the most tractable manner so as to enhance the clarity of the mechanisms involved and to avoid blurring their intuition. One of the means to achieve this was the careful selection of functional forms to allow the derivation of closed-form solutions. Furthermore, in order to maintain a sharp focus on the joint dynamics of social distance and capital accumulation, without undermining our story by making its intuition impenetrable, we absconded from other issues that could provide a broader perspective in terms of both social capital and economic performance. For example, in addition to social distance, other components of social capital that can be transmitted through successive generations of individuals are social norms. Indeed, their importance in relation to economic growth has already been identified by researchers [e.g. Cole et al. (1992)]. Furthermore, besides the dynamics of income per capita, social distance could impinge on other characteristics of the economy such as income inequality or demographics (e.g. fertility behavior). Finally, social distance could interact with other engines of long-run growth such as education/human capital and R&D/technological progress. All these issues certainly merit attention and offer a large scope for future research on the coevolution of economic and social characteristics.

NOTES

1. According to Esteban and Ray (2008), there is conceptual distinction between fractionalization and polarization. The former is the degree to which the society is split in groups that are distinct in their ethnolinguistic, religious, or cultural characteristics; the latter measures the sense of alienation among these distinct groups. In this respect, social distance requires the presence of fractionalization of some sort, but is conceptually closer to polarization. This idea is verified by Alesina et al. (2003), who argue that "the degree of polarization should increase as the 'distance' between groups increases" (pp. 177–178).

2. Evidence on the role of reduced social distance in encouraging trust among different groups of people and, thus, facilitating social cohesion is presented by Buchan et al. (2006), Etang et al. (2011), and Fiedler et al. (2011).

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3. The view of social distance as a dynamic phenomenon is not alien to real-world observations. On the contrary, a number of researchers have shown that social distance can change over time [e.g. Payne Jr. et al. (1974) and Smith et al. (2014)].

4. This is somehow reminiscent of what Matsuyama (1995b) figuratively describes as "the problem of hundreds of people, scattered in a dense, foggy forest, trying to locate one another" (p. 134).

5. See Klasing and Milionis (2014) for an analysis that incorporates heterogeneity in the discount factor.

6. Note that, in this context, we could consider $m_t^{ii} = 1$ as long as this value reflects the absence of any social distance. Nevertheless, this is not necessary. An alternative approach is that, despite the fact that the social distance among groups of *different* characteristics reaches a lower bound when the indicator m_t reaches its maximum value of 1, there are still innate differences across groups that do not make the formation of social ties as effortless as between people who belong to the same group. In this case, $m_t = 1$ reflects the lowest perception of distance between people who possess different characteristics.

7. Nothing will change qualitatively from our subsequent results, if we assume that the utility accruing from such interactions differs from the one corresponding to socialization with people who are more akin to the individual who is establishing social ties.

8. The results remain qualitatively similar even without the specific function form in (13), as long as $z(m_t)$ satisfies the properties outlined in the main part of the analysis. We employ this function for expositional purposes.

9. This is a tractable way to induce intergenerational dynamics in social distance. An alternative way would be to consider a process of direct intergenerational transmission in the manner of Bisin and Verdier (2001). Specifically, we could have two traits with respect to perceived social distance (high and low), with parents devoting effort to instill their own trait in their children. The dynamics would be represented by the share of the population who perceive either a high or a low "distance" to the other group. This approach could complicate the analysis considerably, however, without altering our main message. It should be noted that other researchers have also analyzed the dynamics of social/cultural characteristics, without adopting an explicit process of direct transmission [e.g. Francois and Zabojink (2005)].

10. Effectively, the presence of $\bar{\varphi}^i$ introduces the maximum number of social ties that a person is willing to establish with "outsiders." Naturally, there is scope for creating new experiences that can narrow the perceived social distance intergenerationally as long as the existing interactions fall short of this number.

11. Note that if $\beta > 1/2$, then $\frac{m_{t+1}}{m_t} - 1 < 0 \, \forall m_t$. In other words, the only nontrivial long-run solution would be $m = 0$ in this case. We rule out this scenario due to its limited interest.

12. Let us think of a scenario where the only stock variable is the social distance indicator. For example, we can set $\eta = 0$ in (15) and $\delta = 0$ in (7), and consider the case where the two periods of a person's lifetime are childhood and adulthood. Individuals are active only during adulthood, when they consume and form social ties (i.e. maximizing their utility subject to $c_t^i \leq w_t$ and $0 \leq \varphi_t^i \leq n^i$). It is straightforward to establish that, qualitatively, the implications for path dependency in the evolution of social distance will remain similar. In this case, however, the absence of the capital stock implies the lack of a mechanism that transmits the impact of social distance dynamics to the economic environment.

13. A good example is the "Promoting a Culture of Trust" grant scheme available to Northern Irish schools by the Integrated Education Fund (IEF)—a charitable trust that was partly established with public funds from the European Union and the Department of Education in Northern Ireland, in addition to private donations. Through this scheme, the IEF supports "projects that promote a culture of trust and the development of paths of reconciliation through. . . the development of skills, structures and relationships that enable schools, pupils and their parents. . . to increase their understanding, acceptance and respect for political, cultural and religious differences" (http://www.ief.org.uk/grants/pact/).

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APPENDIX

Proof of Lemma 3. We are looking for solutions satisfying $k_{t+1} = k_t = k$ and $m_{t+1} = m_t = m$. Applying the steady-state condition in (23) yields

$$k = \left[\frac{(1-\eta)H}{N} \left(\frac{X}{e^{\theta - \nu^A - \varphi^A(m)}} + \frac{N-X}{e^{\theta - \nu^B - \varphi^B(m)}} \right) \right]^{\frac{1}{1-\eta}}. \tag{A.1}$$

Recall that from the expression in (21), we have $m_{t+1} = 0 \ \forall t$ whenever $m_t \leq \beta$. Together with (A.1), (14), and Lemma 1, it follows that the pair

$$m^* = 0, \quad k^* = \left[\frac{(1-\eta)H}{N} \left(\frac{X}{e^{\theta - \nu^A}} + \frac{N-X}{e^{\theta - \nu^B}} \right) \right]^{\frac{1}{1-\eta}},$$

is a steady state. Similarly for $m_t > \beta$, we can combine (A.1), (14), and Lemma 1 to obtain the steady-state pairs

$$m^{**} = \frac{\beta}{1-\beta}, \quad k^{**} = \left[\frac{(1-\eta)H}{N} \left(\frac{X}{e^{\theta - \nu^A - \beta n^A(m)}} + \frac{N-X}{e^{\theta - \nu^B - \beta n^B}} \right) \right]^{\frac{1}{1-\eta}},$$

$$m^{***} = 1, \quad k^{***} = \left[\frac{(1-\eta)H}{N} \left(\frac{X}{e^{\theta - \nu^A - (1-\beta) n^A(m)}} + \frac{N-X}{e^{\theta - \nu^B - (1-\beta) n^B}} \right) \right]^{\frac{1}{1-\eta}},$$

where, by virtue of Lemmas 1 and 2, it follows that $k^{***} > k^{**} > k^*$.

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Now, consider the Jacobian matrix associated with the system of difference equations in (23) and (21):

$$\begin{bmatrix} f_k & f_m \\ M_k & M_m \end{bmatrix}.$$

Note that $f_k = \eta$ and $M_k = 0$, whereas for $m_t \leq \beta$ it is $M_m = 0$. Therefore, for the equilibrium pair (k^*, m^*) the eigenvalues are $\lambda_1 = 0$ and $\lambda_2 = \eta \in (0, 1)$, meaning that it is a stable equilibrium. For $m_t > \beta$, it is $M_m > 0$; therefore the eigenvalues for the other two pairs of steady-state equilibria are $\lambda_1 = M_m$ (which, according to Lemma 1, satisfies $M_m > 1$ for m^{**} and $0 < M_m < 1$ for m^{***}) and $\lambda_2 = \eta \in (0, 1)$. It follows that the pair (k^{***}, m^{***}) is also a stable equilibrium whereas (k^{**}, m^{**}) is unstable (i.e. a saddle point). ■

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