Individualism and Collectivism: An Economic Perspective

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Abstract

Individualism and collectivism are formulated as alternative bargaining norms governing cooperative production (absent holdup). Collectivism maximizes welfare for the cooperative group. Individualism maximizes individual welfare subject to the partner's claim (represented by Kalai proportional bargaining). When group members only differ in outside values (autarky productivities), individualism can increase group output. Conversely, when they differ in technological importance—and the more vital member holds at least equal bargaining power—individualism can reduce output. The economic impact of culture is therefore structurally endogenous: collectivism thrives in production with asymmetric specialization.

Key words: Cultural norms, Individualism and collectivism, Bargaining, Team production, Complementarity

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1 Introduction

Individualism and collectivism represent competing principles for organizing cooperative activity. Individualism emphasizes the primacy of individual claims and incentives, while collectivism prioritizes the welfare of the group. These orientations have long been central to philosophical and social-scientific debates. Although formal economic analyses of these principles remain limited, a common view associates individualism with stronger incentives and higher economic performance. Here I provide an economic framework to study these principles. My findings show that the common view is incomplete: the cultural influence on economic performance depends on the underlying structure of cooperation.

Within economics, Greif [8] provides an analytical treatment closest in spirit to the approach taken here. He interprets culture, individualism or collectivism, as a system of self-enforcing norms governing cooperation in repeated interactions; in particular, culture is not a primitive of preferences or technology. I adopt the view of culture as norms rather than fundamentals, and shift the focus to the core economic margin in the individualism–collectivism debate: the division of cooperative surplus. Specifically, I model culture as bargaining norms that determine how this surplus is shared in cooperative production. Each norm implements a statically efficient allocation. A central finding is that, when inputs are (imperfectly) complementary, a norm that preserves individual entitlements can shift effort away from more productive inputs and thereby reduce output relative to a norm that does not preserve such entitlements.

In my setup, cooperation requires investment by partners and yields joint output. The terms of cooperation are agreed upon before investments are made, eliminating holdup. Each norm, individualism or collectivism, selects an efficient allocation for the group. Collectivism prioritizes the interests of the group. This philosophical principle is represented by the norm that maximizes joint welfare. Individualism encourages each individual to pursue his best interest but recognizes that his partner's claim creates a natural boundary—a boundary whose size reflects relative standing within the group. I capture the notion of bounded individual interest in this principle using Kalai proportional bargaining, which allocates surplus in proportion to agents' claims; replacing Kalai bargaining with Nash bargaining does not qualitatively alter the main results.

The two norms induce systematic differences in investment choices across agents. Provided surplus shares weakly preserve relative standing, individualism reduces the investment of stronger agents and increases that of weaker ones relative to collectivism. When inputs are complementary, this entitlement principle generates opposite output effects depending on whether heterogeneity reflects outside values (autarky productivities) or productive roles. When agents differ only in outside values, the shift operates across technologically symmetric inputs and raises output. When agents differ in technological importance, the shift reduces the input of the more productive agent, which can dominate and lower total output.

Although my framework can naturally accommodate holdup problems (e.g., investment precedes partnership formation), I abstract from them for two main reasons. First, the existing literature has established that egalitarian sharing rules, akin to collectivism, weaken *ex ante* investment incentives (Grossman and Hart [10]; Holmström [16]). By contrast, the role of asymmetry within cooperation has received less attention. The analysis shows that, when agents differ in technological importance, assigning a larger surplus share to the more productive member can reduce output by lowering that agent's investment, in contrast to the standard prescription of aligning rewards with contributions. Second, modern cooperation often relies on ongoing ex-post efforts within groups, such as real-time coordination and mutual adjustment (Thompson [23]; Mintzberg [18]; Van de Ven et al. [25]). Abstracting from holdup allows the analysis to focus on how cultural bargaining rules shape effort allocation within cooperation. Moreover, in these environments, *ex ante* incentives may be addressed through sorting (Becker [4]), for example, if one interprets pre-partnership investment as schooling, certification costs, or similar preparations.

This paper relates to the literature on culture and economic performance. As surveyed by Guiso et al. [11], culture persistently influences a wide range of economic outcomes through beliefs, preferences, and norms. On theoretical grounds, Gorodnichenko and Roland [9] argue that individualism promotes innovation and long-run growth, while collectivism favors static efficiency in stable environments. Tabellini [20] shows that intrinsic cultural values can shape the scope of cooperation and incentives in economic interactions. In the present model, by contrast, cultural norms affect economic performance (output, capital accumulation, etc.) not through intrinsic preferences, but through entitlement-constrained bargaining over cooperative surplus and the resulting effort allocation.

2 Two-agent setup

There are two periods and two agents. In the first period, each agent has wealth w which can be consumed or invested to produce a good. The production can be done either individually or by the two-person group; each unit of the produced good turns into ϕ units of a consumed good in the second period. Under group production, the agents obtain $\phi g(a_1, a_2)$ units of good, where $a_i \geq 0$ represents the efficiency level of agent i for $i = 1, 2$, and $\phi > 0$. The function g is concave, strictly increasing in each of its argument, and differentiable, exhibits constant returns to scale, and satisfies $g(1, 1) = 2$. When $g(a_1, a_2) \neq g(a_2, a_1)$ for $a_1 \neq a_2$, heterogeneity between agents affects group output. Individual production yields $\eta_i a_i$ units for type i, where $\eta_i \in (0, 1)$ is an agent-specific productivity parameter. Differences in the η_i reflect heterogeneity that does not enter the group technology.

Efficiency levels in production are endogenous. Agent i can increase efficiency from 0 to a_i by investing a_i units of wealth. Equivalently, letting $z_i \in [0, 1]$ denote the share of wealth invested, we have $a_i = z_i w$. If agent i invests $z_i w$ and receives share λ_i of joint output ($\sum \lambda_i = 1$), his utility is

$$u(c_i, c_{i+}) = u(c_i) + v(c_{i+}),$$

where $c_i = w(1 - z_i)$ and $c_{i+} = \lambda_i \phi w g(z_1, z_2)$ are his consumption in the first period and second, respectively, and where u and v are strictly concave and strictly increasing.

Culture is the bargaining norm that governs the two agents to reach an agreement on the efficiency level of z_i and the share λ_i of the good produced for each agent i . I analyze two orientations. *Collectivism* emphasizes the interests of the group and is therefore the norm that maximizes the joint surplus of the two agents.

Letting $z = (z_1, z_2)$ and $\lambda = (\lambda_1, \lambda_2)$, then collectivism chooses

$$(z^{co}, \lambda^{co}) = \arg\max_{(z,\lambda)} \sum_{i\geq 1} [u(w - z_i w) + v(\lambda_i \phi w g(z))], \tag{1}$$

subject to the participation constraint

$$u(w - z_i w) + v(\lambda_i \phi w g(z)) \geq \kappa_i \text{ for all } i. \tag{2}$$

In (2), κ_i is agent i's outside value when he chooses to produce capital good individually; that is,

$$\kappa_i = \max_{z_i'} [u(w - z_i' w) + v(\eta_i \phi w z_i')]. \tag{3}$$

Individualism encourages each agent to pursue his own interest while recognizing that his partner's claim forms a natural boundary. I represent individualism using Kalai proportional bargaining—this choice reflects an environment where gains are partitioned according to relative claims (as shown in the appendix, replacing Kalai bargaining with Nash bargaining does not qualitatively alter the main results). Letting θ_i denote agent i's weight in surplus sharing ($\sum \theta_i = 1$), $\theta = (\theta_1, \theta_2)$, and agent i's outside value be defined by (3), then individualism chooses

$$(z(\theta), \lambda(\theta)) = \arg\max_{(z,\lambda)} [u(w - z_1 w) + v(\lambda_1 \phi w g(z))] \tag{4}$$

subject to

$$\theta_2 [u(w - z_1 w) + v(\lambda_1 \phi w g(z)) - \kappa_1] = \theta_1 [u(w - z_2 w) + v(\lambda_2 \phi w g(z)) - \kappa_2], \tag{5}$$

I assume that agents are engaged in group production only when cooperation generates positive surplus; that is for both $(z, \lambda) = (z^{co}, \lambda^{co})$ and $(z, \lambda) = (z(\theta), \lambda(\theta))$,

$$\sum_i [u(w - z_i) + v(\lambda_i \phi w g(z)) - \kappa_i] > 0. \tag{6}$$

Proposition 1 *Let $c_i = w - z_i w$, $c_{i+} = \lambda_i \phi g(z) w$, and $g_i(z) = \partial g(z)/\partial z_i$.*

(i) For both $(z, \lambda) = (z^{co}, \lambda^{co})$ and $(z, \lambda) = (z(\theta), \lambda(\theta))$,

$$u'(c_i) = v'(c_{i+}) \phi w g_i(z) \text{ for all } i. \tag{7}$$

Moreover, for $(z,\lambda) = (z^{co}, \lambda^{co})$*, either (a)* $\lambda_1 = \lambda_2$ *or (b) for one* i*,* $\lambda_i > \lambda_j$ *(*$j \neq i$*) and* $u(c_i) + v(c_{i+}) = \kappa_i$*.*

(ii) There exists a unique θ *such that* $(z(\theta), \lambda(\theta)) = (z^{co}, \lambda^{co})$*. This* θ *is* $(0.5, 0.5)$ *in the absence of type heterogeneity (i.e.,* $\eta_1 = \eta_2$*, and* $g(z_1, z_2) = g(z_2, z_1)$ *if* $z_1 = z_2$*), and satisfies* $\theta_i = 0$ *if agent* i*'s participation constraint is binding under collectivism.*

Proof. To prove part (i), fir let $(z, \lambda) = (z^{co}, \lambda^{co})$. By the positive surplus condition, the participation constraint can be binding (2) for at most one agent. When (2) is not binding for either agent, by strict concavity of v, $\lambda_1 = \lambda_2$. Given this, the first order conditions of z_1 and z_2 imply (7). When (2) is binding for one agent, say, agent 1, $\{z_i, \lambda_i\}$ also solves

$$\max u(w - z_2 w) + v(\lambda_2 \phi g(z) w) \tag{8}$$

subject to

$$u(w - z_1 w) + v(\lambda_1 \phi g(z) w) = \kappa_1. \tag{9}$$

Letting ψ denote the Lagrangian multiplier for the constraint (9), the first order conditions are

$$\psi u'(c_1) = [\psi \lambda_1 v'(c_{1+}) + \lambda_2 v'(c_{2+})] \phi g_1(z) w,$$

$$u'(c_2) = [\psi \lambda_1 v'(c_{1+}) + \lambda_2 v'(c_{2+})] \phi g_2(z) w,$$

and $\psi v'(c_{1+}) = v'(c_{2+})$. These imply (7) again. By the positive surplus condition, if $\lambda_1 < \lambda_2$ then slightly reducing λ_2 makes neither participation constraint binding but increases the joint welfare (because v is strictly concave). So we must have $\lambda_1 > \lambda_2$.

Next let $(z, \lambda) = (z(\theta), \lambda(\theta))$. Let μ denote the Lagrangian multiplier for the constraint (5). Then for the problem in (4), the first order conditions on z_1, z_2, and λ_1 are

$$u'(c_1) = \frac{\lambda_1 (1 - \mu\theta_2) v'(c_{1+}) + \lambda_2 \mu \theta_1 v'(c_{2+})}{1 - \mu\theta_2} \phi g_1(z) w, \tag{10}$$

$$u'(c_2) = \frac{\lambda_1 (1 - \mu\theta_2) v'(c_{1t+1}) + \lambda_2 \mu \theta_1 v'(c_{2+})}{\mu\theta_1} \phi g_2(z) w, \tag{11}$$

$$(1 - \mu\theta_2) v'(c_{1+}) = \mu\theta_1 v'(c_{2+}). \tag{12}$$

These immediately imply condition (7).

For part (ii), it suffices to consider the case that $\lambda_1 = \lambda_2$. Substituting these values into the surplus-sharing constraint (5) yields a unique candidate θ_1. With this θ_1, the same allocation satisfies the first-order conditions (10)-(12) under individualism (with the Lagrangian multiplier μ determined by (12). This establishes existence and uniqueness of θ_1. In the absence of type heterogeneity, we have $z_1 = z_2$, $c_{1+} = c_{2+}$, and $\eta_1 = \eta_2$. Substituting into the sharing constraint (5) immediately implies $\theta_1 = 0.5$. ■

The basic logic of Proposition 1 is straightforward. Collectivism selects a Pareto-efficient allocation for the two agents, while varying surplus weights under individualism traces out the same Pareto frontier. This replication, however, does not imply that the two norms are equivalent. This replication does not imply that the two norms are equivalent. Rather, it highlights the central feature of the individualistic spirit: admissible surplus weights are constrained by agents' relative technological importance and outside-option values.

In what follows, I distinguish between a *weak* individualistic ordering, which requires that an agent with a stronger position is not assigned a lower surplus weight, and a *strong* individualistic ordering, which further restricts surplus weights not to exceed relative importance.

In the absence of type heterogeneity, both orderings imply equal treatment, which coincides with the weights that replicate the collectivist allocation. Under heterogeneity, such coincidence is no longer guaranteed. The implications of these orderings for surplus weights in asymmetric environments are the focus of the next section.

3 Implications of the individualistic ordering

This section characterizes how the implications of the individualistic ordering depend on the source of heterogeneity within cooperation. When heterogeneity arises solely from outside values, individualism can increase output. When it reflects differences in technological importance, individualism can reduce output.

These results are established under the functional forms $u(c) = v(c) = \ln c$ and

$$g(z) = 2(\zeta_1 z_1^\sigma + \zeta_2 z_2^\sigma)^{1/\sigma}. \tag{13}$$

In the CES function, the parameter $\zeta_i \in [0, 1]$ reflects technological importance of agent i ($\sum \zeta_i = 1$), and the parameter $\sigma \leq 1$ governs complementarity between the two inputs (perfect substitutes when $\sigma = 1$, with complementarity increasing as σ decreases).

Using these functional forms, one can write the optimal condition (7) as

$$\lambda_i g(z) = (1 - z_i) g_i(z) \text{ for all } i. \tag{14}$$

Moreover, outside value κ_i in (3) can be written as

$$\kappa_i = \ln 0.5w + \ln 0.5\eta_i \phi w.$$

Thus, the surplus of agent i under a given pair (z, λ) is

$$\ln[4(1 - z_i)\lambda_i g(z)/\eta_i]. \tag{15}$$

When λ_i takes the value in (14), this surplus equals

$$S_i(z) \equiv \ln 4(1 - z_i)^2 g_i(z)/\eta_i, \tag{16}$$

and the surplus-sharing constraint (5) becomes

$$\theta_2 S_1(z) = \theta_1 S_2(z). \tag{17}$$

I begin by building devices to analyze the output effect of a norm on (14).

Lemma 1 *Let* $Z = \{z : 2g(z) = \sum_i g_i(z)\}$. *If* z *satisfies* (14) *then* $z \in Z$. *Moreover, the following is true for each* i *and* $j \neq i$.

(i) The set $Z_i \equiv \{z_i : z \in Z\}$ *is connected,* $\min Z_i < 0.5 < \max Z_i$, *and there exists a decreasing and differentiable function* π_j *on* Z_i *such that* $\pi_j(0.5) = 0.5$, *that* $z \in Z$ *if the* j*-th component of* z *equals* $\pi_j(z_i)$ *(i.e.,* $(z_1, z_2) \in Z$ *if* $z_j = \pi_j(z_i)$*), and that*

$$z_i > 0.5 \text{ implies } z_j = \pi_j(z_i) < 0.5. \tag{18}$$

(ii) On Z, $S_i(z)$ *is decreasing in* z_i *and increasing in* z_j.

(iii) Let $h_i(z_i) = g(z)$, *where the* j*-th component of* z *equals* $\pi_j(z_i)$. *Then* $h_i(z_i)$

is constant on Z_i if $\sigma = 1$, and is increasing on $[0.5, maxZ_i]$ and decreasing on $[minZ_i, 0.5]$ if $\sigma < 1$.

(iv) If $\sigma < 1$, $\zeta_i \geq \zeta_j$, and $x > 0.5$, then $h_i(x) \geq h_j(x)$.

Proof. Because $g(z) = \sum_i z_i g_i(z)$, condition (14) implies $z \in Z$.

Part (i). To characterize Z, define $\rho(x) = x^{\sigma-1}(2x-1)$ for $x > 0$. Then $z \in Z$ if and only if

$$\zeta_1 \rho(z_1) + \zeta_2 \rho(z_2) = 0. \tag{19}$$

Because $\rho(0.5) = 0$, $(z_1, z_2) = (0.5, 0.5)$ solves (19). Because $\rho'(x) = 2\sigma x^{\sigma-1} - (\sigma - 1)x^{\sigma-2} > 0$, by the implicit function theorem, equation (19) defines a differentiable function π_j such that $z_j = \pi_j(z_i)$ with

$$\pi_j'(z_i) = -\frac{2\sigma z_i - (\sigma-1)}{2\sigma z_j - (\sigma-1)} \frac{\zeta_i z_i^{\sigma-2}}{\zeta_j z_j^{\sigma-2}}. \tag{20}$$

Moreover, if $z_i > 0.5$ then $\pi_j(z_i) < 0.5$.

Part (ii). Define $L_{ik}(z_i) = S_k(z)$ for $k = 1, 2$, where the j-th component of z is $\pi_j(z_i)$. Because $S_k(z_1, z_2) = L_{1k}(z_1) = L_{2k}(z_2)$, it suffices to show $L_{ii}'(z_i) < 0$ and $L_{ij}'(z_i) > 0$ for $j \neq i$.

We first show these for $z_i \geq 0.5$. Without loss of generality, set $i = 1$ so $z_2 = \pi_2(z_1) \leq 0.5$. Direct differentiation yields

$$L_{11}'(z_1) = -\frac{2}{1-z_1} + \frac{\sigma-1}{z_1} + \frac{(1-\sigma)[\zeta_1 z_1^{\sigma-1} + \zeta_2 z_2^{\sigma-1}\pi_2'(z_1)]}{\zeta_1 z_1^{\sigma} + \zeta_2 z_2^{\sigma}} \tag{21}$$

and

$$L_{12}'(z_1) = [-\frac{2}{1-z_2} + \frac{\sigma-1}{z_2}]\pi_2'(z_1) + \frac{(1-\sigma)[\zeta_1 z_1^{\sigma-1} + \zeta_2 z_2^{\sigma-1}\pi_2'(z_1)]}{\zeta_1 z_1^{\sigma} + \zeta_2 z_2^{\sigma}}. \tag{22}$$

Let us first consider $L_{12}'(z_1)$. Using the expression for $\pi_2'(z_1)$ in (20), the term $\zeta_1 z_1^{\sigma-1} + \zeta_2 z_2^{\sigma-1}\pi_2'(z_1)$ has the same sign as

$$z_1 - z_2 \frac{2\sigma z_1 + (1-\sigma)}{2\sigma z_2 + (1-\sigma)},$$

which is nonnegative when $z_1 \geq 0.5 \geq z_2$. Because $\pi_2'(z_1) < 0$, it follows that $L_{12}'(z_1) > 0$.

For $L'_{11}(z_1)$, $\pi'_2(z_1) < 0$ gives

$$-\frac{1}{z_1} + \frac{1}{\zeta_1 z_1^\sigma + \zeta_2 z_2^\sigma}[\zeta_1 z_1^{\sigma-1} + \zeta_2 z_2^{\sigma-1}\pi'_2(z_1)] = \frac{-\zeta_2 z_2^\sigma + \zeta_2 z_2^{\sigma-1}\pi'_2(z_1)}{z_1(\zeta_1 z_1^\sigma + \zeta_2 z_2^\sigma)} < 0,$$

which implies $L'_{11}(z_1) < 0$.

To show $L'_{ii}(z_i) < 0$ and $L'_{ij}(z_i) > 0$ for $z_i < 0.5$, again, set $i = 1$. Because $L_{1k}(z_1) = L_{2k}(\pi_2(z_1))$, $\pi'_2(z_1) < 0$, and $z_2 = \pi_2(z_1) > 0.5$ (by (18)), the inequalities follow from the signs of $L'_{21}(z_2)$ and $L'_{22}(z_2)$ for $z_2 > 0.5$.

Part (iii). By (20), $h'_i(z_i)$ has the same sign as $(1/z_j - 1/z_i)[(1-\sigma)/z_j + 2\sigma]^{-1}$. If $\sigma = 1$, then $h'_i(z_i) = 0$ so h_i is constant. Now consider $\sigma < 1$. By (18), if $z_i > 0.5$ then $h'_i(z_i) > 0$. If $z_i < 0.5$, use $h_i(z_i) = h_j(\pi_j(z_i))$ and $\pi'_j(z_i) < 0$. Because $z_j = \pi_j(z_i) > 0.5$ (by (18)) and $h'_j(z_j) > 0$ at $z_j > 0.5$, we have $h'_i(z_i) = h'_j(\pi_j(z_i))\pi'_j(z_i) < 0$. Because $h'_i(0.5) = 0$, it follows that $h_i(z_i)$ is increasing on $[0.5, \max Z_i]$ and decreasing on $[\min Z_i, 0.5]$.

Part (iv). Without loss of generality, set $i = 1$. We shall show $g(x, \pi_2(x)) \geq g(\pi_1(x), x)$. Using (19), we have $\zeta_1\rho(x) = -\zeta_2\rho(\pi_2(x))$ and $\zeta_2\rho(x) = -\zeta_1\rho(\pi_1(x))$. Thus $(\zeta_1/\zeta_2)^2\rho(\pi_1(x)) = \rho(\pi_2(x))$. By $\zeta_1 \geq \zeta_2$ and $\rho' > 0$, $\pi_2(x) \geq \pi_1(x)$. It follows that

$$g(x, \pi_2(x)) \geq g(\pi_2(x), x) \geq g(\pi_1(x), x),$$

where the first inequality uses $\zeta_1 \geq \zeta_2$ and the second $\pi_2(x) \geq \pi_1(x)$. ■

Lemma 1 (i) characterizes the set Z of input vectors that satisfy the common optimal condition (14) for both norms. This set can be parameterized by either agent's input. In Lemma 1 (ii) and (iii), the surplus function S_i and the output function h_i trace along agent i's input in this set and provide convenient devices for comparing norms. Lemma 1 (ii) shows that each agent's surplus is decreasing in his own input (because higher effort reduces current consumption) and increasing in his partner's input.

Lemma 1 (iii) implies that when inputs are perfect substitutes ($\sigma = 1$), culture does not affect output (output is constant on Z). Remarkably, the same null effect of culture holds at the opposite polar case of perfect complementarity (σ at the $-\infty$ limit), where $g(z) = 2\min\{z_1, z_2\}$ and both norms yield $z = (0.5, 0.5)$.

The fact that the two norms produce identical output in these two polar cases motivates to examine the full range of imperfect complementarity. In this intermediate range, Lemma 1 (iii) delivers a decisive observation: output is minimized at the symmetric input vector $(0.5, 0.5)$ and increases as inputs become more asymmetric.

Lemma 2 *Let* $Z' = \{z \in Z : S_i(z) \geq 0$ *for all* i *and strict for at least one* $i\}$. *Then* $Z' = \{z(\theta) : \theta$ *ranges over all surplus weights*$\}$ *and the following is true.*

(i) For each i, $z_i(\theta)$ *is decreasing in* θ_i.

(ii) Let $\theta^* = argmax_\theta g(z(\theta))$. *Then* $\theta_1^* \theta_2^* = 0$.

Proof. If $z \in Z$ then one can solve θ from (17) so that $z = z(\theta)$. Because $z(\theta) \in Z'$ for any θ, $Z' = \{z(\theta) : \text{all } \theta\}$. Part (i) follows from Lemma 1 (ii), which establishes that each agent's surplus is decreasing in his own input and increasing in his partner's input. Given part (i), part (ii) follows from Lemma 1 (iii), which shows that output increases as inputs become more asymmetric. ■

Lemma 2 gives a sharp characterization of the output maximizing surplus weights θ^*: they must lie at a corner. Which agent is going to receive the full weight, and whether it is consistent with the individualistic ordering, depends on parameter values.

Thus far, no restrictions have been imposed on parameter values. A natural restriction is that technological importance and outside values are aligned: a more pivotal agent has a weakly higher outside value, and an agent with a higher outside value is not less pivotal. Under this restriction, the weak individualistic ordering yields an unambiguous ranking between the two agents.

However, η_i and ζ_i turn out to have opposing effects on output. As a result, whether the output-maximizing weights θ^* are consistent with the weak individualistic ordering depends on which force dominates. To isolate these effects, I focus on the parameter range in which

$$\text{either (a) } \zeta_i = \zeta_j \text{ or (b)} \zeta_i > \zeta_j \text{ and } \zeta_i/\zeta_j \geq \eta_i/\eta_j \geq 1 \ (j \neq i). \tag{23}$$

This range covers two cases: (a) identical technological importance, where outside-value differences are the sole source of heterogeneity; and (b) a more pivotal agent whose relative technological importance (ζ_i/ζ_j) weakly outweighs his relative outside value (η_i/η_j).

Lemma 3 *Given (23),* $(0.5, 0.5) \in Z'$ *if and only if* $\eta_j < 2\zeta_j$*. Moreover, the following is true if* $\sigma < 1$*.*

(i) Suppose $(0.5, 0.5) \in Z'$*. Define* θ° *by* $z(\theta^\circ) = (0.5, 0.5)$ *and* $\theta_2^\circ S_1(z(\theta^\circ)) = \theta_1^\circ S_2(z(\theta^\circ))$*. Then the composite function* $h_i(z_i(\theta_i))$ *is decreasing on* $[0, \theta_i^\circ]$ *and increasing on* $[\theta_i^\circ, 1]$*. In particular,* $\theta_i^* = 0$ *if* $\zeta_i = \zeta_j$ *and* $\eta_j > \eta_i$*, or if* $\zeta_i > \zeta_j$*.*

(ii) Suppose $(0.5, 0.5) \notin Z'$*. Then* $z_i(\theta_i) \geq 0.5$ *for all* θ_i *and* $h_i(z_i(\theta_i))$ *is decreasing in* θ_i*. In particular,* $\theta_i^* = 0$*.*

Proof. The necessary and sufficient condition for $(0.5, 0.5) \in Z'$ can be directly verified using (1).

Part (i). Because $z_i(\theta^\circ) = 0.5$, it follows from Lemma 1 (iii) and Lemma 2 (i) that $h_i(z_i(\theta_i))$ is decreasing on $[0, \theta_i^\circ]$ and increasing on $[\theta_i^\circ, 1]$.

To proceed, suppose either $\zeta_i = \zeta_j$ and $\eta_j > \eta_i$ or $\zeta_i > \zeta_j$. Under (23), either one implies $S_i(z(\theta^\circ)) > S_j(z(\theta^\circ)) \geq 0$. To determine the value of θ_i^*, it suffices to compare the two corner outcomes (by Lemma 2 (ii))

$$a = z(0, 1) \text{ and } b = z(1, 0).$$

Without loss of generality, let $i = 1$ (so $S_1(z(\theta^\circ)) > S_2(z(\theta^\circ)) \geq 0$). Then $\theta_1^* = 0$ follows from

$$h_1(a_1) > h_2(b_2). \tag{24}$$

Because $S_1(z(\theta^\circ)) > 0$, Lemma 1 (ii) implies

$$a_2 < 0.5 < a_1,$$

so by Lemma 1 (iii), $h_1(b_1) > g(0.5, 0.5)$. If $S_2(z(\theta^\circ)) = 0$ then we are done. For, by Lemma 1 (ii), $z_2(\theta) \leq 0.5$ for all θ so by Lemma 1 (iii), $h_2(b_2) < g(0.5, 0.5)$. Therefore, suppose $S_2(z(\theta^\circ)) > 0$ so that

$$b_1 < 0.5 < b_2.$$

Using $S_1(a) = 0$ and $S_2(b) = 0$, we obtain

$$8(1 - a_1)^2 a_1^{\sigma - 1}(\zeta_1 a_1^\sigma + \zeta_2 a_2^\sigma)^{1/\sigma - 1} = \frac{\eta_1}{\zeta_1},\ a_2 = \pi_2(a_1), \tag{25}$$

$$8(1 - b_2)^2 b_2^{\sigma - 1}(\zeta_1 b_1^\sigma + \zeta_2 b_2^\sigma)^{1/\sigma - 1} = \frac{\eta_2}{\zeta_2},\ b_1 = \pi_1(b_2). \tag{26}$$

We claim that for $z_1 \in Z_1$, $(\zeta_1 z_1^\sigma + \zeta_2 z_2^\sigma)^{1/\sigma - 1}$ with $z_2 = \pi_2(z_1)$ is increasing on $[0.5, \max Z_1]$. To see this, recall that $h(z_1)$ is increasing on $[0.5, \max Z_1]$ (Lemma 1 (iii)). So $\zeta_1 z_1^\sigma + \zeta_2 z_2^\sigma$ with $z_2 = \pi_2(z_1)$ is increasing if $1 > \sigma \geq 0$ and decreasing if $\sigma < 0$, implying the claim.

Now let $a' \in Z$ satisfy $a'_1 = b_2$ and $a'_2 = \pi_2(a'_1)$. Then

$$8(1 - a'_1)^2 a_1'^{\sigma - 1}(\zeta_1 a_1'^\sigma + \zeta_2 a_2'^\sigma)^{1/\sigma - 1} > 8(1 - b_2)^2 b_2^{\sigma - 1}(\zeta_1 b_1^\sigma + \zeta_2 b_2^\sigma)^{1/\sigma - 1} = \frac{\eta_2}{\zeta_2} \geq \frac{\eta_1}{\zeta_1}, \tag{27}$$

where the first inequality uses $b_1 < 0.5 < b_2$, $a_2 < 0.5 < a_1$, and the claim, and the equality uses (26).

Comparing (27) with (25) and applying the claim once more, we have $a_1 > a'_1$ and so by Lemma 1 (iii),

$$h_1(a_1) > h_2(a'_1).$$

By $\zeta_1 \geq \zeta_2$ and $a'_1 = b_2$, Lemma 1 (iv) implies $h_1(a'_1) > h_2(b_2)$, leading to (24).

Part (ii). By $\eta_j \geq 2\zeta_j$, $S_j(0.5, 0.5) \leq 0$. By Lemma 1 (ii), this implies $z_j(\theta) \leq 0.5$ for all θ and, thus by (18), $z_i(\theta) \geq 0.5$ for all θ. Then by Lemma 2 (i) and Lemma 1 (iii), $h_i(z_i(\theta_i))$ is decreasing in θ_i, $h_i(z_i(\theta_i)) \geq h_i(0.5)$, and $h_j(0.5) \geq h_j(z_j(\theta))$. Because $h_i(0.5) = h_j(0.5)$, θ_i^* must be zero. ∎

Lemma 3 highlights the critical role of the source of heterogeneity in determining the output maximizing weights. When agents differ only in outside values, agent i has a lower one. As a result, the input of agent j at $\theta_j = 1$ exceeds the input of agent i at $\theta_i = 1$. Because the two inputs enter symmetrically, assigning all surplus weight to agent j maximizes output. This is consistent with the weak individualistic ordering, as it prioritizes the agent with the stronger outside value.

When agents also differ in technological importance, the logic changes. Now agent i's technological importance outweighs his relative outside value. Precisely because his input is more important, assigning all surplus weight to agent j again maximizes output. This, however, violates the weak individualistic ordering, as it prioritizes the less pivotal agent.

In this case, the response of output to changes in θ_j depends on parameter values. If agent j's outside value is sufficiently high ($\eta_j \geq 2\zeta_j$), his input is bounded above by 0.5, and output is increasing in θ_j. Otherwise, this monotonicity is lost:

once θ_j falls below θ_j° (where each agent contributes 0.5), output increases with θ_j, as the less important input z_j expands and substitutes for the more important input z_i.

The next lemma characterizes the collectivist allocation.

Lemma 4 *Let $\tilde{z} \in Z$ be the unique solution to* (14) *when $\lambda = (0.5, 0.5)$. Then $\tilde{z} = (0.5, 0.5)$ and $\tilde{z} \in Z'$ if $\zeta_i = \zeta_j$, and $\tilde{z}_i > 0.5 > \tilde{z}_j$ if $\zeta_i > \zeta_j$. Define*

$$\tilde{\iota} = \min_i \left\{ \frac{0.5(1-\tilde{z}_i)g(\tilde{z})}{\eta_i} \right\}.$$

Given (23)*, the following holds.*

(i) If $\tilde{\iota} < 1$, then $\lambda_i^{co} > \lambda_j^{co}$ and $z^{co} = z(\theta)$ with $\theta_i = 0$.

(ii) If $\tilde{\iota} \geq 1$, then $\lambda_i^{co} = \lambda_j^{co}$ and $z^{co} = \tilde{z}$. Moreover, if $\zeta_i > \zeta_j$, then $\tilde{\theta}_i < 0.5 < \theta_i^\circ$, where $\tilde{\theta}$ is defined by $\tilde{z} = z(\tilde{\theta})$, and if in addition

$$\zeta_j \ln(\zeta_i/\eta_i) \geq \zeta_i \ln(\zeta_j/\eta_j), \tag{28}$$

then $\tilde{\theta}_i < \zeta_i < \theta_i^\circ$.

Proof. The statements about $\tilde{z}$ follow directly from (14) and (16).

Part (i). By definition, $\tilde{\iota} < 1$ implies that there exists some $k \in \{1, 2\}$ such that

$$\frac{0.5(1-\tilde{z}_i)g(\tilde{z})}{\eta_i} < 1,$$

i.e., $S_k(\tilde{z}) < 0$ and thus $\tilde{z} \notin Z'$. Because the collectivist allocation z^{co} is in Z', it cannot be $\tilde{z}$. By Proposition 1 (i), z^{co} must therefore lie on the boundary where one participation constraint binds and $\lambda_i^{co} \neq \lambda_j^{co}$. Because $\tilde{\iota} < 1$ also rules out $\zeta_i = \zeta_j$, under (23), we must have $\zeta_i > \zeta_j$ and $\zeta_i/\zeta_j \geq \eta_i/\eta_j \geq 1$. We claim that $\lambda_i^{co} > \lambda_j^{co}$. By Proposition 1 (i), the claim implies implies that the binding constraint is that of agent j, $S_i(z^{co}) = 0$. Thus, z^{co} coincides with the individualistic solution with $\theta_i = 0$, i.e., $z^{co} = z(\theta)$ with $\theta_i = 0$.

To verify the claim, assume by contradiction $\lambda_i^{co} < \lambda_j^{co}$. Then by Proposition 1 (i), $S_j(z^{co}) = 0$. But $\zeta_i > \zeta_j$ and (14) require $z_i^{co} > z_j^{co}$. This, $\lambda_i^{co} < \lambda_j^{co}$, and $\eta_i \geq \eta_j$ imply that under (z^{co}, λ^{co}), the surplus of agent i (see (15)) is less than the surplus of agent j, i.e., $S_i(z^{co}) < S_j(z^{co}) = 0$, a contradiction.

Part (ii). By definition, $\tilde{\iota} \geq 1$ implies $S_k(\tilde{z}) \geq 0$ for $k = 1, 2$, so $\tilde{z} \in Z'$. By Proposition 1 (i), $z^{co} = \tilde{z}$ and $\lambda_i^{co} = \lambda_j^{co}$. Now suppose $\zeta_i > \zeta_j$ so $\eta_i \geq \eta_j$. From (14),

$$(1 - \tilde{z}_i)\zeta_i(\tilde{z}_i)^{\sigma-1} = (1 - \tilde{z}_j)\zeta_j(\tilde{z}_j)^{\sigma-1} \tag{29}$$

so $\tilde{z}_i > 0.5 > \tilde{z}_j$ and thus

$$\frac{1 - \tilde{z}_i}{\eta_i} < \frac{1 - \tilde{z}_j}{\eta_j}.$$

This and (29), in turn, imply $S_i(\tilde{z}) < S_j(\tilde{z})$. Using (17), we obtain $\tilde{\theta}_i < 0.5$. To see $0.5 < \theta_i^\circ$, apply (17) to $\hat{\theta} \equiv (0.5, 0.5)$. By $\zeta_i/\eta_i \geq \zeta_j/\eta_j$, $z_i(\hat{\theta}) > z_j(\hat{\theta})$. Then $0.5 < \theta_i^\circ$ follows from $z(\theta^\circ) = (0.5, 0.5)$ and Lemma 2 (i). Finally, we show that (28) implies $\theta_i^\circ \geq \zeta_i$. Note that $S_k(z(\theta^\circ)) = \ln(\zeta_k/\eta_k)$ for $k = 1, 2$. So we have

$$\frac{\theta_i^\circ}{\theta_j^\circ} = \frac{S_i(z(\theta^\circ))}{S_j(z(\theta^\circ))} \geq \frac{\zeta_i}{\zeta_j},$$

where the equality uses (17) and the inequality uses (28). This completes the proof. ■

Lemma 4 shows that the effect of collectivism on output also depends on the source of heterogeneity. When agents differ only in outside values, collectivism selects the output-minimizing symmetric input vector $(0.5, 0.5)$, and assigns equal shares of output to the two agent.

When agents differ in technological importance, the outcome changes. If the more pivotal agent has sufficiently strong technological importance, he supplies the output-maximizing input and receives a larger share of output as compensation, while his participation constraint binds so that his surplus is zero. This outcome directly conflicts with the individualistic ordering.

Even when the more pivotal agent obtains positive surplus under collectivism, his implied surplus weight can remain below his technological importance. In this case, collectivism can generate higher output than individualism when surplus weights under individualism satisfy the strong individualistic ordering (the more pivotal agent is not assigned a relative surplus weight exceeding his relative technological importance).

Integrating the above lemmas, the next proposition summarizes the main findings of this section.

Proposition 2 *If $\sigma = 1$, then $g(z(\theta)) = g(z^{co})$ for all θ. Otherwise, the following holds given (23).*

(i) Suppose $\zeta_i = \zeta_j$. If $\eta_j > \eta_i$, then $g(z(\theta)) > g(z^{co})$ for $\theta_j \geq 0.5$.

(ii) Suppose $\zeta_i > \zeta_j$. If $\tilde{\imath} < 1$, or if $\tilde{\imath} \geq 1$ and $\eta_j \geq 2\zeta_j$, then $g(z^{co}) > g(z(\theta))$ for $\theta_i \geq 0.5$. Otherwise, $g(z^{co}) > g(z(\theta))$ for $\theta_i \in [0.5, \theta_i^\circ]$.

Group with $I > 2$ agents

The bilateral structure is not essential for these results. Both collectivist and individualist norms extend naturally to I-person groups for $I > 2$. Collectivism continues to maximize joint surplus so that the problem (1) remains unchanged apart from extending the summation over all agents. Under individualism, Kalai proportional bargaining admits a direct I-person formulation that preserves relative claims. In particular, the surplus-sharing condition (5) becomes

$$\theta_i[u(c_1) + v(c_{1+}) - \kappa_1] = \theta_1[u(c_i) + v(c_{i+}) - \kappa_i] \tag{30}$$

for $i \geq 2$. The production function g has the property as before, with $g(1, ..., 1) = I$. Consequently, the optimality condition (7) remains unchanged.

Consider a star structure with one pivotal agent, say agent 1, and $I - 1$ symmetric partners, i.e., $\zeta_1 \geq \zeta_2 = ... = \zeta_I$ and $\eta_1 \geq \eta_2 = ... = \eta_I$, $z_i = z_2$ for $i \geq 2$. The equilibrium conditions reduce to those of the two-agent case. Under the functional form $u(c) = v(c) = \ln c$ and $g(z) = I(\sum \zeta_i z_i^\sigma)^{1/\sigma}$, (14) continues to hold. By identifying agent i as agent 1 and agent j as agent 2, Lemmas 1-4 apply without modification. Aggregate production is determined by

$$g(z) = I(\zeta_1 z_1^\sigma + (1 - \zeta_1) z_2^\sigma)^{1/\sigma}.$$

As a result, the effort allocation mechanism and its implications for output and welfare carry over directly.

Conceptually, when I is large, the star structure magnifies technological asymmetry: even with moderate ζ_1, each non-pivotal agent's share ζ_2 becomes small, so ζ_1/ζ_2 is large. This amplifies the effort allocation effect and strengthens the output advantage of collectivism.

To obtain a quantitative sense, let $I = 10$, $\zeta_1 = 0.3$, $\eta_1 = 0.3$, $\eta_2 = 0.1$, and $\sigma = -0.5$. When θ matches ζ_1/ζ_2, $z(\theta) = (0.12, 0.5)$ and $g(z(\theta)) = 2.93$. For comparison, $z^{co} = (0.62, 0.48)$ and $g(z^{co}) = 4.51$, about 54% higher. The output ratio $g(z^{co})/g(z(\theta))$ increases with I: it exceeds 2 at $I = 20$ and 2.3 at $I = 30$.

Dynamic effects in general equilibrium

The static model clearly shows that cultural norms can yield different output levels depending on the physical environment. In particular, collectivism can generate higher output when technological roles differ. In general equilibrium, the output effect of a norm can be amplified, depending on the broader mechanisms at play.

For illustration, one may think of embedding the static two-person or general I-person group model into a two-period-lived overlapping generations (OLG) growth model. In this setup, young agents receive wages, form groups, and invest in producing capital goods. These investments affect both their consumption when young and their capital (and thus consumption) when old. The cultural norms governing surplus sharing within these groups influence the choices regarding investment levels.

In the most straightforward version, group production merely reproduces capital, and each group's output is a perfect substitute for others'. Then the fundamental output differences between collectivism and individualism in the static model operate analogously to differences in saving rates a Solow model: higher group output translates into greater capital accumulation and higher steady-state consumption. The quantitative illustration above suggests that these differences can be substantial, especially when technological asymmetries are amplified in large groups.

The two norms can have even more pronounced long-run implications in environments with additional amplifying mechanisms. For example, group production may generate technological innovation, or the capital goods produced by different groups may be highly complementary. In the latter case, one may think of each group producing an intermediate capital good, with final capital formed by combining these intermediates in an O-ring structure.

4 Interpretation: cooperative tasks and cultural norms

The model links cultural norms to environments characterized by ongoing cooperative tasks. In such environments, production requires continuous interaction among agents, often involving real-time coordination and mutual adjustment. When cooperation is ongoing rather than episodic, individual inputs are interdependent over the course of production, and the efficiency of the group depends on sustained alignment of effort. In these settings, the collectivist norm that prioritizes group outcomes over individual claims can support higher output, particularly when inputs are complementary.

Ongoing cooperative tasks in practice

Environments characterized by ongoing cooperative tasks are pervasive, spanning from early societies to modern economies. In hunter-gatherer societies, production typically required real-time coordination and shared effort, with group survival depending on synchronized action, such as in hunting. The transition to agriculture further shaped cultural selection according to the physical demands of the land: irrigation-based farming, such as rice cultivation, requires sustained collective investment in shared infrastructure and precise coordination of water allocation. In modern settings, similar features arise in high-reliability organizations (e.g., nuclear power plants, air traffic control), where continuous coordination is essential to prevent catastrophic failure (Reason [19]; Gawande [7]). Research on scientific production likewise documents a shift toward team-based collaboration as frontier complexity has moved innovation away from the "lone genius" model (Merton [17]).

Across these environments, collectivist norms appear to be more prevalent. Egalitarian sharing and strong collective practices are widely documented in hunter-gatherer societies (Boehm [5]; Woodburn [27]). In agriculture, rice-growing regions exhibit persistent preferences for collectivist norms (Talhelm et al. [21] and Talhelm and Dong [22]). In modern contexts, a substantial literature documents the importance of collectivist practices in environments requiring deep coordination, including high-reliability organizations, frontier scientific research, entrepreneurial teams, and professional sports (Weick and Roberts [26]; Jones et al. [14]; Baron et al. [3]; Kahn [15]). Early-stage firms, for example, often adopt clan-like cultures to manage high uncertainty and non-modular tasks (Baron et al. [3]; Hellmann and Puri [12]), while evidence from professional sports highlights how individual incentives can undermine performance when complementarities are strong (Azoulay et al. [1]; Frick [6]).

Nonlinearity in the advantage of cultural norms

The evidence above suggests that the advantage of a cultural norm is not tied to a single stage of development. Rather, the same norm may be advantageous in very different environments. The framework developed above helps organize this observation by highlighting two dimensions that evolve with development and jointly shape the relative performance of cultural norms.

Dimension 1: the structure and degree of division of labor

In early societies, division of labor was limited, yet group production often depended on a pivotal individual whose effort was critical for coordination. In such environments, the technological importance of this role was high, as group success hinged on coordinated action in tasks where failure could be catastrophic. Collectivism, by sustaining alignment of effort, could therefore be highly effective.

As economies develop, division of labor deepens and becomes more structured. Within groups, individuals take on specialized roles, and some aspects of production become more modular. In this intermediate stage, the advantages of collectivism may weaken, as coordination can increasingly be supported by clearer task boundaries. The theory above suggests that individualism can enhance output when heterogeneity arises from differences in outside values.

In modern economies, division of labor becomes both deep and pervasive. Production involves tightly interdependent tasks within groups and across groups, generating complementarities at multiple levels. The importance of pivotal roles re-emerges: not through coordination per se, but through differences in the technological importance of specialized inputs. When production exhibits strong complementarities, the mechanism emphasized in the model again favors collectivist norms, as they mitigate misalignment in effort allocation across inputs.

Dimension 2: the timing of investment and the role of information and sorting

Productive capacity depends on both pre-group investment, such as general skills acquired through education, and post-group effort within cooperation. The effectiveness of cultural norms depends on how these two stages interact.

In early societies, individuals operated within small communities where information about others' skills was readily available. This transparency limited frictions in group formation: agents could avoid low-skill partners, reducing inefficiencies in pre-group investment and allowing collectivist norms to prevail. As interactions expanded beyond local communities, however, information about partners' pre-group investments became more limited. In such environments, individuals may underinvest in general skills due to holdup: returns to pre-group investment can be partially appropriated after group formation. Because collectivism weakens the link between individual contribution and surplus, its advantage may be reduced at this stage.

In modern economies, improvements in information and matching technologies—through formal credentials, labor market institutions, and digital platforms—partially restore the ability to sort individuals based on pre-group investment. When agents can match according to their skills, sorting mitigates inefficiencies in general-skill investment and allows cooperative production to operate closer to its efficient frontier. In this context, the theory above suggests that collectivism can again enhance performance by shaping post-group effort allocation within teams.

Nonlinearity

Taken together, these two dimensions imply that the relative advantage of cultural norms is not monotonic in economic development. Instead, it depends on how production is organized and how agents are matched. Collectivism may be advantageous in both early and advanced economies, but for different reasons: in early environments, because survival depends on coordinated effort around pivotal roles, and in advanced economies, because deep division of labor creates many technologically pivotal roles whose importance is not reducible to coordination alone. In intermediate environments where tasks are more modular and sorting is imperfect, the relative advantage of collectivism may diminish.

5 Concluding remarks

Cultural norms shape how effort is allocated within cooperative production. When production is non-linear, different norms select different input compositions, leading to different output outcomes. Individualism can improve performance when heterogeneity arises from outside values, but reduce it when it reflects technological importance. The advantage of cultural norms is therefore structurally endogenous and not monotonic in development.

Appendix

Nash bargaining

Let individualism be represented by generalized Nash bargaining so the problem in (4) is replaced by

$$(z,\lambda) = \arg\max_{(z,\lambda)} \prod_i [u(c_i) + v(c_{i+}) - \kappa_{it}]^{\theta_1}. \tag{31}$$

Now the first order conditions on z_1 and z_2 imply

$$\frac{1}{1-z_1} - \frac{g_1(z)}{g(z)} = \frac{g_1(z)}{g(z)}\frac{\zeta_2}{\zeta_1}\frac{\ln[4(1-z_1)\lambda_1 g(z)/\eta_1]}{\ln[4(1-z_2)\lambda_2 g(z)/\eta_2]}$$

and

$$\frac{1}{1-z_2} - \frac{g_2(z)}{g(z)} = \frac{g_2(z)}{g(z)}\frac{\zeta_1}{\zeta_2}\frac{\ln[4(1-z_2)\lambda_2 g(z)/\eta_2]}{\ln[4(1-z_1)\lambda_1 g(z)/\eta_1]},$$

while the first order condition on λ_1 implies

$$\frac{\lambda_2}{\lambda_1} = \frac{\zeta_2}{\zeta_1}\frac{\ln[4(1-z_1)\lambda_1 g(z)/\eta_1]}{\ln[4(1-z_2)\lambda_2 g(z)/\eta_2]}.$$

Combining these expressions yields (14) and

$$\theta_2(1-z_1)g_1(z)\ln[4(1-z_1)^2g_1(z)/\eta_1] = \theta_1(1-z_2)g_2(z)\ln[4(1-z_2)^2g_2(z)/\eta_2].$$

The last condition can be written as

$$\theta_2(1-z_1)\zeta_1 z_1^{\sigma-1}S_1(z) = \theta_1(1-z_2)\zeta_2 x_2^{\sigma-1}S_2(z). \tag{32}$$

Thus, Nash and Kalai share the same Z and Z' and the same allocations when one agent has all surplus weight. Moreover, Nash preserves the same weight ordering as Kalai for interior allocations in in Z'; that is, if z is associated with a higher surplus weight of agent 1 under Kalai that z', then this is also the case under Nash. Therefore, the results in section 3 can be carried over.

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