BLS WORKING PAPERS

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics

OFFICE OF PRICES AND LIVING CONDITIONS

Duration Dependence in Personal Bankruptcy

Jonathan D. Fisher, U.S. Bureau of Labor Statistics

Working Paper 359
May 2002

All views expressed in this paper are those of the author and do not reflect the views or policies of the Bureau of Labor Statistics.

*Duration Dependence in Personal Bankruptcy**

Jonathan D. Fisher**
Bureau of Labor Statistics
2 Massachusetts Ave, NE Room 3105
Washington, DC 20212
Telephone: 202-691-6596
Fax: 202-691-6583
E-mail: Fisher_J@bls.gov

* An earlier version of this paper was presented under the title "Personal Bankruptcy's Three-year Itch".

** I thank William Hoyt and Mark Berger for their helpful comments and suggestions. I also thank seminar participants at the Bureau of Labor Statistics and the 2002 Midwest Economic Association meetings. All views expressed in this paper are those of the author and do not reflect the views or policies of the Bureau of Labor Statistics (BLS) or the views of other BLS staff members.

Duration Dependence in Personal Bankruptcy

Abstract

This paper represents the first use of the Panel Study of Income Dynamics to examine whether there is duration dependence in personal bankruptcy. The results suggest that there is positive duration dependence in the first three spell-years, followed by negative duration dependence. Another interesting finding is that the median financial benefit for the filers in the year they filed is less than the median benefit in the year before they filed. This indicates that not all households file for bankruptcy when its financial benefit is largest. These findings suggest that some filers avoid bankruptcy even when bankruptcy is financially beneficial.

JEL Classification: D12 (Consumer Economics: Empirical Economics); K0 (Law & Economics: General); and, C41 (Duration Analysis)

I. INTRODUCTION

It was estimated that at least 17 percent of all U.S. households would benefit financially from filing for personal bankruptcy (White, 1998)! However, 1.4 million households filed for bankruptcy in 2001, which represents only 1.3 percent of the 104 million U.S. households. White (1998) obtains her estimate of the percentage that could benefit by calculating the number of households that had a positive financial benefit to filing, which is the standard measure used in the bankruptcy literature. Since the standard model predicts a much higher percentage of households filing than is actually the case, the standard model appears insufficient and the incentives to file do not appear to be entirely understood. As more households file for personal bankruptcy,[1] it is becoming more important to understand these determinants. Further, since Congress is considering altering the personal bankruptcy laws, economists need to understand these determinants to be able to add to the policy debate.[2]

One plausible explanation for White's (1998) findings is that the benefit to filing is not large enough for some households. White (1998, p. 703) calculates the median benefit to filing for those with a positive benefit equals $1,650. It may be that some households do not file when the benefit is relatively small. On the other hand, for those with a relatively large benefit, it is harder to explain why they do not file. One possibility is that these households may not file in the first year that they have this large financial benefit. Rather, some households wait to file in hopes of avoiding bankruptcy altogether. After several years with a positive financial benefit, they may eventually file for bankruptcy.

This paper addresses this possibility by estimating whether the probability of filing is changing over time for a household, holding the financial benefit and other relevant factors constant. To accomplish this, I estimate a hazard function using the personal bankruptcy data in the Panel Study of Income Dynamics (PSID). While this is not the first to use the PSID to examine the personal bankruptcy decision, this represents the first to use the PSID applying duration analysis.

The results indicate that there is duration dependence in bankruptcy. Further, I find that the conditional probability of filing is largest around the third and fourth spell-years, where spell equals the number of years the household has been in its current marital status. These findings indicate that the probability of filing for a household that has been married (divorced) for one year is different than the probability of filing for a household that has been married (divorced) for ten years, ceteris paribus. One implication of these findings is that some households may be avoiding bankruptcy for several years, even when they have a positive financial benefit to filing. This can help explain White's (1998) findings.

The main policy implication from these findings is that assistance early on may help some households avoid bankruptcy altogether. It is hypothesized that some households do not want to file for bankruptcy even when they have a financial benefit to file. However, after several years of financial difficulty, they revise their estimates regarding the costs and benefits of bankruptcy, which leads them to file. If policies were aimed at helping households early on in their financial difficulty, then these households may never reach the point where bankruptcy becomes optimal. If the goal of policy is to decrease the number of bankruptcy filings, these results suggest two policies, one of which is supported directly in this paper. First, an increase in the average Unemployment Insurance (UI) benefits is found to decrease the hazard rate. Second, Sullivan and Worden (1990) found that increases in credit-counseling services decrease the number of filings. If households in financial trouble could receive credit-counseling fairly soon after their financial problems arise, these households may be able to avoid bankruptcy.

The next section presents a model of the decision to file for bankruptcy and the empirical model. In the third section, I present the data and non-parametric estimates of the hazard function. The fourth section presents the empirical results. Finally, I conclude with a summary and extensions to the research.

II. A MODEL OF THE BANKRUPTCY DECISION

This section presents a model of the decision to file for bankruptcy. The purpose of this section is to incorporate the possibility of time-dependence into an existing model. In Dye (1986), the household decides whether to file based on its financial benefit to filing. To this model, I add the concept of a reservation benefit level – a household files for bankruptcy if its financial benefit exceeds its reservation benefit. Dye (1986) and White (1998) assume that the household files if the benefit is positive, which contributes White's (1998) finding that 17 percent of all households could financially benefit from filing. If White assumed that the reservation benefit equals \$1,600, the percentage of households that would benefit would be cut in half. However, assuming one level for every household seems unsatisfactory. In the model that follows, the reservation benefit is allowed to vary across households and over time.

A. The financial benefit and reservation benefit

The financial benefit to filing for household i in year t equals

$$B_{it} = Max\ [\ D_{it} - Max\ (W_{it} - E_{it},\ 0),\ 0]. \qquad (1)$$

D_{it} equals the debt discharged in bankruptcy; W_{it} equals the wealth of the household, and E_{it} equals the state bankruptcy exemptions. If wealth exceeds the exemptions, then the household loses property when it files. If wealth is less than or equal to the exemptions, then the household loses no property. Therefore, the benefit, B_{it}, equals the debt forgiven minus any lost assets.

Each period, the household receives a draw from the financial benefit distribution, $g(B_{it})$. Since the household chooses its debt and wealth, the draw is endogenous. Further, each subsequent draw is dependent on earlier draws; a household with a large benefit this period is more likely to have a large benefit next period. However, the draw received in the current period is exogenous to decisions made in the current period. Bankruptcy law prohibits excessive accumulation of debt in the months preceding a bankruptcy filing.[3] If the household incurs a significant amount of debt several months before filing, these new debts may not be discharged. Bankruptcy law also places restrictions on the transfer and sale of assets in the months preceding a filing. Thus, the draw in the current period depends on decisions made in the previous periods, but it is exogenous to decisions made in the current period.

Assume that v^n is the utility the household receives if it does not file. Further, assume that the utility associated with filing for bankruptcy equals $v^b_{it}(B_{it},\ c_{it})$, where c_{it} represents the costs of filing for bankruptcy, which includes monetary and non-monetary costs. It seems reasonable to assume that $dv^b_{it}/dB_{it} > 0$; a higher benefit is preferred to a lower benefit.

When the household observes its draw from the benefit distribution, it decides whether to file. Under these assumptions, the household's optimal decision can be described by a reservation benefit policy, analogous to a reservation wage policy. A household files for bankruptcy if its benefit is greater than or equal to its reservation benefit. Define the reservation benefit as:

$$B_{it}* = \varphi\{B_{i,t-1}, B_{i,t-2}, \ldots B_{i,t-m}, X_{it}, c_{it}, E^t(v^b_{i,t+1}), E^t(v^b_{i,t+2}), \ldots E^t(v^b_{i,t+n})\}, \qquad (2)$$

where $m = 1, 2, \ldots spell_{it}$; $spell_{it}$ equals the length of time in the current spell.[4] If the current spell has lasted three years, then $m = 3$, and the reservation benefit depends on the financial benefit to filing from the previous three periods. Next, X_{it} is a vector of household characteristics that affect the propensity of households to file, and c_{it} represents the costs of filing. Finally, $E^t(v^b_{i,t+n})$ represents the expectations household i has in period t regarding the benefit to filing in period $t+n$.

It is important to note that the expectations about the benefit to filing in $t+n$ can change over time, i.e., $E^t(v^b_{i,t+n})$ may not equal $E^{t+1}(v^b_{i,t+n})$. These expectations can be revised after more information is revealed in each period. For example, $E^t(v^b_{i,t+1})$ may differ for a household that has been unemployed for four periods than for a household that has only been unemployed for one. Analogously, expectations may differ depending on the length of time the household has had a positive financial benefit to filing.

Intuitively, the household may reach a point when filing for personal bankruptcy becomes tolerable or more acceptable even if its financial situation has not changed significantly. Given the same set of circumstances several years earlier, the household may have never considered bankruptcy. After several years of financial trouble though, bankruptcy may become more acceptable ($B_{it}*$ decreases) because the household believes that its situation may not improve without filing for bankruptcy. The household revises expectations about its future financial condition, which changes the relative costs and benefits of filing for bankruptcy. This suggests that the decision to file depends not only on the current financial conditions but also on past conditions and the expected future conditions. As information is revealed, expectations can be revised, and this may make bankruptcy optimal.[5]

B. The decision to file

At all $B_{it} \geq B_{it}*$, $v^b_{it} > v^n_{it}$, which means that the household increases utility by filing for bankruptcy. The probability that a given benefit level leads to bankruptcy is given by the probability the benefit exceeds the reservation benefit, namely

$$\pi = \int_{B_{it}*}^{\infty} g(B_{it})dB. \qquad (3)$$

The hazard function, which describes the conditional probability of filing, equals $\pi_{it}(B_{it}, B_{it}*)$. If $\partial\pi_{it}/\partial t > 0$ (<0), the hazard function exhibits positive (negative) time-dependence. If $\partial\pi_{it}/\partial t = 0$, the probability of filing does not depend on spell, meaning that there is no time-dependence in bankruptcy.

C. Preliminary evidence for the revision of expectations

Table 1 provides evidence that households may revise their expectations. The table presents summary statistics for the financial benefit variable.[6] Table 1 presents separate statistics for the bankruptcy filers and for the households that did not file for bankruptcy, the non-filers. As expected, the mean financial benefit for the filers ($4,600) is significantly higher than the mean benefit for the non-filers ($2,002). Surprisingly, the mean and median benefit for filers is actually higher in the year before they filed ($6,713 and $1,454) than in the year they filed. Even when the same 150 filers are compared in *t* and *t-1*, the mean and median are higher in the year before they filed.[7]

Existing theory predicts that households should file when the financial benefit is largest. However, the statistics in Table 1 show that this is not always the case. For the filers in *t-1*, we know that $B_{i,t-1}<B_{i,t-1}*$ because they did not file for bankruptcy in *t-1*. Since these households filed in *t*, we know that $B_{it}>B_{it}*$. We also know from Table 1 that for some of the filers $B_{it}<B_{i,t-1}$, which means that B_i* must have decreased between *t-1* and *t*. These households revised their expectations regarding the optimality of bankruptcy after several periods of financial trouble and decreased their reservation benefit.

A story from Sullivan, Warren, and Westbrook (2000) provides a picture of a person trying to avoid bankruptcy. Soon before her divorce, Melanie's husband filed for bankruptcy by himself, leaving her solely responsible for all of their joint debts.[8] Melanie spent a year after her divorce struggling to meet payments. After trying cash advances for an additional two years, she filed for bankruptcy with $50,000 in unsecured debt.[9] Since her ex-husband filed for bankruptcy three years earlier and since Melanie assumed the debts he discharged, it is logical to assume that she could have filed for bankruptcy with her husband. Instead, she tried to avoid bankruptcy. After three years of financial trouble, she revised her estimate of the costs and benefits of bankruptcy, which led her to file for bankruptcy.

D. Specification of the empirical model

Since economic theory does not provide insight into the shape of the hazard function, the estimation technique uses a flexible functional form. This technique allows for a constant hazard function, meaning that there is no time-dependence. If there is time-dependence, then the hazard function would have a non-zero slope.

I obtain semi-parametric estimates of the hazard function with discrete data following Cox (1972), which allows for the inclusion of covariates. The specification is:

$$\frac{h(t,x,\beta)}{1-h(t,x,\beta)}=\frac{h_t}{1-h_t}e^{x_{it}\beta}, \qquad (4)$$

where h_t is an estimated parameter, x_{it} is a vector of covariates that vary across households and over time, and β is the corresponding vector of estimated parameters.

The covariates used, excluding the spell, match the variables used in earlier bankruptcy research using the PSID (Fisher, 2001 and Fay, Hurst, and White, 2002). The household variables are: the financial benefit to filing *(equation 1)*; income of the household; a dummy variable equaling one if the household had a decrease in income between *t-1* and *t*; the age of the household head and its square; tenure of the head at his current job; two dummy variables for the education of the head; family size; whether someone in the household owns a business; whether the household owns a home; the sex of the head; whether the head missed work during the year because of illness; and, three dummy variables for the marital status of the head. The state-level variables are: lagged bankruptcy filing rate; legal employment per capita; bank offices per capita; state per capita income growth; standard deviation of per capita income; average Unemployment Insurance (UI) benefits; and, average Aid to Families with Dependent Children (AFDC) benefits. Table 2 presents the means for these variables. Also included in the model is a set of year dummies.

Finally, an eighth order polynomial of spell is included to allow for a flexible hazard function. The coefficients on the spell polynomial determine the shape of the hazard. The definition of the spell variable is discussed in detail in the next section.

III. DATA

Gross and Souleles (2002) are the first to use duration analysis in the personal bankruptcy literature. While they use a panel of credit card accounts, this paper uses the Panel Survey of Income Dynamics (PSID), which is a panel survey of households that began in 1968. If a PSID household filed for personal bankruptcy in 1996 or earlier, the 1996 wave of the PSID includes information about this filing. The bankruptcy information is matched with income, wealth, and demographic characteristics of the household from 1989-1996 to create an unbalanced panel of 41,186 observations.

Compared to the credit card data used by Gross and Souleles (2002), the PSID has several advantages and several disadvantages. The first advantage of the PSID is that it includes information relevant to the bankruptcy decision such as the income and wealth of the household, while this information is not available in the credit card data.

Second, the PSID includes the age of the household head, which appears to be more relevant to spell duration than the length of time a credit card account has been open. By the nature of their data, Gross and Souleles assume that an account open for a month held by a sixty-year old has the same spell as an account open for a month held by a thirty-year old. Since the spells are identical and since Gross and Souleles do not observe the age of the cardholder, they assume that these two individuals have the same conditional probability of filing, ceteris paribus. However, 50 percent of bankruptcy filers in the PSID were between the ages of thirty and forty, with 25 percent below and 25 percent above this range. Not having the age of the cardholder may help explain why they find little evidence of duration dependence.

In this paper, I treat a thirty-year old person who has been married for one year the same as a sixty-year old person married for one year. However, the individual’s age and age-squared are included in the specifications, which allows the hazard to shift with age. While I assume identical slopes for these two households, the vertical position for the two can differ by age, marital status, and the other covariates.

There are disadvantages to the PSID. First, measurement error inherent in household surveys is less problematic using the credit card data. Second, in my sample, there are only 174 bankruptcy filings in a sample of 41,186 observations (0.42 percent). The credit card data has over 3,900 bankruptcy filings in a sample of 218,000 observations (1.79 percent). The national filing rate over this period equaled 0.89 percent.

While there are advantages and disadvantages to both data sets, the papers address different questions that could not be addressed using the other data set. Gross and Souleles try to account for the increase in the number of filings that occurred in the 1990s. This paper examines the role household structure plays in the bankruptcy decision and whether there is duration dependence in bankruptcy.

This is also not the first paper to use the PSID to estimate the probability of bankruptcy. However, in the existing research that uses the PSID, the unconditional probability of filing for bankruptcy is estimated (Fay, Hurst, and White 2002 and Fisher 2001). Estimating the unconditional probability assumes that the probability remains the same every year for a given set of household characteristics. However, this assumption may be too restrictive. The probability of filing may be different for a person who has been divorced for one year than for a person divorced for five years, holding age and all other relevant factors constant.

A. The spell variable

To estimate *equation 4*, there must be a spell variable because the coefficient on spell determines the shape of the hazard. In applying duration analysis in other areas, spell is clearly defined. This is not the case for personal bankruptcy. For example, Berger and Black (1998) estimate a hazard function for Medicaid participants. The spell variable in their model equals the number of months the individual has been receiving Medicaid benefits.

Unfortunately, no natural length of time defines spell for bankruptcy. Shumway (2001) estimates a hazard model for *business* bankruptcy and uses the number of years the firm's stock has been publicly traded. Gross and Souleles (2002) estimate a *personal* bankruptcy hazard and use the number of months that the credit card account has been open.

The PSID presents a few more options for the definition of spell. In this paper, spell equals the number of years the household has existed in its current structure before it files for bankruptcy. Structure is defined as the household's current marital status, where marital status is: single; married; or divorced, widowed, or separated (DWS).[10] Chiefly, spell is defined by marital status because I believe that a household married, single, or DWS for one year will have a different probability of filing than a household married, single, or DWS for four years. Further, married households may have a different hazard function than single or DWS households.

One alternative would be to use the age the head reaches maturity as the beginning of the spell.[11] However, two households that are ten years past the age of maturity can be vastly different, even after controlling for all other relevant characteristics. For example, two households, both ten years past the age of maturity, may have a different conditional probability of filing if one has been divorced for two years while the other has been divorced for eight years.[12]

While there is only one spell variable, it is beneficial to discuss the measurement of it separately for the filers and the non-filers. For the households that never filed for bankruptcy and for the filers in the year(s) before they filed for bankruptcy,

$$spell_{it} = t - (year\ formed_i) + 1,\ t=1989,\ 1990 \ldots 1996. \qquad (5)$$

Year formed$_i$ equals the year household *i* began its current marital status. For example, a married household forms in the year of the marriage; if the couple marries in 1990 and never files for bankruptcy, their spell equals seven in 1996 (*t=1996*). This method assumes that the change in marital status occurred on the first day of the year.[13] Analogously, a DWS household forms when the divorce, separation, or death occurs. For those that report a different year for their separation and subsequent divorce, the year the household separated is used as the year formed rather than the year divorced.[14] For the households that reported they were single in 1996, the year formed is the year the individual reported splitting off from his main family. If the individual does not report this, the year formed is the first year this individual appears in the data as a household head.

For households that never filed, the sample includes the most recent spell only. For example, if an individual divorces in 1990, remarries in 1993, and remains married to the same person until at least 1996, the sample includes the most recent spell of marriage and not the divorced spell or any earlier marriage(s). Only non-filer spells that are right censored in 1996 or spells that end in bankruptcy between

1989 and 1996 are included. While the sample uses data from 1989-1996, the panel is unbalanced because many households formed after 1989 (see Table 4).

For the bankruptcy filers, the spell in the year they filed equals

$$spell_{it} = (year\ filed_i) - (year\ formed_i) + 1. \qquad (6)$$

Year filed$_i$ equals the year the household filed for bankruptcy. A household, formed in 1980, that filed for bankruptcy in 1994 has a spell equal to fifteen in 1994. The sample includes observations for this household from 1989 to 1994. Analogously, a household that formed in 1990 and filed in 1990 has a spell equal to one and has only one observation in the data.[15]

Analogous to Berger and Black (1998), the data has a stock sample and a flow sample. The stock sample contains the households that had ongoing spells in 1989 – the first year in my sample. Seventy-seven percent of the households in this data come from this sample. The remaining 23 percent come from the flow sample, which contains the households that began their spell after 1988. As argued by Berger and Black, combining these two samples allows for the identification of the hazard function for both long spells and short spells. This allows for better identification of the entire hazard function.[16]

The top panel of Table 3 provides descriptive statistics for the spell variable separated by the filers and non-filers. For all households, the median spell equals twelve years. For the bankruptcy filers, the mean spell length in the year they filed equals 9.6 years. Since the median spell for the filers equals seven years, the distribution is skewed upwards by a few long spells.

In Table 4, I present the empirical distribution for the spell length variable for the flow sample and the empirical distribution for the net spell length for the stock sample. The empirical distribution for the flow sample represents the distributions of the total length of spells, either ending in bankruptcy or ending in 1996 because of censoring. The net spell length for the stock sample equals the distribution of stock sample spells since 1989, as defined by Berger and Black (1998). The net spell equals the length of time the households were at risk of filing for bankruptcy during the sample period (1989-1996).

Two interesting things are found in Table 4. First, the distribution of spells in the flow sample is very similar across the different sub-samples. Second, the data do not support the hypothesis that the distribution of spells is exponential. For the distributions to be exponential, the distribution of the flow sample should be the same as the distribution of the net spells from the stock sample (Heckman and Singer 1984, p. 99). The distribution of the net spells is nearly uniform across the spell-years, while the distribution for the flow sample peaks in the second spell-year and gradually decreases afterwards. Since an exponential distribution can be rejected, this suggests that there is duration dependence in bankruptcy.

B. Non-parametric estimates of the hazard function

Figure 1 presents further evidence of duration dependence. The figure shows the three-year moving average Kaplan-Meier (KM) hazard function, where the hazard rate in spell-year t equals:

$$\hat{h}_t = \frac{d_t}{n_t}, \tag{7}$$

where d_t equals the number of bankruptcy filings in spell-year t, and n_t represents the number of households at risk in spell-year t. This represents a non-parametric estimate of the hazard function (*equation 3*) that does not control for the financial benefit or for any of the other covariates that may affect the decision to file. The figure includes the hazard for the first thirty spell-years. While there are a few households that file for bankruptcy with a spell exceeding thirty, never more than one filing occurs per spell-year after the thirtieth year.

The non-parametric hazard function appears to have two peaks – one in the sixth year and one in the eleventh year. There is another peak around the twenty-ninth spell-year, but this may be the result of a small sample size. Two households filed for bankruptcy in each the twenty-eighth and thirtieth spell-years while no other year after the twenty-first had more than one filing. Since I used a three-year moving average to calculate the hazard, this accounts for the relatively high hazard rate in the twenty-ninth spell-year. The important result for this paper is that the non-parametric hazard rate is not constant.

The bottom panel of Table 3 and the bottom three panels of Table 4 present summary statistics for spell by marital status. While the total number of married filers greatly exceeds the number of DWS filers and single filers, approximately 2.8 percent of married households and 2.2 DWS households in the sample filed for bankruptcy. The percentage of single households that filed is a little lower at 1.7 percent.

By marital status, the empirical distributions appear slightly different, which suggests that the hazard functions may also differ by marital status.

Figures 2A, 2B, and 2C present the Kaplan-Meier hazard functions by marital status. The married hazard (Figure 2A) peaks in the sixth year and gradually decreases afterwards. Despite using a three-year moving-average for the hazard function, there are significant jumps in the hazards for DWS households and single households – Figure 2B and Figure 2C respectively. The DWS hazard starts at a relatively high level and subsequently declines for the first eight spell-years. Then, it jumps dramatically, peaks in the eleventh year, and then decreases just as dramatically as it increased. Interestingly, the single hazard peaks in the thirteenth year but is relatively constant in the preceding spell-years.

While the summary statistics and figures provide evidence that the spells differ by marital status, statistical tests exist to check for this. The first test is a likelihood-ratio test for homogeneity of the spells. This test statistic indicates that the spells are significantly different at the 3 percent level of significance. The second test is a log rank test for the equality of the survivor functions, and this test statistic indicates that the survivor functions are significantly different at the 8 percent level.[17]

These two tests along with Tables 3 and 4, Figures 1 and 2A-2C provide evidence that the hazard functions significantly differ by length of time in current marital status. Additional evidence is presented in the subsequent section, which displays the results of a semi-parametric estimate of the hazard function.

IV. EMPIRICAL RESULTS

Column (I) in Table 5 presents the estimates of *equation (4)*.[18] To estimate this, a logit is used. The dependent variable equals one if household *i* filed for bankruptcy in year *t*, and zero otherwise. The specification includes the variables listed in Table 2 plus the eighth order polynomial in spell and the year dummy variables. Table 5 does not list all of the estimated coefficients.

The coefficients match expectations and/or previous research (Fay, Hurst, and White 2002 and Fisher 2001). The financial benefit is positive and significant, and its square is negative and significant. Household income is negative and significant. While the coefficients on negative income shock, legal employment, and AFDC benefits do not match predictions, all are statistically insignificant. Further, neither Fay, Hurst, and White (2002) or Fisher (2001) found these coefficients to be the correct sign.

Two differences exist between previous findings and the results in Table 5, and both pertain to the statistical significance of coefficients. First, the coefficient on the lagged filing rate is positive as expected, but it is not statistically significant at the 5 percent level. While previous research found the coefficient positive and significant, the results here suggest that households in states with higher filing rates do not have a significantly higher hazard rate.

Second, although the specification allows the hazard to differ by age, the coefficients are statistically insignificant. This indicates that two individuals who are divorced for one year have the same hazard rate, regardless of age. One explanation for this result, as noted by Kiefer (1988), is that age and spell are highly correlated (ρ = *.59*). Consequently, trying to identify their effects separately is difficult, which makes the estimates imprecise. In recognition of this potential problem, I also used dummy variables for age and a spline for age. In these specifications, the coefficients on the new measures of age remained statistically insignificant. It may be that age and age squared in previous research was capturing the effect of spell, meaning that age itself is not a significant determinant of the decision to file.

A. The spell coefficients

Individually, the eight spell coefficients are statistically significant at the 5 percent level. A joint test of the spell coefficients indicates that the coefficients are *not* different from zero at the 5 percent level of significance. Conversely, the result from a likelihood-ratio (LR) test contradicts the joint test. The LR test uses the log-likelihood values associated with the unrestricted model and the restricted model – the restricted model excludes the spell variables.[19] The test statistic indicates that the specification with the spell variables is preferred to the specification without them. Taken as a whole, the results in column (I) of Table 5 present mixed evidence regarding duration dependence in bankruptcy.

One reason for this mixed evidence could be that I am trying to estimate one hazard, regardless of marital status. Evidence presented above indicates that the hazard function for single, married, and DWS households differ. While the specification in column (I) allows the vertical position to differ by marital status, the specification assumes that the slope of the hazard function is identical. By requiring the slopes to equal, I may be placing an unnecessary restriction on the data.

To allow for the possibility that the slopes differ by marital status, column (II) in Table 5 presents the estimates when spell is interacted with two of the dummy variables for marital status – married and DWS. This creates sixteen additional variables: an eighth order polynomial for the spell of married households and an eighth order polynomial for the spell of DWS households. The original spell variable remains in the specification and accounts for the single households.[20]

Other than the three spell polynomials, the covariates presented in column (II) of Table 5 match their counterparts from column (I). Again, there is mixed evidence for the presence of duration dependence. Individually, the original spell coefficients and the married spell coefficients are statistically significant at the 10 percent or the 5 percent level. However, the DWS spell coefficients are not significant at the 10 percent level. Each of the three eighth order polynomials remains statistically insignificant as a group. When the significance of all twenty-four spell coefficients is tested, the hypothesis that all equal zero is rejected at all relevant levels of significance. The results of another likelihood ratio test indicate that the constrained model presented in column (I) is too restrictive. Therefore, the results allowing the slope of the hazard to differ by marital status are preferred. This again presents mixed evidence, but I argue that the results are in favor of finding duration dependence.[21]

This result differs from the findings in Gross and Souleles (2002). In their results, the individual coefficients on spell are generally insignificant, which suggests that there is no duration dependence in bankruptcy.[22] Most likely, two differences drive these contradictory results. First, Gross and Souleles use credit card data while I use the PSID. Second, the spell variables differ considerably, as discussed above. While the PSID may have some limitations compared to the credit card data, the PSID may be a better data set to use for estimating a hazard function.

B. Semi-parametric estimates of the hazard function

Figure 3 presents three estimated hazard functions using the results from column (I). These represent semi-parametric estimates of the hazard, while Figure 1 presents its non-parametric counterpart.

The three lines in Figure 3 represent three different methods of calculating of the hazard. The first two – the ones referred to as the mean probability and the median probability – use the predicted probabilities for all 41,186 observations. The predicted conditional probability for household *i* equals:

$$\hat{p}_i(spell_i \mid x = x_i) = \frac{e^{x_i b + \alpha(spell_i)}}{1 + e^{x_i b + \alpha(spell_i)}}, \qquad (8)$$

where *b* is the vector of estimated coefficients on the covariates from Table 5, and α is the vector of coefficients on the spell polynomial. To calculate the hazard for a specific spell-year, this method uses the observations with a spell equal to the given spell-year. For example, to calculate the hazard rate for the first spell-year, this method uses the 1,665 observations with a spell equal to one. With this sub-sample, the mean and median conditional probability are calculated and used to plot the mean hazard and median hazard, respectively. For spell equal to two, I use the sub-sample of 2,206 households with a spell equal to two and follow the same process.

The third method of calculating the hazard – referred to as the evaluated-at-means hazard – takes the estimated coefficients and the means of the covariates other than spell to find the predicted probability. Define the predicted hazard rate in spell-year *t* as:

$$\hat{p}(spell \mid x = \bar{x}) = \frac{e^{\bar{x} b + \alpha(spell)}}{1 + e^{\bar{x} b + \alpha(spell)}}. \qquad (9)$$

This function can be thought of as the hazard function for the average household.

While the hazards in Figure 3 differ in magnitude, their shapes are relatively similar. Since I am less interested in the magnitude of the hazard and more interested its slope, the three different methods present strikingly similar results. Each increases initially, with the mean and median hazards peaking in the third year while the evaluated-at-means hazard peaks in the fourth year. Afterwards, the hazard exhibits negative duration dependence until the eighth year. From the eighth until the eleventh spell-years, there is slight, positive duration dependence. After, the hazards slope down until the twenty-first year. The evaluated-at-means hazard approaches zero around the twenty-fourth spell-year, while the mean and median hazards approach zero around the forty-fifth spell-year.

Figures 4A-4C present the semi-parametric hazards using the results from column (II) in Table 5. Again, the three separate methods of calculating the hazard are used. However, these figures only include the evaluated-at-means hazards up to the nineteenth year for the married households and the sixteenth year for the DWS households. After the years presented, these two hazards quickly approach one, most likely the result of the relatively small percentage of filers in each category. Rather than exclude these figures altogether, the functions are shown for the early spell-years to give an idea of their shapes.

For married households (Figure 4A), the semi-parametric hazards exhibit positive duration dependence for the first four years, which matches its counterpart from Figure 2A. Afterwards, all three hazards continually decrease, except for the evaluated-at-means hazard, which begins to increase in the sixteenth year.

The semi-parametric estimates of the DWS hazard (Figure 4B) increase for the first two spell-years like its non-parametric counterpart (Figure 2B). Subsequently, all four hazards decrease and bottom out around the seventh spell-year. All increase after the seventh year and peak again in the thirteenth spell-year, except for the evaluated-at-means hazard. For the other two in Figure 4B, they peak in the thirteenth year and gradually decrease thereafter.

Finally, the semi-parametric hazards for single households (Figure 4C) exhibit positive duration dependence for the first three years, and they exhibit negative duration dependence in the fourth through eighth spell-years. Again, this is similar to the non-parametric hazard for single households (Figure 2C). The semi-parametric hazards capture the second peak as well, which occurs in the thirteenth spell-year.

Overall, the semi-parametric hazards and their non-parametric counterparts tell a very similar story. First, there does appear to be time-dependence in personal bankruptcy. Second, the peak in the hazard rate occurs around the third and fourth spell-years.

C. The role of gender in the shape of the DWS hazard

In this paper and in Fisher (2001), the coefficient on the gender of the head of the household is statistically insignificant. The other existing research on personal bankruptcy generally ignores the role of gender in bankruptcy. However, gender may be very important in explaining the entry into bankruptcy of divorced-widowed-separated (DWS) households. A woman may be adversely affected financially by the death of a spouse or a divorce/separation if she was not working before the event. Similarly, the divorce or separation of a household with children can adversely affect the financial situation of both parents, regardless of gender. Of the forty-four households that are DWS and filed for bankruptcy, twenty-five have female heads, and the remaining nineteen have male heads.

A simple test of whether gender plays a role is to interact the gender variable with the DWS variable and the DWS polynomial. This creates a dummy variable for DWS-male and one for DWS-female. Second, there are now two eighth order polynomials for DWS households – one for males and one for females. This allows the intercept and slope of the hazard for DWS to differ by gender. Table 6 presents these results, which are virtually identical to the results in Table 5.

For the DWS intercepts, the female coefficient is about three times smaller than the male coefficient, but the female coefficient is the only one that is statistically significant. The gender coefficient (*Head is male* variable) also remains statistically insignificant. As for the spell polynomials, the joint test of the significance of the female polynomial has a p-value of 11 percent, while the male polynomial only has a p-value of 49 percent. Again, the likelihood ratio test indicates that the specification with the DWS female and DWS male spell polynomials is preferred to a specification without them. Further, the tests for the equality of the hazard functions indicate that the DWS male and female hazards differ at all relevant levels of significance. The likelihood ratio test for the homogeneity of the spells has a p-value of 0.01 percent, and the log-rank test for the equality of the survivor functions has a p-value equal to 0.01 percent as well.

This again presents evidence that there is duration dependence in bankruptcy. Figure 5 plots one semi-parametric hazard for DWS-males and one for DWS-females. Rather than present the three different hazards for both DWS-males and DWS-females, I present the mean hazards only. Interestingly, the shapes appear significantly different. The female hazard starts at a much lower rate than the male hazard, as indicated by the intercept coefficients. Next, the female hazard peaks in the third spell-year and remains relatively constant until the eighteenth spell-year. Conversely, the DWS-male hazard starts at a peak, similar to the DWS hazard from Figure 2B, and bottoms out in the seventh spell-year. There is a second peak in the male hazard in the twelfth year, and then the hazard approaches zero quickly.

It is easy to see how the DWS-male and -female hazards from Figure 5 combine to make the DWS hazard in Figure 4B. The hazard starts at a relatively high rate in between the DWS-male and DWS-female intercepts from Figure 5. Next, the combined hazard peaks in the second year, indicating that the increase in the female hazard was larger than the decrease in the male. However, the female hazard increased by a smaller amount in the third year while the male hazard continued its decrease at about the same rate, which led the combined hazard to fall in Figure 4B. The second peak in Figure 4B is clearly driven by the male hazard as well.[23]

One interpretation of these results is that male DWS households are more likely to file for bankruptcy soon after the event. This suggests that the financial problems for a larger percentage of male-headed households may have begun while still married, but it was not until after the event that the bankruptcy filing occurred. Since female-headed households look more like single and married households, it may be that a higher percentage of female filers had their financial trouble occur after the divorce, separation, or death.

Thus, it appears that gender does play a role in the decision to file, but it comes through the DWS households. Interestingly, there does not appear to be this same difference by gender for single households. For singles, all tests indicated that the hazards did not differ for males and females.

V. SUMMARY, CONCLUSIONS, AND POSSIBLE EXTENSIONS

This paper uses the PSID to examine whether there is duration dependence in personal bankruptcy, and it represents the first use of the PSID to do so. Spell equals the number of years the household has existed in its current marital status – single, married, or divorced-widowed-separated. The non-parametric and semi-parametric estimated hazard functions indicate that there is positive duration dependence for the first three to four years. This seems plausible that some households avoid bankruptcy for a few years, but they revise their estimates of the long-term costs and benefits of bankruptcy when their financial condition does not improve. This revision leads them to file for bankruptcy.

Another finding in this paper reinforces the evidence for duration dependence. As expected, the financial benefit is significantly larger for the filers than the non-filers. Unexpectedly, the mean and median benefit for the filers in the year they filed is less than the mean benefit in the year before they filed. This indicates that one bad year may not lead to bankruptcy for all households, but several years with a positive financial benefit may lead to bankruptcy.

Together, these findings suggest that policies aimed at helping debtors avoid bankruptcy may decrease the number of filings, especially if the help comes early. While some portion of households will file for bankruptcy regardless, the availability of alternatives could help some households avoid bankruptcy. For example, Sullivan and Worden (1990) found that states with more credit-counseling services per capita have a lower filing rate. If households had access to credit-counseling services or the availability of these services was better advertised, it may help some avoid bankruptcy.[24]

In addition to credit counseling, changes in the Unemployment Insurance (UI) program may decrease the number of filings. Fisher (2001) found that increases in average UI benefits decrease the number of households that file for bankruptcy. Results presented here provide supporting evidence (Table 5).[25] For some recently unemployed households, an increase in income from a higher replacement rate or from extended benefits may be the difference between filing for bankruptcy and not filing. For example, even if an employed person has debt problems and a positive financial benefit, he may not file for bankruptcy. If he becomes unemployed, he may be unable to repay his creditors and maintain a minimum level of consumption. This leads him to revise his estimates of the costs and benefits of bankruptcy, which may result in a bankruptcy filing. However, the prospect of receiving UI benefits for twenty-six weeks may lead him to be more optimistic about the future, which means he may not file for bankruptcy.[26] This also suggests that the extension of UI benefits for an additional thirteen weeks during a recession may be a method to help some recently unemployed households avoid bankruptcy. An increase in the replacement rate may also help some households avoid bankruptcy.

There are several logical extensions to this work. First, the PSID could be used to estimate a competing-risks specification. The 1996 wave of the PSID includes data on liens, debt consolidation, and repossessions, each of which could be used in a competing-risks specification. Alternatively, the competing risks could be filing under Chapter 7, filing under Chapter 13, and not filing. Using county filing rates, White (1987) finds that an increase in the county unemployment rate increases the number of Chapter 7 filings but decreases the number of Chapter 13 filings.

References

Berger, Mark C., and Dan A. Black. 1998. The duration of Medicaid spells: an analysis using flow and stock samples," *Review of Economics and Statistics* 80(4): 667-675.

Braucher, Jean, and Roger Henderson. 2001. Report on a study of debtor education in bankruptcy. *American Bankruptcy Institute Law Review* forthcoming.

Cox, D. R. 1972. Regression models with life tables. *Journal of the Royal Statistical Society, Series B* 34: 187-220.

Dye, Ronald A. 1986. An economic analysis of bankruptcy statutes. *Economic Inquiry* 19: 417-428.

Fay, Scott, Erik Hurst and Michelle White. 2002. The household bankruptcy decision. *American Economic Review* forthcoming.

Fisher, Jonathan D. 2001. The effect of transfer programs on personal bankruptcy. *Bureau of Labor Statistics - working paper #346.*

Gross, David, and Nicholas Souleles. 2002. An empirical analysis of personal bankruptcy and delinquency. *Review of Financial Studies* 15(1): 319-347.

Heckman, James J., and Burton Singer. 1984. Econometric duration analysis. *Journal of Econometrics* 24(1/2): 63-132.

Kiefer, Nicholas M. 1988. Economic duration data and hazard functions. *Journal of Economic Literature* 26: 646-679.

Musto, David. 2000. The effect of personal bankruptcy on credit access: evidence from a panel database on credit reports. *University of Pennsylvania working paper*.

Shumway, Tyler. 2001. Forecasting bankruptcy more accurately: A simple hazard model. *Journal of Business* 74(1): 101-124.

Sullivan, A. Charlene, and Debra Drecknik Worden. 1990. Rehabilitation or liquidation: consumers' choice in bankruptcy. *The Journal of Consumer Affairs* 24(1): 69-88.

Sullivan, Teresa A., Elizabeth Warren, and Jay Lawrence Westbrook. 2000. *The fragile middle class: Americans in debt*. New Haven, CT: Yale University Press.

White, Michelle. 1987. Personal bankruptcy under the 1978 bankruptcy code: an economic analysis. *Indiana Law Journal* 63(1): 1-51.

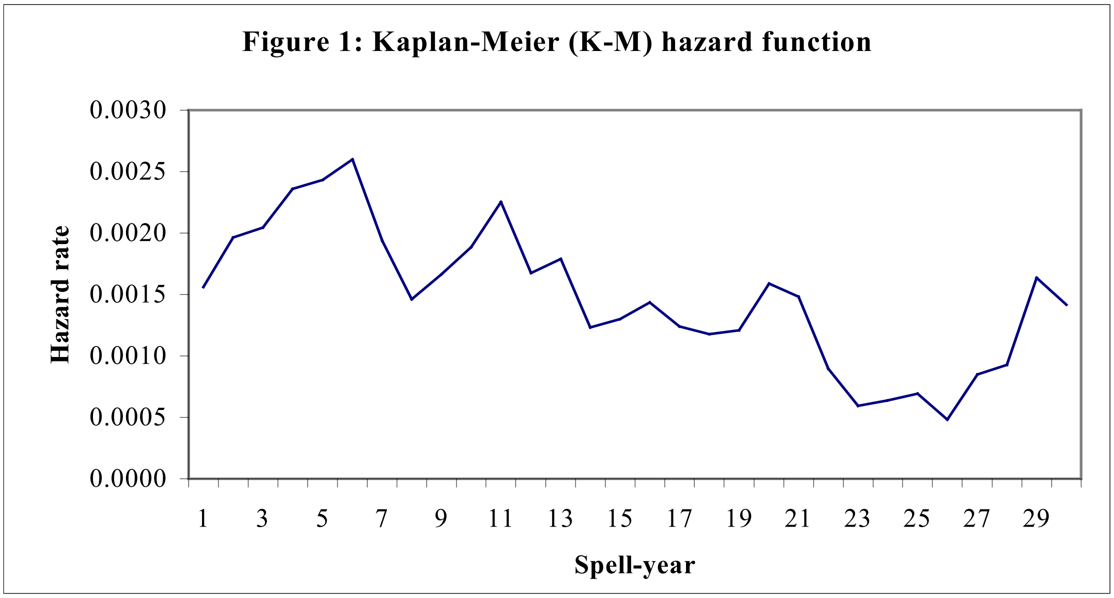
White, Michelle. 1998. Why it pays to file for bankruptcy: A critical look at incentives under U.S. bankruptcy laws and a proposal for change. *University of Chicago Law Review* 65(3): 685-732.

Appendix – The likelihood function

Following Berger and Black (1998), the likelihood function with both a stock and flow sample is:

$$L(\beta)=\prod_{i\in A} f(t_i,x_i,\beta)\times\prod_{i\in B} S(t_i,x_i,\beta)\times\prod_{i\in C}\frac{f(t_i,x_i,\beta)}{S(r_i,x_i,\beta)}\times\prod_{i\in D}\frac{S(t_i,x_i,\beta)}{S(r_i,x_i,\beta)}. \qquad (A1)$$

This assumes that the spell is uncorrelated with the calendar time in which the spell begins. The density function of durations is $f(t, x, \beta)$, where t is the length of the spell, x is a vector of covariates, and β is a vector of parameters. A is the set of flow spells that end during the sample period. B is the set of all flow spells that are right censored. If we let $Pr(t \leq T \mid x) = F(T, x, \beta)$, we can define the survivor function, $S(T, x, \beta)$, as $(1 - F(T, x, \beta))$. C and D are the stock samples, where r_i is the number of periods the spell for household i has lasted before the panel begins. C is the set of stock samples that end during the sample period. D is the set of stock spells that are right censored. For C and D, I know that the spell has lasted for r periods before the panel begins, so that the probability that the total spell length will be t is given by $f(t, x, \beta) / S(r, x, \beta)$. Finally, define the hazard rate as $h(t, x, \beta) \equiv f(t, x, \beta) / S(t, x, \beta)$.



The Kaplan-Meier (K-M) hazard rate equals:

$$\hat{h}_t = \frac{d_t}{n_t}, \qquad (7)$$

where d_t equals the number of households that filed for bankruptcy in spell-year t; and, n_t equals the total number of households with a spell equal to t.

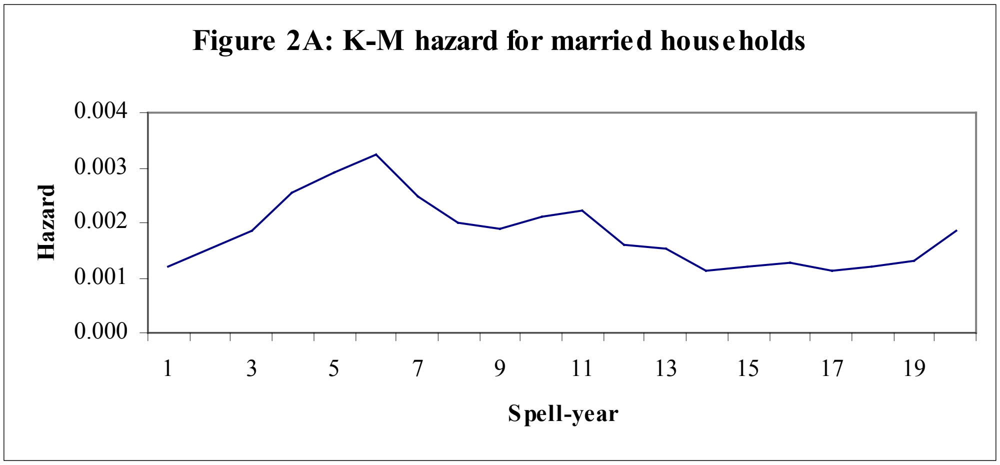


Figure 2A: K-M hazard for married households
Hazard
0.004
0.003
0.002
0.001
0.000
1
3
5
7
9
11
13
15
17
19
Spell-year

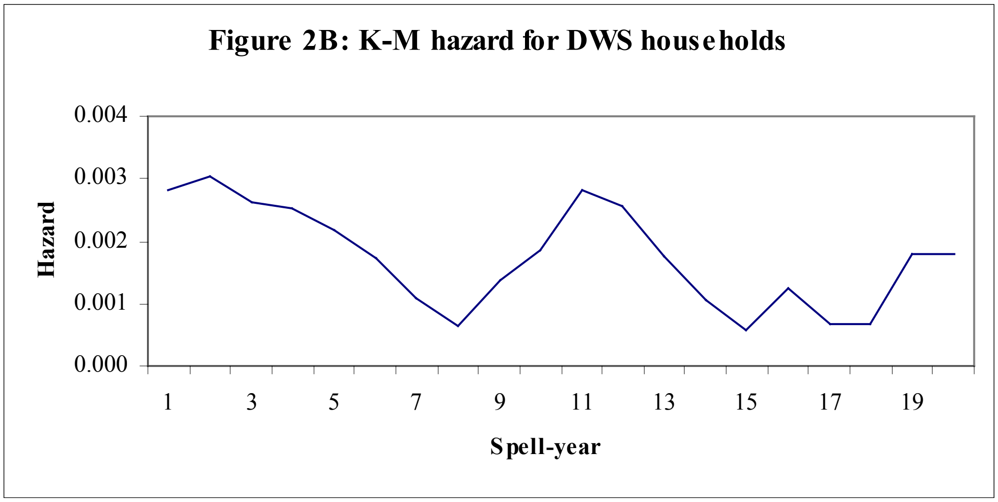


Figure 2B: K-M hazard for DWS households
Hazard
0.004
0.003
0.002
0.001
0.000
1
3
5
7
9
11
13
15
17
19
Spell-year

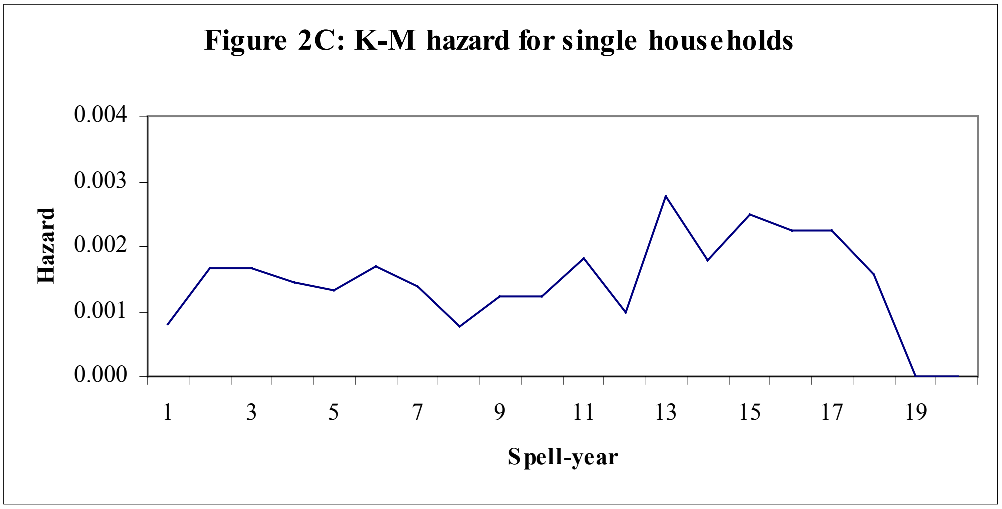
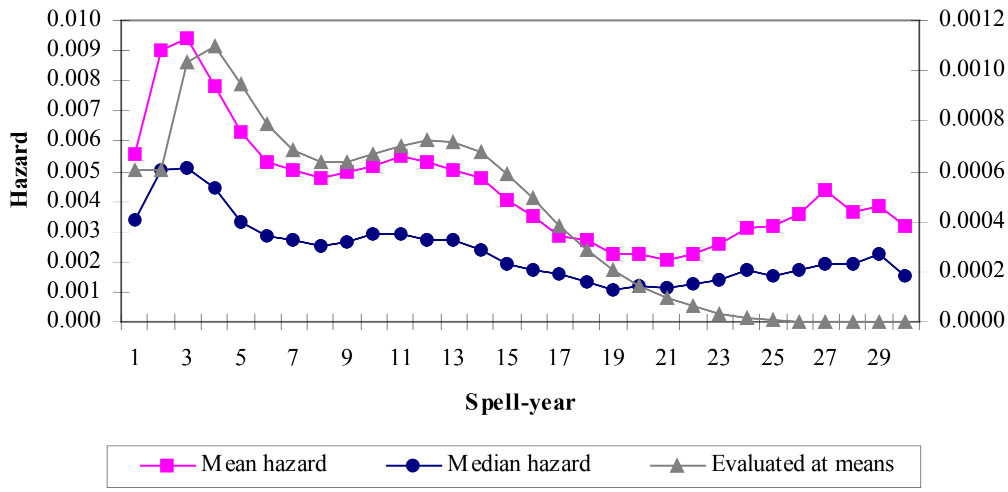


Figure 2C: K-M hazard for single households
Hazard
0.004
0.003
0.002
0.001
0.000
1
3
5
7
9
11
13
15
17
19
Spell-year

Figure 3: Semi-parametric hazard functions



- The mean and median probability hazards are measured on the left axis. The evaluated-at-means hazard is measured on the right axis. The results from column (I) of Table 5 are used to construct this figure.
- The mean and median hazards come from the predicted probability of filing for each household, defined as:

$$\hat{p}_i\left(spell_i \mid x = x_i\right) = \frac{e^{x_i b + \alpha(spell_i)}}{1 + e^{x_i b + \alpha(spell_i)}}, \quad (8)$$

  where *k = 1, 2, …, 30*. The mean hazard is the mean of the predicted probabilities evaluated for a given spell-year, and the median hazard is the median of the predicted probabilities at a given spell-year.
- The evaluated-at-means hazard is defined as the predicted hazard rate in spell-year *t* evaluated at the mean values of the covariates.

$$\hat{p}\left(spell \mid x = \bar{x}\right) = \frac{e^{\bar{x} b + \alpha(spell)}}{1 + e^{\bar{x} b + \alpha(spell)}}, \quad (9)$$

where *b* is the vector of estimated coefficients; and, α represents the vector of estimated coefficients on the spell polynomial.

Figure 4A: Semi-parametric hazard for married households

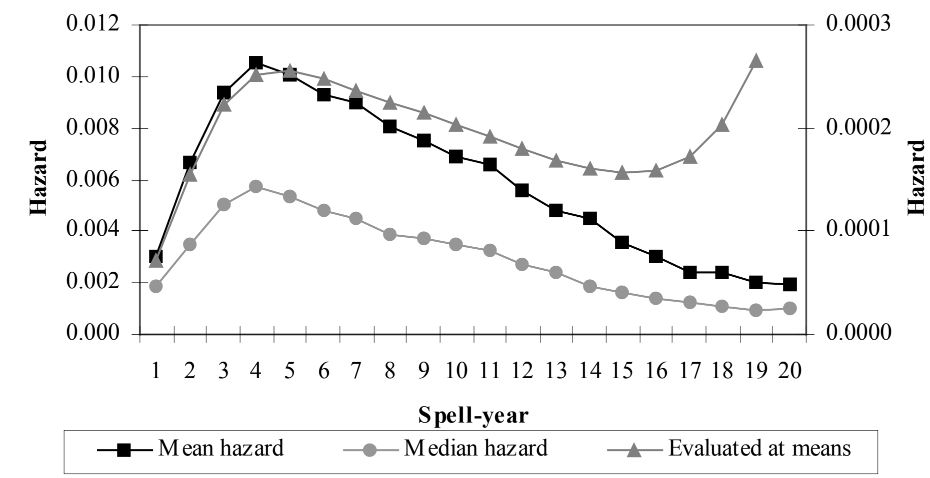
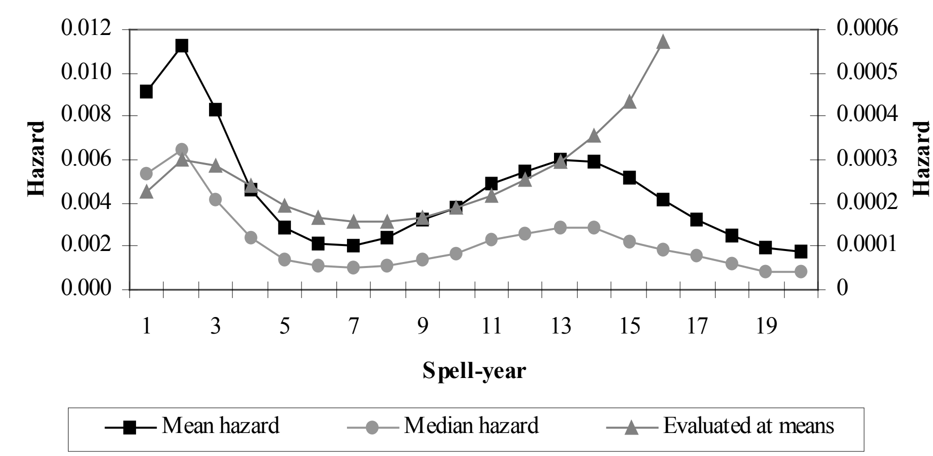
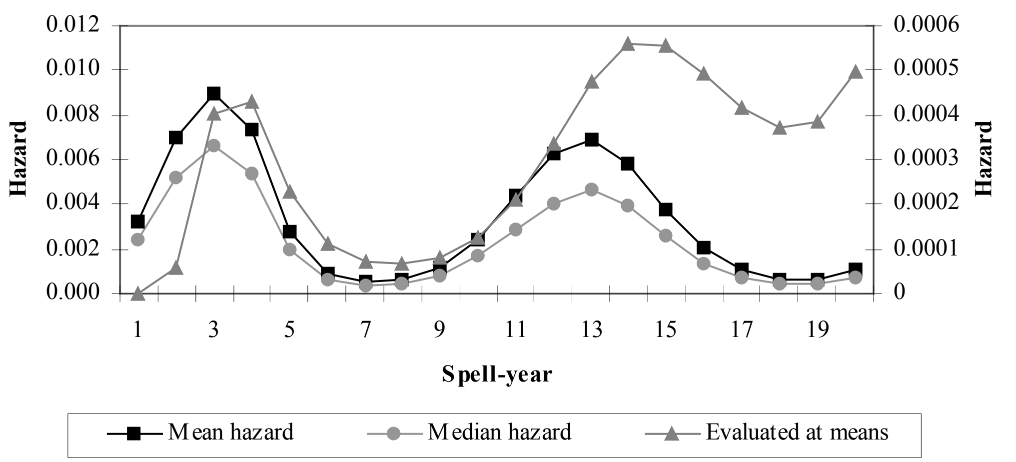


Figure 4B: Semi-parametric hazard for DWS households



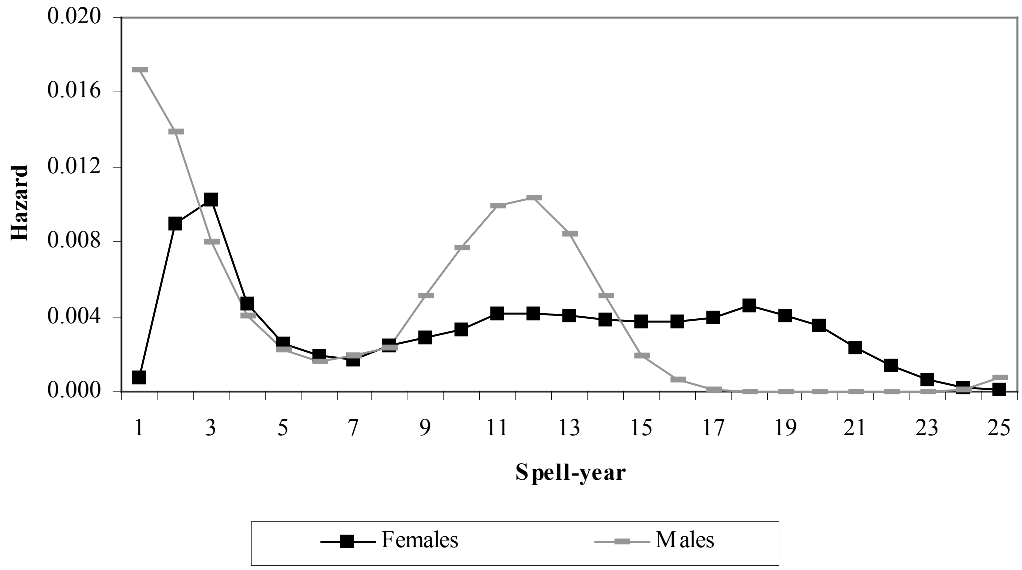
- The married and DWS evaluated-at-means hazards do not continue up to the twentieth spell-year because these hazards increase dramatically after the years shown and approach one quickly.
- The results from column (II) of Table 5 are used to construct this figure.

Figure 4C: Semi-parametric hazard for single households



- The results from column (II) of Table 5 are used to construct this figure.

Figure 5: Semi-parametric DWS hazard by gender



- The figures use the results from Table 6 to construct hazard functions. The mean hazard rate is presented for each gender (see Table 3).

Table 1: Comparison of the financial benefit variable

		Financial benefit[1]		
	n	*Mean*	*Median*	*Std. Dev.*
*Non-filers (all years)**	40,862	$2,002	0	11,066
*Non-filers in 1996***	7,062	$1,829	0	10,339
Filers t	174	$4,600	396	10,262
Filers t-1	150	$6,713	1,454	17,131
*Filers t****	150	$5,831	500	16,668

* This excludes the filers in *t* and *t-1*, but includes the filers in *t-2* and earlier, if they were in the sample.
** This only includes the non-filers from 1996.
***This row only includes the 150 filers that are in the sample in *t* and *t-1*.
- Data come from the Panel Study of Income Dynamics (1989-1996).
[1] $B_{it} = Max[D_{it} - Max(W_{it} - E_{it}, 0), 0]$
D = unsecured debt of household
W = wealth of household
E = state bankruptcy exemptions

Table 2: Table of means for covariates

Variable name	*Mean[1]*	*Median*
Financial benefit to filing ($)[1]	1,895.877	0
Household income ($)	45,785.770	34,000
Negative income shock[2]	0.350	0
Age of head (years)	45.118	42
Tenure of head (months)	63.465	14
Family size	2.711	2
Head graduated high school[2]	0.796	1
Head graduated college[2]	0.268	0
Head missed work (illness)[2]	0.330	0
Own business[2]	0.128	0
Own home[2]	0.576	1
Head is male[2]	0.701	1
Head is married[2]	0.533	1
Head is single[2]	0.187	0
Head is DWS[2]	0.280	0
Average UI benefits ($)	118.462	120
Average AFDC benefits ($)	200.087	196
Lagged state filing rate	0.003	0.003
State income growth	0.016	0.017
Per capita income standard deviation	1,181.766	1139
Legal employment as a percent of population (%)	0.304	0.270
Bank offices as a percent of population (%)	2.7 E-04	2.7 E-04

Notes:

[1] The means only use the observations for the filers in the year they filed and for the non-filers in 1996.

[2] Indicates variable is a dummy variable. The variable equals one if the variable name holds true for the household.

- DWS stands for divorced-widowed-separated.
- The number of observations equals 7,236.
- All dollar-denominated variables are in constant 1997 dollars.

Table 3: Spell length statistics

Spell length by filing status

	n	Mean	Median	Min	Max	Std. Dev.
All						
Spell	41,186	15.502	12	1	78	12.628
Non-filers						
Spell	41,012	15.527	12	1	78	12.639
Non-filers in 1996 (right-censored observations only)						
Spell	7,062	15.577	12	1	78	13.083
Filers						
Spell	174	9.592	7	1	42	7.599

Spell length by marital status & filing status

	n	Mean	Median	Min	Max	Std. Dev.
Married						
Non-filers*	3,749	18.463	15	1	70	14.300
Filers	107	10.065	7	1	42	7.621
DWS						
Non-filers*	1,985	11.464	8	1	59	10.216
Filers	44	8.568	5	1	32	8.323
Single						
Non-filers*	1,328	13.579	12	1	78	11.154
Filers	23	9.348	9	2	24	5.967

* These are statistics for the non-filers from 1996, the last year in the data.

- Spell equals the number of years in current marital status, where marital status is: single; married; or, divorced, widowed, or separated (DWS).
- Filers are the households that filed for bankruptcy, and their data comes from the year of their filing. Th non-filers are the households that never filed for bankruptcy.

Table 4: Empirical distributions of the stock and flow samples

FLOW SAMPLE			STOCK SAMPLE		
Spell length (years)	**All observations** *Frequency*	*Percent*	*Net spell* length (years)*	**All observations** *Frequency*	*Percent*
1	1,665	17.88	1	3,831	12.02
2	2,031	21.81	2	4,050	12.71
3	1,717	18.44	3	4,052	12.71
4	1,380	14.82	4	4,116	12.91
5	1,027	11.03	5	4,128	12.95
6	744	7.99	6	4,194	13.16
7	478	5.13	7	3,085	9.68
8	271	2.91	8	4,417	13.86
Obs.	9,313		**Obs.**	31,873	
	Married			**Married**	
	Frequency	*Percent*		*Frequency*	*Percent*
1	728	16.24	1	2,518	12.76
2	969	21.61	2	2,513	12.73
3	840	18.73	3	2,498	12.65
4	681	15.19	4	2,507	12.70
5	516	11.51	5	2,499	12.66
6	370	8.25	6	2,504	12.68
7	251	5.60	7	2,085	10.56
8	129	2.88	8	2,616	13.25
Obs.	4,484		**Obs.**	19,740	
	DWS			**DWS**	
	Frequency	*Percent*		*Frequency*	*Percent*
1	711	20.75	1	900	13.04
2	771	22.50	2	914	13.24
3	625	18.24	3	913	13.22
4	484	14.13	4	929	13.46
5	339	9.89	5	916	13.27
6	250	7.30	6	936	13.56
7	154	4.50	7	425	6.16
8	92	2.69	8	971	14.06
Obs.	3,426		**Obs.**	6,904	
	Single			**Single**	
	Frequency	*Percent*		*Frequency*	*Percent*
1	226	16.11	1	413	7.90
2	291	20.74	2	623	11.91
3	252	17.96	3	641	12.26
4	215	15.32	4	680	13.00
5	172	12.26	5	713	13.64
6	124	8.84	6	754	14.42
7	73	5.20	7	575	11.00
8	50	3.56	8	830	15.87
Obs.	1,403		**Obs.**	5,229	

* The net spell distribution for the stock sample represents the distribution of spells since 1989, which is the length of time the households were at risk of filing for bankruptcy during the sample period.

- The flow sample includes the spells that began after 1988. The stock sample includes the spells that began in or before 1988.

Table 5: Cox model estimates

	I		II	
	Coefficient	z-stat	Coefficient	z-stat
Head is single	-8.3834	-3.63 *	-22.9055	-2.58 *
Head is married	-7.6379	-3.22 *	-8.3827	-3.21 *
Head is DWS	-7.5773	-3.08 *	-7.5073	-2.43 *
Negative income shock	-0.1355	-0.63	-0.1463	-0.69
Household income	-2.04E-05	-3.70 *	-1.96E-05	-3.54 *
Financial benefit to filing	1.04E-04	4.36 *	1.04E-04	4.32 *
Financial benefit squared	-1.19E-09	-2.30 *	-1.22E-09	-2.35 *
Tenure of head	-0.0016	-1.07	-0.0014	-0.95
Age of head	0.0508	0.92	0.0551	0.92
Age squared	-0.0008	-1.54	-0.0009	-1.46
Family size	0.1842	2.76 *	0.1712	2.42 *
Head graduated college	-0.8964	-2.57 *	-0.9186	-2.63 *
Head graduated high school	0.2273	0.81	0.2131	0.75
Head missed work	0.5565	2.67 *	0.5472	2.63 *
Own business	0.0233	0.12	0.0120	0.07
Own home	-0.4249	-1.65	-0.4314	-1.61
Head is male	0.3860	0.99	0.3929	0.99
Average UI benefits	-0.0094	-1.03	-0.0097	-1.05
Lagged state filing rate	191.8900	1.85	191.8145	1.82
Spell polynomial	YES		YES	
DWS spell polynomial	NO		YES	
Married spell polynomial	NO		YES	

	Chi-squared	*P-value*	*Chi-squared*	*P-value*
Test of spell coefficients	10.63	0.101	6.58	0.362
Test of DWS spell coef.	------		3.42	0.636
Test of Married spell coef.	------		8.74	0.189
Test of all 24 spell coef.	------		68.09*	0.000
LR test of restricted model	18.04* [1]		34.66* [2]	

Notes

* Indicates the test statistic is significant at the 5 percent level of significance.

[1] LR test of the specification including spell versus a specification excluding the spell variables.

[2] LR test of column I versus column II.

- The number of observations equals 41,186.
- Additional state-level variables were included in the specifications but their coefficients are not shown in the table above. These variables are average AFDC benefits, state income growth, standard deviation of per capita income, legal employment, and banks. Also included but not shown are year dummy variables.
- The PSID weights are included in each specification.
- The dependent variable equals one if household *i* filed for bankruptcy in year *t*; equals zero otherwise. The specification was estimated using a logit.

Table 6: Cox model estimates with DWS male and female spells

	Coefficient	*z-stat*
Head is single	-16.9877	-1.63
Head is married	-7.3442	-2.77 *
DWS male	-4.9686	-1.28
DWS female	-15.5866	-2.60 *
Change in income*	-0.1309	-0.62
Household income ($)	-1.96E-05	-3.54 *
Financial benefit to filing ($)	0.0001	4.13 *
Financial benefit squared	-1.21E-09	-2.23 *
Head is male	-0.4256	-0.54
Spell polynomial	YES	
Married spell polynomial	YES	
DWS male spell polynomial	YES	
DWS female spell polynomial	YES	

	Chi-squared	*P-value*
Test of spell coefficients	7.93	0.094
Test of Married spell coefficients	7.42	0.191
Test of DWS male coefficients	6.44	0.490
Test of DWS female coefficients	7.41	0.115
Test of all 24 spell coefficients	67.15	0.000 *
LR test of restricted model[1]	53.57	0.000 *

Notes

[1] The restricted model includes all of the variables except the DWS male spell polynomial and DWS female spell polynomial.

* Indicates the test statistic is significant at the 5 percent level of significance.

- Not all variables included in the specification are presented in this table. See Table 5 for the complete list.
- The PSID weights are used in the specification.
- The number of observations equals 41,186.
- The dependent variable equals one if household *i* filed for bankruptcy in year *t*; equals zero otherwise. The model was estimated using a logit.

[1] In 1985, the United States reached a new high in the number of personal bankruptcy filings at 401,000. Since 1986, the number of filings per year has more than quadrupled to 1.4 million filings. The data on the number of filings come from the American Bankruptcy Institute.

[2] In part, the proposed changes are designed to discourage "abusive filings". The House named their version of the bill "Bankruptcy Abuse Prevention and Consumer Protection Act of 2001", while the Senate named their bill the less transparent "Bankruptcy Reform Act of 2001". Despite the differing names, the bills are very similar. The most significant changes are to chapter choice, where some filers would be required to use current and future income to repay their debts. If these bills become law, filers who are deemed able to repay at least 25 percent of their debt over five years would be required to use Chapter 13 rather than Chapter 7. The other significant change is to cap the allowable homestead exemption at a value around $125,000.

[3] *U.S. Code: Title 11, Section 707(b).*

[4] In the next section, spell is defined in more detail.

[5] I am grateful to William Hoyt for suggesting this change in terminology.

[6] The data come from the from the Panel Study of Income Dynamics (PSID). Section 3 contains the description of the PSID data.

[7] Only 150 households filed for bankruptcy and had observations in both t and $t-1$. The financial benefit variable is measured imprecisely. The variable is constructed using four variables: household debt, non-housing wealth, home equity, and the bankruptcy exemptions. While I have values for the latter two each year, the PSID only reports the former two every five years (1984, 1989, 1994, and 1999). To fill in the intervening years, I fit a linear trend. In the construction of the variable, this means that the values for the benefit in t, $t-1$, or both are fitted values rather than the actual value.

[8] If a married couple incurs debts under both of their names but only one files for bankruptcy, the other remains liable for these joint debts. If they jointly file, then neither remains liable for the debt.

[9] Sullivan, Warren, and Westbrook (2000) p 194.

[10] I use the 1999 Marital Status data released by the PSID and match it with the 1996 wave to create spell.

[11] It has also been suggested that spell be defined the time the household makes a home purchase or incurs its first significant debt. Data restrictions limit my ability to use either of these definitions. Even if I could start from the beginning and create my own data and survey instrument for the sole purpose of estimating a bankruptcy hazard model, no one clear definition of spell exists.

[12] There are other, more technical issues related to the age of maturity. First, what is the age of maturity? Using a fixed age for all households seems flawed. Alternatively, adjusting for education has problems as well. Two individuals that both graduated from college may have become financially independent at different ages.

[13] As a specification check, I define spell as t minus year formed. This new method assumes that the change occurred on December 31. The specification using this new spell variable is not reported, but the results are similar to the ones in Table 5, column (II). The first difference is that 1,665 observations are

lost because these households had a spell equal to zero under the new definition. In addition, the eighth order polynomial for the DWS interaction terms are jointly insignificant. However, the married and single spells remain significant. This means that the hazard for DWS households does not differ from that of single households, which is plausible when comparing Figure 4B to Figure 4C.

[14] This is done only if the household reports itself as separated every year between the first year it reported being separated and the year it reported being divorced. Otherwise, I use the year of the divorce as the beginning of the spell.

[15] In another specification not reported here, I omit the nine households that filed for bankruptcy the same year they formed since it is impossible to determine whether the filing occurred before or after the new household formed. The results do not change significantly when these nine households are omitted.

[16] Since the PSID reports the year all changes in marital status begin, there is no left censoring in the sample. This means that the likelihood function is identical to Berger and Black (1998, p 668). The likelihood function is shown in an appendix.

[17] Both tests are standard test statistics produced by Stata using the "ltable" command. In the likelihood-ratio test, the chi-squared test statistic equals 6.96, and the chi-squared test statistic in the log rank test equals 4.83. Both tests have two degrees of freedom.

[18] The PSID weights are used in all specifications to make the sample representative. The results do not change significantly if the weights are not used. The standard errors are corrected following the Huber-White method, recognizing that the multiple observations from a household are not independent.

[19] This specification is not shown but is available upon request.

[20] The specification for the spell variables is as follows: $\alpha_1(Married_i) + \alpha_2(DWS_i) + \alpha_3(Single_i) + \delta(Spell_{it}) + \phi(Spell_{it})*(Married_i) + \eta(Spell_{it})*(DWS_i)$. The spell variable is an eighth order polynomial, and δ, ϕ, and η are vectors of coefficients. δ accounts for the slope of the single hazard function, and $(\delta+\phi)$ accounts for the slope of the married hazard. Finally, $(\delta+\eta)$ accounts for the slope of the DWS hazard.

[21] Additional specifications were run with different measures of spell. In the new specifications, the spell begins the year the head of the household reaches maturity. One method assumes this age to equal eighteen, and another method assumes twenty-two. Spell in either method equals the age of the head minus the age of maturity. Specifications were run under both assumptions. In both specifications, the spell coefficients were statistically insignificant - individually and jointly. I do not take this as evidence that there is no duration dependence. Rather, I take this as evidence that spell is mis-measured in these specifications and more properly measured in the reported specifications.

[22] Gross and Souleles (2002) also examine duration dependence in defaulting on debt. In the default specifications, the spell coefficients are generally statistically significant, but no joint test is presented. While Gross and Souleles find no duration dependence in bankruptcy, their paper still addresses an interesting question – what factors have led to the increase in the number of bankruptcy filings? The lack of duration dependence does not hinder their ability to address this question.

[23] One concern about divorced households that filed for bankruptcy is that the dissolution of the marriage is related to the bankruptcy filing. The question is did the divorce lead to the bankruptcy filing. Alternatively, did the financial problems that caused the bankruptcy filing contribute to the decision to divorce? It appears impossible with the current data to determine which came first – the financial

problems or the marital problems. One way to get a sense of it is to compare the widows to the divorcees. Since no widowers filed for bankruptcy, I focus on the widows that filed for bankruptcy. Eight widows filed for bankruptcy, with a minimum and maximum spell of five and twenty years respectively. The mean and median spells for the widows that filed equal 11.75 and 11.5. For the seventeen females that were divorced or separated at the time of filing, the minimum and maximum spells equal two and thirty-two years respectively. Finally, the mean and median spells equal 8.9 and 5 years. While the range is larger for the divorced and separated women, ten of the seventeen filed in the first five years while only one of seven widows filed in the first five years. This suggests that there may have been financial trouble during the marriage that led to the divorce.

[24] Braucher and Henderson (2001) use data on Chapter 13 filers to determine whether a state-mandated financial management course increases the percentage of filers that complete their repayment plan. They found no evidence that filers who took the course were more likely to complete their repayment plan. However, this type of credit counseling occurs after the household files for bankruptcy. Providing this service before the filing occurs may be more beneficial, as indicated by Sullivan and Worden (1990).

[25] The average UI coefficient is positive but statistically insignificant in Table 5. Similar to the findings in Fisher (2001), the average UI coefficient is statistically significant at the 1 percent level of significance if the lagged filing rate is not in the specification. Since the interaction of UI and bankruptcy is not a focus of this paper, I use the results that include the lagged filing rate in order to present a specification more similar to Fay, Hurst, and White (2002).

[26] There are costs and benefits of UI and bankruptcy, which suggests that there is an optimal tradeoff between these programs. See Fisher (2001) for a discussion of these issues.