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The Rise and Fall of Divorce – A Sociological Adjustment of Becker's Model of the Marriage Market

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The Rise and Fall of Divorce

A Sociological Adjustment of Becker's Model of the Marriage Market

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Abstract

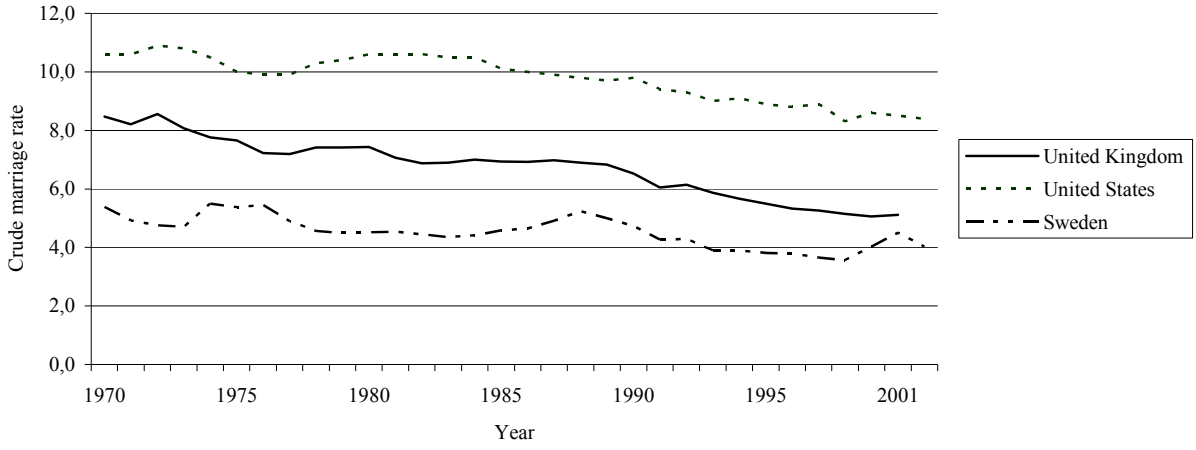
Despite the strong and persistent influence of Gary Becker's marriage model, the model does not completely explain the observed correlation between married women's labor market participation and overall divorce rates. In this paper we show how a simple sociologically inspired extension of the model realigns the model's predictions with the observed trends. The extension builds on Becker's own claim that partners match on preference for partner specialization, and, as a novelty, on additional sociological theory claiming that preference coordination tend to happen subconsciously. When we incorporate this aspect into Becker's model, the model provides predictions of divorce rates and causes that fit more closely with empirical observations. (JEL: J1)

1. Introduction

During the last decades, developed countries have witnessed a substantial increase in married women's labor market participation, along with a sharp increase in divorce rates. Gary S. Becker's economic model of the marriage market (Becker 1991; Becker, Landes and Michael 1977) provides a coherent explanation of this development, an explanation which has greatly influenced our understanding of marriage and the causes of divorce. Becker claims that the rise in women's wages causes married couples to allocate more of the women's time to paid labour, rather than to housework. Hereby the relative value of traits like housework efficiency drops, while the value of breadwinning efficiency rises. This produces a mismatch in marriages that are formed before and still exist during and after the transition of the social conditions: because of an imperfect correlation between domestic skills and market skills, suitable female partners in the 'old' matching regime are likely to be less suitable in the new regime. As a consequence, divorce rates increase. We find empirical evidence of this development in most western countries during the post World War II period.

According to Becker's model this social trend furthermore reduces the use of sex specific specialization in marriage, as well as the general gains from marriage. This then reduces the probabilities of marriage and remarriage after divorce. The prediction of decreased marriage rates is also somewhat consistent with the development observed in most western countries. As illustrated in figure 1, marriage rates show a slowly decreasing tendency in the US, UK and Sweden, from 1970 till now; thus although there are fluctuations, especially for the UK, the evidence points to a reduced interest in marriage over time. In addition, the model's prediction of reduced probabilities of marriage and remarriage is consistent with the findings of a number of empirical studies (see cites in the following sections).

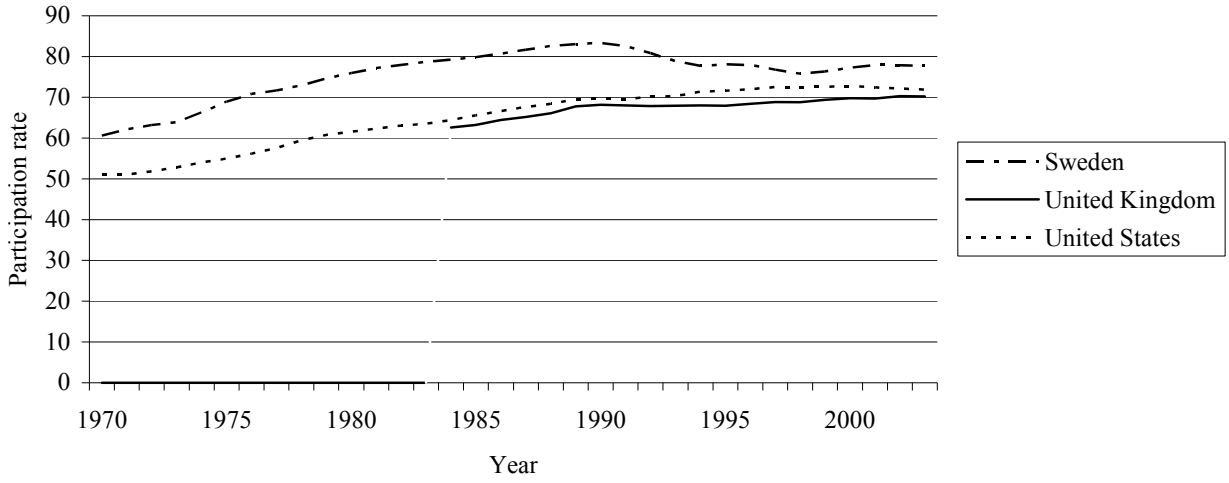
Figure 1: Crude marriage rate: number of marriages per 100,000 population



The curves of the figure are based on data from OECD.

A subtle implication of Becker's model is that divorce rates return to their initial level once women's labour market participation rates stabilise. Though there is a permanent reduction of the marital gains from specialisation and the fall in marriage and remarriage rates persist, a stabilization of the social conditions reduces the possibilities of mismatch and subsequent divorces between partners. Becker (1974) notes this implication himself and it is easy to derive. However, this implication of Becker's theory has not yet materialized (see e.g. Schoen & Standish, 2001). Even though labour market participation rates for married women are stabilizing in a number of countries there are no indications of falling divorce rates. Figure 2 illustrates the development in women's labour market participation rates: here, we see how this rate increases from 1970 until the late 1980ies in both the US, UK and Sweden (note that our data from the UK is limited). After this period, the rate stabilizes at participation rates between 70 and 80 percent, where the UK has the lowest and Sweden the highest, but somewhat fluctuating, rate. Comparing figure 1 and 2 demonstrates that marriage rates continue to drop in all three countries even after women's labour market participation rates have stabilized.

Figure 2: Female labor force participation rate

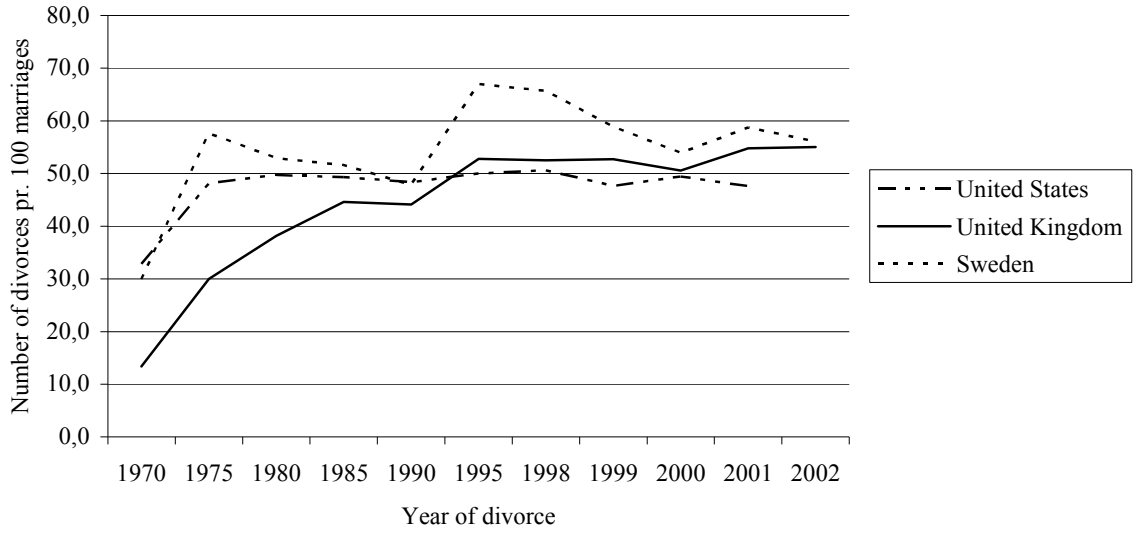


The curves of the figure are based on data from OECD, for U.S. evidence, see also Oppenheimer, 1994, Oppenheimer, 1997a).

Figure 3[1] illustrates the development in divorce rates. The three rates, for the US, the UK and Sweden, diverge, but there is a pattern of rising rates until the early 1990ies, and stabilization thereafter, however with fluctuating rates for Sweden. Interestingly, the stabilization seems to occur simultaneously with the stabilization of women's labour market participation rates shown in figure 2. Also, figure 3 show no indication of the declining divorce rates predicted by Becker's model.

[1] Note that the distance between the data-points at the x-axis changes in 1998

Figure 3: Divorce rates



The curves of the figure are based on data from OECD.

While the fall predicted by Becker's model may potentially materializes in the future - the underlying system determining divorce is complex and may be subject to substantial time lags - these looming divergences make the search for other or additional explanations a relevant endeavour.

The literature already proposes several extensions of Becker's model (e.g. Chiappori & Weiss 2006; Lam 1988; Weiss 1997; Lich-Tyler, unpublished paper), however, we are aware of only one that accommodates the observed divorce rates: The study by Chiappori and Weiss (2006) suggests that a bigger market for remarrying partners reduces search costs. Their model implies that a temporary initial rise in divorce induces an equilibrium shift which increases the attractiveness of divorce permanently. Thus, this scenario is consistent with the actual development in divorce rates

Our paper presents a different extension of Becker's model. It builds on Becker's own claim that in addition to partners' matching on productivity traits, also

matching on preferences for partner specialization matters. The extension of Becker's model presented by Chiappori and Weiss (2006) does not consider this claim, despite the convincing empirical evidence of its importance: A number of empirical studies question the importance of productivity based traits (e.g. Huber and Spitze, 1980; Sayer and Bianchi; 2000) and presents substantial empirical evidence that mismatched preferences on partner specialization is a major cause of marital conflicts (e.g. Chinitz and Brown, 2002; Arrindell and Luteijn, 2000). Thus, empirical evidence points to the importance of including preference based matching in an extension of Becker's model

However, in addition to including the aspect of preference based matching, we make the novel claim that the matching on preferences for partner specialization occurs as a result of subconscious coordination mechanisms. We hereby uphold the assumption in Becker's model of utility maximization, but depart from the economic paradigm concerning the conscious rational actor. Using agent based modeling we demonstrate how this extension of the model produces predictions which fit closely to the observed trends in divorce rates *and* allows for divorce to be caused by preference mismatch. Thus this paper contributes to the literature by emphasizing the importance of preference based matching, and by demonstrating the potential of departing from a classical economic assumption, which has dominated extensions of Becker's model so far.

The paper proceeds as follows. First, we develop a version of Becker's classical model of marriage matching on productivity traits and show this model's predictions of the development in marriage and divorce rates, using a simulation model. Second, we introduce matching on preferences on partner specialization into this model, and show that while this model can generate preference based mismatch its predictions of divorce rates do not change qualitatively. Finally, we introduce a subconscious coordination mechanism of these preferences which produces predictions which are more in line with the observed trends in divorce rates.

2. Becker's marriage market

As mentioned, Becker's model of marriage and divorce includes partner matching on both productivity traits and on preferences on partner specialization. However, as the model is mainly known for its focus on partners' matching on productivity traits, this first section develops a Becker model, which only includes matching on productivity traits, to show the implications of this popular version of the model.

Becker's principles of matching

Becker's initial assertion is that men and women are utility maximizers and that marriage is part of a utility-maximizing strategy. Gains from marriage arise from complementarity in the production of various household goods, because marriage facilitates division of labor and specialization. The outcome from men and women's joint efforts in household production exceeds the outcome if a single person's household displayed the same effort (children is an example of complementarity). However, to get the most of this 'exchange-based' community, the two partners must accept this division of labor and the resulting specialization. Since women give birth, and the pregnancy and subsequent nursing of the child is more compatible with housekeeping than a labor-market career, she is left with domestic specialization and he with labor-market specialization. This then explains the existence of sex-specific specialization.

Taking outset in Becker (1991) we formally express these aspects of marriage as the income plus the income equivalent of utility from consuming household production within a marriage:

$$U = W\beta_m t_m + w\beta_w t_w + H((T - t_w)\alpha_w, (T - t_m)\alpha_m) \qquad (1)$$

where w is the general wage rate for married women and β_w and t_w the work productivity and time spent working per calendar period by the specific woman

in question and so $w\beta_w t_w$ is the income earned by the woman. In the same way $W\beta_m t_m$ is income earned by the man. Since income is spent on consumption goods and utility is expressed in its income equivalent, these elements enter additively. $H(.)$ is the utility derived from household production which requires spending time on household chores[2]. T is the total amount of time available for the woman so that $T - t_w$ is the amount of time spent by the woman on household chores (correspondingly for the man). Note that time spent working is bounded below by zero and above by what corresponds to full time employment ($\bar{t} < T$). α_w is the woman's productivity in household chores so that $(T - t_w)\alpha_w$ is the effective input to household production delivered by the woman (correspondingly for the man). Specialization gains result if e.g. the woman is more productive at household chores ($\alpha_w > \alpha_m$) and/or less productive on the labor market ($w < W$). In this case the married couple can specialize in the production where each has a comparative advantage and this increases the combined outcome compared to production in single households. Note that the two partners differ only in their productivity traits – not in their basic preferences for how to allocate time in the family. Thus within a given marriage the partners identify the optimal allocation of their time and implement this – because it is in their mutual interest to do so.

For simplicity we assume that the man holds full-time employment ($t_m = \bar{t}$) and so only the woman's labor market-participation is a decision variable for married

[2] $H(.)$ is characterized by falling marginal productivity of time input. Note that $H(.)$ may reflect complementarity in production of e.g. children (where $H''_{12}((T - t_w)\alpha_w, (T - t_m)\alpha_m) > 0$ allowing $H((T - t_w)\alpha_w, (T - t_m)\alpha_m) > H((T - t_w)\alpha_w, 0) + H(0, (T - t_m)\alpha_m))$ for small investments of time while still implying substantial substitution possibilities between partners' time investment in connection with household chores (and e.g. $H''_{12}((T - t_w)\alpha_w, (T - t_m)\alpha_m) < 0$) for higher levels of time investment.

couples. The woman's utility maximizing participation level t_w^* is given by the first order condition: $w\beta_w = H_1((T-t_w)\alpha_w, \alpha_m)\alpha_w$ implying that utility maximizing participation for a given couple is a function of both productivity traits and the woman's wage rate, i.e. $t_w^*(w\beta_w, \alpha_w, \alpha_m)$ and so is the couple's resulting utility level, i.e.

$$U^* = U^*(w\beta_w, \alpha_w, \alpha_m) \qquad (2)$$

Clearly optimal participation is bounded below and so if $t_w^* = 0$ optimal participation becomes independent of the $w\beta_w, \alpha_w$ and α_m traits. Inserting this into (1) we see that the corresponding utility level $U_0^* = W\beta_m \bar{t} + H((T)\alpha_w, (T-\bar{t})\alpha_m)$ becomes independent of $w\beta_w$, i.e.

$$U_0^* = U_0^*(\alpha_w, \alpha_m) \qquad (3)$$

The Marriage Market.

Becker assumes that partner search resembles a market (the marriage market) where men and women search for partners with traits that maximize their utility. Here, a person evaluates a potential partner's traits and the utility outcome of a possible marriage according to the relevant utility equation ((2) or (3) depending on the current wage level). This results in a utility offer (a share of the total utility that marriage would generate) which the potential partner evaluates and decides to accept or reject. This is done in competition with other men and women and the resulting matches gravitate toward the set of matches that maximizes the total utility of participating couples (for details, see Becker, 1991). If the current allocation of partners does not maximize utility, then partners are likely to reorganize[3]. Hence only the set of matches that maximizes

[3] Consider two men with trait values 1 and 10, respectively, and two women also with trait values 1 and 10. If a couple's resulting utility is found by multiplying trait values then clearly matching the high valued partners will maximize total utility (10*10+1*1 as opposed to 10*1+10*1 with mixed matching). Now if mixed marriages occur and the two partners with high trait values meet the man

the total utility of all couples is stable, and a set of matches that does not maximize utility will tend to break down due to better offers in the market. If there are no search costs (i.e. the market is efficient and transparent) men and women know their own 'value' at the market and their gains from relationships with different types of partners. Here, only marriage offers, which are part of the set of utility maximizing set of matches are given and accepted and the marriage market quickly settles down at this equilibrium.

The key result emitting from Becker's work (Becker 1991; see also Becker et al. 1977) is that the interaction of partners' traits in household production determines the utility maximizing sorting of partners. We can determine this sorting from the cross derivative term of the utility expression (3), and if

$$\frac{\delta^2 U_0^*}{\delta\alpha_w \delta\alpha_m} > 0 \qquad \text{for all trait values in the market} \qquad (4)$$

the positive assortative sorting of the men's α_m trait and the women's aggregate α_w trait maximizes total welfare (as in the example above). When an increase in the man's trait increases the utility effect of increasing the woman's trait then pairing high trait values generates a 'double dividend'. Thus, if there are no search costs, and utility at the time of marriage is defined by (3) and (4), the marriage market equilibrium is the positive assortative trait sorting of partners that we denote:

$$S(\bar{\alpha}_w, \bar{\alpha}_m) \qquad (5)$$

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can make the woman a better utility offer than she is getting in her current marriage that only generates 10 utility points to be shared with her current partner (while still leaving him with a gain) since the now marriage will generate 100 utility points.

where $\bar{\alpha}_w$ and $\bar{\alpha}_m$ are vectors of the men's and women's trait values in the marriage market.

Changing Social Conditions and Divorce.

According to Becker, optimal sorting changes under changing social conditions. Relationships formed in a social situation where women only specialize as housewives (resulting in the partner sorting (5)) might find that it is advantageous for women to work as social conditions change (e.g. because wage rates have risen). Then partners decide labor-market participation according to (2). Assuming that women's productivity traits ($w\beta_w$ and α_w) are separable from men's productivity traits in the resulting utility function (i.e. $U^* = \tilde{U}^*(u_w(w\beta_w, \alpha_w), \alpha_m)$) then if

$$\frac{\delta^2 U^*}{\delta u_w \delta \alpha_m} > 0 \qquad (6)$$

we have that positive assortative sorting in the men's α_m trait and the women's aggregate u_w productivity trait will maximize total utility. A new equilibrium partner sorting then characterizes the marriage market:

$$S(\bar{u}_w, \bar{\alpha}_m) \qquad (7)$$

where $\bar{u}_w$ and $\bar{\alpha}_m$ are vectors of men and women's trait values in the marriage market.

Generally, there will be a discrepancy between the partner sorting which is optimal at the time of marriage (5) and the partner sorting which is optimal after the social change (7). Though the women's personal traits (β_w, α_w) have not changed, the changing social conditions change the relative value of these traits.

This affects women's value at the marriage market and may lead to mismatch and divorce (e.g. wives with high 'values' at the time of marriage due to high housework productivity might have poor breadwinning skills and hence low 'value' in the new social situation). This rise in the divorce rate is a consequence of the changing social conditions (rising w) and is correlated with the rising level of married women's labor-market participation. However, with a stabilization of the social conditions, the systematic mismatch caused by unforeseen development in the general wage level of married women will disappear along with the rise in the divorce rate, because the rise in the divorce rate brought about by changing social conditions in this way is transitory in nature. Thus, when the equilibrium sorting that applies as family life unfolds corresponds to the one that applies at marriage, no mismatch will develop because partners ascertain each others traits perfectly at the time of marriage.

However, evaluation of traits is difficult and costly, which means that perfect sorting is often not the result. Because of search costs and uncertainty some men and women may choose to remain single (because expected gains are smaller than expected costs of searching for a partner). Further, the resulting set of marriages may deviate from (4) because of uncertain ascertainment of traits at marriage. Thus, even without changing social conditions, a person might be disappointed with the traits of his or her partner after marriage, and if this disappointment is great enough divorce and subsequent search for a new partner might be advantageous.

Hence, uncertain trait estimates may generate a positive rate of divorce under stable social conditions. But more importantly, a change in social conditions affecting the optimal sorting may also cause the trait estimation uncertainty at marriage to change if the estimation uncertainty associated with the aggregate productivity trait u_w differs from that associated with α_w. This may cause a permanent change in divorce rates if the change in estimation uncertainty at marriage causes a change in the level of partner mismatches that lead to divorce.

Hereby Becker's marriage market model implies two important mechanisms through which a rise in women's labor-market participation may affect divorce: 1) a transitory effect on the generation experiencing the social change and so experiencing a change in the equilibrium sorting between the time of marriages and the time family life unfolds, and 2) a permanent effect which results if estimation uncertainty associated with the traits that are relevant after the social change is different from the estimation uncertainty associated with the traits that are relevant before the rise in women's participation rates changes.

Divorce in Becker's model is then the result of partners realising that they can get a better deal with another partner e.g. because the current partners productivity traits or preferences were misjudged at marriage or because social conditions change causing the value of the current partner's traits to change. To understand the resulting correlation pattern between participation and divorce we formally introduce uncertainty and search costs into our marriage market model. Because it is intractable to introduce uncertainty into the analytical model above, we assume a specific functional form for $H(.)$ in (1). This allows us to program a simulation model of the marriage market, which includes uncertainty and search cost. This simulation model allows us to assess the exact predictions of Becker's model.

3. A Simulation Model with uncertainty and search costs

We base our simulation model on the assumption that the household production function has the specific form $H(.) = \sqrt{(T - t_w)\alpha_w + (T - t_m)\alpha_m + K}$ (see appendix for details). *K* is a positive gain from marriage and reflects basic complementarities in household production. The variable elements reflect input substitution possibilities at the margin. This specific form satisfies the general conditions laid out above and implies that market equilibrium (when there is no estimation error) is a consequence of positive assortative sorting of partner traits according to (4) and (6) respectively.

The simulation model allocates traits (home and labor-market productivities) drawn from uniform distributions to the market participants. Then we simulate the initial marriage market by randomly matching one couple at a time. When the first couple is matched they evaluate their potential partner's traits, with error. We assume that each market participant knows current wage rates and the distribution of traits in the market. Thus, the market participants correctly calculate the expected utility gain from continued search versus marriage in the evaluation of a potential partner. If positive net-utility is possible for both partners they marry, otherwise they continue to search and return to the pool of singles. Then the next couple is matched and so on. When no more marriages occur we move to the family life stage. Here two things happen: 1) partners learn the true trait values of their partners and 2) women's wage rate may change. Since traits were estimated with error, mistakes are made just as changed wage rate may cause the realized distribution of couples to deviate from the utility maximizing distribution. Once again partners correctly calculate the expected gain from continued partner search in the marriage market and if this is greater than his/her search costs it results in a divorce.

With no estimation errors and no search costs the model settles down at the positive assertive sorting solution (as defined in (5)). In this second round all participants marry and there are no divorces if the women's wage rate is held constant. But if we allow the women's wage rate to increase between the initial marriage stage and the second family life stage the model emits the new equilibrium trait sorting (7). If the women's trait rankings according to α_w and u_w differ so will the equilibrium sortings (5) and (7) and the result will be a divorce. The resulting divorce rate from a given wage increase depends on the correlation between the women's α_w and u_w traits. With perfect correlation there is no mismatch and no divorces. Thus, the model replicates the analytical model developed above when search costs and trait estimation error are zero.

If we introduce trait estimation error and search costs, the market settles down at something close to but not perfect positive assortative sorting in the first stage. Some participants do not marry and others make mistakes when evaluating traits, and this causes 'mismatches'. In the second round some of these mismatches end in divorce even when the wage rate does not change because of an expected net gain from renewed partner search. The size of these effects depends on the size of the assumed estimation error and search costs.

We use this simulation model to investigate how an increase in the women's wage rate affects divorce rates. The increase spans from a situation where no women participate in the labor market to a situation where all women participate at an average rate of about 60% of men's full-time participation rate. We do this under different assumptions about correlation of women's α_w and u_w traits and under different assumptions about the difference in trait estimation error associated with α_w and u_w. We also simulate divorce rates under stable social conditions with both a low and a high woman's wage rate replicating the stable situation before and after the wage increase.

Table 1. Dynamics of Divorce Simulated for Becker's Marriage Market Model with consciously coordinated productivity trait

Correlation between women's α_w and u_w Traits	Difference in uncertainty about women's α_w and u_w traits[1]	Before wage increase			Just after wage increase			Long after wage increase		
		Partici-pation rate[2]	Single rate[3]	Divorce rate[4]	Partici-pation rate[2]	Single rate[3]	Divorce rate[4]	Partici-pation rate[2]	Single rate[3]	Divorce rate[4]
Large	None	0.00	0.10	0.17	0.57	0.17	0.31	0.60	0.17	0.01
Some	None	0.00	0.11	0.19	0.57	0.16	0.57	0.60	0.16	0.00
Some	Some	0.00	0.11	0.19	0.57	0.16	0.59	0.60	0.16	0.05
Some	Large	0.00	0.11	0.19	0.57	0.14	0.56	0.60	0.14	0.30

1) If there is a difference, uncertainty about the u_w trait is larger.

2) Average married women's labor-market participation as a fraction of men's.

3) Fraction of men and women who are single.

4) Fraction of married couples who divorce.

The table illustrates the general points made above in a specific simulation run of the model using 90 men and 90 women. The first column shows the correlation between the women's α_w and u_w traits. The next column shows the difference in estimation error at marriage between the two traits α_w and u_w.

The 'Before wage increase' columns show how marriage and divorce unfold under a low woman's wage ensuring that no woman chooses to work. The first column shows the average labor-market participation rate of married women after marriage, the second column shows the fraction of single men and women after the initial marriage market equilibrium and the third column shows the fraction of married couples who choose to divorce after observing traits. The numbers replicate the stable situation before the wage increase, and trait estimation errors at marriage are the only cause of the resulting divorce rate.

The 'Just after wage increase' columns show how marriage and divorce unfolds following a wage increase. Here partners marry under a low woman's wage, and divorce unfolds after a wage increase which induces all women to work part time as indicated in the participation rate column (the indicated rate is the average participation rate – all women work, but the labor supply varies between women since men and women's traits vary). Thus, in addition to divorces caused by trait estimation errors at marriage, this also captures the transitory increases in divorce caused by changing societal conditions between the time of marriage and divorce.

The 'Long after wage increase' columns show how marriage and divorce unfold under a high woman's wage ensuring that all women work. This reflects the permanent divorce rate under the new social conditions (after the disappearance of the transitory effect on divorce rates), and captures the effect of a change in trait estimation error if estimation error associated with α_w differs from that associated with u_w.

We present four simulations which illustrate different combinations of assumptions about α_w u_w trait correlations and estimation errors. As expected, rising labor-market participation reduces gains from marriage relative to remaining single (as it reduces specialization gains of marriage), and causes a positive correlation between the rate of single households and women's wages. In the first simulation where women's traits are highly correlated, partners who wish to be single are the main cause of temporary rise in divorce rates. In the other three simulations the shift in optimal trait-sorting causes the temporary rise in divorce rates to be even higher as some partners now also divorce because of the unforeseen trait shift and seek a better matched partner.

The last three simulations illustrate how much larger trait estimation errors of u_w have to be compared to α_w to get a permanent, positive effect on the divorce rates. As shown we need a large increase in the new traits estimation error to generate a permanent divorce rate increase (i.e. with errors of the same magnitude the permanent divorce rate falls). This is because a reduction in gains from marriage also reduces the negative utility effects of trait estimation errors and since search costs do not change, a general reduction of search effort in the market is optimal. For some participants this implies remaining single, and for partners that remain in the marriage market this implies accepting partners with greater trait mismatch (because the utility effect of this mismatch is smaller than before).

There is always a positive temporary effect caused by partners divorcing to remarry. Since the shift in optimal sorting produces this temporary effect, the effect will be present unless there is a perfect correlation between the pre- and postparticipation rise sortings. The assumptions, which ensure a close correlation of α_w and $u_w(w\beta_w, \alpha_w)$ for the relevant range of *w* values, are clearly restrictive and unlikely to apply. Further, if such assumptions would apply then logically

the errors made when partners estimate $u_w(w\beta_w, \alpha_w)$ would not exceed those made when estimating α_w since α_w in this case would be a perfect proxy for the $u_w(w\beta_w, \alpha_w)$ trait.

In conclusion, Becker's productivity trait model can produce scenarios with a permanent increase in divorce rates if men's uncertainty about women's labor market productivity trait is larger than their uncertainty about women's household productivity trait. However, this model will then always produce an additional temporary increase in divorce for remarriage during the period where women's labor market participation rates are rising because this rise causes relative trait values to change after marriage. This temporary rise in divorce rates disappears again when labor market participation rates stabilize and relative trait values no longer change after marriage. Thus when Becker's model (as specified above) predicts a permanent rise in divorce rates it always also predicts a temporary rise implying that divorce rates fall again (to some extent) when women's labor market participation rates stabilize. It is this fall that we have not yet seen in a number of countries even though women's labor market participation rates have stabilized (see figures 2 and 3)

4. Previous studies of causes of marital instability

As demonstrated in the previous section, the predictions made using Becker's basic model of selection on productivity traits do not comply with the observed long run trends in marriage and divorce rates. And while a number of empirical studies support the model's claim that divorce results from disappointment with the current partner's productivity traits (see for instance Bruderl and Kalter 2001; Goldscheider and Waite 1986; Heidemann, Sihomlinova and Rand 1998; Heckert, Nowak and Snyder 1998; Mueller and Campbell 1977; Preston and Richards 1975; Ressler and Waters 2000; Svarer 2002; Wolf and MacDonald 1979; Voydanoff 1990; Weiss and Willis 1997), other empirical studies question the focus on the production based traits. For instance Huber and Spitze (1980)

find that absolute earnings of married men and women do not affect considerations of divorce, and South and Lloyd (1995) find no effect of female labor-market participation on marital instability (for similar results, see Ekert-Jaffe and Solaz 2001; Lichter et al. 1992; Hoffman and Duncan 1995; Oppenheimer 1997a, 1997b; Ottesen 2000: 99ff). Moreover, Sayer and Bianchi (2000) find that productivity traits are not very important indicators of marital instability (which is also the conclusion of Rogers and DeBoer 2001). Thus, matching on productivity based traits does not fully explain marriage and divorce dynamics.

However, the empirical evidence of Becker's claim that also preference based matching matters for marital conflicts seems more unanimous (e.g. Chinitz and Brown, 2002; Arrindell and Luteijn, 2000). And within this literature, some studies find interesting evidence of an interaction between preferences and the division of labor in the household. Here, Spitze and South (1985) show how the destabilizing effect of a woman's labor-market participation only occurs when her husband disapproves of his wife's wage labor. Moreover, Sayer and Bianchi (2000) show how the significant and negative effect of wife's income on marital stability disappears when controlling for both wife's and husband's gender ideology (see also Perry-Jenkins and Folk, 1994; Blair and Johnson, 1992; Greenstein, 1995; Kalmijn, de Graff and Portman, 2004). These findings demonstrate that matching on preferences is not important vis-a-vis matching on productivity based traits rather they are important because they determine what is the proper matching of the partners' productivity traits. Because of this compelling evidence of the importance of preference based matching, we introduce selection on preferences into Becker's basic model in the next section (as suggested by Becker himself and others).

However, it is our claim that a simple extension of the basic economic model (of conscious rational selection on traits) ignores important aspects of matching on preferences that have been suggested by more elaborated theories on the issue. In

addition, just using the full version of Becker's model, which includes both matching on productivity traits and on preferences, does not produce predictions in line with the observed divorce rates. Next, we therefore present and discuss additional theories on preference based mating, to consider whether and how they add to our understanding of this type of matching.

5. Alternative theories on preference based matching

The studies mentioned above which analyze the implications of preference based matching often only make implicit references to theoretical frameworks (e.g. Kalmijn, Loeve & Manting, 2007). However, we do find theories of the relationship between preferences over womens' labor market participation (t_w) and marriage and divorce patterns, that facilitate useful extensions of Becker's model.

One early example of a theory which considers the interaction between partner's productivity and preference based traits is Rodman's classical "theory of resources in cultural context" (Rodman, 1967; 1971). According to this theory the relationship between married men's resources and their authority in marriage varies between countries, because family norms – or partners' preferences on specialization - vary between countries. Thus while the man's authority increases by his educational attainment in one country, there is no correlation between the two aspects in other countries. This then suggests that the norms which guide a marriage determine the influence of the resources of the spouses and of changes in these resources. The theory concerns differences between countries. However we may also use it to suggest that family norms or preferences differ between individuals and that these differences affect their expectations towards a potential spouse, and hence the degree to which the acquisition or lack of a certain resource is reason for divorce. This then also implies that compatibility between partner's preferences will ease negotiations on which resources to acquire and accumulate, and thus reduce conflicts and the probability of divorce.

In his 1994-article from American Journal of Sociology, Matthijs Kalmijn presents and tests a somewhat similar theory. It is his claim that individuals prefer the company of likeminded, as being with likeminded people provides a common basis of conversation and reduces friction within marriage which may arise as a result of dissimilarities in taste (see also Oppenheimer, 1994). Thus, also Kalmijn's proposition strongly supports the idea of preference based matching. However, none of these theories provide us with a theoretical model which will yield qualitatively different predictions than Becker's models; both theories claim that partners match on preferences and that the preferences are important for the individuals' appreciation of their partner's productivity traits.

But in contrast, in the theory on the habitus formulated by the French sociologist Pierre Bourdieu, the idea about preference based matching appears with a slight twist. Bourdieu agrees that we prefer the company of likeminded, but in addition, he suggests an alternative coordination mechanism for marriage. He claims that even though people are able to make rational decisions, most decisions take place at a *subconscious* level. As a consequence, partners tend to sort according to preferences over t_w without observing this trait consciously or rationally considering its implications. Consequently, individuals feel subconsciously attracted to partners with corresponding preferences over t_w even in situations where this trait is not critical for expectations regarding family life (Bourdieu 1984:174). While this process is subconscious and not dependent on rational utility maximizing behavior, it is nevertheless consistent with it, and the resulting selection looks as though it could have been the result of a conscious rational decision-making process. However, the important difference between the two processes is that conscious selection with respect to a trait only takes place when partners expect this trait to be important for family life after marriage. In contrast, because the subconscious selection process is not based on rational calculus, it is always present, and so ensures selection on traits that are important for marital outcome under the current social conditions *as well as* selection on traits that are *not* currently important for outcome.

Bourdieu is not the only scholar who promotes the idea about subconscious decision making – in sociology we find it in Giddens' structuration theory (1984.) just as Milton Friedman introduces the concept into the discipline of economics (1953). And while the power of subconscious decision making is also evident from a number of empirical studies (Dijksterhuis et al., 2006; Dijksterhuis, 2004; Burke and Miller, 1999; Kleinmuntz, 1990), Bourdieu's theory is among the few that suggests a link between this type of decision making to marital behavior. From the studies on subconscious decision making, we furthermore learn that compared to decision making based on rational calculus, subconscious decision making is less efficient and precise (for a review, see Kleinmuntz, 1990).

In the following section we show, first, what predictions regarding marriage and divorce rates Becker's model produces when it also includes preference based matching, and second, the predictions made by the model when we introduce a subconscious coordination mechanism.

6. Introducing matching on preferences

We first introduce preference over t_w into the basic model without search costs developed in section 2 in a simple way by redefining household utility as:

$$\hat{U}(t_w) = U(t_w) + \pi u_m(t_w) + (1-\pi)u_w(t_w)$$

where $U(.)$ is household income including the income equivalent of household production as defined in (1). $u_m(t_w)$ is the man's utility derived from his preferences over the woman's labor market participation and $u_w(t_w)$ is the woman's

corresponding utility. π is the relative weight of the man's utility in the households aggregate utility[4] and we assume the following functional form:

$$u_m(t_w) = U(t_w + \sigma_m) - U(t_w)$$

$$u_w(t_w) = U(t_w + \sigma_w) - U(t_w)$$

where the σ-parameters capture the partners' preferences over the woman's participation. If $\sigma_m = 0$, the man has no preference for or against women's participation (i.e. $u_m(t_w) = 0$). But if $\sigma_m < 0$, the man systematically prefers a lower participation rate than the one that maximizes household income (i.e. if t_w^* maximizes household income the man perceives $t_w^* - \sigma_m$ as the optimal participation rate). Clearly, partners with the same σ trait values agree on the utility evaluation of different family situations and they can generate higher benefits of marriage than partners who disagree and perceive different t_w values as optimal[5].

For a couple that aggress on participation preferences ($\sigma = \sigma_w = \sigma_m$) we have the following simple relationship:

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[4] Note that $0 < \pi < 1$ and that this weight is not a structural parameter but dependant on the resulting marriage market equilibrium essentially reflecting the relative value of the partner's alternative possibilities on the market.

[5] Formally, irrespective of the family income distribution π and agreed participation adjustment σ we have that

$$U(t_w^* + \sigma) \geq \pi U(t_w + \sigma_w) + (1 - \pi) U(t_w + \sigma_m) \quad \forall t_w \qquad \text{(i)}$$

where t_w^* maximizes $U(t_w^* + \sigma)$. To see this note that the definition (6) implies that $U(t_w^* + \sigma) \geq U(t_w + \sigma_w) \quad \forall t_w$ with equality applying only for the t_w that maximizes $U(t_w + \sigma_w)$ Thus only when $\sigma_m = \sigma_w$ will this t_w also maximize $U(t_w + \sigma_m)$ whereby (i) is satisfied with equality. Otherwise (i.e. for $\sigma_m \neq \sigma_w$), only one of the two right-hand side elements can be maximized and so (i) will be satisfied with strict inequality.

$$\hat{U}(t_w) = \pi U(t_w + \sigma_m) - (1-\pi)U(t_w + \sigma_w) \qquad (8)$$

Thus, in a social situation where Becker's basic productivity trait model indicates that t_w^* is the optimal participation level, a couple that agrees on preferences maximizes utility by choosing a participation level of $t_w^{*\sigma} = t_w^* - \sigma$ (on the other hand a couple that disagrees can never achieve this level of utility).

Now let us reconsider Becker's marriage market for this model. Retracing the derivations in the previous section, the utility maximizing woman's labor-market participation for a given couple is a function of productivity traits and the woman's wage rate. However, with our extension, it is now also dependent on the σ parameters, i.e. $t_w^{*\sigma} = t_w^*(w_w, \alpha_w, \alpha_m, \sigma_w, \sigma_m)$, whereby the corresponding utility level depends on all five parameters, i.e.

$$\hat{U}^* = \hat{U}^*(w\beta_w, \alpha_w, \alpha_m, \sigma_w, \sigma_m) \qquad (9)$$

Again optimal participation is bounded below and so if $t_w^* = 0$ optimal participation becomes independent of the $w\beta_w$ and σ_w, σ_m traits, and so the corresponding utility level becomes independent of $w\beta_w$ and σ_w, σ_m, i.e.

$$\hat{U}_0^* = \hat{U}_0^*(\alpha_w, \alpha_m) \qquad (10)$$

Rational conscious preference trait selection

Focusing on the effect of rising women's wage rates on the optimal sorting, we consider families started in a social situation corresponding to (10). As in section 2 rational productivity coordination ensures sorting along productivity traits according to (5). Since σ_w, σ_m are irrelevant for marital outcome in this social situation, these traits are not part of the rational and conscious partner selection. When women's wage rates rise and optimal participation levels become positive, a

mismatch occurs if the new optimal productivity sorting (according to (7)) does not correspond to the original sorting according to (5), just as in the original model. In addition since original mating was not coordinated over σ_w, σ_m these will also mismatch in the new situation where preferences over participation become relevant for marital outcome. When social conditions have stabilized again, conscious partner selection will ensure coordination over both traits and this prevents further mismatch and subsequent divorce. Thus without uncertainty or search costs, a transitional rise in the divorce rate driven by mismatch of both productivity and preference traits will arise.

Subconscious preference trait selection

With the alternative subconscious coordination mechanism, partners sort according to preferences over t_w without observing this trait consciously or rationally considering its implications. Rather, individuals feel subconsciously attracted to partners with the same preferences and tend to find partners with similar σ values – even in situations where this trait is not important for expectations regarding family life. When we embed the subconscious coordination mechanism into our model, the resulting matching corresponds to the matching produced through rational utility maximizing behavior in the marriage market. Thus subconscious mechanism ensures coordination of the σ trait (ideally $\sigma_m = \sigma_w$) even when this particular trait does not affect the resulting utility of marriage in the current social situation.

Again consider families started in a social situation corresponding to (10). Subconscious coordination ensures coordination over σ and as in the previous section, rational productivity coordination ensures sorting along productivity traits according to (5). Further differentiating (8), the same assortative sorting of partners according to productivity traits as in Becker's original model ((5) and (7)) applies, though the resulting labor-market participation is shifted for all couples according

to σ.[6] When women's wage rates rise and optimal participation levels become positive, mismatch may develop if the new optimal productivity sorting (according to (7)) does not correspond to the original sorting according to (5) just as above. However, the original preference coordination ($\sigma_m = \sigma_w$) is still optimal. This situation causes a transitional rise in the divorce rate, but it is only driven by productivity mismatch. Because the subconscious preference coordination is independent of conscious rational choice, partners coordinate on this trait dimension in both situations and it does not contribute to the transitional rise in the divorce rate.

At a first glance, it is difficult to see how this extension addresses the two empirical issues in focus: the cause of divorce and the 'missing' transitional rise. However, this becomes clear when we introduce coordination error and search costs. Then the combination of participation preferences and the subconscious coordination mechanism may shift the cause of divorce toward preferences and eliminate the transitional rise in divorce rates. This then produces predictions that correspond more with the actual development in both divorce causes and divorce rates.

7. Participation Preferences with Uncertainty and Search Costs

We adjust our simulation model from section 3 by endowing partners with a preferred participation adjustment parameter corresponding to (8). This reduces the resulting income equivalent of the utility of marriage if partner parameters diverge and reflects the compromise over the woman's participation rate that mismatched couples must make (resulting in a chosen participation rate somewhere between the

[6] Formally letting t_w^* denote optimal participation in the Becker model and inserting $t_w^* - \sigma$ for the optimal participation level in (6) and differentiating $\hat{U}(.)$ we have:

$$\frac{d^2\hat{U}(t_w^* - \sigma)}{d\eta d\varepsilon} = \frac{d^2U(t_w^*)}{d\eta d\varepsilon} \qquad \text{(i)}$$

for traits ε and η, and so for any given σ an optimal sorting applying to $U(.)$ also applies to $\tilde{U}(.)$.

two partners' differing preferred values - see the appendix for details). To simplify we assume that there are two possible values of this parameter and so the partners either agree or disagree on optimal participation.

We repeate the simulation of partner search, marriage and divorce from section 3. We normalize men's participation preference trait to zero ($\sigma = 0$). They select partners among women of which some proportion is endowed with the non-zero parameter value (all other parameters except for those specified in the tables below remain unchanged). The simulation presented in table 2 assumes rational conscious coordination. In the 'before' situation we do not expect participation preferences to affect the outcome of marriage and partners do not coordinate on this trait. Without coordination we assume the probability of mismatch is 0.6. Conscious coordination at marriage occurs when the trait affects realized marriage outcomes in the social conditions applying at the time of marriage. The resulting mismatch is then a result of partners' imperfect evaluation of a trait. In the 'just after' and 'long after' situations, preferences are important for marital outcome, which means that partners evaluate then and coordinate according to then. Here we assume that the probability of mismatch is reduced to 0.4. We assume that each market participant knows the probability of σ trait mismatch in addition to the distribution of other traits and current wage rates[7]. This implies that participants can correctly calculate the expected utility gain from continued search when he or she meets and evaluates a potential partner. In the family life stage partners learn the true σ trait of their partner if it actively affects labor supply decisions and once again partners correctly calculate the expected gain from continued partner search in the marriage market. If this is greater than his/her search costs the marriage dissolves.

Table 2. Dynamics of Divorce Simulated for Becker's Marriage Market Model, with consciously coordinated productivity trait and consciously coordinated preference trait

[7] Partners do not look for a potential partner σ trait specifically rather, it is an integrated part of subconsciously evaluating the general preference compatibility. However, partners do realize that there is a risk of mismatch and divorce due to other traits than those consciously evaluated and take this unspecified risk into account when deciding to marry or divorce just like they take into account that consciously evaluated traits are estimated with error.

Imporance of σ trait mismatch between partners	Before wage increase			Just after wage increase			Long after wage increase		
	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]
None	.00	.11	.19 (0.00)	.57	.16	.59 (0.00)	.60	.16	.05 (0.00)
Small	.00	.11	.19 (0.00)	.58	.16	.67 (0.78)	.61	.16	.29 (1.63)
Some	.00	.11	.19 (0.00)	.60	.16	.65 (1.15)	.62	.16	.32 (1.66)
Large	.00	.11	.19 (0.00)	.65	.16	.59 (1.44)	.65	.16	.32 (1.67)

We assume 'some' correlation between women's α_w and u_w traits and that there is 'some' difference in uncertainty about the traits (i.e. uncertainty about the u_w trait is somewhat larger).

1) Married women's average labor-market participation as a fraction of men's.
2) Fraction of men and women who are single.
3) Fraction of married couples who divorce.

In table 2 (same headings etc. as table 1) we present simulation results for different utility weights of σ trait mismatch (a zero utility weight of mismatch corresponds to Becker's model from the previous section). When we introduce preference based coordination error the permanent divorce rates increase, and this effect increases with its importance as its utility weight increases when we move down the table.

We have added an indicator of the importance of diverging preferences on specialization for utility loss of couples that divorce. The number in parenthesis after the divorce rate is the utility gain from harmonizing participation preferences relative to the expected gain from divorce averaged over couples that divorce. We see that inharmonious participation preferences is a quantitatively important effect that dominates (a ratio greater than 1) the gain from divorce in the lower parts of the table where the relative weight of participation preferences is large. Thus when we introduce preferences over participation into the model we find that preference disagreement is an important cause of divorce. However, reflecting the dynamics of

the model without estimation error above, we still have a substantial transitory increase in divorce rates. This is not surprising, since all we do in the augmented model is to increase the number of uncoordinated traits before transition from one to two. While the importance of the new trait in generating divorce obviously increases as this traits' utility weight increases, the dynamics of the model is not affected qualitatively since its coordination is based on the same conscious mechanism.

We now rerun the simulations for the same set of men and women but now with the subconscious coordination mechanism. We assume that the subconscious coordination mechanism is prone to error, just as the trait estimation error affecting productivity coordination. This is not estimation error as such (since traits are not estimated consciously), but the unconscious coordination process is unlikely to be perfect and will cause some level of mismatch (i.e., deviation between σ_m and σ_w). This error and resulting mismatch along the σ dimension apply both when women's participation rates are zero and when they are positive since the coordination process is independent of the participation rate. For comparability we assume the probability of mismatch is 0.4 like for the conscious mechanism above.

Table 3. . Dynamics of Divorce Simulated for Becker's Marriage Market Model, with consciously coordinated productivity trait and *sub*consciously coordinated preference trait

Imporance of σ trait mismatch between partners	Before wage increase			Just after wage increase			Long after wage increase		
	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]	Particip-ation rate[1]	Single rate[2]	Divorce rate[3]
None	.00	.11	.19 (0.00)	.57	.16	.59 (0.00)	.60	.16	.05 (0.00)
Small	.00	.11	.19 (0.00)	.57	.16	.53 (0.45)	.61	.16	.29 (1.63)
Some	.00	.11	.19 (0.00)	.58	.16	.45 (0.85)	.62	.16	.32 (1.66)
Large	.00	.11	.19 (0.00)	.61	.16	.36 (1.22)	.65	.16	.32 (1.67)

We assume 'some' correlation between women's α_w and u_w traits and that there is 'some' difference in uncertainty about the traits (i.e. uncertainty about the u_w trait is somewhat larger).

1) Married women's average labor-market participation as a fraction of men's.
4) Fraction of men and women who are single.
5) Fraction of married couples who divorce.

Table 3 has the same headings and utility weights etc. as table 2. The only difference is that the σ trait is now coordinated at marriage also in the 'before' situation because of the subconscious mechanism where this was not the case in table 2. The coordination mechanism in the "just after" and "long after" situations is exactly the same as in table 2. But in contrast to previous simulations, the preference traits are now coordinated in the "before" situation. However the "before" result remains the same. This is because preference trait has no influence on marital utility in this situation where no women work. Also the result in the 'long after' situation is exactly the same: Although this trait matters for the utility of marriage, both the suggested mechanism imply a coordination of this trait when women work. However, results for the just after situation differ crucially. As in table 2, increasing the utility weight of preferences over participation as we move down the table does not increase the temporary divorce effect which, in the first line, is entirely due to productivity mismatch. However, as the importance of

preference trait increases, it crowds out the temporary effect of rising wages and subsequent productivity trait mismatch on both divorce and remarriage. As in table 2, we see that inharmonious preferences are important (a ratio greater than 1) as this situation contributes significantly to the gain from divorce in the lower part of the table. Thus, the value of having a good σ trait match dominates the divorce decision and matched σ traits in the 'just after' situation stabilizes couples even in case of poor matches on productivity traits. This is because the utility cost of getting a σ trait mismatch at remarriage overshadows the potential gain of a grater productivity trait match.

To sum up, when preferences over participation are important enough, they dominate couples' decisions about divorce and crowd out the 'productivity mismatch' effects. If preferences are coordinated by the conscious mechanism this does not change the dynamics of the model because this trait then generates its own transitory rise in divorce. However if this trait is coordinated by the subconscious mechanism it does not have a transitory effect. Then as it crowds out 'productivity mismatch' so is the transitory effect caused by productivity mismatch. This development is more consistent with the empirical divorce and remarriage rates seen in a number of countries and also consistent with a number of empirical studies that find that preferences over participation are more important causes of divorce than productivity mismatch.

8. Concluding remarks

Our paper shows that Becker's basic productivity trait model of marriage is at odds with empirical evidence on two fronts and is presents a simple extension of the model with a subconscious coordination mechanism based on sociological theory, which realigns its predictions.

In Becker's productivity trait model changing social conditions may induce a permanent rise in the divorce rate when coordination errors are larger for the set of traits that affect outcome in the new social situation. However, such a shift also causes a temporary increase in divorce rates when conscious rational 'economic' coordination mechanism ensures trait coordination. The mechanism

implies that, at the time of marriage, partners refrain from coordinating traits that they expect not to be important for outcomes. In the transition period divorce rates increase because couples, that were well-matched at marriage under the old social conditions, are now mismatched in the new social situation. This effect disappears again once cohorts married under the old social conditions pass on (or coordinates under the new regime through divorce and subsequent remarriage). Hereafter, divorce rates are affected only by cohorts that have also married under the new regime.

We accept the utility perspective used by economists, but not the general (universal) applicability of conscious rational choice model of behavior. Instead we introduce a subconscious coordination mechanism for preferences over women's labour market participation. This coordination mechanism works at the time of the marriage even when partners consider them irrelevant for outcomes. Whereas this mechanism does not contribute to the temporary rise in divorce rates, it will, to the extent that it is imperfect, contribute to the permanent rise. It may even (if it is strong enough) crowd out temporary effects caused by the productivity traits coordinated by a conscious evaluation mechanism, that is characteristic of economic models of marriage. When this is the case our model also predicts that preference mismatch is the dominant cause of divorce. Thus, our extension of Becker's model produces predictions that are consistent with both the dynamics of divorce and the causes of divorce that we observe in a number of countries. While extensions in the economic tradition may also be able to produce consistent dynamic predictions (an example of this might be Chiappori and Weiss, 2006), there is potential for extensions inspired by sociological theory, which the literature formally modeling divorce and marriage largely overlooks. Thus, to facilitate a more precise understanding of the historical trends, empirical studies designed with the explicit purpose of investigating and testing implications of the sociological perspective presents promising area for future research.

Appendix: A simulation model of the marriage market

The model simulates partners matching in a marriage market with search costs and uncertain estimation of traits by partners.

Utility of a household is as defined in equation (1):

$$U = W\beta_m t_m + w\beta_w t_w + H((T - t_w)\alpha_w, (T - t_m)\alpha_m)$$

where the household production function is given the specific form $H(.) = \sqrt{(T - t_w)\alpha_w + (T - t_m)\alpha_m + K}$ where K is a positive gain from marriage reflecting complementarities in household production and the variable elements reflecting input substitution possibilities at the margin in household production. The man's wage W is set so that at the models parameter values it is always optimal for the male to work full time (i.e. $t_m = \bar{t} < T$) while it may be optimal for women to work less than full time or not at all. Given wage rates (W,w) and trait values ($\beta_w, \alpha_w, \beta_k, \alpha_k$) the optimal value of t_w for any couple (which we denote t_w^*) can be found and the households utility calculated. The utility of a single's household is found by setting $t = T$ for the partner and K to zero and optimizing labor supply.

To simplify the solution of the model we assume that men are residual claimants and that men must give women their utility share in the woman's optimal marriage (i.e. equal to utility of her staying-single option plus the woman's marginal contribution to the optimal marriage). Only males endure search costs and the man's decision problem is to weigh the expected gain from continued search against the cost of continued search. If there were no search costs in the market all men would continue searching until they by chance meet their optimal match. We assume that men know the distribution of women's β_w, α_w traits in the market and so are able to evaluate the expected gain from continued search, and so for each man we can calculate a span of acceptable woman trait values (conditional on the current wage rate). When a man meets a woman whose traits fall within this span they enter into marriage (with the woman receiving a utility share equal to her share in optimum and so this marriage is also acceptable to her). The random meeting process with search costs generates a number of marriages and some men and

women who by design or chance remain single. Search costs may make it unprofitable for some men to search for a partner (if the gains from marriage in their optimal marriage are relatively small). This automatically implies that an equal number of women (primarily those with matching attributes) also remain single. Also some men remain single by chance because their optimal partners have been taken by others who decided to stop searching before finding their optimal partner.

We simulate partner search, marriage and divorce for men with participation preference trait normalized to zero ($\sigma = 0$) among an equal number of women. Without coordination on this trait we assume the probability of mismatch is 0.6. This probability is reduced to 0.4 with coordination irrespective of this coordination being conscious or subconscious. Conscious coordination at marriage occurs when the trait affects realized marriage outcomes in the social conditions applying at the time of marriage. The resulting mismatch then is a result of partners observing the trait imperfectly. Subconscious coordination at marriage occurs irrespective of whether the trait affects realized marriage outcomes in the social conditions applying at the time of marriage. Coordination happens through a subconscious process that does not involve a utility calculation – but when it coordinates perfectly, it results in a coordination that is consistent with utility maximization if the trait were to affect realized marriage outcomes. If a couple has incompatible preference traits then the male must still compensate the female according to her optimal marriage either by allowing in-optimal (from his perspective) labor market participation or by compensating her for accepting in-optimal (from her perspective) labor market participation. We simulate this by calculating household utility using a woman's labor supply be set at $t_w^* + \lambda\sigma$ where λ indicates the strength of the preference trait effect (i.e. in the Becker model $\lambda = 0$). This captures the utility loss endured by the husband associated with incompatible preference traits.

We assume that males observe female traits β_w, α_w with error and that these are always subject to conscious coordination. Men are assumed to know the distribution of the estimation errors and to take into account the probability of preference trait mismatch when marrying. If preference trait coordination is

conscious this corresponds to the way other traits are taken into account when marriage/divorce decisions are made. If preference trait coordination is subconscious, the uncertainty associated with this trait is not identified as such but rather perceived as a general uncertainty about the realized outcome from engaging in a new marriage. Following Becker, the basic assumption is that the market tends toward the optimal sorting after expected utilities (i.e. given the assumed trait observation uncertainties). Thus, we assume that men and women know the utility level of their own staying-single option and their own expected marginal contribution to the marriage dictated by the optimal sorting (calculated as expected utility for observed trait values and current wage rates with expectations taken over the trait estimation error and the unobserved preference trait characteristic distributions).

As marriages unfold wage rates change and new spans of acceptable traits are calculated for all men. Then women's traits are realized/observed, and for some men it turns out that at the new wage rates and realized/observed traits including the preference trait characteristic the realized utility level is so low that renewed search becomes optimal and so divorce results (since women must receive a utility share corresponding to what they would receive in their new optimal marriage the man's expected gains from continued search are now greater than his search costs).

The men's wage productivity β_m is fixed and equal ($\beta_m = 2.5$) while the male household productivity trait and the female's wage and household productivity are drawn from a uniform distribution (α_m with a mean of 1 and a span of 0.5, α_w and β_w with a mean of 2 and a span of 0.1). In addition, an observation error for the two female traits is drawn from a uniform distribution with mean 0 and a span as indicated bellow in table 3. The men's wage rate *W* is 1 in all simulations so the women's wage rate *w* is the wage relative to men's. In the before wage-rise situation *w* is 0.8 while *w* is 1 in the after wage-rise situation. There are 30 men and 30 women in each market and search costs are set so that four women are acceptable to each man in the initial marriage market situation where the *K* parameter is set so that the male in the least productive marriage just prefers marriage to remaining single. We have aggregated results for three different

markets differing only in the random trait drawings for males and females. The before wage-increase divorce rate is simulated by letting partners marry and divorce at the woman's wage rate w=0.8, the just after wage-rise divorce rate is simulated by letting partners marry at w=0.8 and divorce at w=1.0 while the long after wage-increase divorce rate is calculated by letting partners marry and divorce at the woman's wage rate w=0.8.

We conduct all simulations for the same sample of 90 men and 90 women organized in three markets of 30 pairs each. We simulate the model with SAS using the NLP procedure to find the optimal match sorting and drawing traits and errors using the standard random number generator provided by SAS (the program is available on request). The table gives specific parameter values for the simulation runs presented in tables 1 and 2.

Table 4. Parameter values for simulations

Simulation	Correlation between women's α_w and β_w Traits	Uniform distribution span for α_w estimation error	Uniform distribution span for β_w estimation error	Proportion of lifestyle trait σ mismatch resulting from coordination	Proportion of lifestyle trait σ mismatch without coordination	Value of lifestyle trait utility Strength parameter λ
No. 1 Table 1	0.9	0.000003	0.000003	-	-	0.00
No. 2 Table 1	0.5	0.000003	0.000003	-	-	0.00
No. 3 Table 1	0.5	0.000003	0.00003	-	-	0.00
No. 4 Table 1	0.5	0.000003	0.0003	-	-	0.00
No. 1 Table 2	0.5	0.000003	0.00003	0.4 (Concious)	0.6	0.00
No. 2 Table 2	0.5	0.000003	0.00003	0.4 (Concious)	0.6	0.02
No. 3 Table 2	0.5	0.000003	0.00003	0.4 (Concious)	0.6	0.05
No. 4 Table 2	0.5	0.000003	0.00003	0.4 (Concious)	0.6	0.13

No. 1 Table 3	0.5	0.000003	0.00003	0.4 (Subconcious)	0.6	0.00
No. 2 Table 3	0.5	0.000003	0.00003	0.4 (Subconcious)	0.6	0.02
No. 3 Table 3	0.5	0.000003	0.00003	0.4 (Subconcious)	0.6	0.05
No. 4 Table 3	0.5	0.000003	0.00003	0.4 (Subconcious)	0.6	0.13

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