SOCIAL APPROVAL AND TEENAGE CHILDBEARING

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Abstract

We examine the phenomenon of "pockets of teenage illegitimacy" in a model of social approval, where attitudes to such illegitimacy are *endogenously* determined at a local community level. Both a woman's actual well-being and her community's *perception* of that well-being in each potential state – staying in school and early childbearing – impact her decisions. In particular, since individuals can better appreciate the successes and failures of those making similar choices as themselves, the accuracy of a community's perception of a woman's well-being increases in the fraction of her community who chose her state. With positive correlation in potential well-being across the two states, these imprecise community perceptions can lead to multiple steady states: Pockets of high/low illegitimacy emerge even though individuals do not, per se, derive utility from conformity. These pockets could be triggered off by public policy measures (such as AFDC), but also by exogenous "shocks" such as the urban middle class flight from the inner city – as suggested by Wilson (1987). A novel prediction of the model is that the lower the variability in potential well-being in the childbearing state, the more easily a community can become trapped in the high-illegitimacy steady state. So, programs such as EITC, which increase the variability in well-being among single mothers, may be more effective in reducing teenage illegitimacy, than traditional approaches, such as AFDC, which reduce this variability. Finally, these high-illegitimacy pockets may be more responsive to *non-pecuniary* measures such as integrated housing projects and mentors, which increase the diversity of a teenager's circle of social interaction, than individual financial incentives.

KEY WORDS: Illegitimacy; Welfare; Education; Social Approval
JEL: I3

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1. Introduction

Non-marital childbearing, especially among teenagers, increased rapidly over the past four decades, resulting in about one third of all births being illegitimate in 1995.[1] Not surprisingly, the percentage of unwed mothers and the number of children growing up in poverty have followed similar trends. In light of the strong empirical connection between a child's socio-economic background and her future economic attainment, these trends are disconcerting. While several theories have been advanced to explain these trends, empirical evidence in support of them has been weak. In this paper, we present a status-based rational choice model of non-marital childbearing that connects illegitimacy to public policy in a plausible manner and is consistent with the stylized facts concerning non-marital childbearing.

Previous models attempting to explain this substantial increase in non-marital births over this period of time fall into two categories – those that attribute it to policy changes such as welfare benefits under AFDC (Aid for Families with Dependent Children), and those that attribute it to other non-policy changes.[2] The problem is that when the empirical literature finds the predicted effects arising from policy changes, their magnitudes are too small to explain the time trend over the past forty years.[3] While our model too predicts a rise in illegitimacy immediately following an increase in welfare benefits, the addition of status to the utility function allows a better fit with the time-series data. In short, status links behavior across generations, allowing short-run changes to have a long-run impact on teenagers' choices.

Specifically, we construct a two-period overlapping-generations model in which utility is separable in well-being and status. A woman's well-being can be thought of as her utility in a traditional model without status. It is a function of material possessions, the presence and attainment of children, leisure, job satisfaction and innumerable additional factors. We do not

[1] All data on national birth rates are from Ventura (1995) and Ventura et al. (1997).
[2] Wilson (1987) argues worse employment prospects decreased the number of men in poor communities that are able to marry, while Akerlof, Yellen and Katz (1996) claim that the advent of legally available abortions reduced the number of males who are willing to marry.
[3] See Hoynes (1996) for a review of these trends.

model the components of this function; we simply take the distribution of women's well-being as a parameter of the model. Furthermore, we model the set of life choices, as presented to a girl at the threshold of adulthood, to consist of two possible states – early (illegitimate) childbearing and education. Here, education (or a career) as a life-choice is really a catch-all state for the set of alternatives other than childbearing.[4]

We assume that a woman's status is an increasing function of her well-being, as *perceived* by those people in the community in which she lives. However, unlike traditional formulations, such as Moffit (1983), Besley and Coate (1996) and Nechyba (1999), our concept of status is determined at a local level.[5] Also, in our model, early childbearing does not automatically reduce a women's status. While our approach is somewhat non-traditional – as it permits having a child to increase a teenager's status – our motivation for such a set up comes from ethnographic studies. Fernandez-Kelly (1995) portrays attitudes of teenage girls in her study of Upton, an impoverished suburb outside of Baltimore. Seventeen-year old Latanya Williams, expecting her second child, puts forth a typical view:

> I waited for a long time before I had my baby. Anyone can tell you, all my girlfriends had babies long before me and I was jealous 'cause when you don't have a child to call your own, you's nothing; you got nothing to be proud of …

An important issue here is who determines such a sense of pride or status among these young women. We model status as a function of the perceptions of the older generation, which could consist of a girl's parents and other adults in her life, as well as other young women slightly older than herself.[6] This assumption seems a natural one to make, given evidence about the strong influence of parental figures and peers on youngsters' choices with regard to early

[4] Early childbearing does not preclude continuing one's schooling either.
[5] The empirical literature appears to support such a local definition of this parameter. Borjas (1995) finds evidence of social group effects at the neighborhood level (as defined by the 1970 US Census and containing approximately 4,000 persons), but no evidence of such effects at the county level. Similarly, Bertrand, Luttmer and Mullainathan (forthcoming) finds empirical evidence in support of network effects in welfare participation, which are stronger at more disaggregate levels.
[6] Although we exclude peer groups, this omission is done for expositional purposes. Including peer groups complicates the mathematics and affects transition paths, but does not alter any steady state behavior.

childbearing (as Latanya's words indicate) or in other matters.[7] 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." Thus, social approval not only influences the decisions of teenagers with regard to having children out of wedlock, but also shapes their perceptions about the desirability of the available alternatives, such as education.

Additionally, we assume that individuals are better equipped to evaluate the well-being of those girls who choose life styles similar to their own. For instance, educated women are more likely to appreciate the challenges that other girls who aspire to do well in school face, as well as their achievements. Similarly, single mothers share similar trials and joys, enabling them to better assess the successes and failures of others like themselves. Alternatively, a woman who becomes a single mother spends more time with other single mothers, than she would have in the absence of the child. This increased exposure allows other single mothers to have a better idea of how well she is doing. Such a bias in individuals' ability to assess others' well-being is a key element of our model.[8]

Given this framework, the model yields multiple long-run equilibria where communities differ both in the fraction of their members who opt for single motherhood, as well as their (rationally inferred) perceptions of these choices. Multiple equilibria and clustering arise in other models in the social status literature. For comparative purposes we roughly divide that literature into two categories: (1) models that assume a desire to conform[9] and (2) models that assume

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[7] For instance, in analyzing educational attainment, Feinstein and Symons (1999) conclude that "peer groups together with parental interest … provides the major input" into a child's educational attainment.
[8] Bisin and Verdier (1998) make a similar assumption stating that parents want to socialize their children to their own preferences because children with preferences different than their parents' would choose actions that maximize their own and not their parents' preferences. We do not assume that parents have a bias towards children following in their footsteps. Instead, we assume that they can better appreciate both success and failures when a child chooses a path more similar to the one they themselves chose.
[9] For example, see Akerlof (1980), Bernheim (1994) and Nechyba (1999).

individuals want to appear as talented as possible.[10] In the first category, given the desire to conform, it is not surprising that multiple equilibria exist and that there is the potential to get trapped in an equilibrium that is dominated by sustainable alternatives.[11] Our work is closer to the second category, since agents aim to achieve better status by being perceived as high achievers, rather than by conforming to a norm. In spite of this, there are equilibria with "clustering" in teenagers' choices, where most of them opt to be unwed mothers. This equilibrium occurs because the average level of perceived well-being from choosing the other option – education – is *endogenously* lower, making it an unattractive choice.[12]

We highlight two important predictions of our analysis. First, concentrated pockets of illegitimacy emerge, in which the rate of non-marital childbearing is "close" to one hundred percent. For instance, these types of pockets could arise from "urban flight" (the out-migration of the middle class to the suburbs) or the concentration of poverty associated with inner-city housing projects – scenarios which accord well with the Wilson (1987) hypothesis about the deterioration of life in the inner city. What is distinct about these pockets is that they are unlikely to respond to standard *financial* incentives that attempt to reduce illegitimacy – for instance, welfare initiatives (such as AFDC) or policy measures that encourage education (such as individual-level merit scholarships). However, our modeling of the formation of status leads to alternative policy solutions. For example, altering the composition of a woman's community, rather than her own personal incentives, could be more effective. One such policy would be to reduce the homogeneity of housing projects through integrated housing schemes with a more diverse population of adults and peers.

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[10] For example, see Piketty (1998). This desire to be outstanding is also true in conspicuous consumption models of status. See, for instance, Ireland (19??).

[11] For instance, in Nechyba (1999) the social disapproval of being an unwed mother decreases as the number of unwed mothers rises.

[12] Such a desire to do well, but also, a perception of choices actually available, is evident in Latanya's words: "It's not like I don't want to get an education, but its not so easy… And besides, I don't know no one, I tell you no one, who has a good job by finishing high school." As Fernandez-Kelly concludes: "Most impoverished people, living in racially segregated neighborhoods, express adherence to *mainstream* American mores: Hard work, … and individual achievement are part of their cultural repertory. Nevertheless, the translation of values into action is shaped by the tangible milieu that encircles them."

Second, where financial incentives do work, it is not only the *level* of welfare benefits that affect the childbearing decision. A novel prediction of the model is that the impact of these incentives on the *variability* of outcomes within the cohort of potential single mothers also affects a teenager's choice. The greater the variability in well-being within a cohort of potential single mothers, the less likely it is that a community becomes a pocket of illegitimacy.[13] Traditional welfare programs, such as AFDC and Food Stamps, reduce the variability of well-being within a cohort, because the offered benefit is lower for every dollar earned by a single mother. This decreased variability increases the number of at risk communities. On the other hand, the Earned Income Tax Credit (EITC) increases welfare compensation with earnings (subject to an upper limit). Since this increases variability of well-being within the cohort of single mothers, it discourages this choice and reduces the number of at risk communities.

2. The Model

We construct a two-period overlapping-generations model in which utility is separable in well-being and status. A woman's well-being can be thought of as her utility in a traditional model without status. It is a function of material possessions, the presence and attainment of children, leisure, job satisfaction and innumerable additional factors. We do not model the components of this function; we simply take the distribution of women's well-being as a parameter of the model. In the first period, women are single and their only decision is whether or not to bear a child. If a woman bears a child, we say she is in the child-rearing sector, while if she remains childless, we say she is in the education sector. Although we refer to the two sectors as childbearing and education, we do not mean to imply that childbearing precludes continuing one's schooling. It is perfectly consistent with the model to include the possibility of continuing education in the function that determines a woman's well-being as a single mother. Each woman's well-being in the two sectors is given by the random variables K and E, for childbearing and education, respectively. A woman's endowment is a random draw of these

[13] This result does not depend on a reduction in the risk faced by individual women. In fact, there is no individual-level risk in the model, since we assume away all uncertainty.

variables, $\{k, e\}$, and known before any decisions are made. By treating well-being as known, we abstract from any issues of risk aversion and its effects on women's decisions.

In the second period, each woman confers status on the younger generation. The status she confers to a young agent is her best inference of that woman's well-being. However, this component of utility is not publicly known, and individuals differ in their capacity to assess it. Specifically, we assume that older women perfectly determine the well-being of women with similar childbearing patterns to themselves, but only determine the average level of those in the other sector. The total status conferred on a young woman is a simple average of the status conferred on her by individual agents. Let θ_t be the fraction of women who bore children in period *t* and $\bar{k}_{t+1}$ and $\bar{e}_{t+1}$ be the realized average well-being in each sector for the younger generation. Then, the status accorded by the community to the *i*th member of the younger generation if she chooses childbearing is

$$\theta_t\, k_{i,t+1} + (1-\theta_t)\bar{k}_{t+1}\,,$$

while it is

$$\theta_t\, \bar{e}_{t+1} + (1-\theta_t)e_{i,t+1}$$

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

To complete the model, let each woman's utility be a weighted average of her well-being and her status, where α is the relative importance of status. For example, utility is given by

$$(1-\alpha)k_i + \alpha\left[\theta_t\, k_i + (1-\theta_t)\bar{k}\,\right]$$

for those bearing children. We assume that there is a continuum of women, so each woman takes the average endowment in the two sectors as given, despite the fact that it is endogenously determined for the population as a whole.

The main point of this paper is to demonstrate that concerns over status can cause traditional welfare programs to increase early illegitimate childbearing both through changing the mean and the variance in the distribution of endowments. Note that k either remains unchanged or increases for each member of the population in the presence of traditional welfare programs, since these programs subsidize childbearing. Therefore, as is standard in the welfare literature, the subsidy to this component of utility (typically the only component considered) draws more individuals into childbearing. Thus, the more weight is placed on well-being, the easier it is to establish our desired result. For this reason, throughout the analysis, we assume women solely care about status, i.e. α is equal to one.

Setting α equal to one, a woman with endowment $\{k, e\}$ is indifferent between the two sectors if her status is the same in both sectors. This condition can be expressed as

$$e = \bar{k} + \left[\theta_t \big/ \left(1-\theta_t\right)\right]\left(k - \bar{e}\right) \equiv y_0 + mk \tag{2-1}$$

where $m \equiv \left[\theta_t \big/ \left(1-\theta_t\right)\right]$ and $y_0 \equiv \bar{k} - m\bar{e}$. Notice that this indifference line summarizes two potentially competing forces. First, women would like to be outstanding in the sector they choose, creating an incentive to follow their comparative advantage. Second, successful women want others to recognize their accomplishments. Therefore, those individuals with high endowments in both sectors are drawn to the larger sector, irrespective of where their comparative advantage lies. Similarly, those agents with poor endowments in both sectors prefer to hide in the smaller sector.

We refer to the equality (2-1) above as the "indifference line." All agents with an endowment e greater (less) than the right-hand side of this equality strictly prefer continuing education (childbearing). From the indifference line, we can compute the current period fraction bearing children and the average well-being in each sector by the double integrals

$$\theta = \int_{-\infty}^{\infty} \left\{ \int_{-\infty}^{y_0+mk} f\left(k,e\right) de \right\} dk\ , \tag{2-2}$$

$$\bar{k} = \int_{-\infty}^{\infty} k \cdot \left\{ \int_{-\infty}^{y_0+mk} f\left(k,e\right) de \right\} dk \Big/ \theta \tag{2-3}$$

and

$$\bar{e} = \int_{-\infty}^{\infty} \left\{ \int_{y_0 + mk}^{\infty} e \cdot f(k,e)\, de \right\} dk \Big/ (1-\theta) \tag{2-4}$$

where $f(k,e)$ represents the joint distribution of endowments in the two sectors. After substituting out for θ, this is a non-linear system of two equations and two unknowns.

3. Single Period Equilibrium

In each period, the fraction of the older generation that bore children is given. Therefore, the slope of the indifference line separating individuals into the two sectors is fixed at $m = \theta_t \big/ (1-\theta_t)$. Without loss of generality, we assume that at least half of the previous generation bore children, which implies that the slope *m* is at least one.[14] As depicted in Figure I, everyone above and to the left of the indifference line prefers education and everyone below and to the right of the line prefers childbearing.

Shifting the indifference line to the left or right simultaneously changes the fraction bearing children, the *y*-intercept and the sector means; $\{\theta, y_0, \bar{k}, \bar{e}\}$. Thus, in principle, the single period equilibrium can be analyzed in terms of any of the four variables listed above.[15] 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 restrictions on the joint density of endowments, 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, i.e.

$$\begin{pmatrix} k \\ e \end{pmatrix} \sim N\left(\begin{bmatrix} \mu_K \\ \mu_E \end{bmatrix}, \begin{bmatrix} \sigma_K^2 & \sigma_{KE} \\ \sigma_{KE} & \sigma_E^2 \end{bmatrix} \right).$$

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 unimodal distribution.

[14] If this is not true, we can re-label the two sectors and interpret the results in terms of the educational sector instead of the child-rearing sector.

[15] 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.

3.1 Sector Specific Mean Endowment

An individual's status in either sector is a convex combination of her well-being and the (conditional) mean well-being in that sector. So, to characterize the single period equilibrium, we need to determine how the mean well-being 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

$$\bar{k} = \mu_K - \rho_K \sigma_K \lambda\left(-y_0^*\right) \qquad \text{and} \qquad \bar{e} = \mu_E + \rho_E \sigma_E \lambda\left(y_0^*\right),$$

where $\rho_K = \mathrm{corr}\left(k, e - mk\right)$, $\rho_E = \mathrm{corr}\left(e, e - mk\right)$, $y_0^* = \left[y_0 - \left(\mu_E - m\mu_K\right)\right] / \sigma^*$, $\sigma^* = \mathrm{var}\left(e - mk\right)$ 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 number of women who bear children. With more than half the agents originally bearing children, the average well-being in this sector must fall -- since more women with a smaller comparative advantage in childbearing choose it. This makes childbearing less attractive for potential entrants. Of course, this movement into childbearing affects the average in the educational sector too. If $\bar{e}$ decreases by less than $\bar{k}$, education is more attractive than before and we have a unique single period equilibrium. However, if $\bar{e}$ decreases more than $\bar{k}$, then education is less attractive than before, drawing even more women into motherhood. In such a case, there can be multiple equilibria for any given previous period θ_t. Whether $\bar{e}$ decreases by more or less than $\bar{k}$ depends upon the degree of correlation in endowments across the two sectors that is defined more precisely in the following two sections. We now use the characterization of the sector means as given in Lemma 1, to characterize the single period equilibrium.[16]

[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.

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:

$$y_0 = \bar{k}(y_0) - m\bar{e}(y_0)\,. \qquad (3\text{-}1)$$

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 $\bar{k}$ and $\bar{e}$ (using Lemma 1) and then indirectly computes y_0, using its definition, $y_0 = \bar{k} - m\bar{e}$. 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 of equation (3-1).

Proposition 1: Given θ_t, the fraction of the previous generation bearing children, there exists a unique stable interior solution for θ_{t+1}, if the correlation in well-being across the two sectors is negative, zero or weakly positive. If the degree of positive correlation in well-being 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 low positive correlation in well-being 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 $\rho < 1/m$.[18] At such low levels of positive correlation, a rise in θ causes the mean well-being in education to rise, while the mean in childbearing falls. This ensures a unique single period equilibrium.

L2 through L4 depict the equilibria for increasing degrees of positive correlation in endowments. 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, for certain combinations of positive correlation and

[17] An equivalent diagram in the Appendix depicts the single period equilibrium in terms of y_0.

[18] If variances are not identical in both sectors, the condition is $\sigma_{KE}/\sigma_E^2 < 1/m$.

[19] Stable equilibia are robust to small perturbations in θ. Therefore, the higher interior equilibrium in curve (3) 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.

previous rates of childbearing, a large number of agents choosing childbearing generates sufficient downward pressure on the mean well-being in education for a stable corner solution of every one bearing children to exist (L3 and L4).[20] In fact, for sufficiently high levels of correlation, the corner solution is the only stable equilibrium (L4).

To understand why a stable corner solution may exist, consider the case of identical endowment distributions in both sectors and perfect positive correlation. When the majority of the previous generation bore children, young women choosing childbearing place greater weight on individual, rather than average endowment (and vice versa for those in education). Since all women have equal well-being in both sectors, those with above average draws would choose childbearing. Suppose there exists an equilibrium in which all agents with well-being below some critical level, say η, choose education and the rest bear children. Perfect positive correlation implies two properties of any such equilibrium: The mean endowment for those with children would be above η and the mean endowment for those in education would be below η. Given these facts about the sector means, the marginal agent strictly prefers child-rearing; switching from education to children increases her status from the mean in education to η amongst elderly mothers and from η to the mean in childbearing amongst the elderly non-mothers. Thus, the marginal agent always prefers childbearing, resulting in everyone bearing children as the only equilibrium.[21]

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

4. Steady State

A steady state in this economy is defined as a situation where the current period fraction of women bearing children, as well as the average conditional well-being in the two sectors, are the same as in the previous period. We examine the set of steady states for this economy in two

[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.
[21] Similarly, if a majority of the previous generation continued schooling, then everyone in the education sector is the only equilibrium.

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 rearing children, "extreme clustering," is a steady state, given sufficiently high positive correlation in endowments, $\rho > \sigma_K / \sigma_E$.[22]

As noted earlier, sufficiently high positive correlation in endowments implies that if a large fraction of well-off women choose one of the two sectors, it substantially lowers the average well-being in the other sector. Given a large enough initial fraction of old agents in one sector, agents with high endowments in that sector are induced to choose it, so that their accomplishments 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, women highly endowed in that sector do not want to move because their position is recognized by a large audience. For the reasons just mentioned everyone knows highly endowed individuals in the low-variance sector will not switch sectors. Therefore, if an agent switches sectors, she must have been doing poorly. For a sufficiently positive correlation (as defined in Proposition 2), this fact implies that her expected endowment in the high-variance sector is also relatively low. However, since the other sector has a greater variance, a relatively

[22] When $\rho = \sigma_K / \sigma_E$, extreme clustering is a steady state if $2\sigma_K^2 > \sigma_E^2$.

low endowment in that sector is worse than a relatively low endowment in the low-variance sector. So, her status is even worse if she 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.[23]

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.[24] Using a numerical simulation approach however turns out to be a very reliable alternative, since the steady state is characterized by a single variable, the fraction of the population in bearing children, which is bounded between zero and one.

Before discussing any particular simulation, there are a few overarching points relevant to the discussion. First, Table 1 presents two measures of the efficiency of steady states, the fraction of the population misallocated to each sector and the loss in total well-being relative to the efficient allocation of women. Unfortunately, the magnitude of the losses in well-being have no natural metric; by shifting the means and variances in the two sectors, the percentage change

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[23] 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).

[24] 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 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.

in efficiency can be made arbitrarily large or small. Therefore, discussions of efficiency losses focus on the misallocation across sectors. Second, our baseline case has endowments that are independently distributed, standard normal random variables. In this case, even though women care about social appreciation, their choices correspond with their comparative advantage, resulting in an efficient, stable and unique steady state allocation of women across the two sectors.[25] Now, we turn to deviations from this baseline case.

First, steady states in which the distribution of well-being in the two sectors (by mean and variance) are depicted in the middle and bottom panels of Table 1, respectively. The sector with the greater mean or greater variance is the larger sector in the steady state and has more status associated with it, i.e. it is the "preferred" sector since it has a higher conditional mean endowment. In general, when both the means and variances differ, the life style with the greater conditional mean endowment under the efficient allocation of women will become the preferred sector – attracting highly endowed women and repelling poorly endowed women.

Second, the introduction of a positive correlation in well-being across sectors results in over-allocation in one of the two sectors, with the degree of misallocation increasing with the strength of the correlation. Note that women are misallocated to both sectors; the preferred sector attracts relatively highly endowed agents with an absolute advantage in the other (smaller) sector, while the smaller sector attracts relatively poorly endowed agents with an absolute advantage in the preferred sector. As illustrated in Figure III, whether education or childbearing becomes the preferred life style in the steady state is determined by the historical predisposition of the community.

As seen in the top panel of Table 1, the degree of positive correlation must be fairly large before the misallocation is noticeable. When the distributions in well-being are identical in the two sectors, misallocation occurs only when the degree of positive correlation in well-being is high. Hence, only a few women want to sacrifice their advantage in the smaller sector to move to

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

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 distributions differ, one of the sectors is larger even 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) women 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. 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.

5. Policy Issues

We concentrate our analysis on the implications of welfare policy for relatively poor communities in which welfare receipt is common. Furthermore, we assume throughout this discussion that early motherhood is the low-variance sector, as evidenced by this population's lower variability in after-tax income.

A major contribution of this paper is to illustrate that not only the mean, but also the variance in the endowments in the two sectors affect the fraction of women opting for illegitimate childbearing. In particular, Proposition 2 claims that the entire community can opt for childbearing in the steady state given sufficient differences in variability in well-being across the two sectors. Therefore, the manner in which public policy affects the ratio of the variances may have a dramatic effect on the number communities trapped in this early childbearing equilibrium.

5.1 Welfare Programs

Traditional welfare programs, such as Aid to Families with Dependent Children (AFDC), Food Stamps (FS) and Temporary Assistance to Needy Families (TANF), provide a subsidy to illegitimate childbearing that decreases with the size of a woman's endowment in the absence of the program. Therefore, these programs reduce the variability in the distribution of endowments in the childbearing sector, decreasing the ratio of the variances across sectors, which increases the risk of clustering in early childbearing.

Similar to these traditional welfare programs, the Earned Income Tax Credit (EITC) subsidizes childbearing.[26] However, the EITC is initially increasing in a woman's earnings. Currently, the maximum credit is approximately $4,000 and the credit increases linearly from zero to $4,000 over the first $10,000 of earnings. Therefore, in communities where the majority of the women would earn below $10,000 as single mothers, the EITC increases the variability in potential well-being in the childbearing sector.[27] Thus, both traditional welfare programs and the EITC subsidize illegitimate childbearing, increasing the number of illegitimate births. However, by decreasing the variability in outcomes among potential young mothers, traditional welfare programs increase the number of communities at risk for illegitimacy rates near 100 percent. On the other hand, the EITC increases the variability in outcomes, reducing the number of at risk communities.

5.2 Breaking the High Illegitimacy Steady State

As in Nechyba (1999), the theory suggests that although traditional welfare programs may be responsible for the rise in illegitimacy, the elimination of these programs may not correct the program. However, due to our richer nature of the formation of social status, we are able to suggest alternative interventions that may reduce illegitimacy rates to their historic levels. First, we characterize the type of community likely to be trapped in a high-illegitimacy equilibrium.

If a community starts with an over-representation of women in the (high-variance) education sector, it seems unlikely that a small increase in benefits from any form of welfare program would send the community spiraling down the path to high illegitimacy. However, there exists a subset of communities for which the mean endowment, after taking welfare benefits into account, is greater in the childbearing sector. In these communities, a relatively small shock can

[26] In more recent years there has been an EITC for individuals without children, but this credit is very small.
[27] In general, if the distribution of endowments it the education sector dominates (first order stochastic dominance) the distribution of endowments in the childbearing sector, then the EITC will increase the ratio of the variances.

initiate a transition to the high-illegitimacy steady state. So, although having an illegitimacy rate close to 100 percent is technically possible whenever childbearing is the low-variance sector, due to transitional dynamics, we only expect this equilibrium to develop in communities in which the mean endowment in the childbearing sector exceeds that of the educational sector.

Individual level incentives may be ineffective in breaking high-illegitimacy equilibrium, since, in this steady state, individuals are relatively unresponsive to changes in personal well-being. Recall from the single period problem that there is a critical number of women that need to opt for the educational sector before the high-illegitimacy steady state can be broken (see L3 in Figure II). Therefore, the equilibrium will not be a continuous function of the size of individual-level incentives. Instead, these incentives will have no effect at all until they affect a large enough group to switch the single period solution to the interior steady state. A nice example of such a group level incentive altering the focus of a community is Eugene Lang's college scholarship guarantee experiment, which he offered to an *entire class* of sixth graders in Harlem, New York.[28] Six years later, 40 out of the 51 students had done well enough to be able to enter college *without* Lang's financial assistance.

An alternative approach to breaking the high-illegitimacy equilibrium is to alter the community that serves as a woman's reference group. Increasing the number of people who appreciate the efforts of a woman pursuing an education reduces that woman's dependence on the average attainment of the other women in the education sector. This decreased dependence makes it much easier to escape the high-illegitimacy equilibrium. There are many possible ways in which to change a woman's reference group. Mentor programs can provide an outside source of encouragement. Housing projects can be exchanged for integrated housing, providing a diverse population of adults. The list of possibilities abounds, but the main point is that programs of this nature may be much more effective policy instruments than the level or duration of traditional welfare benefits.

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

6. Discussion and Extensions

The model fits both the stylized facts of illegitimate childbearing highlighted by economists and much of the ethnographic evidence compiled by sociologists. Starting with the former, the inclusion of status allows the model to fit the time series data. Status links the generations in a manner that prevents the population from jumping from one steady state to another when there is a change in public policy. Instead, the community slowly transitions from the old steady state to the new steady state. In particular, the model predicts that the expansion of welfare starting in the 1960s and its subsequent reduction in the last two decades should generate a parabolic transition path to the new steady state. However, since the model gives no guidance as to how long it should take for the community to reach the new steady state, it is consistent with any parabolic time trend in illegitimacy rates.

Second, the model offers an explanation for some of the conclusions from ethnographic studies. Consistent with the findings of Fernandez-Kelley (1995), a woman's status can increase by becoming a single mother. This result is in contrast to models that constrain welfare receipt or illegitimacy to be stigmatizing events. Additionally, when the majority of the community opts for early motherhood, the education sector suffers from negative selection; the average woman choosing education has a lower well-being after her schooling than the average woman in the population would have after schooling. If we relax the assumptions of the model, allowing for uncertainty about one's endowment (and abstract from any other changes this may cause), then women could incorrectly infer from the observed outcomes of the previous generation that the return to education is lower than it actually is. This result may help explain why young women from ghetto communities do not view education as the path to success.

Finally, the model could be extended to explain why illegitimacy rates have increased among groups of the population who are ineligible for welfare benefits. One approach is to allow overlapping communities in which there exists a chain of relationships linking any two members of society. For example, schools, which draw from multiple neighborhoods, are an instance of such overlap.

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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 well-being in education is

$$E\left\{e \middle| e > y_0 + mk\right\} = E\left\{e \middle| e - mk > y_0\right\}.$$

Let $\tilde{z} = z - \mu_z$, then $e = \mu_E + a\left(\tilde{e} - m\tilde{k}\right) + \nu$ where

$$\begin{aligned} a &= \text{cov}\left(e, e - mk\right) / \text{var}\left(e - mk\right) \\ &= \left(\sigma_E^2 - m\sigma_{KE}\right) / \left(\sigma_E^2 + m^2\sigma_K^2 - 2m\sigma_{KE}\right) \\ &= \left(\sigma_E^2 - m\sigma_{KE}\right) / \sigma^{*2} \end{aligned}$$

and $\text{cov}\left(\nu, \tilde{e} - m\tilde{k}\right) = 0$ by construction. Substituting in for *e* yields

$$\begin{aligned} E\left\{e \middle| e > y_0 + mk\right\} &= \mu_E + E\left\{a\left(\tilde{e} - m\tilde{k}\right) + \nu \middle| e - mk > y_0\right\} \\ &= \mu_E + aE\left\{\left(\tilde{e} - m\tilde{k}\right) \middle| e - mk > y_0\right\} + E\left\{\nu \middle| e - mk > y_0\right\} \\ &= \mu_E + a\sigma^* E\left\{\frac{\left(\tilde{e} - m\tilde{k}\right)}{\sigma^*} \middle| \frac{\left(\tilde{e} - m\tilde{k}\right)}{\sigma^*} > \frac{y_0 - \left(\mu_E - m\mu_K\right)}{\sigma^*}\right\} \\ &= \mu_E + a\sigma^* \lambda\left(y_0^*\right) \\ &= \mu_E + \rho_E \sigma_E \lambda\left(y_0^*\right) \end{aligned}$$

where $y_0^* = \left[y_0 - \left(\mu_E - m\mu_K\right)\right] / \sigma^*$, $\lambda\left(y_0^*\right)$ is the inverse Mills ratio and $\rho_E = \text{corr}\left(e, e - mk\right)$. Similar manipulations yield the conditional mean in the child-rearing sector.

7.2 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

$$y_0 = \bar{k} - m\bar{e} = -\rho_K \sigma_K \lambda\left(-y_0^*\right) - m\rho_E \sigma_E \lambda\left(y_0^*\right).$$

Take derivatives of both sides, yielding

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

and

$$\partial RHS / \partial y_0 = \left(1/\sigma^*\right)\left[\rho_K \sigma_K \delta\left(-y_0^*\right) - m\rho_E \sigma_E \delta\left(y_0^*\right)\right]$$

where Heckman and Honoré (1990) establish that $0 < \delta\left(y_0^*\right) \equiv \partial\lambda\left(y_0^*\right) / \partial y_0^* < 1$ and $\partial\delta\left(y_0^*\right) / \partial y_0^* > 0$.

There are two cases to consider. First, if the covariance is sufficiently small, then $\rho_K < 0$ and $\rho_E > 0$. 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 $\rho_K > 0$ and $\rho_E < 0$. Then, $m < \sigma_{KE} / \sigma_K^2$ and $m^{-1} < \sigma_{KE} / \sigma_E^2$. Combining these two terms yields

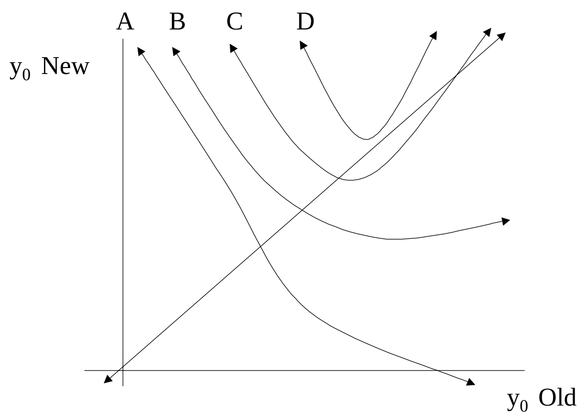
$$1 = m \cdot m^{-1} < \left[\sigma_{KE} / \sigma_K^2\right] \cdot \left[\sigma_{KE} / \sigma_E^2\right] = \rho^2 .$$

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,

$$\partial^2 RHS / \partial y_0^2 = -\frac{1}{\sigma^{*2}}\left[\rho_K \sigma_K \frac{\partial\delta\left(-y_0^*\right)}{\partial\left(-y_0^*\right)} + m\rho_E \sigma_E \frac{\partial\delta\left(y_0^*\right)}{\partial y_0^*}\right]$$

which is always negative (positive) when both correlations are positive (negative).

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 (the translation of this graph into the proportion of the population bearing children is in the main paper):



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 $m^{-1} < \sigma_{KE}/\sigma_E^2$). 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.

7.3 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:

$$m^2\left[\sigma_{KE} - \sigma_K^2\right] + m\left[2\sigma_{KE} - \sigma_E^2\right] - \sigma_E^2 > 0 \qquad \text{(A-1)}$$

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

7.4 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 both in 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
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 Child-Rearing and Education

Agents to the left choose education, while those to the right choose child-rearing.

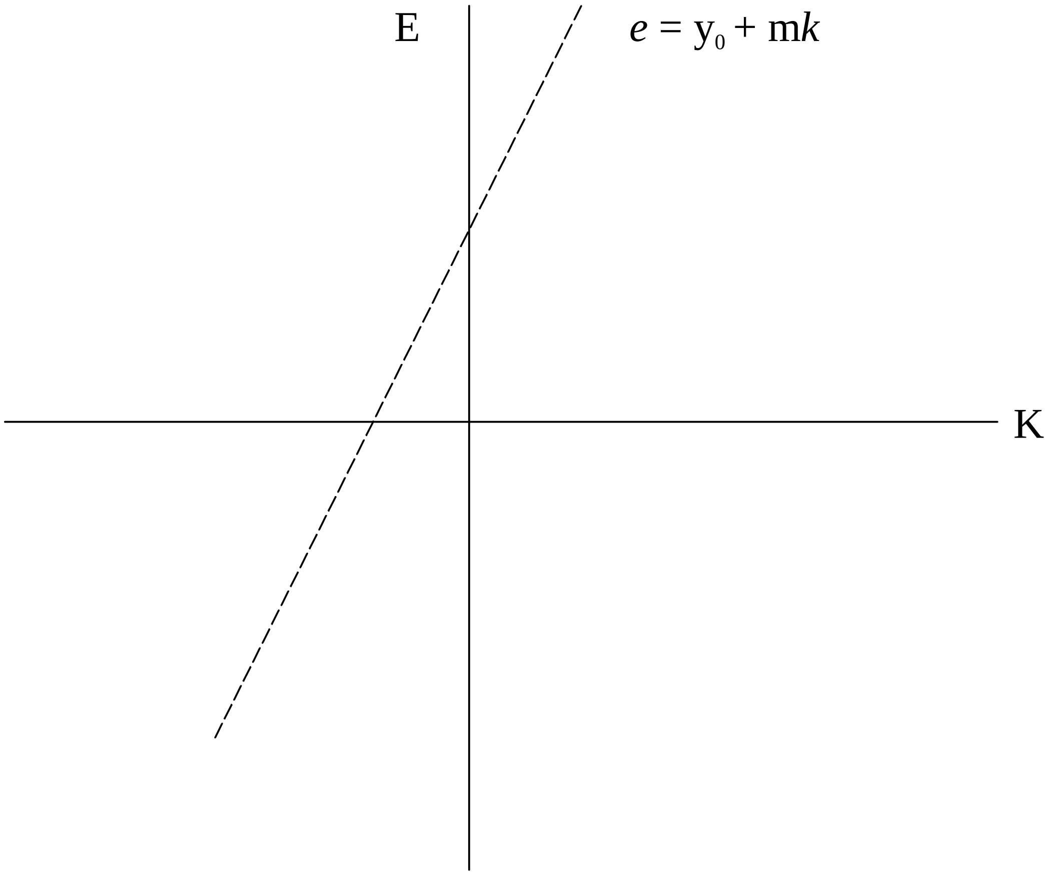


Figure II

The Fraction of the Population Desiring Single Motherhood as a Function of the Fraction Actually Choosing Single Motherhood

Solutions to the single period problem must lie on the forty-five degree line.

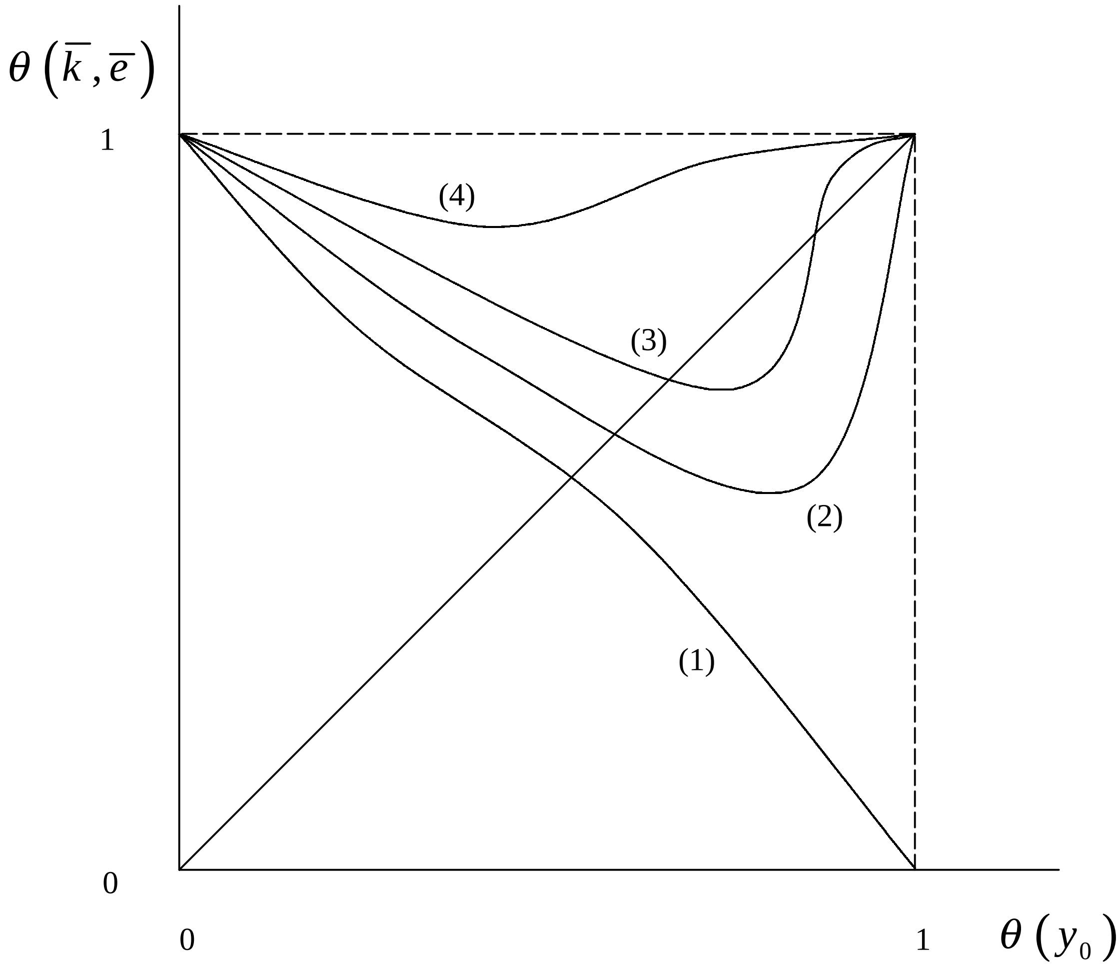


Figure III

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

(Steady states are intersections with the 45-degree line at a slope less than one)