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The Effects of Marriage and Divorce on Financial Investments: Learning to Love or Hate Risk?

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Abstract: We investigate how changes in marital status affect the decision to take on financial risks. As an alternative to the traditional approach of comparing different groups of investors (men and women) at each point in time, we use a difference-in-differences estimation strategy to compare how the same individual invests at different points in time (before and after marriage or divorce) compared to a benchmark investor, thereby controlling for unobserved systematic differences as well as various background characteristics**.** We investigate both the propensity to participate in the stock market and the propensity to invest in more risky portfolios. We find that marriage acts as a "financial risk-reducer" for men and as a "financial risk-increaser" for women, in the sense that women increase the fraction of wealth invested in stocks after marriage and decrease it after divorce, whereas men show the opposite investment behavior.

Keywords: Gender; Marriage; Divorce; Difference-in-differences; Stock market participation; Portfolio choice

JEL Classifications: G11, J16, D14

1 Introduction

The literature on gender differences in financial investment decisions generally provides three overall conclusions: women make less risky investments in financial markets compared to men, married investors take on more risk than unmarried investors, and the differences between male and female investors is more pronounced for single investors. For instance, Sundén and Surette (1998) and Jianakoplos and Bernasek (1998) find that single women are relatively more risk averse than single men. Barber and Odean (2001) use data from an online internet broker and report that men trade more than women, which is taken to imply that women are not as overconfident as men, and that the "differences in turnover and return performance are even more pronounced between single men and single women". Agnew, Balduzzi and Sundén (2003) use data from 401(k) plans and conclude that "Men invest more in equities and trade more frequently than women. Married investors invest more aggressively than their single counterparts". Love (2010) finds that married investors hold more risky assets than single investors. The question is, however, whether these correlations represent causal effects or are spuriously caused by other factors. In this paper, we provide new perspectives on the impact of changes in marital status on the investment behavior of men and women using high quality representative data and empirical strategies that allow us to get closer at identifying a causal effect of marital status on portfolio choice.

Our main contribution thus relates to the empirical strategies we use to study gender differences in investment decisions resulting from changes in marital status. In the current literature, the behavior of one group of investors (e.g. single women) is, at each point in time, compared to the behavior of another group of investors (e.g. married women). There are three potential concerns with such cross-sectional estimators. The first concern is that single individuals might differ from married individuals in some unobserved systematic way (for instance in their abilities or preferences), such that unobserved differences influence the outcome of interest. The second related concern is that it might be different types of individuals who marry or stay single, hence responses to information and other macroeconomic shocks may differ. The third concern is that some singles have never been married whereas others have been married but live on their own due to a divorce, which confounds the comparison due to different prior histories and information sets.[1]

[1]Love (2010) also studies the effects of divorce. The main differences between Love's investigation

To tackle these concerns, we exploit the unique detailed panel structure of our data, which both allows us to identify individuals who change marital status (at different points in time) and provides information on their overall portfolio decisions and many background characteristics. We thus analyze the effects that occur around changes in marital status. In particular, we focus on individuals' financial portfolio before and after marriage/divorce. This enables us to compare the changes in the financial portfolio of the same individual over time, while properly benchmarking any other common influences by similar investors not changing marital status and also taking background differences into account. Thereby we isolate the causal effect of changes in marital status on financial investments of men and women using a difference-in-differences estimation strategy.

Our second contribution relates to the stylized empirical fact that many investors do not participate in the stock market, implying that the decision of an investor can be split in two: first, the investor decides whether he/she should invest in the risky stock market at all, and, second, if the investor decides to hold stocks, which stocks and how many should the portfolio contain.[2] Here, we investigate both whether there are gender differences in the stock market participation decisions and in the choices of portfolio riskiness.[3]

The data consist of a random sample of 10% of the total Danish adult population for the period 1997-2003, thus the results are not influenced by self-selection biases. We focus on those individuals who get married (app. 143,000 individuals get married) or divorced (app. 89,000 get divorced) during the sample period, and compare their behavior with those investors who stay single (app. 370,000 individuals stay single

and ours is that we exploit both the rich cross-section and time dimension of our panel data - comparing treatment and control groups over time, whereas Love compares different groups of individuals at the same points in time. In addition, we study both what happens when individuals get married and divorced, where Love studies divorce. Finally, we analyse both the participation decision and the choice of the level of risk, whereas Love only analyses the level of risk.

[2]Hong, Kubik and Stein (2004) report that 51% of U.S. households do not hold stocks in 1998 while Guiso, Haliassos and Jappelli (2003) report that 76% of the European households do not hold stocks in 1998.

[3]In most of the literature, such as Barber and Odean (2001), only stock holders are present in the sample, so it is not possible to model the stock market participation decision. However, some of the cited papers use empirical methods that allow for a proper investigation of portfolio risk, taking into account the fact that a large fraction of the individuals do not participate in the stock market: For instance, Jianakoplos and Bernasek (1998), Love (2010), and Christiansen, Joensen and Rangvid (2010) use tobit models for the fraction of financial wealth invested in stocks, but they do not isolate marital status effects.

during the sample period) or married (app. 850,000 stay married), respectively.

We first show that the data reveal the same unconditional characteristics as those already reported in the literature that uses e.g. U.S. data: Unconditionally, men on average hold more risky portfolios, and this is even more pronounced for singles. For instance, the average unconditional rate of stock market participation is higher for men, their stock holdings are higher, and their portfolios are on average more risky.

We then turn to our main investigation of what happens to the portfolio of men and women, respectively, after moving together or apart. We find that women who get married on average choose to hold a higher fraction of financial wealth in stocks after the marriage, compared to those women who do not get married. After divorce, women on average reduce the fraction held in stocks, compared to women who do not get divorced. For men, it is the other way around: Single men reduce the fraction of wealth in stocks after they get married, whereas they increase this fraction after divorce. Hence, marriage acts as a "financial risk-reducer" for men whereas it acts as a "financial risk-increaser" for women. Interestingly, we also find that these conclusions are to a large extent driven by the experience of young (i.e. 20-30 year old) investors and those with lowest education (i.e. only compulsory schooling). That indicates that young and low educated investors are more influenced by their spouses when making financial investments, whereas this is only less so for older and higher educated investors. In this sense, experience (age) and knowledge (education) make investors take more independent financial decisions.

Our next findings relate to the likelihood of holding stocks. Single women tend to participate more in the stock market after they get married, but the likelihood is not lower after divorce, i.e. they do not return to their original stock market participation behavior. Men increase their stock market participation rate after getting married and they reduce their rate of participation after getting divorced.

Overall, our results provide evidence on the causal effect from marital status to financial decision takings, as we find that there are important differences between the financial decisions taken by one-headed and two-headed households. Indeed, after marriage, investors participate more in the stock market and hold portfolios that are less risky than male's but more risky than female's. On the other hand, becoming a single household makes males go back to the previous single behavior, whereas females continue participating in the stock market but with less risky portfolios.

The remainder of the paper is organized as follows. Section 2 introduces the data. Section 3 explains the DID estimation procedure. Section 4 illustrates the choices of treatment and control groups. Section 5 shows the stock market participation results and Section 6 the portfolio riskiness results. Section 7 concerns the overall effects from marriage and divorce. Section 8 contains some robustness analysis. Finally, Section 9 concludes.

2 Data

We use a very rich register-based panel data set comprising a random 10% sample of the Danish population covering end-of-year data during the period 1997-2003. The data stem from Statistics Denmark, which has gathered the data from different sources, mainly from administrative registers. Given that the data are register based and concern a large representative sample, the results are not influenced by self-selection biases. The scope and quality of the data are comparable to other studies using Scandinavian data such as Christiansen, Joensen and Rangvid (2008), Calvet, Campbell and Sodini (2007), Calvet, Campbell and Sodini (2009), Massa and Simonov (2005), Grinblatt and Keloharju (2000), and Grinblatt and Keloharju (2001). We restrict the sample to individuals between 20 and 60 years.[4]

Table 1 provides summary statistics on the variables we use in this study. We show statistics for women and men separately. Moreover, the investors are divided into four groups. The first two groups comprise the basis for investigating the effects of marriage: investors who are single throughout the sample (212,113 males and 157,333 females) and investors who get married during the sample period (77,464 males and 66,377 females). The last two groups comprise the basis for investigating the effects of divorce; investors who are married throughout (406,957 males and 443,209 females) and investors who divorce during the sample period (41,092 males and 47,455 females).

Investors who change marital status during the sample period are younger than investors who do not. Fewer males than females have children living at home. The income of men is higher than the income of women across all types of marital status, and the income of married investors is generally higher than the income of single investors,

[4] We exclude individuals above the age of 60 in order to disregard observations where an older widow inherite the stock holdings of her husband. Such women would otherwise show up as single potentially biasing our overall conclusions.

with this difference being even more pronounced for men. We include an economist dummy in the regressions, as Christiansen et al. (2008) show that economists are more likely to hold stocks than investors with any other education; slightly more men are economists.

The stock market participation rate varies between 16.6% and 29.6% with married investors participating more than single investors, and men participating more than women. The same goes for the riskiness of the investors' portfolios: Men invest a higher fraction of their financial wealth in stocks, and married investors also hold more risky portfolios. These stylized facts are thus like those found in the U.S. data, as mentioned in the Introduction..

2.1 Definition of Marriage and Divorce

In order to compare investment decisions of single versus two-adult households, we include both lawfully married couples and unmarried cohabiting couples in the definition of married investors.[5] Getting married thus includes both getting lawfully married and moving in together and it does not include couples that already live together that get lawfully married. Similarly, getting divorced includes both divorce of lawfully married individuals and cohabiting individuals moving apart.[6]

If there are tax benefits associated with one part of a married couple owning the financial assets, the holdings of married men and women might not reflect the "true" preferences towards risk of each individual. However, in Denmark, there is no tax-advantage from "transferring" ownerships of stocks to the partner, as taxation of financial income is done at the household level for married couples as well as for couples living together.[7]

3 Difference-in-Differences Estimation

We make primarily two empirical investigations in this paper, both based on panel-data estimations: One where the outcome variable is the stock market participation and

[5] The results are robust to only including legally married couples in the definition of married.

[6] We delete individuals who make more than one marital status transition in the sample period. Consequently, the control groups consist of individuals who are married and single, respectively, during the whole sample period.

[7] The tax incentives to buy stocks can change after marriage as the marginal tax rate might change.

another where the outcome variable is the portfolio riskiness. The outcome variable for individual i at time t is denoted Y_{it}.

Both types of estimations are conducted as difference-in-differences (DID) estimations. When considering the effect of marriage (divorce) we select all individuals who are single (married) at the end of year $t-1$. Then we distinguish between those who are also single (married) at the end of year t and those who are married (single) at the end of year t. We let $T_j = 1$ for those individuals who get married (divorced) at $t_0 \in \{1998, ..., 2002\}$ and $T_j = 0$ for the remaining individuals.[8] We are interested in estimating the average effect on the outcome variable for the investors who get married (divorced): $E\left[Y_{it}^1 - Y_{it}^0 | T_j = 1\right]$ for $t > t_0$, where Y_{it}^1 is the outcome for investor i at time t when the investor is married (divorced) and Y_{it}^0 is the outcome the investor would have had if staying single (married). Since an investor's outcome cannot be observed both when the investor gets married (divorced) and does not get married (divorced), the central problem of evaluating this effect is the construction of counterfactuals.

The simple DID estimator compares the change in the outcome variable for investors who get married (divorced) with the change in the outcome variable for investors who stay single (married). The implicit identifying assumption is that if none of the investors had married (divorced), the change in the outcome variable would have been the same for both groups of investors.[9] The simple unconditional DID estimator is consequently calculated as:

$$E[Y_{i,t>t_0}^1 - Y_{i,t<t_0}^0 | T_j = 1] - E[Y_{i,t>t_0}^0 - Y_{i,t<t_0}^0 | T_j = 0]. \quad (1)$$

We control for additional background variables using a regression framework to generalize specification (1). Let $After_{it} = \mathbf{1}\left[t > t_0\right]$ denote the indicator of whether the observation is after the individual married (divorced). The DID estimator of the effect of marriage (divorce) is the estimated coefficient (γ_{DID}) to $After_{it} * T_j$ in the following OLS regression of the outcome variable Y_{it} on T_j, $After_{it} * T_j$, time effects, d_t, and

[8] The earliest changes in marital status that we consider pertain to 1998 (the second year of the sample) such that we have observations for the year before the change. Similarly, the latest changes in marital status belong to 2002 (the penultimate year of the sample) such that we have observations for the year after the change.

[9] Formally, this identifying assumption is $E[Y_{i,t>t_0}^0 - Y_{i,t<t_0}^0 | T_j = 1] = E[Y_{i,t>t_0}^0 - Y_{i,t<t_0}^0 | T_j = 0]$. This assumption cannot be tested directly since $Y_{i,t>t_0}^0$ is unobserved for $T_j = 1$. However, we establish the credibility of this "common trends" assumption by testing whether there are any marriage group-specific trends.

various additional control variables; see e.g. Heckman, LaLonde and Smith (1999) for details:

$$Y_{it} = \gamma_0 + d_t + \gamma_1 T_j + \gamma_{DID} After_{it} * T_j + X_{it}\delta + \epsilon_{ijt}. \quad (2)$$

where X_{it} is the vector of additional control variables and $\epsilon_{ijt} \sim N(0, \sigma^2)$ is the unobserved idiosyncratic variation in outcomes across individuals, marriage, and year. One potential problem - with no straightforward solution - is if some of this variation is common to individuals in the same year and marriage group; e.g. $\epsilon_{ijt} = u_{jt} + \varepsilon_{ijt}$. To accommodate the inference problem arising in the presence of marriage-year specific random effects, u_{jt}, we show two kinds of standard errors: First, assuming ϵ_{ijt} are i.i.d., OLS standard errors provide valid inference. Second, assuming errors are independent across years and marriage groups; thus clustering standard errors by marriage and year ($T_j \times t$) should generate valid inference.[10]

3.1 Stock Market Participation

First, the outcome variable is the stock market participation ($Y_{it} = S_{it}$). At the end of each year t we observe the amount held in stocks by individual i, denoted by S^*_{it}, $i = 1, ..., N$ and $t = 1, ..., T_j$. We focus on the binary choice variable $S_{it} = \mathbf{1}[S^*_{it} > 0]$, where S_{it} is an indicator for participation in the stock market of individual i at time t.

3.2 Portfolio Riskiness

Second, the outcome variable is the portfolio riskiness ($Y_{it} = \frac{S^*_{it}}{W_{it}}$). We use the proportion of financial wealth invested in stocks, $\frac{S^*_{it}}{W_{it}}$ to measure the portfolio riskiness. This is the traditional measure of portfolio riskiness and is also used in e.g. Love (2010). The first set of DID estimates for the portfolio riskiness is based only on individuals participating in the stock market and are calculated using the OLS regression in Eq. (2).

Since the proportion of stocks in the portfolio is only observed for those investors who participate in the stock market, the OLS regression in Eq. (2) might produce

[10] See Angrist and Pischke (2008) for a more detailed discussion of these issues. A third type of standard errors are not reported: We do not allow for arbitrary correlations in errors within marriage groups by clustering by marriage. This should in principle generate valid inference in the case of serial correlation in the random effects. Yet, the caveat is that we only have a fairly small number of clusters and inference relies on having a large number of clusters (and not only cluster size).

biased estimates. We correct for potential self-selection bias arising from limited stock market participation using tobit models specifying the partially unobserved underlying latent variable $\frac{S_{it}^*}{W_{it}^*}$ as a linear in parameters model:

$$\frac{S_{it}^*}{W_{it}^*} = \gamma_0 + d_t + \gamma_1 T_j + \gamma_{DID} After_{it} * T_j + X_{it}\delta + \epsilon_{ijt}^* \tag{3}$$

The observed outcome variable is given by $\frac{S_{it}^*}{W_{it}} = \max\left\{0, \frac{S_{it}^*}{W_{it}^*}\right\}$ and the parameters are consistently estimated by maximum likelihood. The tobit model thus takes into account that portfolio riskiness is only observed for those investors who choose to participate in the stock market. For the considerable fraction of investors who choose the corner solution not to participate, the observed portfolio riskiness is zero. By comparing the OLS and tobit DID estimates we can evaluate whether it is important to account for limited stock market participation.

4 Illustrating the Choices of Treatment and Control Groups

The goal of this paper is to evaluate the impact on financial decisions resulting from a change in marital status. We do this by comparing the choices of those individuals who change marital status (the treatment group) with the choices of those who do not change marital status (the control group). As it is not possible to observe what the individuals in the treatment group would have done, had they not been treated, we can instead illustrate how the individuals in the control group compare with those that were treated late respectively early in the sample period. The idea is that if the dynamics of responses of those being treated late differ from the responses of the individuals in the control group, the identifying assumptions might be problematic. In addition to illustrating the appropriateness of the identifying assumptions, this will also illustrate some of the main features of the outcome series we analyze in this paper.

Consider Figure 1a first. The figure shows the stock market participation rate of those male investors who stay single during the whole sample period, those who get married early in the sample period, and those who get married late in the sample period.

There are some noteworthy patterns: For all three groups of individuals, the participation rate increases over time. However, the participation rate of those who get married early in the sample period increases more than the participation rate of those who stay single during the sample period, and it also increases more than the partici-

pation rate of those who get married late in the sample period. In itself, this indicates a positive impact on stock market participation from getting married (unconditionally, i.e. not taking into account other changes in background characteristics, which we do below). But are those investors different from those investors not getting married? We can get a sense of this by comparing the dynamics of the participation rates of the investors in the control group (those who stay single) and the investors getting married late in the sample period. These trends are almost identical, indicating that individuals who stay single do not behave very differently from singles who marry, but marry late. In other words, the identifying assumptions seem reasonable.

Figures 1b, 1c, and 1d are structured in the same way as Figure 1a, i.e. they show what happens to stock market participation for investors in the control group during the sample period, investors getting treated in 1998, and investors getting treated in 2002. In Figure 1b, we show what happens when women get married, in 1c when men get divorced, and in 1d when women get divorced. The main aspects to notice are the following: The trends in the stock market participation rate of those who get treated late and the control group are more or less parallel, i.e. the identifying assumptions seem reasonable.

Figure 2 describes the same patterns as Figure 1, but for portfolio riskiness. The main issue to notice is again that trends in portfolio riskiness for the late-treatment and control group seem to be parallel. Second, Figure 2 also illustrates that there is a clear spike in portfolio riskiness around year 2000 associated with the stock market boom up until 2000 and the drop after 2001. We will pay special attention to this particular feature of the data in Section 8.2. Furthermore, we will provide more formal tests of the identifying assumptions in Section 7.1.

5 Participation Results

Table 2 presents the DID estimates of the change in the stock market participation rate after marriage and divorce. We estimate three specifications of Eq. (2) for each of the treatments: (i) where the explanatory variables are T_j, $After_{it} * T_j$ and year dummies, (ii) where we also include socioeconomic control variables (dummy for children living at home, age, length of education, economist dummy), and (iii) where we also include log nonfinancial income.

5.1 Participation Effects for Men

Consider first the effects on stock market participation for men who get married. After men get married their stock market participation rate is on average higher than the stock market participation rate of those men who do not get married. To explain the numbers, consider the simplest model (i) where the DID estimator is 0.011. This implies that the average participation rate increases by 1.1 percentage points when men get married**.** To get a sense of the economic magnitude, the 1.1 percentage points is compared to the overall unconditional rate of stock market participation of 20% for men who stay single, cf. Table 1.

Consider next what happens to men's stock market participation rate after divorce. We find that the stock market participation rate for men decreases by 1.2 percentage points after the divorce. All in all, for men, the results indicate that they increase their stock market participation after they get married, and reduce it after they get divorced.

Overall, the inference is neither affected by clustering of standard errors nor by whether it is based on DID estimates from OLS or probit models.

5.2 Participation Effects for Women

The participation rate of women also increases after they get married (compared to the participation rate of women who do not get married). In addition, the effect is larger for women than for men: even in model (iii), where we control for both income and socioeconomic factors, the participation probability of women increases by 1.6 percentage points when they get married. Interestingly, women's participation rate stays high after divorce. So, women increase their participation rate both after they get married and after they get divorced. Thus, there seems to be a kind of learning to love risk effect or habit persistence for women: Women on average participate less in the stock market, but after they get married they increase their participation rate. In contrast to men, women also increase their participation rate after a divorce.

6 Portfolio Riskiness Results

In Table 3, we show the results from the DID estimations for the fraction of financial wealth held in stocks. The main point to notice is that single men invest more risky than

married men, and single women invest less risky than married women. Hence, for men, marriage acts as a "risk-reducer" whereas marriage acts as a "risk-increaser" for women. We make this conclusion for the following reasons: After men get married they reduce their relative position in risky assets. Men, on the other hand, increase their portfolio riskiness after getting divorced. For women it is the other way around: Women increase their portfolio riskiness after getting married, and decrease the portfolio riskiness after they get divorced.

More specifically, we see that men's fraction of wealth invested in stocks falls on average by a significant 1.2 percentage points after getting married in model (iii), whereas women's share increases by an insignificant 1.0 percentage point after getting married. On the other hand, men increase their position in stocks out of wealth with a significant 1.8 percentage points (model (iii)) after getting divorced, whereas women reduce their position with a large 4.2 percentage points.

Overall, the conclusions are identical whether they are based upon OLS or clustered standard errors, with the exception of women getting divorced; for women getting divorced, the effects are significant using OLS standard errors, but insignificant using clustered standard errors. We also note that there are only minor differences between the DID estimates from the OLS and tobit models. This means that it is not very important to account for the stock market participation decision when analyzing how the portfolio riskiness changes in relation to marital status.

7 Overall Effects from Marriage and Divorce

Marriage makes men participate more in the stock market, but hold less risky assets in their financial portfolio. Divorce makes men participate less in the stock market and invest in more risky assets. For females, both marriage and divorce make them participate more in the stock market and to invest in more risky assets. Hence, becoming a two-headed household makes investors participate more in the stock market. Becoming a two-headed household also makes investors hold portfolios that are less risky than male's but more risky than female's. Becoming a single household makes males go back to the previous single behavior, whereas females continue participating to a higher extent in the stock market, but hold less risky assets in their financial portfolio.

8 Specification Testing and Robustness Analysis

8.1 Specification Testing

In this section, we test whether the DID identifying assumptions hold via a number of specification tests. We present the results in Table 4.

8.1.1 Group Specific Trends. As mentioned in footnote 9, we can test the credibility of the identifying assumption (that the change in financial market behavior would have been the same for the control and the treatment group, had there been no change in marital status for the treatment group) by testing for "common trends" in the treatment and control groups. We do this by extending the DID regressions with the following variable: $T_j * t$ where t is simply the year of the observation.[11] If the identifying assumption holds, then $T_j * t$ is insignificant. We show the results using the subgroup of investors who change marital status in 2002. The results (p-values) are shown in Table 4 in rows "H_0: No group-specific trend, only 2002 transitions". We accept the null hypotheses in most cases. Reassuringly, for those investors in the treatment group that we observe for the longest time before changing marital status, we cannot reject that the identifying assumption is satisfied.

8.1.2 No Anticipatory Effects. The second identifying assumption is that changes in marital status are exogenous. We therefore test whether changes in marital status affects stock market behavior. In other words, do investors change marital status because they anticipate that this will lead to a change in their exposure to the stock market? Hence, we would like to test for reverse causality; i.e. whether the effects we identify run from changes in marital status to financial market behavior, and not vice versa.

We test whether the results are driven by anticipatory effects by including leads of $After_{it} * T_j$ in the regressions. The leads of $After_{it} * T_j$ should be insignificant if the model is well specified. We show the results using the subgroup of investors who change marital status in 2002**.** The results (p-values) are shown in rows "H_0: No leads, only 2002 transitions". It is seen that the null hypotheses that the leads are insignificant in general cannot be rejected. Hence, we conclude that changes in marital status do not

[11] Apart from allowing for this linear time-trend, we test a fully-flexible time-trend, but this leads to similar conclusions.

occur because individuals anticipate that it will change their stock market behavior, but that the changes in financial market behavior we observe can be attributed to the change in marital status.[12]

8.1.3 Time Patterns. The final specification test we conduct is a test where we include lags of $After_{it} * T_j$ in the DID regressions. The pattern of the estimated coefficients to these lags can tell us something about changes over time in the effects on financial market behavior resulting from changes in marital status, for instance whether there is learning going on such that effects become stronger or weaker over time, after a change in marital status. To conduct these tests, we obviously need a history of data after the change in marital status. We thus conduct this analysis for those investors who change marital status early in the sample (1998). In Table 4 we show the estimated coefficients to the different lags of $After_{it} * T_j$.

The lagged effects are generally not significant. Hence, in statistical terms it is difficult to claim that a learning process goes on. Looking at the sizes of the estimated coefficients on their own, though, it seems that these indicate a kind of learning process after a change in marital status: the estimated coefficients increase in size from the first to the second lag, and then again to the third lag, after which the effects become smaller (perhaps with possible exceptions of females' stock market participation and male's choice of risk in the portfolio, where the patterns are not so clear), i.e. the effect on financial markets is the largest three years after the change in marital status. However, as first mentioned, the effects are not statistically significant so these are tentative conclusions.

8.2 Robustness Analysis

In order to better understand the results, we provided three additional tests. First, we evaluated whether age influences the conclusions. Second, we further examine the role of education. Finally, we pay special attention to what happens around 2000-2001 where the stock market fell significantly. The results are shown in Table 5.

[12]Note that it is only for divorcing females' financial portfolio riskiness measure that we tend to have systematic violations of the identifying assumptions. This could be solved by matching a control group prior to DID estimation.

8.2.1 Age. It is a standard finding in the stock market participation literature that participation is positively correlated with age. For this reason, we include age as a control variable in the models ((ii) and (iii)) above. To investigate further whether age plays a role for the effects of changes in marital status on financial market behavior, we now interact $After_{it} * T_j$ with age. The interaction terms are generally not significant, though, as seen in Table 5. Hence, we conclude that the effects of changes in marital status on financial market behavior are independent of the age of the investor experiencing the change in marital status. Allowing these age effect to be non-linear, however, reveals that our conclusions are mainly driven by large effects for young (i.e. 20-30 year old) investors.

8.2.2 Education. We investigate the role of education further by interacting $After_{it} * T_j$ with the number of years an investor has received education. With the exception of men's choice of the level of risk in the portfolio, education does not seem to influence the results we have reported above. For men, though, we find that the higher the level of education is, the lower is the DID effects otherwise reported in Table 3. In Table 3 we report that males who marry reduce the level of risk in their portfolio (compared to men who stay single). We now find that higher educated investors who get married reduce risk even more. We also find in Table 3 that men increase their risk after getting divorced. We now find that this effect is not as strong for men with higher levels of education. In other words, education seem to reduce the changes in men's financial portfolio resulting from changes in marital status. This finding is consistent with education making individuals more independent with respect to their investment decisions from their spouses. Corroborating this finding, allowing these effects to vary non-linearly with education shows that the conclusions are mainly driven by those with lowest education (i.e. only compulsory schooling).

8.2.3 2001 Stock Market Drop. From its peak in late 2000, the Danish stock market had dropped by around 30% in late 2001. It is possible that this could cause some investors who change marital status after the drop in the stock market (i.e. after 2001) to behave differently than investors who have not experienced similar drops in stock prices. To see whether this is the case, we estimate separate DID models for investors changing marital status in 1999, i.e. before the stock market drop, and in 2002, i.e. after the stock market drop. From Table 5 it is evident that the DID estimates

lead to similar conclusions when considering 1999 and 2002 changes in marital status. Thus, the 2000-2001 stock market drop does not seem to have influenced the effects of marriage and divorce upon investors' financial decisions.

9 Conclusion

A unique feature of our data is that we can directly evaluate the total effect of marriage and divorce on financial market behavior. We have investigated how changes in marital status affect the stock market behavior of men and women. As an alternative to the use of cross-section estimators that compare, e.g., single and married investors at given points in time, we have made extensive use of panel data estimators that compare how the same investor changes behavior after a change in marital status, compared to investors who do not experience a change in marital status. This allows us to properly benchmark other changes in background characteristics and to evaluate how marriage and divorce differ in their influence on portfolio choice.

We find that marriage causes men to reduce the fraction of wealth they hold in risky assets (indicating that marriage makes men invest less risky), whereas they increase risk after divorce. For women, it is the other way around. Hence, marriage acts as a "financial risk-reducer" for men and a "financial risk-increaser" for women. We also study how changes in marital status affect the likelihood of holding stocks at all. Here we find that both men and women increase their participation rate after marriage, whereas men reduce their rate of participation after divorce, though women do not.

We have investigated the effect of changes in marital status on the choices of the levels of risk in men's and women's portfolios. It could be interesting to extend the analysis and see whether changes in marital status has consequences for the degree of diversification of men's and women's portfolios, or the amount of trading, using the same identification strategies pursued in this paper. To study such effects, more detailed data on the portfolio holdings of the investors are required, though. Another interesting question is whether the larger degree of financial literacy among women, as documented in Lusardi and Mitchell (2008), explains why women are more reluctant to make more risky investments. And if so, whether this financial literacy should be addressed from a policy perspective. Our findings that higher educated and more experienced investors make more independent decisions indicate that policy actions directed against financial education could potentially have an effect on financial decisions, which is also found in

Christiansen, Joensen and Rangvid (2008).

Finally, it would be interesting to open the black box of how couples make financial investment decisions, as well as what determines the differences in background risks. In this paper, we have quantified the total effects of marriage and divorce on stock investments. Our results clearly reveal differences in financial investments of one- and two-headed households. There are several potential channels through which being a couple can affect individual portfolio choice: (i) When credit markets are imperfect, two of the economic reasons to form a couple are: risk sharing, and extending credit by coordinating investments. (ii) The pooling of income, information, and other resources as well as risk sharing and bargaining in the household complicate the asset allocation issue substantially. (iii) Division of labor in the household, e.g. to exploit comparative advantages, may further alter the labor supply, hence the labor income of each household member. Basically, a full analysis of these issues has to both quantify the gains of marriage, and take a stance on how these gains are distributed in the household. Our results will hopefully encourage future research on these issues of two-headed household portfolio choice.

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Table 1: Summary Statistics

	Males				Females			
Variable	Always Single	Single to Married	Always Married	Married to Single	Always Single	Single to Married	Always Married	Married to Single
Children	1.7%	19.7%	51.2%	28.8%	18.0%	26.1%	46.8%	44.6%
Age	37.0	32.1	45.8	40.8	40.2	31.6	44.6	40.8
Length of Education	11.3	12.0	12.2	11.8	11.8	12.2	11.9	11.9
Economics education	3.0%	4.1%	4.6%	3.4%	2.5%	3.3%	3.5%	3.1%
Noncapital Income (DKK)	220,490	265,872	387,376	310,095	208,811	197,781	239,330	235,898
Stock Market Participation Rate	20.0%	20.1%	29.6%	19.9%	18.4%	16.6%	22.8%	18.7%
Stock Value (DKK)	17,146	10,486	28,900	13,733	23,554	8,834	13,611	12,412
Ratio Stock/Financial Assets Value	33.2%	33.8%	33.9%	34.2%	30.1%	29.6%	33.9%	30.4%
Observations	212,113	77,464	406,957	41,092	157,333	66,377	443,209	47,455

The table shows the average/proportion for various variables for various groups of investors.

Table 2: Stock Market Participation

	Single to Married			Married to Single		
Additional Explanatory Variables	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Socioeconomic		+	+		+	+
Log Noncapital Income			+			+
Males						
DID estimator	0.011	0.011	0.005	-0.013	-0.016	-0.012
Std. Error (OLS)	(0.003) **	(0.003) **	(0.003)	(0.005) **	(0.005) **	(0.005) **
Std. Error (clustering)	(0.004) *	(0.003) **	(0.003)	(0.003) **	(0.004) **	(0.005) *
Probit DID estimator (marg effect)	0.011	0.011	0.005	-0.011	-0.013	-0.011
Std. Error (probit)	(0.003) **	(0.003) **	(0.003)	(0.005) *	(0.005) **	(0.005) *
Observations	289,065	279,171	276,986	447,142	439,078	437,462
Females						
DID estimator	0.020	0.018	0.016	0.019	0.019	0.017
Std. Error (OLS)	(0.003) **	(0.003) **	(0.003) **	(0.004) **	(0.004) **	(0.004) **
Std. Error (clustering)	(0.004) **	(0.004) **	(0.004) **	(0.006)	(0.007)	(0.006)
Probit DID estimator (marg effect)	0.021	0.020	0.018	0.023	0.024	0.021
Std. Error (probit)	(0.003) **	(0.003) **	(0.003) **	(0.004) **	(0.004) *	(0.004) **
Observations	223,109	216,787	215,222	490,101	481,586	475,331

Notes: The table shows the DID estimatas (based on OLS and probit estimations) for the stock market participation when investors change marital statues. OLS, clustering, and probit standard errors are shown. */** indicates significance at the 5%/1% level of significance.

Table 3: Portfolio Riskiness

	Single to Married			Married to Single		
Additional Explanatory Variables	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Socioeconomic		+	+		+	+
Log Noncapital Income			+			+
Males						
DID estimator	0.000	-0.014	-0.012	0.010	0.018	0.018
Std. Error (OLS)	(0.005)	(0.006) *	(0.006) *	(0.007)	(0.007) *	(0.007) *
Std. Error (clustering)	(0.003)	(0.004) **	(0.004)	(0.006) *	(0.008) **	(0.008) **
Tobit DID	0.000	-0.011	-0.010	0.008	0.014	0.014
Std. Error (tobit)	(0.005)	(0.006) *	(0.006) *	(0.007)	(0.007) *	(0.007) *
Observations	57,792	57,138	56,860	128,354	127,149	126,826
Females						
DID estimator	0.022	0.010	0.010	-0.044	-0.042	-0.042
Std. Error (OLS)	(0.006) **	(0.006)	(0.006)	(0.007) **	(0.007) **	(0.007) **
Std. Error (clustering)	(0.007) **	(0.006)	(0.006)	(0.016)	(0.015)	(0.015)
Tobit DID	0.017	0.008	0.008	-0.035	-0.033	-0.033
Std. Error (tobit)	(0.006) **	(0.006)	(0.006)	(0.007) **	(0.007) **	(0.007) **
Observations	39,799	39,342	39,135	109,699	108,898	107,812

Notes: The table shows the DID estimatas (based on OLS and tobit estimations) for the portfolio riskiness when investors change marital statues. OLS, clustering, and tobit standard errors are shown. */** indicates significance at the 5%/1% level of significance.

Table 4: Specification Tests

	Single to Married			Married to Single		
Additional Explanatory Variables	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Socioeconomic		+	+		+	+
Log Noncapital Income			+			+
Males: Stock Market Participation						
H0: No group-specific trend, only 2002 transitions	0.950	0.615	0.311	0.790	0.878	0.977
H0: No leads, only 2002 transitions	0.953	1.000	0.972	0.169	0.801	0.567
Only 1998 transitions:						
DID estimator	0.004	0.007	0.005	-0.011	-0.015	-0.014
Lag 2	0.007	0.007	0.006	0.001	0.001	0.000
Lag 3	0.012	0.014	0.012	0.011	0.007	0.004
Lag 4	0.002	0.000	0.000	-0.004	-0.004	-0.002
Lag 5	0.007	0.008	0.007	0.003	0.002	0.008
Females: Stock Market Participation						
H0: No group-specific trend, only 2002 transitions	0.056	0.230	0.247	0.053	0.021 *	0.026 *
H0: No leads, only 2002 transitions	0.209	0.776	0.767	0.037 *	0.140	0.205
Only 1998 transitions:						
DID estimator	0.009	0.013	0.012	0.024	0.020	0.017
Lag 2	0.013	0.013	0.013	0.005	0.002	0.002
Lag 3	0.019	0.018	0.017	-0.016	-0.018	-0.017
Lag 4	0.000	-0.002	-0.002	-0.001	-0.001	-0.002
Lag 5	0.006	0.003	0.003	-0.006	-0.006	-0.005

Males: Portfolio Riskiness						
H0: No group-specific trend, only 2002 transitions	0.025 *	0.715	0.820	0.826	0.533	0.530
H0: No leads, only 2002 transitions	0.783	0.666	0.663	0.730	0.874	0.587
Only 1998 transitions:						
DID estimator	-0.023	0.001	-0.034	-0.034	-0.032	-0.030
Lag 2	0.045 *	0.002	0.043	0.066 *	0.069 *	0.069 *
Lag 3	0.019	0.035	0.012	-0.011	-0.010	-0.013
Lag 4	-0.017	0.000	-0.018	0.007	0.006	0.008
Lag 5	-0.018	0.015	-0.021	-0.016	-0.017	-0.015
Females: Portfolio Riskiness						
H0: No group-specific trend, only 2002 transitions	0.025 *	0.038 *	0.043 *	0.002 **	0.003 **	0.001 **
H0: No leads, only 2002 transitions	0.197	0.250	0.265	0.001 **	0.001 **	0.001
Only 1998 transitions:						
DID estimator	0.005	0.001	0.001	0.017	0.020	0.019
Lag 2	0.005	0.002	0.002	0.014	0.011	0.011
Lag 3	0.043	0.035	0.035	-0.062 *	-0.063 *	-0.063 *
Lag 4	0.001	0.001	0.000	0.027	0.030	0.032
Lag 5	0.018	0.015	0.015	0.020	0.014	0.014

Notes: The first two rows of each sub-table show the p-values of the specificaton tests. The last five rows of each sub-table shows the DID estimator for 1998 transitions as well as the parameter estimates for the lags. */** indicates significance at 5%/1% level of significance.

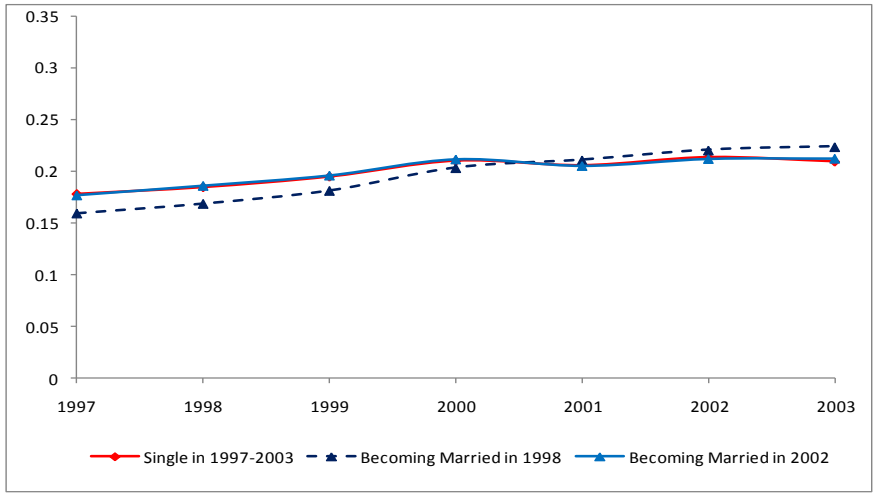
Table 5: Robustness Analysis

	Single to Married			Married to Single		
Additional Explanatory Variables	(i)	(ii)	(iii)	(i)	(ii)	(iii)
Socioeconomic		+	+		+	+
Log Noncapital Income			+			+
Males: Stock Market Participation						
DID interaction with age	-0.0004	0.0000	0.0004	-0.0004	0.0000	0.0004
DID interaction with education length	0.0017	0.0007	0.0012	0.0017	0.0007	0.0012
DID, only 1999 transitions	0.0137	0.0205	0.0186	0.0137	0.0205	0.0186
DID, only 2002 transitions	0.0034	0.0017	-0.0002	0.0034	0.0017	-0.0002
Females: Stock Market Participation						
DID interaction with age	0.0001	0.0003	0.0005 *	0.0001	0.0003	0.0005 *
DID interaction with education length	0.0010	0.0002	0.0002	0.0010	0.0002	0.0002
DID, only 1999 transitions	0.0142	0.0184	0.0166	0.0142	0.0184	0.0166
DID, only 2002 transitions	0.0121	0.0087	0.0080	0.0121	0.0087	0.0080
Males: Portfolio Riskiness						
DID interaction with age	0.0008	0.0009 *	0.0008 *	0.0008	0.0009 *	0.0008 *
DID interaction with education length	-0.0056 **	-0.0066 **	-0.0068 **	-0.0056 **	-0.0066 **	-0.0068 **
DID, only 1999 transitions	-0.0425	-0.0542 *	-0.0495 *	-0.0425	-0.0542 *	-0.0495 *
DID, only 2002 transitions	-0.0272	-0.0407 *	-0.0424 *	-0.0272	-0.0407 *	-0.0424 *
Females: Portfolio Riskiness						
DID interaction with age	-0.0003	-0.0001	-0.0003	-0.0003	-0.0001	-0.0003
DID interaction with education length	0.0003	-0.0007	-0.0007	0.0003	-0.0007	-0.0007
DID, only 1999 transitions	-0.0318	-0.0352	-0.0335	-0.0318	-0.0352	-0.0335
DID, only 2002 transitions	0.0080	0.0030	0.0022	0.0080	0.0030	0.0022

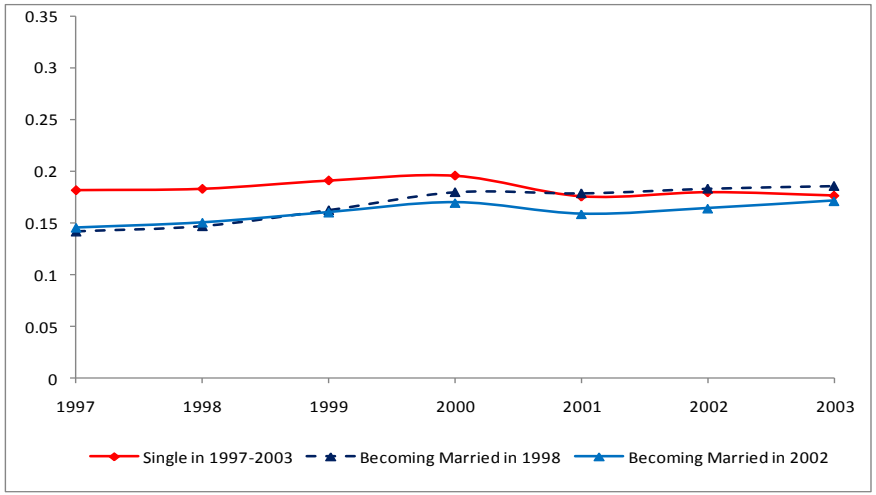
Notes: The table shows the DID interactions with age and education length and the DID estimates (OLS estimations) for the stock market participation and portfolio riskiness when investors change marital statues. */** indicates significance at 5%/1% level of significance.

Figure 1: Stock Market Participation

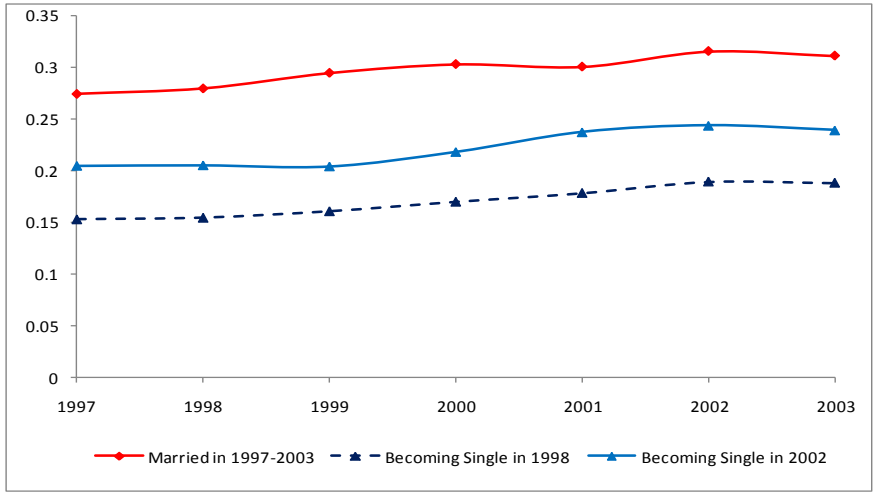
a. Males, Single to Married



b. Females, Single to Married



c. Males, Married to Single



d. Females, Married to Single

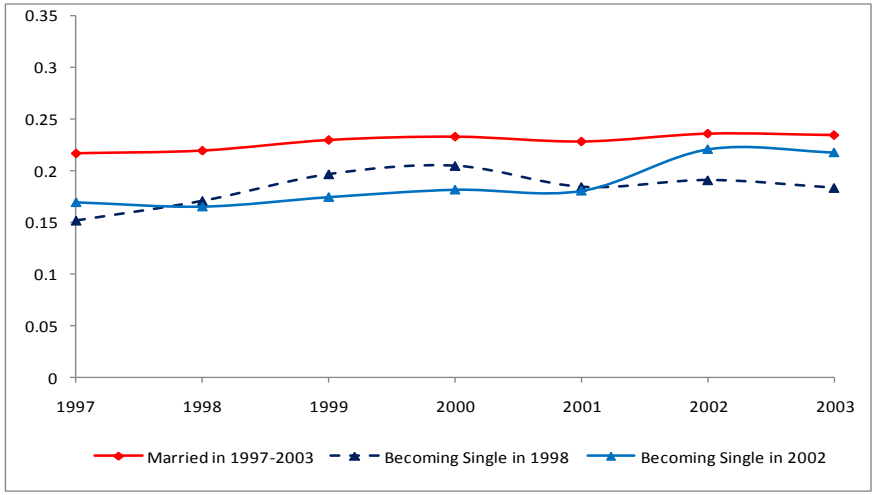
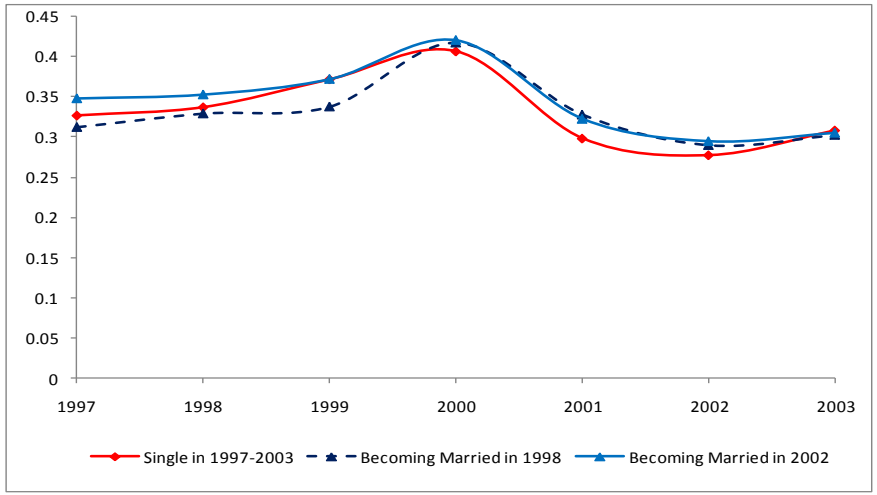
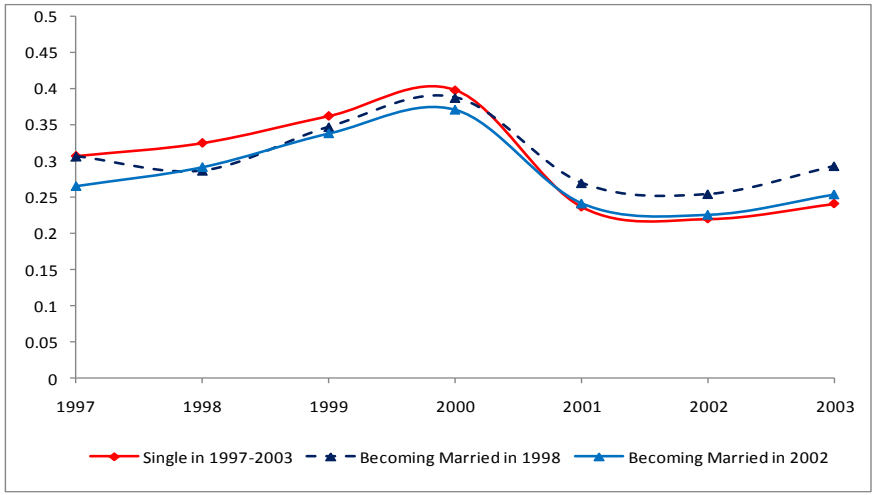


Figure 2: Portfolio Riskiness

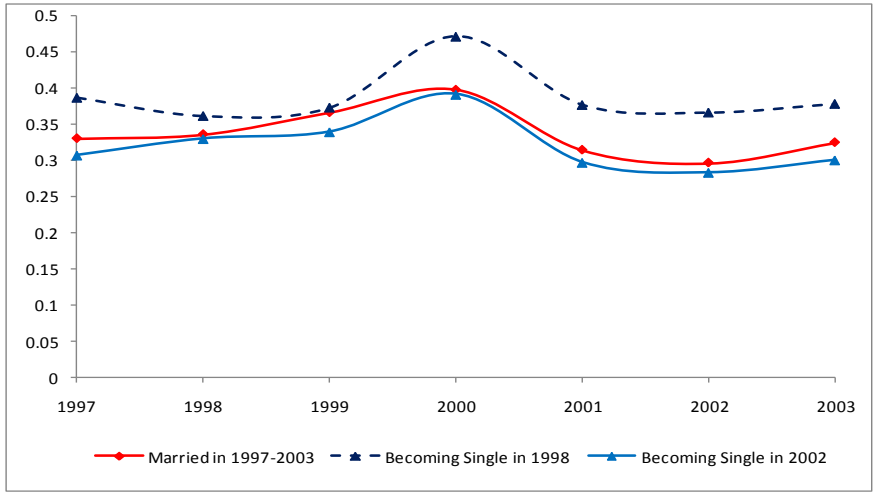
a. Males, Single to Married



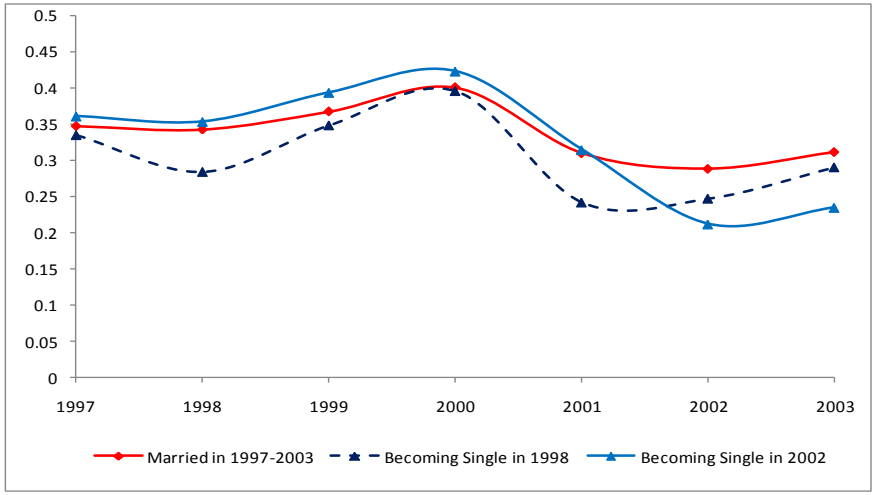
b. Females, Single to Married



c. Males, Married to Single



d. Females, Married to Single



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