Social Culture and Economic Performance

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By HANMING FANG*

The connection between obtaining higher paying jobs and undertaking some seemingly irrelevant activity is interpreted as "social culture." In the context of a society trying to adopt a new technology, I show that by allowing the firms to give preferential treatment to workers based on some "cultural activity," the society can partially overcome an informational free-riding problem. Therefore, social culture may affect the economic performance by altering the effective production technology of the economy. (JEL P17, Z13)

What is social culture? What is the role of social culture in economic performance? In a provocative article, Kenneth Arrow (1971) argued that "norms of social behavior, including ethical and moral codes, ... , are reactions of society to compensate for market failure." Somewhat surprisingly, this idea of the role of social culture has not been further pursued in the literature.

In this paper I take Arrow's viewpoint seriously, and construct a simple model to examine the possibility that social culture may alleviate market failure. I consider a society that is deciding whether to adopt a new technology. Three important assumptions are made about the economy: first, adoption decisions are made by entrepreneurs (or firms), but the operators of the new technology are workers; second, the new technology can be successfully operated only when the worker has invested in some imperfectly observable requisite skills; and third, it is costly for the workers to acquire the skills.[1] Because of the imperfect observability

of the costly-to-acquire requisite skills, an interesting *informational free-riding* problem arises. To fix ideas, consider an extreme case: suppose that every worker in the economy invests in skills. Then, regardless of the observed signal of whether a worker is skilled, the firms should rationally assign any worker to the new technology; but then no worker will have incentive to incur the costly skill investment. Free-riding results because the firms' perception of the fraction of skilled workers in the population is a *public good*. To convey my main idea, I focus on environments in which the free-riding problem is so severe that the unique equilibrium involves nonadoption of the new technology, even though it could induce a rise in productivity greater than the skill acquisition costs. Now I introduce in such an environment an activity A with three properties: first, it is observable to firms; second, it is intrinsically irrelevant for production; third, workers are heterogenous in their tastes toward undertaking activity A, but the taste distribution is *independent* of workers' skill investment costs. I show that by allowing the firms to treat workers differently, based on whether they undertake activity A, an equilibrium in which a positive fraction of workers is assigned to the new technology can be sustained. The main insight is as follows: firms now have to form separate perceptions about the fractions of the skilled workers among those who undertake A and among those who do not

[1] The last two assumptions are quite standard. The first one can be justified if the new technology requires some expensive inputs that only entrepreneurs can afford due to imperfect credit markets, or if the assembly of new machines requires some firm-level know-how.

undertake A and this makes the firms' perception for each group a *local public good*. In this type of equilibria, the subpopulation that receives preferential treatment has a higher fraction of low investment cost workers because the skilled and unskilled workers have different incentives to join the preferentially treated group. In other words, activity A becomes an endogenously generated signaling instrument for skilled workers. The severity of the informational free-riding problem is reduced when limited to this subpopulation of group A workers.

I would like to somewhat loosely interpret the connection between undertaking the seemingly irrelevant activity A, which serves as the defining characteristic of the preferentially treated group, and obtaining higher-paying jobs on the new technology, as "social culture." I would argue that this interpretation is consistent with prominent definitions of "culture" by scholars in various fields. Suppose that an outsider observes the society previously described. In an effort to understand the connection between activity A and higher-paying jobs, the observer may interpret it simply "as rules of the game which provide the informal constraints on human interactions," which is the "definition" of culture given by economist Douglas North (1990). Alternatively, the observer may think of group A workers as social elites, and interpret undertaking activity A as "the set of standards and values held up and prized by some social elite." This is one of the two views of culture proposed by political scientist James Wilson (1994).[2] If the outsider takes this view, he may then, from the connection between activity A and higher-paying jobs, form the opinion that in this society social elites are preferentially treated by the labor market. Finally, he may simply rationalize the connection between activity A and higher paying jobs as "a distinct way of doing things which characterizes [this] given community," which is the definition of culture given by a leading sociologist and anthropologist Ernest Gellner (1988). However, as pointed out by a referee, one can just as plausibly interpret activity A as "social custom" or "tradition." Indeed in the sociology literature the terms "social culture," "social custom," and "tradition" are sometimes interchangeably used (e.g., Gellner, 1988).

I will call the seemingly irrelevant but socially valued activity that underlies the "social culture" the *cultural activity,* and those workers who undertake the cultural activity (who thus receive preferential treatment) *elites.* An equilibrium with social culture is called *cultural equilibrium.* One concrete example of cultural activities is norms of etiquette. Most European societies require social elites to master complex etiquette. A second example is fashion. Fashions such as designer clothing, exclusive cars, furniture, and electronic equipment are characterized by being expensive and not particularly more functional than standard items. Georg Simmel (1957 p. 544) wrote that "[f]ashion is merely a product of social demands. ... This is clearly proved by the fact that very frequently not the slightest reason can be found for the creation of fashion from the stand-point of an objective, aesthetic or other expediency." But being fashionable is necessary to be considered as elites in many societies. Most people will agree that whether one masters these norms of etiquette, or whether one is fashionable, is not directly related to productivity, but nonetheless social elites often receive preferential treatments in their search for jobs.[3,4] Some sociologists such as Jon Elster (1989) have been puzzled by the complexity of the norms of etiquette for social elites, and argued that "norms of etiquette" and an "Oxford accent," "if anything, ... , seem to make everybody worse off, by requiring wasteful investments in pointless behavior." This paper sheds some light on why it might be necessary for cultural activities to be as complicated as they are. As we see in Section

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[2] Wilson (1994) also refers to culture as "a widely shared integrating perspective or world view by which people interpret their experiences, a perspective that is passed on from one generation to the next by precept, myth and ritual."

[3] See, however, Wolfgang Pesendorfer (1995) for an alternative explanation of fashion as a signaling device in dating games.

[4] Another example is personal beauty. Daniel Hamermesh and Jeff Biddle (1994) find that good-looking workers earn more in the labor market, and it is not because their looks are more productive in their occupations. The availability of plastic surgery makes personal looks changeable; thus the theory in this paper provides an explanation for their findings without resorting to taste-based discrimination.

II, the efficiency role of social culture might not be fulfilled if the distribution of utility costs in the economy does not satisfy certain conditions. Similarly, the characteristically high prices of fashion goods can be explained as the way in which a society creates a disperse disutility distribution in the population, so that fashion as a cultural activity can alleviate some market failure. A little less related, some corporate culture, such as working long hours among junior investment bankers on Wall Street, singing company songs, and wearing company uniforms, can also be viewed as ways to alleviate incentive problems within a firm.

This paper belongs to the emerging literature on the microfoundations of cultural effects. Instead of thinking of cultural differences as simply arising from differences in preferences and/or opportunities, this literature attempts to derive the social norm, or culture, from standard preferences and the fundamental economic paradigm of individual maximization, and to explain how social norms or culture interact with the market to induce agents to have different preferences or outcomes.[5] Harold Cole et al. (1992) introduce in an otherwise standard neoclassical growth model some nonmarket goods and decisions (e.g., marriage partners). They show that different rules governing the matching of marriage mates can be supported as equilibria, and different norms of marriage imply different economic outcomes. My paper shows how social culture based on some seemingly irrelevant activity can change the effective production technology by alleviating the market failure caused by informational free-riding. In contrast, Guido Cozzi (1998) analyzes an overlapping generations growth model in which "culture" is assumed to enhance the production efficiency of future generations. His main concern is to characterize the balanced growth paths with "culture," which are supported by rational bubbles. This paper complements Cozzi's in explaining how "culture" may increase production efficiency, even though I use a very different setup. It should be noted that Cozzi's use of the term "culture" is more in line with Wilson's (1994) second view (see footnote 2).

The main idea in the current paper, that differential treatment of groups may enhance efficiency, also appeared in Andrea Moro and Peter Norman (1999) and, more directly, in Norman (1999). They study a model of discrimination with exogenous groups based on specialization, and show that informational gains from specialization in a discriminatory equilibrium may outweigh the losses from increased investment costs. In this paper I study differential treatment of endogenously chosen groups, and the underlying force of the cultural equilibrium is precisely the different incentives that skilled and unskilled workers have in joining the preferentially treated group. Moreover, the simplicity of my model allows me to state my welfare results using a Pareto criterion, whereas Norman's is stated in terms of a utilitarian social welfare function. There is a less-related literature in which authors directly put concerns for status into agents' utility function and then study the implications of such preference on some aspects of agents' behavior [see, e.g., Arthur Robson (1992); Chaim Fershtman and Yoram Weiss (1993); B. Douglas Bernheim (1994)] and I will refer the readers to Cole et al. (1992 p. 1097) for a critical discussion of this approach.

The remainder of the paper is structured as follows. Section I describes the basic structure of the model and establishes the conditions under which a new superior technology will not be adopted in the absence of social culture. Section II introduces cultural activity and studies the existence and welfare properties of cultural equilibria. Finally, Section III concludes.

I. A Basic Model

In this section, I endogenize the wage offers in a model similar to that of Stephen Coate and Glenn C. Loury (1992) to illustrate how a superior technology may fail to be adopted because of informational free-riding.

A. Firms and Technologies

There are two (or more) firms, indexed by $i = 1, 2$. They both have a traditional (old) and a new technology at their disposal. Every worker can produce 1 unit of output with the traditional technology. Workers with some requisite skills can produce $x_q > 1$ units of outputs

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[5] I thank an anonymous referee for this concise summary of the literature.

with the new technology, but those without the skills will produce 0. We assume that the firms are risk neutral and maximize expected profits.

B. Workers

There is a continuum of workers of unit mass in the economy. Workers are heterogeneous in their costs of acquiring the requisite skills for the new technology. For simplicity, I assume that a worker is either a *low cost type,* whose skill acquisition cost is C_L, or a *high cost type* with cost C_H, where $0 < C_L < C_H$. The fractions of low cost and high cost workers are λ_L and λ_H, respectively; of course $\lambda_L + \lambda_H = 1$. A worker's cost type is her private information. It is assumed that the workers are risk neutral and that they do not directly care about the technology to which they are assigned.

To dramatize the market failure caused by informational free-riding, I assume that it is socially optimal for every worker to invest in skills and use the new technology:

ASSUMPTION 1: $x_q - C_H > 1$.

Assumption 1 explains the need for the assumption that entrepreneurs have access to the new technology, whereas workers do not; otherwise, social optimum will be trivially achieved.

C. Timing and Strategies

The timing of the game and the strategies of the players are described in five stages:

Stage 1: *Investment Decision.*—A worker of type $C \in \{C_L, C_H\}$ chooses an action from $\{e_q, e_u\}$, where e_q means that she invests in skills (and becomes a *qualified* worker) and e_u that she does not invest (and thus remains *unqualified*). She pays a monetary cost of C if she chooses e_q, and pays no cost if she chooses e_u. Write the investment decision profile as $e : \{C_H, C_L\} \rightarrow \{e_q, e_u\}$. It is assumed the firms do not perfectly observe a worker's investment decision; instead they observe some noisy but informative public signals (e.g., test scores, interviews, recommendation letters) of her qualification.

Stage 2: *Test Signal.*—Each worker receives a signal $\theta \in [0, 1]$ that is observed by both firms. The signal θ is distributed according to probability density function f_q for qualified workers and f_u for unqualified ones. We assume that $f_q(\cdot)/f_u(\cdot)$ is strictly increasing in θ. This standard monotone likelihood ratio property (MLRP) implies that skilled workers are more likely to receive higher signals than unqualified ones. MLRP captures the notion that the test is informative of the worker's qualification.

Stage 3: *Wage Offer.*—The firms compete in the labor market for workers by simultaneously announcing wage schedules as functions of the test signal θ.[6] A pure action of firm i at this stage is a Borel measurable function $w_i : [0, 1] \rightarrow \mathcal{R}_+$.[7]

Stage 4: *Offer Acceptance.*—The workers observe wage schedules w_1 and w_2 announced in Stage 3, and decide for which firm to work.[8] If a worker is indifferent between two firms, I assume that she will flip a coin.

Stage 5: *Technology Assignment.*—In this final stage each firm allocates its available workers between the old and new technologies using an assignment rule, which is a Borel measurable function $t_i : [0, 1] \rightarrow \{0, 1\}$, where $t_i(\theta) = 1$ (respectively, 0) means that firm i assigns all workers with signal θ to the new (respectively, old) technology.[9]

D. Bayesian Nash Equilibrium

A *Bayesian Nash equilibrium* (BNE) of the game is a list including the workers' skill

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[6] I assume that the output level is not contractible.

[7] To simplify the description of the firms' strategy sets, we assumed that the firms cannot observe the aggregate distribution of the test signals. This assumption does not affect the equilibrium outcomes.

[8] I should in principle allow the acceptance rule to depend on the worker's investment decision e as well as her characteristic C. But the worker's sequential rationality requires that e and C should not affect her offer acceptance decision in equilibrium because in this stage her investment decision has been irreversible, and the firms' wage offers do not depend on e or C because of unobservability.

[9] A more complete description should allow the firms' assignment rules to be contingent on the wage schedules offered in Stage 4. However, because firms do not behave strategically in Stage 5, allowing for this will not affect any of the results.

investment decision profile e and offer acceptance rules, and the firms' wage schedules and technology assignment rules $\{w_i(\cdot), t_i(\cdot)\}$ such that every player optimizes against other players' strategy profiles.

In Stage 3 firms decide what wage to offer to a worker with signal θ. The firms interpret signal θ based on some perception about the fraction of skilled workers in the population, denoted by π, which serves as the prior in the application of Bayes' rule. Because firms compete for workers in "Bertrand" competition (wage posting), standard arguments establish that in equilibrium firms will make identical offers to a worker with test signal θ at her expected productivity on her more productive technology. In Stage 4 the rationality of the worker dictates that she accept a higher wage offer with probability 1 and randomize only if the offers are the same. In Stage 5, firms' profit maximization implies that each worker will be assigned to her more productive technology. The following lemma, formally proved in the Appendix, summarizes the preceding discussion.

LEMMA 1: *Suppose that in some BNE the fraction of skilled workers is π. Then:*

1. For almost all $\theta \in [0, 1]$,

$$(1) \quad w_1(\theta) = w_2(\theta) = w(\pi, \theta)$$

$$\equiv \max\left\{1, \frac{\pi f_q(\theta)}{\pi f_q(\theta) + (1 - \pi) f_u(\theta)} x_q\right\};$$

2. For almost all θ, $t_1(\theta) = t_2(\theta) \equiv t(\theta)$, where $t(\theta) = 1$ if and only if

$$\frac{\pi f_q(\theta)}{\pi f_q(\theta) + (1 - \pi) f_u(\theta)} x_q \geq 1.$$

The first element in the max operator of equation (1) is the worker's productivity on the old technology, and the second element is her expected productivity on the new technology. She will be assigned to the technology on which she is more productive.

Now I analyze the workers' skill investment decisions in Stage 1. It is obvious that the *social benefit* of skill investment is $x_q - 1$, regardless of other workers' decision. However, from an individual worker's viewpoint the benefit of

investing only comes from the higher likelihood of receiving better test signals. How firms interpret a signal depends on the firms' perception of the fraction of skilled workers in the population. Thus the *private benefit* of skill investment depends on π and is given by

$$B(\pi) = \int_0^1 w(\pi, \theta)[f_q(\theta) - f_u(\theta)] \, d\theta.$$

That the private benefit is a function of π is the source of informational free-riding. The function B will also determine the magnitude of free riding. First, B is clearly continuous in π; second, $B(0) = B(1) = 0$. If the firms' perception is that a zero measure of workers is skilled, then all workers will be assigned to the old technology regardless of their signals, which means that there is no point in getting better signals. In other words, $w(0, \theta) = 1$ for all θ, hence $B(0) = 0$. Analogously if the firms perceive all workers to be skilled, then all workers will be assigned to the new technology regardless of their signals, hence $w(1, \theta) = x_q$ for all θ and $B(1) = 0$. The value of B will be positive when the firms' perception of the population is neither too optimistic nor too pessimistic. From the preceding discussion, it is clear that $\pi = 0$ always corresponds to an equilibrium of the economy.

To convey my main idea that introducing cultural activity may compensate for market failure, I will in fact focus on the set of the economies in which $\pi = 0$ is the unique equilibrium outcome. To characterize the skill investment decision of a worker, it is important to know when the private benefit of investment exceeds her cost. We define Π_L and Π_H to be the sets of values of π that will respectively induce low and high cost type workers to invest in the skills, that is, $\Pi_L \equiv \{\pi \in [0, 1] : B(\pi) \geq C_L\}$; $\Pi_H \equiv \{\pi \in [0, 1] : B(\pi) \geq C_H\}$. It is worth remarking that the sets Π_L and Π_H are completely specified by the primitives of the economy $\{f_q, f_u, x_q, C_L, C_H, \lambda_L, \lambda_H\}$ because the function B is well defined by them.[10]

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[10] Although the function B is single peaked in many examples, I am unable to establish single-peakedness as a general property of B. If B is indeed single peaked, then both Π_L and Π_H will be intervals.
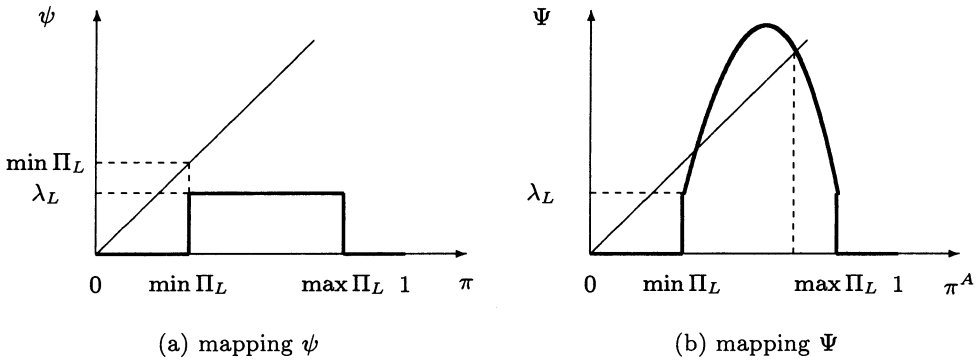
(a) mapping ψ (b) mapping Ψ

FIGURE 1. MAPPINGS ψ AND Ψ WHEN Π_L IS AN INTERVAL

Obviously Π_H is a subset of Π_L. The following two assumptions are sufficient, but by no means necessary, for the economy to have a unique equilibrium with $\pi = 0$.

ASSUMPTION 2: $\Pi_L \neq \varnothing$ *and* $\min \Pi_L > \lambda_L$.

ASSUMPTION 3: $\Pi_H = \varnothing$.

PROPOSITION 1: *If Assumptions 2 and 3 hold, then the economy has a unique equilibrium in which no workers invest in skills and the new technology is not adopted.*

PROOF:

To induce C_L type workers to invest, it must be that $\pi \in \Pi_L$; however, because $\lambda_L < \min \Pi_L$ this can occur only if some C_H type workers also invest, which is ruled out by Assumption 3.

The domino effect underlying Proposition 1 can be generalized to a model with more than two cost types of workers. Suppose that there are n types with $C_1 < C_2 < \cdots < C_n$. Assume that the measure of C_k type workers is λ_k. Define a sequence of sets $\{\Pi_k\}$ analogous to Π_L and Π_H. If for $k = 1, \ldots, n - 1$, $\min \Pi_k > \sum_{j=1}^{k} \lambda_j$ and $\Pi_n = \varnothing$, then the economy will have a unique equilibrium with $\pi = 0$. It is also helpful to relate the preceding result to George Akerlof's (1970) lemons problem. The existence of high cost type workers—"lemons" because they never invest as a result of Assumption 3—dampens the incentives of the low cost workers to invest in skills.

To facilitate the comparison with cultural equilibrium, it is useful to define a mapping $\psi : [0, 1] \to [0, 1]$ as follows:

$$\psi(\pi) = \begin{cases} 0 & \text{if } \pi \notin \Pi_L \\ [0, \lambda_L] & \text{if } \pi \in \partial \Pi_L \\ \lambda_L & \text{if } \pi \in int(\Pi_L), \end{cases}$$

where $\partial \Pi_L$ and $int(\Pi_L)$ are respectively the boundary and the interior of Π_L. ψ gives the measure of workers who will find skill acquisition worthwhile when the firms' perception is π. In any equilibrium the firms' perception must be consistent with the workers' investment decisions. That is, any equilibrium is characterized by a fixed point of ψ. Assumptions 2 and 3 imply that the unique fixed point of ψ is at $\pi = 0$ [see Figure 1(a)].

II. Cultural Activity and Cultural Equilibria

In this section, I introduce an activity, called "cultural activity," into the basic model.

A. *Cultural Activity*

Suppose there is an activity A that workers can undertake. Let $V \in \mathcal{R}$ be a worker's utility (or disutility if negative) in monetary terms from activity A. Therefore each worker now has two private characteristics (C, V). Let $H(V|C)$ denote the cumulative distribution of V conditional on the skill acquisition cost C. I assume that whether a worker undertakes activity A is *observable* to firms. The defining characteristic

of a cultural activity is that it is a priori completely irrelevant to other economic fundamentals:

ASSUMPTION 4 (*Independence of C and V*): $H(V|C_L) = H(V|C_H) \equiv H(V)$, and H is continuous and strictly increasing in V with support $[\underline{V}, \bar{V}] \subset \mathcal{R}$.[11]

ASSUMPTION 5: *A worker's test signal, and her qualification for the new technology, are not affected by whether she undertakes activity A.*

Now I augment the basic model by adding a stage 0:

Stage 0: *Activity Choice.*—A worker of type (C, V) chooses $j \in \{A, B\}$, where $j = A$ means that she undertakes activity A and $j = B$ that she does not. She derives from activity A (dis)utility V if she chooses $j = A$, and zero utility otherwise. Write the activity choice profile as $g : \{C_L, C_H\} \times [\underline{V}, \bar{V}] \to \{A, B\}$. Workers who choose A will be called *A-workers,* and those who choose B, *B-workers.* The description of the strategies for Stages 1–5 and the definition of Bayesian Nash equilibrium should of course be appropriately modified.

B. *Noncultural Equilibrium*

Because of the a priori irrelevance of activity A we can suitably augment the equilibrium decision rules of the basic model, and obtain an equilibrium of the augmented model in which activity A plays no role in the firms' wage offer schedules and technology assignments. We call such an equilibrium a *noncultural equilibrium.* The activity and skill acquisition choices in the noncultural equilibrium are pictured in Figure 2(a). It is obvious that in the noncultural equilibrium no workers are skilled, hence the new technology is not adopted.

C. *Cultural Equilibrium*

The introduction of the observable activity A allows the firms to potentially offer wage schedules and technology assignment rules contin-

gent on whether activity A is undertaken. If firms do use this type of contingent wage schedules, then workers may undertake activity A for instrumental reasons. If A-workers are preferentially treated (in a manner to be made precise below), then some workers who intrinsically dislike activity A may choose A to get the preferential treatment. Of course in equilibrium it must be rational for firms to give preferential treatment to A-workers.

An *A-cultural equilibrium* is defined to be a Bayesian Nash equilibrium of the augmented model in which a positive mass of A-workers are assigned to the new technology, whereas all B-workers are assigned to the old technology. A-workers will be called *elites* in any A-cultural equilibrium. *B-cultural equilibrium* can be analogously defined.

I will first characterize some properties of an A-cultural equilibrium if it exists. Because B-workers are never assigned to the new technology, in this equilibrium the fraction of the skilled among B-workers, denoted by π^B, must be zero. Furthermore, in order for some positive fraction of A-workers to be assigned to the new technology, the proportion of the skilled among A-workers, denoted by π^A, must belong to the set Π_L. An A-cultural equilibrium exists if and only if for some value $\pi^A \in \Pi_L$, the population will self-select the activity choices such that the fraction of C_L types among A-workers is exactly π^A.

It should be clear from the proof of Lemma 1 that workers will still be paid their expected productivity. Therefore firm i's sequentially rational wage offer schedule to B-workers w_i^B is

$$w_1^B(\theta) = w_2^B(\theta) = w(0, \theta) = 1$$

$$\text{for all } \theta \in [0, 1].$$

Suppose that the proportion of the skilled among A-workers is π^A. Then firm i's equilibrium wage schedule to A-workers w_i^A is

$$w_1^A(\theta) = w_2^A(\theta) = w(\pi^A, \theta).$$

For every π^A, the expected wage of a skilled A-worker is $W_q^A(\pi^A) = \int_0^1 w(\pi^A, \theta) f_q(\theta) \, d\theta$, and that of an unskilled A-worker is $W_u^A(\pi^A) = $
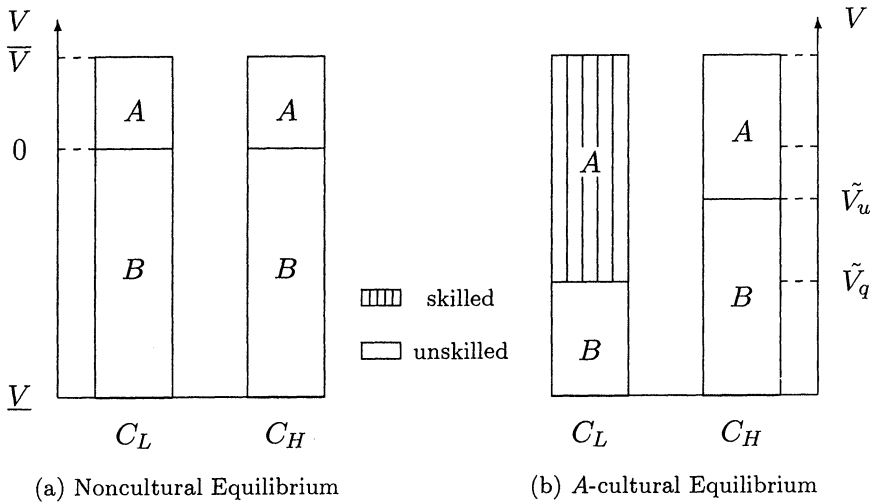
FIGURE 2. ACTIVITY AND SKILL ACQUISITION CHOICES

$\int_0^1 w(\pi^A, \theta) f_u(\theta) \, d\theta$. The following lemma characterizes the activity and skill acquisition choice profiles if there is an A-cultural equilibrium. It is proved by revealed preference arguments in the Appendix.

LEMMA 2: *Suppose in an A-cultural equilibrium the proportion of the skilled among A-workers is π^A. Then the following must be true:*

$e(C, V)$

$$= \begin{cases} e_q & \text{if } C = C_L, \ V \geq 1 + C_L - W_q^A(\pi^A) \\ e_u & \text{otherwise} \end{cases}$$

$g(C, V)$

$$= \begin{cases} A & \text{if } C = C_L, \ V \geq 1 + C_L - W_q^A(\pi^A) \\ A & \text{if } C = C_H, \ V \geq 1 - W_u^A(\pi^A) \\ B & \text{otherwise.} \end{cases}$$

The activity and skill acquisition choices in an A-cultural equilibrium are portrayed in Figure 2(b), where we have defined $\tilde{V}_q(\pi^A) = 1 + C_L - W_q^A(\pi^A)$ and $\tilde{V}_u(\pi^A) = 1 - W_u^A(\pi^A)$ as the threshold disutility values that respectively a skilled and an unskilled worker are willing to incur to be a member of the elites. Note that $W_q^A(\pi^A) - W_u^A(\pi^A) \geq C_L$ because $\pi^A \in \Pi_L$. Because $W_u^A(\pi^A) \gg 1$ whenever there is a

positive mass of A-workers assigned to the new technology, we have

$$(2) \qquad \tilde{V}_q(\pi^A) \ll \tilde{V}_u(\pi^A) \ll 0.$$

Inequality (2) establishes that in a cultural equilibrium, a single-crossing property (SCP) of the cultural activity is *endogenously* generated. More specifically, let us denote the *net* benefit to undertake activity A for a skilled and an unskilled worker with the same utility type V by $b(e_q, V; \pi^A) = V - \tilde{V}_q(\pi^A)$ and $b(e_u, V; \pi^A) = V - \tilde{V}_u(\pi^A)$, respectively. Inequality (2) yields that $b(e_q, V; \pi^A) > b(e_u, V; \pi^A)$ for every type V. In other words, in any A-cultural equilibrium, a skilled worker is more willing than an unskilled one to endure disutility from activity A to be an elite, which in turn justifies A-workers as elites. Undertaking activity A becomes a signaling instrument for skilled workers as a result of the endogenously generated SCP, which differs from Michael Spence's (1973) educational signaling models where that property has been assumed. It is *not* true that I have simply replaced the SCP by assuming MLRP on the testing technology. Indeed, in the noncultural equilibrium SCP does not hold, whereas MLRP is still assumed. In this sense, SCP does not merely follow from assuming MLRP in this model.

Now I will provide the necessary and

sufficient condition for the existence of A-cultural equilibria. For any $\pi^A \in \Pi_L$, Lemma 2 tells us how workers make activity and skill acquisition choices. For every postulated

value of π^A, I can then calculate the proportion of the skilled among A-workers. Specifically, we define a mapping $\Psi : [0, 1] \rightarrow [0, 1]$ by

$$\Psi(\pi^A) = \begin{cases} \dfrac{\lambda_L(1 - H(\tilde{V}_q(\pi^A)))}{\lambda_L(1 - H(\tilde{V}_q(\pi^A))) + \lambda_H(1 - H(\tilde{V}_u(\pi^A)))} & \text{if } \pi^A \in \Pi_L \\ 0 & \text{otherwise,} \end{cases}$$

where the numerator of the fraction is the total mass of skilled A-workers [see the shaded area in Figure 2(b)] and the denominator is the total mass of A-workers [the area marked "A" in Figure 2(b)]. Every fixed point of the mapping Ψ will correspond to an A-cultural equilibrium. An illustration of Ψ is provided in Figure 1(b). The way Ψ is defined highlights the local public good aspect of group reputation in cultural equilibria. That is, A-workers' skill investment choices depend only on the firms' perception of the proportion of the skilled among A-workers. In contrast the firm's perception is a public good in the basic model.

Let $\Delta \equiv \max_{\pi^A \in \Pi_L} [\Psi(\pi^A) - \pi^A]$ be the maximal difference between the function Ψ and the identity map. It should be clear that Δ is well defined in terms of the primitives of the model, regardless of any equilibrium considerations. The following proposition is proved in the Appendix.

PROPOSITION 2: *There exists at least one A-cultural equilibrium if and only if $\Delta \geq 0$.*

When $\Delta \geq 0$ holds, Proposition 2 establishes that the economy admits at least one A-cultural equilibrium. In fact multiple A-cultural equilibria may exist. Moreover, besides the noncultural equilibrium that we knew always exists, an economy may simultaneously admit A- and B-cultural equilibria because an analogous necessary and sufficient condition for the existence of B-cultural equilibria does not necessarily exclude $\Delta \geq 0$. In this sense exactly which group of workers will receive preferential treatment can be quite arbitrary.

The following proposition establishes that economies that admit a cultural equilibrium can be readily constructed. It is proved in the Appendix.

PROPOSITION 3: *Fix $\{ x_q, C_L, C_H, \lambda_L, f_q, f_u \}$ satisfying Assumptions 1–3. For any $\pi^A \in int(\Pi_L)$, there exists some continuous and strictly increasing distribution function H such that π^A is the proportion of the skilled among A-workers in some A-cultural equilibrium of the economy $\{ x_q, C_L, C_H, \lambda_L, f_q, f_u, H \}$.*

D. Welfare

In a cultural equilibrium, the new technology is adopted by a positive mass of workers. In the meantime, some workers are enduring the disutility of activity A to be members of the elites. The trade-off is in favor of welfare improvement.[12]

PROPOSITION 4: *Any cultural equilibrium Pareto-dominates the noncultural equilibrium.*

PROOF:
With no loss of generality consider an A-cultural equilibrium. B-workers are exactly as well off as they are in the noncultural equilibrium. By revealed preference A-workers are strictly

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[12] If, instead of Assumption 4, the utility costs of undertaking activity A are the same for every worker, then A-workers will be indifferent between the A-cultural and the noncultural equilibria. In this case the A-cultural equilibrium involves mixed strategies by low cost workers.

better off than they are in the noncultural equilibrium.

Recall that in Spence's (1973) signaling model low ability workers are worse off in the separating equilibrium. This is attributed to the assumed negative relationship between ability and investment cost, which is necessary for signaling to arise in his model. I can dispense with this negative relationship because the SCP is endogenously generated. This explains the difference in welfare properties from Spence.

In this paper social culture is always efficient. However, this is only because I have chosen as the benchmark economy where the informational free-riding problem is extremely severe (Assumptions 2 and 3). In fact if Assumption 2 were not satisfied, then the basic model might have an equilibrium in which the new technology is adopted by a positive mass of workers. The introduction of the cultural activity will again make cultural equilibrium possible, but then there will be no guarantee that it is Pareto improving. To be more specific, suppose that the primitives of the basic economy are such that $0 < C_L < B(\lambda_L) < C_H$. Obviously this economy violates Assumption 2 because $\min \Pi_L < \lambda_L$. It is easy to see that the benchmark economy admits an equilibrium in which a worker invests in skills if and only if she is of low cost type, and the firms will assign a worker with a high enough test signal to the new technology. Suppose now we introduce in such an environment a cultural activity A from which all workers derive negative utility. Analogous to the earlier analysis, one can find conditions on the distribution H under which the augmented economy will admit an A-cultural equilibrium in which only A-workers are assigned to the new technology with positive probability. It is easy to see that all the B-workers are worse off in this A-cultural equilibrium than they were in the noncultural equilibrium.

III. Conclusions

This paper presents an explicit model to illustrate Kenneth Arrow's (1971) idea that social norms or social culture are reactions of the society to cope with market failure. I interpret the connection between obtaining higher paying jobs and undertaking some seemingly irrelevant activity as "social culture." I argue that this interpretation is consistent with many existing definitions of "culture." I show that by allowing the firms to give preferential treatment to workers based on some "cultural activity," the society can partially overcome an informational free-riding problem. There are two useful ways to understand why social culture may reduce the free-riding problem: first, the introduction of cultural activity changes the firms' perception of the proportion of skilled workers from a public good into a local public good; second, a single-crossing property is generated in a cultural equilibrium, which makes undertaking the cultural activity an endogenous signaling instrument for skilled workers.

An important message of this paper is that the distribution of the utility (or disutility) from undertaking an activity plays an important role in determining whether it can be used as a cultural activity (see Proposition 2). It is entirely possible that there is no single activity that alone can be used as a cultural activity, but by requiring the elites to undertake more than one activity the society can nonetheless partially overcome the informational free-riding problem. This suggests that there may be some efficiency-enhancing rationale for the seemingly unnecessary complexity of the norms of etiquette.

This paper is only a step toward a better understanding of the role of social culture in economic performance. In the preceding oversimplified static model I can impose a stability restriction only on what can be used as a cultural activity. This limited setting precludes me from analyzing important issues of selection and evolution of social culture. For example, when there are many activities that qualify as cultural activities, which are more likely to emerge? When technologies change, what kind of pattern can we expect in the evolution of culture? The answers to these questions will be crucial to understand why a previously successful culture turns disastrous or a previously unsuccessful one causes a miracle. These are exciting topics for future research and can be addressed only in dynamic models.

APPENDIX: PROOFS OF LEMMA 1, LEMMA 2, PROPOSITION 2, AND PROPOSITION 3

PROOF OF LEMMA 1:
It is implied by the following three intermediate lemmas.

LEMMA A1: *Suppose $\langle w_i, t_i \rangle_{i=1,2}$ is a pair of best responses, then $w_1(\theta) = w_2(\theta)$ for almost all $\theta \in [0, 1]$.*

PROOF:

Suppose to the contrary that there is a positive measure set $\Theta \subseteq [0, 1]$ such that $w_i(\theta) > w_j(\theta)$ for all $\theta \in \Theta$. Then the alternative strategy $\langle w_i', t_i' \rangle : t_i'(\theta) = t_i(\theta)$ for all $\theta \in [0, 1]$, and $w_i'(\theta) = w_i(\theta)$ for all $\theta \in [0, 1] \backslash \Theta$ and $w_i'(\theta) = (w_i(\theta) + w_{i'}(\theta))/2$ for $\theta \in \Theta$, is a profitable deviation for firm i—a contradiction.

LEMMA A2: *If $t_i : [0, 1] \rightarrow \{0, 1\}$ is the task assignment rule on the equilibrium path for firm $i = 1, 2$, then there exists some $\tilde{\theta}_i \in [0, 1]$ such that $t_i(\theta) = 1$ for almost all $\theta > \tilde{\theta}_i$ and $t_i(\theta) = 0$ for almost all $\theta < \tilde{\theta}_i$. Furthermore, $\tilde{\theta}_1 = \tilde{\theta}_2 = \tilde{\theta}(\pi)$, where $\tilde{\theta}(\pi)$ is defined by*

$$\frac{\pi f_q(\tilde{\theta})}{\pi f_q(\tilde{\theta}) + (1 - \pi) f_u(\tilde{\theta})} x_q = 1.$$

PROOF:

First we prove the cutoff property. Suppose not. Then there are positive measure sets Θ^h, $\Theta^l \subseteq [0, 1]$ such that $\theta^h > \theta^l$ for all $(\theta^h, \theta^l) \in \Theta^h \times \Theta^l$, $t_i(\theta^h) = 0$ for all $\theta^h \in \Theta^h$, and $t_i(\theta^l) = 1$ for all $\theta^l \in \Theta^l$. Write $f_\pi(\theta) = \pi f_q(\theta) + (1 - \pi) f_u(\theta)$, and $\bar{\theta}^l = \sup \Theta^l$. We can, without loss of generality, assume that $\int_{\Theta^h} f_\pi(\theta) \, d\theta = \int_{\Theta^l} f_\pi(\theta) \, d\theta$. Write the expected productivity of a worker with signal θ as $x(\pi, \theta) = \pi f_q(\theta) x_q / f_\pi(\theta)$. Consider an alternative task assignment rule t_i', where $t_i'(\theta) = 1$ for all $\theta \in \Theta^h$, $t_i'(\theta) = 0$ for all $\theta \in \Theta^l$, and $t_i'(\theta) = t_i(\theta)$ for all other $\theta \in [0, 1]$. The difference in profits between t_i and t_i' is

expected productivity of assignment rule t_i'

$$\left[\int_{\theta \in \Theta^h} x(\pi, \theta) f_\pi(\theta) \, d\theta + \int_{\theta \in \Theta^l} 1 \cdot f_\pi(\theta) \, d\theta \right]$$

expected productivity of assignment rule t_i

$$- \left[\int_{\theta \in \Theta^l} x(\pi, \theta) f_\pi(\theta) \, d\theta + \int_{\theta \in \Theta^h} 1 \cdot f_\pi(\theta) \, d\theta \right]$$

$$> \int_{\theta \in \Theta^h} [x(\pi, \theta) - x(\pi, \bar{\theta}^l)] f_\pi(\theta) \, d\theta > 0,$$

where the inequality is the result of strict MLRP—a contradiction.

By the definition of $\tilde{\theta}(\pi)$, the task assignment rule t with $\tilde{\theta}(\pi)$ as the critical point strictly increases profit over any other thresholds. Hence $\tilde{\theta}_1 = \tilde{\theta}_2 = \tilde{\theta}(\pi)$.

LEMMA A3: *If the fraction of skilled workers is π, then $w_1(\theta) = w_2(\theta) = w(\pi, \theta)$ where $w(\pi, \theta)$ is given by (1).*

PROOF:

Lemma A1 establishes that $w_1(\theta) = w_2(\theta) = w(\theta)$ almost everywhere. Suppose to the contrary that $w(\theta) < \max\{1, x(\pi, \theta)\}$ for a positive measure set $\tilde{\Theta} \subseteq [0, 1]$. Consider an alternative strategy w_1' for firm 1, where $w_1'(\theta) = w(\theta) + \varepsilon$ for $\theta \in \tilde{\Theta}$ for some $\varepsilon > 0$ and $w_1'(\theta) = w(\theta)$ for $\theta \in [0, 1] \backslash \tilde{\Theta}$, and $t_1'(\theta) = 1$ if $\theta \geq \tilde{\theta}(\pi)$, $t_1'(\theta) = 0$ otherwise. All workers whose test signal $\theta \in \tilde{\Theta}$ will then

accept firm 1's offer. The difference in profits for firm 1 between $\langle w'_1, t \rangle$ and $\langle w, t \rangle$ is

$$\int_{\theta \in \tilde{\Theta}} \{\tfrac{1}{2}[\max\{1, x(\pi, \theta)\} - w(\theta)]$$

$$- \varepsilon\} f_\pi(\theta) \, d\theta,$$

which is strictly positive if ε is sufficiently small. Similar arguments can establish that profitable deviation exists if $w(\theta) > \max\{1, x(\pi, \theta)\}$.

PROOF OF LEMMA 2:
    It will be proved via a sequence of intermediate results.

LEMMA A4: *In an A-cultural equilibrium, at least some C_L type A-workers choose $e = e_q$, whereas all C_H type A-workers choose $e = e_u$.*

PROOF:
    Obvious because $\Pi_H = \varnothing$.

LEMMA A5: *In an A-cultural equilibrium, if (C_L, V) is an A-worker, then (C_L, V') must be an A-worker for all $V' \geq V$; similarly, if (C_H, V) is an A-worker, then (C_H, V') must be an A-worker for all $V' \geq V$. In fact for all $V \geq 1 + C_L - W_q^A(\pi^A)$, a C_L type worker undertakes A; and for all $V \geq 1 - W_u^A(\pi^A)$, a C_H worker undertakes A.*

PROOF:
    If (C_L, V) chooses to be an A-worker in an A-cultural equilibrium, then from Lemma A4, she is at least as well off by choosing $e = e_q$. Thus, by revealed preference, it must be that $W_q^A(\pi^A) - C_L + V \geq 1$, where $W_q^A(\pi^A) - C_L + V$ is her expected payoff from being a skilled A-worker, and 1 is her expected payoff from being a B-worker. But then the inequality $W_q^A(\pi^A) - C_L + V' \geq 1$ holds for all $V' > V$. And the threshold value of V for a C_L type worker is $1 + C_L - W_q^A(\pi^A)$. Similar arguments applies to C_H type workers.

LEMMA A6: *In an A-cultural equilibrium, all C_L type A-workers choose $e = e_q$.*

PROOF:
    Lemma A4 states that at least some C_L type A-workers choose $e = e_q$. Suppose that some do not choose $e = e_q$. This implies that they are indifferent between $e = e_q$ and $e = e_u$, which is equivalent to $W_q^A(\pi^A) - C_L = W_u^A(\pi^A)$. Then from Lemma A5, we have that $\pi^A = \lambda_L$. By Assumption 4 $\lambda_L < \min \Pi_L$. Thus we obtain a contradiction to Lemma A4 that some C_L type A-workers choose $e = e_q$.

    Lemma 2 is a direct consequence of Lemmas A4–A6.

PROOF OF PROPOSITION 2:
    Define a function $F(\pi) = \Psi(\pi) - \pi$. An A-cultural equilibrium is characterized by the values of π^A that satisfy $F(\pi^A) = 0$. The necessity of $\Delta \geq 0$ is obvious: when there exists an A-cultural equilibrium, then $\Delta \geq F(\pi^A) = 0$. Now we will establish its sufficiency.

    From the definition of $\Pi_L \equiv \{\pi \in [0, 1] : B(\pi) \geq C_L\}$, Π_L must be a union of intervals (taking singletons as degenerate intervals) because $B(\cdot)$ is continuous in π. Furthermore Π_L is closed. Write $\Pi_L = \cup_{k=1}^{K} \Pi_L^k$, where Π_L^k is the kth interval, and K may be infinity.
    If $\Delta = 0$, then because Π_L is closed, we have found a fixed point of Ψ. If $\Delta > 0$, then for some value $\hat{\pi} \in \Pi_L$, $F(\hat{\pi}) > 0$. Suppose $\hat{\pi} \in \Pi_L^n$ for some $1 \leq n \leq K$. We claim that Π_L^n is not a singleton set. Suppose it was; then it must be that $B(\hat{\pi}) = C_L$. Otherwise, if $B(\hat{\pi}) > C_L$, then the continuity of B implies that any π within a neighborhood of $\hat{\pi}$ will also satisfy $B(\pi) \geq C_L$, a contradiction to the supposition that Π_L^n was a singleton. But if $B(\hat{\pi}) = C_L$ and Π_L^n was a singleton, then $\Psi(\hat{\pi}) = \lambda_L < \min \Pi_L \leq \hat{\pi}$, a contradiction to the supposition that $F(\hat{\pi}) > 0$. Hence Π_L^n must be an interval. Because F is continuous on the interval Π_L^n and by the definition of Π_L, $\tilde{V}_q(\max \Pi_L^n) = \tilde{V}_u(\max \Pi_L^n)$, hence $F(\max \Pi_L^n) = \lambda_L - \max \Pi_L^n < 0$. Because in this case $F(\hat{\pi}) > 0$, by the intermediate value theorem, there exists some value of $\pi^* \in \Pi_L^n$ such that $F(\pi^*) = \pi^*$. In particular, $\pi^* > \lambda_L$.

PROOF OF PROPOSITION 3:

For any $\pi \in int(\Pi_L)$, $W_q^A(\pi) - W_u^A(\pi) > C_L$ and $W_u^A(\pi) \gg 1$. Hence all low cost A-workers will acquire skills. Consider the following parametric family of distributions $\{H_\alpha\}_{\alpha \in (0,1)}$ with support $[1 + C_L - W_q^A(\pi), 0]$:

$$H_\alpha(V) = \begin{cases} \alpha/(W_q^A(\pi) - W_u^A(\pi) - C_L) & \text{if } 1 + C_L - W_q^A(\pi) \leq V \leq 1 - W_u^A(\pi) \\ \alpha + (1 - \alpha)/(W_u^A(\pi) - 1) & \text{if } 1 - W_u^A(\pi) \leq V \leq 0. \end{cases}$$

Suppose that the postulated π is the equilibrium proportion of skilled among A-workers for some economy with distribution H_α. Then all low cost A-workers are skilled because $V + W_q^A(\pi) - C_L \geq 1$ for all V in the support of H_α. It is also clear that only those high cost workers with $V \geq 1 - W_u^A(\pi)$ will undertake activity A, but they will not invest in skills. Therefore the proportion of the skilled among A-workers is $\lambda_L/(\lambda_L + \lambda_H(1 - \alpha))$. To ensure that π corresponds to an equilibrium for the economy H_α, we choose α such that

$$\frac{\lambda_L}{\lambda_L + \lambda_H(1 - \alpha)} = \pi,$$

which yields a unique value of $\alpha^* = 1 - \lambda_L(1 - \pi)/\lambda_H\pi$. Because Assumption 3 implies that $\lambda_L < \min \Pi_L < \pi$, we have $1 - \pi < 1 - \lambda_L = \lambda_H$. Thus $\alpha^* \in (0, 1)$. Clearly H_{α^*} is continuous and strictly increasing.

REFERENCES

Akerlof, George. "The Market for Lemons: Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics*, August 1970, *84*(3), pp. 488–500.

Arrow, Kenneth. "Political and Economic Evaluation of Social Effects and Externalities," in Michael Intriligator, ed., *Frontiers of quantitative economics*. Amsterdam: North-Holland, 1971, pp. 3–25.

Bernheim, B. Douglas. "A Theory of Conformity." *Journal of Political Economy*, October 1994, *102*(5), pp. 841–77.

Coate, Stephen and Loury, Glenn C. "Will Affirmative Action Policies Eliminate Negative Stereotypes?" *American Economic Review*, December 1993, *83*(5), pp. 1220–40.

Cole, Harold; Mailath, George J. and Postlewaite, Andrew. "Social Norms, Savings Behavior, and Growth." *Journal of Political Economy*, December 1992, *100*(6), pp. 1092–125.

Cozzi, Guido. "Culture as a Bubble." *Journal of Political Economy*, April 1998, *106*(2), pp. 376–94.

Elster, Jon. "Social Norms and Economic Theory." *Journal of Economic Perspectives*, Fall 1989, *3*(4), pp. 99–117.

Fershtman, Chaim and Weiss, Yoram. "Social Status, Culture and Economic Performance." *Economic Journal*, July 1993, *103*(4), pp. 946–59.

Gellner, Ernest. *Plough, book and sword: The structure of human history*. London: Collins Harvill, 1988.

Hamermesh, Daniel and Biddle, Jeff. "Beauty and the Labor Market." *American Economic Review*, December 1994, *84*(5), pp. 1174–94.

Moro, Andrea and Norman, Peter. "Affirmative Action in a Competitive Economy." Mimeo, University of Minnesota and University of Wisconsin-Madison, 1999.

Norman, Peter. "Statistical Discrimination and Efficiency." Mimeo, University of Wisconsin-Madison, 1999.

North, Douglas. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press, 1990.

Pesendorfer, Wolfgang. "Design Innovation and Fashion Cycles." *American Economic Review*, September 1995, *85*(4), pp. 771–92.

Robson, Arthur. "Status, the Redistribution of Wealth, Private and Social Attitudes to Risk." *Econometrica*, July 1992, *60*(4), pp. 837–57.

Simmel, Georg. "Fashion." *American Journal of Sociology*, December 1957, *62*(6), pp. 541–58.

Spence, Michael A. "Job Market Signaling." *Quarterly Journal of Economics*, August 1973, *87*(3), pp. 355–74.

Wilson, James. "Culture, Incentives, and the Underclass," in Henry Aaron, Thomas Mann, and Timothy Taylor, eds., *Values and public policy*. Washington, DC: Brookings Institution Press, 1994, pp. 54–80.