Choosing the Right Pond: Social Approval and Occupational Choice

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October 2001

* We are grateful to William Collins, Andy Daughety, Jennifer Reinganum and especially Ping Wang for valuable comments and suggestions.

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Abstract

We examine the impact of a desire for social approval on education and occupation choice and model the endogenous determination of perceptions that influence such approval. In a two-sector overlapping generations framework, agents born with ability endowments in both occupations must choose one as their career. An agent's choice is influenced by social approval, which depends upon the community's perception of her ability in her chosen career. The accuracy of a community's perception increases with the fraction of its members performing similar work, because it is easier to assess ability in one's own profession. With positive correlation in skills, the desire for social approval, combined with imperfect assessment of ability, leads to multiple steady states. In all steady states there is overcrowding in the favorably perceived occupation, with misallocation across both occupations. Which sector becomes the favorable occupation depends on the initial occupational composition in the community. When skill distributions differ across sectors, positive correlation in skills can result in a low-education trap as described by Wilson(1987) -- i.e. the entire community opts for the low variance (low-skilled) occupation. The model explains when individual pecuniary incentives may not reduce under-investment in education, and suggests alternative solutions to improve outcomes.

JEL Number: J24, I21

1. Introduction

The issues of educational attainment and occupational choice have been analyzed from various perspectives in economic literature. The development literature examines the impact of market imperfections, especially the lack of easy access to credit, on educational investment and occupational choice.[1] The labor literature addresses this issue based on a standard comparison of pecuniary costs and benefits.[2] However, decisions about educational and career choices are based on more than purely economic considerations. A desire for our choices to be appreciated by those in our social group, to meet their approval, is also a part of this decision. This paper analyzes the impact of this need for social approval on educational and occupational choices.

In doing so, it is related to the recent literature analyzing the impact of a desire for social status on occupational choice. While the desire for social approval (as we describe it) and social status are closely related, we make one important distinction. The papers in this recent literature treat the demand for status to be income elastic, while we view the desire for social approval as being universal -- it is not a concern of those at higher income levels alone.[3] Individuals care about the approval of elders and peers simply because they derive utility from the appreciation of family, friends and others in the community (or perhaps for more sophisticated reasons!). As Akerlof (1997) puts it, "… Like children on the merry-go-round who look up to see if anyone is watching, youth who are attaining an education look around to see if their work is being appreciated by the adult and teenage worlds around them. The absence of a favorable response takes away the fun." It is this recognition of one's accomplishments by others that we attempt to model and derive the implications of in this paper. Additionally, we note that attitudes to education and career choices across communities are far from uniform;[4] but it is very

[1] This literature includes, to name a few papers, Banerjee and Newman (1993) and Galor and Zeira (1993).
[2] We refer here to the classic work by Roy (1951), and the literature that followed in its wake.
[3] For example, see Fershtman and Weiss (1993) and Fershtman, Murphy and Weiss (1996) which assume status is income elastic, then focus on the impact of the income and wealth distribution on educational investment, labor market outcomes and growth.
[4] In their classic work, *Beyond the Melting Pot*, Glazer and Moynihan (1970) contrast the central role of education in the life of children in Jewish homes with education's peripheral standing in families of southern Italian descent in New York City. "The emphasis on getting a college education touches every Jewish schoolchild. The pressure is so great that what to do about those who are not able to manage college intellectually has become a serious social and emotional problem for them and their families." Whereas "… it was the 'bad' son who wanted to go to school instead of to work, the 'bad' daughter who wanted to

likely that perceptions on these matters are shaped by the experiences and choices of community members themselves.[5] Hence, we examine not only how community perceptions affect education and occupation choice, but also how such perceptions across communities emerge.

We use a two-sector overlapping generations framework, in which the sectors represent occupations or types of occupations (for instance, those intensive in formal education and those which are not). Agents are born with an ability endowment in both sectors and must choose one as a career. In addition to income, the social approval an agent receives in each sector affects her decision. This approval depends upon the community's *perception* of her ability in her chosen occupation, where the accuracy of the community's perception increases with the fraction of agents performing similar work. In particular, individuals accurately infer the ability of agents working in occupations similar to their own, but rely heavily on an occupation's reputation for those working in other areas.[6] This lack of perfect inference on agents' abilities is central to the model. If the community's perception of skills in both sectors were perfect, occupation choice would be based solely on comparative advantage. However, since the accuracy of a community's perception depends upon how many people are engaged in similar work, the occupational composition of the community also affects agents' choices.

We focus on the more plausible case of a positive correlation in ability across sectors -- i.e. where there is some "innate" ability that is common to both sectors. When the distribution of ability is similar in the two sectors and the positive correlation in ability is weak, both sectors benefit from positive selectivity bias -- the average skill level in either sector is higher than the population average. Whenever there is positive selectivity bias in both sectors, there is a unique and stable solution to the allocation of agents across the two occupations. However, when the positive correlation in skills is strong, agents do not have a large comparative advantage in either sector. Hence,

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remain in school instead of helping her mother… For the children of the South Italian peasants in New York to get college education …was a heroic struggle."

[5] Work by sociologists Kohn and Schooler and others shows that individual attitudes towards a wide variety of issues, including desirable occupational attributes and the qualities they would value in their children, are governed by two very particular aspects of their socioeconomic class – their education and occupation.

[6] Since ability is not perfectly observed, there is status by association, as in Basu (1989) - the more high ability people are in your sector the better. However, within an occupation there is no relative status, as in Frank (1985). Thus, high ability agents confer positive externalities on the others in their profession.

individuals with high skill in both sectors choose the initially larger sector, where the community better appreciates their talent. As a result, the larger sector benefits from positive selectivity bias. On the other hand, those agents with low skill in both sectors prefer the smaller sector, where their inability is better obscured. If the correlation in skills is sufficiently high, then this latter behavior results in the smaller sector suffering from negative selectivity bias -- the average skill level here is lower than the population average. The presence of negative selectivity bias creates the possibility of multiple equilibria. Moreover, all stable steady states distort career choices away from what is dictated by comparative advantage. Thus, even when two sectors are ex ante identical in their skill distributions, the larger or “preferred” sector ex post, has greater status associated with it in the community.

When the distributions of ability differ across the two sectors, a new potential steady state arises. Typically, the sector with the greater variance becomes the preferred sector, but when the correlation in skills is sufficiently high, *complete* clustering in the low-variance sector is possible. It is noteworthy that complete clustering can occur only in the low-variance sector, since such sectors are typically those with lower mean skill levels. In other words, our results imply that the need for appreciation within a community can drive *all* its members to opt for low-education occupations, but they never all choose high-skilled occupations. Furthermore, this last result supports Wilson’s (1987) hypothesis that the out migration of middle income families to the suburbs triggered the deterioration of education and career outcomes of inner city residents. In the framework of our model, the exodus of middle income families is exactly the type of shock necessary to send a community into a low-education trap. On the brighter side, this result implies that altering the composition of the reference group could be an effective way to break a low-education trap in disadvantaged communities. This could involve, for instance, moving them out of housing projects to more mixed neighborhoods with higher educational achievement.[7]

[7] Along similar lines, Feinstein and Simmons (1999) find that parental involvement is much more important than schooling in determining educational attainment of children. This suggests that the neighborhood effects on education outcomes discussed in Borjas (1992, 1995), Crane (1991) and Cutler and Glaeser (1997), arise more due to the kind of effects described in this paper, than due to a paucity of school resources or information.

Our analysis is related to the literature in economics that examines factors that affect individual decisions about education investment and occupation choice. However, our results rely neither on externalities in the production of goods or human capital[8] nor financial constraints or the distribution of wealth.[9] Instead, status is purely a function of how an agent's community perceives her ability in her chosen occupation. In this dimension, our work is closely related to Piketty (1998) and Akerlof (1997). Although both this paper and Piketty model status as an increasing function of perceived ability, we extend Piketty's approach to a vector of abilities across occupations which allows us to analyze occupational choice and the endogenous emergence of preferred sectors within a community. Akerlof uses a model of "social distance" to explain how identity differences across communities can affect career and life choices. In his work, and some other papers in the status literature, a desire to conform is embedded into the utility function.[10] In the present paper, individuals do not intrinsically care about being similar to others in their cohort. In fact, within their own group, they would like to be perceived as outstanding. However, the group members' ability to judge or appreciate their talent is limited by their own background.[11] This limitation leads to differences in perceptions and choices with respect to education and occupation across communities, which at times appear similar to a desire to conform.

2. The Model

We consider a two-period overlapping-generations model with two sectors, X and Y. At birth, individuals receive an endowment $\{x_i, y_i\}$ of skills in the two sectors.[12] During the first period of their life, they choose in which sector to work -- based upon their endowment, the relative wages in the two sectors and the status they can attain in either sector – and earn income. In the second period, individuals solely confer status on the younger generation. The status that an old agent confers on a young agent equals his best inference of the young worker's ability in her chosen sector. However, her ability is not

[8] For example, see Benabou (1993).

[9] This includes work in the development literature by Banerjee and Newman (1993), Galor and Zeira (1993), Loury (1981) and in the status literature by Fershtman and Weiss (1993) and Fershtman, Murphy and Weiss (1996), cited earlier.

[10] For other examples, see Bernheim (1994) and Jones (1984).

[11] Bisin and Verdier (1998) have a similar framework in which parents ability to appreciate the accomplishments of their children is limited by their own experiences.

[12] Although we abstract from invest in human capital and effort, the endowment can be viewed as an individual's potential in each sector.

publicly known, and individuals differ in their capacity to assess it. Specifically, we assume that members of the older generation are able to perfectly determine the skill level of workers in the sector to which they belonged, but can only determine the average skill level of those in the other sector. The community-wide status conferred on a young agent is a simple aggregate of the status conferred on her by the individual old agents. Let θ_t be the fraction of the old generation that was in sector X in period *t* and $\overline{x}_{t+1}$ and $\overline{y}_{t+1}$ be the realized average skill levels in those sectors for the younger generation. Then, the status accorded by the community to the *i*th member of the younger generation in sector X is

$$\theta_t \, x_{i,t+1} + (1-\theta_t)\,\overline{x}_{t+1},$$

while it is

$$\theta_t \, \overline{y}_{t+1} + (1-\theta_t)\, y_{i,t+1}$$

if she chooses sector Y. To simplify notation, from this point forward time subscripts are used only when they differ from $t+1$.

At this point we abstract from wages. When analyzing an economy as a whole (for instance, blue versus while collar jobs), the general equilibrium effect of wages will mitigate, but not reverse, the effects of status in individuals' decisions. When evaluating a small community within a larger economy, we can safely ignore any general equilibrium effects. Therefore, leaving them in the model presents no real gain. On the other hand, including wages substantially increases the notational burden and the complexity of the model. Ignoring wages, an individual with an endowment $\{x, y\}$ maximizes the status she receives, i.e. her objective function is

$$\max \left\{\theta_t \, x + (1-\theta_t)\,\overline{x}, \theta \, \overline{y} + (1-\theta_t)\, y\right\}.$$

Therefore, she is indifferent between the two sectors if

$$y = \overline{x} + \left[\theta_t / (1-\theta_t)\right](x - \overline{y}) \equiv y_0 + mx \qquad (2\text{-}1)$$

where $m \equiv \left[\theta_t / (1-\theta_t)\right]$ and $y_0 \equiv \overline{x} - m\overline{y}$. Notice that this indifference line summarizes two potentially competing forces. First, agents would like to be outstanding in the sector they choose, creating an incentive to choose the occupation in which they have a comparative advantage in skill. Second, talented agents want others to recognize their skill. Therefore, those individuals with high talent in both occupations are drawn to the larger sector, irrespective of where their comparative advantage lies. Similarly, those agents with lesser talent in both occupations prefer to hide in the smaller sector. (Refer to Figure I.)

We refer to the equality (2-1) above as the "indifference line." All agents with an endowment *y* greater (less) than the right hand side of this equality strictly prefer sector Y (sector X). From the indifference line, we can compute the current period fraction in sector X, and the average skill level of those choosing each sector by the double integrals

$$\theta = \int_{-\infty}^{\infty} \left\{ \int_{-\infty}^{y_0+mx} f(x,y)dy \right\} dx, \tag{2-2}$$

$$\bar{x} = \int_{-\infty}^{\infty} x \cdot \left\{ \int_{-\infty}^{y_0+mx} f(x,y)dy \right\} dx \Big/ \theta \tag{2-3}$$

and

$$\bar{y} = \int_{-\infty}^{\infty} \left\{ \int_{y_0+mx}^{\infty} y \cdot f(x,y)dy \right\} dx \Big/ (1-\theta) \tag{2-4}$$

where $f(x,y)$ represents the joint distribution of skills in the two sectors. After substituting out for θ, this is a system of two equations and two unknowns.

3. Single Period Equilibrium

In each period, the fraction of the older generation that was employed in sector X is given. Therefore, the slope of the indifference line separating individuals into the two sectors is fixed at $m = \theta_t / (1-\theta_t)$. Without loss of generality, we assume that at least half of the previous generation was in sector X, which implies that the slope *m* is at least one.[13] As depicted in Figure I, everyone above and to the left of the indifference line prefers sector Y, while everyone below and to the right of the line prefers sector X.

Shifting the indifference line to the left or right simultaneously changes the current period fraction in sector X, the *y*-intercept and the sector means, $\{\theta, y_0, \bar{x}, \bar{y}\}$. Thus, in principle, the single period equilibrium can be analyzed in terms of any of the four variables listed above.[14] For clarity in exposition, we carry out our analysis in terms of the intercept y_0, and deduce the corresponding value of θ. However, without any

[13] If this is not true, we can re-label sectors X and Y such that this holds.

[14] The only exception is when a sector mean is invariant to shifts in the indifference line. In this case, that sector mean may not be used.

restrictions on the joint density of skills, this system can have an arbitrary number of solutions. Since this is not very insightful, we restrict our analysis to the case of the bivariate normal distribution,

$$\begin{pmatrix} x \\ y \end{pmatrix} \sim N\left(\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}, \begin{bmatrix} \sigma_x^2 & \sigma_{xy} \\ \sigma_{xy} & \sigma_y^2 \end{bmatrix} \right).$$

This assumption places the model on similar ground to the Roy (1951) model and allows us to draw on many of the results concerning the Roy model in Heckman and Honoré (1990). Furthermore, we believe that the results obtained can be generalized to any 'well-behaved' unimodal distribution.[15]

3.1 Sector Means

An individual's status in either sector is a combination of her own skill and the (conditional) mean skill level in that sector. So, to characterize the single period equilibrium, we need to determine how the mean skill level in each sector varies with y_0. This task is accomplished by Lemma 1, which expresses these conditional means as functions of y_0. (The proofs of all lemmas and propositions are in the appendix.)

Lemma 1: As a function of y_0 (the *y*-intercept of the indifference line) the conditional means in the two sectors are

$$\bar{x} = \mu_x - \rho_x \sigma_x \lambda\left(-y_0^*\right) \qquad \text{and} \qquad \bar{y} = \mu_y + \rho_y \sigma_y \lambda\left(y_0^*\right),$$

where $\rho_x = \operatorname{corr}\left(x, y - mx\right)$, $\rho_y = \operatorname{corr}\left(y, y - mx\right)$, $y_0^* = \left[y_0 - \left(\mu_y - m\mu_x\right)\right] / \sigma^*$, $\sigma^* = \operatorname{var}\left(y - mx\right)$ and $\lambda\left(y_0^*\right)$ is the inverse Mills ratio ($\lambda\left(y_0^*\right) \equiv \phi\left(y_0^*\right) / \left[1 - \Phi\left(y_0^*\right)\right]$).

To intuitively understand how the sector means vary with y_0 and how this affects the single period equilibrium, consider increasing the fraction of agents choosing sector X to more than 50 percent. With more than half the agents originally in X, the average skill level in that sector must fall -- since more agents with a smaller comparative advantage enter it. This makes sector X less attractive for potential entrants. Of course,

[15] Under a bivariate normal distribution, an individual's status in one sector is a linear function of her status in the other sector, with a slope equal to the correlation, and a homoscedastic error term. By 'well-behaved', we mean that this relationship remains approximately linear with a fixed slope and a nearly homoscedastic error term.

this movement into X affects the average in Y too. If $\bar{y}$ decreases by less than $\bar{x}$, sector Y is more attractive than before and we have a unique single period equilibrium. However, if $\bar{y}$ decreases more than $\bar{x}$, sector Y is less attractive than before, hence drawing even more agents into X. In such a case, there can be multiple equilibria for any given previous period θ_t. Whether $\bar{y}$ decreases by more or less than $\bar{x}$ depends upon the degree of correlation in skills across the two sectors. We now use the definitions of $\bar{x}$ and $\bar{y}$, as stated in Lemma 1, to characterize the single period equilibrium.[16]

3.2 Solution to the Single Period Problem

To locate the fixed point(s) of the single-period problem, observe that any fixed point y_0 should satisfy the following condition:

$$y_0 = \bar{x}(y_0) - m\bar{y}(y_0) . \tag{3-1}$$

Consider any given value of y_0 on the left-hand side of (3-1). The right-hand side uses this y_0 to first compute $\bar{x}$ and $\bar{y}$ (using Lemma 1) and then indirectly computes y_0, using its definition, $y_0 = \bar{x} - m\bar{y}$. If a given value of y_0 coincides with the computed value of y_0, it is a fixed point. The value of θ that it yields, using (2-2), would be an equilibrium value. Proposition 1 characterizes the equilibrium values of θ corresponding to the fixed points that satisfy (3-1).

Proposition 1: Given θ_t, the fraction of the previous generation employed in sector X, there exists a unique stable interior solution for θ_{t+1}, if the correlation in skills across the two sectors is negative, zero or weakly positive. If the degree of positive correlation in skills is sufficiently large, there exists a unique stable interior solution for θ_{t+1} and/or a boundary solution, with all agents in one sector.

Figure II shows the solutions for the single period value of θ.[17] L1 depicts the case when there is negative, zero or sufficiently low positive correlation in skills across the two sectors, which results in a unique and stable interior solution for θ. For instance, if the variances across the two sectors are the same, "sufficiently low" positive correlation is a degree of correlation $\rho \leq 1/m$.[18] At such low levels of positive correlation, a rise in θ

[16] When all agents are in one sector, the mean in the other sector is not well defined. To maintain continuity, we define the sector means at each boundary as the limiting value.
[17] An equivalent diagram in the Appendix depicts the single period equilibrium in terms of y_0.
[18] If variances are not identical in X and Y, the condition is $\sigma_{xy}/\sigma^2_y \leq 1/m$.

causes the mean in sector Y to rise, while the mean in X falls. This ensures a unique single period equilibrium.

L2 through L4 depict the equilibria for increasing degrees of positive correlation in skills. As seen in Figure II, higher positive correlation gives rise to the possibility of multiple equilibria. With moderate positive correlation, there remains a unique and stable interior solution for θ (L2 and L3).[19] However, given sufficiently high positive correlation, a high concentration of the previous generation in sector X induces a large number of high skill agents to choose sector X. This generates sufficient downward pressure on the mean in sector Y for a stable corner solution to exist, along with an interior solution.(L3 and L4).[20] For sufficiently high levels of correlation however, the corner solution is the only stable equilibrium (L4).

To understand why a stable corner solution may exist, consider the case of identical skill distributions in both sectors, with perfect positive correlation. When the older generation belonged largely to sector X, greater weight is placed on individual, rather than average talent, for those choosing sector X (and vice versa for those choosing Y). Since all agents are equally talented in both sectors (due to perfect positive correlation), those with above average skills would choose X. Suppose there exists an equilibrium in which all agents with skills below some critical level, say η, choose Y and the rest go to X. Perfect positive correlation implies two properties of any such equilibrium: The mean skill level in X would be above η and the mean skill in sector Y would be below η. Given these facts about the sector means, the marginal agent strictly prefers sector X; switching from Y to X increases her status -- from the mean in sector Y to η amongst elderly of sector X and from η to the mean in sector X amongst the elderly of sector Y. Thus, the marginal agent always prefers sector X, resulting in everyone in sector X as the only equilibrium.

A question that logically follows is that of the persistence of such an extreme clustering in one sector in the long run. We turn to this issue in the next section.

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[19] Stable equilibia are robust to small perturbations in θ. Therefore, the higher interior equilibrium in curve (L3) is unstable; a small perturbation results in the desired value running away from the equilibrium value towards either the corner solution or the lower interior equilibrium.

[20] The *unbounded* nature of the normal distribution gives rise to the stable boundary solution. For bounded distributions, high positive correlation results in a stable equilibrium value of θ close to one.

4. Steady State

A steady state in this economy is defined as a situation where the current period fraction of agents and the average skill level in each sector are the same as in the previous period. We examine the set of steady states for this economy in two parts. Using an analytical approach, we first specify the conditions under which boundary steady states exist. Second, we use a numerical approach to provide a complete characterization of the set of interior steady states.

4.1 Analytic Steady States

In this sub-section we describe the conditions under which a boundary steady state exists. Proposition 2 states these conditions.

Proposition 2: The entire population in sector X, "extreme clustering," is a steady state if and only if there is sufficiently high positive correlation in skills, i.e. $\rho \geq \sigma_x / \sigma_y$.[21]

As noted earlier, sufficiently high positive correlation in skill implies that if a large fraction of high skill agents choose one of the two sectors, it lowers the average skill level in the other sector significantly. Given a large enough initial fraction of old agents in one sector, agents with high skill in that sector are in fact induced to choose that sector, because their individual talent will be better appreciated. When this induces a very sharp decline in the average skill in the other sector, it results in extreme clustering in the sector that is initially larger. What is more interesting, however, is where such extreme clustering can occur and where it cannot.

Corollary 1: Extreme clustering is possible only in the low-variance sector.

Note that Corollary 1 holds even when the mean in the low-variance sector is below that of the high-variance sector. The intuition for this result is as follows: If the entire population is in the low-variance sector, people highly skilled in that sector do not want to move because their skill is recognized by a large audience. However, why do people with relatively low skill in this sector remain? The answer lies in the inferences that will be made about them if they were to move. For the reasons just mentioned everyone knows highly skilled individuals in the low-variance sector will not switch sectors.

[21] When $\rho = \sigma_x / \sigma_y$, extreme clustering is a steady state if and only if $2\sigma_x^2 > \sigma_y^2$.

Therefore, if an agent switches sectors, she must have a relatively low endowment. When the positive correlation in skills is sufficiently high (as defined in Proposition 2), this implies that an individual’s expected skill in the high-variance sector is also relatively low. However, since the other sector has a greater variance, a relatively low skill endowment in that sector is worse than a relatively low skill endowment in the low-variance sector. So, his status is even worse if he switches.

The reason why extreme clustering is not possible in the high-variance sector is most readily developed in a case of bounded endowments. Suppose both sector endowments have a mean of zero, but the range of the high-variance sector is twice that of the low-variance sector. Now, suppose the entire population resides in the high-variance sector. The worst person in this sector has an incentive to switch to the low-variance sector. Even if the remainder of the population assumes she has the lowest possible endowment in that sector, her status is still greater than what she received in the high-variance sector. The same argument applies to two normal distributions after noting that the distribution with a greater variance effectively has a smaller lower bound.[22]

The result in Corollary 1 is significant especially because sectors with lower variance are typically low-skill sectors. Seen in this light, the result suggests that the desire for recognition and approval in one's cohort can result in all its members making occupation choices that are low skilled --- choices that others outside the cohort may perceive as less desirable, or even self-destructive. Further, while individuals in a community can all get caught in such a “low” equilibrium trap, it is unlikely that *all* of them would end up in the higher skill sector, despite the desire to be appreciated. We discuss the policy implications after a description of the set of interior steady states.

4.2 Numerical Simulations

Switching the analysis from steady states on the boundary to those on the interior presents some technical difficulties arising from the fact that the cumulative normal density function has no closed form solution.[23] Using a numerical simulation approach

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[22] The argument follows from noting two facts about normal distributions. First, the mass of a normal random variable truncated from above approaches unit mass at the point of truncation as the truncation point diverges into the tail. Second, regardless of the population means, the normal distribution with the greater variance eventually has more mass in the tail (where both distribution share a common point defining the tail).

[23] An increase in the value of θ in steady state has two effects – a leftward shift in the indifference line, as well as an increase in its slope. The first effect causes the average skill in sector X to decrease and that in Y

however turns out to be a very reliable alternative. This is because the steady state is characterized by a single variable, the fraction of the population in sector X, which is bounded between zero and one. An arbitrarily accurate grid search therefore can be computed over the unit interval. Such an approach allows us to provide a more complete characterization of the set of possible interior steady states. Further, it produces some quantitative measures of the extent of misallocation that arises when the desire for social approval affects career choices.

Before discussing any particular simulation, we make a few general remarks relevant to the discussion. Table 1 presents two measures of the efficiency of steady states, the fraction of the population misallocated to each sector(columns (4) and (5)) and the loss in total productivity relative to the efficient allocation of labor (treating the skill employed in each sector as efficiency units of labor – columns (6) and (7)). However, the magnitudes of the productivity losses have no natural metric; by shifting the means and variances in the two sectors, the percentage change in efficiency can be made arbitrarily large or small. Therefore, discussions of efficiency losses focus on the misallocation across sectors. Additionally, for each steady state Table 1 contains the fraction of the population in sector X and the mean skill level in each sector. Figures III through VI show the fraction of the population in sector X as a function of the fraction in that sector in the previous generation. Here, the intersections between these transition paths with the forty-five degree line denote steady states.

The baseline case we consider is one where skills are independently distributed, standard normal random variables. In this case, even though agents care about social appreciation, their choices correspond with their comparative advantage, resulting in an efficient, stable and unique steady state allocation of agents across the two sectors.[24] This result is illustrated in Figure III and the corresponding numbers are presented in the first ('Baseline') row in Table 1. Now, we turn to deviations from this baseline case.

First, we discuss deviations from the baseline where skills across the two sectors are still independent, but the skill distributions are not identical. There are two cases: Figure IV and the middle panel of Table 1 present the case of differences in means

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to increase, the second effect produces exactly the opposite outcome in both sectors. The lack of a closed form solution for the normal CDF. makes it difficult to determine which effect dominates.

[24] This result generalizes to negative correlations in endowments. An analytical proof of this outcome can be obtained from the authors upon request.

across the two sectors(keeping skill variances identical). The sector with the greater mean, X, is the larger sector in the steady state. This may not be surprising, given its higher conditional mean skill level. However, note that in spite of the higher mean in X, there is misallocation to *both* sectors.

The second case is one with identical mean skill levels, but differences in the skill variance across the two sectors. As seen in Figure V and the bottom panel of Table I, this time there is misallocation only towards the higher variance sector, in this case, Sector X.

Finally, for the case of positive (negative) correlation between individual's skills in the two sectors (with identical skill distributions), we return to Figure III and the top panel of Table 1. We find that positive(negative) correlation in skills exacerbates (mitigates) deviations from the efficient allocation of workers.[25] Note that individuals are misallocated in both sectors, with the degree of misallocation increasing with the strength of the correlation.; the larger sector attracts relatively highly endowed agents with an absolute advantage in the smaller sector, while the smaller sector attracts relatively poorly endowed agents with an absolute advantage in the larger sector. As seen in Figure III, positive correlation in skills results in multiple steady states with misallocation in both occupations. In steady state, a community is over-represented in the sector to which it was historically (or initially) predisposed. In other words, the steady state occupation allocation in a community directly depends upon initial conditions.

As seen in the top panel of Table 1, the degree of positive correlation must be fairly large before the misallocation effect is noticeable. However, this effect quickly increases for positive correlations beyond 0.5 -- as much as 48 percent of the population is misallocated when the correlation is 0.8. Moreover, misallocation occurs at much lower levels of positive correlation if we do not restrict the marginal distributions to be identical. For example, when the means differ by half a standard deviation, a correlation of 0.2 results in an additional six percent of the population being misallocated (not shown

[25] The finding that a negative correlation in skills reduces the degree of misallocation is in contrast to some previous results in the literature. For example, Jovanovic (1982) has overcrowding in the sector with larger variance, which is exacerbated when individual skills across sectors are *negatively* correlated. The rationale behind these apparently contradictory results is identical. In our model, when the correlation in skills is negative, low-skilled individuals are those that are mediocre in everything. The concern for social status induces these individuals to hide in the smaller sector, decreasing the overcrowding in the high-variance sector. Jovanovic assumes that skills are perfectly observable in the low-variance sector and unobservable in the high-variance sector. Therefore, the only location to hide is the high-variance sector. Thus, in both cases it is the desire of the low skilled to remain anonymous that drives the results, but difference in assumptions about the *observability* of skills that reverses the direction of the conclusion.

in the graph). Also, as seen in Figure VI, for the case of differences in skill variances, there is an over allocation of 14 percent to the high variance sector (X) for a positive correlation of 0.3 itself.[26]

The model can explain why differences in the marginal distributions should amplify the effect of a positive correlation in skills. In particular, when the marginal distributions are identical and the correlation in endowments is weak, most agents have a distinct absolute advantage in one of the two sectors. Hence only a few of them want to give up such an advantage in the smaller sector to move to the larger one. This keeps the size of the two sectors close. To complete the circle, the fact that the two sectors are close in size makes it rational for only those with small absolute advantages to move. However, when the marginal distributions differ, one of the sectors is larger when the correlation in endowments is zero. The presence of a large sector increases (decreases) the size of the absolute advantage necessary for highly endowed (poorly endowed) people to remain in the smaller (larger) sector. In other words, the presence of a large sector creates a built-in stage on which the highly endowed can be seen and a hiding place (the smaller sector) for poorly endowed individuals.

5. Policy Implications

We address the policy implications of our analysis, in particular of Proposition 2 and Corollary 1. The corollary states that extreme clustering can occur only in the low-variance sector. Typically, it is the relatively low-skilled sectors that have lower variance. For instance, wage dispersion amongst poorly educated workers is much smaller than that among highly educated workers.[27] Thus, our analysis suggests that when individuals care about status in their cohort, either a few too many people pursue a high-education career or the entire community gets stuck in a low-education trap. Consider a case where a given cohort is entirely clustered in a low-variance sector, e.g., unskilled labor. What would it take to bring a cohort out of this equilibrium? There are two possible policy interventions that may help. First, if there exists a stable interior solution to the single period problem (L3 in Figure II), offering personal incentives to enough individuals could cause the single period solution to shift from the extreme clustering equilibrium to a more efficient

[26] When the marginal distributions differ, a negative correlation in endowments decreases the amount of misallocation.
[27] In the classic paper Roy (1951), sectoral wages are found to be a increasing function of sectoral skill variance.

interior equilibrium. Second, lowering the local ratio of low-education to high-education workers, increases the recognition of one's true skill in the well-educated sector. Therefore, people entering this sector are not as dependent on their colleagues for social status. A sufficient decrease in this ratio eliminates extreme clustering as a stable equilibrium, causing the current generation to revert to a more efficient interior solution (switching from L3 to L2 in Figure II).

For example, the inner city housing projects are areas of low education and underachievement. Given the choices made by most of its members, it is much harder for individuals to break this vicious cycle. Our analysis suggests that moving families out of such projects to more mixed neighborhoods where a larger fraction of agents opt for higher education careers, can have a positive effect on their life choices. An alternative approach to changing this ratio is to *collectively* shift the focus of the current residents. A nice example of this latter kind is the impact of Eugene Lang's college scholarship guarantee experiment, which he offered to an *entire class* of sixth-grade boys in Harlem, New York.[28] Six years later, 40 out of the 51 boys had done well enough to be able to enter college *without* Lang's financial assistance. Alternatively, programs that devote large amounts of resources for education in the housing projects may be a deadweight loss, until a more positive environment is provided, where educational performance is encouraged and appreciated by the reference group.

By the same token, policies that provide merit-based (isolated) incentives to individuals who reside in low-education communities may not be very effective in improving performance. Our point is captured in the poignant case of Eddie Perry, reported in Akerlof (1997). Eddie was a successful graduate of Phillips Exeter Academy with a full scholarship to Stanford; but nevertheless, he found himself extremely isolated, with little acceptance or appreciation of his hard work and success among his peers. Eddie was ridiculed in his cohort because "he didn't even know how to play basketball." A few weeks prior to entering Stanford, he was shot dead while attempting to rob a cop in New York City. Thus, isolation and a lack of appreciation of one's achievements in the reference group can diminish the incentive effects of merit awards enough to result in choices that go against comparative advantage.

[28] This story is taken from Ellwood (1988).

At the same time, cost subsidies and scholarships could have a greater impact in altering individual choices in a community if it is already at an interior equilibrium. In the context of the policy debate with respect to measures to improve the educational attainment of disadvantaged minorities in the United States, we believe that recognizing this distinction between interior and boundary steady states may be critical to implementing successful interventions.

6. Discussion

We would like to make a couple of remarks on the generality of our basic assumptions.

Peer effects: First, it is widely regarded that individual choices are influenced not only by parents and adults in the family, but peers as well. When solving for the steady states of the model, it was convenient to assume that young agents were solely influenced by the perceptions of the older generation (parents, mentors, etc.). Taking peer effects into account means that the perception of one's actions now depends on the actions of one's peers. In the limit, if young agents only cared about the opinions of their peers, then every steady state is feasible for each generation and which one is realized will be the outcome of a pure coordination game. More generally, once peers are considered, multiple single-period equilibria become more common. (It is also possible to have multiple single-period equilibria without peer-group effects, see L3 in Figure II.)

Once multiple single-period equilibria exist, expectations over others behavior will determine which one is chosen. But here again, public policy can play a role in shaping those expectations and, hence, help determine which outcome is realized. The case of Lang's college scholarship program for an entire school of sixth-grade boys, discussed earlier, is another example of this.

Skill costs: Second, the current set up does not include the cost of up front investment in skills. However, such a modification would imply that the degree of ex-ante positive correlation in skills would be even higher than the ex post correlation in skills. In this sense, our results could be interpreted to include the case of investment in skills, where the degree of positive correlation in skills is interpreted as the level of correlation between ex ante potential in each sector.

Concept of Social Status: Finally, we have chosen a particular definition of social approval. Of course, the point of this paper has been not to present a comprehensive formulation of social status, but rather to take one component of social status, namely occupational status, and derive its influence on individual's choice of profession. Hence, while our definition of social status is suitable for our purpose, but there are additional factors that influence one's standing in a community, many of which are interesting to study in their own right. Also, we have implicitly assumed a single, closely-knit community setting, so that the cohort of people determining an individual's status are identical in every way other than, perhaps, in occupation choice. Here, it would be interesting to examine how greater heterogeneity in an individual's cohort would impact the effects of status considerations.

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7. Appendix

This Appendix contains proofs of the lemmas and propositions stated in the text. In some instances, we sketch proofs in order to conserve space.

7.1 Proof of Lemma 1

The conditional mean skill level in sector Y is

$$E\left\{y\middle|y>y_0+mx\right\}=E\left\{y\middle|y-mx>y_0\right\}.$$

Let $\tilde{z}=z-\mu_z$, then $y=\mu_Y+a\left(\tilde{y}-m\tilde{x}\right)+v$ where

$$\begin{aligned} a &= \operatorname{cov}\left(y,y-mx\right)/\operatorname{var}\left(y-mx\right) \\ &= \left(\sigma_Y^2-m\sigma_{XY}\right)/\left(\sigma_Y^2+m^2\sigma_X^2-2m\sigma_{XY}\right) \\ &= \left(\sigma_Y^2-m\sigma_{XY}\right)/\sigma^{*2} \end{aligned}$$

and $\operatorname{cov}\left(v,\tilde{y}-m\tilde{x}\right)=0$ by construction. Substituting in for *y* yields

$$\begin{aligned} E\left\{y\middle|y>y_0+mx\right\} &= \mu_Y+E\left\{a\left(\tilde{y}-m\tilde{x}\right)+v\middle|y-mx>y_0\right\} \\ &= \mu_Y+aE\left\{\left(\tilde{y}-m\tilde{x}\right)\middle|y-mx>y_0\right\}+E\left\{v\middle|y-mx>y_0\right\} \\ &= \mu_Y+a\sigma^*E\left\{\frac{\left(\tilde{y}-m\tilde{x}\right)}{\sigma^*}\middle|\frac{\left(\tilde{y}-m\tilde{x}\right)}{\sigma^*}>\frac{y_0-\left(\mu_E-m\mu_K\right)}{\sigma^*}\right\} \\ &= \mu_Y+a\sigma^*\lambda\left(y_0^*\right) \\ &= \mu_Y+\rho_Y\sigma_Y\lambda\left(y_0^*\right) \end{aligned}$$

where $y_0^*=\left[y_0-\left(\mu_Y-m\mu_X\right)\right]/\sigma^*$, $\lambda\left(y_0^*\right)$ is the inverse Mills ratio and $\rho_Y=\operatorname{corr}\left(y,y-mx\right)$. Similar manipulations yield the conditional mean in sector X.

7.2 Lemma 2

(a): As y_0 increases, the mean endowment in sector X falls at a decreasing rate when the slope of the indifference line is greater than the slope of the conditional mean, i.e. $\sigma_{XY}/\sigma_X^2<m$. (Alternatively, the mean rises at a decreasing rate when $\sigma_{XY}/\sigma_X^2>m$, and it is stationary when $\sigma_{XY}/\sigma_X^2=m$.)

(b): As y_0 increases, the mean in endowment in sector Y rises at an increasing rate when the slope of the indifference line is less than the slope of the conditional mean, i.e.

$\sigma_Y^2/\sigma_{XY} > m$. (Alternatively, the mean falls at an increasing rate when $\sigma_Y^2/\sigma_{XY} < m$, and it is stationary when $\sigma_Y^2/\sigma_{XY} = m$.)

Proof: Heckman and Honoré (1990) establish that $0 < \delta\left(y_0^*\right) \equiv \partial\lambda\left(y_0^*\right)/\partial y_0^* < 1$ and $\partial^2\lambda\left(y_0^*\right)/\partial y_0^{*2} > 0$ for all finite values of y_0^*. Therefore, as y_0^* increases, the mean endowment in sector Y is increasing in magnitude at an increasing rate (unless $\rho_Y = 0$) with the same sign as ρ_Y. Thus, the mean endowment in sector Y is negative and decreasing at an increasing rate if $\left[\sigma_{XY}/\sigma_Y^2\right]^{-1} < m$ and positive and increasing at an increasing rate if $\left[\sigma_{XY}/\sigma_Y^2\right]^{-1} > m$.

In contrast to sector Y, as y_0^* increases, the mean endowment in sector X is decreasing in magnitude at a decreasing rate (unless $\rho_X = 0$) with the opposite sign as ρ_X. Thus, the mean endowment in sector X is negative and increasing at a decreasing rate if $m < \left[\sigma_{XY}/\sigma_X^2\right]$ and positive and decreasing at a decreasing rate if $m > \left[\sigma_{XY}/\sigma_X^2\right]$.

7.3 Proof of Proposition 1

Continuing with the notation from the lemmas, substitute the closed form solution for the sector mean endowment levels into the expression for y_0 to get

$$y_0 = \bar{x} - m\bar{y} = -\rho_X\sigma_X\lambda\left(-y_0^*\right) - m\rho_Y\sigma_Y\lambda\left(y_0^*\right).$$

Take derivatives of both sides, yielding

$$\partial LHS/\partial y_0 = 1$$

and

$$\partial RHS/\partial y_0 = \left(1/\sigma^*\right)\left[\rho_X\sigma_X\delta\left(-y_0^*\right) - m\rho_Y\sigma_Y\delta\left(y_0^*\right)\right].$$

There are two cases to consider. First, if the covariance is sufficiently small, then $\rho_X < 0$ and $\rho_Y > 0$. In this case, both terms for the RHS derivative are negative and the RHS is always decreasing, while the LHS is always increasing. Thus, there exists a unique solution.

Second, for a sufficiently large covariance, one of the above correlations changes sign. However, it is not possible for both to change signs. Assume that $\rho_X > 0$ and $\rho_Y < 0$. Then, $m < \sigma_{XY}/\sigma_X^2$ and $m^{-1} < \sigma_{XY}/\sigma_Y^2$. Combining these two terms yields

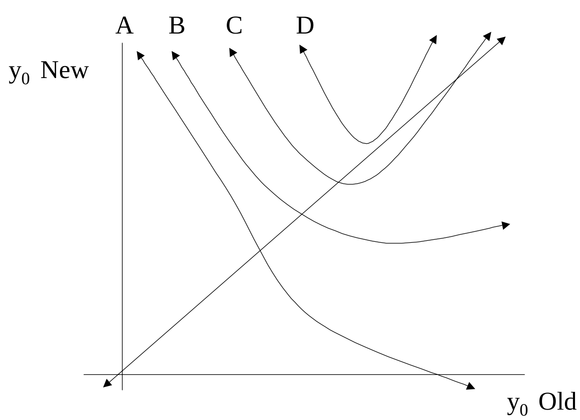
$$1 = m \cdot m^{-1} < \left[\sigma_{XY} / \sigma_X^2\right] \cdot \left[\sigma_{XY} / \sigma_Y^2\right] = \rho^2 .$$

The squared correlation has an upper bound of one, so this result creates a clear contradiction. The remaining two possibilities are mirror images of each other with the RHS being a convex function when both correlations are negative and concave when both correlations are positive. To see this relationship, consider the second derivative of the RHS,

$$\partial^2 RHS / \partial y_0^2 = -\frac{1}{\sigma^{*2}} \left[\rho_X \sigma_X \frac{\partial \delta\left(-y_0^*\right)}{\partial\left(-y_0^*\right)} + m \rho_Y \sigma_Y \frac{\partial \delta\left(y_0^*\right)}{\partial y_0^*} \right]$$

which is always negative (positive) when both correlations are positive (negative). (Heckman and Honoré (1990) demonstrate that $\partial \delta\left(y_0^*\right) / \partial y_0^*$ is positive.)

Therefore, the solution can take one of four forms that range in the number of fixed points from zero to two. Additionally, there exists the possibility of another solution in the limit at y_0 equal to plus or minus infinity. The four possibilities are illustrated for the convex case in the following graph by the lines labeled A through D (This graph is equivalent to Figure II referred to in the main paper; the difference here is that it is represented in terms of the y-intercept, y_0 (rather than the fraction of agents in sector X), in line with how the proof is written.)



The standard case is depicted by line A and has a unique solution. However, as the correlation increases, the slope of the line increases, eventually becoming positive (when ρ_Y is negative, i.e. $m^{-1} < \sigma_{XY} / \sigma_Y^2$). There exists a range of correlations for which the slope is positive, but less than one. In this case there are two solutions, the fixed point depicted in the graph (line B) and the limiting point of y_0 equal to plus infinity.

However, the limiting point is unstable. As the correlation gets even stronger, the slope of the function will exceed one, as illustrated by line C. When this occurs, there are two fixed points; the first is stable, while the second is unstable. Additionally, the limiting point of y_0 equal to plus infinity is a solution that is now stable. Finally, for correlations sufficiently close to one, the function never dips below the forty-five degree line and the only solution is the limiting point of y_0 equal to plus infinity which is stable.

Therefore, in all cases but line C, there is a unique single-period stable equilibrium. However, for the range of correlations corresponding to line C, there are two stable equilibria: one in the interior and the other with the entire population in one sector.

7.4 Proof of Proposition 2

From proposition 1, we know that extreme clustering in childbearing is a single period equilibrium if and only if the slope of the RHS of (3-1) is greater than one. Mathematically, this can be stated as:

$$m^2\left[\sigma_{XY}-\sigma_X^2\right]+m\left[2\sigma_{XY}-\sigma_Y^2\right]-\sigma_Y^2>0 \qquad \text{(D-1)}$$

If extreme clustering were to be a steady state, *m* is infinite. Given that the first term on the LHS of (D-1) is quadratic, the condition holds if $\sigma_{XY}>\sigma_X^2$ which simplifies to $\rho>\sigma_X/\sigma_Y$.

7.5 Proof of Corollary 1

The proof is a direct application of Proposition 2

Table 1

The Loss in Total Employed Skill and the Fraction of the Population in both Sector X and Misallocated to Each Sector, Assuming a Bivariate Normal Distribution of Skills

(Deviations from Independent Standard Normal Distributions are Noted in the Table)

Distribution		Fraction in Sector X	Mean Skill Level X	Mean Skill Level Y	Fraction Misallocated to Sector X	Fraction Misallocated to Sector Y	Total Skill Efficient	Total Skill Steady State
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline		0.50	0.56	0.56	0.00	0.00	0.40	0.40
Correlation	0.50	0.50	0.40	0.40	0.00	0.00	0.40	0.40
	0.60	0.71	0.44	-0.28	0.24	0.03	0.36	0.23
	0.70	0.88	0.23	-1.02	0.40	0.02	0.31	0.08
	0.80	0.96	0.09	-1.69	0.47	0.01	0.25	0.02
Difference in Means	0.25	0.59	0.79	0.54	0.04	0.02	0.70	0.69
$(m_x - m_y)$	0.50	0.67	0.98	0.48	0.07	0.03	0.85	0.82
	1.00	0.83	1.30	0.30	0.10	0.04	1.20	1.13
	1.50	0.93	1.64	0.14	0.09	0.02	1.60	1.54
	2.00	0.98	2.06	0.06	0.06	0.01	2.05	2.01
Ratio of Variances	2.00	0.56	0.87	0.44	0.06	0.00	0.69	0.68
(s_x^2 / s_y^2)	4.00	0.60	1.23	0.31	0.10	0.00	0.89	0.86
	9.00	0.62	1.81	0.20	0.12	0.00	1.26	1.19
	16.00	0.62	2.31	0.15	0.12	0.00	1.57	1.49

Figure I

Indifference Line Dividing Sector X and Sector Y

Agents to the left choose Sector Y, while those to the right choose Sector X.

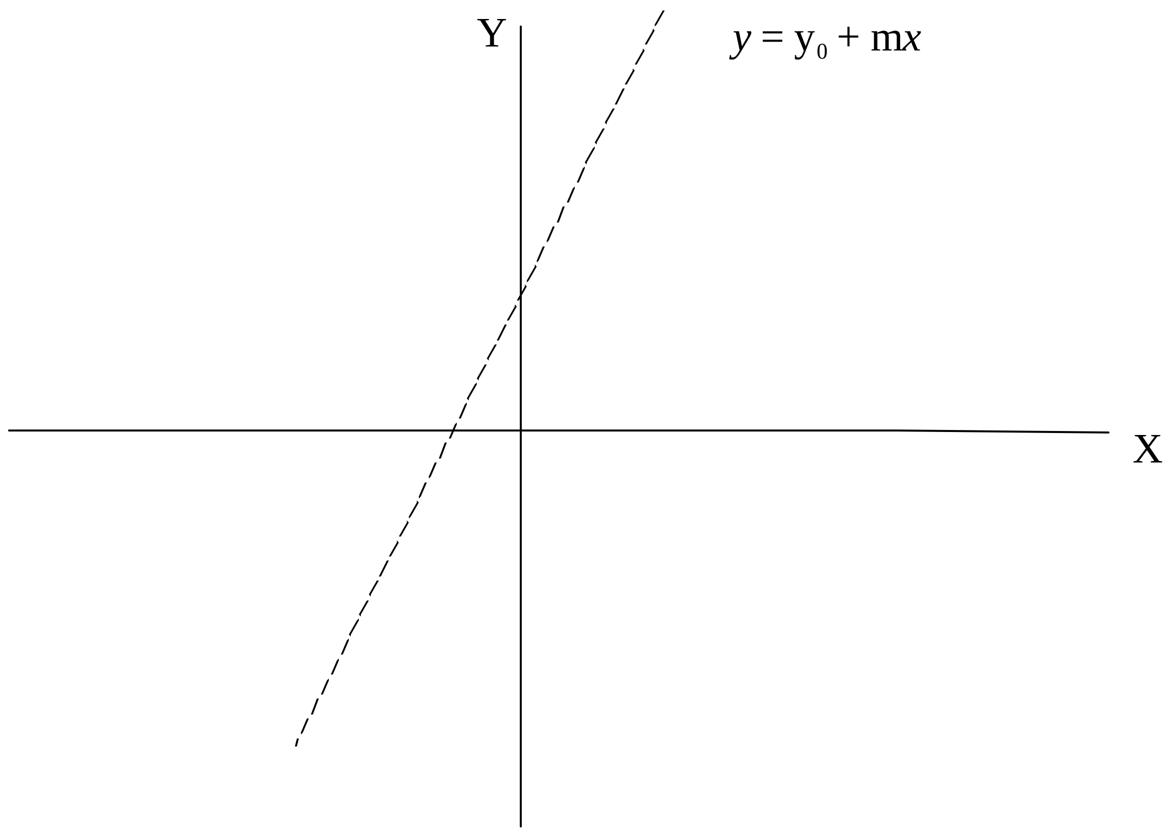


Figure II – Single Period Equilibrium

The Fraction of the Population Desiring Sector X as a Function of the Fraction Actually Choosing Sector X

Solid (open) circles indicate stable (unstable) steady states.

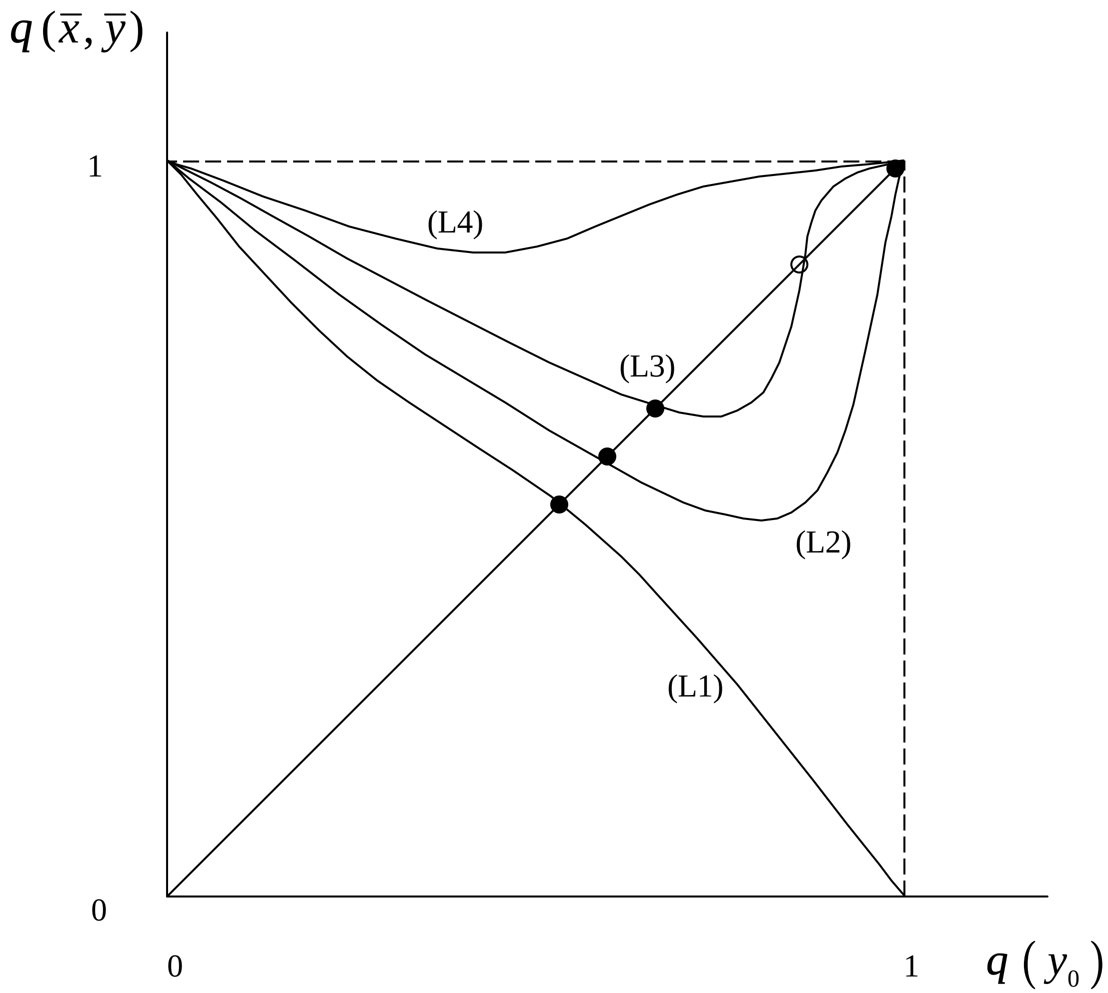


Figure III -- Baseline Case

Single Period Transitions: Equal Means and Variances in the Two Sectors

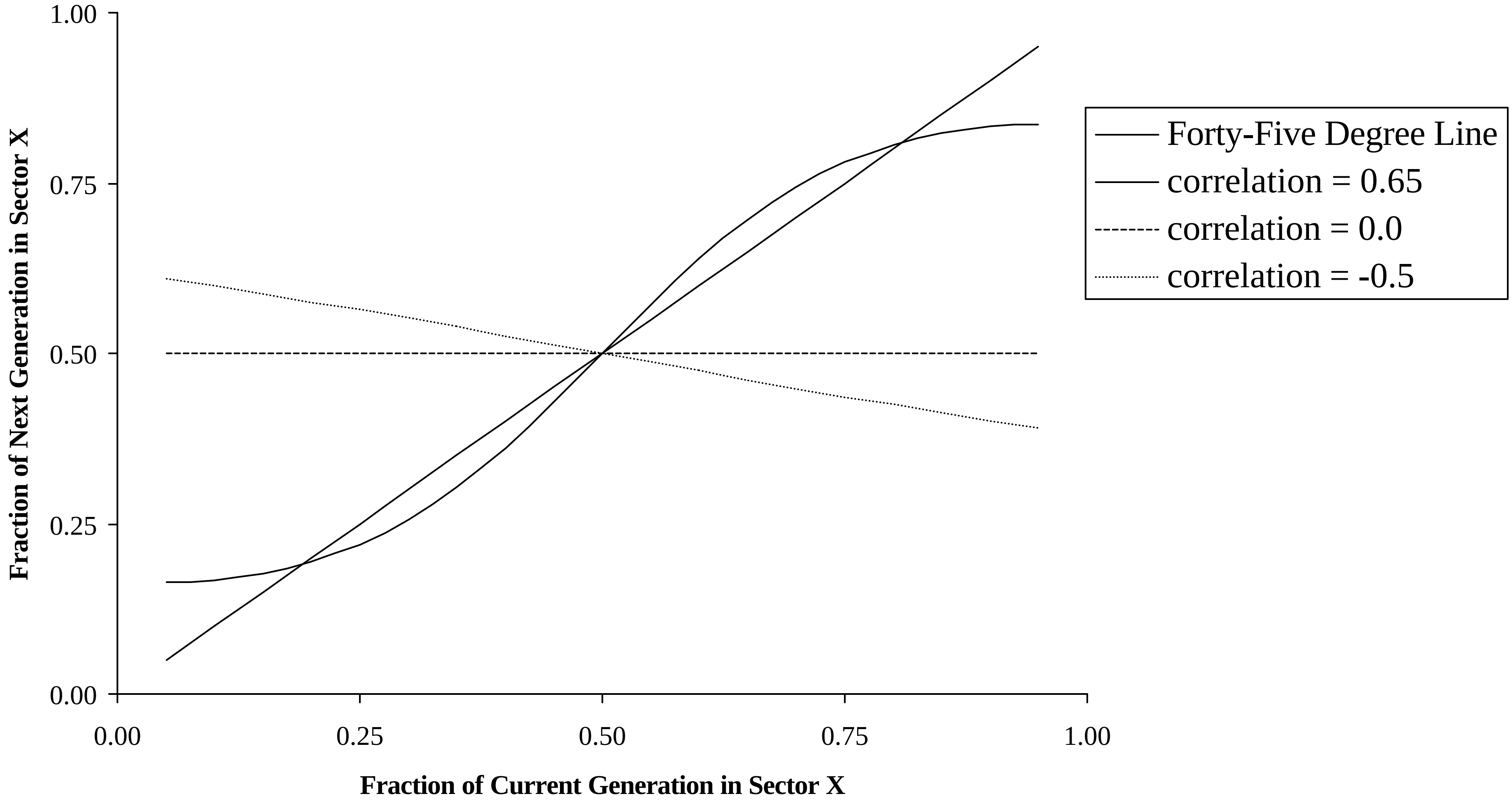


Figure IV

Single Period Transitions: Endowments Are Uncorrelated with Equal Variances (Differences in Sector Means Are Given in Standard Deviations)

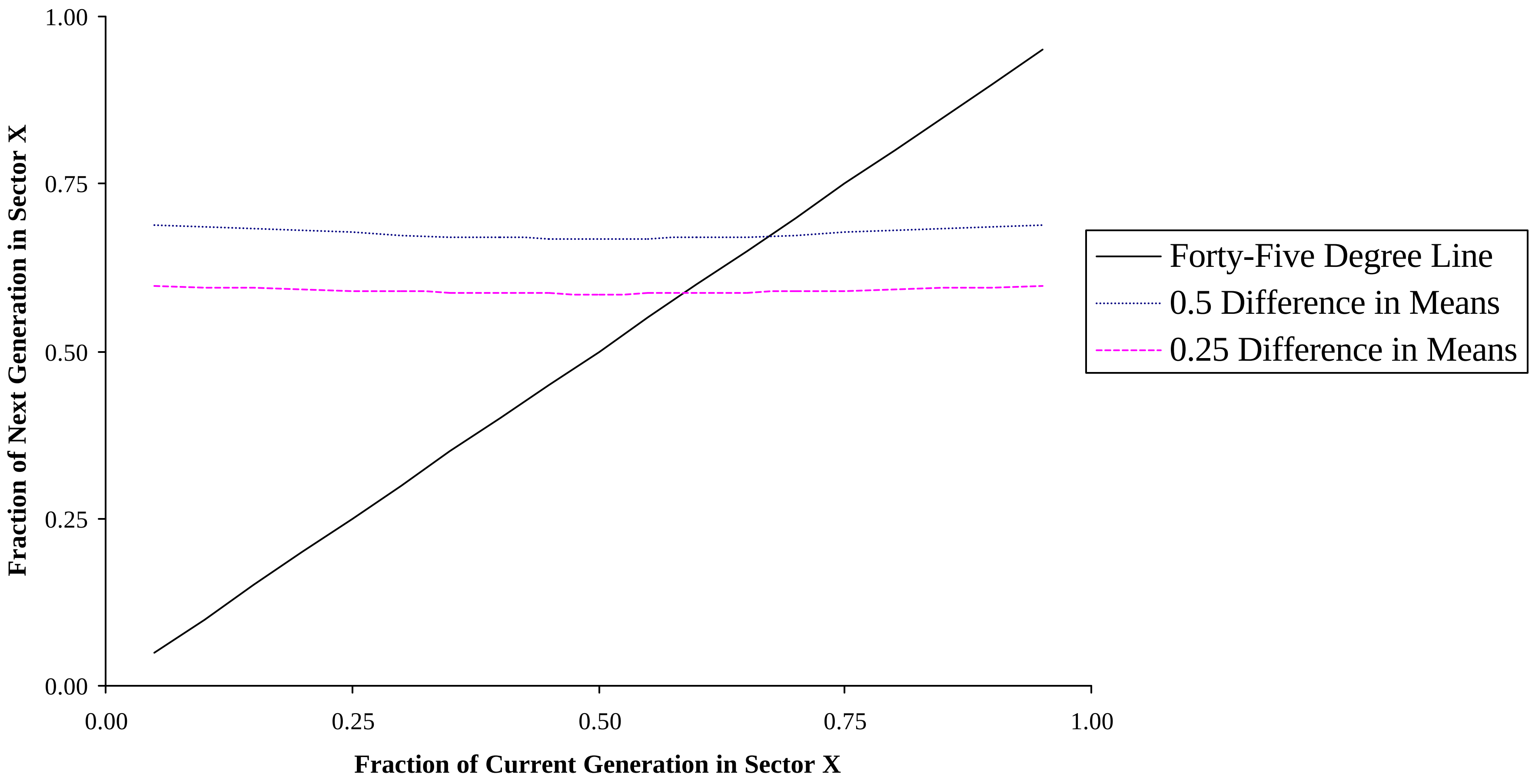


Figure V

Single Period Transitions: Equal Means and Zero Covariance Between the Sectors

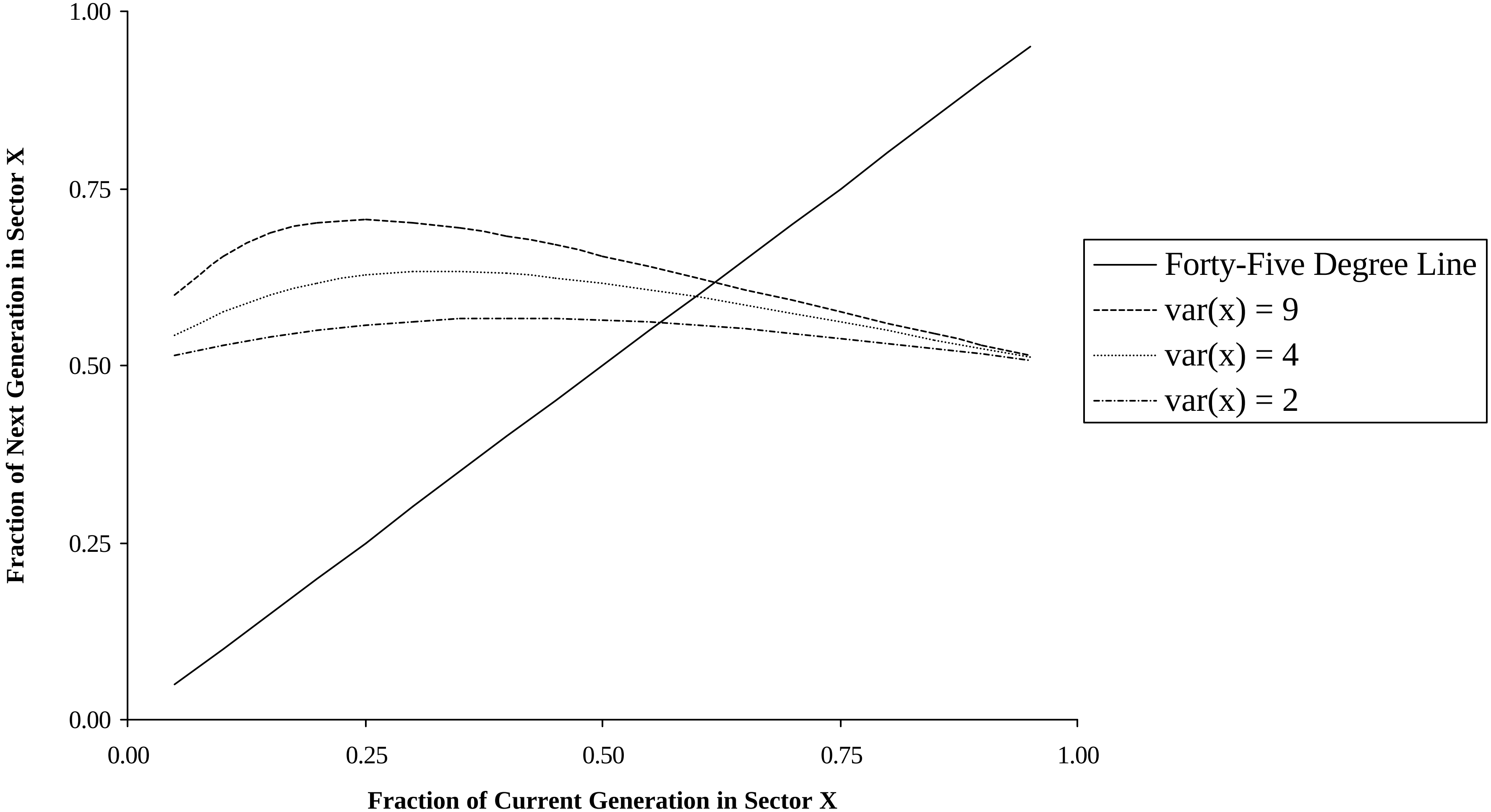


Figure VI

Single Period Transitions: The Standard Deviation in Sector X Is Twice that of Sector Y and the Two Sectors Have Equal Means