A New Estimate of Marital Disruption in the U.S., 1860 – 1948

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December 2008

Abstract: Divorce rate is a poor indicator of marital instability because many marital disruptions never become divorces. This paper provides the first estimate of the rate of marital disruption in the U.S. in 1860 – 1948. Marital disruption rate was similar to divorce rate after the Civil War but the two rates wildly diverged in the early 20th century. In 1900 – 1930, the disruption rate was as much as double the divorce rate, implying that perhaps half of all disruptions never reached the court. In the long run, the cohort rate of marital disruption increased from about 10% in the mid-1860s to about 30% in the 1940s.

Key words: marital disruption, desertion, separation, divorce

[a]I thank George Alter, Jeremy Atack, Howard Bodenhorn, Hannah Brueckner, Tom Mroz, Charles Thomas and participants of the Social Science History Association conference in Miami, October 2008, for their valuable feedback. All errors are mine. Author address: Tomas Cvrcek, John E. Walker Department of Economics, Clemson University, 222 Sirrine Hall, Clemson, SC 29634; tcvrcek@clemson.edu; phone: (864) 656-1154; fax: (864) 656-4192

1. Introduction

Divorce and widowhood are two relatively public ways a marriage can end. For a long time in American history, they have been subject to at least some level of public record keeping – even if the accuracy of the resulting statistics may be debated (U.S. Bureau of Census, 1909: 6; Reiss, 1976: 308; Haines, 1998; Haines, 2006). Overwhelming historical evidence suggests, however, that many marriages ended long before the coroner or divorce judge became involved[1] and that frequently, both parties had their reasons to keep silent about their marital disruption (Porter Benson, 2007; Schwartzberg, 2004, 2007).[2] The general recognition among social scientists that a large numbers of failed marriages passed entirely "under the legal radar" has been traditionally accompanied by an equally widespread skepticism about the retrievability of any reliable estimate of the actual rate of marital disruption (Brandt, 1905: 10; Crosby, 1980: 54; Eubank, 1916:22; Plateris, 1973: 15; Price-Bonham and Balswick, 1980: 966; Igra, 2007: 75). Without a more precise idea about the prevalence of desertion and separation, the analysis of many aspects of marriage becomes difficult. In the period from 1860 to 1948, family life was undergoing fundamental change, one aspect of which was a change in the way a marriage could end. The greater is the number of desertions and separations that never become legal divorces, the less reliable are divorce statistics as a gauge of overall marital instability. That is why an estimate of the rate of marital disruption inclusive of desertion and separation is an important piece of the puzzle.

This paper offers just such an estimate. The cohort-specific rates capture the proportion of each marriage cohort from 1860 to 1948 that ended in eventual disruption – whether through actual divorce, through mutually agreed separation, or through the unilateral "poor man's divorce", i.e. desertion and abandonment (Eubank, 1916: 17 – 19; Igra, 2007: 77). From the cohort-specific proportions, I also

[1] Such evidence includes case files of the National Desertion Bureau of New York, established in 1911 (Igra, 2007), claims of "contesting widows" for deceased husbands' pensions from the Union Veterans records (Schwartzberg, 2004), court records from cases prosecuting bigamy, studies conducted by local charities in numerous American cities and other sources.
[2] In this paper, I use "marital disruption" as an umbrella term denoting all the various ways in which a marriage effectively ends (e.g. desertion and abandonment, separation as well as divorce), other than widowhood.

impute annual rates of disruption and compare them to annual rates of divorce. The main conclusions emerging from the estimation are that the marital disruption rate was relatively close to the divorce rate right after the Civil War, but that the two rates wildly diverged in the early 20th century. Throughout the 1910s and 1920s, the disruption rate was as much as double the divorce rate, implying that perhaps half of all marital disruptions during this time never reached the court. The two rates then converged by the time of the Second World War. The long-run trend was for the proportion of marital cohort ending in marital disruption to increase from about 10% in the mid-1860s to about 30% in the 1940s. The estimates are constructed using data on mortality, size and age composition of individual marriage cohorts and on information, obtainable from the censuses of 1900, 1910 and 1950, regarding the survival of marriages from each marriage cohort – all demographic variables. No economic or social variables are directly used in the estimation. Whatever sensitivity the disruption estimates may have with respect to such variables, it is unlikely a product of the estimation methodology but rather a reflection of actual influence of the economy and society on the success of individual marriages.

2. Direct historical evidence on marital disruption

The two main direct sources regarding marital instability in 1860 – 1948 were charity studies[3] and official divorce statistics (U.S. Bureau of census, 1909). Both are useful in providing general stylized facts but as sources of reliable data, they are piecemeal and ridden with problems. The charity research usually consisted of isolated city-specific studies based on cases of deserted women seeking aid. Their samples were unrepresentative due to self-selection (as they included only aid recipients) and provided only a snapshot of the problem at one point in time. Yet in many aspects they all presented similar picture: incidence of desertions declined with duration of marriage (Brandt, 1905; Marquis, 1916; Zunser, 1929), husbands overwhelmingly were the deserting party (Eubank, 1916: 14;

[3] See, for example, Smith (1901) for Boston, Britton (1916) for Cook County (Chicago), Marquis (1916) for Kansas City, Zunser (1929) for New York City. Brandt (1905) works with data provided by charities from several cities. Eubank (1916) is a meta-study of much of the city-specific research.

Zunser, 1929: 101), and the most frequently cited immediate causes of desertion were the pregnant wife's confinement (Smith, 1901: 4; Brandt, 1905: 35), a quarrel (Marquis, 1916) and the husband's drinking spree (Zunser, 1929: 103; Brandt, 1905: 35).

Desertion also appears in published divorce statistics. Divorce proceedings were fault-based throughout the relevant period.[4] 'Desertion and abandonment' was the most cited primary ground of divorce, accounting for about 40% of all divorce cases between 1867 and 1906 (U.S. Bureau of Census, 1909: Table 22). Its share declined to about 17% by 1950 (Jacobson, 1959: Table A25). However, it was also the most frequently abused legal ground for divorce, particularly by colluding spouses who hoped to secure a divorce decree at a time when courts were most unsympathetic to a mutually agreed divorce (Eubank, 1916; Britton, 1916). Even those divorces that were rightfully granted for desertion and abandonment were only a belated legal recognition of a marital disruption that had occurred several years earlier because many states had statutory provisions that the abandonment had to last two to five years before it was admissible as a legal ground for divorce.[5] Divorce was also costly in terms of time, money and prestige and so the poorer strata of the society often resorted to simple desertion and abandonment – the "poor man's divorce" – which often went unrecorded (Crosby, 1980: 53).[6] Thus, historical divorce statistics are inaccurate and insufficient indicators of the overall level of marital instability. Not only do they probably capture just a limited

[4] The grounds for divorce varied from state to state. One extreme was South Carolina which outlawed divorce altogether in 1878; the other extreme was Nevada where divorce was considered very easy. A great majority of states recognized several grounds for divorce, most frequently including adultery, desertion and abandonment for a stated period of time, cruelty, drunkenness, conviction of felony and neglect to provide (U. S. Bureau of Census, 1909: 264 – 328).

[5] Rhode Island was the state that required a desertion of five years as admissible grounds for divorce. The statute also stated, however, that the court had the discretion to grant divorce for shorter desertions (U. S. Bureau of Census, 1909: 317 – 318).

[6] In his dissertation on desertion, Eubank (1916: 22) summarized the motivation for silence among deserted women thus: "Except in occasional instance we have no way of getting information regarding deserted women who, for various reasons, may desire to refrain from making public record of having been forsaken: wives who, because of the disgrace of it, are not willing to have their status known; wives who, because of the fear of reprisals on the recreant husbands, do not dare to resort to legal means to bring them to task; wives who maintain silence because of preferring their absence to their presence; wives who for very loyalty to the disloyal absent ones shield them by not speaking; wives who would report their case if they only knew how to go about the perplexing business. How many of these there are and how their numbers might swell, we have no means of knowing."

portion of all failed marriages, they also record the disruption with a delay, introduced by the slow operation of the courts (Plateris, 1973: Table 16).

3. The method of estimation

Given how unreliable and incomplete the direct sources can be, I propose to estimate the disruption rate indirectly, by way of an accounting exercise. At any point in time, a marriage must be in one of three states: 1. still intact, 2. terminated through death of one of the spouses (widowhood), or 3. ended through desertion, separation or divorce (disruption). Moreover, if we follow a marriage cohort for a sufficiently long time, sooner or later all marriages will end either through death (state 2) or through disruption (state 3). Thus, if we have a good estimate, at some point in time, of the proportion of a marriage cohort falling into two of the three states, we can infer the proportion falling into the third.

[Figure 1 here]

Figure 1 provides a stylized depiction of the lifetime experience of a marriage cohort of size M, married at time $\tau = 0$. As time goes on, death and disruption take their toll until at τ^* the cohort of marriages becomes extinct. Over the whole cohort lifetime, a proportion ω of these marriages end in widowhood while a proportion π ends in disruption. The relative size of these two proportions will, of course, depend on many factors, among them the time profiles of the competing risks of widowhood and disruption.[7]

The fraction of disrupted marriages, π, is the indicator of interest. Its estimation requires combining data from several sources. As the diagram illustrates, the four crucial pieces of evidence used in estimation are (i) the initial size of marriage cohort, M, (ii) the size of the marriage cohort still intact at some point after the time of marriage, such as at τ_{census}, (iii) the age/time profile of the risk of

[7] In that respect, Diagram 1 reflects the understanding that the risk of disruption is relatively higher in the initial years of marriage while the risk of widowhood becomes more acute in later years of marriage when a couple can be expected to be of high age (Jacobson, 1949).

widowhood and (iv) the duration profile of the risk of disruption. As it happens, such information is available or can be reasonably estimated for the period from 1860 to 1948.

Estimation of the cohort rates of disruption is an iterative process starting from a naïve estimate of $\pi = 0$ (i.e. the first guess is that no marriages were disrupted and all marriage dissolutions can be accounted for by death of one of the spouses). Thus, in the first iteration, a marriage cohort is simply "survived", using the relevant mortality rates and age composition, between the year of marriage and the census date and the resulting imputed proportion of marriages still remaining is compared to the actual proportion of intact marriages observed in the census. The difference between the two – the marriages neither in the census nor accounted for by the incidence of widowhood – is used to update the proportion of marriages disrupted and used in the second iteration. The iterations run until the process converges.

The estimation process requires some specification of how marital disruption depends on duration of marriage because, at the moment of census, each marriage cohort is captured at a different point in its lifecycle. Thus, with the exception of the very oldest marriages, any given number of intact marriages at the moment of census can be expected to contain some non-zero proportion of couples destined for disruption after the census. The duration profile allows the conversion of a snapshot of the incidence of disruption up to the moment of census into an estimate of a life-time percentage disrupted, π. For example, if the duration profile of disruption risk specifies that 75% of all of a cohort's lifetime disruptions occur before the eleventh year of marriage and the computations show that, as of 1950, 9% of all 1939 marriages have been disrupted, then one can estimate that a total of 12% (= 0.09/0.75) of all 1939 marriages will end up in disruptions over the life cycle of the marriage cohort.

4. Data and adjustments

4.1. Size of marital cohorts

The size of each marital cohort was obtained from Jacobson (1959: Table 2). The same data are also cited in Plateris (1973: Table 1). Jacobson (1959) obtained the number of marriages for 1867 – 1956 from National Office of Vital Statistics and estimated those for 1860 – 1866 himself. These numbers are totals of marriages solemnized on American soil in a given year. Thus, they can tell us nothing about the marriages of immigrants who already came to USA married.

4.2. Intact marriages at τ_{census}

The proportion of a marriage cohort that is still intact at a point in time after marriage is estimated with the aid of IPUMS (Ruggles et al., 2007) and of the totals from Jacobson (1959). Three US censuses – those in 1900, 1910 and 1950 – included a question about duration of current marriage (variable DURMARR).[8] In all three instances, enumerators were asked to record completed years of marriage.[9] Based on the reported duration of marriage, one can assign each marriage recorded in the census to a specific marriage cohort.

A few issues of definition and delimitation need to be addressed, however. One is the distinction between "native" marriage (that is, one solemnized on American soil) and "foreign" marriage. I exclude foreign marriages because α, the proportion of intact marriages at τ_{census}, is calculated out of Jacobson's estimates of native marriages. As a rule, I consider a marriage to be foreign if the reported duration of marriage is strictly greater than the reported years in the United States (variable YRSUSA1) of either of the spouses. The foreign marriages amounted to about 6-7% of all marriages in 1900 and 1910. The variable YRSUSA1 is not available in the census of 1950, so there it was impossible to distinguish between native and foreign marriages. However, most foreign marriages in the 1900 and 1910 censuses were marriages of immigrating families and since

[8] The 1950 census asked the question only of sample-line respondents.
[9] In 1900 and 1910, only those currently married were asked the question about duration, although the 1900 enumerator instructions allowed that widowed and divorced respondents may volunteer information about the duration of their marriage before death of spouse or divorce. The 1950 census asked more generally about the duration of current marital status, whether that be marriage, widowhood or being divorced.

immigration was low throughout the interwar period, it is unlikely that the foreign marriages constituted a large share of total marriages in the 1950 census.

Another issue – even more complex – is to determine more precisely which marriages are truly intact. The marital status variable (MARST) distinguishes between respondents who were "married, spouse present" and those who were "married, spouse absent". The latter is an imputed value assigned to those who reported to be "married" but for whom a statistical program could not locate a spouse in their household. To what extent can such a lonely spouse be considered to live in an intact marriage? Absence of a husband or wife can be due to many things – seasonal employment, incarceration, attendance at a far-away college – none of which need to imply that the marital bond has been broken. However, one could also be "married, spouse absent" as a result of desertion and abandonment. There is no clear-cut line between the two cases.[10] The truth probably lies somewhere in between: some but not all "married, spouse absent" respondents were probably already deserted but were unaware of their unfortunate predicament. I provide separate estimate for either measure of intact marriage and discuss this issue further in section 5.

The precision with which duration of marital status was recorded varied from census to census. The exact date of the census is important in interpreting data. The 1900 census was taken as of 1st June, the 1910 census as of 15th April and the 1950 census as of 1st April. In all three instances, the enumerators were instructed to record full completed years of duration. Strictly speaking, a person who reported to have been married for, say, 16 years in the 1900 census would be expected to have married some time between 1st June 1883 and 31st may 1884, so it is not clear a priori whether this marriage falls into the marital cohort of 1883 or 1884. A further complication is that the recall error

[10] Eubank (1916: 38) notes that desertions may in fact be quite gradual: "Desertion is by no means always intentional. Previous separations for a perfectly legitimate character may wean husband from wife and grow gradually – almost accidentally – into desertion. This form of desertion is most likely to appear when the nature of a man's employment takes him away from home for extended periods…. Unemployment may lead the bread-winner into distant towns or states in search of occupation. Failure to find it may keep him going further afield. A sense of shame possibly will restrain him from returning home with empty pockets." It would be extremely hard, if not impossible, to pinpoint, in this slow drift, the precise moment when a long term absence turns into a desertion.

probably increased with age of the respondents and duration of marriage. Plotting the totals of married population against marital duration revealed considerable amount of heaping at multiples of five – especially for couples who had been married for more than a decade. To correct for both problems, I assign 7/12 of the marital cohort to year 1883 and 5/12 to year 1884 and I smooth the resulting series using a 5-year centered moving average. Similar approach is applied to data from the 1910 and 1950 censuses with a view to the precise date of each census.

[Figure 2 here]

One exception to this correction is the 1940s. In Figure 2, total marriages display considerable variation during this decade. Plotted are also two measures of intact marriages surviving to the 1950 census where each marriage was assigned to a marriage cohort without any correction (i.e. the year of marriage was calculated as 1950 – DURMARR). The downswing in Jacobson's estimates from 1942 to 1944, the explosion of 1944-46 and another decline in 1946-49 is clearly reproduced in the census data. Applying the specified correction for the date of the census (1st April 1950), i.e. lagging three quarters of each marriage cohort by one year, would actually produce non-sensical results for the 1940s: for example, the number of 1945 marriages still intact in 1950 would then be higher than the total marriages solemnized in 1945. Thus, for the period 1942 – 1949 I retain the uncorrected census results.

Note, however, how different the situation is for the 1930s. Jacobson's estimates reach a trough in 1932, then there is a sharp upswing to 1934 and further growth until, in 1938, marriages decline again. This development, too, finds a counterpart in the census data – but misaligned by one year: the uncorrected intact marriages bottom out in 1933, the sharp upswing ends in 1935 and the latter decline occurs in 1939. Here, correcting for the fact that the 1950 census was taken as of 1st April and that therefore about three quarters of intact marriages have to be lagged by one year produces the proper alignment.

Finally, couples who have only recently been married (under 3 years) seem to be very deficient in reporting their marital duration, so in my estimation, I omit cohorts married within two years of the census.

4.3. Incidence of widowhood

I exploit the age information in IPUMS to reconstruct the age distribution of wives and husbands in each marital cohort.[11] Using sixteen 5-year age bins (from 10-14 years to 85+ years of age), I split each marriage cohort into 16x16 cells on the basis of husband's and wife's age. This allows me to pay relatively close attention to the age of spouses, when applying the mortality rates.

The incidence of widowhood was estimated from the available information on mortality during the period in question. Age-specific death rates by sex for 5-year age intervals come from the Historical Statistics of the United States (Carter et al., 2006: Ab 988 – 1047) for each year from 1900 onwards. These were converted into mortality rates (probabilities of death) using the relevant formula from Siegel and Swanson (2004: 289) and used to calculate the probability of a marriage ending in widowhood in a given year, given the age of wife and of husband.

For the 1860 – 1900 period, I used data from the U.S. mortality model presented in Haines (1998). Haines' 5-year life tables, separate for men and women, are available at decadal intervals so the years between decades had to be interpolated. In order to capture the year-to-year variation in mortality, I applied the fluctuations in Massachusetts infant mortality (Carter et al., 2007: Ab 928) to the decadal trend in mortality in Haines' life tables. Since the age categories in these life tables do not extend higher than 75-79 years, I calculated the mortality for 80-84 year-olds and 85+ year olds on the assumption that the ratios between mortalities of these three age groups are roughly constant.[12] At any

[11] This, of course, is only possible for couples where both spouses are present, thus it is based on respondents who were "married, spouse present."

[12] For example, the data for 1900-1950 indicate that death rates of 80-84 year olds are on average 1.5 times higher than the death rates of 75-79 year olds. Moreover, this ratio is quite stable ($\sigma = 0.04$).

rate, the death rates of these old age groups have very little effect on overall estimation since only very few couples – even in the oldest marriage cohorts – fall into these age groups.

Adjustment needs to be made for the mortality differential between married men and women and the general population. Information on the mortality premium can be obtained from Willcox (1933: 109) for the period 1924 – 1928 and from Grove and Hetzel (1968: Table 57) for 1940, 1950 and 1960. The published volumes for the 1890 and 1900 census also contain some information about death rates by marital status but these data mostly predate proper death registration and their reliability is often questioned (Haines, 2006). By and large, however, the mortality differentials emerging from the 1890 – 1900 census death rates correspond with the mortality differentials observed in Grove and Hetzel (1968) (see Table 1). In order to adjust the general mortality risk for the mortality premium accruing to married men and women I therefore apply the 1890 premia to death rates in 1860 – 1890, the 1900 values to death rates in years 1900 – 1910, the 1924-28 values for the period 1920-1930 and I interpolate in the remaining periods. Generally, the probability of a marriage terminating in a given year *t* through death of either of the spouses is calculated as

$$P_t(widowhood) = P_{Ht}(death|age_H) + P_{Wt}(death|age_W) - P_{Ht}(death|age_H)P_{Wt}(death|age_W)$$

where the subscripts *H* and *W* denote husband and wife.[13]

[Table 1 here]

4.4. Duration profile of marital disruption

A duration profile of marital disruption is necessary to convert the rate of disruption at a particular point in time into a lifetime disruption rate. Given that desertions often leave no paper trail or other record (see n. 6 and 11) one must rely on available data on divorces which are subset of all disruptions. This raises the question to what extent are the disruptions-turned-divorces representative of disruptions generally. Those who eventually get divorced may be a self-selected group. Castro

[13] Note that this formula implicitly assumes that the probabilities of each spouse's death in a given year are independent of each other.

Martin and Bumpass (1989: 40) claim, for example, that older women with no interest in remarriage may never follow a separation all the way to a divorce. The problem of self-selection could be potentially more severe for the period of late 19th and early 20th century when divorce was a more cumbersome procedure than it is today. Since one of the primary benefits of divorce was to sort out property arrangements among former spouses, divorce held grater appeal to propertied couples while the poorer ones more often resorted to desertion, the "poor-man's divorce". Another selection mechanism is the length of divorce proceedings which can vary from couple to couple: thus when we observe two couples in the same divorce cohort it does not follow that they both separated at the same time or after the same number of years (even if they both belonged to the same marriage cohort).

[Figure 3 here]

In view of these selection issues, it is reassuring that the cumulative distribution of duration to separation is very stable in time (see Figure 3).[14] The general shape corresponds to that of an exponential distribution where $F(t,r) = 1 - e^{-rt}$ for $t \geq 0$. It is steepest in the early years of marriage which is in agreement with the claims of numerous researchers that the risk of separation is highest in the first years of marriage and that it monotonically declines in duration of marriage (Monahan, 1962; Plateris, 1973). Using data on couples divorced in 1977, Plateris (1981: 7 – 10, Figure 5) notes that separations occurred modally in the first year and that the distribution of all divorces by duration to separation is a decreasing function. This pattern holds in 11 of the 15 states he lists (Plateris, 1981: Table 5). It appears in the charity data collected by Marquis (1915), too. U.S. Bureau of Census (1909) also indicates that the pattern seems to hold across states.

Not only is the general pattern the same across time and place, the actual proportions of (ultimately divorced) marriages disrupting in particular intervals of duration are very close: about 14% of all marriages that eventually end up divorced separate in the first year of marriage and about three

[14] Duration to separation was apparently not tabulated between 1907 and 1975 even for those couples who eventually got divorced.

quarters of all such disruptions occur in the first eleven years of marriage. Since the pattern is very stable across the 20th century, it is plausible that the problem of self-selection is not very severe: the duration profile of separation is the same among divorced couples in the 1970s and 1980s (when presumably a high proportion of all disrupted marriages ended in divorce) as it was in 1887 – 1906 (when divorce was relatively more expensive and so a smaller proportion of failed marriages could be expected to make it to the court).

I adopt the exponential distribution as a basis for the duration profile. Its sole parameter, *r*, is estimated simply by finding the best fit to the fifteen duration profiles presented in Figure 3. This produces fifteen estimates of *r* ranging from 0.1305 to 0.1346, all with standard errors below 0.0023. I choose $r = 0.133$ which would comfortably fall within the 95% confidence interval around any of the fifteen estimates. The duration profile therefore takes the form $F(t) = 1 - e^{-0.133t}$.

This one-size-fits-all profile, applied to all cohorts regardless, obviously ignores many finer points of the dynamics of marital disruption. It does not take into account the age of spouses at marriage (younger couples are more unstable), the age difference between spouses (high differences tend to destabilize marriage), the order of marriage (second and higher-order marriages are less stable than first marriages), income and living standards of a couple (risk of marital disruption weakly decreases with income), existence of children prior to marriage (increases the risk of disruption). Moreover, it is based on cross-sectional data, yet it is applied to each cohort throughout their lifetime. However, considering the relative scarcity of comprehensive data on marriage disruptions in the past, the adopted methodology is perhaps the closest one can get to actually estimating the rate at which historical marriages failed.

5. Results and sensitivity

The estimated proportion of each cohort ending in marital disruption, $\hat{\pi}$, is presented in Table 2, in columns (3) and (4), and in Figure 4 (baseline estimate). Given that the estimation inevitably

contains some amount of error in spite of all the adjustments, a three-year centered moving average is also depicted in order to highlight the underlying trend. Period-specific rate of disruption is in column (8) of Table 1 and also in Figure 5. The most general finding is that the proportion $\hat{\pi}$ exhibits a long-term increasing trend from under 10% in the 1860s and 1870s to 30% in the 1940s. There was, however, considerable fluctuation around this long-term increase. The proportion ever disrupted was clearly much more volatile than the proportion ever divorced, as calculated by Preston and McDonald (1979). From the late 1860s, $\hat{\pi}$ increased only slowly and stayed relatively close to the proportion ever divorced. After 1889, however, there is a noticeable increase in the gradient which becomes even steeper after the turn of the century. Between 1905 and 1930 the proportion ever disrupted consistently stayed above 20% (with the exception of the 1918 marriage cohort which married during the Spanish flu epidemic) and, even more importantly, high above the cohort divorce rate so that in some marriage cohorts (1906, for example) a full half of all marital disruptions never came to any legal closure. This arc of high cohort disruption rates from 1900 to 1930 is a very robust result of the estimation, as is the plunge we can observe during the Great Depression. Another decline in 1938 again corresponds to an economic downturn. Cohort propensity to marriage disruption was clearly closely linked to the economic conditions at the time of marriage.

[Table 2 and Figure 4 here]

Using the disruption profile, specified in section 4.4., I converted the cohort rates into period rates of disruption (Figure 5). In its basic outlines, the graph is similar to cohort rates because a majority of disruptions occur in the first five years of marriage. The period disruption rate also grew vigorously in the first two decades of the 20th century, excepting a dip during the epidemic of 1918 – 1919. After a peak in 1923, there was a gradual decline which turned into a dive with the onset of the Great Depression.

[Figure 5 here]

The precision of these marital disruption rates depends on the precision of inputs. They are most sensitive to variation in mortality rates, somewhat sensitive to variation in the proportion intact and least sensitive to variation in duration profile. However, the underlying movements in disruption rates are not affected by any of these variations.

The sensitivity to proportion intact is apparent from Figure 6. The late 19th century marriage cohorts can be observed both in the 1900 census and in the 1910 census. This allows the construction of two independent estimates based on the two census data sets which ideally would yield near-identical results. As Figure 6 shows, between 1882 and 1896 the estimates are relatively close and highly correlated but for the period 1868 and 1881 the two estimates diverge. What is presented in Table 2 and Figure 4 as the "baseline estimate" takes the values generated from the 1900 census data for the period 1860 – 1881 and a linear combination of the two series in Figure 6 for the 1882 – 1896 period.

[Figure 6 here]

The baseline estimate is also constructed on the assumption that intact are those marriages where both spouses are present ("married, spouse present"). If an alternative definition was used, where all respondents reporting to be married, regardless of the presence of a spouse, were considered a part of a functioning intact marriage, the resulting estimates would be about 3 to 4 percentage points lower, as shown in Figure 7. This is not surprising, given that "married, spouse absent" responses represent about 4% of all marriages in a cohort. The problem with this broader definition is that it produces negative results, which is conceptually impossible. Moreover, the respondents who are married but whose spouse is not reported to live with them are inevitably suspect of misreporting which can be quite widespread particularly among respondents who are ashamed (for whatever reason) of their real marital status (Preston and McDonald, 1979: 8). Contrast this with the "married, spouse present" responses which can be easily verified by checking the census record of the household for the spouse. The disparity between all marriages and marriages with present spouses is not as large in the

1950 census because the census allowed for a "separated" response which apparently absorbed close to a half of what in other censuses would be "married, spouse absent" respondents.

[Figure 7 here]

The high sensitivity of the estimate with respect to mortality is given by the fact that when cohorts are survived from marriage to census the probabilities of widowhood are compounded. Thus, even a small increase in mortality can produce large changes in the estimated proportion disrupted. In Table 3, I present, by way of example, the results of estimation based on the 1950 census data with the mortality rates varied by +/-10%. Of course, such variation greatly impacts the earliest cohorts where the compounding has the largest effect: having a 10% higher probability of death at every year throughout the cohort's lifetime decreases the estimated disruption rate by 7 percentage points. The effect gets smaller as one moves to cohorts closer to 1950.

[Table 3 here]

A similar +/-10% variation in the parameter *r* which governs the duration profile of marital disruption has the opposite effect: it most strongly affects the most recent cohorts. These cohorts have only been married for a short time as of the date of the census and any inference about their lifetime rate of marital disruption is open to relatively larger error than it is in case of cohorts that have most of their disruptions behind them. Even so, the range is the greatest for the marriage cohort of 1946 where the estimated disruption rate varies by +/-4 percentage point.

6. Further conceptual issues

As the discussion already showed, it is much harder to empirically establish the reality of a marital disruption than it is of a divorce. The census is only a snapshot of the population, taken every decade. It therefore provides insufficient or inaccurate information about many aspects of the population's evolution between census years. In the case of marital disruption, this presents a particular problem in those cases where a separated couple may reunite after some – potentially even relatively

extensive – period of time. Since, legally, such movement would not change the marital status of the couple, who would be observed in a census year as an intact marriage, there is no way to know how many and how long such intermittent disruptions were. As a result, the disruption statistic could seriously underestimate the incidence of marital disruptions.

Intermittent disruption is, of course, still a disruption in the same way that a divorced couple can remarry each other a few years later and their divorce still rightfully appears in the divorce statistics. However, the nature of the marital situation in cases of repeated short-term desertions need not be as clear-cut as it is with divorces which become a statistic at the strike of the gavel. Families, where the husband leaves regularly at the time of his pregnant wife's confinement and comes back shortly thereafter (Smith, 1901: 4), though obviously dysfunctional, are clearly not failures in the same way as those where a husband is gone for, say, five years and counting. Eubank (1916: 41 – 45) argues that the "intermittent husbands" – the chronic, repeat deserters – in fact, do not wish to end their marriage: they rather use it as a spring-board for occasional (sometimes regular, periodic and even seasonal) but relatively short-term absences. Such marriages could probably be regarded as still intact, if dysfunctional, and it is likely that such intermittent husbands would be recorded in the census as living with the family. On the other hand, in those cases, where the separation has been long term – such as over a year – a firmer inference can be made that both spouses have probably come to regard the marriage as *de facto* terminated.

The second issue is that period from 1929 to 1940 presents a seeming paradox: in those cohorts, there seem to be fewer lifetime disruptions than there were lifetime divorces, which is conceptually impossible, given that "disruption" is an umbrella term covering separations, desertions and divorces. The two series were calculated from different sources and using different techniques. Preston and McDonald (1979) obtained their estimates from the available evidence on divorces. American divorce statistics were consistently collected for period 1867-1906, the year 1916, the ten-year period from 1922 to 1932 and then again from 1949 until 1988. These government reports

included duration data at varying levels of precision.[15] Between the years covered by the government reports, estimates of total divorces granted in the United States are available from Jacobson (1959: Table 42) or Plateris (1973: Table 1) but not their distribution by duration. So, for the period 1933 – 1948, Preston and McDonald (1979) employed "linear interpolation between distributions of divorce by duration in 1927 – 31 and 1949 – 1953" (Preston and McDonald, 1979: 24). The period 1933 – 1948 happened to be the most volatile time in American marital relations. Figure 5 illustrates that the divorce rate went from 6.1 in 1933 to 18.2 in 1947, falling back to 11.6 in 1948. Marriage rate climbed from 56 marriages per 1000 marriageable women in 1932 to 120 in 1946 and fell to 98 by 1948. These wild gyrations in marriage and divorce indicate that estimates based on interpolation are likely to miss significant amount of variation and put too much stress on the underlying trends. Moreover, Jacobson's (1949: Figure 6) estimates of divorce rate by duration of marriage show that the Great Depression acted to reduce the divorce rate of relatively new marriages while leaving divorce rates of older marriages mostly constant. The reverse was true after the end of World War Two: divorce rates among young marriages spiked, while older marriages were mostly unaffected.

When all these factors combined, they likely introduced considerable variability to the duration distribution of divorces between 1933 and 1948: few marriages were celebrated during the Great Depression and those that proved unhappy were strongly discouraged from a divorce by the hard times – whereas struggling marriages from the 1920s were not as strongly discouraged. On the other hand, the late 1930s/early 1940s marriage cohorts were relatively large and they were much more divorce-happy in 1946 – 1948 than the marriages from the 1930s. In fact, even if the Great Depression marriages were as prone to divorce as the 1940s marriages, they would have contributed relatively little to overall divorces because these cohorts were 50% smaller than the 1940s marriage cohorts. For

[15] For example, U.S. Bureau of the Census (1909, Part II: Table 6) provides the number of divorces in every year from 1887 to 1906 for each year of duration from 1 to 49 years. U. S. Bureau of the Census (1934: Table 5), on the other hand, notes divorces by duration of marriage for years 1930, 1931 and 1932 but only for single-year durations of one to nine years and for five-year duration groups above that.

all these reasons the estimates of Preston and McDonald (1979) may understate the wild fluctuations of the Great Depression and the Second World War times and that could be why their cohort rates of divorce are higher than the present estimates of cohort rates of disruption.

Like the cohort measures of marriage failure, the period measures were also closely tied with the economy, as is clear from Figure 5 and columns (7) and (8) of Table 2. The economic stagnation of most of the 1880s coincides with only a mild increase in disruption rate. After the recession of 1894-95, when disruption rate also declined somewhat, one can see a new upward trend which becomes even more pronounced after 1900. The disruption rate naturally declines during the Great Depression: disruptions are most prevalent in early years of married life, so the small marriage cohorts of the 1930s produced relatively fewer disruptions and so a low disruption rate. The disruption rate increases throughout the 1940s, with the exception of 1945.

There are two brief periods, 1938 – 1940 and 1944 – 1947, when the divorce rate exceeds the disruption rate but unlike with cohort measure, this overtaking does not necessarily constitute a paradox: it merely indicates that marriages which broke down under the strains of the Depression or the War were only officially divorced a few years later. Generally, one can expect some delay between a separation and a divorce: it is therefore plausible to argue that many of the marriages which were disrupted in 1937 – 1944 were then converted into divorces in the immediately post-war years. This would also closely correspond with Jacobson's (1949) assessment that it was the most recent marriages that experienced a particularly strong spike in divorce rate in 1947.

The third important conceptual issue is that the estimation lacks any explicit specification of period effects. Some period effects, such as the influenza epidemic of 1918-1919, operate through the mortality rates which affect all the marriage cohorts that lived through it and as such are therefore accounted for in the estimation. Non-death-related period effects, however, are not controlled for. This shortcoming is the price paid for relying on the census (which is a snapshot at one point in time) to infer something about the respondents' course of life: the census presents an outcome shaped by both

cohort effects and period effects. But while the cohort effects can be separated (with the aid of variable DURMARR), the period effects cannot. This problem is partly offset by the shape of the duration profile: given that most marriage break-ups occur in the first few years of marriage, one can argue that the period effects exert their greatest influence on the most recent marriages and so in this way the period and cohort effects are basically conflated. To what extent is this offsetting influence a sufficient cure for this issue is unclear.

8. Conclusion

The estimates of marital disruption presented in this paper are the first serious attempt to quantify a grey area of marriage dynamics that historically occurred under the radar of the law. While marriage and divorce usually are a matter of public record, desertion and separation often went unrecorded. Using available information on mortality and census records on intact marriages, I infer that marriages that have neither ended in widowhood, nor remained intact, must have been disrupted – whether with the aid of the court or without it.

The estimates indicate that, in the marriage cohorts of the mid-1860s, about 10% ended up disrupted over their lifetime. This percentage was relatively close to the cohort divorce rate, indicating that a majority of disruptions were finding their way to the divorce court. However, the picture changed dramatically around the turn of the century when both cohort and period rates of disruption diverged from the rates of divorce. A growing proportion of marriages were disrupted without being divorced, leaving the spouses (especially wives) in a legal limbo and under a considerable economic and social strain. Not surprisingly, this period of rapidly increasing disruptions witnessed a proliferation of literature by social scientists, legislators and social workers on the problem of family desertion. It was only in the 1930s and 1940s when the rates of disruption and divorce converged again, first through a decline in the disruption rate (during the Great Depression), then through a concurrent increase of both. This probably reflects the fact that divorce was getting cheaper not only in

terms of time and money but also in terms of social prestige lost (as public acceptance of divorce became gradually more widespread).

As one of the oldest and most diverse human institution, marriage was always rich in aspects that stood aside from formal law. The estimated unrecorded marital disruptions provide a glimpse of how prevalent such extra-legal behavior may have been in the United States between 1860 and 1948.

Literature:

Brandt, Lillian. *Five Hundred and Seventy-Four Deserters and Their Families: A Descriptive Study of Their Characteristics and Circumstances*. New York City: the Charity Organization Society, 1905. Reprint edition: New York: Arno Press, 1972

Britton, Gertrude H. *Marriage and Divorce Analysis of Cook County Statistics For Years 1914 and 1915*. Bureau of Social Service Publication no. 1, Chicago, IL: Board of County Commissioners, Cook County, IL, 1916

Brockelbank, W. J. "Family Desertion Problem across State Lines," *Annals of the American Academy of Political and Social Science* 383: Progress in Family Law, May 1969: pp. 23 – 33

Carter , Susan B., Gartner, Scott Sigmund, Haines, Michael R., Olmstead, Alan L., Sutch, Richard, Wright, Gavin. *Historical Statistics of the United States: Millennial Edition*, Cambridge: Cambridge University Press, 2006.

Castro Martin, Teresa and Bumpass, larry L. "Recent Trends in Marital Disruption", *Demography* 26 (1), February 1989: pp. 37 – 51

Crosby, John F., "A Critique of Divorce Statistics and Their Interpretation," *Family Relations* 29 (1), January 1980: pp. 51 – 58

Eubank, Earle Edward. *A Study of Family Desertion*. Chicago, IL: Department of Public Welfare, 1916

Grove, Robert D. and Hetzel, Alice M. *Vital Statistics Rates In The United States, 1940 – 1960*. Washington, DC: National Center for Health Statistics, 1968

Haines, Michael R. "Estimated Life Tables for the United States, 1850 – 1910", *Historical Methods* 31 (4), Fall 1998, pp. 149 – 169

Haines, Michael R. "Chapter Ab: Vital statistics", in Carter , Susan B., Gartner, Scott Sigmund, Haines, Michael R., Olmstead, Alan L., Sutch, Richard, Wright, Gavin (ed.). *Historical Statistics of the United States: Millennial Edition*, Cambridge: Cambridge University Press, 2006, pp. 1-381 – 1-390

Igra, Anna R. *Wives without Husbands: Marriage, Desertion & Welfare in New York, 1900 – 1935*. Chapel Hill, NC: University of North Carolina Press, 2007

Jacobson, Paul H. "Total Marital Dissolution in the United States: Relative Importantce of Mortality and Divorce", in: George F. Marr (ed.). *Studies in Population; Proceedings of the Annual Meeting of the Population Association of America at Princeton, NJ, May 1949*, Princeton, NJ: Princeton University Press, 1949

Jacobson, Paul H. *American Marriage and Divorce*. New York, NY: Rinehart & Co, 1959

Liebman, Walter H. "Some General Aspects of Family Desertion," *Journal of Social Hygiene* 6 (2), April 1920: pp. 197 – 212

Marquis, Eva M. *A Survey of the Extent, Financial and Social Cost of Desertion and Artifically Broken Homes in Kansas City, Missouri During the Year 1915.* Kansas City, MO: Board of Public Welfare, 1916

Monahan, Thomas P. "When Married Couples Part: Statistical trends and Relationships in Divorce," *American Sociological Review* 25 (5), October 1962: pp. 625 – 633

National Center for Health Statistics. *Vital Statistics of the United States: 1975, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1979

National Center for Health Statistics. *Vital Statistics of the United States: 1976, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1980

National Center for Health Statistics. *Vital Statistics of the United States: 1977, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1981

National Center for Health Statistics. *Vital Statistics of the United States: 1978, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1982

National Center for Health Statistics. *Vital Statistics of the United States: 1979, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1984

National Center for Health Statistics. *Vital Statistics of the United States: 1980, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1985

National Center for Health Statistics. *Vital Statistics of the United States: 1981, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1985

National Center for Health Statistics. *Vital Statistics of the United States: 1982, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1986

National Center for Health Statistics. *Vital Statistics of the United States: 1983, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1987

National Center for Health Statistics. *Vital Statistics of the United States: 1984, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1988

National Center for Health Statistics. *Vital Statistics of the United States: 1985, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1989

National Center for Health Statistics. *Vital Statistics of the United States: 1986, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1990

National Center for Health Statistics. *Vital Statistics of the United States: 1987, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1991

National Center for Health Statistics. *Vital Statistics of the United States: 1988, Volume III – Marriage and Divorce*. Hyattsville, Maryland: National Center for Health Statistics, 1996

Plateris, Alexander A. *100 Years of Marriage and Divorce Statistics: 1867 – 1967*. Rockville, MD: US Department of Health, Education, And Welfare – National Center for Health Statistics, 1973

Plateris, Alexander A. *Duration of Marriage before Divorce: United States*. Hyattsville, Maryland: National Center for Health Statistics, 1981

Porter Benson, Susan. *Household Accounts: Working-Class Family Economies in the Interwar United States*. Ithaca, NY: Cornell University Press, 2007

Preston, Samuel H. and McDonald, John. "The Incidence of Divorce Within Cohorts of American Marriages Contracted Since the Civil War", *Demography* 16 (1), February 1979, pp. 1 – 25.

Price-Bonham, Sharon and Balswick, Jack O. "The Noninstitutions: Divorce, Desertion, and Remarriage," *Journal of Marriage and the Family* 42 (4), November 1980: pp. 959 – 972

Reiss, I. *Family systems in America* (2nd ed.). Hinsdale, IL: Dryden, 1976

Ruggles, Steven, Sobek, Matthew, Alexander, Trent, Fitch, Catherine A., Goeken, Ronald, Hall, Patricia K., King, Miriam and Ronnander, Chad. *Integrated Public Use Microdata Series: Version 3.0* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor], 2004.

Schwartzberg, Beverly. "'Lots of them did that': Desertion, Bigamy, and Marital Fluidity in Late-Nineteenth Century America", *Journal of Social History*, Spring 2004: pp. 573 – 600

Schwartzberg, Beverly. "Documenting Bigamy: Criminal Records and Other Sources", working paper 2007

Siegel, Jacob S. and Swanson, David A. *The Methods and Materials of Demography*, 2nd ed. Oxford: Elsevier Academic Press, 2004

Smith, Zilpha D. *Deserted Wives and deserting husbands: a study of 234 families based on the experience of the district committees and agents of the Associated Charities of Boston*. Boston: George H. Ellis, 1901

U.S. Bureau of the Census, *Marriage and Divorce, 1867 – 1906, Parts I and II*. Washington, DC: Government Printing Office, 1909

U.S. Bureau of the Census, *Marriage and Divorce, 1932*. Washington, DC: Government Printing Office, 1934

U.S. Bureau of Labor. *A report on marriage and divorce in the United States, 1867 to 1886 including an appendix relating to marriage and divorce in certain countries in Europe*. Washington: Govt. Print. Off., 1897

Weiss, Robert S. *Marital Separation.* New York: Basic Books, Inc., Publishers, 1975

Willcox, Walter F. *Introduction to the Vital Statistics of the United States, 1900 to 1930*. Washington: Govt. Print. Off, 1933

Zunser, Charles. "Family Desertion (Report on a Study of 423 Cases)", *Annals of the American Academy of Political and Social Sciences* 145, part 1: Law and Social Welfare, September 1929: pp. 98 – 104

Figure 1 – Widowhood and disruption in the lifetime of a marriage cohort

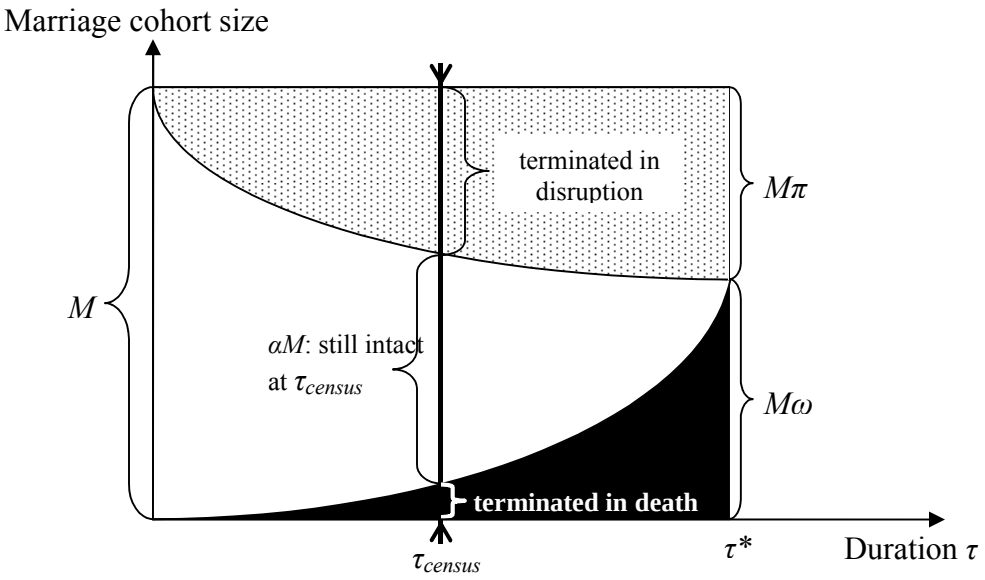
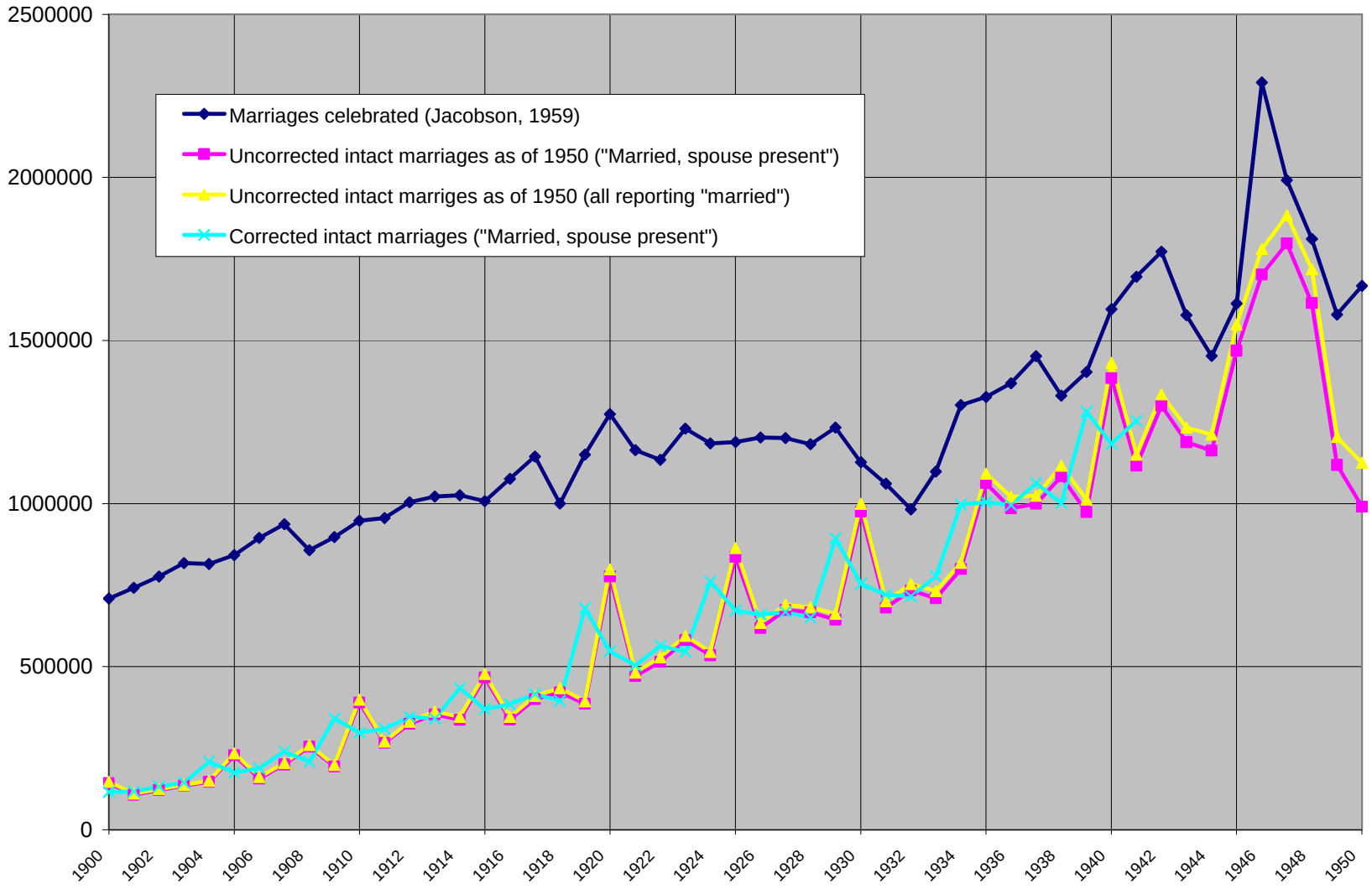
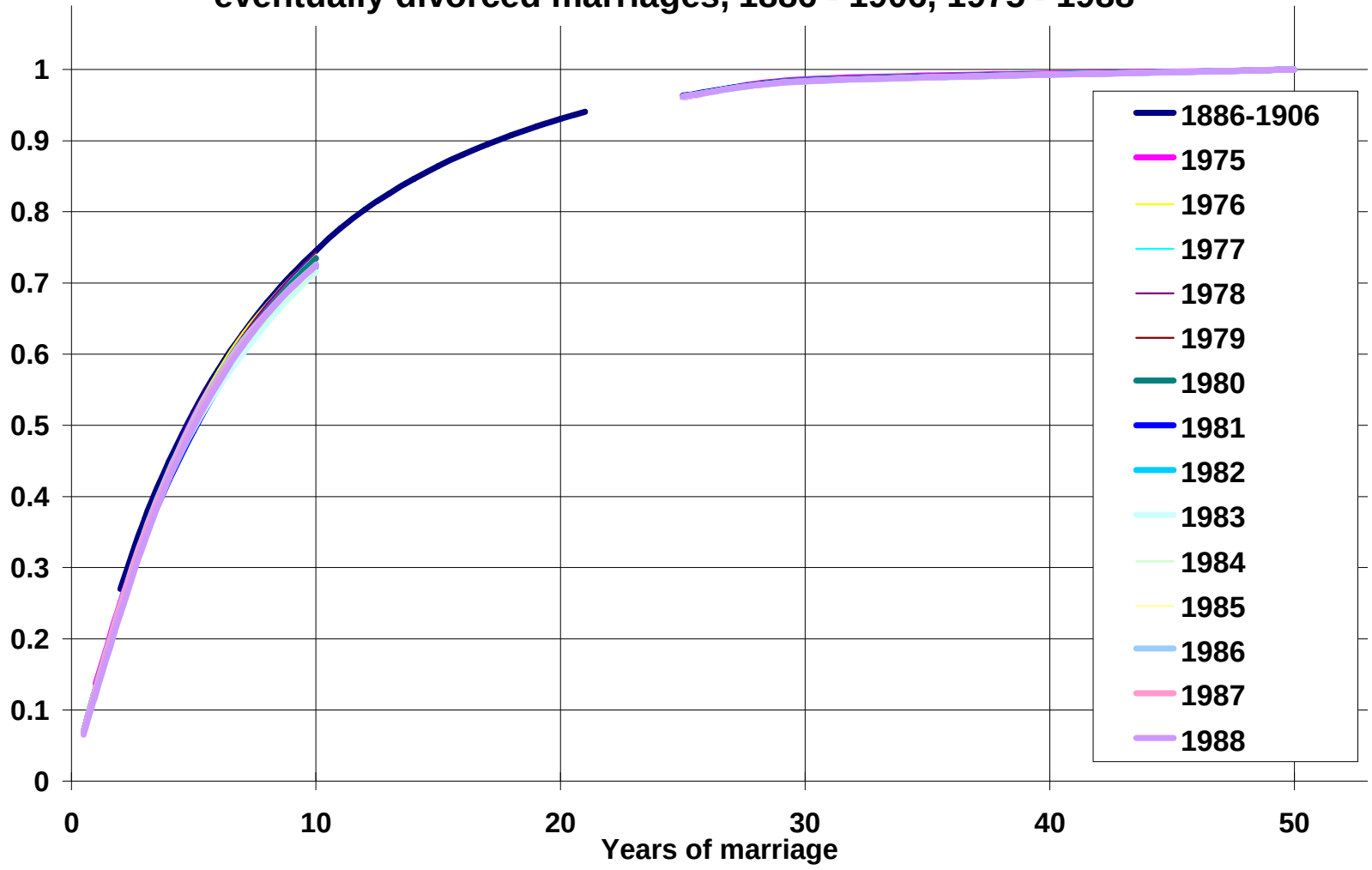


Figure 2 - Marital cohorts (1900 - 1950) and intact marriages as of 1950



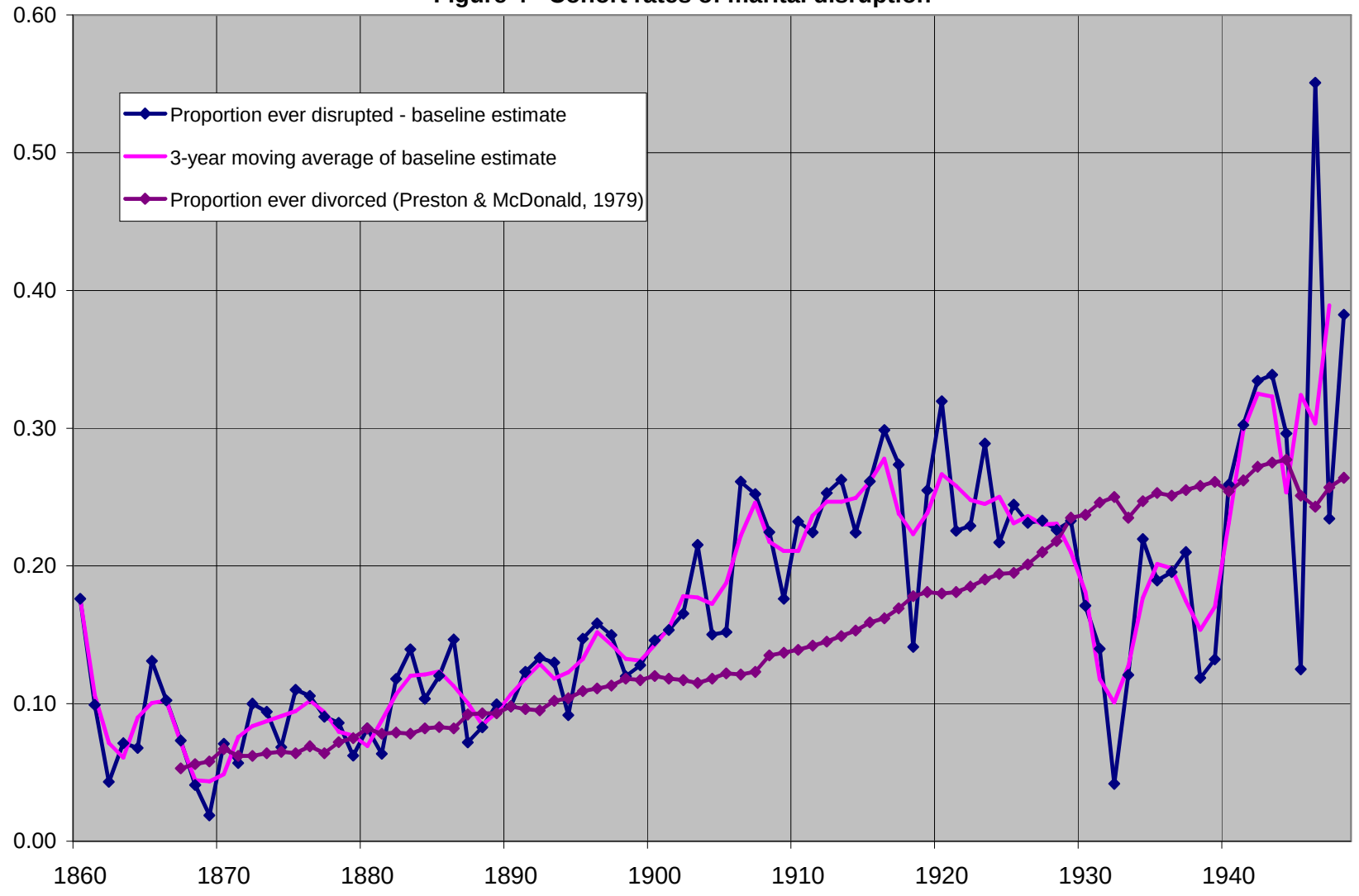
Source: IPUMS, Jacobson (1959)

Figure 3 - Cumulative distribution of duration-to-separation of eventually divorced marriages, 1886 - 1906, 1975 - 1988



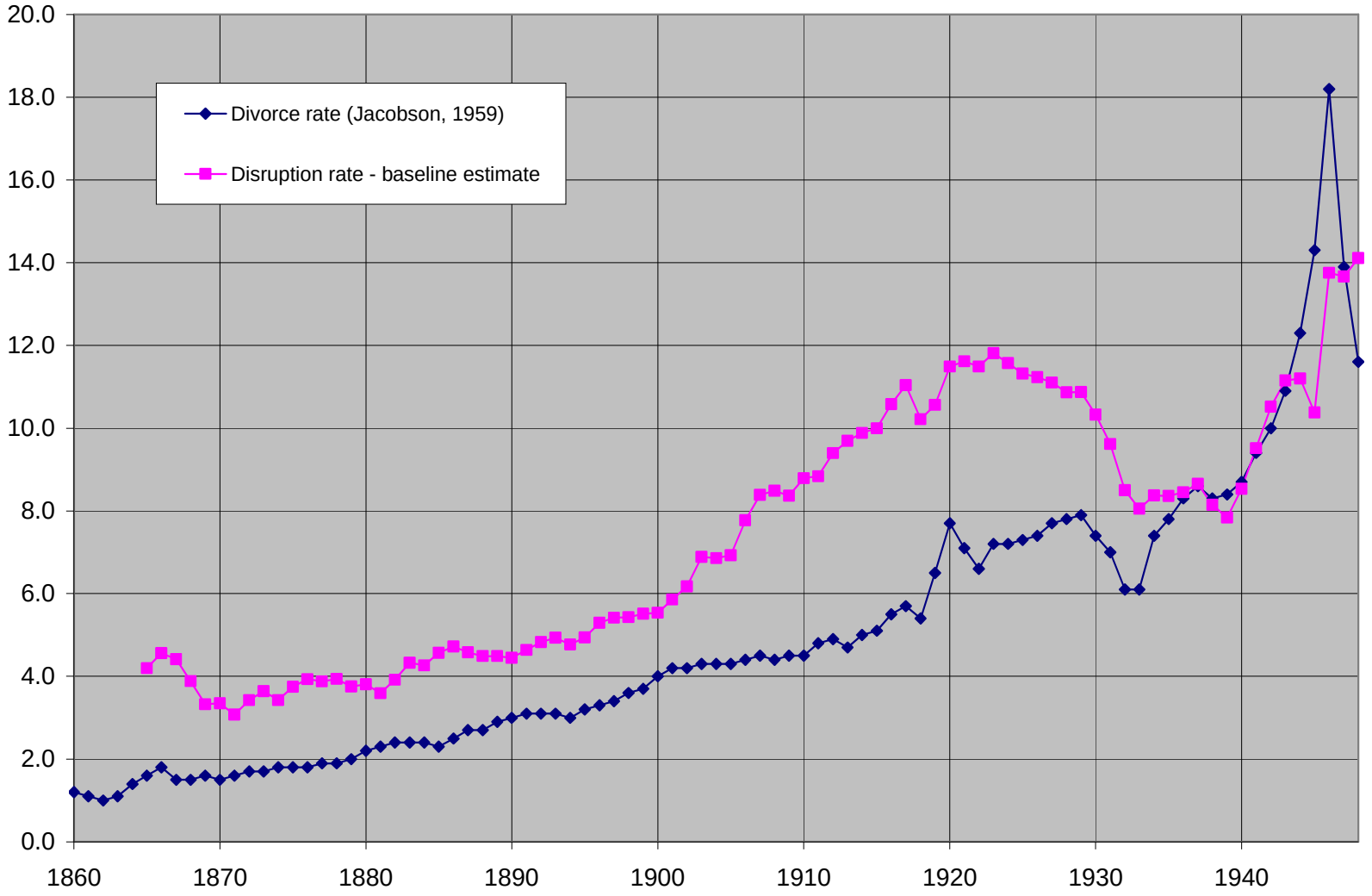
Source: Vital Statistics of the United States, Vol III, 1975 – 1988, Marriage and Divorce 1867 – 1906 (1909)

Figure 4 - Cohort rates of marital disruption



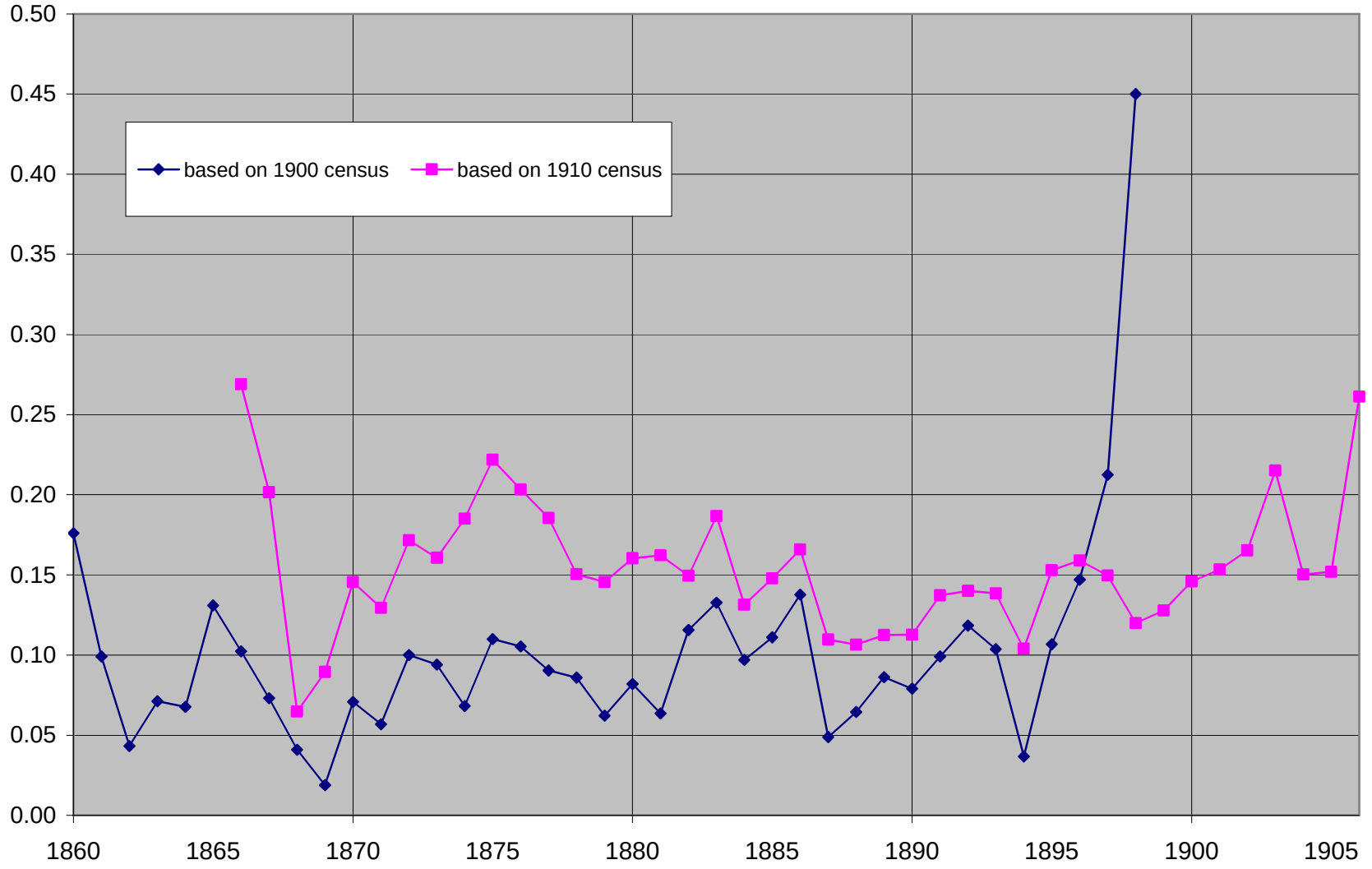
Note: For specific numerical values, see Table 2.

Figure 5 - Legal vs Real ends of marriage, period rates per 1000 marriages



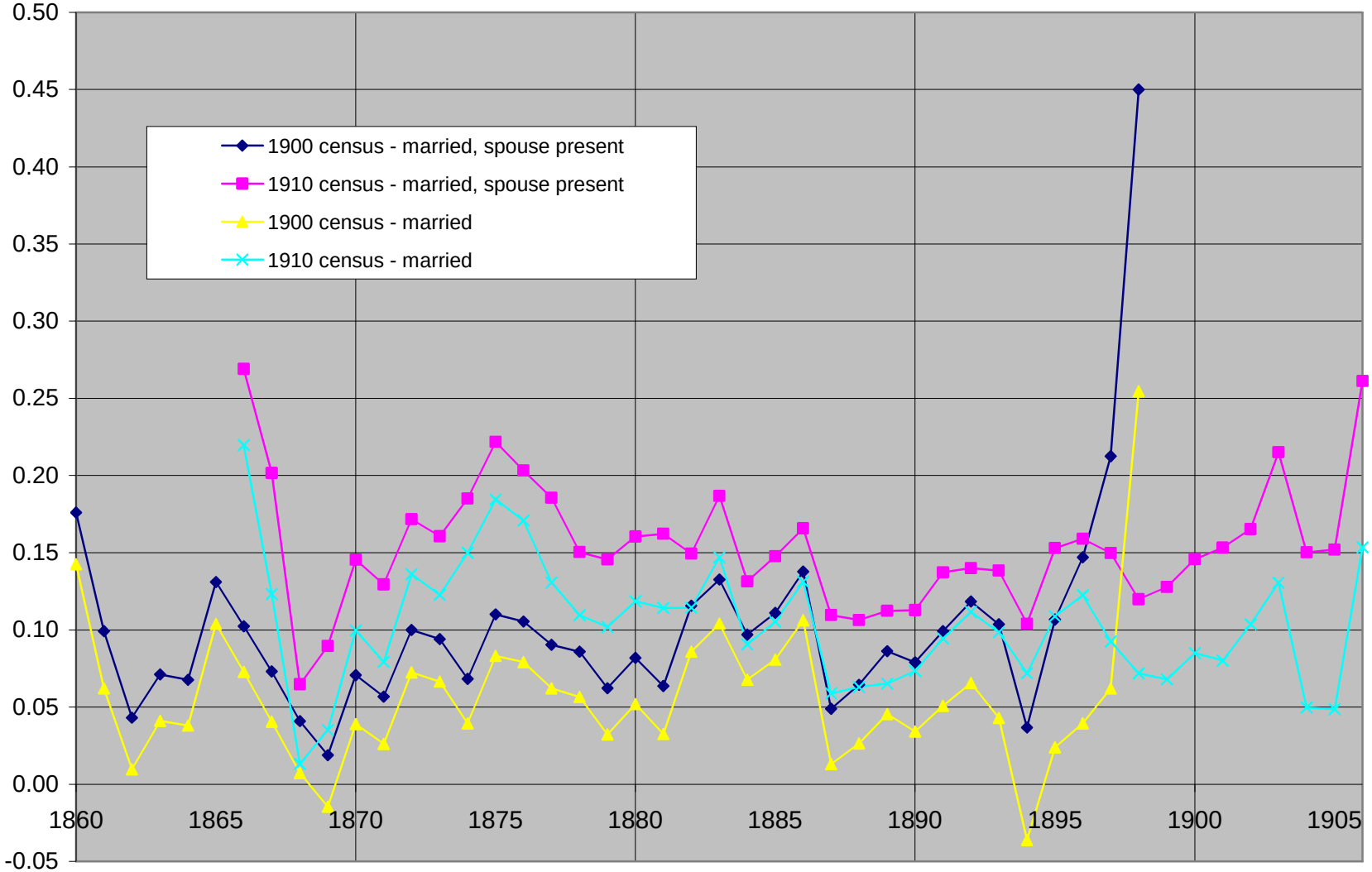
Note: For specific values, see Table 2.

Figure 6 - Various estimates of proportion ever disrupted



Note: See section 5.

Figure 7 - Various estimates of proportion ever disrupted



Note: See section 5.

Table 2 - Ratios of death rates of married men and women to the death rates of all men and women

Males	**U15 YO**	**15-19 YO**	**20-24 YO**	**25-29 YO**	**30-34 YO**	**35-39 YO**	**40-44 YO**	**45-49 YO**	**50-54 YO**	**55-59 YO**	**60-64 YO**	**65-69 YO**	**70-74 YO**	**75+ YO**
1890		2.8444	0.9907	0.7363		0.7959		0.8291		0.8472		0.7937		
1900		1.6080	0.6827	0.7033		0.7875		0.8392		0.8689		0.7980		
1924-28		1.2581	0.8095	0.7826	0.7963	0.7941	0.8140	0.8304	0.8377	0.8630	0.8682	0.8845	0.8889	0.8519
1940	0.5556		0.8148	0.7647		0.8136		0.8480		0.8643	0.8762	0.8775	0.8868	0.8279
1950	0.5152		0.7368	0.7727		0.8372		0.8692		0.8894	0.8900	0.8905	0.9010	0.8385
1960	0.4615		0.6667	0.7895		0.8108		0.8485		0.8649	0.8846	0.8986	0.8975	0.8464
Females	**U15 YO**	**15-19 YO**	**20-24 YO**	**25-29 YO**	**30-34 YO**	**35-39 YO**	**40-44 YO**	**45-49 YO**	**50-54 YO**	**55-59 YO**	**60-64 YO**	**65-69 YO**	**70-74 YO**	**75+ YO**
1890		1.7127	1.1809	1.0132		0.9510		0.8873		0.8722		0.7167		
1900		1.5769	1.1691	1.0130		0.9477		0.8820		0.8293		0.6978		
1924-28		2.0000	1.1463	1.0000	0.9800	0.9831	0.9583	0.9355	0.9141	0.9106	0.9038	0.9163	0.9034	0.7849
1940	0.8000		1.0000	0.9259		0.9111		0.9070		0.8993	0.9000	0.9132	0.7385	0.7568
1950	0.4000		0.9000	0.8571		0.8966		0.8906		0.9027	0.9029	0.9035	0.8981	0.7515
1960	0.3158		0.8571	0.8182		0.8696		0.8679		0.8617	0.8733	0.8894	0.8965	0.7081

Sources: Values for 1890 and 1900 were calculated from the numbers of deaths, by age and marital status, and numbers of persons, by age and marital status from published census volumes. Only registration states were included. Values for 1924 - 1928: Wilcox, Walter F. Introduction to the Vital Statistics of the United States; 1900 - 1930, Washington: Government Printing Office, 1933, p. 109. Values for 1940 - 1960: Grove, Robert D. and Hetzel, Alice M., Vital Statistics Rates In The United States, 1940 - 1960, Washington, DC: National Center for Health Statistics, 1968, Table 57, p. 334

Table 2 - Results of estimation and other marriage statistics								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Cohort-specific rates				Period-specific rates	
Year	Total marriages	Marriage rate per 1000 marriageable women	Proportion disrupted (π)		Proportion divorced	Total disruptions	Divorce rate	Disruption rate
Source:	Jacobson (1959: Table 2)		baseline estimates	3-year moving average of (3)	Preston & McDonald (1979)	(1)*(4)	Jacobson (1959: Table 42)	estimate
1860	256000	83	0.1760	0.1760		45062	1.2	
1861	232000	69	0.0991	0.1061		24620	1.1	
1862	236000	65	0.0432	0.0712		16799	1	
1863	256000	66	0.0712	0.0607		15544	1.1	
1864	282000	68	0.0677	0.0900		25374	1.4	
1865	334000	77	0.1310	0.1004		33521	1.6	4.20
1866	354000	78	0.1024	0.1022		36166	1.8	4.56
1867	357000	76	0.0731	0.0722	0.053	25758	1.5	4.41
1868	345000	71	0.0410	0.0443	0.056	15285	1.5	3.89
1869	348000	69	0.0188	0.0435	0.058	15139	1.6	3.32
1870	352000	68	0.0707	0.0488	0.067	17173	1.5	3.35
1871	359000	68	0.0568	0.0758	0.062	27226	1.6	3.08
1872	378000	69	0.1000	0.0836	0.062	31602	1.7	3.43
1873	386000	69	0.0940	0.0874	0.064	33741	1.7	3.64
1874	385000	67	0.0682	0.0908	0.065	34945	1.8	3.42
1875	409000	70	0.1100	0.0946	0.064	38680	1.8	3.75
1876	405000	68	0.1054	0.1020	0.069	41298	1.8	3.93
1877	411000	67	0.0904	0.0939	0.064	38607	1.9	3.88
1878	423000	68	0.0859	0.0795	0.072	33643	1.9	3.94
1879	438000	69	0.0622	0.0767	0.075	33590	2.00	3.75
1880	453000	71	0.0819	0.0692	0.082	31366	2.20	3.80
1881	464000	70	0.0636	0.0878	0.078	40725	2.30	3.59
1882	484000	70	0.1178	0.1069	0.079	51753	2.40	3.92
1883	501000	70	0.1394	0.1202	0.078	60223	2.40	4.33
1884	485000	66	0.1034	0.1210	0.082	58684	2.40	4.26
1885	507000	67	0.1202	0.1234	0.083	62549	2.30	4.57
1886	534000	69	0.1465	0.1128	0.082	60235	2.50	4.72
1887	513000	64	0.0717	0.1003	0.092	51476	2.70	4.58

1888	535000	65	0.0828	0.0846	0.093	45275	2.70	4.49
1889	563000	67	0.0993	0.0934	0.093	52578	2.90	4.49
1890	570000	67	0.0980	0.1068	0.098	60861	3.00	4.45
1891	592000	67	0.1230	0.1181	0.096	69898	3.10	4.64
1892	601000	67	0.1332	0.1287	0.095	77330	3.10	4.83
1893	601000	66	0.1298	0.1182	0.102	71011	3.10	4.93
1894	588000	63	0.0915	0.1228	0.104	72203	3.00	4.77
1895	620000	65	0.1471	0.1323	0.109	82027	3.20	4.94
1896	635000	65	0.1583	0.1517	0.111	96345	3.30	5.29
1897	643000	65	0.1497	0.1426	0.113	91722	3.40	5.42
1898	647000	64	0.1199	0.1325	0.118	85710	3.60	5.43
1899	673000	66	0.1278	0.1312	0.117	88270	3.70	5.51
1900	709000	68	0.1458	0.1423	0.12	100900	4.00	5.54
1901	742000	70	0.1534	0.1548	0.118	114876	4.20	5.86
1902	776000	72	0.1653	0.1779	0.117	138082	4.20	6.18
1903	818000	74	0.2151	0.1769	0.115	144696	4.30	6.88
1904	815000	73	0.1502	0.1724	0.118	140533	4.30	6.86
1905	842000	74	0.1519	0.1878	0.122	158115	4.30	6.93
1906	895000	77	0.2612	0.2217	0.121	198442	4.40	7.77
1907	936936	80	0.2520	0.2459	0.123	230371	4.50	8.39
1908	857461	72	0.2244	0.2175	0.135	186486	4.40	8.49
1909	897354	74	0.1760	0.2108	0.137	189190	4.50	8.37
1910	948166	77	0.2321	0.2108	0.139	199869	4.50	8.79
1911	955287	76	0.2243	0.2364	0.142	225864	4.80	8.83
1912	1004602	79	0.2529	0.2466	0.145	247735	4.90	9.39
1913	1021398	79	0.2626	0.2465	0.149	251795	4.70	9.69
1914	1025092	78	0.2241	0.2493	0.153	255546	5.00	9.89
1915	1007595	76	0.2613	0.2613	0.159	263288	5.10	10.00
1916	1075775	80	0.2986	0.2778	0.162	298822	5.50	10.58
1917	1144200	84	0.2735	0.2377	0.169	271997	5.70	11.04
1918	1000109	73	0.1411	0.2231	0.178	223152	5.40	10.22
1919	1150186	83	0.2548	0.2385	0.181	274268	6.50	10.56
1920	1274476	92	0.3194	0.2666	0.18	339801	7.70	11.49
1921	1163863	83	0.2256	0.2580	0.181	300309	7.10	11.62
1922	1134151	79	0.2290	0.2478	0.185	281046	6.60	11.49
1923	1229784	85	0.2888	0.2449	0.19	301205	7.20	11.81
1924	1184574	80	0.2170	0.2501	0.194	296208	7.20	11.57
1925	1188334	79	0.2444	0.2309	0.195	274371	7.30	11.32

1926	1202574	78	0.2313	0.2362	0.201	284034	7.40	11.23
1927	1201053	77	0.2329	0.2300	0.21	276297	7.70	11.10
1928	1182497	74	0.2260	0.2305	0.218	272562	7.80	10.87
1929	1232559	76	0.2326	0.2099	0.235	258673	7.90	10.87
1930	1126856	67	0.1710	0.1811	0.237	204067	7.40	10.32
1931	1060914	62	0.1397	0.1175	0.246	124647	7.00	9.61
1932	981903	56	0.0418	0.1008	0.25	98938	6.10	8.50
1933	1098000	62	0.1208	0.1273	0.235	139827	6.10	8.05
1934	1302000	72	0.2194	0.1765	0.247	229857	7.40	8.37
1935	1327000	72	0.1894	0.2014	0.253	267272	7.80	8.36
1936	1369000	74	0.1954	0.1983	0.251	271439	8.30	8.45
1937	1451296	78	0.2100	0.1746	0.255	253467	8.60	8.65
1938	1330780	71	0.1185	0.1536	0.258	204356	8.30	8.15
1939	1403633	74	0.1321	0.1699	0.261	238434	8.40	7.84
1940	1595879	83	0.2590	0.2311	0.254	368747	8.70	8.54
1941	1695999	89	0.3021	0.2985	0.262	506195	9.40	9.52
1942	1772132	94	0.3343	0.3250	0.272	576022	10.00	10.52
1943	1577050	84	0.3387	0.3231	0.275	509473	10.90	11.15
1944	1452394	76	0.2961	0.2532	0.277	367812	12.30	11.20
1945	1612992	84	0.1249	0.3239	0.251	522524	14.30	10.38
1946	2291045	120	0.5508	0.3033	0.243	694967	18.20	13.75
1947	1991878	107	0.2343	0.3892	0.257	775174	13.90	13.67
1948	1811155	98	0.3824		0.264		11.60	14.11

Note: The period-specific rates are per 1000 married couples. The cohort-specific rates are percentages of a marriage cohort.

Table 3 - Estimates of π and variation in parameters					
	Benchmark estimate	Mortality		*r*	
		10%	-10%	0.120	0.147
1907	0.2520	0.1630	0.3301	0.2481	0.2556
1908	0.2244	0.1517	0.2913	0.2221	0.2268
1909	0.1760	0.0921	0.2514	0.1738	0.1781
1910	0.2321	0.1630	0.2950	0.2295	0.2344
1911	0.2243	0.1618	0.2822	0.2224	0.2263
1912	0.2529	0.1958	0.3060	0.2508	0.2550
1913	0.2626	0.2085	0.3129	0.2606	0.2646
1914	0.2241	0.1586	0.2826	0.2206	0.2271
1915	0.2613	0.2140	0.3059	0.2599	0.2629
1916	0.2986	0.2537	0.3407	0.2971	0.3004
1917	0.2735	0.2279	0.3161	0.2723	0.2750
1918	0.1411	0.0849	0.1923	0.1400	0.1423
1919	0.2548	0.2143	0.2931	0.2544	0.2556
1920	0.3194	0.2850	0.3521	0.3194	0.3201
1921	0.2256	0.1827	0.2648	0.2247	0.2268
1922	0.2290	0.1949	0.2614	0.2296	0.2290
1923	0.2888	0.2619	0.3148	0.2904	0.2880
1924	0.2170	0.1842	0.2480	0.2180	0.2165
1925	0.2444	0.2187	0.2692	0.2464	0.2433
1926	0.2313	0.2038	0.2574	0.2333	0.2300
1927	0.2329	0.2095	0.2554	0.2356	0.2310
1928	0.2260	0.2050	0.2464	0.2292	0.2237
1929	0.2326	0.2070	0.2565	0.2357	0.2304
1930	0.1710	0.1468	0.1939	0.1739	0.1688
1931	0.1397	0.1207	0.1577	0.1425	0.1376
1932	0.0418	0.0197	0.0626	0.0427	0.0411
1933	0.1208	0.1048	0.1362	0.1239	0.1183
1934	0.2194	0.2034	0.2347	0.2257	0.2144
1935	0.1894	0.1741	0.2039	0.1954	0.1846
1936	0.1954	0.1816	0.2084	0.2022	0.1898
1937	0.2100	0.1964	0.2228	0.2181	0.2034
1938	0.1185	0.1084	0.1285	0.1236	0.1143
1939	0.1321	0.1204	0.1432	0.1382	0.1270
1940	0.2590	0.2511	0.2666	0.2721	0.2478
1941	0.3021	0.2885	0.3127	0.3183	0.2883
1942	0.3343	0.3271	0.3415	0.3542	0.3172
1943	0.3387	0.3322	0.3451	0.3605	0.3198
1944	0.2961	0.2897	0.3024	0.3167	0.2783
1945	0.1249	0.1192	0.1305	0.1343	0.1168
1946	0.5508	0.5460	0.5556	0.5952	0.5120
1947	0.2343	0.2297	0.2389	0.2546	0.2165
1948	0.3824	0.3784	0.3864	0.4178	0.3513