SMU ECONOMICS & STATISTICS WORKING PAPER SERIES

SMU SINGAPORE MANAGEMENT UNIVERSITY

Sex Ratios, Divorce Laws and the Marriage Market

Brishti Guha
November 2010

Paper No. 28 -2010

Sex Ratios, Divorce Laws and the Marriage Market

Brishti Guha[1]
Singapore Management University

Abstract

We show how an interaction between the skewness of the sex ratio and the jump in divorce rates after a liberalization in divorce laws can obtain in a model of marriage market matching with non-transferable utility. This model is partly motivated by a significant cross-country correlation between these two variables. We also find that men's hopes or fears about women's marriage market odds are self-confirming under mutual consent, resulting in multiple equilibria. The multiplicity vanishes with a more skewed sex ratio or a liberalization of divorce laws. Our work sheds some light on the possible implications of divorce liberalization and pro-marriage policies.

JEL Classification : J12, K36,D82

Keywords: Divorce, sex ratios, marriage, skewness, matching, non-transferable utility.

---

[1] Department of Economics, Singapore Management University, 90 Stamford Road, Singapore 178903. Email : bguha@smu.edu.sg.

1. Introduction

Recent research in law and economics has explored the impact of changes in divorce laws (notably from fault to no-fault, or mutual consent to unilateral divorce regimes) on other outcomes, including marriage market outcomes. An exogenous change in laws which alters the ease with which a divorce may be obtained can have implications for the frequency of marriage and divorce, particularly if models of Coasian bargaining within the family are considered unrealistic. The bulk of theoretical and empirical research on this topic[2] indicates a consensus that a liberalization of the divorce regime increases divorce rates, at least in the short run, though conclusions about long-run implications are more ambiguous.

A seemingly unrelated topic of much research among development economists has been imbalance in sex ratios – the phenomenon of "missing women" in China and India, for example. A poor sex ratio is a feature of many developing countries, some of which have faced a ratio which actually *deteriorates over time* (as in many Indian states). At the other extreme, some western countries have started facing the other type of imbalance – with too many women compared to men. When development economists have looked at sex ratios, they have mainly tried to work on possible *causes* of imbalance in sex ratios. Some have looked at whether sex ratios can be affected by changes in women's bargaining power or economic clout which might affect mothers' ability to care better for their daughters or to oppose female infanticide or deliberate malnutrition which daughters might otherwise face in societies marked by a strong preference for sons.

To the best of our knowledge, there has been no work on possible *interaction effects* between the sex ratio and the response of divorce rates to a liberalization in divorce laws (although there has been research – alluded to in the literature review – on the effects that sex ratios and divorce regimes may independently have on other outcomes like female labor supply ; there has also been some empirical evidence on the impact of sex ratios on divorce *rates,* but not of how sex ratios impact *changes* in the divorce rate following a change in divorce laws). Why should we be interested in modeling such an interaction effect? We discuss shortly why such an interaction effect makes intuitive sense. Our developing a theoretical model that provides a foundation for such an effect was *in addition* motivated by the discovery of a positive and significant cross-country correlation (with a coefficient of .547) between sex ratios and the size

---

[2] A literature review will follow.

of the jump in divorce rates following a transition from mutual consent to unilateral divorce. In other words, countries with more skewed sex ratios experienced a larger jump in divorce rates when they transited from mutual consent to unilateral divorce regimes (the countries in question include a cross section of European countries, Australia and New Zealand).[3]

While a correlation does not provide evidence of causality, it was sufficient to induce us to build a theoretical model that ties these two areas – divorce law changes and imbalances in sex ratios – together in the present paper. Instead of focusing on the *causes* of sex ratio imbalance, we focus on the *consequences* of unbalanced sex ratios, given that such imbalance is a current reality.

The intuition underlying our model is the following. It would be reasonable to suppose that an unbalanced sex ratio would affect interactions within a marriage, as well as the frequency of marriage and the likelihood of divorce conditional on marriage. One channel of influence would be that men and women would have different degrees of advantage in the marriage market – their differing numbers would imply different degrees of success in search for a partner. How does this tie up with divorce laws? When we consider that the possibility of remarriage after a divorce must be factored into the value of divorce as an "outside option" in a marriage, we can see that this outside option's value would also differ across the sexes. If one sex expects a much better chance of getting remarried in case of a divorce, it would affect this sex's willingness to get divorced. The divorce law regime becomes important here because a shift to unilateral divorce laws implies that a spouse may obtain a divorce easily even if his or her partner is unwilling. Conversely, if laws require mutual consent for divorce, the actual frequency of divorce will be dictated by the preferences of the partner who is less willing to divorce – partly perhaps due to poorer remarriage options. This intuition holds provided we rule out perfect costless bargaining between spouses (an assumption discussed in more detail later).

Thus, our focus in this paper is *not* on whether and in which direction divorce regime liberalization affects the divorce rate in the short or long run – a topic on which there is much controversy – but on the role of the sex ratio in a framework of marriage, divorce and remarriage and its interplay with shifts in the divorce regime. As an interesting by-product, we find that under a mutual consent divorce regime, men's hopes or fears about women's marriage market odds are self-confirming, creating either a "hopeful equilibrium" where women face good

---

[3] Readers are referred to the appendix for details on the correlations.

marriage prospects and more men are willing to marry, or a "fearful equilibrium" where women face poor marriage prospects and few men marry. This effect disappears either with a transition to unilateral divorce laws or with a heavily skewed sex ratio.

To focus exclusively on the effects of an asymmetric sex ratio, we abstract from other possible sources of asymmetry between the sexes on the marriage market, such as property settlement laws that redistribute wealth in the event of divorce or marriage payments (dowry, brideprice). For the same reason we also abstract from differences in intrinsic preferences between the genders.

The rest of the paper is organized as follows. Section 2 contains a brief literature review. Section 3 contains our model and its solution, along with comparative statics on the effects of varying sex ratios. Section 4 concludes with some discussion of the policy implications of our results.

2. Some Relevant Literature

Theoretical research on the impact of divorce laws on divorce rates dates back to Becker (1977, 1981) who argued that a shift to a unilateral divorce regime should not impact divorce rates as it merely re-assigns "property rights" within a marriage. This assumed Coasian bargaining was possible between spouses. Similar models based on Nash bargaining include McElroy and Horney (1981).

However, later models [Parkman (1992), Stevenson and Wolfers (2006)] have questioned the assumption that Coasian bargaining applies to the marital framework. Pollak (1985) discusses the role of transaction costs in marriage. Clark (1999) and Fella et al (2004) have also shown that divorce law changes may impact divorce rates even in the absence of transaction costs and asymmetric information. Rasul (2006) has a matching model in which a shift to unilateral divorce increases divorce rates in the short run but in which this increase may taper off or even reverse over the long run. Wickelgren (2009) has a model of marital investments in which these investments are affected by the divorce regime and where, as in Rasul (2006), divorce rates increase following liberalization but then taper off.

Empirical work on this theme has also yielded mixed results. While Peters (1986,1992) found an effect of unilateral divorce laws close to zero in his study of US states, Allen (1992) found a marked effect of unilateral divorce laws in increasing the divorce rate, as did Friedberg

(1998) : however Wolfers (2006) found that the effect was small particularly over the long run. While all these studies focused on the US, exploiting differences in the timing of divorce law changes across states, Gonzalez and Viitanen (2006) focus on Europe and find that divorce law liberalization accounts for about 20% of the increase in divorce rates in Europe between 1960 and 2002.

The focus of the present paper is however not on whether or by how much divorce rates change in response to shifts in divorce regimes. It is focused instead on how such change (or the lack of it) is influenced by the extent of skewness of the sex ratio. Thus the paper examines the interaction between divorce rates, divorce law shifts and the sex ratio.

Work on sex ratios within development economics is extensive. We only mention the most relevant here. Angrist (2002) empirically studies immigrants to the US. Using the fact that such immigrants have a high incidence of endogamy (marrying within the community) and skewed sex ratios, he studies the impact on women's marriage rates, as well as other outcomes like labor force participation and earnings. His findings are broadly consistent with the theory that a favorable sex ratio increases women's bargaining power within the household. However, divorce and incentives to divorce, or the impact of divorce laws, are not explored.

Chiappori, Fortin and Lacroix (2002) also emphasize the idea that factors such as favorable sex ratios and divorce laws that are generous to women improve a woman's outside option in the event of marital dissolution, thereby increasing her bargaining power within the marriage and affecting her labor supply. They provide empirical evidence that women's labor supply falls with a sex ratio that favors women, or with a divorce regime that favors women. Lafortune (2009) shows that pre-marital investments (specifically investment in education) respond to the sex ratio. Incidentally this paper also contains some empirical evidence on the effect of sex ratios on divorce (showing that men are more likely to be divorced when the ratio of men to women is high, though the effect was not significant), but not on the impact of sex ratios on a *change* in divorce rates following a shift in divorce regime.

Other work on sex ratios includes Edlund (1999) who shows that biased sex ratios may be caused by son preference and explores the relationship between unbalanced sex ratios and marriage patterns like spousal age gaps, hypergamy (women marrying up), within-caste marriages, and cousin marriages. Her focus is on the causes of a sex ratio imbalance, and she does not explore the link between sex ratios and divorce, or even between sex ratios and the

incidence of marriage. Qian (2006) empirically sheds light on how greater bargaining power within the household for women can influence their capability to choose the sex ratio of their children. While relating sex ratios to within-marriage outcomes this study again looks at the *causes* rather than the consequences of sex ratio imbalances (unlike the present study).

3. A Model

3.1 Assumptions and Timing

We assume a multi-period model in which individuals – both males and females – have a probability 1-β of dying in any one period. The number of births in each period exactly matches the number of deaths so that the population remains constant. To begin with, we assume a stable steady state sex ratio of f (>1 without loss of generality, so that there are more females than males). To simplify things, we assume that this ratio is the same across all birth cohorts so that there is no difference between sex ratio at birth and the overall sex ratio in the population.[4] We also assume that both males and females may choose to enter the marriage market in the first period of life. M new males and F new females are born in each period, with $F = fM$: however all of these do not necessarily enter the marriage market. A number N_{Sj}, $j = M, F$ of either sex choose to deliberately stay single by staying off the marriage market (we will endogenize the number of such singles shortly).

An important assumption is that men and women have *no* information *at the time of meeting a potential match* regarding their compatibility post-marriage with this match (as opposed to any other matches). Therefore, if a man or woman *on the marriage market* meets a potential match, nothing is to be gained by prolonging the search for a marriage partner, as information is not sufficient to distinguish the match they meet from any one else. Those who meet a match will marry, while only those who cannot find a match (there are always some of these in our model due to a skewed sex ratio) will prolong their search into future periods. The only information known to men and women before marriage is a *distribution* of possible "post-marriage levels of satisfaction" denoted by the cdf $G[\phi]$ and density $g(\phi)$ where ϕ is any value of per-period post-marriage satisfaction[5] drawn from a distribution with support $[\underline{\phi}, \overline{\phi}]$. Thus

---

[4] We will later perform comparative static exercises to compute the effects of a change in sex ratio.
[5] Note that this refers to satisfaction that obtains conditional on the marriage remaining intact.

6

men and women know the distribution and by implication also know the *average* level of per-period post marriage satisfaction they can obtain, $E(\phi)$ where

$$E(\phi) = \int_{\underline{\phi}}^{\overline{\phi}} \phi dg(\phi) \qquad (1)$$

However they do not know the exact realization of ϕ that will obtain if they marry a particular partner.

The assumption that this information becomes known only after marriage and is not revealed during courtship may be questioned by some. While strong, this assumption underlines the fact that there is a qualitative difference in a couple's interaction after they marry. While partial information revelation during courtship could be allowed for by introducing an (imprecise) signal of post-marriage satisfaction during the courtship period, we make the no-information assumption in the interests of simplicity.

After marriage, the married couple draws a realization of ϕ. This realization remains constant: for every period the marriage survives, the couple will continue to draw a per-period satisfaction level of ϕ (and this is known to the couple).

An individual i obtains a *per period* satisfaction s_i by staying *off* the marriage market. We will suppress the subscript wherever possible. Thus s varies across individuals and is distributed with a cdf H(s) with density h(s), on the interval $[\underline{s}, \overline{s}]$. Each individual's s is private information known only to this individual, though every one knows the distribution H(s). We assume that both males and females face identical distributions. Moreover we have

A1: $E(\phi) = \int_{\underline{\phi}}^{\overline{\phi}} \phi dg(\phi) > E(s) = \int_{\underline{s}}^{\overline{s}} sdh(s)$

This assumption means that if we aggregate across individuals (of either sex), the average per-period satisfaction from staying off the marriage market is less than the expected value of the per-period post-marriage satisfaction level. Note that this *does not* imply that every individual expects higher satisfaction from marriage than from staying single.

The timing of the game is as follows. Every period, men and women decide whether to enter the marriage market. Those on the marriage market attempt to find a match. Those that find a match get married. Married couples draw a realization, in the first period after marriage, of the per-period satisfaction they will continue to get conditional on the marriage remaining intact.

They then form (differing) preferences on whether to continue with the marriage or to seek a divorce. The type of divorce law in place (unilateral or mutual consent) will determine the actual frequency of divorces given these preferences. Freshly divorced people join the marriage market (we will prove later that they will never have an incentive to go off the marriage market) and the cycle of search, marriage and possible divorce continues.

We have made two other important assumptions in our analysis. First, we assume that utility is non-transferable between spouses. If utility were completely transferable, there would be no difference in divorce rates between unilateral and mutual consent regimes. If, for example, a husband wanted to divorce but his wife did not, the husband could, even under a mutual consent divorce regime, "compensate" his wife so that she would allow him to leave. Similarly, the wife could compensate her husband to persuade him to stay, even in a unilateral divorce regime. However, the fact that empirical studies *have* found that divorce rates change with divorce laws indicates that such Coasian bargaining within the household is implausible. Our assumption is also made in other models on marriage and divorce (eg Rasul (2006)). As an alternative to non-transferable utility, we could assume transaction costs in bargaining. As long as transferability is imperfect, our qualitative results would continue to hold as there would be some difference in divorce rates between the two divorce regimes. We do not explicitly model transaction costs, but assuming that they are too high to allow spouses to compensate each other is equivalent to ruling out Coasian bargaining.

Finally, we also make the assumption that there is no particular stigma against a divorcee. This is because ϕ should be regarded as a *couple-specific* utility. If individual i and individual j prove to be incompatible after marriage, this does not indicate that individual i would also be incompatible with individual k. Therefore, divorce carries no "signal" of intrinsic unworthiness. Here we follow assumptions made in other types of matching models, for instance, in Shapiro and Stiglitz (1984). Shapiro and Stiglitz assume that there is no stigma against workers who are fired by one firm, so that other firms make no distinction between them and never-matched workers and are equally willing to take either type out of the unemployment pool.[6]

3.2 Solving the Model

---

[6] In their model new prospective employers merely regard a worker having shirked in his previous job as a sign that his previous employer was not paying him enough. The history of shirking conveys nothing about the worker's type.

M men are born in every period and M - N_{SM} of them enter the marriage market (where N_{SM} is to be endogenized later). These men are all assured of finding a partner due to a sex ratio that favors men. This is not immediately obvious. Even if there are more women than men, if the proportion of women who chose to voluntarily stay single is much larger than the corresponding proportion of such men, this may not hold. However, we will show later that this is not the case: the proportion of men who stay off the marriage market is even larger than the corresponding proportion for women. For the time being, we proceed under the assumption (proved to hold later) that all men on the marriage market are indeed assured of finding a partner, or equivalently, that the number of women on the marriage market exceeds the number of men on it.

As search costs are zero and as people have no information about the relative merits of the potential matches they meet, no man has an incentive to prolong his search. Therefore, at any point in time, the marriage market only contains two types of men – those who have just entered it in their first period of life and those who are freshly divorced (we denote this number by D : D will shortly be endogenized. We will prove later that men who are freshly divorced will never stay *off* the marriage market. Intuitively, this is because only men who have a low utility from staying single get married in the first place: such men continue to have a low utility from staying off the marriage market, even post divorce). Of the men on the marriage market, there are none who have been unsuccessful in finding a partner in previous periods. Moreover, all divorced men can also find partners by the end of any period. Partners have no preference between divorced and never-married potential matches, because divorce in our model conveys no signal of intrinsic unworthiness and only signals that the divorcee was incompatible with his or her previous match.

In contrast, not all women who enter the marriage market are assured of immediate success in finding a partner. Therefore, apart from women who have newly entered the marriage market (there are fM - N_{SF} of these, where N_{SF} is to endogenized) or from freshly divorced women (who, like freshly divorced men, always re-enter the marriage market, for similar reasons), the marriage market at any point in time also contains (a) women who have never been married but who were unsuccessful in finding a partner in previous periods, and (b) women who were previously divorced but failed to find a partner. Again, at any point in time the number of freshly divorced women is D (to be endogenized later) as the number of newly divorced women

must equal the number of newly divorced men. Let p be the steady state probability of a woman on the marriage market successfully finding a match in any given period (p will also be endogenized later). Then we have the following relationship :

$$\frac{fM + D - N_{SF}}{1 - \beta(1 - p)} = \frac{M + D - N_{SM}}{p} \tag{2}$$

We derive (2) as follows. The left hand side shows the number of women on the marriage market in any period. This includes not only women who have newly entered the marriage market (who number F- N_{SF} = fM- N_{SF}) and newly divorced women (numbering D), but also surviving never-married and divorced women who entered the marriage market in previous periods but were unsuccessful in finding matches. The denominator comes from adding these women.[7] On the right hand side, the number of men on the marriage market is simply M+D- N_{SM} (men who have freshly entered the marriage market, or freshly divorced men). The number of women on the marriage market must be a multiple 1/p of the number of men on the marriage market to result in a steady state probability p of a woman who is "single and looking" finding a match in any period.

Rearranging (2), we get

$$M[(f - \beta)p - (1 - \beta)] - pN_{SF} = D(1 - p)(1 - \beta) - [1 - \beta(1 - p)]N_{SM} \tag{3}$$

3.3 Unilateral Divorce

3.3.1 The Basics

We now examine divorce under a unilateral divorce regime. We start by examining men's payoffs to (a) staying married if already in a marriage, $V^m(MR)$ (b) joining the ranks of the "single and looking", $V^m(SL)$ and (c) staying off the marriage market, $V^m(SNL)$. We have

$$V^m(SNL) = s + \beta \max[V^m(SNL), V^m(SL)] \tag{4}$$

Here, we have suppressed the subscript i on the per-period satisfaction that man i gets from staying off the marriage market. The second term on the RHS of (4) indicates that if he survives into the next period he can choose either to stay as he is or to enter the pool of those single and looking. We also have

$$V^m(SL) = E(\phi) + \beta \max[V^m(MR), V^m(SL), V^m(SNL)] \tag{5}$$

---

[7] That is, we have a GP with first term fM+D- N_{SF} and common ratio β(1-p) [the probability of survival times the probability of being unsuccessful in finding a match].

10

Equation (5) denotes the anticipated utility of a man at the *beginning of the period* in which he is contemplating entering the marriage market. As soon as he enters the market, he expects to find a match, from which he gets the expected satisfaction of a match $E(\Phi)$ (note that he will only get information on the true satisfaction in his particular match after the first period of marriage). Such a man, if he survives into the next period, then faces the choice of staying married, getting divorced and re-entering the marriage market, and getting divorced and going off the marriage market. Again, suppressing subscripts, the satisfaction that a married man gets from continuing in the marriage is given by

$$V^m(MR) = \phi + \beta Max[V^m(MR), V^m(SL), V^m(SNL)] \qquad (6)$$

Here ϕ is the true quality of his match (revealed after the first period of marriage). At any point in time he will stay married if the continuation value of that option exceeds the expected value from getting divorced and either re-entering the marriage market or of getting divorced and staying off the marriage market.

Proposition 1: Divorcees always re-enter the marriage market.

Proof: Any man who got married in the first place must have been on the marriage market to start with. Hence we can infer that for such a man, $V^m(SL) > V^m(SNL)$. Thus when a married man considers the option of divorce, he only has to choose between staying married and re-entering the marriage market as a divorcee (an option which strictly dominates going off the marriage market). A similar logic applies to women who divorce: hence divorcees always re-enter the pool of the single and looking. Q.E.D.

A married man will therefore stay married if and only if $V^m(MR) > V^m(SL)$. From (5) and (6), we can show that this is equivalent to

$$\phi > E(\phi)$$

- an event that will happen with probability 1-G($E(\phi)$). With probability G($E(\phi)$), his match is revealed to be of sufficiently poor quality to induce him to seek a divorce and re-enter the marriage market.

Note that men who choose to stay off the marriage market have $V^m(SNL) > max[V^m(SL), V^m(MR)]$: for such men, we can show, using (4) and (5), that s > E(ϕ). This happens for a fraction $1 - H(E(\phi))$ of men who have high enough utilities from staying single.

Men who *do not* choose to stay single, on the other hand, have s < E(ϕ). This must be true of any ever-married man. Men are more willing to divorce as they face better remarriage prospects than women: under unilateral divorce, it is their preferences that matter. Thus the divorce *rate* is G[E(ϕ)]. A proportion 1 − H[E(ϕ)] of men in each cohort stay off the marriage market as they have a high utility from staying single.

What about women's decision of whether to enter the marriage market? The adverse sex ratio against women always results in women's being less keen on a divorce relative to men. However, they know that if their husband divorces them, they will return willy-nilly to the pool of the single and looking – even if they would have preferred to continue with the marriage. A woman's *anticipated* utility from entering the marriage market is now denoted by

$$V^{f,a}(SL) = pE(\phi) + (1-p)s + \beta(1-p)V^{f,a}(SL) + \frac{\beta p[1-G(E(\phi))]}{1-\beta} \int_{E(\phi)}^{\bar{\phi}} \phi dg(\phi) + \beta pG(E(\phi))V^{f,a}(SL)$$

$$= \frac{pE(\phi) + (1-p)s + \frac{\beta p[1-G(E(\phi))]}{1-\beta} \int_{E(\phi)}^{\bar{\phi}} \phi dg(\phi)}{1-\beta[1-p(1-G(E(\phi)))]}$$

(7)

(7) can be explained as follows. A woman expects that in the first period of entering the marriage market, her search will be successful with probability p, in which case she gets the expected value of post-marriage satisfaction E(ϕ). With probability 1-p she gets s, which is her individual utility from singlehood. If this happens, and she survives into the next period, she again gets the expected utility of a woman entering the marriage market, and this happens with probability β(1-p). If she is successful in finding a match, and survives into the next period, which happens with probability βp, then for a match quality above E(ϕ), she continues in the marriage. Prior to entering the match, she does not know its actual quality, but knows that if it continues it must be of quality between E(ϕ) and the maximum quality $\bar{\phi}$, and can hence calculate the expected match quality conditional on remaining married. However for match quality below E(ϕ), she expects to be divorced by her husband and to re-enter the marriage market as a single.

From (7), we can see that a woman will *not* enter the marriage market if and only if $V^{f,a}(SL) < \dfrac{s}{1-\beta}$. Collecting common terms and simplifying, we find that this condition boils down to

$$s > \frac{(1-\beta)E(\phi) + \beta(1-G(E(\phi)) \int\limits_{E(\phi)}^{\bar{\phi}} \phi dg(\phi)}{1-\beta G(E(\phi))} = s* \qquad (8)$$

Thus a proportion $1 - H(s*)$ of women in each cohort stay off the marriage market. As s* is independent of p, from (8), the proportion of women who stay off the marriage market is independent of p.

Proposition 2: A greater proportion of men than women stay off the marriage market.

Proof : We have

$$E(\phi)(1-\beta G(E(\phi)) = E(\phi)(1-\beta) + \beta(1-G(E(\phi))E(\phi)$$

$$< E(\phi)(1-\beta) + \beta(1-G(E(\phi))) \int\limits_{E(\phi)}^{\bar{\phi}} \phi dg(\phi)$$

or $E(\phi) < s*$. Hence $1 - H(E(\phi)) > 1 - H(s*)$. QED.

Thus from Proposition 2, and given that the *total* number of women exceeds the total number of men, our initial assumption that the number of women on the marriage market exceeds the number of men on it is shown to be true.

3.3.2 Equilibrium

Equilibrium under unilateral divorce is characterized by a quadruple (p**, D**(M), N**_{SF}(M), N**_{SM}(M)) such that

(a) The number of men on the marriage market is a fraction p** of the number of women on the marriage market.

(b) All men on the marriage market get married.

(c) No one who is off the marriage market expects to get higher utility by entering it.

(d) All divorcees re-enter the marriage market.

(e) Divorces occur when a man expects to get higher utility by re-entering the marriage market than by staying in his current match. Women may have to re-enter the marriage market when they would have preferred to continue in their current match, but take this into account when deciding whether to enter the marriage market.

13

From the preceding analysis, we have

$$N^{**}_{SF}(M)=[1 - H(s^*)]fM \tag{9}$$

where s* is defined by (14),

$$N^{**}_{SM}(M)=[1 - H(E(\phi))]M \tag{10}$$

And

$$D^{**}(M) = G(E(\phi))(M - N^{**}_{SM}(M))= G(E(\phi))H(E(\phi))M \tag{11}$$

We may now solve for p** using (3) and (9)-(11) : simplifying, we obtain

$$fp^{**}H(s^*) =[1- \beta(1- p^{**})](1+G(E(\phi))H(E(\phi)) - p^{**}G(E(\phi))H(E(\phi)) \tag{12}$$

We can plot the LHS and RHS of (12) as functions of p. The LHS is linearly upward sloping with constant slope $fH(s^*)$. It has value 0 at p = 0 and a value of $fH(s^*)$ at p=1. The RHS is also linearly upward sloping in p, with a constant slope

$$\beta(1+G(E(\phi)))H(E(\phi)) - G(E(\phi))H(E(\phi)) > 0 \text{ given}$$

A2: $\beta > \dfrac{1}{1+1/G(E(\phi))}$

At p = 0, the RHS has an intercept of $(1- \beta)(1+G(E(\phi))H(E(\phi)) > 0$ as long as some men enter the marriage market. At p = 1, it reaches its maximum value of $H(E(\phi))$. By Proposition 2, $H(E(\phi)) < H(s^*) < fH(s^*)$. Hence the RHS is higher than the LHS at p = 0 and lower than the LHS at p = 1: as both are linear, they have a *unique* intersection. This is shown in Figure 1.

3.3.3 Effects of a skewed sex ratio

An increase in f does not affect the RHS of (12), while it pivots the LHS upward, increasing its slope (shown by the dotted line in Figure 1). This reduces the equilibrium p**, worsening women's marriage market odds. However, this does not affect either the divorce rate – $G(E(\phi))$ (divorces conditional on marriage) or the fraction of men entering the marriage market – $H(E(\phi))$: hence it does not affect the number of divorces, either.

However, our main interest lies in correlating the sex ratio to the *jump* in divorce rates after a transition from a mutual consent to a unilateral divorce regime. Therefore, in the next sub-section we will examine divorce in a mutual consent divorce regime.

3.3 Mutual Consent Divorce

3.4.1 The Basics

We now examine divorce under a mutual consent divorce regime. We start by examining women's payoffs to (a) staying married if already in a marriage, $V^f(MR)$(b) joining the ranks of the "single and looking", $V^f(SL)$and (c) staying off the marriage market, $V^f(SNL)$. We have

$$V^f(SNL) = s + \beta \max[V^f(SNL), V^f(SL)]$$ (13)

Here, we have suppressed the subscript i on the per-period satisfaction that woman i gets from staying off the marriage market. The second term on the RHS of (13) indicates that if she survives into the next period she can choose either to stay as she is or to enter the pool of those single and looking. We also have

$$V^f(SL) = pE(\phi) + (1-p)s + \beta p \max[V^f(MR), V^f(SL), V^f(SNL)] + \beta(1-p)V^f(SL)$$ (14)

(14) shows the utility a woman expects at the beginning of any period when she contemplates entering the marriage market. With probability p, a woman who is single and on the marriage market finds a match, from which she gets the expected satisfaction of a match $E(\Phi)$ (note that she will only get information on the true satisfaction in her particular match after the first period of marriage). Such a woman, if she survives into the next period, then faces the choice of staying married, getting divorced and re-entering the marriage market, and getting divorced and going off the marriage market (however, by Proposition 1 no ever-married woman will go off the marriage market) . With probability 1 – p, the woman does not find a match and gets s, the satisfaction from staying single, in the current period while in the next, subject to survival, she re-joins the ranks of the single and looking. Again, suppressing subscripts, the satisfaction that a married woman gets from continuing in the marriage is given by

$$V^f(MR) = \phi + \beta Max[V^f(MR), V^f(SL), V^f(SNL)]$$ (15)

Here ϕ is the true quality of her match (revealed after the first period of marriage). At any point in time she will stay married if the continuation value of that option exceeds the expected value from getting divorced and either re-entering the marriage market (from Proposition 1, she will never go off the marriage market after divorce).

A married woman will therefore stay married if and only if $V^f(MR) > V^f(SL)$. From (14) and (15), we can show that this is equivalent to

$$\phi > pE(\phi) + (1-p)s = \mu$$

- an event that will happen with probability 1 – G(μ). With probability G(μ), her match is revealed to be of sufficiently poor quality to induce her to seek a divorce and re-enter the marriage market.

Note that women who choose to stay off the marriage market have $V^f(SNL) > \max[V^f(SL), V^f(MR)]$: for such women, we can show, using (13) and (14), that s > E(ϕ). This happens for a fraction 1 – H(E(ϕ)) of women who have high enough utilities from staying single.

Women who *do not* choose to stay single, on the other hand, have s < E(ϕ). This must be true of any ever-married woman. As the probability of a married woman seeking a divorce is G(μ), we can now check that this probability is increasing in p as μ is increasing in p. The lower a woman's odds of finding a match when on the marriage market, the lower the payoff she expects from re-entering the marriage market as a fresh divorcee, and the less her willingness to seek a divorce (or equivalently, the worse the quality of the marginal match which induces her to divorce). Applying this logic to men, we see that since any man who is looking is assured of finding a match, this indicates that men would be more willing to divorce than women: however, as divorce requires mutual consent, the woman's willingness to divorce is the crucial factor in the actual incidence of divorce.

To examine men's motivations, we could look at equations similar to (13)-(15), setting p = 1. Thus a married man would like to be able to divorce if the match quality is revealed to be less than E(ϕ). However, men realize that once married, they will only get a divorce if their match quality is lower than μ. Their wife's utility from staying single, s, enters into the calculation of μ. Men do not know the value of s for their spouse, however, they know the distribution of s and can calculate the average probability (taken over all possible values of s between s̲ and E(ϕ) - as a woman with a higher s would not enter the marriage market) that their wife will wish to seek a divorce. A man who is trapped in a marriage against his will (in circumstances when he would like to divorce but cannot) gets a disutility of κ from each such period of marriage. Here, κ should be interpreted as a psychological disutility that the man gets as a result of frustration at not being able to get a divorce when he would like one. Under mutual consent, a man anticipates the probability of getting trapped in this situation, and this affects his willingness to enter the marriage market in the first place. While we have treated κ as a constant

to simplify our calculations, our results would be unaffected if we allow κ to be a decreasing function of ϕ, actual match quality (so that the worse the match, the higher the man's disutility from being trapped in it). We summarize the modifications to our calculations for this case in footnote 8.[8]We now denote a man's *anticipated* satisfaction from entering the marriage market by $V^{m,a}(SL)$. We have

$$
\begin{aligned}
V^{m,a}(SL) = & E(\phi) + \frac{\beta[1-G(E(\phi)]}{1-\beta} \int\limits_{E(\phi)}^{\bar{\phi}} \phi dg(\phi) - \frac{\beta\kappa}{1-\beta}[G(E(\phi)) - E_s[G(\mu)]] \\
& + \beta E_s[G(\mu)]V^{m,a}(SL)
\end{aligned}
$$

Or

$$
V^{m,a}(SL) = \frac{E(\phi) + \dfrac{\beta[1-G(E(\phi))]}{1-\beta} \int\limits_{E(\phi)}^{\bar{\phi}} \phi dg(\phi) - \dfrac{\beta\kappa}{1-\beta}[G(E(\phi) - E_s[G(\mu)]}{1-\beta E_s[G(\mu)]} \tag{16}
$$

The explanation of the terms in (16) is as follows. A man on the marriage market is sure to find a match, yielding a one-period level of expected satisfaction $E(\phi)$. Subject to surviving into the next period, the man would want to stay married if he discovers that his match quality exceeds $E(\phi)$. This happens with probability $1 - G(E(\phi))$. Prior to entering the marriage market, the man does not of course know the value of his match. Therefore he assigns an expected value to the match subject to its being between $E(\phi)$ and its maximum value $\bar{\phi}$: this is the value he expects conditional on wanting to stay on in the marriage. However, the man also expects that with probability $G(E(\phi)) - E_s[G(\mu)]$, the match quality will be such that he wants to get a divorce but cannot, as match quality is not sufficiently poor to induce the average woman to agree to a divorce. Recalling that μ depends on s, the subscript s on the expectations operator denotes that the expectation that the wife will seek a divorce is taken over all possible values of s between $\underline{s}$ and $E(\phi)$ (as a woman with a higher s would not enter the marriage market). In this event, the man gets a disutility κ from each such period of marriage. The man also anticipates that with probability $E_s[G(\mu)]$, match quality will be so poor that his wife also wants to divorce : in this case there is a divorce and the man will return to the pool of single and looking men.

---

[8] In this case, κ in (16) would be replaced by $\lambda = E[\kappa(\Phi)]$ where the expectation is taken over values of Φ between $E(\Phi)$ and μ. We can show that $V^{m,a}(SL)$ would still be an increasing function of p. Hence our qualitative results would be unaffected.

When deciding whether to enter the marriage market, the man compares $V^{m,a}(SL)$, the expected payoff of entering the marriage market, with the payoff s/(1-β) of staying off the marriage market. Thus a fraction 1 – H($(1-\beta)V^{m,a}(SL)$) of men stay off the marriage market because their utility of remaining single outweighs the expected gains of entering the marriage market.

We may verify that $V^{m,a}(SL)$ increases in p. Thus, the worse a woman's odds of finding a match, the stronger a man's incentive to stay off the marriage market. Of course, more men staying off the marriage market only worsens a woman's odds of finding a match, so there is a feedback loop.

Proposition 3: A larger proportion of men than women stays off the marriage market under mutual consent.

Proof : In the appendix.

3.4.2 Equilibrium

Equilibrium under mutual consent divorce is characterized by a quadruple (p*, D*(M), N*_SF(M), N*_SM(M)) such that

(a) The number of men on the marriage market is a fraction p* of the number of women on the marriage market.

(b) All men on the marriage market get married.

(c) No one who is off the marriage market expects to get higher utility by entering it.

(d) All divorcees re-enter the marriage market.

(e) Divorces occur when a woman expects to get higher utility by re-entering the marriage market than by staying in her current match. Men may be trapped in marriages against their will but take this into account when deciding whether to enter the marriage market.

From the preceding analysis, we can infer that

$$N*_{SF}(M) = [1 - H(E(\phi))]fM \tag{17}$$

$$N*_{SM}(M) = [1 - H((1-\beta)V^{m,a}(SL)(p*))]M \tag{18}$$

where we have indicated the dependence of $V^{m,a}(SL)$ on p. We also have

$$D*(M) = E_s[G[\mu(p*)]](M - N*_{SM}(M))$$

$$= E_s[G[\mu(p*)]]H((1-\beta)V^{m,a}(SL)(p*))M \tag{19}$$

(19) may be derived as follows. We have established that in a mutual consent regime, a married woman may expect to divorce with probability G[μ]. Averaging over all women, the divorce rate (ratio of divorces to marriages) is $E_s[G[\mu]]$ where the subscript s denotes that the expectation is taken over all possible values of s between $\underline{s}$ and $E(\phi)$. In every new cohort of men, a fraction $H((1-\beta)V^{m,a}(SL)(p^*))$ enter the marriage market : therefore, the number of marriages in each period is $H((1-\beta)V^{m,a}(SL)(p^*))M$. The *number* of divorces is therefore the divorce rate times the number of marriages which is given by (19) (where the dependence of μ on p* is indicated by expressing μ as μ(p*)).

We can now solve for p* using (3), (17), (18) and (19). Substituting (17), (18) and (19) in (3) and canceling common terms, we obtain

$$fp * H(E(\phi)) =$$
$$[1-\beta(1-p^*)](1+E_s[G(\mu(p^*))])H((1-\beta)V^{m,a}(SL)(p^*)) - p * E_s[G(\mu(p^*))])H((1-\beta)V^{m,a}(SL)(p^*))$$

(20)

We may now plot the LHS and RHS of (20) as functions of p, which necessarily lies between 0 and 1. The LHS is linearly upward sloping with a constant slope of $fH(E(\phi))$, which is also its maximum value at p = 1. Its minimum value is 0, at p = 0. We assume that a large enough fraction of women enter the marriage market, such that

A3 : $fH(E(\phi)) > H((1-\beta)V^{m,a}(1))$

where $V^{m,a}(1)$ is the payoff a man would expect from entering the marriage market if every woman on the marriage market were sure of finding a match. Indeed, from Proposition 3, A3 always holds (the number of women on the marriage market is always greater than the number of men on it).

The RHS of (20) is also upward sloping. Its derivative with respect to p* is

$$\beta(1+E_s(G(.)))H(.) - E_s(G(.))H(.) + [(1-\beta(1-p))-p]H(.)\frac{\partial E_s(G(.))}{\partial p}$$
$$+[(1-\beta(1-p))(1+E_s(G(.))) - pE_s(G(.))]\frac{\partial H(.)}{\partial p}$$

(21)

Now, both $E_s(G(.))$ and $H(.)$ increase in p : the first because μ increases in p : and the second because $V^{m,a}(SL)$ increases in p. Moreover, as p cannot be greater than 1, we have

p(1-β)≤1-β or 1-β+ βp≥p or 1- β(1-p) ≥p. Given these conditions, we may check that a *sufficient* condition for (21) to be strictly positive is

$$\mathbf{A4}: \beta > \frac{1}{1+1/E_s(G(.))}$$

At p = 0, the value of the RHS – which is also its intercept – equals

$(1-\beta)(1+G(s))H((1-\beta)V^{m,a}(0))$ >0 provided that there is always at least one man who finds it worthwhile to enter the marriage market. At p = 1, the value of the RHS is $H((1-\beta)V^{m,a}(1))$ which from (A3) is less than the value of the LHS at p = 1. Since the RHS has a higher intercept than the LHS at p = 0 (whose value at p = 0 is simply 0) and a lower value at p = 1, and since both the LHS and RHS are continuous and increasing functions of p, they must intersect an odd number of times. Figure 2 shows us the case where they intersect once – giving us the equilibrium p* - while Figure 3 shows an example with 3 intersections – multiple steady states.

3.4.3 The Possibility of Multiplicity : Hopeful and Fearful Equilibria

Figure 3 illustrates a case with multiple steady states. Thus, we could have a steady state triple of $(p*^1, N*_{SM}(p*^1), D*(p*^1))$, or $(p*^2, N*_{SM}(p*^2), D*(p*^2))$, or $(p*^3, N*_{SM}(p*^3), D*(p*^3))$ (note that $N*_{SF}$ is independent of p*, while from (8) and (10), $N*_{SM}$ and D* are affected by it).

The key to possible multiplicity is in the feedback loop connecting women's marriage market odds to men's willingness to enter the marriage market. To understand the intuition underlying the possibility of multiple equilibria, it is helpful to refer to a steady state corresponding to a high p* - and therefore a low $N*_{SM}$ and a high D* - as a "hopeful equilibrium" and to a steady state with a low p* - and therefore a high $N*_{SM}$ and a low D* - as a "fearful equilibrium". In a "fearful equilibrium", men fear that women face bad marriage market odds (low p*). Hence, they believe that any woman they marry will not easily agree to give them a divorce, should they want one, as she will be reluctant to re-enter the marriage market given her poor remarriage prospects. Men, therefore, fear being stuck in a marriage against their will, and in anticipation of this possibility, many of them do not enter the marriage market at all (high $N*_{SM}$). In turn, the fact that so many men stay off the marriage market worsens women's probability of finding a match, confirming the men's fears of a low p*.

In the "hopeful equilibrium", on the other hand, men are more optimistic. Believing that women's marriage market odds are not bad (medium to high p*), they think that if their marriage turns out to be bad, their wife might be willing to grant them a divorce, as she will then be able to enter the marriage market with a fair chance of remarriage. Therefore, they are more willing to marry (low N^*_{SM}). In turn, the fact that fewer men stay off the marriage market improves women's probability of finding a match, confirming the men's hopes of a high p*.

Why do we have a unique equilibrium in the unilateral divorce case, in contrast to mutual consent where multiplicity is possible provided the sex ratio was not too skewed?

The reason is that the mechanism driving the hopeful and fearful equilibria under mutual consent was not applicable to unilateral divorce. Under unilateral divorce, men can get a divorce whenever they want it. Therefore, when deciding whether to enter the marriage market, they do not have to worry about women's marriage market odds, and hence their likelihood of agreeing to a divorce. Thus, we see in (10) that the number of men who stay off the marriage market is independent of p, women's marriage market odds. Therefore in unilateral divorce the connection between the number of men staying off the marriage market, and p is unidirectional instead of bidirectional: if fewer men enter the marriage market, this does affect women's marriage odds: however, women's marriage odds no longer affect men's decision to enter or stay out of the marriage market.

3.4.4 The Effects of a skewed sex ratio

Now let us perform a simple comparative static exercise: increase f so that the sex ratio becomes yet more heavily tilted in favor of men. This does not affect the RHS of (20). However, it increases the slope of the LHS when plotted as a function of p: the LHS pivots upward. This has the effect of shifting its new intersection with the RHS to the left, so that the equilibrium p* decreases. Thus a woman on the marriage market is less likely to find a match. In both Figures 2 and 3, we show the new LHS as a dotted line. In Figure 3, the effect is to destroy the multiplicity of equilibria, so that the LHS now only intersects the RHS once, at a p lower than p*[1], the left-most of the previous intersections. The interpretation of this is that a heavily skewed sex ratio makes it hard for men to be optimistic about women's marriage market odds – therefore the "hopeful equilibria" disappear.

What about D*(M)? From (19), we can see that as p* falls, the number of divorces D*(M) falls because of two reasons. First, the equilibrium divorce *rate* - $E_s[G[\mu]$ – falls as p* falls (a fall in p* decreases μ). As women have a lower probability of finding a match, due to an unfavorable sex ratio, already married women are less keen to get divorced and re-enter the marriage market. Secondly, the *number* of divorces falls for an additional reason – fewer marriages as $H((1-\beta)V^{m,a}(SL)(p^*))$ falls. Men expect a lower payoff from entering the marriage market as the lower the p*, the more likely they are to find themselves trapped in a marriage against their will, and unable to get a divorce. This induces many men to stay off the marriage market, reducing the number of marriages and hence of divorces.

In conclusion, therefore, a more skewed sex ratio results in fewer divorces – both as a fraction of total marriages and as a fraction of the total population - under a mutual consent regime. This leads us to our main result.

Proposition 4: The size of the jump in divorce *rates* following divorce law liberalization is larger when the sex ratio is more skewed. Moreover, the size of the jump in divorces as a fraction of the population is also larger for a more skewed sex ratio.

Proof: We have already shown that a more skewed sex ratio – a higher f – leads to a lower divorce rate in a mutual consent regime, lowering $E_s[G[\mu]$. The divorce rate in a unilateral divorce regime is $G[E(\phi)]$ which is higher than the divorce rate in mutual consent as long as p* < 1 (as s < $E(\phi)$ in mutual consent, for any woman ever on the marriage market). However this divorce rate is unaffected by f. Therefore, an increase in f does not affect the divorce rate under a unilateral regime but decreases it under a mutual consent regime. Thus the *jump* in divorce rates after a liberalization of the regime is larger when f increases. Moreover, the fraction of men entering the marriage market in a unilateral divorce regime, $H[E(\phi)]$, is unaffected by f, while rises in f lower the fraction of men entering the marriage market under mutual consent. Hence while divorces as a fraction of the population under unilateral divorce, $G[E(\phi)]H[E(\phi)]$, are unaffected by f, a more skewed sex ratio lowers divorces as a fraction of the population under mutual consent. Thus the size of the jump in divorces as a fraction of the population is also positively related to the degree of skewness. Q.E.D

3.4.5 Discussion

Note that in our model the *only* reason why men and women differ in their willingness to divorce is the skewness of the sex ratio. For a balanced sex ratio, women's willingness to divorce would equal men's as women would also be certain of finding a partner in the event of divorce.[9]

Our non-transferability assumption (or equivalently our assumption of high transaction costs) is also important here. As explained earlier, with perfect transferability a husband could compensate his wife to the point where her willingness to divorce him would match his willingness to divorce her.

As explained in the introduction, we have abstracted from differences in property settlement across the sexes in the event of divorce, or from prenuptial contracts or marriage payments. Intriguingly though, the above analysis does suggest one additional rationale for such phenomena. Since men may be trapped against their will in a marriage when they would prefer to divorce, or women may be forced to leave a marriage when they would have preferred not to, both sexes may need devices to provide partial insurance against such risks. Prenuptial contracts, marriage payments or property settlement laws are examples of just such devices. Of course, we do not claim that this is the only reason for the existence of such devices.

4. Conclusion

Our main purpose in this paper has been to examine the three-way interaction between sex ratios, divorce rates and divorce law changes. The model we construct is motivated by the discovery of a significant cross country correlation indicating that countries with more skewed sex ratios experienced a larger jump in divorce rates following liberalization in their divorce laws. We have constructed a theoretical model in which people lack information about their potential matches until the time they actually marry them. However, they receive a signal in the first period of marriage regarding their future compatibility with the mate they have chosen. This, along with the expected payoff from divorce, into which potential remarriage prospects enter, determines each partner's willingness to divorce – a willingness which differs across partners owing to a skewed sex ratio. This in turn implies that the actual divorce rate will differ depending on

---

[9] Assuming away differences in *intrinsic* preferences (ie not allowing ϕ to vary by gender) enables us to isolate differences in willingness to divorce across gender that are *solely attributable* to a skewed sex ratio. We make the above abstraction in order to sharply focus on the effects of a skewed sex ratio.

whether mutual consent is required for divorce (in which case the less willing partner's preferences determine the divorce rate) or whether unilateral divorce is allowed.

A chief implication of the model is that the jump in divorce rates following a transition from mutual consent to unilateral divorce will be larger if the sex ratio is skewed: it will be relatively small for a more balanced sex ratio. This has significant implications for social policy. States that are ill-equipped to handle the social consequences of a sudden jump in divorces need to look at their sex ratios when contemplating a liberalization of their divorce regimes. A natural extension of our research (for which we lack data at present) would be to rigorously empirically test the effect of sex ratio changes on a change in divorce rates following divorce law liberalization. For instance, this could be done in a "natural experiment" like setting where some states experience large shocks to their sex ratios, provided there are other states which also liberalize their divorce laws but do not experience such shocks.

Another interesting result is that under mutual consent divorce laws, men's hopes or fears about women's marriage market odds are self-confirming and create the possibility of multiple equilibria – either a "fearful" equilibrium with few men being willing to marry and poor marriage prospects for women, or a more "hopeful" equilibrium with more men marrying and better marriage prospects for women. However, multiplicity vanishes either if the sex ratio is heavily skewed or if divorce laws change permitting unilateral divorce. From a policy perspective, a state that *does not* wish to liberalize its divorce laws but wishes to increase its marriage rate – perhaps regarding marriage as a desirable outcome – could possibly do so by announcing pro-marriage incentives (for instance, tax breaks for married couples). Apart from the direct incentive effect, our analysis suggests that such an announcement would serve as a "co-ordination device" co-ordinating men's expectations on the "hopeful equilibrium" rather than the "fearful" one. Because they would expect these incentives to have an effect, men would assume that women's chances of marriage would improve. This would induce them to be less fearful about the possibility of being trapped in a marriage, unable to get a divorce, and would encourage them to marry.

References

Allen, D.W (1992) "Marriage and Divorce : Comment", *American Economic Review* 82(3) : 679-685.

Angrist, Josh (2002) "How do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation", *Quarterly Journal of Economics*, 117(3) : 997-1038.

Becker, G, E. Landes and R. Michael (1977) "An Economic Analysis of Marital Instability", *Journal of Political Economy* 85(6) : 1141-1188.

Chiappori, P.A, B. Fortin and G. Lacroix (2002) "Marriage Market, Divorce Legislation and Household Labor Supply", *Journal of Political Economy* 110(1) : 37-72.

Becker, G (1981) "*A Treatise on the Family*", Harvard University Press, Cambridge.

Clark, S.J (1999) "Law, Property and Marital Dissolution", *Economic Journal* 109 : C41-C54.

Edlund, Lena (1999) "Son Preference, Sex Ratios and Marriage Patterns", *Journal of Political Economy*, 107(6) : 1275-1304.

Fella, G, P. Manzini and M. Mariotti (2004) "Does Divorce Law Matter?", *Journal of the European Economic Association* 2(4) : 607-633.

Friedberg, L. (1998) "Did Unilateral Divorce Raise Divorce Rates? Evidence from Panel Data", *American Economic Review* 88(3) : 608-627.

Gonzalez, L. and T.K. Viitanen (2009) "The Effect of Divorce Laws on Divorce Rates in Europe", *European Economic Review* 53(2) :127-138.

Lafortune, J. (2009), "Making Yourself Attractive : Pre-Marital Investments and the Returns to Education in the Marriage Market", Working Paper, University of Maryland.

Maitra, S. (2006) "Population Dynamics and Rising Dowries : the Long-Run Mechanism of a Marriage Squeeze", Working Paper, York University.

McElroy, M. and M. Horney (1981) "Nash-bargained Decisions : Towards a Generalization of the Theory of Demand", *International Economic Review* 22 : 333-349.

Parkman, A.M (1992) "Unilateral Divorce and the Labor-Force Participation Rate of Married Women, Revisited", *American Economic Review* 82(3) : 671-678.

Peters, H.E (1986) "Marriage and Divorce : Informational Constraints and Private Contracting", *American Economic Review* 76(3) : 437-454.

Peters, H.E (1992) "Marriage and Divorce : Reply", *American Economic Review* 82(3) : 686-693.

Pollak, R.A (1985) "A Transaction Cost Approach to Families and Households", *Journal of Economic Literature* 23 : 581-608.

Qian, N. (2006) "Missing Women and the Price of Tea in China : The Effect of Relative Female Income on Sex Imbalance", *Quarterly Journal of Economics* 123(3), forthcoming.

Rasul, I. (2006) "Marriage Markets and Divorce Laws", *Journal of Law, Economics and Organization*, 22(1) : 30-69.

Shapiro, C. and J. Stiglitz (1984) "Equilibrium Unemployment as a Worker Discipline Device", *American Economic Review* 74(3) : 433-444.

Stevenson, B. and J. Wolfers (2006) "Bargaining in the Shadow of the Law : Divorce Laws and Family Distress", *Quarterly Journal of Economics* 121 (1) : 267-288.

Wickelgren, A (2009) "Why Divorce Laws Matter: Incentives for Noncontractible Marital Investments Under Unilateral and Consent Divorce", *Journal of Law, Economics and Organization* 25(1): 80-106.

Wolfers (2006) "Did Unilateral Divorce Raise Divorce Rates? A Reconciliation and New Results", *American Economic Review* 96(5) : 1802-1820.

Appendix

The Correlations

The correlations mentioned in the introduction are performed using data on European countries – to which we also add data from Australia and New Zealand. Our data on divorce rates in European countries at different points of time, as well as our data on which of these shifted to unilateral divorce and when they did so, is drawn from Gonzalez and Viitanen (2006), supplemented by Eurostat data. Data on sex ratios is available from the World Development Indicators. Data on divorce rates and timing of laws in Australia and New Zealand is drawn from multiple sources.[10] Our method has been to correlate the size of changes in divorce rates in countries after they transited to unilateral divorce, with the sex ratio prevailing in the relevant countries at the time of the regime shift.[11] Our sample included 14 European countries which had all transited to unilateral divorce regimes – Austria, Belgium, Denmark, Finland, Germany, Greece, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom; we also included Australia and New Zealand. Our choice of countries is

---

[10] Data on divorce rates at the time of transition to unilateral divorce (1975 in Australia, 1981 in New Zealand) is drawn from the United Nations Demographic Yearbook (1968,1982). Data on recent (2002) divorce rates is from Americans for Divorce Reform and is available at http://www.divorcemag.com/statistics/statsWorld.shtml.

[11] Note that sex ratios in different countries have remained largely stable over time.

dictated by data considerations : we were not able to find comparable data, particularly on timing of divorce law liberalization, for other countries.

We expressed the sex ratio as the number of women per 100 people (more than 50 in all the countries under consideration)[12], and computed the size of the long-term jump[13] in divorce rates as the difference between the divorce rate some 20 to 25 years after the regime shift and the divorce rate immediately prior to the shift.[14] The correlation between these two variables was positive with a coefficient of 0.547, and the correlation was significant at the 5% level. We tabulate the relevant figures below. Note that the sex ratio in the tables is expressed as the number of women per 100 population. In terms of our model this would be $F/(M+F) = f/(1+f)$ which is an increasing function of f.

Table 1

Country	Sex ratio as number of women per 100 population	Long term jump in divorce rates after transit to unilateral divorce
Austria	52.79	.2
Belgium	51.06	.2
Denmark	50.71	0
Finland	51.58	.2
Germany	52.59	.2
Greece	51.04	.1
Luxembourg	50.63	.2
Netherlands	50.13	.1

---

[12] Due to the stability of sex ratios over the time periods studied (as mentioned in the previous footnote), there is no reason to expect a marked difference between overall sex ratios and sex ratios at marriage. Thus the simplifying assumption maintained in our theoretical framework that sex ratios do not vary across birth cohorts is likely to be valid.

[13] The reason for looking at the long-term effect is that some of the mechanisms in our model – such as changes in decisions on whether to enter the marriage market at all – might take time to work as people slowly adjust their expectations and behavior patterns.

[14] The exception is Switzerland, which only experienced the regime shift in 2000. For Switzerland we computed the jump using the latest available divorce rate figures and subtracting the pre-2000 divorce rate.

Norway	50.52	0
Portugal	52.46	.3
Spain	51.15	.2
Sweden	50.08	.2
Switzerland	51.1	.1
United Kingdom	51.54	.2
Australia	50.2	.17
New Zealand	50.2	-.1
Correlation coefficient	**.547**	
p value	.0464	

Data on change in divorce rates (expressed in terms of divorces per thousand mid-year population) is taken from Eurostat. Data on sex ratios is from the World Development Indicators (World Bank).

In our correlation we use overall sex ratios, rather than the sex ratios between cohorts who marry each other (for which we lack data). It may be argued, therefore, that the skewness of the sex ratios in the countries we have looked at merely represents the greater longevity of women but not the ratios of marriageable women and men in the population. We have two responses to this criticism. First, we point to the stability of the sex ratio across time and over cohorts. Secondly, as men usually tend to marry slightly younger women, a positive population growth rate would imply even more marriageable women per cohort of marriageable men (Maitra 2006) – thus strengthening our results.

Our positive and significant correlation coefficient does not prove causality but does indicate a positive association between the size of the jump in divorce rates following a shift to unilateral divorce laws, and the skewness of the sex ratio. Moreover, since we are looking not at absolute divorce rates, but at *changes* in divorce rates, time-invariant country-specific factors become irrelevant. Exploring these relationships further, perhaps with a larger sample of countries and controls, remains part of a future agenda for research.

Proof of Proposition 3

Under mutual consent, men's anticipated utility from entering the marriage market is given by (16). If men were free to obtain a divorce whenever they wanted it, the terms in κ in the

numerator of the RHS of (16) would vanish. Thus the numerator would increase. Moreover, the denominator would change as the term $E_s[G(\mu)]$ would be replaced by G(E(Φ)) – the new probability that a married man would get divorced and re-enter the marriage pool. Note that E(Φ) necessarily exceeds μ = pE(Φ) + (1 − p)s as E(Φ) > s for the relevant range of s over which expectations are taken. Therefore G(E(Φ)) > $E_s[G(\mu)]$ so that the denominator of (16) would shrink. An increase in the numerator and a drop in the denominator would mean that a man entering the marriage market would expect a higher payoff under unilateral than under mutual consent divorce, hence the proportion of men entering the marriage market would be higher in unilateral divorce than the proportion of men who enter the marriage market under mutual consent. However, note that in a unilateral divorce regime, men do not want to enter the marriage market unless s < E(Φ). Similarly, women in a mutual consent regime do not want to enter the marriage market unless s < E(Φ). Since the distribution of s across the sexes is identical, the proportion of women entering the marriage market in mutual consent must equal the proportion of men entering the marriage market in unilateral divorce. We must infer by transitivity that if the proportion of men entering the marriage market in unilateral divorce is higher than the proportion of men entering the marriage market under mutual consent (which we have just shown), then the proportion of women entering the marriage market in mutual consent is higher than the proportion of men entering the marriage market in mutual consent. Q.E.D
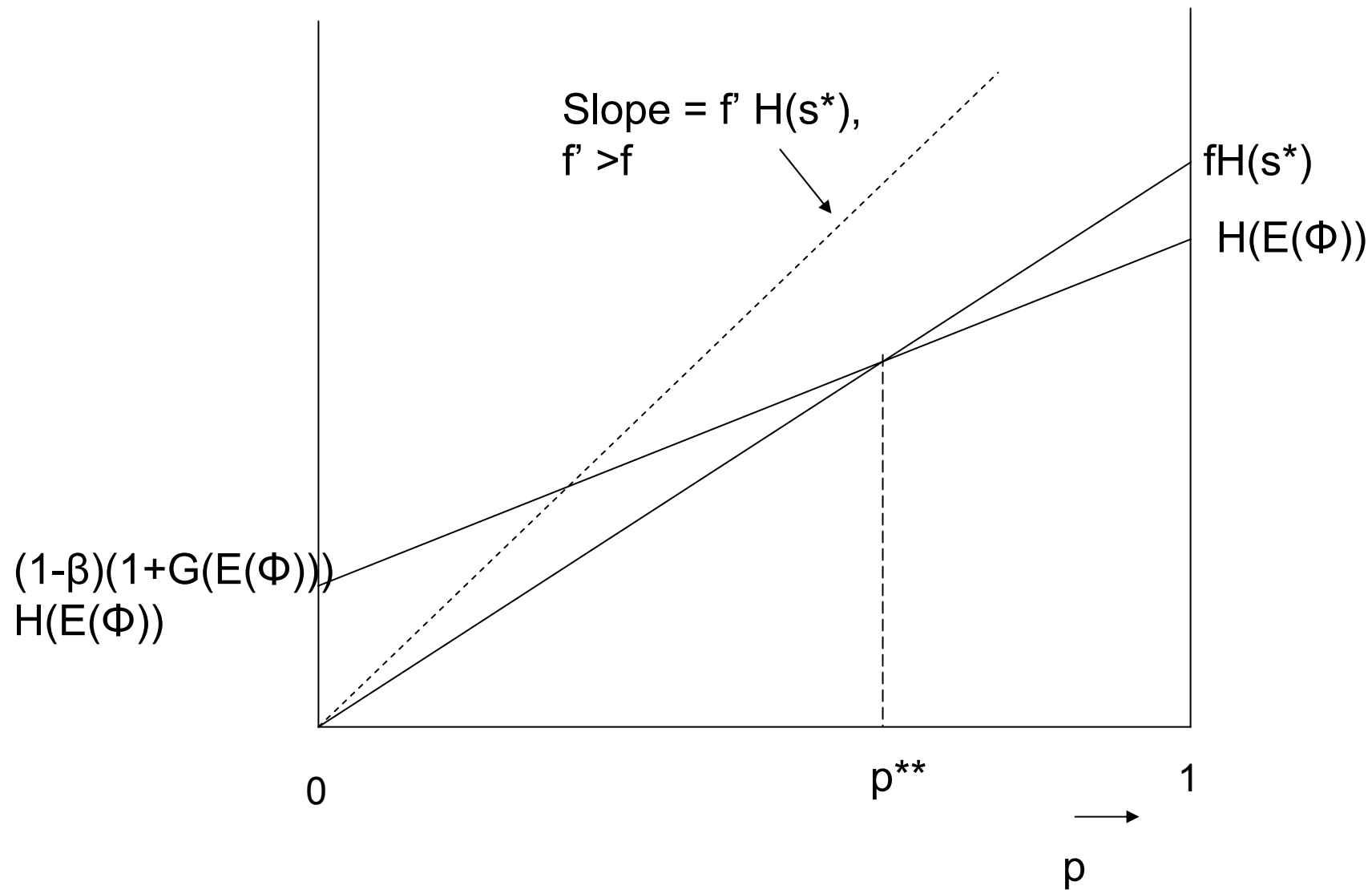
Figure 1 : Unilateral Divorce

Slope = f' H(s*), f' >f

fH(s*)

H(E(Φ))

(1-β)(1+G(E(Φ))) H(E(Φ))

0   p**   1

p

Figure 2: Mutual Consent, Unique Equilibrium

Slope =
f' H(E(Φ)),
f' > f

fH(E(Φ))

H((1-β)V^{ma}(1)

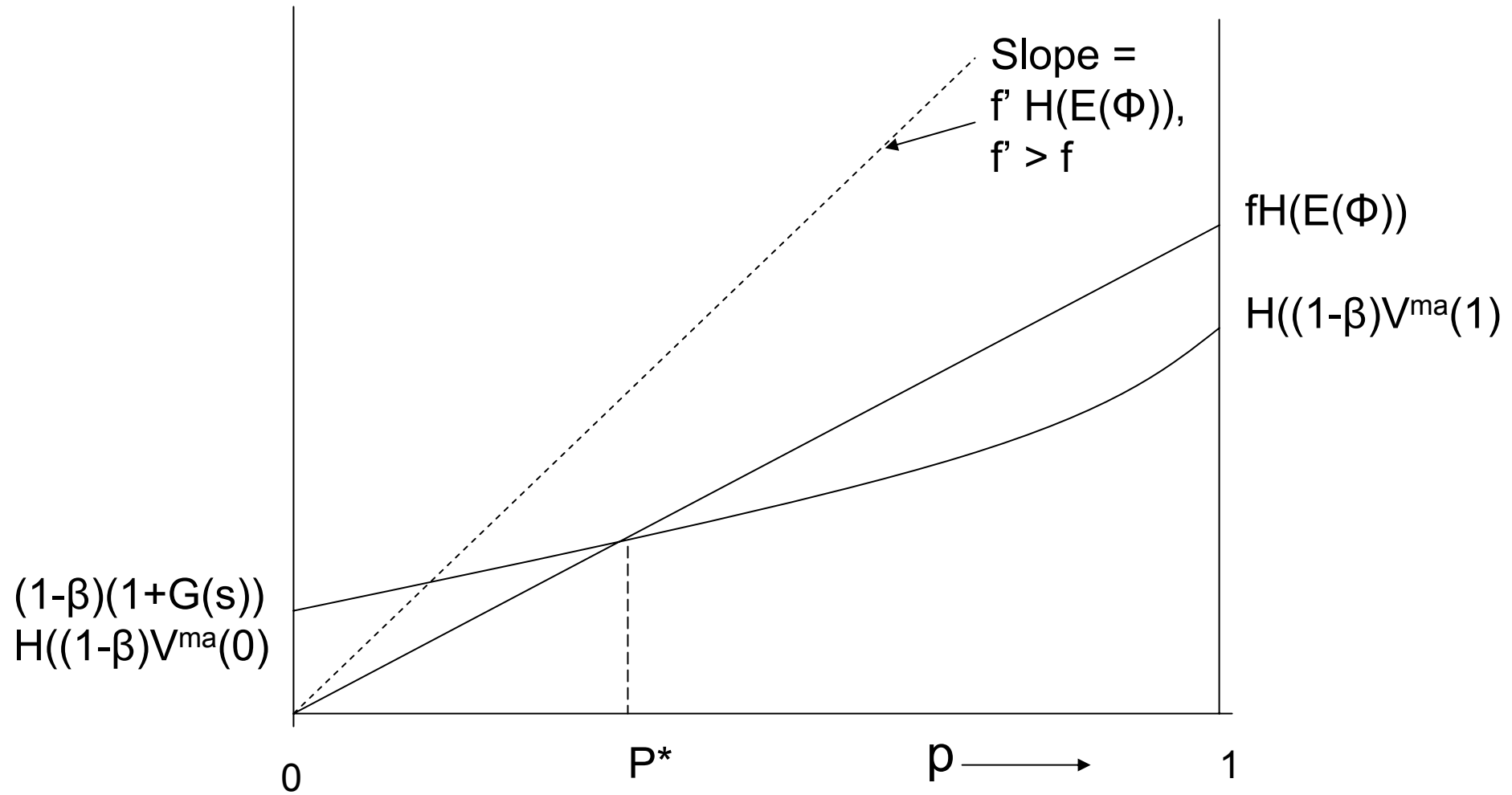(1-β)(1+G(s))
H((1-β)V^{ma}(0)

0   P*   p ⟶   1

Figure 3 : Mutual Consent, Multiple Equilibria

Slope =
f' H(E(Φ)),
f' > f

fH(E(Φ))

H((1-β)V^{ma}(1)

(1-β)(1+G(s))
H((1-β)V^{ma}(0)

0   p*1   p*2   p*3   1

p