Divorce, Remarriage and Child Support

By

Pierre-Andre Chiappori and Yoram Weiss

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Pierre-Andre Chiappori[†]and Yoram Weiss[‡]

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Abstract

Modern marriage markets display increasing turnover, with less marriage but more divorce and remarriage. As a consequence, a large number of children live in single parent and step parent households. There is substantial evidence that children of divorced parents do not perform as well as comparable children in intact families. However, there is also some evidence that this gap declines with the *aggregate* divorce rate. We develop a model in which the higher expectations for remarriage associated with higher divorce rates can trigger an equilibrium in which divorced fathers make more generous transfers that benefit their children and the mother in the aftermath of divorce. As a result, the welfare loss of children from the separation of their parents can be *lower* when divorce and remarriage rates rise.

1   Introduction

The last century has been characterized by changes in family structure, including a reduction in marriage and fertility and increased marital turnover. Divorce has been rising throughout the century and more men and women are now divorced and unmarried. Interestingly, however, the rise in divorce rates is associated with an increase in remarriage rates, relative to first marriage rates (see Figure 1) and *both* divorce and remarriage rates are substantially higher among recent cohorts. About 85 percent of men and 65 percent of women aged 50-59 in 1966 who ever divorced remarried. Moreover, in a given cohort, the remarriage rate among the young is

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similar to first marriage rate and exceeds the divorce rate, suggesting that, despite the large turnover, marriage is the "natural" state.

One consequence of higher turnover is the large number of children who live in single parent and step parent households. In the US 2002, 69 percent of children less than 18 years old lived with two parents (including step parents), 23 percent lived only with their mother and 5 percent lived only with their father, the rest lived in households with neither parent present, see Table 1.

There is substantial evidence that children of divorced parents do not perform as well as comparable children in intact families.[1] Such empirical evidence should however be interpreted with some care, for two reasons. First, selection issues are both paramount and hard to disentangle from possible causality; after all, dysfunctional families are more likely to generate both divorce *and* poor child performance.[2] Secondly, even if divorce causes poor performance at the individual level, the impact of the *aggregate* divorce rate on the welfare of children is a different issue. Picketty (2003) shows, for instance, that the increase in the divorce rate in France have reduced the gap in school performance between children of divorced parents and children from intact families.[3] There are several possible channels by which aggregate divorce can affect the welfare of children following the separation of their parents. First, as noted by Picketty, as the costs of divorce decline, the average divorce will reflect a better quality marriage prior to divorce. Second, the legal environment responds to the rise in divorce (and remarriage) and more flexible custody and child support arrangements are enforced (see Case et al., 2003, and Del-Boca, 2003). Finally, as divorce rises, the stigma associated with it may decline and children of divorced parents may feel less different.

In this paper, we analyze another channel by which aggregate divorce can affect the welfare of children; the willingness of fathers to transfer money to the custodial mother under various living arrangements. Although alimony is rare in the US, the available data shows clearly that child support payments and alimony combined are more rare and lower when the custodial mother is married (see Figures 2, 3 and Table 2).[4] We provide a theoretical analysis that incorporates this feature together with

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[1] The literature on this topic is large and covers psychological and economic outcomes. See, for instance, Argys et al.(1998), Lamb et al.(1999), Hetherington and Stanley-Hagan (1999), Gruber (2004) Lerman (2002) and Stafford and Yeung (2005).

[2] A recent paper by Bjórklund and Sundstrom (2005), using Swedish longitudinal data on siblings, argues that inferior performances of divorced children can largely be attributed to selection effects.

[3] Picketty shows that the school completion rates of children of divorced parents are lower than those of children in intact families. These gaps are similar whether the divorced parents remain single or remarry. However, the gaps in school completion decline as the proportion in the population of children who live in intact families declines over time and across regions. Picketty brings further evidence that shows that gaps are created in school completion even before the marriage breaks, suggesting that bad marriages (that end in divorce) also harm the children.

[4] The effect of mother marital status continues to hold in both the CPS and PSID when one controls for the mother's age, education, number of eligible children and year. John Ermisch reports, in private communication, that it also holds in the British Family and Children panel, allowing for

the positive relationship between aggregate divorce and remarriage to show that a higher divorce (remarriage) rate can *raise* the welfare of children. The reason is that post divorce transfers respond to the expected remarriage rates. We concentrate on conditional commitments, i.e. payments made by the divorced father only when the mother remains single and argue that such commitments are also (and in our context essentially) useful when the mother *remarries*. Indeed, frictions in the (re)marriage market leave room for bargaining between the new spouses, and commitments from the ex husband raise the bargaining power of the mother, which ultimately benefits the child as well. The higher the expected remarriage rate, the more willing will be each father to commit on such payments.

We simplify the analysis substantially by assuming that fertility is exogenous and all couples choose to have children even in the absence of any transfers. We further assume that the mother always has full custody of the children in the event of separation. We focus our attention on the *agency problems* that arise in caring for children and their relation to the aggregate conditions in the marriage market. Children are viewed as a collective good for their natural parents and both care about their welfare. This remains true whether the parents are married or separated. However, marital status can affect the expenditures on children, and the welfare of parents and children. Separation may entail an inefficient level of expenditures on children for several reasons. If the custodial parent (here the mother) remains single, not only does she lose the gains from joint consumption, but she may also determine child expenditures without regard to the interest of the ex-spouse. If she remarries, the presence of a new spouse who cares less about step children reduces the incentives to spend on children from previous marriages. Finally, parents that live apart from their children can contribute less time and goods to their children and may derive less satisfaction from them. These problems are amplified if the partners differ in income and cannot share custody to overcome the indivisibility of children. As a result, the level of child expenditures following separation is generally below the level that would be attained in an intact family, reducing the welfare of the children and possibly of their parents.

To mitigate these problems, the partners have an incentive to sign *binding* contracts that will determine some transfers between the spouses. Such contracts are signed "in the shadow of the law" (see Mnookin and Kornhauser, 1979). In particular, some child support payments are mandatory; however, the non custodial father may still augment the transfer if he wishes to influence the expenditures of the custodial mother on the children. Payments made to the custodial mother are fungible and the amount that actually reaches the children depends on whether the mother is single or remarries and on the commitments of prospective mates for remarriage to their-ex-wives. Thus, the commitment that a particular father wishes to make to his ex-wife

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fixed effects. Ermisch and Pronzato (2005) find that child support transfers also depend on the marital status of the father. This additional feedback will not be discussed in this paper.

upon separation depends on the commitments made by others and the prospects of remarriage. The model determines an equilibrium level of transfers and an equilibrium divorce and remarriage rates that are tied to each other. We identify two stable equilibria. There is one equilibrium with low divorce (and remarriage) in which all fathers transfer nothing to their ex-wives above the minimal support mandated by law. In this equilibrium, the level of child expenditures falls short of the amount spent in an intact family. However, high divorce (remarriage) equilibrium also exists, in which all fathers commit to transfer to their ex-wives a substantial amount if they remain single. This amount is sufficient to make the mother indifferent between remarriage and remaining single, so that the influence of the new husband on child expenditures is reduced and the level of child expenditures upon remarriage is the same as it would be if the parents did not separate.[5]

Diamond and Maskin (1979) were the first to examine contracting and commitments in general equilibrium matching models, including a matching technology with increasing returns. However, they did not discuss issues connected with children. The presence of children means that parents continue to be connected even if the marriage relationship breaks. This special but important feature is absent from the usual matching models between employers and workers, in which partnerships break without a trace.

A more closely related paper is Aiyagari, Greenwood and Guner (2000) who construct and simulate a model of the marriage market which includes individual shocks, divorce, remarriage and child support payments, among other things. They show that, at their chosen parameters, an increase in mandated child support raises welfare. Our model is substantially simpler than theirs, allowing us to discuss more explicitly the circumstances under which such an outcome is likely to occur. However, we achieve this added transparency at a substantial cost. In our model, members of each sex are assumed to be ex-ante identical so that all issues of assortative mating are set aside, and there is no role for ex ante redistribution. Similarly, there are no unexpected changes in earnings that can trigger divorce and create ex-post heterogeneity and we do not discuss wealth accumulation and the intergenerational implications of marriage and divorce.[6]

2　The model

We use a very stylized model in which the economic gains from marriage consist of sharing consumption goods. There are also non monetary benefits from companionship and love, which are uncertain at the time of marriage. Marriage is an "experience

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[5]The step function pattern of average divorce displayed in Figure 1 suggests a shift across marriage market equilibria that happened in the decade 1965-1975. Michael (1988) documents this shift and provides some explanations.

[6]Recent papers that touch on these issues are Burdett and Coles (1997 and 1999), Coles, Mailath and Postlewaite (1998), Burdett and Wright (1998) and Ishida (2003).

good" and the quality of match is discovered after some lag. Negative surprises about the quality of the match trigger divorce. However, the probability of separation conditioned on a bad realization depends on the prospects of remarriage, the post divorce transfers made by the couple and also on the transfers made by potential mates to their ex-wives. In the absence of adequate transfers, remarriage may have a negative effect on the children because the new husband of the custodial mother may be less interested in the child's welfare and the mother may wish to marry him even if the child's welfare declines, provided that she is compensated by higher adult consumption. We may refer to this problem as the "Cinderella effect". This effect reduces the incentive of the non custodial father to support the children, because part of the transfer is "eaten" by the new husband. The model includes search frictions and we seek an equilibrium in which the expectations for remarriage are consistent with the divorce and contracting individual choices that are based on these expectations. Assuming that it is easier to remarry if there are many divorcees, the model can generate multiple equilibria.

2.1   Incomes

All men are assumed to be identical and have a fixed income, y. Similarly, all women are identical and assumed to have the same fixed income z. However, women earn less than men $(z < y)$. The basic reason for this asymmetry is the presence of children, which, by assumption, requires that the mother who gives birth to the children and spends time caring for them foregoes some of her earning capacity. [7] Otherwise, we assume that labor supply is fixed and that incomes do not vary over time.

2.2   Preferences

A family spends its income on two goods an adult good a and a child good c. The adult good a is a public good for all members of the same household and the child good c is private to the children.

The (aggregate) utility of the children is quadratic:

$$u_c = g(c) = \alpha c - \frac{1}{2}c^2, \tag{1}$$

where $\alpha > 1$.

Children are viewed as public good for their natural parents even if the children and parents live apart, with a correction for proximity by a discount factor, δ, that

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[7]Becker (1991. Ch. 2) argues that mothers' comparative advantage at taking care of children, at least at an early age, endogenously generates wage differences between men and women as mothers typically reduce their work in the market, hence their future earning capacity, after the birth of a child. Lummerud and Vagstad, (2000), Breen and Penasola (2002) and Albanesi and Olivetti, 2005) add that women may specialize in home work and have lower earnings because of asymmetric information and stereotyping.

captures the idea that "far from sight is far from heart". In addition, each married couple derives utility from companionship that we denote by θ. The quality of match, θ, is an independent draw from a given symmetric distribution with zero mean.

Let $j = m$ indicates the mother and $j = f$ indicates the father. The utility of a single parent j is

$$u_j = a_j + u_c, \tag{2a}$$

if the parent and children live together and

$$u_j = a_j + \delta u_c, \tag{2b}$$

if the parent and children live apart. Similarly, the utility of a married parent j is

$$u_j = a_j + u_c + \theta_j, \tag{3a}$$

if the parent and children live together and

$$u_j = a_j + \delta u_c + \theta_j, \tag{3b}$$

if the parent and children live apart.

Adult consumption and the quality of match are viewed as household public goods. Any two married individuals who live in the same household share the same value of a and θ. Thus, parents who live together in an intact family have the same value of a and θ and enjoy equally the utility from their children u_c. However, if the parents divorce and live apart in different households, they will have different values of a and θ, and the custodial parent who lives with the children will have a higher utility from the child.[8]

2.3 Matching

There are equal numbers of males and females in each cohort. To keep things simple, we assume that, after separation, each partner can remarry only with a divorced person from the same cohort, provided that a "suitable match" who also wants to remarry is found. However, the search process involves frictions and remarriage is neither immediate nor certain. Consequently, following divorce, agents may fail to meet an eligible new mate and hence remain single. A key ingredient of the model is that the probability of remarriage *rises with the average divorce rate in the population* because remarriage is easier; the larger is the number of singles around.[9]

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[8]It is easy to generalize the model to allow the child to be affected (linearly) by the amount of the adult good consumed by the parents and by the quality of the match, θ.

[9]This contrasts with most search models of the labor market that assume constant returns, whereby the probability of meeting would depend on the *ratio* of single individuals of each sex. Matching models with increasing returns have been analyzed by Diamond and Maskin (1979) and Diamond (1982).

There are several reasons why such increasing returns should be present in our context. One is that, although the two sexes meet in a variety of occasions (work, sport, social life, etc.),[10] many of these meetings are "wasted" in the sense that one of the individuals is already attached and not willing to divorce. Obviously, non wasted meeting are more frequent when the proportion of divorcees in the population is larger. Another reason is that the establishment of more focused channels, where singles meet only singles, is costly and they will be created only if the "size of the market" is large enough. Thirdly, as noted by Mortensen (1988), the search intensity of the unattached decrease with the proportion of attached people in the population. The reason is that attached individuals are less likely to respond to an offer, which lowers the return for search. Empirical support for increasing returns is given by the geographic patterns of matching, which show that the degree of assortative mating into a given group tends to rise with the relative size of the group within the total population.[11] There is also a tendency of singles, of either sex, to congregate in large cities, especially if they have special marital needs.[12] We do not fully specify the matching process and summarize it by a reduced form *matching function*, $m = \phi(d)$, where d is the common proportion of divorced men and women, and m is the probability that divorcees of opposite sex meet. The probability of remarriage is denoted by p, where $p \leq m$, with $p = m$ only if each meeting with a potential mate ends up in remarriage.

2.4 Timing

Agents live two periods. In the beginning of each period, they can marry if they find a match. We assume that in the first period each agent finds a match with probability one. All matches end up in marriage, because individuals are identical and the expected gains from marriage are positive.

We think of marriage as a binding commitment to stay together for one period, with no search "on the job".[13] The quality of the match θ is revealed with a lag at the end of each period, after having experienced the marriage. When the partners observe the common value of their match quality, θ, each partner chooses whether to continue the marriage or walk away and seek an alternative match.

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[10]Lauman et al. (1994, Table 6.1) report that about half of the marriages arise from meeting in school, work, and private party and only 12 percent originate in specialized channels such as social clubs or bars.

[11]For instance, Bisin et al. (2001) show that the *difference* between within group marriage rates and population shares *rises* with the share of the religious group in the population, which suggests increasing returns. That is, a Jew, who presumably wants to marry a Jew, is more likely to do so if there are many Jews around.

[12]Costa and Kahn (2000) bring evidence that singles, especially with high schooling, are more likely to reside in large metropolitan areas. Black et al. (2000) and Lauman et al. (1994, Table 8.1) report that gays are more likely to live in large cities.

[13]Relaxing this assumption would not significantly affect the qualitative conclusions of the model, provided that the increasing return property is maintained.

All married couples produce the same fixed number of children at the beginning of the first period. If the parents separate, one parent obtains the custody over the children and the other may make transfers to custodian with the objective to influence the welfare of the child, about whom both parents continue to care.

If two divorced man and woman meet at the beginning of the second period, they can choose whether to remarry. Otherwise, they remain single for the rest of their life.

2.5 Legal framework

We assume that the mother is always the custodial parent[14] and discuss two types of child support payment; a *fixed* payment, s, that the mother receives if a separation occurs independently of the subsequent marital status of the parents and a *contingent* payment σ that may depend on the mother's subsequent marital status.[15] However, payments cannot be earmarked: children support is fungible and child expenditures (especially time spent with children) are not easily verifiable.

A common legal practice is to tie the child support transfer to the child's needs and the parents' ability to provide these needs. In our quasi-linear framework, one can easily characterize a transfer that guarantees that the custodial wife, *if single,* would restore the same level of child expenditures as under marriage; we thus assume that s is set at this level and is mandatory. However, such payment is insufficient to maintain that level of child expenditure if the mother remarries, because of potential conflict with the new husband who cares less about the child. There is thus room for additional payment by the father to influence child expenditure if the mother remarries; this is the main focus of the paper.

The additional payment, σ, is freely contracted upon by the parents, although it has to be non negative (so that it cannot undo the children support payment mandated by law). This payment can be made contingent on future events (typically, the wife's remarriage); it can be determined either *ex-post* (i.e., after the ex spouses' marital status has been determined) or *interim* (i.e., after divorce but before remarriage).[16] We concentrate on transfers that are determined at the interim stage

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[14]Although other custody arrangements are possible, this is still the prevalent arrangement. Mother custody can be justified by the economic comparative advantage of women in child care.

[15]This classification is a tractable way to capture the observed dependence of transfers on the marital status of the partners. In practice, the partners negotiate a contract that is stamped by the court. Most states in the US now have guidelines but parents can agree to transfer more than the amounts specified in these guidelines. The contract can be renegotiated and restamped as circumstances (e.g., the "reasonable needs" of the child and the "abilities" of each of the parties to provide the needed support) change.

[16]Contracts can also be signed *ex-ante* (i.e., at the time of marriage), but such agreements typically raise renegotiation proofness issues . For instance, the partners may want to sign ex ante a contract that is interim (and ex post) inefficient, because of its favorable impact on the divorce decision. However, such a contract will be almost impossible to implement in practice, because both parties realize that it will be renegotiated should divorce take place nevertheless. See Chiappori and Weiss

following divorce, which is the most common form of transfers. The legal payment s is assumed to be 'large' enough to discourage fathers from making additional, *ex post* voluntary transfers to their ex-wives, whatever her marital status.[17] Yet, interim, they may voluntarily commit on payments to the custodial mother conditional on her remaining single. As we shall see, such commitments, although pointless if the mother remains single, turn out to be productive if she remarries, since by raising the mother's bargaining position in her new household they benefit the child (hence the father).

3 The allocation of household resources

We begin by describing the allocation of household income between the adult and child goods under different household structures.

3.1 Intact family

If the parents remain married, they maximize their common utility

$$\max_{a,c} \ a + g(c) + \theta \tag{4}$$

s.t.

$$a + c = y + z,$$

implying that

$$g'(c) = \alpha - c = 1. \tag{5}$$

We denote the unique solution to (5) by $c^* = \alpha - 1$. It is natural to assume that

$$z < c^* < y + z, \tag{6}$$

which means that the income of the mother, z, is not sufficient to support the optimal level of child expenditures, while the pooled income of the two parents $y + z$ is large enough to support the children and still leave some income for adult consumption.

3.2 Mother remains single

In this case, the mother solves

$$\max_{a,c} \ a + g(c) \tag{7}$$

(2002) for a related analysis in a slightly different context.

[17]The level of s is such that the husband is unwilling to make additional transfers if his ex wife remains single. While such payments might take place when the mother remarried, they are less likely to benefit the child, hence the father, because part of the transfer is consumed by the new husband. Chiappori and Weiss (2004) provide a detailed analysis of this issue. For the sake of brevity, we simply assume no transfers when the mother remarries.

s.t.

$$a + c = z + s + \sigma.$$

where σ denote the transfer that the mother receives from the father if she remains single in addition to the compulsory payment, s.

Given the quasi linear structure of preferences, the choice between adult consumption and children goods follows a very simple rule:

- if $z + s + \sigma \leq c^*$ then $a = 0$ and $c = z + s + \sigma$

- if $z + s + \sigma > c^*$ then $a = z + s + \sigma - c^*$ and $c = c^*$

That is, the mother spends all her income, $z + s + \sigma$, on the children if her income is lower than the children's "needs", as represented by c^*. If her total income exceeds c^* then the mother will spend c^* on the children and the rest on herself.

In particular, a regulation imposing a minimum level of child support payment of $c^* - z$ or more guarantees that, no matter what the voluntary transfers may be, child expenditures in a single parent (here mother) households will be the same as in intact households.

3.3   Mother remarries

If the custodial mother remarries, the problem becomes more complicated because of the involvement of a *new* agent, namely the new husband of the mother. The new husband receives little or no benefits from spending on the child good. To sharpen our results, we assume that the new husband derives no utility at all from the step children, which means that the child good is a *private* good for the wife in the new household. It follows that if $c > c^*$, both partners agree that the marginal dollar should be spent on the adult good. If, however, $c < c^*$, then an increase in the amount spent on the child good raises the utility of the mother, because she values this expenditure more than the forgone adult good, while the benefit for the new husband is nil. In this range, there is a *conflict* between the mother and her new husband.

One can distinguish two different mechanisms that determine the expenditures on children in newly formed households, depending upon whether binding commitments on child expenditures can be made prior to remarriage. Without any commitment, the custodial mother will decide how much to spend on the children, taking as given the amount she receives from her former husband and the amount that her new husband gives to his former wife. We make the alternative assumption that the matched partners can bargain prior to remarriage on the division of the gains from remarriage and reach some binding agreement (or an 'understanding') that will determine the expenditure on children.

We use a symmetric Nash-Bargaining solution to determine the bargaining outcome. The Nash axioms imply that the bargaining outcome maximizes the product

of the gains from remarriage, relative to remaining single, of the two partners. The gain of the remarried mother depends on the transfers that she expects to receive from her ex-husband, when remarried or single and on the expected payments that her new husband is going to pay his ex-wife, when married or single. At the time of meeting between the two separated individuals, neither of them knows what the marital status of their ex-spouses will be. Because agents are assumed to be risk neutral, we can use the expected payments in calculating the gains from remarriage.

We denote the payments by a given father to his ex-wife by σ and payment made by other men by σ^{-}[18] With this notation, the voluntary payments of the *new* husband to his *ex-wife*, is $s + \sigma^{-}$ if his ex-wife remains single and s if she remarries. The realized value of the transfer is not known at the time of the bargaining and we shall denote its *expected* value by $\sigma_e^{-} = (1-p)\sigma^{-}$, where p is the probability of remarriage. We denote by y_e^{-} the expected net income that the new husband brings into the marriage, that is $y_e^{-} = y - s - \sigma_e^{-}$.

Since the new husband cares only about the adult good that he receives in the new household and because, by assumption, his payments to the ex-wife and thus the utility of his children are independent of his marital status, his gain from marriage depends only on the additional adult good (and the value of companionship that he expects, the mean of which is zero); it is thus given by

$$G_h = z + s - c. \tag{8}$$

The utility gain of the mother upon remarriage consists of the additional adult consumption and the change in her utility from child expenditures. For $s \geq c^{*} - z$, these amount to

$$G_m = \gamma(c) + y_e^{-} - \sigma, \tag{9}$$

where

$$
\begin{aligned}
\gamma(c) &\equiv g(c) - c - (g(c^{*}) - c^{*}) \tag{10} \\
&= c^{*}(c - c^{*}) - \frac{1}{2}\left(c^2 - (c^{*})^2\right).
\end{aligned}
$$

Note that for $c \leq c^{*}$, $\gamma(c)$ is non positive, increasing and concave with a maximum at c^{*}, where $\gamma(c^{*}) = \gamma'(c^{*}) = 0$.

The Nash bargaining solution, if interior, can be written in the form

$$\gamma'(c) = \frac{\gamma(c) + y_e^{-} - \sigma}{z + s - c}, \tag{11}$$

where $\gamma'(c)$ is the slope of the Pareto frontier (in absolute value) and $\frac{\gamma(c) + y_e^{-} - \sigma}{z + s - c}$ is the ratio of the utility gains of the two partners. It is possible, however, that (11) has

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[18]It is possible that identical agents will select different commitments to their identical ex-wives. However, because we are looking for symmetric equilibria, there is no loss of generality in assuming that all other fathers pay the same amounts to their ex-wives.

a negative solution for c, in which case the Nash bargaining outcome is that child expenditures are set to zero.

Let $\hat{c}$ be the solution to (11) then, because remarriage occurs only if both partners have a non negative gain from marriage, $\gamma'(\hat{c}) \geq 0$ and $\hat{c} \leq c^*$. That is, the step family generally spends less on child goods.

From (11), we obtain that in an interior solution

$$\frac{\partial \hat{c}}{\partial \sigma} = -\frac{\partial \hat{c}}{\partial y_e^-} > 0 \ \text{ and } \ \frac{\partial \hat{c}}{\partial z} = \frac{\partial \hat{c}}{\partial s} > 0. \tag{12}$$

These inequalities reflect the impact of each member's resources when single on his\her bargaining strength. In particular, $\partial \hat{c}/\partial \sigma > 0$ implies that an increase in the payment to the wife as single, σ, is always beneficial to the children if the mother remarries, because it does not change the total resources of the new household but increases her bargaining power, hence allowing her to control a larger fraction of these resources. Finally, an important feature of the Nash bargaining solution is that the amount of child expenditures in a remarried couple depends only on the difference $y_e^- - \sigma = y - s - (1-p)\sigma^- - \sigma$. Thus, if the mother is expected to remarry a new husband with a low σ^- and, therefore, a high bargaining power that induces lower child expenditures, the father can offset this effect by raising σ.

4 Equilibrium: characterization

4.1 Legal payment

The existence of a legal floor on the father's payment can be justified by the insufficiency of voluntary ex post transfers. Indeed, if both parents are single, the father would, ex post, voluntarily augment the mother's total income up to some level c_δ, given by

$$\delta g'(c_\delta) = 1. \tag{13}$$

Clearly, $c_\delta < c^*$ if $\delta < 1$, implying a reduction in the children's welfare relative to continued marriage. This would violate a common consideration in determining the size of the compulsory child support payments, namely that the child should maintain her "accustomed standard of living". Thus there is room for a legislation imposing a transfer that can support the level of child expenditures c^*, that is, $s = c^* - z$. If the mother remains single, such a policy guarantees that the children receive exactly c^*; clearly, it "crowds out" all voluntary ex-post payments.

Mandatory payments have one additional role in our model which is to encourage remarriage. In the absence of mandatory transfers (e.g., $s = 0$), interim commitments to the mother *if single* may be used by the father to discourage her from remarrying (which guarantees that the child receives the optimal amount c^*). The equilibrium that emerges then implies lower welfare because the gains from sharing the adult

consumption good are lost. However, under our assumption that $s = z - c^*$, a father that promises to augment the mandatory payment if the mother remains single can induce the efficient level of child support even if the mother remarries. In what follows, we thus assume that $s = c^* - z$.

4.2 Optimal interim Contracts

Our previous analysis reveals an interesting dilemma; if the custodial mother remains single, the father is unwilling to give her any transfer beyond the minimum set by law. However, if she remarries, he would like her to *have been promised* more money if single, because this would boost her bargaining power vis a vis her new spouse, hence benefit the children, at no cost for the father. This situation calls for a *voluntary binding contract*, whereby the father commits to pay a certain amount, σ, to his ex-wife if and only if she remains single.

We define the expected net incomes of the father and new husband of the mother as $y_e = y - s - (1 - p)\sigma$ and $y_e^- = y - s - (1 - p)\sigma^-$, respectively. Let $x = y_e^- - \sigma$, then condition (11) can be rewritten in the form

$$\gamma'(c) = \frac{\gamma(c) + x}{c^* - c}, \tag{14}$$

implying

$$c = h(x) = \begin{cases} c^* - \sqrt{\frac{2}{3}}\sqrt{x} & if \quad x \le \frac{3}{2}(c^*)^2 \\ 0 & if \quad x > \frac{3}{2}(c^*)^2 \end{cases}. \tag{15}$$

When the new husband's expected wealth x is 'too large', his bargaining position is so favorable that nothing is spent on the stepchild. In the remaining of the paper, we shall concentrate on the less extreme case in which the amount spent, $c = h(x)$, is positive; note that it is still smaller than the optimal amount c^*. Then (15) shows that $h(x)$ is decreasing and convex. Recalling that $x = y_e^- - \sigma = y - s - \sigma + (1 - p)\sigma^-$, it is seen that an increase in commitment of either the father or the new husband raise the expenditures on the child in the remarried household. In particular, if the father sets $\sigma = y_e^-$ and $x = 0$ then $h(x) = c^*$. That is, the father can attain the efficient level of child expenditures by a sufficiently large commitment. At this point, both the mother and the new husband are just indifferent between remarriage and remaining single. Moreover, the convexity of $h(x)$ creates *strategic interactions* among different agents, in the sense that the *marginal* impact of the commitment made by the father to his ex-wife, σ, is affected by the commitments made by others, σ^-. These interactions have different consequences at different marital states. If the mother remarries, a larger σ^- will increase the marginal impact of σ. However, if the father remarries, a higher commitment by others raises the bargaining power of the new wife and the marginal cost of the commitment made by the father will be higher. Thus, to fully describe the strategic interactions we need to look at the effects of commitments on the *expected* utilities of the fathers.

The expected utility of a particular father upon separation can be written as $E(u_f) = \delta E(u_c) + E(a_f)$, where

$$E(a_f) = y_e + p\left(z - h\left(y_e - \sigma^-\right)\right) \tag{16}$$

is the father's expected adult consumption, and

$$E(u_c) = pg(h(y_e^- - \sigma)) + (1-p)g(c^*) \tag{17}$$

is the expected utility of the children upon separation. Taking the derivative of $E(u_f)$ with respect to σ, holding σ^- constant, we obtain

$$\frac{\partial E(u_f)}{\partial \sigma} = -(1-p)\left[1 - ph'\left(y_e - \sigma^-\right)\right] \tag{18}$$
$$-p\delta g'\left(h\left(y_e^- - \sigma\right)\right)h'\left(y_e^- - \sigma\right).$$

The father pays σ only if the mother remains single, which occurs with probability $(1-p)$. At the margin, this commitment would cost him 1 dollar if he remains single and $1 + (-h'(y_e - \sigma^-))$ dollars if he remarries, where the added positive term $-h'(y_e - \sigma^-)$ represents the additional expenditures on the children of the *new* wife, resulting from the decline in the father's bargaining power when he increases the commitment to his ex-wife. The father gets benefits from σ only if the mother remarries, which occurs with probability p. In this case, the payment raises the mother expenditures on the children because her bargaining power is stronger. The increase in child expenditures is $h'(y_e^- - \sigma)$ and the father gain from this increase is $\delta g'(h(y_e^- - \sigma))h'(y_e^- - \sigma)$.

The expressions above are valid only in the range in which the commitments are consistent with remarriage of the mother and the new wife of the father, that is

$$\sigma \leq y_e^- = y - s - \sigma^-(1-p), \tag{19}$$
$$\sigma^- \leq y_e = y - s - \sigma(1-p).$$

We shall refer to condition (19) as the incentive compatibility constraints. The father will never choose $\sigma > y_e^-$ because by setting $\sigma = y_e^-$ he can induce a child expenditures within remarriage at a level of c^* and a single mother never chooses a higher level of c. [19]

An interior optimal solution for σ given σ^- must satisfy these constraints and the necessary conditions for individual optimum $\frac{\partial E(u_f)}{\partial \sigma} = 0$ and $\frac{\partial^2 E(u_f)}{\partial \sigma^2} < 0$. However,

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[19]In addition, the commitments must be feasible and satisfy

$$0 \leq \sigma \leq y - s,$$
$$0 \leq \sigma^- \leq y - s.$$

However, these conditions are implied the incentive compatibility constraints (19), and we may safely omit them.

as we shall show shortly, *corner solutions* in which agents select either $\sigma = 0$ or the maximal level permitted by constraints (19) will play an important role in the analysis.

A salient feature of the model is that the probability of remarriage, p, has a systematic influence on the willingness of each father to commit. Indeed:

Proposition 1 *If the remarriage probability is p small enough, the optimum is attained at the lower bound $\sigma = 0$. If the remarriage probability is p close enough to one, the optimum is attained at the upper bound $\sigma = y_e^-$.*

Proof. Just note that for $p = 0$

$$\frac{\partial E(u_f)}{\partial \sigma} = -1 < 0,$$

and for $p = 1$

$$\frac{\partial E(u_f)}{\partial \sigma} = -\delta g' \left(h \left(y_e^- - \sigma \right) \right) h' \left(y_e^- - \sigma \right) > 0.$$

The conclusion follows by continuity. ■

The interpretation is quite simple. The father commits to pay only if the mother remains single and gets the benefits only if she remarries. Thus, if p is low he is more likely to pay and less likely to benefit. Conversely, if p is high, the father is less likely to pay and more likely to benefit.

We can now examine how the commitments of others affect the expected utility of each father and his incentives to commit. From (16) and (17), we see that an increase in σ^- reduces the gain of the father if he remarries by $h'(y_e - \sigma^-)$, because his new wife will have a higher bargaining power. On the other hand, if the mother remarries she will have a higher bargaining power if her prospective new husband has higher commitments to his ex-wife, which raises the expected utility of the father by $-(1-p)\delta g'(h(y_e^- - \sigma))h'(y_e^- - \sigma)$. Generally, it is not clear which of these two effects is stronger, but for p close to 1, the first effect dominates and $\frac{\partial E(u_f)}{\partial \sigma^-} < 0$, implying that a higher transfer by others reduces the expected utility of each father. It can be shown that for, $\delta = 1$, the transfers of different fathers are local complements, $\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-} > 0$, if $\sigma > \sigma^-$ and local substitutes, $\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-} < 0$, if $\sigma < \sigma^-$ (see Lemma 4 in the Appendix). Under usual circumstances, the sign of $\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-}$ is sufficient to determine the strategic interactions among agents. However, in our model, transfers are usually set at the boundary and interior solutions are irrelevant. As we shall now show, the probability of remarriage, p, determines the relevant boundaries for the chosen levels of σ and σ^- and the nature of the strategic interactions.

4.3 Partial Equilibrium

To simplify the analysis of equilibria at the boundary, we shall from now on assume that $\delta = 1$. This assumption guarantees that the father cares sufficiently about the children to support an equilibrium in which everyone is willing to commit.

A symmetric partial (or conditional) equilibrium exists when, given the probability of remarriage p, all agents choose the same level of σ, taking the choices of others as given. The term partial is used here because the remarriage rate is endogenous in our model and must be determined too.

A first result rules out interior equilibria:

Proposition 2 *An interior, symmetric equilibrium cannot exist.*
Proof. *Such an equilibrium exist if for some $\bar{\sigma}$, one has that*

$$\frac{\partial E(u_f)}{\partial \sigma} = 0 \quad and \quad \frac{\partial^2 E(u_f)}{\partial \sigma^2} \leq 0$$

when $\sigma = \sigma^- = \bar{\sigma}$. But, for $\delta = 1$, $\frac{\partial^2 E(u_f)}{\partial \sigma^2} > 0$ when $\sigma = \sigma^- = \bar{\sigma}$ (see Lemma 1 in the Appendix). ∎

The reason for non existence can be traced back to the convexity of the Nash bargaining outcome in the commitment made by each father to the custodial mother. This convexity implies that each father can individually gain from a unilateral departure from the interior equilibrium. However, a symmetric equilibrium can still occur at the *boundaries* of the incentive compatibility constraints. Specifically, two cases can obtain. In the first case, equilibrium transfers are set at the minimum level; then $\sigma = \sigma^- = 0$. Alternatively, they may reach the upper bound. Then

$$\sigma = y_e^- = y - s - \sigma^-(1 - p),$$

and symmetry implies that

$$\sigma = \sigma^- = \frac{y - s}{2 - p}.$$

For such boundary values to support a symmetric equilibrium, it must be the case that the best response to $\sigma^- = 0$ (resp. $\sigma^- = \frac{y-s}{2-p}$) be $\sigma = 0$ (resp. $\sigma = \frac{y-s}{2-p}$).

Proposition 3 *If all agents set $\sigma^- = 0$, then any agent that considers a deviation must choose between the lower boundary, i.e., $\sigma = 0$ and the upper boundary given by $\sigma = y - s$. If $p \leq \frac{3}{4}$ and all agents set $\sigma^- = \frac{y-s}{2-p}$, any agent that considers a deviation must choose between the lower boundary $\sigma = 0$ and the upper boundary given by $\sigma = \frac{y-s}{2-p}$. For $p > \frac{3}{4}$, no agent deviates from $\sigma^- = \frac{y-s}{2-p}$.*

Proof. Follows from lemmas 1-3 in the appendix. ∎

Based on the properties of the best response functions, we can now identify the regions in which the two possible symmetric equilibria apply.

Proposition 4 *There exist a unique pair of critical values, p_0^* and p_1^*, with $0 < p_0^* < p_1^* < 1$, such that:*

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- *For $p < p_0^*$, the only symmetric equilibrium is such that all fathers set $\sigma = 0$.*

- *For $p > p_1^*$, the only symmetric equilibrium is such that all fathers set $\sigma = \frac{y-s}{2-p}$.*

- *For $p_1^* > p > p_0^*$, there is no symmetric equilibrium, because the best response to $\sigma^- = 0$ is $\sigma = y - s$ and the best response to $\sigma = \frac{y-s}{2-p}$ is $\sigma = 0$.*

Proof. See Appendix ∎

The first two parts of Proposition 4 are closely related to Proposition 1. If the probability of remarriage is high, all fathers are willing to commit, no matter what others do. Similarly, if the probability of remarriage is low, no father wishes to commit, irrespective of what others do. In the intermediate range, the behavior of others becomes relevant. If other fathers commit, no single father wants to commit, while if all other fathers do not commit each father individually wishes to commit all his disposable income to his ex-wife if she remains single. The pattern described in Proposition 4 is displayed in Figure 4. We see that σ and σ^- are, globally, strategic substitutes. Each father is less willing to contribute if others do, and thus the critical value at which all fathers contribute occurs at a higher p than it would if others do not contribute.

5   Divorce

Having observed the realized quality of the current match, each spouse may consider whether or not to continue the marriage. A parent will agree to continue the marriage if, given the observed θ, the utility in marriage exceeds his/her expected gains from divorce. Under divorce at will, the marriage breaks if

$$u^* + \theta < \max\{E(u_m), E(u_f)\}, \tag{20}$$

where $E(u_m)$ and $E(u_f)$ are the expected utility of the mother and father at divorce and

$$u^* = y + z + g(c^*) - c^* \tag{21}$$

is the common utility of the husband and wife if the marriage continues, not incorporating the quality of the match. Note that this divorce rule is different from the more familiar condition

$$u^* + \theta < \frac{E(u_m) + E(u_f)}{2} \tag{22}$$

that would apply if utility is transferable within couples. Our assumption that all the goods that are consumed in an intact family are public precludes compensation within couples that would "bribe" the parent with the better outside options to remain in the marriage.

Let us define the critical value of θ that triggers divorce as

$$\theta^* = max\{E(u_m), E(u_f)\} - u^*. \tag{23}$$

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Excluding the quality of match θ_i, the utility of each parent following separation cannot exceed the common utility that the parents attain if marriage continues, because the allocation between adult and child goods in an intact family is efficient and all the opportunities of sharing consumption are exploited. Therefore, $\theta^* \leq 0$. The probability that a couple will divorce is

$$\Pr\{\theta \leq \theta^*\} = F(\theta^*), \tag{24}$$

where $F(.)$ is the cumulative distribution of θ. Assuming independence of the marital shocks across couples and a large population, the proportion of couples that will choose to divorce is the same as the probability that a particular couple divorces. Symmetry implies that $F(0) = \frac{1}{2}$ and, therefore, the fact that divorce is costly from an economic point of view implies that less than half of the marriages will end up in divorce as a consequence of "bad" realizations of match quality.

An important feature of the model is that the decision of each couple to divorce depends on the probability of remarriage that in turn depends on the decision of others to divorce, because a remarriage is possible only with a divorcee. In addition, the decision to divorce depends on the commitments that the partners make, as well as the commitment made by others. Post divorce transfers between the parents can reduce their cost of separation in the event of a bad quality of match. However, commitments made by others imply that prospective matches are less attractive for remarriage, which can increase the cost of divorce.[20]

To analyze these complex issues, we limit our attention to symmetric equilibria. We have seen that symmetric equilibria (if any) cannot be interior, hence must occur at the boundary; as we shall see later, such equilibria do actually exist under mild conditions. We must thus consider two cases, depending on whether equilibrium transfers are set at zero or at the upper bound (then $\sigma = \sigma^- = \frac{y-s}{2-p}$).

We first examine the expected utilities of the children, husband and wife, evaluated at the time of divorce. In equilibria without commitment, $\sigma = 0$,

$$\begin{aligned}
E(u_c) &= pg(c_0) + (1-p)g(c_0) \equiv \bar{u}_c^0, \tag{25}\\
E(u_f) &= y + z - c^* + p(c^* - c_0) + \bar{u}_c^0 \equiv \bar{u}_f^0,\\
E(u_m) &= p(y + z - c_0) + \bar{u}_c^0 \equiv \bar{u}_m^0,
\end{aligned}$$

where $c_0 = h(y - s)$ is the Nash bargaining outcome when all fathers set $\sigma = 0$. The children's expected utility declines with the probability of remarriage, p, because child expenditures if the mother remarries, c_0, are lower than if she remains single, c^*. The mother must gain from an increase in p because, remarriage is voluntary and she fully internalizes the impact of her remarriage on the child.[21] By the same logic,

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[20]Walker and Zu (2005) find that increased level of child support, caused by an unanticipated change in the law, reduced marital dissolution in Britain.

[21]The effect of p on the mother's expected utility is

$$\frac{\partial E(u_m)}{\partial p} = y + z + g(c_0) - c_0 - g(c^*),$$

the father's expected adult consumption must increase with p, or else he would not remarry. However, taking into account the utility of the child that is controlled by the mother, the expected utility of the father declines in p.[22] Nevertheless, the expected utility of the father upon separation exceeds that of the mother by $(1-p)(y+z-c^*)$, because of his higher consumption of adult goods if he remains single.

In equilibria in which all fathers commit to $\sigma = \frac{y-s}{2-p}$,

$$E(u_c) = g(c^*), \tag{26}$$
$$E(u_m) = E(u_f) = \frac{y+z-c^*}{2-p} + g(c^*) \equiv \bar{u}^1.$$

That is, the efficient level of child expenditures is attained whether or not the mother remarries. Both the father and the mother are indifferent between remarriage and remaining single. The expected utility of the mother upon divorce equals that of the father and both rise with the probability of remarriage, p.

We conclude

Proposition 5 *The expected utility of the father upon divorce is at least as large as that of the mother and he determines whether or not the marriage will continue. If no father commits, $\sigma = 0$, then $\bar{u}_f^0 > \bar{u}_m^0$ and the father will break the marriage for all θ such that $\theta < \bar{u}_f^0 - u^*$. Inefficient separations occur when the father wants to leave but the mother wants to maintain the marriage, $\bar{u}_f^0 - u^* > \theta > \bar{u}_m^0 - u^*$. If all fathers commit to $\sigma = \frac{y-s}{2-p}$ then the father and mother have the same expected utility $\bar{u}^1$ and separations are efficient.*

The assumption that $\delta = 1$ is crucial for the result that the father and mother have the same expected utility. Clearly, the father is at a disadvantage if proximity is valuable and the mother gains custody. It is also clear that equilibrium outcome in the aftermath of divorce is inferior to the utility that an average couple obtains in marriage, because $\frac{y-s}{2-p} \leq y - s$. This difference reflects the inability to share in the adult good when one of the partners remains single. It is only when remarriage is certain, that one can expect to recover the average utility in the first marriage.

6   Full equilibrium

We can now close the model and determine the equilibrium levels of divorce and remarriage. Equilibrium requires that all agents in the marriage market act optimally,

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which is exactly her own gain from remarriage.

[22] The net effect of p on the father's expected utility is

$$\frac{\partial E(u_f)}{\partial p} = c^* - c_0 + (g(c_0) - g(c^*)),$$

which is negative because $g(c^*) - c^* > g(c_0) - c_0$.

given their expectations, and that expectations are realized. The decision of each couple to divorce depends on the expected remarriage rate, p. Given a matching function $m = \phi(d)$, and that all meetings end up in marriage,[23] we must have

$$p = m = \phi[F(\theta^*(p))]. \tag{27}$$

In addition, the contracting choices of all participants in the marriage market must be optimal, given p. Based on our previous analysis, we define $\theta_0^*(p)$ as the trigger if all fathers set $\sigma = 0$ and $\theta_1^*(p)$ as the trigger if all fathers set $\sigma = \frac{y-s}{2-p}$. Then, the equilibrium divorce and remarriage rates are determined by $p = \phi\left[F\left(\theta_0^*(p)\right)\right]$ or $\phi[F(\theta_1^*(p))]$, depending upon whether the induced commitment is $\sigma = 0$ or $\sigma = \frac{y-s}{2-p}$.[24]

To separate the economic considerations embedded in $\theta^*(p)$ from the exogenously given distribution of match quality, $F(\theta)$, and matching function, $\phi(d)$, it is useful to rewrite condition (27) in the form

$$F^{-1}[\phi^{-1}(p)] = \theta^*(p). \tag{27'}$$

The function $F^{-1}[\phi^{-1}(p)]$ is always increasing in p, while $\theta^*(p)$ depends on the commitments that individual fathers wish to make, given their evaluation of the remarriage prospects of their ex-wife. Our previous analysis shows that $\theta^*(p)$ first declines and then rises in p, with a discontinuity when all fathers switch from no commitment to full commitment.

Obviously, the exact properties of the equilibria depend on the precise form of the distribution F and the matching function ϕ. It is however clear that the model typically generates *multiple* equilibria and large responses to relatively small exogenous changes. Specifically:

Proposition 6 *If the equation*

$$F^{-1}[\phi^{-1}(p)] = \theta_1^*(p)$$

has a solution p_1 in $[p_1^*, 1]$ then there exists a symmetric equilibrium in which all transfers are set at the maximal incentive compatible level ($\sigma = \sigma^- = \frac{y-s}{2-p}$) and the divorce rate is $\phi^{-1}(p_1)$. If the equation

$$F^{-1}[\phi^{-1}(p)] = \theta_0^*(p)$$

has a solution p_0 in $[0, p_0^*]$, there exists a symmetric equilibrium in which no voluntary transfers are made ($\sigma = \sigma^- = 0$) and the divorce rate is $\phi^{-1}(p_0)$. Finally, solutions of the above equations that fall in the region $p_0^* < p < p_1^*$ cannot be symmetric equilibrium points.

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[23]Strictly speaking, all agents are indifferent toward marriage if $\bar{\theta} = 0$. However, for any positive $\bar{\theta}$, the father gains and the mother is either indifferent or gains too. Thus, we interpret the case with $\bar{\theta} = 0$ as a limit in which the expected gains from companionship approach zero.

[24]These equilibrium requirements implicitly assume symmetric equilibria in which all agents behave in the same manner. Such equilibria are a natural choice given that all agents are initially identical, but other equilibrium may exist.

One can readily construct examples in which both equilibria coexist (remember that the functions F and ϕ are essentially arbitrary). Because the two regions, with commitment and without commitments, are separated from each other, the divorce and remarriage probabilities in each region can differ substantially.

To better understand these results, let us summarize the main feedbacks that are present in our model.

- The increasing returns in matching, whereby it is easier to remarry if there are more divorcees around, creates a *positive* feedback from the expected remarriage rate to the realized divorce rates. As is well known, this force alone can create multiple equilibria, because a higher divorce rate generates a higher remarriage rate and a higher expected remarriage rate creates stronger private incentives to divorce.[25]

- However, in our model, a higher remarriage rate encourages divorce only if there are adequate transfers that ensure that the children do not suffer if the custodial mother remarries. In the absence of such transfers, the father who determines the divorce decision, will in fact be *less* likely to divorce if the remarriage rate is high.

- An important *positive* feedback in our model is that, when the expected remarriage rate is high, fathers are more willing to commit on payments that are contingent on the mother remaining single, because then the father is less likely to pay and more likely to reap the benefits. The stronger commitments raise the divorce rate because the children are less likely to suffer and, consequently, a higher remarriage rate is possible.[26]

- Finally, our model allows for *strategic* interactions in the commitments made by different parents. These interactions arise because the bargaining outcome for remarried couples depends, in a non linear manner, on both the transfer that the father is committed to make and the transfer that the new husband of the mother commits to his ex-wife. Strategic substitution weakens the positive feedback, because in the intermediate range of remarriage probability, each father is *less* willing to commit if others do.

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[25] Diamond (1982) discusses the connections between increasing returns and multiplicity in a search economy. Positive feedback in can raise the impact of exogenous changes even if the equilibrium is unique. Such "social multipliers" are discussed in Glaeser and Sheinkman (2003)

[26] Diamond and Maskin (1979) discuss compensation for the damage imparted on the other partner when a separation occurs and show that the willingness to make such commitments *declines* with the probability of rematching. Our model differs in that the incentive to commit is related to the maintenance of child quality by the custodial mother and, consequently, commitments rise with the probability of remarriage.

A final remark is that our assumption that all goods are public for first married couples weakens the positive feed backs and *reduces* the likelihood of multiple equilibria.[27] Would it be possible to transfer utilities within marriage on a one to one basis (transferable utility) then the divorce rule would depend on the *sum* of the expected gains from divorce of the two parents. As we have shown, in the absence of commitments, the father's expected utility upon divorce declines in p, while that of the mother rises with p. Thus, adding the two expected gains, it is more likely for $\theta^*(p)$ to rise with p in the range in which fathers make no commitments and $\sigma = 0$.

7   Welfare

From a policy perspective, it is meaningful to evaluate welfare ex-ante, before of the realization of the quality of match, because at the time of marriage all members of the same sex are identical and their expected life time represent the average outcome for respective populations, that would arise after each couple draws it idiosyncratic quality of match. However, due to the asymmetries embedded in the model, men and women may have different expected utilities. The expected utility of parent j in a particular couple, evaluated at the time of marriage, is

$$W_j(p) = u^0 + \int_{\theta^*(p)}^{\infty} (u^* + \theta) f(\theta) d\theta + F(\theta^*(p)) V_j(p), \tag{28}$$

where, $V_j(p)$ denote the expected utility upon divorce, $j = f$ for the father and $j = m$ for the mother. The term u^0 represent the parents average utility in the first period, while $u^* = y + z + g(c^*) - c^*$ represents the utility in an intact family (excluding the impact of the non monetary return θ) in the second period.[28] The expected utility following divorce, $V_j(p)$, may be different for the two parents, depending upon the agreement they make about transfers and on the agreements made by others, which determines their value as potential mates for remarriage. As a consequence, the expected life time utility evaluated at the time of marriage, $W_j(p)$, may differ for males and females.

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[27] This result is in contrast to Burdett and Wright (1998) who consider marriage between heterogeneous agents and show that non transferable utility can lead to multiplicity even in the absence of increasing returns. A negative feedback arises in their model, whereby if one side (say men) is more selective then the other side (women) will have fewer options and become less selective. Thus an equilibrium in which men are selective and women are not and an equilibrium in which women are selective but men are not can both exist.

[28] The economic costs of bearing and raising children are reflected by the assumption that $z < y$. Because these costs are largely borne by the mother, she may refrain from having children unless the father makes further commitments at the time of marriage about post divorce settlements. To avoid these further complications, we assume here that the total gains from having children (including possible benefits in the first period) exceed these economic costs.

The expected life time utility is higher for the partner with the higher gains from divorce, who determines the divorce decision. In fact, the expected life time utility can be rewritten as

$$
W_j(p) = \begin{cases} u^0 + u^* + \int\limits_{-\infty}^{\theta^*(p)} (\theta^*(p) - \theta) f(\theta) d\theta & if \quad V_j(p) \geq V_i(p) \\ u^0 + u^* + \int\limits_{-\infty}^{\theta^*(p)} (\theta^*(p) - \theta) f(\theta) d\theta & if \quad V_j(p) < V_i(p) \\ \quad -F(\theta^*(p))(V_i(p) - V_j(p)) & \end{cases} \tag{29}
$$

where the term $u^0 + u^*$ is the expected value of the marriage if it never breaks and the term $\int\limits_{-\infty}^{\theta^*(p)} (\theta^*(p) - \theta) f(\theta) d\theta$ is the *option value* of breaking the marriage if it turns sour because of a bad draw of θ. The option to sample from the distribution of θ is a motivation for marriage that exists even if marriage provides no other benefits. However, this option is more valuable for the person with higher gains from divorce, who determines the divorce. When the marriage breaks, an event that happens with probability $F(\theta^*(p))$, the spouse who does not initiate the divorce and is left behind suffers a capital loss given by $V_i(p) - V_j(p)$. The value of the option for the spouse who determines the divorce, increases with the variability in the quality of match, because then the ability to avoid negative shocks becomes more valuable.

Using the expressions in (28) and (29), we can calculate the welfare of each agent in equilibrium. The main result is that exogenous shocks that raise the divorce rates can increase the welfare of the children and the mother, because they provide incentive to fathers to raise their commitments. However, a large change in the probabilities of divorce and remarriage may be needed to induce fathers to commit to a level of transfer that entails an improvement in the child's welfare.

Proposition 7 *The second period expected utility of children is the same as in intact family, given by $g(c^*)$, if the probability of remarriage p is either zero or larger than p_1^* (then $\sigma = \frac{y-s}{2-p}$). For $p < p_0^*$, where $\sigma = 0$, the expected utility of children declines linearly with p and is given by $g(c^*) - p[(g(c^*) - g(c^0)]$, where $c_0 = h(y - s)$.*

It follows from Proposition 7 that any marriage market equilibrium that falls in the high range $p > p_1^*$ is preferable for children to a marriage market equilibrium in the low range $p < p_0^*$ (except for $p = 0$). For instance, consider an exogenous change in the gains from divorce, such as improved matching technology or a higher variance in the shocks to marital quality, that shifts the equilibrium remarriage rate from the lower range to the upper range then the rise in aggregate divorce (and remarriage) will be beneficial to children.

We can further note the following points;

- In the range $p > p_1^*$, where $\sigma = \frac{y-s}{2-p}$, the life time utility of both parents equals and rises with the remarriage rate. If two equilibrium points exist in this range

then welfare will be higher when the equilibrium divorce (remarriage) rate is higher. This is a direct outcome of the assumed increasing returns, whereby a higher divorce rate makes remarriage easier, and the result that no other externalities exist. In particular, the mother is not hurt by the decision of the father to break the marriage (i.e., divorce is efficient) and the children (and thus the father) are not hurt by the remarriage of the mother.

- In contrast, in the range $p < p_0^*$, where $\sigma = 0$, all family members can be hurt by a higher divorce (remarriage) rate. The father and children are certainly hurt and the mother may also be hurt because separations are inefficient and the father determines the divorce. However, the mother never loses from remarriage, because she fully internalizes the (negative) impact on the child in her decision to remarry.

8   Conclusion

Broadly viewed, divorce is a corrective mechanism that enables the replacement of bad matches with better ones. The problem, however, is that private decisions may lead to suboptimal social outcomes because of the various externalities that infest search markets. These externalities exist at the level of a single couple and the market at large. At the level of a couple, the spouse who initiates the divorce fails to internalize the interest of the other spouse in continued marriage; and the parent that remarries fails to internalize the impact of lower child expenditures on the ex-spouse, who continues to care about the child. At the market level, a person who chooses to divorce fails to take into account the impact on the remarriage prospects of others, and if commitments are made, on the quality of prospective mates. We have shown that the problems at the couple's level can be resolved by voluntary commitments that entail efficient level of child expenditures and efficient separation. However, such commitments are made only if the expected remarriage rate is sufficiently high.

The willingness to commit at high divorce levels is a consequence of the social interaction between participants. In the marriage market, as in other "search markets", finding a mate takes time and meetings are random; the decision of each couple to terminate its marriage depends not only on the realized quality of the particular match, but also on the prospects of remarriage and, therefore, on the decisions of others to divorce and remarry. We have shown that such feedbacks may improve the welfare of children, because fathers may be more willing to commit on post divorce transfers to their ex-wives in high divorce environments, in order to influence their bargaining power upon remarriage. Of course, the quantitative importance of these links from aggregate divorce to remarriage and child support must be determined empirically. However, such research can be quite challenging, given the difficulties of establishing more obvious channels, such as the influence of legal enforcement on child support (see Case et al, 2003).

The analysis of this paper can be extended to include endogenous fertility. As we have shown, the ex-post asymmetry between parents caused by having children can create problems in caring for them if the marriage breaks up and contracts are incomplete. Because men often have higher expected gains from divorce, they initiate the divorce, at some situations in which the mother would like to maintain the marriage. Such inefficient separations imply that the gains from having children are smaller to the mother than to the father. Because the production of children requires both parents, the mother may avoid birth in some situations in which the husband would like to have a child. The consequence is an inefficient production of children. This suggests another role for contracts, to regulate fertility, which may require some ex-ante contracting at the time of marriage. However, contracts that couples are willing to sign at the time of marriage may be inconsistent with contracts that the partners are willing to sign in the interim stage, after divorce has occurred and the impact of the contract on the divorce and fertility decisions is not relevant any more. With such time inconsistency, the partners may wish to renegotiate, thereby creating a lower level of welfare for both of them from an ex-ante point of view. Assuming that renegotiation takes place, the contracts will be similar to the interim contracts discussed here but they would apply for a broader range of remarriage probabilities. It can then be shown that fertility choice creates further feedbacks that can generate multiple equilibria, with and without children. These are important issues for further research.

APPENDIX

A   Calculation of the father's expected utility

By definition,

$$E(u_f) = E(a_f) + \delta E(u_c). \tag{A1}$$

If the mother remains single, the child's utility is $g(c^*)$ and if she remarries, the child's utility it is $g(h(y_e - \sigma)$. Taking expectations,

$$E(u_c) = (1-p)g(c^*) + pg(h(y_e^- - \sigma)). \tag{A2}$$

If the father remains single, his expected consumption is

$$p(y-s) + (1-p)(y-s-\sigma). \tag{A3}$$

If the father remarries, his expected consumption is

$$p(y + z - h(y_e - \sigma^-)) + (1-p)(y + z - h(y_e - \sigma^-) - \sigma). \tag{A4}$$

The uncertainty in A3 and A4 cases concerns the remarriage of the mother. Taking now expectations on the father's marital status and using the assumption that his transfers to the mother are independent of his marital status

$$\begin{aligned}
E(a_f) &= (1-p)\left(p\left(y-s\right) + (1-p)\left(y-s-\sigma\right)\right) + \tag{A5} \\
&\quad p\left(y - s + c^* - h\left(y_e - \sigma^-\right) - (1-p)\sigma\right),
\end{aligned}$$

which simplifies to

$$E(a_f) = y_e + p\left(c^* - h\left(y_e - \sigma^-\right)\right). \tag{A6}$$

Thus,

$$E(u_f) = y_e + p\left(c^* - h\left(y_e - \sigma^-\right)\right) + \delta(1-p)g(c^*) + \delta pg\left(h\left(y_e^- - \sigma\right)\right). \tag{A7}$$

Calculation of $\frac{\partial E(u_f)}{\partial \sigma}$

$$\begin{aligned}
\frac{\partial E(u_f)}{\partial \sigma} &= \frac{\partial E(a_f)}{\partial \sigma} + \delta \frac{\partial E(u_c)}{\partial \sigma} \tag{A8} \\
&= -(1-p)\left(1 - ph'\left(y_e - \sigma^-\right)\right) - \delta pg'\left(h\left(y_e^- - \sigma\right)\right) h'\left(y_e^- - \sigma\right).
\end{aligned}$$

For the quadratic case $g(c) = \alpha c - \frac{1}{2}c^2$,

$$g'(h(y_e^- - \sigma) = \alpha - h(y_e^- - \sigma) = 1 + \sqrt{\frac{2}{3}}\left(y_e^- - \sigma\right)^{\frac{1}{2}}$$

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and

$$h'(x) = -\frac{1}{\sqrt{6}} x^{-\frac{1}{2}}.$$

Therefore,

$$\frac{\partial E(u_f)}{\partial \sigma} = -(1-p)\left(1 + \frac{p}{\sqrt{6}}\left(y_e - \sigma^-\right)^{-\frac{1}{2}}\right) + \delta p\left(\frac{1}{\sqrt{6}}\left(y_e^- - \sigma\right)^{-\frac{1}{2}} + \frac{1}{3}\right), \quad \text{(A9)}$$

$$\frac{\partial^2 E(u_f)}{\partial \sigma^2} = -\frac{p(1-p)^2}{2\sqrt{6}}\left(y_e - \sigma^-\right)^{-\frac{3}{2}} + \frac{\delta p}{2\sqrt{6}}\left(y_e^- - \sigma\right)^{-\frac{3}{2}}, \quad \text{(A10)}$$

$$\frac{\partial E(u_f)}{\partial \sigma^-} = -\frac{p}{\sqrt{6}}(y_e - \sigma^-)^{-\frac{1}{2}} + p(1-p)\delta[\frac{1}{\sqrt{6}}(y_e^- - \sigma)^{-\frac{1}{2}} + \frac{1}{3}], \quad \text{(A11)}$$

$$\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-} = \frac{p(1-p)}{2\sqrt{6}}[-(y_e - \sigma^-)^{-\frac{3}{2}} + \delta(y_e^- - \sigma)^{-\frac{3}{2}}]. \quad \text{(A12)}$$

We now describe some properties of these derivatives to be used later, assuming that $\delta = 1$.

Lemma 1 For $\delta = 1$ and $p > 0$, $\sigma \geq \sigma^- \Rightarrow \frac{\partial^2 E(u_f)}{\partial \sigma^2} > 0$.
Proof. Suppose that $\sigma \geq \sigma^-$ then

$$y_e^- - \sigma < y_e - \sigma^-,$$

Therefore, for $\delta = 1$

$$\frac{\partial^2 E(u_f)}{\partial \sigma^2} > \frac{1}{2\sqrt{6}}(y_e - \sigma)^{-\frac{3}{2}}]p(1 - (1-p)^2) > 0.$$

Lemma 2 For $\delta = 1$ and $p < \frac{3}{4}$, we have

$$\frac{\partial E(u_f)}{\partial \sigma} = 0 \Rightarrow \frac{\partial^2 E(u_f)}{\partial \sigma^2} > 0.$$

Proof. The first order condition $\frac{\partial E(u_f)}{\partial \sigma} = 0$ gives, from (A9),

$$\left(y_e^- - \sigma\right)^{-\frac{1}{2}} - (1-p)\left(y_e - \sigma^-\right)^{-\frac{1}{2}} = \frac{\sqrt{6}(1-p)}{p} - \frac{\sqrt{6}}{3}.$$

Then, (A10) becomes

$$\begin{aligned}
\frac{\partial^2 E(u_f)}{\partial \sigma^2} &= \frac{p}{2\sqrt{6}}\left(y_e^- - \sigma\right)^{-\frac{3}{2}} - \frac{p(1-p)^2}{2\sqrt{6}}\left(y_e - \sigma^-\right)^{-\frac{3}{2}} \\
&\geq \frac{p}{2\sqrt{6}}\left(\left(y_e^- - \sigma\right)^{-\frac{3}{2}} - (1-p)^2\left(y_e - \sigma^-\right)^{-\frac{3}{2}}\right) \\
&\geq \frac{p}{2\sqrt{6}}\left(\left(y_e^- - \sigma\right)^{-\frac{3}{2}} - (1-p)\left(y_e - \sigma^-\right)^{-\frac{3}{2}}\right) \\
&= \frac{p}{2\sqrt{6}}\left(\frac{\sqrt{6}(1-p)}{p} - \frac{\sqrt{6}}{3}\right) = \frac{1}{2} - \frac{2}{3}p,
\end{aligned}$$

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which is positive for $p < \frac{3}{4}$.

Lemma 3 For $\delta = 1$ and $p > \frac{3}{4}$, $\sigma^- \leq \frac{y-s}{2-p} \Rightarrow \frac{\partial E(u_f)}{\partial \sigma} > 0$.

Proof. For any σ,

$$y_e - \sigma^- \geq (1 - p)(y_e^- - \sigma)$$

if and only if $\sigma^- \leq \frac{y-s}{2-p}$. Therefore,

$$
\begin{aligned}
\frac{\partial E(u_f)}{\partial \sigma} &= -(1-p)\left(1 + \frac{p}{\sqrt{6}}(y_e - \sigma^-)^{-\frac{1}{2}}\right) + p\left(\frac{1}{\sqrt{6}}(y_e^- - \sigma)^{-\frac{1}{2}} + \frac{1}{3}\right) \\
&= -(1-p) + \frac{p}{3} + \frac{p}{\sqrt{6}}\left((y_e^- - \sigma)^{-\frac{1}{2}} - (1-p)(y_e - \sigma^-)^{-\frac{1}{2}}\right).
\end{aligned}
$$

Since $-(1-p) + \frac{p}{3} > 0$ for $p > \frac{3}{4}$, the conclusion follows.

Lemma 4 For $\delta = 1$, $\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-} > 0$ iff $\sigma > \sigma^-$.

Proof. We have

$$y_e^- - \sigma < y_e - \sigma^- \text{ iff } \sigma > \sigma^-,$$

Therefore, for $\delta = 1$

$$\frac{\partial^2 E(u_f)}{\partial \sigma \partial \sigma^-} = \frac{p(1-p)}{2\sqrt{6}}[-(y_e - \sigma^-)^{-\frac{3}{2}} + (y_e^- - \sigma)^{-\frac{3}{2}}] > 0 \text{ iff } \sigma > \sigma^-.$$

B   Equilibrium at the lower boundary

If all men set $\sigma = 0$ then

$$E(u_c) = pg(c_0) + (1 - p)g(c^*), \tag{A13}$$

where $c_0 = h(y - s)$.

Therefore,

$$E(u_f) = y - s + p(c^* - c_0) + pg(c_0) + (1 - p)g(c^*). \tag{A14}$$

If one father deviates, Lemma 2 and 3 imply that the best deviation is to promise his wife $\sigma = y - s$. Then the amount spent on his children if the mother remarries will be $h(0) = c^*$. If the father remarries, the amount spent on the children of his new wife will be c_1, where $c_1 = h(p(y - s))$; note that $c_0 < c_1 < c^*$ since h is decreasing.

The expected utility of the father is then

$$E_d(u_f) = p(y - s) + p(c^* - c_1) + g(c^*). \tag{A15}$$

Taking differences, we have

$$E(u_f) - E_d(u_f) = (1 - p)(y - s) + p(c_1 - c_0 + g(c_0) - g(c^*)) \equiv D_0(p). \tag{A16}$$

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We see that $D_0'(p) < 0$, because $\frac{\partial c_1}{\partial p} < 0$, $c_1 - c_0 + g(c_0) - g(c^*) < c^* - c_0 + g(c_0) - g(c^*) < 0$, and c_0, c^* are independent of p. Also, $D_0(0) = y - s > 0$ and $D_0(1) < 0$. There is thus a *unique* p_0^* such that $0 < p_0^* < 1$ and $D_0(p_0^*) = 0$, where the father is indifferent between deviating and conforming.

For the quadratic case, $g(c) = \alpha c - \frac{1}{2}c^2$,

$$D_0(p) = (1-p)(y-s) - p\left(\sqrt{\frac{2}{3}}\sqrt{p}\sqrt{y-s} + \frac{1}{3}(y-s)\right) \tag{A17}$$

and the solution p_0^*, as a function of $y - s$, is plotted below.
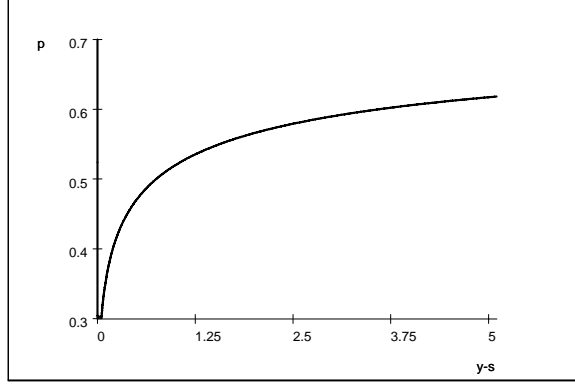
C Equilibrium at the upper boundary

If all fathers commit to pay $\sigma = \frac{y-s}{2-p}$, implying that $c = c^*$ upon remarriage, then the expected utility of each father is

$$E(u_f) = \frac{y-s}{2-p} + g(c^*). \tag{A18}$$

We first note that no father wants to deviate up from this pattern and select $\sigma > \frac{y-s}{2-p}$. Such deviation would mean that the *both* the father and the mother cannot remarry, because $\sigma^- = \frac{y-s}{2-p} > y_e$ and $\sigma > \frac{y-s}{2-p} = y_e^-$. In this case, the gain from not deviating becomes

$$
\begin{aligned}
E(u_f) - E_d(u_f) &= \frac{y-s}{2-p} - (y-s-\sigma) \tag{A19}\\
&> \frac{y-s}{2-p} - (y-s) + \frac{y-s}{2-p} = p\frac{y-s}{2-p} > 0.
\end{aligned}
$$

Now suppose that a father that deviates selects some $\sigma < \frac{y-s}{2-p}$. From lemmas 2 and 3, his deviation must be to $\sigma = 0$. Then, if the mother remarries, child expenditures will be

$$\hat{c} = c^* - \sqrt{\frac{2}{3}}\left(\frac{y-s}{2-p}\right)^{\frac{1}{2}}.$$

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If the father remarries, the expenditures on the child of his new wife will be

$$\tilde{c} = c^* - \sqrt{\frac{2}{3}}(1-p)^{\frac{1}{2}}(\frac{y-s}{2-p})^{\frac{1}{2}}.$$

The father expected utility upon deviation is now

$$E_d(u_f) = (1-p)(y-s) + p(y+z-\tilde{c}) + (1-p)g(c^*) + pg(\hat{c}).$$

Therefore,

$$D_1(p) \equiv E(u_f) - E_d(u_f) = -\frac{1-p}{2-p}(y-s) + p\left(g(c^*) - c^* - (g(\hat{c}) - \tilde{c})\right). \quad \text{(A20)}$$

We see that $D_1(0) = -\frac{y-s}{2} < 0$ and $D_1(1) = g(c^*) - c^* - (g(\hat{c}) - \tilde{c}) > g(c^*) - c^* - (g(\hat{c}) - \hat{c}) > 0$. Therefore, there exists a p_1^* such that $0 < p_1^* < 1$ and $D_1(p_1^*) = 0$, where the father is indifferent between conforming to $\frac{y-s}{2-p}$ and deviating to $\sigma = 0$.

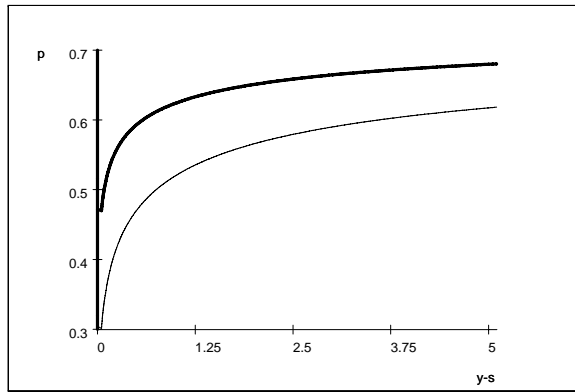For the quadratic case, $g(c) = \alpha - \frac{1}{2}c^2$,

$$g(c^*) - g(\hat{c}) = \sqrt{\frac{2}{3}}(\frac{y-s}{2-p})^{\frac{1}{2}} + \frac{1}{3}(\frac{y-s}{2-p}),$$

$$\tilde{c} - c^* = -\sqrt{\frac{2}{3}}(\frac{1-p}{2-p})^{\frac{1}{2}}(y-s)^{\frac{1}{2}}.$$

Hence,

$$D_1(p) = \frac{4p-3}{3}(y-s) + p\left(1 - (1-p)^{\frac{1}{2}}\right)\sqrt{\frac{2}{3}}(\frac{y-s}{2-p})^{\frac{1}{2}}. \quad \text{(A21)}$$

It is seen from (A21) that $D_1(p)$ rises with p. Hence, there exists a *unique* p_1^* such that $D_1(p_1^*) = 0$. The solution p_1^*, as a function of $y-s$, is plotted below in bold; the value of p_0^* is also plotted in thin.

One can see that $p_1^* > p_0^*$, a property that can be readily checked analytically.

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Figure 1: Rates (per 1,000) of First Marriage , Divorce, and Remarriage: U.S. 1921 to 1989 (3-Year Averages)
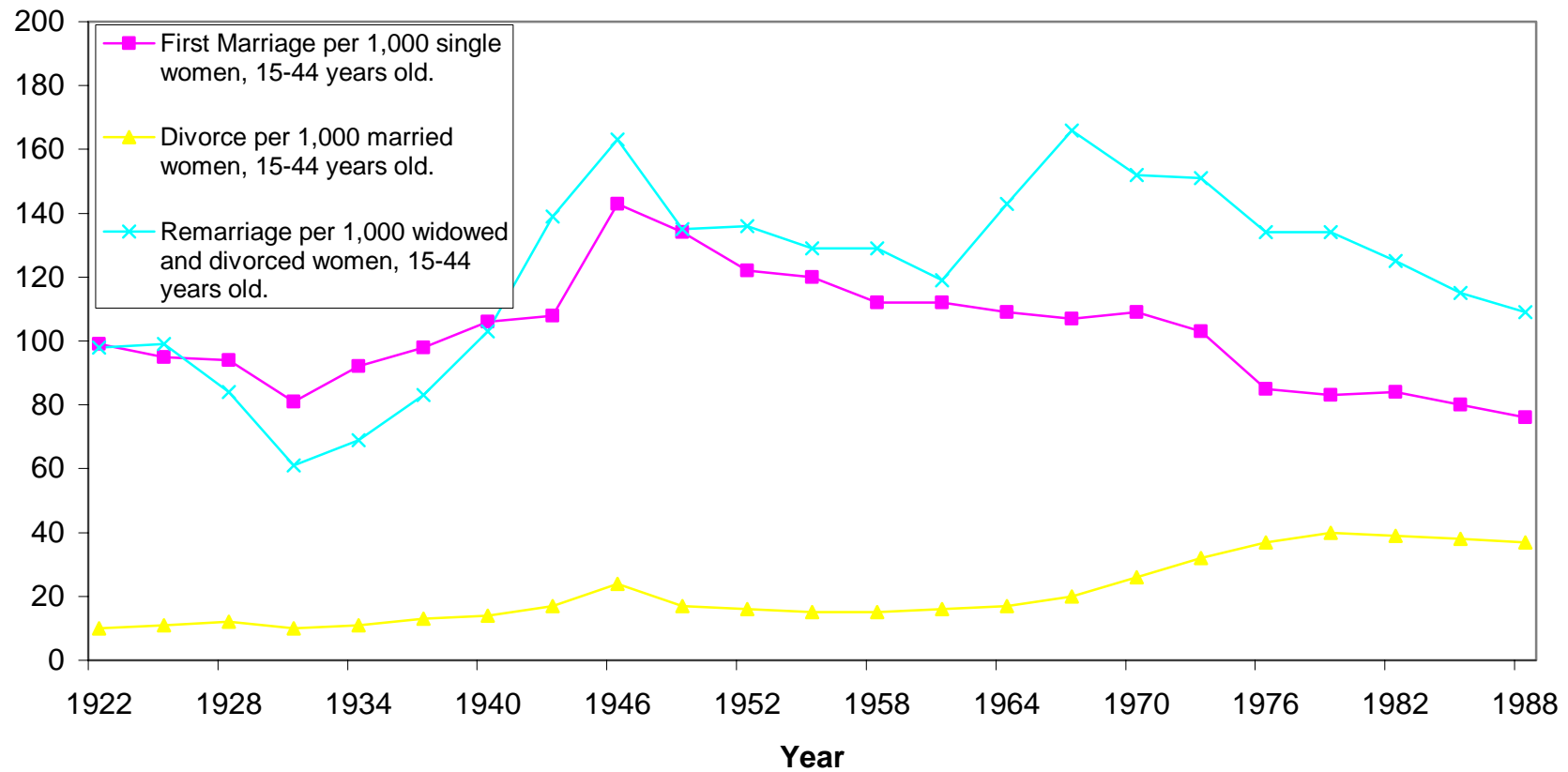
Source: National Center of Health Statistics.

Figure 2: Percent of Mothers with Eligible Children 0-18 Receiving Child Support and Alimony, by Marital Status, U.S. 1985-2003
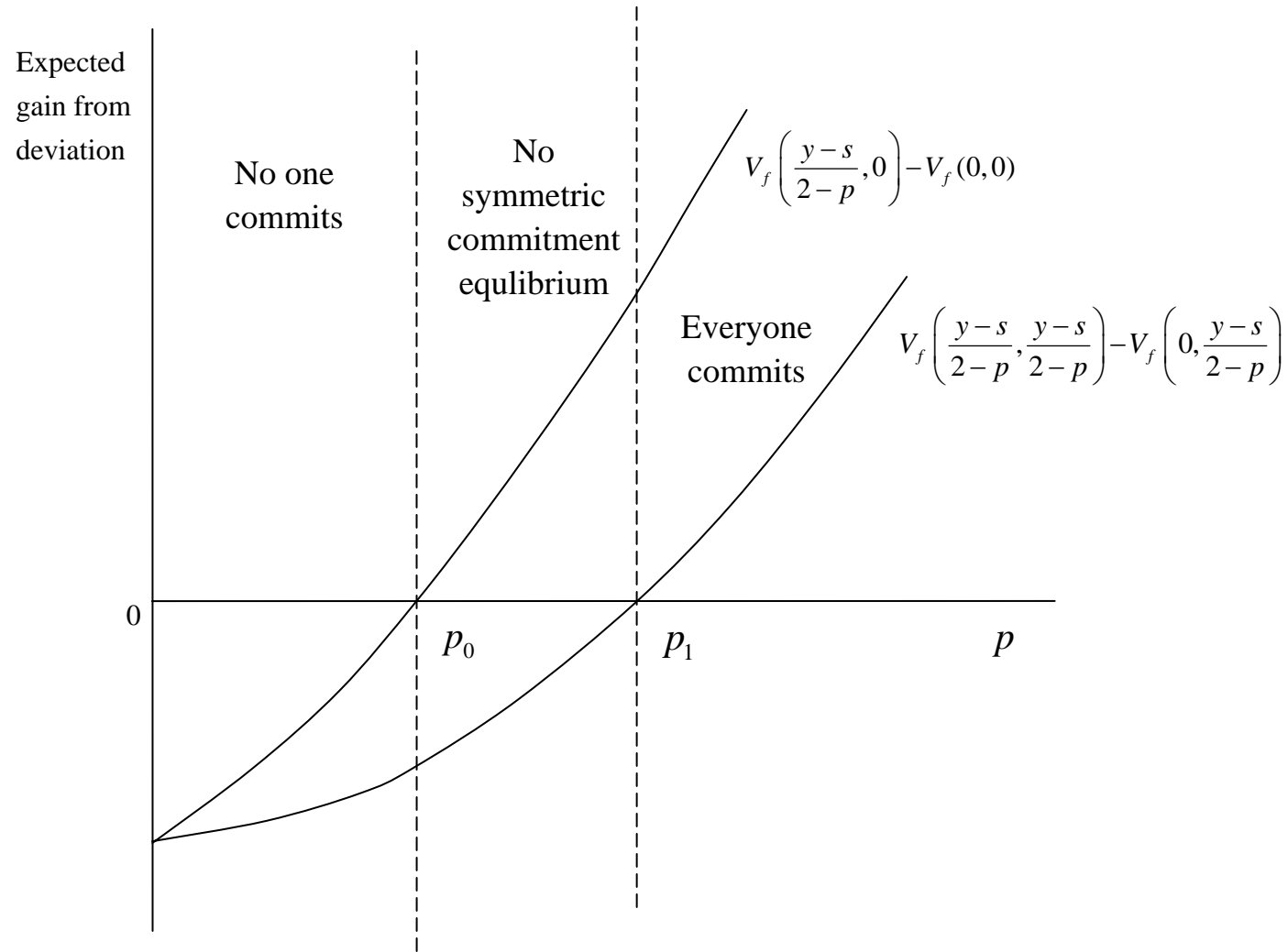
— divorced — married — never married
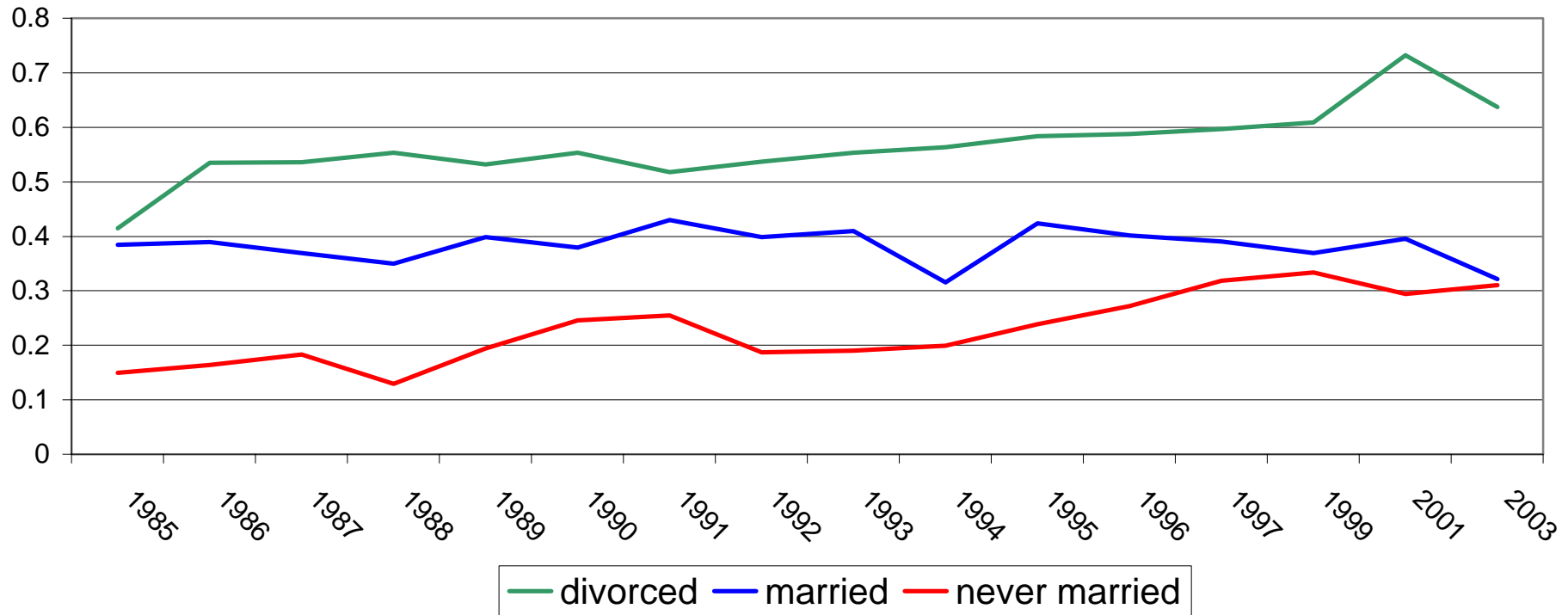
Source: PSID , Mother's age is 20-60. Mother's children do not include children born in new marriage.

Figure 3 : Child Support and Alimony Received (in 1982-84 dollars) by Mothers Living with Children 0-18 , by the Mother's Marital Status, U.S. 1979-2004
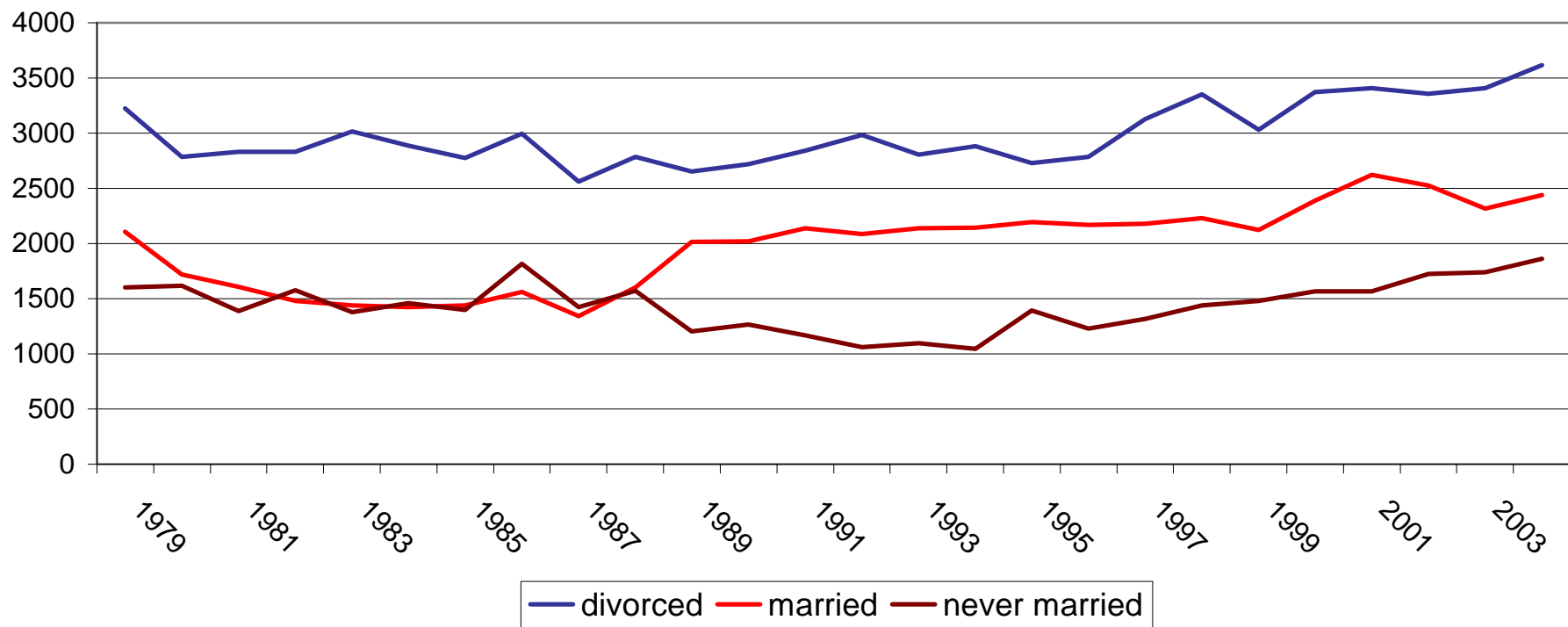
Source: CPS , mother's age is 20-60 , positive payments only.

Figure 4: Incentives to commit $V_f(\sigma^-,\sigma^-)\text{-}V_f(\sigma,\sigma^-)$ **in relation to the probability of remarriage, p, and commitments of others,** $\sigma^- = \dfrac{y-s}{2-p}$ **or** $\sigma^- = 0$ **, when** σ^- **and** σ **are strategic substitutes**

Expected
gain from
deviation

No one
commits

No
symmetric
commitment
equilibrium

$V_f\left(\dfrac{y-s}{2-p},0\right)-V_f(0,0)$

Everyone
commits

$V_f\left(\dfrac{y-s}{2-p},\dfrac{y-s}{2-p}\right)-V_f\left(0,\dfrac{y-s}{2-p}\right)$

0

p_0

p_1

p

Væà|^F: Living Arrangments of U.S.
Children, Aged less than 18

Year	Children with two parents	Children with mother	Children with father
1950	.927	.059	.013
1960	.914	.074	.012
1970	.877	.107	.015
1980	.805	.168	.027
1990	.761	.195	.044
2000	.718	.219	.063

Source: U.S. Census.

Table 2: Child Support and Alimony (in 1982-1984 dollars) Received by Mothers with Children 0-18 in the CPS and PSID Data, Mother's age is 20-60

	CPS		PSID	
	Divorced	**Married**	**Divorced**	**Married**
	1993-2004		**1985-2003**	
Percent receiving CS	47.40	4.69	54.62	37.70
Amount of CS. if positive	2,892	2,275	2,812	2,392
Percent receiving Alim.	2.84	0.05	5.11	**
Amount of Alim. if positive	5,409	4,437	5,312	**
Percent receiving CS&Alim.	47.76	4.71	53.61	37.70
Amount of CS&Alim. if positive	3,192	2,309	3,224	2,392
Number of Obs.	26,910	192,490	5,023	8,102

PSID: Mother's children do not include children born in new marriage.
CPS: Mother's children include children born in new marriage.

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