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**Your Conscience You Must Keep,  
or it Must be Kept for You**

by

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## Your Conscience You Must Keep, or it Must be Kept for You

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Parents in several cultures ‘discipline’ their daughters to inculcate the supposedly feminine virtues. The measures taken by parents range from the benign to the brutal across societies. The paper formalizes the idea that this process can be understood as an equilibrium outcome of a signaling game between parents of girls and prospective suitors. We identify the conditions that make a society-wide norm *feasible*, and those that determine the *extent* of restrictions faced by girls in equilibrium. The predictions of the model can help understand the persistence of extreme practices like foot-binding and genital mutilation of young girls.

*Keywords:* Marriage, Signaling, Virginity

*JEL Codes:* C7, J1, Z1

## I. Introduction

First Lady Eleanor Roosevelt begins her list of America's greatest women with Anne Hutchinson. In the first half of the seventeenth century Anne Hutchinson used to organize meetings to discuss sermons by ministers of the Massachusetts Bay Colony, and express her own theological views. She stressed the individual's intuition as a means of reaching God and salvation, rather than the observance of institutionalized beliefs and the precepts of ministers. In response, she was charged with heresy, sedition, and lewd conduct as both men and women used to attend her meetings. During the trial the Governor of the colony told her that she had troubled the peace of the commonwealth and the churches because her meetings were not tolerable nor comely in the sight of God nor fitting for a woman. She tried to defend herself by saying that her views were guided by her conscience. The Governor's response was—"Your conscience you must keep, or it must be kept for you."<sup>1</sup>

The trial of Anne Hutchinson is but one example representing how women have been expected to, and subjected to, play a subservient role to men during a significant part of our history. It also highlights the interaction between the legal institutions and the religious orientation of a society in determining the extent of confinement of women. The present paper attempts to provide a formal framework to understand why women are confined in various ways, and what determines the intensity of their confinement.<sup>2</sup>

Parents in several cultures even today 'discipline' their daughters to inculcate the supposedly feminine values. This is particularly true of societies where the institution of marriage is highly regarded. An important component of this disciplining process is moral indoctrination which often relies on particular interpretations of religious scriptures.<sup>3</sup>

In most societies till mid-twentieth century, arguably the most important concern of parents that drove this process was how to limit the possibility of their daughter's physical relations with a man prior to marriage. The importance of an unmarried girls virginity can be gauged from the fact that in the United States (till 1935) the legal punishment of a man for the 'breach of promise' to marry a girl was greater if the girl had lost her virginity during courtship (Brinig, 1990).

Such parental concerns continue to affect the lives of girls to different extents across

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<sup>1</sup>See, for example, Carnes and Winship (2004).

<sup>2</sup>We use the term *confinement* since we focus on the restrictions placed on women. We shall focus exclusively on the confinement of unmarried women, and refer to them as girls.

<sup>3</sup>For example, Titus 2:5 in King James version of the Bible says that elder women should train the younger women "...to be sober-minded, chaste, workers at home, kind, being in subjection to their own husbands, that God's word may not be blasphemed." Similarly, Quran 4:34 tells "...righteous women are (meant to be) devoted and to guard what God has (willed to be) guarded even though out of sight (of the husband). As for those (women) on whose part you fear ill-will and nasty conduct, admonish them (first), (next) separate them in beds (and last) beat them. But if they obey you, then seek nothing against them."

societies. In some cultures parents may not go beyond regulating the dress code of their daughters, while in others social norms compel them to have their daughters undergo genital mutilation. The State Department of the United States Government estimates that “...the number of females who have been subjected to this practice range from 115 million to 130 million worldwide and an estimated two million girls are at risk each year.” How intensely parents need to confine their daughters can also be gauged from the punishment of those girls who do not follow the norms of the society. While cohabitation and unwed motherhood is becoming increasingly common in some societies, girls in some other societies are killed in the name of honor “...by her male family members for a perceived violation of the social norms of sexuality, or a suspicion of having transgressed the limits of social behavior imposed by traditions. This includes seeing or meeting a man even if this is only a suspicion or a gossip.”<sup>4</sup>

We examine whether confinement of girls can be understood as an equilibrium outcome of a signaling game between parents of girls and prospective suitors, where parents try to signal their daughter’s potential for remaining fidel.<sup>5</sup> The signaling model we use rests upon two implicit assumptions motivated by evolutionary considerations. (1) Parents of girls prefer to have their daughters married; and, controlling for other factors, a richer groom is preferred over a poorer one (Edlund, 1999). (2) Genetic relatedness (Hamilton, 1964) would imply that men would prefer to spend resources on their ‘own children.’ We therefore assume that men prefer those girls as marriage partners who are more likely to remain fidel.

If men indeed care about fidelity they would value other attributes in girls that they believe are correlated with the likelihood of remaining fidel. We propose that one such trait is *docility*. The word docility is being used precisely in its dictionary sense: ‘easily managed or handled’, and ‘readily trained or taught.’ Fisman et al. (2006) conduct a speed dating experiment and find that “...on average men do not *value* womens intelligence or ambition when it exceeds their own; moreover, a man is less likely to *select* a woman whom he perceives to be more ambitious than he is.” Men probably entertain the belief that more intelligent and ambitious women are not likely to be ‘easily managed or handled.’

Girls in any given society will be assumed to be of two types– docile and non-docile. However, the true type of a girl is private information of her family. Parents confine their daughters to signal docility.<sup>6</sup> Confinement is costly for parents, but more so for parents

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<sup>4</sup>The complete report on mutilation is available at: [www.state.gov/g/wi/rls/rep/crfgm/](http://www.state.gov/g/wi/rls/rep/crfgm/). The one on honor-killings is available at: [www.un.org/womenwatch/daw/egm/vaw-gp-2005/docs/experts/khafagy.honorcrimes.pdf](http://www.un.org/womenwatch/daw/egm/vaw-gp-2005/docs/experts/khafagy.honorcrimes.pdf).

<sup>5</sup>The basic idea is evident in Dickemann (1981) and Posner (1992), among several others.

<sup>6</sup>Confinement can be narrowly interpreted as parental regulation of their daughter’s choices on issues that directly or indirectly affect the possibility of premarital sex. Treas and Giesen (2000) find a positive

of non-docile girls. Once all parents choose the level of confinement for their daughters, men observe it, update their beliefs regarding the type of each girl, and decide whether or not to *consider* a girl as a potential marriage partner.

Men in any given society value a girl as a potential partner by taking into account (i) her unobservable docility, and (ii) the observed extent of her premarital confinement (Buss, 1989). The valuation of both docility and signals of confinement may vary across societies.

Lifestyle choices that can affect the marriage prospects of a girl clearly lie in a domain where parental involvement is present (Cheung, 1972; Edlund and Lagerlöf, 2006). We assume that girls in different societies have different degrees of *agency*— the freedom to make choices without (parental) interference. The index of agency of girls is a characteristic of the society determined by the interplay of its economic, legal, and religious institutions. The marginal cost of confining a non-docile girl relative to a docile girl is assumed to be higher in societies where girls have greater agency.<sup>7</sup>

The unique equilibrium in a society can either involve all girls being confined to the same level (the pooling equilibrium), or a higher level of confinement for docile girls (the separating equilibrium). We interpret the common level of confinement in a pooling equilibrium as representing the norm in a society regarding the behavior of girls prior to marriage. Low agency of girls, and sufficiently low valuation of signals of confinement relative to the valuation of docility, make a society-wide norm feasible. Societies with low agency, high valuation of docility, and high relative valuation of signals of confinement will exhibit higher levels of confinement. We use these results to discuss how population density, production technology, and the descent and inheritance rules of a society affect the patterns of confinement.

The paper is organized as follows. Section II presents the formal framework. In Section III we describe the separating and the pooling equilibria of the signaling game. Section IV provides a detailed discussion of the unique prediction for each society. Section V concludes with a brief review of the related literature. An appendix collects all the technical details.

## II. The Model

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association between premarital sexual behavior and infidelity using the 1992 National Health and Social Life Survey data.

<sup>7</sup>It may be that on average parents are more likely to deal with disobedient children in ways that are less time consuming in a society where agency of children is low. But, it is difficult to provide empirical support for this assumption as most of the research on agency of children and adolescents has focused on developed countries. However, there is evidence that socio-economic conditions affect how parents treat their children (Paxson and Waldfogel, 1999).

The decision making unit(s) will be referred to as ‘parents of girls’ on one side, and ‘men’ on the other side. Docile and non-docile girls will be denoted as type- $d$  and type- $n$ , respectively. The game proceeds as follows: (i) Nature determines the type of each girl, with  $\mu_o$  being the common prior probability that a girl is docile. One could also interpret  $\mu_o$  as the prior belief of men regarding the fraction of docile girls in the society. (ii) Parents of both types of girls choose the extent of confinement for their daughters. (iii) Men observe the extent of confinement of each girl and update their beliefs regarding the type of each girl. (iv) Each man then determines which girls he would be willing to *consider* as a potential match.

Confinement will be denoted by the non-negative variable  $e$ . It is important to note that signaling usually takes place over time. The extent of confinement can be thought of as the observed history of a girl. Informally, the type of a girl refers to who she ‘is’; whereas the extent of confinement captures who she ‘appears to be’ to the society.

Confinement of a girl can be costly for parents in several ways. There can be opportunity costs of confining a girl, and psychic costs of justifying the confinement. The costs of confining docile and non-docile girls are given by  $c_d(e; \theta) = \sqrt{\theta}e^2$  and  $c_n(e; \theta) = \theta e^2$ , respectively. The parameter  $\theta > 1$  is an index of *agency* of girls in a society. Low values of  $\theta$  refer to societies where both types of girls have low agency. Controlling for other factors, a society wherein religious scriptures are interpreted as strictly suggesting that women should be ‘in subjection to their husbands’ are likely to have a relatively lower  $\theta$ . Parents can draw upon such beliefs to justify confinement as something for the future benefit of their daughters, and girls themselves might internalize such views over time. Among otherwise similar societies, those with underdeveloped female labor markets will also have a lower  $\theta$ . At any  $\theta > 1$ , the properties of the cost function are

- $\frac{\partial c_d}{\partial e} \geq 0$  and  $\frac{\partial c_n}{\partial e} \geq 0$ , for all  $e \geq 0$ .
- $\frac{\partial c_n}{\partial e} \geq \frac{\partial c_d}{\partial e}$ , at any common  $e \geq 0$ .
- $\frac{\partial}{\partial \theta} \left[ \frac{\frac{\partial c_n}{\partial e}}{\frac{\partial c_d}{\partial e}} \right] > 0$ , at any common  $e \geq 0$ .

The first two properties refer to the non-negative marginal costs for both types, and the relatively higher marginal cost for non-docile girls, respectively. The third property captures our assumption that the marginal cost of confining a non-docile girl relative to a docile girl is higher in societies where girls have greater agency.

The value of a docile girl to men is assumed to be  $v_d(e) = \alpha + \sqrt{\beta}e$ . Without loss of generality, the value of non-docile girls,  $v_n(e)$ , is normalized to zero. The parameter  $\alpha > 0$

is the valuation of docility of girls by men in the society. The parameter  $\beta > 0$  reflects the marginal valuation of signals of premarital confinement of girls by men in the society. A strictly positive  $\beta$  formalizes the assumption that confinement not only serves as a signal of docility, but men derive additional utility from marrying a girl who is publicly observed to have been confined. We shall use the parameter  $\gamma$  to denote the relative valuation of signals ( $\frac{\beta}{\alpha}$ ) by men. Informally,  $\gamma$  will be high in societies where men value girls primarily for what they appear to be.<sup>8</sup>

Each man in the society is fully characterized by his wealth  $w$ . In order to model the behavior of men we assume that every man expects that a fraction  $\lambda \in (0, 1)$  of his wealth will be spent on the girl he will end up marrying. Without loss of any generality we may take  $\lambda = \frac{1}{2}$ . The utility function of men thus becomes

$$u_m(t, e, w) = \begin{cases} v_t(e) + \frac{1}{2}w & \text{if married to girl - } (t, e). \\ w & \text{if unmarried.} \end{cases} \quad (1)$$

Each man decides whether he would be willing to consider a girl as a potential partner after observing her extent of confinement. The strategy of all men can be concisely represented by an indicator function–  $d(e|w)$ – which takes the value 1 if the man with wealth  $w$  would be willing to consider the girl whose confinement is observed to be  $e$ , and takes the value 0 if he would not be willing to consider her.

Let  $\mu_d(e) \in [0, 1]$  denote the common updated probability that the girl is docile, after her extent of confinement is observed to be  $e$ . The expected value of this girl, as evaluated by men is

$$E_t[v_t(e)] = \mu_d(e)v_d(e). \quad (2)$$

We assume that men would be willing to consider all those girls as potential marriage partners who leave them at least as well off as in the unmarried state. Thus a girl whose confinement is observed to be  $e$  would be considered by all men having wealth  $w$  such that

$$E_t[u_m(t, e, w)] \geq w. \quad (3)$$

$$\Rightarrow w \leq 2\mu_d(e)v_d(e) = 2E_t[v_t(e)] = \bar{w}(e), \quad (4)$$

where  $\bar{w}(e)$  denotes the wealth of the *critical suitor*– the richest man willing to consider the girl whose confinement is observed to be  $e$ .

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<sup>8</sup>The reason for defining  $\gamma$  as  $\frac{\beta}{\alpha}$ , instead of  $\frac{\sqrt{\beta}}{\alpha}$ , will become clear in the following section.



Parents choose the extent of confinement for their daughters to maximize

$$u(t, e, \bar{w}) = \bar{w} - c_t(e). \quad (5)$$

The indifference curves of parents of girls are upward sloping and convex in the  $(e, \bar{w})$ -space. Indifference curves with higher utility will lie towards the north-west in this space.

Each society in our model is characterized by four parameters– the agency of girls ( $\theta$ ), the valuation of docility by men ( $\alpha$ ), the relative valuation of signals of confinement by men ( $\gamma$ ), and the prior belief of men regarding the frequency of docile girls in the society ( $\mu_o$ ). The distribution of societies over this four-dimensional parameter space may not be uniform as some (or, all) of these parameters are likely to be correlated. We do not address what determines the present set of parameters characterizing a society, or how they evolve over time. Given the parameters associated with a society at any point in time, the results of the model should be interpreted as predictions regarding what we would expect to observe in the society at that time.

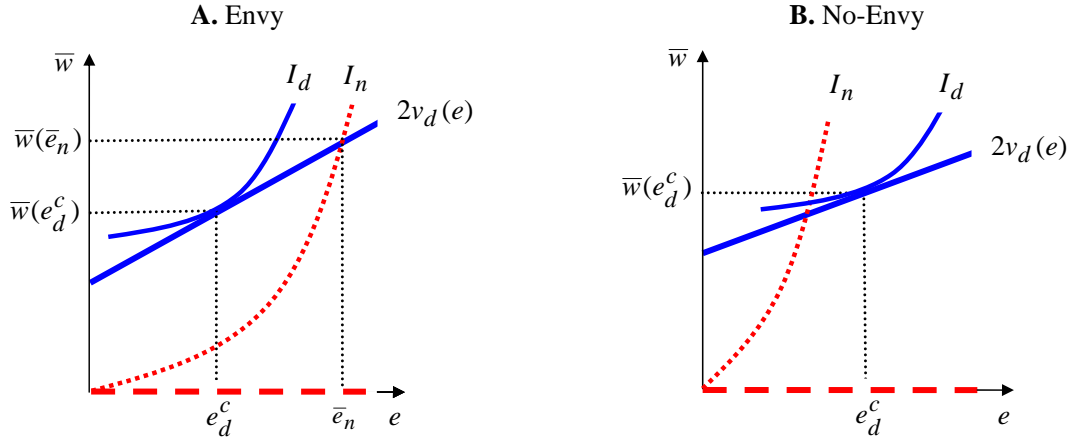
We identify the undefeated equilibrium (Mailath et al., 1993) of the signaling game described above. The focus shall be on understanding (i) what makes a society-wide norm feasible, and (ii) what determines the equilibrium level of confinement.

We would like to make two remarks about our model. First, we have made the simplifying assumption that all parents of girls within a society are identical except in the type of their daughters. Second, we do not model who will get married to whom. Imagine the approach graduate schools might take to deal with a large number of applications for the position of an assistant professor. In the first stage, the hiring committee might use some useful criterion (for e.g., rank of the applicant’s university) to decide which applications to ‘consider’. Only in the second stage the committee might look at the strengths and weaknesses of the remaining candidates in detail. We explore the first stage of the marriage market where each man only decides which girls he would be willing to consider using signals of premarital confinement as the useful criterion.

### III. Equilibrium Analysis

We begin by analyzing the benchmark complete information setting where docile girls will be believed to be docile with probability 1, and non-docile girls will be believed to be docile with probability 0. The optimal confinement choice by parents of the two types of girls would be

$$e_d^c = \operatorname{argmax}_e [2v_d(e) - c_d(e)] \quad \text{and} \quad e_n^c = \operatorname{argmax}_e [2v_n(e) - c_n(e)]. \quad (6)$$



**Figure 1:** COMPLETE INFORMATION EQUILIBRIUM.

$$\Rightarrow e_d^c(\alpha, \gamma, \theta) = \sqrt{\frac{\alpha\gamma}{\theta}} \quad \text{and} \quad e_n^c = 0. \quad (7)$$

The equilibrium confinement level of docile girls in the complete information setting increases with the valuation of docility and the relative valuation of signals by men, but decreases with an increase in agency of girls. The zero confinement of non-docile girls is a consequence of our simplifying assumption that men attach a value of zero to non-docile girls. The wealth of the critical suitors corresponding to the two types of girls will be

$$\bar{w}(e_d^c) = 2v_d(e_d^c) \quad \text{and} \quad \bar{w}(e_n^c) = 2v_n(e_n^c). \quad (8)$$

$$\Rightarrow \bar{w}(e_d^c) = 2\alpha\left(1 + \frac{\gamma}{\sqrt{\theta}}\right) \quad \text{and} \quad \bar{w}(e_n^c) = 0. \quad (9)$$

The resulting utilities of parents are

$$u(d, e_d^c, \bar{w}(e_d^c)) = \alpha\left(2 + \frac{\gamma}{\sqrt{\theta}}\right) \quad \text{and} \quad u(n, e_n^c, \bar{w}(e_n^c)) = 0. \quad (10)$$

#### A. *Asymmetric Information*

The equilibrium confinement choices in the complete information setting are  $(e_d^c, 0)$ . It is customary to divide the analysis of the asymmetric information setting into two subcases: the *no-envy* case, and the *envy* case (Figure 1). In envious societies parents of non-docile girls have a strict incentive to mimic the (complete information) confinement choice by

parents of docile girls. The cost of increasing confinement (from 0 to  $e_d^c$ ) for parents of non-docile girls is outweighed by the benefit from the corresponding increase in the wealth of the critical suitor (from 0 to  $\bar{w}(e_d^c)$ ). Formally, envious societies are those where

$$u(n, e_d^c, \bar{w}(e_d^c)) > u(n, e_n^c, \bar{w}(e_n^c)). \quad (11)$$

$$\Rightarrow \frac{2}{\gamma} + \left(\frac{2}{\sqrt{\theta}} - 1\right) > 0. \quad (12)$$

$$\Rightarrow 2\alpha + \beta\left(\frac{2}{\sqrt{\theta}} - 1\right) > 0. \quad (13)$$

Signaling, by its very nature, is meaningful only in envious societies. An increase in the valuation of docility ( $\alpha$ ), and a decrease in the agency of girls ( $\theta$ ) are likely to make a society envious. The former increases the reward of posing one's non-docile daughter as a docile girl, while the latter decreases the cost of doing so. An increase in the marginal valuation of signals ( $\beta$ ) increases the wealth of the critical suitor for docile girls because the equilibrium confinement is higher. The incentive for parents of non-docile girls to mimic this increased confinement level depends on the benefit of a wealthier critical suitor compared to the cost of increasing confinement in order to attract the wealthier suitor. It turns out parents of non-docile girls have the incentive to mimic if and only if agency of girls is below a certain threshold ( $\theta \leq 4$ ), such that the cost of increasing confinement is not too high.

### B. Separating Equilibria

A separating equilibrium involves the choice of a strictly higher extent of confinement by parents of docile girls, than parents of non-docile girls. In envious societies parents of docile girls will not be able to distinguish their daughters by choosing  $e_d^c$ . The minimum confinement that helps parents of docile girls distinguish their daughters equals the maximum confinement parents of non-docile girls would be willing to choose for their daughters. This maximum level,  $\bar{e}_n$ , makes parents of non-docile girls indifferent between (i) choosing  $e_n^c$  ( $= 0$ ) and revealing their daughters as non-docile girls, and (ii) choosing  $\bar{e}_n$  and posing their daughters as docile girls (see Figure 1(A)). Thus,  $\bar{e}_n$  is given by

$$u(n, \bar{e}_n, \bar{w}(\bar{e}_n)) = u(n, e_n^c, \bar{w}(e_n^c)). \quad (14)$$

$$\Rightarrow \bar{e}_n = \frac{\sqrt{\alpha}(\sqrt{\gamma} + \sqrt{\gamma + 2\theta})}{\theta}. \quad (15)$$

**Proposition 1.** *Among all possible separating equilibria in the envy case, the one which provides parents of docile girls maximum utility is as follows.*

- (i) *The strategy of the parents of girls is:  $(e_d^*, e_n^*) = (\bar{e}_n, 0)$ ;*
- (ii) *The belief of men is:  $\mu_d^*(e) = 1$  if  $e \geq \bar{e}_n$ , and  $\mu_d^*(e) = 0$  if  $e < \bar{e}_n$ ;*
- (iii) *The strategy of men is:*

$$d^*(e|w) = \begin{cases} 1 & \text{if } e \geq \bar{e}_n \text{ and } w \leq 2v_d(e). \\ 1 & \text{if } e < \bar{e}_n \text{ and } w \leq 0. \\ 0 & \text{otherwise.} \end{cases} \quad (16)$$

On the *equilibrium path* in the envy-separating equilibrium mentioned above (i) the confinement of docile girls is  $\bar{e}_n$  while the non-docile girls are not confined, (ii) men believe a girl to be docile if her confinement is  $\bar{e}_n$ , and non-docile if she is not confined, and (iii) all men with wealth  $w \leq 2v_d(\bar{e}_n)$  would be willing to consider all the confined docile girls as potential partners, whereas only men with wealth  $w \leq 0$  would be willing to consider the unconfined non-docile girls.

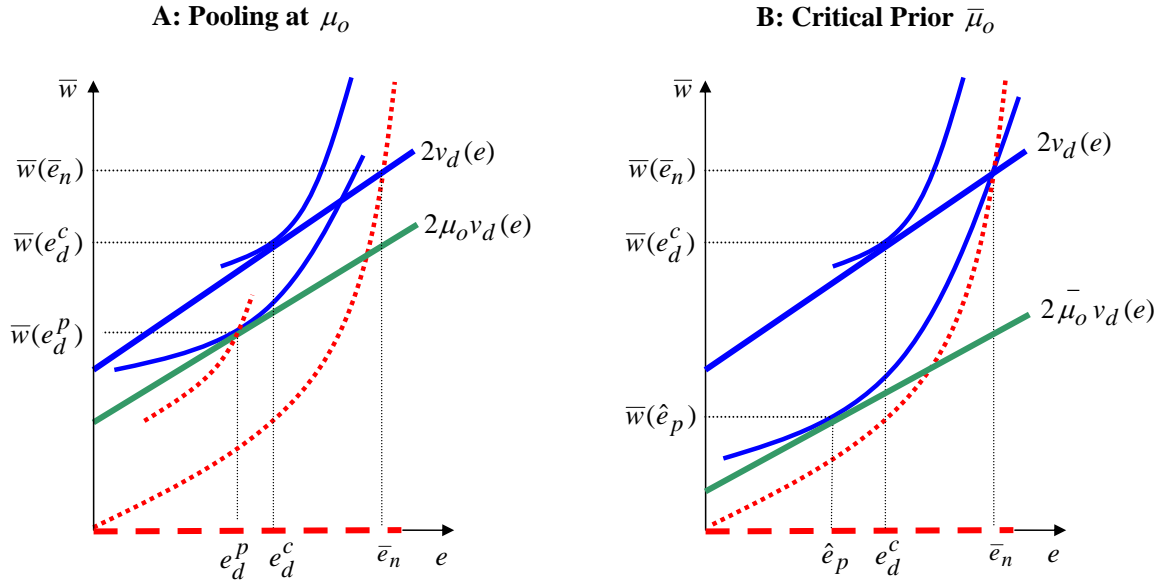
It can be easily verified that among all possible separating equilibria in the *no-envy* case, the one which provides parents of docile girls maximum utility is identical to the equilibrium in the complete information setting (see Figure 1(B)).

### C. Pooling Equilibria

In a pooling equilibrium parents of both types of girls choose the same extent of confinement. The updated beliefs of men regarding the fraction of docile girls in the society will be the same as their prior belief  $\mu_o$ . In our set up pooling is possible in both envious and non-envious societies at several levels of confinement for any  $\mu_o \in (0, 1)$ . The pooling equilibrium which provides parents of docile girls the highest utility (see Figure 2(A)) among all the possible pooling equilibria for any given  $\mu_o \in (0, 1)$  involves

$$e_d^p = \operatorname{argmax}_e [2\mu_o v_d(e) - c_d(e)] = \mu_o \sqrt{\frac{\alpha\gamma}{\theta}}. \quad (17)$$

**Proposition 2.** *For a given  $\mu_o \in (0, 1)$ , among all possible pooling equilibria in the envy case, the one which provides parents of docile girls maximum utility is as follows.*



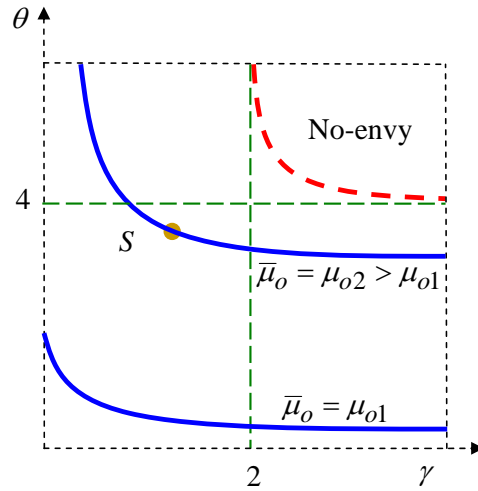
**Figure 2: POOLING EQUILIBRIA.**

- (i) The strategy of the parents of girls is:  $(e_d^*, e_n^*) = (e_d^p, e_n^p)$ ;
- (ii) The belief of men is:  $\mu_d^*(e) = \mu_o$  if  $e \geq e_d^p$ , and  $\mu_d^*(e) = 0$  if  $e < e_d^p$ ;
- (iii) The strategy of men is:

$$d^*(e|w) = \begin{cases} 1 & \text{if } e \geq e_d^p \text{ and } w \leq 2\mu_o v_d(e). \\ 1 & \text{if } e < e_d^p \text{ and } w \leq 0. \\ 0 & \text{otherwise.} \end{cases} \quad (18)$$

On the *equilibrium path* in the pooling equilibrium mentioned above (i) all girls are confined to the same level of  $e_d^p$ , (ii) men believe each girl is docile with (the prior) probability  $\mu_o$ , and (iii) all men with wealth  $w \leq 2\mu_o v_d(e_d^p)$  would be willing to consider all girls in the society as potential marriage partners.

In any non-envious society the utility of parents of *docile* girls in the no-envy separating equilibrium at  $(e_d^c, 0)$  is strictly higher than in any feasible pooling equilibrium irrespective of the prior (see Figure 1(B)). However, in envious societies there exists a  $\bar{\mu}_o \in (0, 1)$  such that some of the feasible pooling equilibria for any  $\mu_o > \bar{\mu}_o$  provide them a strictly higher utility than the envy separating equilibrium mentioned in Proposition 1. As illustrated in Figure 2(B), the value of  $\bar{\mu}_o$  in a given society is such that parents of docile girls are indifferent between (i) pooling at  $\hat{e}_p(\alpha, \gamma, \theta, \bar{\mu}_o)$ , and (ii) separating by choosing  $\bar{e}_n(\alpha, \gamma, \theta)$ . Thus, the critical prior is given by



**Figure 3:** CONTOURS OF THE CRITICAL PRIOR.

$$u(d, \hat{e}_p, \bar{w}(\hat{e}_p)) = u(d, \bar{e}_n, \bar{w}(\bar{e}_n)). \quad (19)$$

$$\Rightarrow \bar{\mu}_o = -\frac{\sqrt{\theta}}{\gamma} + \sqrt{\frac{\theta}{\gamma^2} + 2\left(\frac{\sqrt{\theta}-1}{\theta}\right)\left(1 + \frac{\theta}{\gamma} + \sqrt{1 + \frac{2\theta}{\gamma}}\right)}. \quad (20)$$

In our setup the critical prior for a given society depends only on the relative valuation of signals by men and the agency of girls in the society. As illustrated in Figure 3, it is non-decreasing in both agency of girls and the relative valuation of signals by men (see Appendix B for details). The dark dashed curve in the north-west corner of Figure 3 demarcates envious and non-envious societies in the  $(\gamma, \theta)$ -space (see equation 12). The downward sloping dark solid curves are the contours of the critical prior. The contour associated with a higher value of the critical prior lies completely above the contour for any comparatively lower critical prior.

#### IV. The Unique Prediction and Interpretation

Consider the point  $S$  in Figure 3 which denotes a ‘set’ of societies such that every society in this set has the same agency  $(\theta)$ , the same relative valuation of signals  $(\gamma)$ , and the same critical prior  $(\bar{\mu}_{o2})$ , but may have any  $\alpha > 0$  and any  $\mu_o \in [0, 1]$ .<sup>9</sup> The following

<sup>9</sup>Figure 3 is a faithfully modified version of the output from Mathematica 6.0. The original output is provided in Appendix B.

proposition tells us which of these societies will exhibit a pooling/separating equilibrium.

**Proposition 3.** *The unique undefeated equilibrium in non-envious societies is the separating equilibrium at  $(e_d^c, 0)$ . The unique undefeated equilibrium in an envious society having a prior of  $\mu_o$  is*

- *the pooling equilibrium at  $(e_d^p, e_d^p)$  if  $\mu_o \geq \bar{\mu}_o(\gamma, \theta)$ .*
- *the separating equilibrium at  $(\bar{e}_n, 0)$  if  $\mu_o < \bar{\mu}_o(\gamma, \theta)$ .*<sup>10</sup>

The identical confinement of all girls in the pooling equilibrium can be interpreted as a *society-wide norm*. The conditions prevailing in such societies (as captured by the four parameters  $\alpha, \gamma, \theta, \mu_o$ ) provide parents of docile girls no incentive to distinguish their daughters as being docile, while parents of non-docile girls have all the incentive not to let their daughters be identified as non-docile. The separating equilibrium arises when the incentives of parents are such that a society-wide norm of confinement can not emerge.<sup>11</sup>

#### A. Interpretation

Let us consider the three-dimensional subset shown in Figure 4(A) such that men in each society in this subset have the same prior (say,  $\mu_o = \mu_{o1}$ ). As mentioned earlier, it is unlikely that only one of the four parameters changes in a society because of the possible correlations among them. In the following we describe the predictions of the model *across* societies. The pattern of confinement in non-envious societies will not be discussed as it is qualitatively similar to that in the separating equilibrium in envious societies.

*Feasibility of Norm:* All societies in Figure 4(A) have a prior of  $\mu_{o1}$ . Societies having a critical prior equal to  $\mu_{o1}$  lie on the contour labeled  $\bar{\mu}_o = \mu_{o1}$ . Figure 3 illustrates that contours associated with relatively higher critical priors are located relatively higher in the  $(\gamma, \theta)$ -space. All societies below the  $\bar{\mu}_o = \mu_{o1}$  contour in Figure 4(A) will have a critical prior lower than  $\mu_{o1}$ . Therefore, all societies below the  $\bar{\mu}_o = \mu_{o1}$  contour will exhibit a pooling equilibrium, while all societies above this contour will exhibit a separating equilibrium.

Figure 4(A) clearly illustrates that since the critical prior depends only on the agency of girls and relative valuation of signals by men, whether a society will exhibit the norm

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<sup>10</sup>In a model with more than two types the intuitive criterion (Cho and Kreps, 1987) can also lead to pooling as the unique outcome under certain conditions. See Mailath et al. (1993) for compelling reasons for using the undefeated equilibrium.

<sup>11</sup>Posner (2000, pp. 26) provides a detailed analysis of social norms as equilibria of signaling games.

or not does not depend on the valuation of docility of girls by men.<sup>12</sup> All societies with a sufficiently low agency of girls will exhibit a society-wide norm of confinement (the pooling equilibrium), while no society with a sufficiently high agency of girls can exhibit a norm. For societies in the intermediate range of agency, a society-wide norm will arise if and only if the relative valuation of signals of confinement by men is sufficiently low. The reason for this pattern is that marginal cost of confinement of non-docile girls relative to docile girls increases as we move from societies with low agency to societies with high agency of girls. In order for parents of non-docile girls to have the incentive to pose their daughters as docile girls, the required equilibrium level of confinement (which is increasing in relative valuation of signals) must not be too high. We can broadly summarize that, for any given prior, the feasibility of a norm is high if (i) agency of girls is low, and (ii) relative valuation of signals of confinement by men is also low.

Two societies with identical *relative* valuation of signals ( $\gamma$ ) may differ dramatically in the valuations of docility ( $\alpha$ ) and signals ( $\beta$ ). For example,  $\gamma$  can have a low value of 0.1 for  $(\alpha, \beta) = (0.1, 0.01)$ , or  $(100, 10)$ . History rarely offers examples of societies where girls have low agency and men attach little value to both docility and signals of confinement. On the other hand, societies characterized by low agency of girls, and high valuations of both docility and signals of confinement by men, have been the rule rather than the exception (Sacks, 1979).

*Extent of Confinement:* The extent of confinement of all girls in the pooling equilibrium, and that of docile girls in the separating equilibria is

$$\tilde{e}_p = \tilde{\mu}_o \sqrt{\frac{\alpha\gamma}{\theta}} \quad \text{and} \quad \bar{e}_n = \frac{\sqrt{\alpha}(\sqrt{\gamma} + \sqrt{\gamma + 2\theta})}{\theta}, \quad \text{where} \quad \gamma = \frac{\beta}{\alpha}. \quad (21)$$

A partial increase in the valuation of docility by men leads to an increase in the equilibrium confinement without altering the equilibrium regime (from pooling to separating, or vice-versa) as the critical prior is independent of valuation of docility by men.

Let us now consider the effect of a partial increase in the agency of girls starting at  $\theta$  close to 1, for any fixed valuation of docility and fixed relative valuation of signals of confinement by men. Partial increments in agency result in a decrease in confinement till we reach the boundary demarcating the pooling and separating regimes. As we cross the boundary there is a discontinuous increase in confinement for docile girls (from  $\tilde{e}_p$  to  $\bar{e}_n$ ), and a discontinuous decrease in confinement for non-docile girls (from  $\tilde{e}_p$  to 0). The confinement of docile girls keeps decreasing with further partial increases in agency, and becomes negligible at extremely high levels of agency.

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<sup>12</sup>This statement is not strictly true as it is an artifact of the particular functional forms we have used.



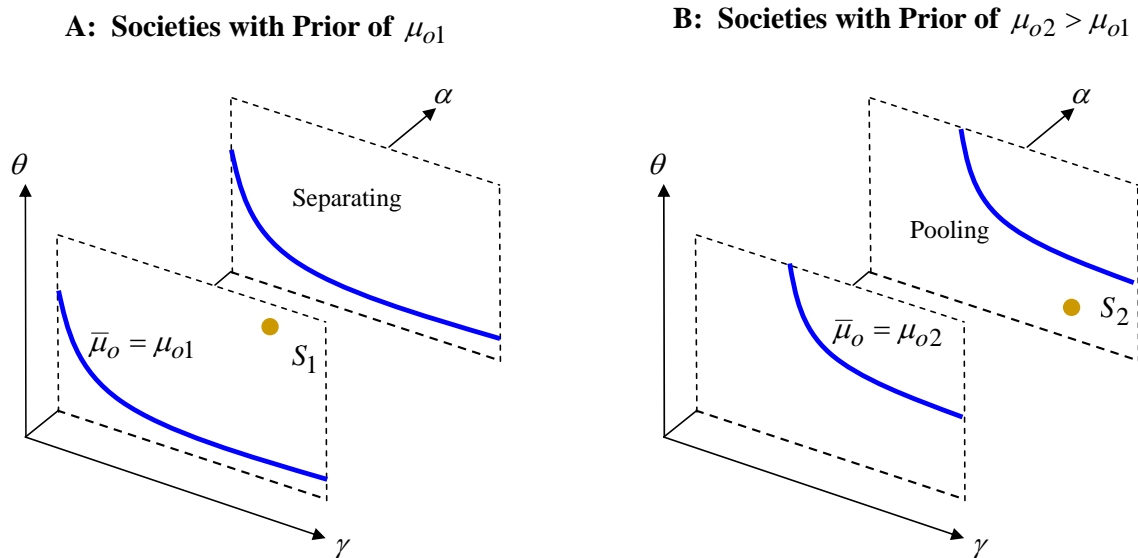


Figure 4: EQUILIBRIUM REGIMES.

Next, let us consider the effect of partial increase in the relative valuation of signals by men. At any fixed valuation of docility, if the agency of girls is fixed at a sufficiently low level (the pooling regime), then an increase in the relative valuation of signals is associated with the level of confinement going from very low to very high for all girls. At sufficiently high values of agency (the separating regime), it is only the confinement of docile girls that continuously increases. For intermediate levels of agency, a partial increase in relative valuation of signals first leads to an increase while we are in the pooling regime, then a discontinuous increase (decrease) occurs for docile (non-docile) girls as we enter the separating regime, and then further increases in confinement happen only for docile girls.

In summary, (i) a partial increase in the valuation of docility by men always leads to a higher confinement, (ii) a partial increase in the relative valuation of signals of confinement by men leads to an (possibly discontinuous) increase in confinement, and (iii) a partial increase in agency of girls leads to a decrease in confinement (except for societies on the boundary).

*Effect of the Prior:* Each society in the three dimensional subset illustrated in Figure 4(B) has a prior of  $\mu_{o2} (> \mu_{o1})$ . The boundary demarcating the pooling and separating regimes for the subset of societies having the higher prior of  $\mu_{o2}$  will be displaced vertically upwards relative to the boundary for the subset of societies having the lower prior of  $\mu_{o1}$ . Thus, a greater measure of societies will satisfy the feasibility conditions required for the

emergence of a society-wide norm in the subset of societies having the higher prior.

*B. Discussion*

Anthropologists have long examined the correlation between the socio-economic organization of societies and the extent of confinement of unmarried girls (Goody, 1999; Schlegel, 1991). Although causal inferences are hard to make, the model presented in the paper can serve as a starting point to organize such findings. For example, when land is plenty and the marginal product of labor is high, a woman's fertility becomes paramount as greater number of children add to the labor force of the family. Fertility may override the concern with fidelity, making signals of premarital confinement less valuable to men. Accordingly, the model would predict low levels of confinement. Patrilineal descent rules make fidelity a relatively more important concern for men as compared to matrilineal descent rules, and thus the mechanism described in the paper would once again predict high levels of premarital confinement of girls. With regard to the inheritance rules of a society, note that the balance of decision making power would shift in favor of parents when daughters may also inherit parental property. Controlling for other factors, this implies that the agency of girls will be lower in societies where they can inherit property. In line with the anthropological evidence, the model predicts a higher level of confinement in such societies. Finally, when women contribute substantially in the production process the confinement will be low as agency of girls will be high. This is as much true of modern economies as of subsistence economies where gender differences in strength are relatively unimportant in the production process.<sup>13</sup>

Edlund and Korn (2002, pp. 208-209) have remarked that "...women have suffered seclusion, bound feet, and mutilation as a result of inability to commit to fidelity." In order to explore this in detail it is helpful to first distinguish premarital confinement by parents from postmarital confinement by husbands (Posner, 1992). It was from a very young age that the feet of girls used to be bound in China. Historians believe that foot binding served first as a signal by parents and then as insurance for husbands (Dorothy, 2005). Similarly, genital mutilation in several African communities is primarily performed on young girls aged 5- 12 (see footnote 4). Gitano gypsies in Spain provide a curious case as they create strong incentives for parents to confine their daughters prior to marriage by testing the virginity of brides 'during' the marriage ceremony (Martin and Gamella, 2005). Postmarital confinement is aimed at avoiding moral hazard by wives and ensuring their fidelity. Premarital confinement, which is the focus of the present paper, helps parents signal their daughter's potential for postmarital fidelity.

Secondly, these extreme practices show up as a group level phenomena (Mackie, 1996).

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<sup>13</sup>We have assumed that the anthropological measure of 'sexual non-permissiveness' reflects confinement.

The underlying conditions ought to structure the incentives in a manner such that a common pattern of behavior can be sustained for different types of individuals. This is why understanding what makes the pooling equilibrium feasible becomes important. But, a pooling equilibrium may involve any common extent of confinement chosen by parents of all girls. Therefore, in order to understand these extreme practices in totality, we also need to know what conditions lead to extreme confinement in the pooling equilibrium. This is the reason we have tried to discuss both these aspects in detail.

We conclude this discussion by comparing what might be crudely termed as liberal and traditional societies. Consider two societies  $S_1 = (\alpha_1, \beta_1, \theta_1, \mu_{o1})$  and  $S_2 = (\alpha_2, \beta_2, \theta_2, \mu_{o2})$  as shown in Figure 4, where  $\alpha_2 \gg \alpha_1$ ,  $\beta_2 \gg \beta_1$ ,  $\theta_2 \ll \theta_1$ ,  $\mu_{o2} > \mu_{o1}$ , but  $\gamma_2 = \frac{\beta_2}{\alpha_2} = \gamma_1 = \frac{\beta_1}{\alpha_1}$ . The lower valuation of docility, higher agency of girls, and relatively low prior in  $S_1$  will make this society more likely to exhibit a separating equilibrium. Could the pattern of confinement in a very liberal society be thought of as pooling at low levels of confinement? Our answer is no. The high agency of girls makes the pooling equilibrium infeasible. Moreover, the beliefs of men regarding the frequency of docile girls in a liberal society would be quite low, further reducing the likelihood of a pooling equilibrium. Since the agency of girls is very high, the confinement of even the docile girls in  $S_1$  will be negligible, making the separating equilibrium almost similar to a pooling equilibrium involving zero confinement.

In contrast, society  $S_2$  with its low agency, high valuation of docility, and high prior is likely to exhibit a pooling equilibrium. If agency is extremely low, the pooling equilibrium will arise irrespective of the values of the other parameters. Since agency of girls is very low, and valuations of both docility and signals of confinement are very high, the associated level of confinement for all girls in society  $S_2$  will be extremely high. Practices like genital mutilation, foot binding, and honor killings are probably the manifestations of a strict underlying society-wide norm, rendered feasible primarily by the extremely low agency of girls.

## V. Conclusion

Gary Becker (1973, pp. 814) motivated his pioneering analysis of marriage by observing that “...since marriage is practically always voluntary, *either* by the persons marrying *or* their parents, the theory of preferences can be readily applied.” Whether the *either* and the *or* are really interchangeable was rarely addressed. It is only recently that economists have started exploring the determinants and the implications of the balance of decision making power between parents and children. Our paper contributes to this literature by studying one of the most pervasive effects of the lack of agency and provides a formal framework to understand patterns of confinement of girls across societies.

Edlund and Lagerlöf (2006) point out that a move from parental consent to the consent of the marrying individuals regarding the choice of marriage partner may affect growth positively through several channels. For example, the human capital of grandchildren is likely to be higher as parents may have a greater incentive than grandparents to invest in the child. They also add that in the parental consent regime, parents might arrange the marriage of their child at a young age to minimize resistance from the child. Our model suggests the complementary explanation that since early marriage reduces the possibility of bad signals to potential suitors, the average age at marriage will be relatively lower in societies where men value signals of premarital confinement highly and agency of girls is low.

Lundberg et. al (2007) explicitly model the interaction between parents and children and highlight the subtle tradeoffs faced by parents: should parents control a child's decision making to avoid costly mistakes, or let the child make independent decisions and learn from his mistakes, or should they encourage shared decision-making. These tradeoffs are faced by every parent and the manner in which they are resolved can have important implications for the development of a child. Though beyond the scope of our paper, we speculate that excessive parental control might lead to an inefficient allocation of talent in a society by influencing the career choices of children, and thereby affect an economy adversely.

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## Appendix A: Proofs

Let  $e_d$ ,  $e_n$ , and  $d(e|w)$  denote the strategy of parents of docile girls, parents of non-docile girls, and men, respectively; and,  $\mu_d(e)$  denote the updated probability of men that a girl whose confinement is observed to be  $e$  is of type- $d$ . A Perfect Bayesian Equilibrium is a collection of strategies and beliefs ( $E^* = e_d^*, e_n^*, d^*(e|w), \mu_d^*(e)$ ) that satisfy the following three requirements: (i) strategies are mutual best responses given the beliefs, (ii) beliefs *on* the equilibrium path are updated according to Bayes rule, and (iii) beliefs *off* the equilibrium path may be arbitrary.

### *Proof of Proposition 1*

It can be easily verified that the equilibrium presented in Proposition 1 satisfies all the three conditions mentioned above. Note that one can construct innumerable other separating equilibria. For example, replacing  $\bar{e}_n$  by any  $e_d^s > \bar{e}_n$ , gives us another separating equilibrium. Clearly, any such separating equilibrium provides parents of docile girls a lower utility than the one in which they choose  $\bar{e}_n$ . *QED*.

### *Proof of Proposition 2*

The equilibrium satisfies the three conditions and, by definition, provides parents of docile girls maximum utility among all possible pooling equilibria for a given prior. *QED*.

### *Proof of Proposition 3*

The Sequential equilibria of the game are the same as the Perfect Bayesian Equilibria of the game (Fudenberg and Tirole, 1991). We follow Mailath et al. (1993) in the exposition of the proof. Let  $E^*$  be a proposed equilibrium, and  $E^{**}$  be an alternative equilibria. Suppose, the confinement choice of  $e^{**}$  is sent *on* the equilibrium path in  $E^{**}$  by some  $t \in \{d, n\}$ , but not in  $E^*$ . Or,  $e^{**}$  is an *off* the equilibrium path message by type- $t$  with respect to  $E^*$ . Further suppose that the type(s) that chooses  $e^{**}$  strictly prefers the equilibrium  $E^{**}$  over  $E^*$ . If the belief of men in  $E^*$  at the off equilibrium message  $e^{**}$  are inconsistent with their belief at  $e^{**}$  in the  $E^{**}$  equilibrium, then the alternative equilibrium defeats the proposed equilibrium. An equilibrium which can not be defeated by any other equilibrium in this manner is referred to as an *undefeated equilibrium*.

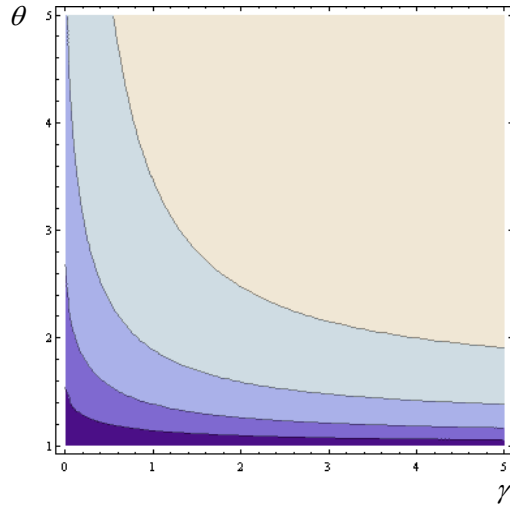
We shall prove the two parts of the proposition for the envy scenario. The proof of

the no-envy scenario is identical to the proof of the envy scenario for  $\mu_o < \overline{\mu}_o$ . So, first let us consider the envy scenario with  $\mu_o < \overline{\mu}_o$ . Let the separating equilibrium in Proposition 1 be the proposed equilibrium. (i) Any separating equilibrium with  $e_d^{**} > \bar{e}_n$  does not even qualify as an *alternative* equilibrium since neither type of parents would strictly prefer it over the separating equilibrium at  $(e_d^*, e_n^*) = (\bar{e}_n, 0)$ . (ii) There does not exist any envy-separating equilibrium involving an  $e_d^{**} < \bar{e}_n$ . (iii) Let any pooling equilibrium, say, the one in Proposition 2 be the alternative equilibrium. This alternative equilibrium is preferred only by type- $n$  parents over the proposed separating equilibrium. Moreover, the proposed separating equilibrium involves men assigning any choice of  $e \leq \bar{e}_n$  to type- $n$ . Hence, the beliefs in the proposed equilibrium are consistent with the beliefs in the alternative equilibrium. We can thus conclude that the proposed envy-separating equilibrium is not defeated by any other equilibrium. Proceeding in a similar manner one can easily show that it defeats any other proposed equilibrium. Therefore, the envy separating equilibrium in Proposition 1 is the unique undefeated equilibrium if  $\mu_o < \overline{\mu}_o$ .

Now let us consider the envy scenario for  $\mu_o > \overline{\mu}_o$ . Let the separating equilibrium in proposition 1 be the proposed equilibrium. Let the pooling equilibrium in Proposition 2 be the alternative equilibrium. This alternative equilibrium is strictly preferred by parents of both types compared to the proposed equilibrium. But, in the proposed equilibrium a choice of  $e_d^p$  is assigned to type- $n$  parents only. This inconsistency implies that the pooling equilibrium in Proposition 2 defeats the separating equilibrium in Proposition 1 if  $\mu_o > \overline{\mu}_o$ .

Now let the pooling equilibrium in Proposition 2 be the proposed equilibrium. (i) Any separating equilibrium with  $e_d \geq \bar{e}_n$ , or any pooling equilibrium at an  $e > e_d^p$  does not even qualify as an alternative equilibrium as it is not strictly preferred by either type of parents. (ii) Let a pooling equilibrium at an  $e < e_d^p$  be the alternative equilibrium. This alternative pooling equilibrium is preferred only by type- $n$  parents. The belief of men in the proposed pooling equilibrium are consistent with this. Hence, the proposed pooling equilibrium at  $e_d^p$  is not defeated by any other equilibrium.

Finally, (i) let the pooling equilibrium at an  $e^p > e_d^p$  be the proposed equilibrium and the pooling equilibrium at  $e_d^p$  be the alternative equilibrium. The alternative equilibrium is preferred by both types of parents. The proposed pooling equilibrium assigns the choice of  $e_d^p$  to only type- $n$  parents, and is therefore inconsistent. (ii) Let the pooling equilibrium at an  $e^p < e_d^p$  be the proposed equilibrium and the pooling equilibrium at  $e_d^p$  be the alternative equilibrium. The alternative equilibrium is not preferred by type- $n$  parents. The proposed equilibrium, however, assigns the choice of  $e_d^p$  to type- $n$  parents with strictly positive probability, and is therefore inconsistent. Since the pooling equilibrium at  $e_d^p$  defeats every other equilibrium but is not defeated by any other equilibrium, it is the unique undefeated equilibrium in the envy case when  $\mu_o > \overline{\mu}_o$ .



**Figure 5:** CONTOURS OF THE CRITICAL PRIOR.

### Appendix B: The critical prior

Equation (19) can be rewritten as

$$[\bar{w}(\hat{e}_p) - \bar{w}(\bar{e}_n)] + \sqrt{\theta}[(\bar{e}_n)^2 - (\hat{e}_p)^2] = 0 \quad (22)$$

$$\Rightarrow \alpha \cdot \left[ \left( \frac{\gamma}{\sqrt{\theta}} \right) \cdot \bar{\mu}_o^2 + 2 \cdot \bar{\mu}_o + \left( \frac{r^2}{\theta \sqrt{\theta}} - 2 \left( 1 + \frac{\sqrt{\gamma} r}{\theta} \right) \right) \right] = 0 \quad (23)$$

where  $r = (\sqrt{\gamma} + \sqrt{\gamma + 2\theta})$ . The positive root of the above given quadratic equation is

$$\bar{\mu}_o = -\frac{\sqrt{\theta}}{\gamma} + \sqrt{\frac{\theta}{\gamma^2} + 2 \left( \frac{\sqrt{\theta} - 1}{\theta} \right) \left( 1 + \frac{\theta}{\gamma} + \sqrt{1 + \frac{2\theta}{\gamma}} \right)}, \quad (24)$$

$$\text{with } \lim_{\gamma \rightarrow 0} [\bar{\mu}_o(\gamma, \theta)] = 1 - \frac{1}{\sqrt{\theta}}, \quad \text{and } \lim_{\gamma \rightarrow \infty} [\bar{\mu}_o(\gamma, \theta)] = 2\sqrt{\frac{\sqrt{\theta} - 1}{\theta}}. \quad (25)$$

The contour plot of  $\bar{\mu}_o(\gamma, \theta)$  as generated in Mathematica 6.0 is shown in Figure 5. The commands used to generate this figure were:

1.  $\bar{\mu}_o(\gamma, \theta) = -\frac{\sqrt{\theta}}{\gamma} + \sqrt{\frac{\theta}{\gamma^2} + 2 \left( \frac{\sqrt{\theta} - 1}{\theta} \right) \left( 1 + \frac{\theta}{\gamma} + \sqrt{1 + \frac{2\theta}{\gamma}} \right)}.$



2. ContourPlot[If[ $\frac{2}{\gamma} + (\frac{2}{\sqrt{\theta}} - 1) \geq 0$ ,  $\bar{\mu}_o(\gamma, \theta)$ ], { $\gamma$ , 0.001, 5}, { $\theta$ , 1.001, 5}, Contours -> {0.2, 0.4, 0.6, 0.8}].

3. We checked the shape of contours for various contour levels and for several ranges of the parameters  $\gamma$  and  $\theta$ . Figure 5 was included because it conveys all the information clearly. Contours of higher critical priors have lighter shades.