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The Anatomy of U.S. Personal Bankruptcy under Chapter 13[*]

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Abstract

By compiling a novel dataset from bankruptcy court dockets recorded in Delaware between 2001 and 2002, we build and estimate a structural model of Chapter 13 bankruptcy. This allows us to quantify how key debtor characteristics, including whether they are experiencing bankruptcy for the first time, their past due secured debt at the time of filing, and income in excess of that required for basic maintenance, affect the distribution of creditor recovery rates. The analysis further reveals that changes in debtors' conditions during bankruptcy play a nontrivial role in governing Chapter 13 outcomes, including their ability to obtain a financial fresh start. Our model then predicts that the more stringent provisions of Chapter 13 recently adopted, in particular those that force subsets of debtors to file for long-term plans, do not materially raise creditor recovery rates but potentially make discharge less likely for that subset of debtors. This finding also arises in the context of alternative policy experiments that require bankruptcy plans to meet stricter standards in order to be confirmed by the court.

In short, the bankruptcy system operates behind a veil of darkness created by the lack of reliable data about its operations. The lack of information about "what is going on" in the bankruptcy system leads to a distrust of its results - a belief by some that creditors, debtors, and professionals within the system are all somehow taking advantage of one another and the public at large, and that the system suffers from widespread fraud, abuse, and inefficiency.

1997 National Bankruptcy Commission

1 Introduction

On April 20, 2005, the "Bankruptcy Abuse Prevention and Consumer Protection Act (BAP CPA)," was signed into law and ended a comprehensive legislative effort that began under the Clinton administration. The most significant (and controversial) change introduced by the new personal bankruptcy law was to impose a "means test" on debtors contemplating bankruptcy filing. The aim was to ensure that debtors with sufficient income would file under Chapter 13 and complete a repayment plan out of future income.[1] Despite the prominent role given to Chapter 13 in the reform act, there exists virtually no empirical evidence regarding how Chapter 13 actually performs both as a collection device for creditors and as a means to provide debtors with a financial fresh start.

In this paper, we first construct a novel dataset and present evidence on the actual performance of Chapter 13. The data we provide and analyze exploits information contained in court files related to all Chapter 13 personal bankruptcies recorded by the United States Bankruptcy Court for the District of Delaware between August 2001 and August 2002. The data suggest considerable variation in creditor recovery rates under Chapter 13, with a median recovery rate of 12 percent for both secured and unsecured debt. Related to this observation, we also find that less than half of the debtors are ultimately successful in being discharged. Finally, despite the fact that the court dockets predate the new law, and thus cover voluntary Chapter 13 filers only, about twenty percent of debtors never even have their proposed repayment plan approved by the bankruptcy court.

With the help of this dataset, we address two key questions: First, given the legal structure at the time of filing, what debtor characteristics help explain, on the one hand, whether they are successful in discharging their debts and, on the other hand, creditor recovery rates? Second, what are the effects of more stringent bankruptcy rules on the discharge of debt and

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[1]U.S. personal bankruptcy law also allows a debtor to file under Chapter 7, in which case the debtor obtains a discharge by surrendering his assets. Under Chapter 7, however, important state asset exemptions exist, such as unlimited homestead exemptions in Florida, that severely reduce creditors' ability to collect on loans in default. See section 2 for greater details.

creditors' recovery rate? In particular, we assess the effect of provisions recently added to Chapter 13 that force subsets of debtors to file for long-term plans, as well as other hypothetical policies that require proposed plans to meet stricter standards in order to be confirmed by the bankruptcy court.

To tackle these questions, we build a theoretical model that captures the salient features of personal bankruptcy under Chapter 13. The model highlights a basic trade-off debtors face in proposing long repayment plans versus short ones. Long repayment plans are costly in that they impose restraints on debtors for longer periods, but these plans are also more likely to be confirmed by the court and, ultimately, to result in a financial fresh start. Bankruptcy rules that govern what plans are confirmed given debtors' conditions, as well as what plans are allowed to continue as those conditions vary, are embodied in a trustee's decision rule that we estimate and that debtors take as given. The model then allows debtors to make decisions regarding whether or not to file under Chapter 13 and, if so, what plan length to propose. The model also lets debtors choose, at a later bankruptcy stage, whether to continue or voluntarily default on a confirmed plan as their circumstances change. Our analysis underscores the fact that bankruptcy outcomes cannot be related to plan characteristics independently of some structure, either in the form of a model or assumptions regarding instrumental variables, since Chapter 13 plans are chosen endogenously. Furthermore, even with proper instrumental variables, the empirical framework must take into account that the decision to file for Chapter 13 is itself endogenous.[2] To address these concerns, our paper follows a structural estimation approach that is closely related to the estimation of dynamic discrete choice structural models (surveys of this literature can be found in Eckstein and Wolpin (1989), Rust (1994), and Aguirregabiria and Mira (2007)).[3]

Our analysis allows us to quantify how key debtor characteristics, including whether they are experiencing bankruptcy for the first time, their past due secured debt at the time of filing, and income in excess of that required for basic maintenance, affect the distribution of creditor recovery rates. The analysis further reveals that changes in debtors' conditions during bankruptcy play a significant role in governing Chapter 13 outcomes, including their ability to obtain a financial fresh start. Finally, our model predicts that the more stringent provisions of Chapter 13 recently adopted, in particular those that force subsets of debtors to file for long-term plans, do not materially affect creditor recovery rates but potentially make discharge less likely for that subset of debtors. This finding also arises in the context of alternative policy experiments that require bankruptcy plans to meet stricter standards

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[2]In other words, the framework must address the issue of sample selection bias.

[3]See Keane (2007) also for a detailed a discussion of structural versus atheoretical approaches to econometrics

in order to be confirmed by the court. It appears, therefore, that a stricter bankruptcy code can make it more difficult for debtors to obtain a fresh start but without necessarily helping raise creditor recovery rates.

The paper contributes to a growing area of research whose aim is to assess behavioral and welfare consequences of different bankruptcy schemes. For the most part, the existing theoretical and empirical literature on consumer bankruptcy have proceeded in parallel. Empirical studies are typically concerned with establishing stylized facts and robust statistical links between bankruptcy variables of interest. They have also mostly focused on consumer bankruptcy under Chapter 7. Thus, researchers have looked into factors that are important for consumers' bankruptcy decisions (Fay, Hurst and White, 2002, Buckley and Brignig 1998, Domowitz and Sartain, 1999, Gross and Souleles, 2002, Sullivan, Warren, and Westbrook, 1989, 2000, Warren 2003, 2005) and examined the effects of personal bankruptcy law on the supply of and demand for credit (Gropp, Scholz and White, 1997, and Lin and White, 2001), consumption (Filer and Fisher 2005, and Grant 2005), labor supply (Han and Li 2007), and mobility (Elul and Subramanian 2002). More recently, in light of the debates that surrounded the proposal and eventual passage of BAPCPA, some attention has been devoted to consumer bankruptcy under Chapter 13, with Norberg and Velkey (2007), and Warren (2003), documenting filers' profile and tracking their performance.

Theoretical contributions in the consumer bankruptcy literature have typically aimed at providing tractable models that explain how documented empirical facts relate to aggregate considerations, but that are generally less able to study factors that drive microeconomic data. A number of theoretical studies have used calibration and simulation exercises to explain observed U.S. consumer bankruptcy filing rates, and to evaluate the effects of changes in bankruptcy laws on welfare in general equilibrium settings.[4]

This paper brings together these two strands of literature by estimating a theoretical framework that focuses specifically on Chapter 13 bankruptcy. Given that the framework takes into account the various incentives faced by debtors who file under this Chapter, the exercise is especially suited to analyzing the effects of changing bankruptcy provisions based on estimates from microeconomic data.

The remainder of this paper is organized as follows. Section 2 presents institutional details associated with U.S. personal bankruptcy law as well as a summary of creditors' options outside bankruptcy. Section 3 provides a description of the data and its construction. We also document four measures of Chapter 13 performance: the proposed plan length, the discharge rate, creditors' recovery rate, and proposed plans' confirmation rate. In Section 4,

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[4]See Athreya (2002), Chatterjee, Corbae, Nakamura, and Rios-Rull (2006), Li and Sarte (2006), Livshits, MacGee and Tertilt (2007).

we present a structural model of Chapter 13 bankruptcy. Section 5 presents our estimation results and identifies debtor characteristics that play a significant role in governing Chapter 13 outcomes. Section 6 assesses the effects of policy experiments both directly related to BAPCPA as well as hypothetical. Section 7 offers some concluding remarks.

2   Legal Background

This section first briefly reviews creditors' legal remedies outside bankruptcy. It then addresses the main features of U.S. personal bankruptcy law, and focuses in detail on Chapter 13 court procedures.

2.1   Creditors' Legal Remedies Outside of Bankruptcy

When a debtor defaults on his debt obligations without explicitly filing for bankruptcy, secured creditors, such as mortgage lenders or car loan lenders, will seize property to recover what they are owed. Unsecured creditors, such as credit card issuers, often start with making calls and writing letters soliciting payments. They then typically sell their debts to collecting agencies. Unsecured creditors also have the option to sue the debtor and obtain a court judgment against him. They collect on the judgment by having the court order that the debtor's employer take a portion of his paycheck and remit that money to the sheriff, who then forwards the payment appropriately. This process is known as "wage garnishment." Unsecured creditors can also potentially seize a debtor's bank account and/or foreclose on his home. Different states, however, restrict the amount and type of assets that can be seized to different degrees. Therefore, the process of seizing an account or foreclosing on a property can be costly and, in practice, unsecured creditors rarely do so.

2.2   Main Features of U.S. Personal Bankruptcy Law Prior to BAPCPA

U.S. personal bankruptcy law features two distinct procedures: Chapter 7 and Chapter 13. Given the time span covered by our dataset and the objectives of this paper, the basic features of personal bankruptcy law we provide below predate the passage of the 2005 bankruptcy reform act. Thus, prior to BAPCPA, debtors had the right to choose between the two chapters.

Chapter 7 is often referred to as "liquidation." Under Chapter 7, the debtor surrenders all assets above an exemption level that varies across states. In exchange, he obtains the

discharge of most of his unsecured debt.[5] A debtor cannot file again for Chapter 7 during the six years that follow the last filing. In contrast, Chapter 13 is formally known as "adjustment of debts of consumers with regular income." Under Chapter 13, a portion of a debtor's future earnings are used to meet part of his debt obligations. The repayment plan can last for a period of up to five years. While the debtor's assets are unaffected under Chapter 13, at the end of the payment plan, any remaining debt is discharged. A debtor is prevented from filing again under Chapter 13 for a period of 180 days following his last filing.

2.3   Bankruptcy Procedure under Chapter 13

A Chapter 13 case begins when a debtor files a petition with the bankruptcy court. This petition gives a description of, among other information, the debtor's assets, debts, income, and expenditures. The petition also details past income and lawsuit information. In the petition, the debtor also proposes a repayment plan that devotes all of his "*excess disposable income*" – defined as any income net of necessary living expenses (including insurance and mortgage payments) – to the payment of unmet claims.[6] In order to be confirmed by the court, the proposed plan must be carried out for at least 3 years but cannot exceed 5 years. It must also be filed in good faith. In particular, the debtor must propose to pay at least as much as the value of the assets creditors would have otherwise received under Chapter 7. Finally, the plan must cure any default on secured debt before providing for payments to unsecured creditors. Because the law requires debtors to devote all of their disposable income to the payment plan, the key element of the repayment plan is the proposed plan length.

Upon the filing of a petition, a trustee is appointed by the bankruptcy court. As an instrument of the court, the trustee is responsible for evaluating and recommending whether or not to confirm a proposed plan. He also works as a disbursing agent during the implementation of the plan, collecting payments from debtors and distributing them to creditors. Within a month of the petition filing, the trustee schedules a section 341 meeting. At this

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[5] A discharge releases the debtor from personal liability for certain debts known as dischargeable detbts. It prevents creditors who are owed those debts from taking any action against the debtor. The discharge also prohibits creditors from communicating with the debtor regarding unpaid debts, including by means of telephone calls, letters, or personal contact.

[6] The concept of excess disposable income as implemented by the court is actually quite strict and allows debtors very little room for discretionary expenses. In our sample, the only such item listed in debtors' petitions relates to recreational expenses. Calculations reveal that monthly recreational expenses averaged $48 or 1.9 percent of total expenses. For the median filer, recreational expenses amounted to $30, or approximately 1.5 percent of total monthly expenses. One third of our debtor population reported no recreational expenses.

meeting, creditors are given an opportunity to ask any questions regarding the debtor's financial situation that may affect the plan. Ultimately, the trustee recommends to the court that a proposed plan either be confirmed, along with the implied repayment schedule, or that the plan be dismissed.[7]

If the plan is dismissed, the case ends. Creditors can resume legal remedies outside bankruptcy, as described above, to pursue the payment of their debts. If a repayment plan is confirmed, the debtor starts making payments specified in the plan. Once the plan payments are made, any remaining debt is discharged It is possible that a plan that is initially confirmed can be changed. In particular, the debtor is free to prepay his debts in the event that his assets appreciate or that he receives additional income from an unexpected source, say in the form of inheritance. The debtor can also potentially convert the case to a Chapter 7 bankruptcy, even after confirmation of the Chapter 13 plan, or voluntarily default on the confirmed plan and have the case dismissed. When a debtor benefits from a substantial increase in income after confirmation of a repayment plan, the trustee will require the debtor to increase his payments by the amount of the increase (unless expenses for basic maintenance have also changed). Ultimately, the final plan that is carried out can look very different from the proposed and confirmed plan.

3   The Data

3.1   Data Collection

The data collected in this paper is obtained using an electronic public access service to case and docket information from Federal Bankruptcy courts and the U.S. Party/Case Index. This service is commonly known as Public Access to Court Electronic Records (PACER) and offers bankruptcy court information including: i) a listing of all parties and participants including judges, attorneys, and trustees, ii) a chronology of the dates of case events entered in the case record, iii) a claims registry, and iv) the types of documents filed for specific cases and imaged copies of these documents.

The docket sheet together with court files contained therein allow us to extract information concerning important dates that mark the Chapter 13 bankruptcy procedure, including the filing date, the confirmation date, and the dismissal or discharge date, as well as filers' financial and income information at the time of filing and the final outcome of the case. The court files include debtor petitions, attorney disclosure forms, statements of financial affairs, Chapter 13 plans, and the trustee report. The debtor petitions contain different

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[7]In practice, the court then follows the trustee's recommendation.

schedules, labeled A through J, that set forth the financial situation of the debtor, including real property that is owned, other personal assets in the form of furniture, cash, or insurance, liabilities such as secured debt and unsecured priority debt (taxes), and maintenance expenses for food, clothes, and transportation among other basic expenses.

The court files are mostly "pdf" images from which information cannot be directly extracted using software. We manually collected all of our data by downloading these images and coding them into a database. The data was entered twice and the corresponding entries were cross-checked. The data was also checked against different sources where the same information was reported. For instance, the summary of schedules provides headline numbers on filers' assets, debts, income, and expenditures while petition schedules A through J provide the same information in greater detail.

According to court documents and discussions with court legal staff, as of August 2005, the onset of this research project, 62 of the 94 U.S. bankruptcy courts required mandatory online filing. We focus on the Delaware bankruptcy court in our study because Chapter 13 plans can last as long as 5 years, and Delaware was one of the very first states to start mandatory online filing. Furthermore, we consider all Chapter 13 cases filed between August 2001 and August 2002 anticipating that the large majority of these cases will be closed as of the writing of this paper.

There were 1084 Chapter 13 bankruptcy cases filed in Delaware over our sample period. Of the 1084 cases, we deleted from our sample 136 cases that have incomplete information resulting from either court recording or filing error, and that were therefore trivially dismissed. Our final sample contains 948 cases, 59 of which were later converted to Chapter 7 filings. Of the 948 cases, 872 (or 92 percent of the cases) were closed as of August 4, 2007. Of the cases that were terminated under Chapter 13, 385 debtors (or 44 percent) successfully completed their repayment plans and obtained a discharge while 428 cases were dismissed under Chapter 13. Of the 59 cases that were converted to Chapter 7 filings, 55 debtors were successful in obtaining a discharge while 4 cases were dismissed. Table 1 summarizes this information.

3.2 Data Description

3.2.1 Who uses Chapter 13?

Most of the variables we use in our analysis are directly available from the court files. Others are constructed on the basis of these original variables. For comparison, demographics, employment status, and income information are obtained for the State of Delaware from the 2000 Census and Mortgage Bankers Association. Balance sheet information is obtained from

the 2001 Survey of Consumer Finances at the national level.

Compared to their peers, Chapter 13 filers in our sample are less likely to be married, with 45 percent of the sample being recorded as married versus 54 percent for the state of Delaware. However, they have a slightly larger family, with 2.67 persons in the family relative to the state average of 2.5. Approximately 16 percent of the filers listed alimony as part of either their monthly income or monthly expenses thus suggesting a recent divorce.[8] Over 80 percent of the debtors in our sample own their homes which exceeds the 70 percent state home ownership rate. That said, about one-fifth of homeowners who file for bankruptcy have pending foreclosure lawsuits, much higher than the state average foreclosure rate of 0.35 percent. More generally, over half of the debtors in our sample (53 percent) have pending lawsuits.

We refer to a debtor as a *repeat filer* if he has filed for bankruptcy at least once prior to the current filing since 1980 . In our sample, over 20 percent of the debtors had previously filed for either Chapter 7 or 13, and had thus already been exposed to the experience of bankruptcy.

The debtors in our sample are somewhat less likely to be unemployed than the average Delaware resident, with 4 percent of the filers being unemployed compared to 5 percent in Delaware. Interestingly, about 5 percent of the filers are self-employed. On the other hand, average monthly income for the debtors in our sample is $2900, which falls short of Delaware's average adjusted gross income by approximately 30 percent. Filers for whom we have income data for both the current and previous year show a decline in income prior to filing of close to 20 percent on average. After income deductions for taxes and living expenses, filers were left on average with $490 a month to devote to their repayment plan.

As expected, the most striking aspect of Chapter 13 filers relates to their level of indebtedness. Specifically, their median total debt is about $120,980, around 6.6 times the national median, while their median total assets are $102,966, less than half of the corresponding national median. Their median unsecured debt is $15,631, compared to a national median of zero. Median arrearages on secured loans (which we refer to as *arrears* henceforth), such as mortgages and car loans, amount to $10,769. Together, total debt outstanding for the median filer – arrears as well as unsecured debt – amounts approximately to annual gross income. We estimate a lower bound for medical debts by flagging keywords such as "health",

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[8]Spousal support or alimony falls into one of two categories: temporary maintenance and permanent maintenance. Temporary maintenance is the most common type, and typically lasts at most a few years. The goal of temporary maintenance is to allow the receiving spouse to become adjusted to new conditions. Permanent maintenance refers to rare situations where a couple negotiates and agrees to an award of permanent alimony.

"medical," or "Labcorp," that are listed either as the debt type or the associated creditor. This lower bound comes to $1,084 for the average filer and more than one third of the filers report positive medical debts.

To sum up, Chapter 13 filers do not appear to make up the most destitute part of the general population with respect to assets. However, they do tend to earn noticeably less than average and are very heavily indebted. These observations are broadly consistent with previous findings in the literature.[9]

3.2.2   Outcomes under Chapter 13

Creditors' recovery rate and debtors' ability to obtain a discharge are arguably the key outcomes of the personal bankruptcy process. These outcomes, however, depend importantly on the types of plans that are chosen by debtors and whether these plans are confirmed by the trustee. Hence, this paper focuses on four quantifiable aspects of Chapter 13. These are:[10]

The choice of plan length: This choice is made by the debtor and reflects a trade-off between shorter plans that impose restraints for a shorter period of time but are less likely to be confirmed, and longer plans that are also more likely to be confirmed by the trustee but restrain the debtor for a longer period of time.

The confirmation rate: The percentage of cases that are confirmed. Cases that are not confirmed are either converted to Chapter 7, and may eventually be discharged under that chapter, or dismissed. Given the small number of Chapter 7 conversions in our sample, we do not formally distinguish between dismissal and chapter conversion in our analysis.

The recovery rate: This measure captures payments received by various creditors under Chapter 13 relative to the face value of unpaid claims. Chapter 13 recovery rates are then necessarily zero for cases that are dismissed without confirmation.

The discharge rate: The percentage of cases that are discharged under Chapter 13 and, therefore, result in a financial fresh start for the corresponding debtors.

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[9]See Domowitz and Sartain (1999), Nelson (1999), as well as Fay, Hurst, and White (2002). High asset households and households with regular income are much more likely to file under Chapter 13.

[10]Our analysis must also be consistent with debtors choosing to file for bankrupcty under Chapter 13 rather than resorting to an outside option.

The rate of confirmation captures bankruptcy outcomes in the first stage of bankruptcy.[11] Discharge is an outcome that is observed in the final stage only. Cases that are discharged must necessarily first be confirmed. The recovery rate for creditors summarizes outcomes that can occur at any stage during bankruptcy (e.g. a debtor may decide to voluntarily exit Chapter 13 three quarters of the way through a plan, in which case the recovery rate is calculated as of at that date). Our analysis is based on recovery rates and discharge rates associated with cases that have already terminated.

Figures 1 and 2 illustrate noteworthy aspects of proposed Chapter 13 plans in our sample. First, proposed plan lengths in Figure 1 are nearly bimodal, with the majority of filers proposing either 5-year or 3-year plans.[12] The fact that a large fraction of debtors proposes long term plans is not surprising given that it often takes at least 3 years for filers to make up arrears on secured debt. Second, there exists considerable variation in proposed creditor recovery rates. As shown in Figure 2A, the majority of filers propose to repay at least half of their debt. The mean and median proposed recovery rates are close to 70 cents and 63 cents on the dollar respectively. Around 26 percent of filers propose to pay their creditors back in full.

As far as Chapter 13 bankruptcy outcomes are concerned, the following observations stand out in our dataset. First, close to 20 percent of the filers in our sample are dismissed without ever obtaining the confirmation of a plan, despite the fact that all debtors filed for bankruptcy voluntarily. Second, conditional on being terminated, less than half of the plans are carried out to completion. Even if all cases that are still open eventually resulted in the discharging of debt, the discharge rate would still be less than 50 percent. Third, attorney fees as well as trustee commission and expenses account for an important fraction of total disbursements. Specifically, in Delaware, the trustee receives 6 percent of total payments made under a confirmed plan. Attorney fees represent over 6 percent of plan payments on average.

Finally, currently closed cases indicate that creditors ultimately collect 28 cents on every dollar they are owed on average, with a median recovery rate of 12 percent. As illustrated in Figure 2B, these recovery rates are strikingly lower than those implied by proposed plans. An important reason for the discrepancy is that many debtors in bankruptcy end up not

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[11]Trustees typically ask Chapter 13 filers to start submitting periodical payments according to the plan as soon as the plan is filed. Payments are distributed to creditors only if the plan is confirmed and are otherwise refunded. This practice, together with other court rules, discourages debtors from staying in Chapter 13 bankruptcy without a confirmed plan for too long.

[12]Less than 5 percent of filers propose to use the proceeds from car or home sales, or home refinancing, to pay off some of their debts. For these debtors, the proposed plan length is, on average, 3 months shorter than for those who do not plan on using some of their assets to repay their debts.

carrying out their plans in full, either because they are dismissed by the trustee at a later stage or because they voluntarily exit Chapter 13 before completing their plans. Accordingly, the distribution of actual recovery rates looks very different depending on whether debtors completed Chapter 13 and were successfully discharged of their debts. This is shown in Figure 3, panel A. Furthermore, Figure 3, panel B, illustrates that the duration of the plan proposed by debtors also matters for the distribution of recovery rates. Paradoxically, debtors that propose longer plans (greater than 4 years) are associated with a lower average recovery rate than those that propose shorter plans. Taken together, these facts suggest that changes in debtors' conditions that are unobservable at the time of filing, and that may induce a dismissal by the trustee or a voluntary exit later in the bankruptcy process, play a significant role in determining bankruptcy outcomes.

Ultimately, our Chapter 13 performance measures indicate that creditor recovery rates are considerably lower than those that are first proposed. In addition, more than half the debtors fail to obtain the financial fresh start potentially afforded by bankruptcy law. A summary of these findings is given in Table 2, and a natural question is: what debtor characteristics, or other aspects of Chapter 13, are associated with these outcomes? To answer this question, the next section builds a structural model of Chapter 13 bankruptcy.

4   The Model

This section models debtors' behavior during their Chapter 13 bankruptcy procedure taking as given trustees' decision rules. We do not explicitly model the creditors' problem since they do not actively participate in the bankruptcy process.

Our analysis begins with a debtor's decision to file for bankruptcy under Chapter 13. In order to get a discharge of his debt, the debtor must propose a repayment plan, have it confirmed by the court, and carry it out in full. In the event that the debtor does not obtain a discharge, his case is either converted to a Chapter 7 filing or dismissed. In the latter case, state collection laws apply.

A debtor's payoff from filing depends on whether his debts are ultimately discharged, as well as on the amount of payments made under Chapter 13. We normalize the payoff obtained from resorting to options outside of Chapter 13, including informal default or conversion to Chapter 7, to zero. The net payoff derived from successfully obtaining a discharge, when payments P are made under a confirmed plan, is given by $u_D(Z) - P$ where Z is a set of predetermined exogenous debtor characteristics observable at the time of filing. Aside from excess disposable income, denoted by X, and the amount owed to creditors at the time of default, denoted by B, variables in Z include information obtained from the docket sheets

such as the amount the debtor owes in arrears or the recovery rate he is proposing.

Since the law requires that all of a debtor's excess income be applied to the repayment plan, debtors have little say over per period plan payments and these are treated as exogenous. Their decisions then effectively reduce to choosing whether or not to file for bankruptcy under Chapter 13 and, if so, what plan length in years, L, to propose. Debtors must also potentially decide, at a later stage in the bankruptcy process, wether or not to continue with a confirmed plan given changes in their state. We restrict proposed plan lengths to take either the value three or five, $L \in \{3, 5\}$. While this assumption is made for simplicity, it is consistent with the observed distribution of proposed plan lengths being highly bimodal around these two values (recall Figure 1). Hence, we shall refer to debtors as choosing either short-term plans or long-term plans and, in the remainder of the analysis, we let $L = \{3, 5\}$.

Once a plan is proposed, a trustee must decide whether or not to confirm the proposed plan. We let the dummy variable C take the value one when a plan is confirmed and zero otherwise. In addition, we let $P(C|L; Z)$ denote the probability that characterizes the trustee's confirmation decision. The likelihood of having a plan confirmed is made conditional on the debtor choosing a plan of length L and Z. The debtor takes the confirmation rule followed by the trustee as given. In choosing what plan to propose, he recognizes that its duration has a bearing on the confirmation outcome. By the time they file for bankruptcy, debtors in default do not have much leeway under the law to obtain the discharge that bankruptcy affords them. The interpretation of bankruptcy law, however, is not entirely unambiguous from the standpoint of the trustee and the rule that we estimate allows for some variation in the interpretation of its provisions.

In practice, a debtor's excess disposable income will be subject to changes within the plan resulting from fluctuations in the debtor's circumstances. For example, once a plan is confirmed, a debtor may switch employment, gain additional income in the form of inheritance, or obtain access to refinancing on secured debt. These changes can in principle be observed by the trustee but are not documented and, therefore, unavailable to the researcher.[13] Nevertheless, we can gain insight into these changes by modeling variations in excess income during bankruptcy as being governed by latent variables to be estimated. Specifically, we assume the existence of proportional shocks to excess income, $\eta \in \mathfrak{H} = [0, \infty)$, that can arise at any time $\tau \in [0, L]$. At date τ, the debtor has already contributed $X\tau$ to the plan. Therefore, if per period payments $X\eta$ are made during the remainder of a plan of length L, total plan payments are given by $X\tau + (L - \tau)X\eta$.

Even if a Chapter 13 plan is initially confirmed by the trustee, this plan may nonetheless

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[13]The trustee reviews debtors' W-2 forms annually. Changes in debtors' asset positions, however, are more difficult to monitor except in cases where a substantial appreciation has occurred.

be later dismissed when the shock η is realized. As an example, consider the case where a debtor's income unexpectedly increases while under Chapter 13. The law specifically requires that this increase in income be reflected in payments made under the existing plan.[14] Therefore, any attempt to keep payments unchanged by the debtor, say by arguing for a raise in maintenance expenses, may well result in a dismissal of the case depending on the trustee's view of the argument. Alternatively, suppose that a debtor's income unexpectedly falls while under Chapter 13. Depending on whether this fall does not constitute genuine hardship in the eyes of the trustee, he may well decide to dismiss the initial bankruptcy plan. Thus, we denote the probability that a case is dismissed following the particular realization of a shock η at time τ by $\theta(\eta, \tau, L, Z)$.

If a plan is dismissed at τ after being initially confirmed, then total payments made under Chapter 13 are given by $P = \min\{X\tau, B/(1-\phi)\}$ and the payoff to the debtor is $-\min\{X\tau, B/(1-\phi)\}$. The expression for P in this case reflects the fact that payments made under Chapter 13 never exceed the amount owed. In particular, because the trustee receives a fee that reflects a percentage, ϕ, of payments made under the plan, a debtor repays his debts in full only if $P \geq B/(1-\phi)$. If the plan is not dismissed after the shock η is realized and the debtor stays with Chapter 13, then $P = \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\}$. Even if a plan is not dismissed by the trustee at τ, it is possible that upon the realization of η, the change in a debtor's situation may dictate voluntarily exiting Chapter 13. Whether or not this is the case depends on a comparison of payoffs associated with continuing with the plan after τ or opting out. Because the debtor has already made payments $\min\{X\tau, B/(1-\phi)\}$ at the time η is realized, if $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} < -\min\{X\tau, B/(1-\phi)\}$, he simply exits Chapter 13 and stops making payments. In contrast, if $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} \geq -\min\{X\tau, B/(1-\phi)\}$ and the plan is not dismissed after date τ, the debtor always stays with Chapter 13 and makes payments in the amount of $\min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\}$.

4.1   Discharge and Recovery Rate Outcomes Under Chapter 13

When an initial plan proposal is dismissed outright by the trustee, the debtor's case is terminated without a discharge. We let the dummy variable D take on the value one when the debtor obtains a discharge and zero otherwise. When a proposed plan is never confirmed, creditors do not collect anything under Chapter 13. The recovery rate under Chapter 13, denoted by $R \in [0, 1]$, is then zero.[15] Next, consider the case where a plan is initially

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[14]See Li and Sarte (2006) for a discussion of this contingency.

[15]Creditors who recover nothing under Chapter 13 may nevertheless be able to collect a positive amount outside bankruptcy or under Chapter 7. While our analysis is specifically concerned with outcomes under Chapter 13, section 6 also provides overall recovery rate estimates based on different assumptions regarding

confirmed by the trustee. Several outcomes are then possible.

As explained above, once a plan is initially confirmed, the debtor begins to carry it out and makes payments to offset his debts. As his circumstances change, the trustee re-evaluates the plan. If the plan is dismissed at a later stage $\tau \in [0, L]$, the debtor fails to obtain a discharge, $D = 0$, and creditors' recovery rate is then given by $X\tau(1-\phi)/B$. If, as the plan progresses, variations in the debtor's situation are such that the trustee sees no reason to dismiss the case, the debtor still has to make a decision as to whether to continue with Chapter 13. If $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} \geq -\min\{X\tau, B/(1-\phi)\}$ upon the realization of η, the debtor brings the plan to conclusion and obtains a discharge, $D = 1$. The recovery rate in this case is either $R = 1$ if the debtor has repaid his debts in full or $[X\tau + (L-\tau)X\eta](1-\phi)/B$ otherwise. If instead, $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} < -\min\{X\tau, B/(1-\phi)\}$ once the shock η is realized, the debtor fails to obtain a discharge (since he chooses to opt out of Chapter 13), $D = 0$, and creditors recover the fraction $X\tau(1-\phi)/B$ of their loans. An illustration of the bankruptcy process and its potential outcomes is given in Figure 4. With this description in hand, we can now turn to the formal statement of the debtor's problem.

4.2 The Debtor's Problem

When a debtor initially chooses to file under Chapter 13, he proposes a plan of length L. If the plan is not initially confirmed by the trustee, the case is dismissed and the debtor receives a payoff of zero. If the plan is confirmed, the debtor begins to make payments and obtains a payoff denoted by $V(L, Z)$. Hence, at the time of filing, a debtor chooses L so as to maximize his expected payoff,

$$\max_{L \in \mathfrak{L}} \ P(C = 1|L; Z)V(L, Z), \tag{1}$$

where, given the environment we have just described,

$$
\begin{aligned}
V(L, Z) \ = \ E_{\eta,\tau} \Bigg[& \theta \left(-\min \left\{ X\tau, \frac{B}{1-\phi} \right\} \right) \\
& + (1-\theta) \max \left\{ -\min \left\{ X\tau, \frac{B}{1-\phi} \right\}, u_D(Z) - \min \left\{ X\tau + (L-\tau)X\eta, \frac{B}{1-\phi} \right\} \right\} \Bigg],
\end{aligned} \tag{2}
$$

and $\theta = \theta(\eta, \tau, L, Z)$. We assume that shocks to excess income while under Chapter 13 are governed by the distribution function $f_\eta(\eta|L; Z)$. The distribution describing the time at which this shock occurs is given by $f_\tau(\tau|L; Z)$. The expectations in equation (2) are then taken with respect to these distributions. The first term in square brackets captures the fact

what creditors can potentially recover outside Chapter 13.

that with probability $\theta(\eta, \tau, L, Z)$, the debtor is dismissed at date τ, in which case he has already made payments in the amount $\min\left\{X\tau, \frac{B}{1-\phi}\right\}$. The second term indicates that with probability $1 - \theta(\eta, \tau, L, Z)$, the trustee does not dismiss the case at τ. The debtor can then decide whether or not to voluntarily exit his plan depending on how his circumstances have changed after τ. Note that if L is the chosen plan, then it must be the case that $V(L, Z) \geq 0$. If it were the case that $V(L, Z) < 0$ $\forall L \in \mathfrak{L}$, a debtor would simply not file under Chapter 13 in the first place and resort instead to his best outside option.

4.3   Econometric Specification and the Likelihood Function

In this section, we derive the likelihood function that represents the basis for the estimation of our structural model. The contribution to the likelihood function of each debtor in our sample is equal to the probability of observing the vector of (endogenous) events (L, C, D, R) conditional on the vector of (exogenous) debtor characteristics, Z, and the model's parameters, $\boldsymbol{\beta}$.[16] Given the optimization decisions faced by debtors under Chapter 13, this probability can be written as

$$P(L, C, R, D | Z, \boldsymbol{\beta}) = P(L | Z, \boldsymbol{\beta}) P(C | L; Z, \boldsymbol{\beta}) E_{\eta, \tau} \left[P(R, D | C, L, \eta, \tau; Z, \boldsymbol{\beta}) \right]. \qquad (3)$$

The remainder of this section addresses each of the component on the right-hand side of (3).

To reconcile any potential discrepancy between the model's predictions and observed plan length choices, we allow for the fact that debtors evaluate the probability of first obtaining confirmation of a proposed plan, $P(C = 1 | L; Z, \boldsymbol{\beta})$, using information that is unavailable to the econometrician. A debtor's health or educational status, for instance, may influence the trustee's decisions in a way that is not directly observable. We denote by ε_L a multiplicative error term that lets us differentiate between the debtors' probability assessment of initial plan confirmation and the analogous evaluation made by the econometrician. Hence, we have that the true conditional probability of confirmation is given by

$$P(C = 1 | L, \varepsilon_L; Z, \boldsymbol{\beta}) = Q(C = 1 | L; Z, \boldsymbol{\beta}) \varepsilon_L, \qquad (4)$$

where $Q(C = 1 | L; Z, \boldsymbol{\beta})$ reflects the econometrician's assessment of initial plan confirmation and is parameterized below. We assume that ε_L is characterized by the distribution $G_L(\varepsilon_L)$ with support $\mathcal{E}_L$. (The fact that the probability of confirmation is in $[0, 1]$ imposes restrictions on the $\mathcal{E}_L$. We explicitly discuss these restrictions in the next section.) Although the

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[16]The expected payoff from filing under Chapter 13, $V(L)$, is also endogenous in the model. The vector of endogenous events, therefore, implicitly takes into account the fact that all debtors in our sample have chosen to file under that chapter.

debtor's assessment of having a proposed plan first confirmed uses more information than is available to the econometrician, there is no *a priori* reason why the econometrician's estimate of $P(C = 1|L; Z, \boldsymbol{\beta})$ should be biased. Therefore, we require that $E(\varepsilon_L) = 1\ \forall L$ which immediately implies that

$$P(C = 1|L; Z, \boldsymbol{\beta}) = E[P(C = 1|L, \varepsilon_L; Z, \boldsymbol{\beta})] = Q(C = 1|L; Z, \boldsymbol{\beta}). \tag{5}$$

Let $\widehat{L}$ denote the observed plan length that solves the debtor's problem (1). Given the assumptions maintained in the previous subsection, it must then be the case that

$$Q(C = 1|\widehat{L}; Z, \boldsymbol{\beta})\varepsilon_{\widehat{L}}V(\widehat{L}, Z) \geq Q(C = 1|L; Z, \boldsymbol{\beta})\varepsilon_L V(L, Z) \tag{6}$$

for all $L \in \mathfrak{L}$ and where $V(.)$ is given by equation (2). It follows that if $V(L, Z) \geq 0$,

$$P(\widehat{L}|\varepsilon_{\widehat{L}}; Z, \boldsymbol{\beta}) = P\left(\varepsilon_L \leq \frac{Q(C = 1|\widehat{L}; Z, \boldsymbol{\beta})\varepsilon_{\widehat{L}}V(\widehat{L}, Z)}{Q(C = 1|L; Z, \boldsymbol{\beta})V(L, Z)} \middle| \varepsilon_{\widehat{L}}\right), \tag{7}$$

which is simply $G_L\left(\frac{Q(C=1|\widehat{L};Z,\boldsymbol{\beta})\varepsilon_{\widehat{L}}V(\widehat{L},Z)}{Q(C=1|L;Z,\boldsymbol{\beta})V(L,Z)} \middle| \varepsilon_{\widehat{L}}\right)$ and, moreover,

$$P(\widehat{L}|Z, \boldsymbol{\beta}) = \int_{\mathcal{E}_{\widehat{L}}} P(\widehat{L}|\varepsilon_{\widehat{L}}; Z, \boldsymbol{\beta})dG_{\widehat{L}}(\varepsilon_{\widehat{L}}). \tag{8}$$

If $V(L, Z) < 0$ and $V(\widehat{L}, Z) \geq 0$, equation (6) is always satisfied and $P(\widehat{L}|Z, \boldsymbol{\beta}) = 1$. Observe also that if $V(\widehat{L}, Z) < 0$, then $P(\widehat{L}|Z, \boldsymbol{\beta}) = 0$.

Given the expressions in (5) and (8) for $P(C|\widehat{L}; Z, \boldsymbol{\beta})$ and $P(\widehat{L}|Z, \boldsymbol{\beta})$ respectively in equation (3), it remains only to derive expressions for the last term, $E_{\eta,\tau}[P(R, D|C, \widehat{L}, \eta, \tau; Z, \boldsymbol{\beta})]$. This involves keeping track of the different discharge and recovery rate outcomes that are generated by debtors' decisions contingent on the shocks η and τ. Conditional on the trustee's initial confirmation decision and the plan length chosen by the debtor, a debtor's recovery rate and discharge outcomes depend only on his decision to carry out his plan in full if allowed to continue after date τ. From the perspective of a debtor for whom η and τ have been revealed, this decision is deterministic. From the perspective of an econometrician, however, the debtor's recovery rate and discharge outcomes are random and depend on the structure of the model used to study the data. In our model, for example, a case that is not discharged after initial confirmation reflects either that the case was later dismissed by the trustee or that the debtor chose to voluntarily exit the plan. The derivations that allow us to identify bankruptcy outcomes associated with different debtor decisions, and hence to obtain explicit expressions for $E_{\eta,\tau}[P(R, D|C, \widehat{L}, \eta, \tau; Z, \boldsymbol{\beta})]$, are given in Appendix A.

In the end, the likelihood function we seek to maximize is given by

$$\mathcal{L} = \Pi_{i=1}^{N} P(\widehat{L}_i, C_i, R_i, D_i), \tag{9}$$

where N refers to the number of debtors in our dataset.

4.4   Parameterization

In order to carry out the maximization of the likelihood function (9), several objects must first be parameterized taking into account the restrictions implied by both our model and the econometric specification. These objects relate to the conditional probability of initial plan confirmation, $Q(C|L; Z, \boldsymbol{\beta})$, the probability of dismissal after the shocks η and τ are realized, $\theta(\eta, \tau, L, Z, \boldsymbol{\beta})$, the payoff obtained from discharge, $u_D(Z)$, the density functions that govern the shocks η and τ, $f_\eta(\eta|L; Z, \boldsymbol{\beta})$ and $f_\tau(\tau|L; Z, \boldsymbol{\beta})$ respectively, and the distribution of ε_L, $G_L(\varepsilon_L)$. Choosing parametric forms for these functions first requires that we be explicit about the variables in Z.

For each debtor, we include the following exogenous variables in the estimation of $Q(C| L; Z, \boldsymbol{\beta})$: his ratio of arrears to total debt owed at the time of filing, ARR_DEBT; whether his medical debts exceed 10 percent of total debt, MED_DEBT; the debtor's asset to debt ratio, $ASSET\_DEBT$; his proposed recovery rate, $PROP\_REC$; the debtor's job tenure, $TENURE$, measured in years; whether the debtor's income is above state median income, INC_ABOVE; whether the debtor is a "repeat filer," $REPEAT$; and his attorney's experience in handling bankruptcy cases, ATT_EXP, measured as the in-sample frequency (i.e. the number of cases) associated with the attorney representing the debtor.

We posit that $Q(C|L; Z, \boldsymbol{\beta})$ is given by the logistic function,

$$Q(C = 1|L; Z, \boldsymbol{\beta}) = \frac{e^{q(L;Z,\boldsymbol{\beta})}}{1 + e^{q(L;Z,\boldsymbol{\beta})}}, \tag{10}$$

where

$$\begin{aligned} q(L; Z, \boldsymbol{\beta}) = {}& \beta_0^C + \beta_1^C L + \beta_2^C ARR\_DEBT + \beta_3^C MED\_DEBT \\ &+ \beta_4^C ASSET\_DEBT + \beta_5^C PROP\_REC + \beta_6^C TENURE \\ &+ \beta_7^C INC\_ABOVE + \beta_8^C REPEAT + \beta_9^C ATT\_EXP, \end{aligned}$$

and the β_i^C's are parameters to be estimated. To make sure that the implied conditional probability of plan confirmation, $P(C = 1|L; Z, \boldsymbol{\beta})$, lies in $[0, 1]$, the support of ε_L must be bounded. Specifically, we require that $\mathcal{E}_L = [0, \frac{1}{Q(C=1|L;Z,\boldsymbol{\beta})}]$. In addition, we assume that ε_L is characterized by the power distribution, $G_L(\varepsilon_L) = [\varepsilon_L Q(C = 1|L; Z, \boldsymbol{\beta})]^{\varphi_L}$. Our assumption that $E(\varepsilon_L) = 1 \ \forall L$ then requires that $\varphi_L = \frac{Q(C=1|L;Z,\boldsymbol{\beta})}{[1-Q(C=1|L;Z,\boldsymbol{\beta})]}$. These restrictions, therefore, tie down both the shape and the support of $G_L(\varepsilon_L)$.

We use the same set of exogenous variables in estimating the probability of dismissal, $\theta(\eta, \tau, L, Z, \boldsymbol{\beta})$, except that we replace the proposed recovery rate, $PROP\_REC$, with the recovery rates obtained upon discharge, DIS_REC, and upon dismissal, $DSMS\_REC$, since the shocks that may have affected the debtor after initial confirmation are known

to the trustee at that stage. In addition, we include the shocks τ and η directly in the estimation since they potentially affect the trustee's dismissal decision independently of their implications for recovery rates. In particular, a trustee may well dismiss a filer whose excess disposable income unexpectedly falls, even if the implied change in recovery rate is small, when the decrease in disposable income is interpreted as an attempt on the part of the filer to artificially inflate basic maintenance expenses. Descriptive statistics for the variables in Z are reported in Table 3.[17] As with $Q(.)$, we let a logistic function describe the probability of dismissal,

$$\theta(\eta, \tau, L, Z, \boldsymbol{\beta}) = \frac{e^{d(L;Z,\boldsymbol{\beta})}}{1 + e^{d(L;Z,\boldsymbol{\beta})}}. \tag{11}$$

where

$$
\begin{aligned}
d(L; Z, \boldsymbol{\beta}) = \ & \beta_0^d + \beta_1^d L + \beta_2^d ARR\_DEBT + \beta_3^d MED\_DEBT \\
& + \beta_4^d ASSET\_DEBT + \beta_5^d DIS\_REC + \beta_6^d DSMS\_REC \\
& + \beta_7^d TENURE + \beta_8^d INC\_ABOVE + \beta_9^d REPEAT \\
& + \beta_{10}^d ATT\_EXP + \beta_{11}^d \eta + \beta_{12}^d \tau.
\end{aligned}
$$

We estimate the payoff obtained from discharge as

$$u_D(Z, \boldsymbol{\beta}) = \beta_1^D DEBT + \beta_2^D ASSET, \tag{12}$$

where $DEBT$ and $ASSET$ denote a debtor's total debts and assets respectively. This specification allows for the possibility that debtors enjoy greater a payoff from a financial fresh start the larger the debts they are able to discharge and the more assets they are able to shield under Chapter 13.

In order to limit the number of parameters to be estimated, we assume that τ has a simple power distribution and is independent of Z so that

$$f_\tau(\tau|L; Z, \boldsymbol{\beta}) = \left(\frac{\tau}{L}\right)^{\beta_L^\tau} \ \text{ for } \tau \in [0, L].$$

Finally, we let a Gamma distribution describe the distribution of η,

$$f_\eta(\eta|L; Z, \boldsymbol{\beta}) = \eta^{(\beta_{0L}^\eta - 1)} \frac{(\beta_{1L}^\eta)^{\beta_{0L}^\eta} e^{-(\beta_{1L}^\eta)\eta}}{\Gamma(\beta_{0L}^\eta)},$$

where $\Gamma(.)$ is the incomplete Gamma function.[18] The family of distribution functions we choose has enough flexibility to capture any potential effects of a debtor's plan length choice

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[17] The dataset contains additional variables, such as marital or home ownership status, that are omitted since we find that they do not matter for bankruptcy outcomes when included.

[18] An important benefit of having the distributions of τ and η be independent of Z relates to the considerable reduction in computing time required for the numerical evaluation of the likelihood function.

and characteristics on the likelihood that his case will be confirmed and discharged, as well as the determination of his implied recovery rate. These bankruptcy outcomes in turn feedback into the expected payoff from a given plan length choice and, therefore, whether a debtor even chooses to file for bankruptcy in the first place and, if so, whether he carries out his plan in full.

5 Estimation Results

Tables 4, 5, and 6 present the maximum likelihood estimates of the model's parameters. These estimates allow us to answer two questions of interest. First, what debtor characteristics significantly influence the likelihood that a Chapter 13 bankruptcy plan is initially confirmed by the bankruptcy court? In a related vein, do these characteristics still matter at a later bankruptcy stage as the debtor's circumstances have changed and the trustee reevaluates the plan? The second question concerns how specific debtor characteristics affect Chapter 13 bankruptcy outcomes. More specifically, how do particular debtor attributes affect creditor recovery rates holding everything else constant.

5.1 Parameter Estimates

Table 4 indicates that, all else equal, long-term plans are more likely to be initially approved by the trustee than short-term plans. Although longer plans typically imply higher recovery rates, it is notable that this finding emerges independently of the fact that the likelihood of plan confirmation directly (and significantly) increases with the plan's proposed recovery rate. In other words, independently of the proposed recovery rate, the trustee attaches significant weight to the proposed plan length, perhaps as evidence of good faith on the part of the debtor. In contrast, the fact that a debtor is a repeat filer decreases the probability that his plan will be initially confirmed. This finding suggests that, in the eyes of the trustee, being a repeat filer potentially reveals a type that is prone to abusing the implicit insurance provided by the bankruptcy code. This need not be the case since a filer whose case is not initially confirmed has little chance of seeing his financial situation improve without outside help and, by law, must wait at least 180 days before attempting a new filing. Repeat filers, therefore, could simply represent debtors who are unable to extricate themselves from a dire financial situation on their own. In our dataset, however, only 11 percent of the repeat filers were found to attempt subsequent filings at around 180 days.

As expected, having considerable arrears in relation to total debt owed decreases the probability that a plan will be approved since these arrears make it more unlikely that

a plan will be carried out to completion. Working in the other direction, a debtor's job tenure, and his having higher income (i.e. above the state median), suggest some degree of stability in the debtor's financial situation and increase the probability that the trustee will initially endorse his plan. Interestingly, having an experienced attorney does not seem to matter for having a plan confirmed in the first bankruptcy stage. This is not necessarily surprising, however, since this initial stage leaves debtors with little leeway to make special arrangements.

Table 5 presents parameter estimates associated with the likelihood of dismissal later in the bankruptcy procedure, as the debtor's conditions have potentially changed and the trustee reassesses his plan. The table indicates that, by and large, only new information matters at that stage. Put another way, information taken into account in the initial confirmation decision, such as the ratio of arrears to debt or job tenure, are no longer significant for the likelihood of dismissal in this later phase of bankruptcy.[19] There are two exceptions to this finding. First, being a repeat filer continues to increase the likelihood of dismissal, even conditional on the shocks received. Second, having an experienced attorney lowers the probability that a case will be dismissed after being initially confirmed. Contrary to the initial bankruptcy stage, the law does not provide clear guidance for dealing with unexpected shocks during bankruptcy – job loss, unforeseen medical expenses, etc... – and trustees have to make judgment calls. What is acceptable in some cases may not be in others, and having a guide who knows the local practices proves helpful. Of course, a lawyer who stands by a debtor for three to five years expects to be paid but, as we have seen, legal fees are explicitly considered in the decision to propose a particular repayment plan.[20]

Most notably, Table 5 indicates that the trustee puts significant weight on information regarding changes in the debtor's conditions after initial confirmation of his plan. Thus, the likelihood of dismissal falls with τ, since the longer a debtor has stuck by his initial plan before facing a change in circumstances, the more he has already contributed to this plan. Similarly, the likelihood of dismissal falls with η since increases in excess disposable income raise creditors' recovery rate. That said, we estimate that, on average, debtors who file for short-term plans experience a 5 percent decrease in annual excess disposable income during bankruptcy while those who commit to long-term plans experience a larger 36 percent fall in excess income. More formally, $E_\eta(\eta|L = 3) = 0.95$ while $E_\eta(\eta|L = 5) = 0.64$. The

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[19]Observe that the signs of the parameter estimates are reversed relative to Table 4 since Table 5 captures a likelihood of dismissal rather than confirmation.

[20]Medical debt emerges as insignificant in both Tables 4 and 5, which likely reflects that the lower bound we are able to calculate represents a poor measurement of health related expenses. The fact that the ratio of assets to debt does not matter for the estimation confirms that Chapter 13 provides an effective shield against debtors having to indirectly use some of their assets to repay unmet claims.

parameters governing the gamma distributions, $f_\eta(\eta|L;\boldsymbol{\beta})$ for $L \in \mathfrak{L}$, are reported in Table 6 and are all statistically significant at the 5 percent level.

Figure 5 illustrates the estimated distribution functions governing shocks to excess disposable income during bankruptcy. The leftward shift in $f_\eta(\eta|L=5)$ relative to $f_\eta(\eta|L=3)$ is perhaps not surprising since being bound to a given level of income for a five-year period, to cover basic maintenance only, affords little wiggle room to postpone dealing with adverse events. In contrast, debtors with three-year plans are in a better position to postpone unforeseen expenses until completion of their bankruptcy case. Basic expenses that can only be postponed in the short term vary widely and include, for example, house or car-related repairs, additional expenses associated with a divorce, and unexpected health problems. Finally, Table 6 indicates a statistically significant and increasing relationship between the payoff obtained from discharge and the amount of debt held at the time of filing. Interestingly, we estimate that debtors value their financial fresh start at 87 percent of their debt.

5.2 Effects of Debtor Characteristics on the Distribution of Recovery Rates

The second question of interest in this section relates to the effects of specific debtor characteristics on Chapter 13 outcomes and, in particular, the distribution of creditor recovery rates. For example, given that we have identified being a repeat filer as a significant variable in the trustee's confirmation and dismissal decisions, what then are the implications for the distribution of recovery rates? In answering this question, the lens provided by the particular model at hand is crucial since, in the raw data, one cannot possibly condition on being a repeat filer only while insuring that debtors are otherwise identically distributed in every other dimension. In contrast, the model allows us to create artificial debtors that are identically distributed in all dimensions but one, say being a repeat filer, by boostraping from observed debtor characteristics (outside of being a repeat filer). Having created these artificial debtors, we can then explore how the distribution of recovery rates changes depending on whether, in addition, these debtors are assumed to be repeat filers.[21]

Figure 6, panel A, illustrates how the distribution of creditor recovery rates changes depending on one's experience with bankruptcy. We can see that repeat filers are generally associated with lower recovery rates, with 63 percent of debtors repaying between 0 to 20 percent of their debt. In contrast, only 54 percent of debtors are associated with the

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[21]See Diermeier, Eraslan, and Merlo (2003), for an alternative application of this procedure in a political economy context.

lowest recovery rates among first-time filers. More generally, creditors recover 29 percent of what they are owed on average from first-time filers but only 24 percent from repeat filers. Similarly, Figure 6, panel B, depicts changes in the distribution of recovery rates depending on the amount of arrears debtors hold as a fraction of their total debt. Debtors for whom arrears constitute 15 percent of their debt (those in the lowest 25th percentile) are associated with a 30 percent average recovery rate, and 53 percent of those debtors repay between 0 and 20 percent of their debt. In contrast, when debtors hold arrears equal to 69 percent of their debt (those in the highest 25th percentile), the average recovery rate falls to 21 percent while the measure of debtors repaying less than 20 percent increases by 15 percentage points. Finally, Figures 6, panel C, illustrates the extent to which the distribution of recovery rates changes conditional on debtors having a given ratio of excess (annual) disposable income to debt. This measure essentially determines what debtors can potentially repay depending on the plan length they choose. Debtors in the lowest 25th percentile, those with excess disposable income representing 8 percent of their debt, repay only 18 percent of what they owe on average. Debtors in the highest 25th percentile, those whose excess disposable income represent 21 percent of their debt, are associated with a significantly higher 40 percent average recovery rate.

Figure 7 provides lower and upper bounds in terms of what creditor can expect to recover in Chapter 13 by considering extreme debtor types based on the experiments carried out in Figure 6. The distribution of recovery rates related to "bad types" conditions on being a repeat filer, having high arrears, and having low excess disposable income relative to debt. This "worst" case scenario generates an average recovery rate of only 8 percent, with a substantial 84 percent of debtors repaying less than 20 percent of their debt and none repaying more than 20 percent. At the other extreme, the distribution of recovery rates for "good types" conditions on being a first-time filer, having low arrears, and high excess income relative to debt. This distribution is associated with a much higher 46 percent average recovery rate, with only 37 percent of the debtors repaying between 0 and 20 percent of their debt and 26 percent of debtors repaying at least 80 percent. In sum, comparing Figure 7 to Figure 2, it emerges clearly that specific debtor characteristics have a considerable influence on recovery rates.

5.3   Importance of Shocks in Bankruptcy

We saw in Table 5 that shocks η and τ played a significant role in the trustee's reevaluation of previously confirmed cases. In the model, these shocks represent either bad or good luck that affect debtors while in bankruptcy including, for instance, loss of employment, divorce,

or unforeseen expenses for basic maintenance. To some degree, we might also interpret these shocks as a stand in for aspects of debtors' behavior that we are unable to identify due to lack of data. For example, because all of a debtor's disposable excess income contributes to his bankruptcy plan, he may decide at some later stage to lower work effort wherever employed. Should this result in a loss of income, and because expenses for basic maintenance are fixed, excess disposable income available to repay creditors would then have to fall. While we do not have access to data that can directly confirm this hypothesis, a trustee may decide to dismiss a bankruptcy plan based on his inference that the plan is not being carried out in good faith. This would provide an additional justification for the fact that the likelihood of dismissal decreases with η in Table 5. In either case, however, a question arises as to the importance of subsequent changes in debtors' conditions, whether truly exogenous or self-generated, for Chapter 13 outcomes?

To answer this question, Table 7 provides a comparison of Chapter 13 outcomes between our benchmark model and the model estimated without latent variables η and τ. In the absence of shocks after plan confirmation, we find that debtors are more willing to commit to long-term plans, and the rate of confirmation increases slightly. Most notably, however, without being affected by changing circumstances while in bankruptcy, all debtors with confirmed plans are eventually discharged. This represents 82 percent of the debtors in our sample as opposed to only 41 percent in the benchmark model. Furthermore, because debtors experience a fall in excess income on average while in Chapter 13 (recall our estimates of $E_\eta(\eta|L)$ above), the mean recovery rate increases from 28 percent in the benchmark model to 48 percent in the model without shocks. Therefore, aside from debtor characteristics that are observable at the time of filing, it emerges from our analysis that changes in debtors' conditions after the start of the bankruptcy procedure play a considerable role in governing Chapter 13 outcomes.

5.4   Goodness of Fit

In order to gauge the fit of our model, we present figures that compare its predictions for the distributions of endogenous variables with the analogous empirical distributions in the data. Each of these figures focuses on key aspects of Chapter 13 bankruptcy that we have been emphasizing, namely the distribution of plan length chosen by debtors, the confirmation rate, the discharge rate, and the distribution of recovery rates. We assess how well our model fits the data using Pearson's χ^2 test,

$$N \sum_{j=1}^{K} \frac{\left[f(j) - \widehat{f}(j)\right]}{f(j)} \sim \chi_{K-1}^2,$$

where $f(.)$ denotes the empirical density function, or histogram, of a given endogenous variable and $\widehat{f}(.)$ is the corresponding maximum likelihood estimate of the density function of that variable, N is the number of observations, and K is the number of bins used in the histogram.

Figure 8, panel A, shows a comparison of the distribution of plan length chosen by debtors generated by the model with the corresponding distribution in the data. As we can see from the Figure, the χ^2 goodness-of-fit test does not reject the model at conventional significance levels. Panels B and C of Figure 8 illustrate similar comparisons with respect to the confirmation rate and the discharge rate. In both cases, the model is capable of reproducing the empirical distributions quite well and the χ^2 goodness-of-fit tests cannot reject the model at conventional significance levels. Finally, we can see from Figure 8, panel D, that the shape of the distribution of recovery rates produced by the model matches closely that of the corresponding empirical distribution. The model tends to underpredict somewhat the fraction of debtors associated with the highest recovery rates (i.e. those between 90 and 100 percent), which implies a slightly lower average recovery rate than is observed in the data. As in the other cases, however, the χ^2 goodness-of-fit test does not reject the model at standard significance levels.

6   Policy Analysis

Recent changes in bankruptcy law embodied in BAPCPA were primarily intended to raise creditor recovery rates for subsets of debtors perceived to be benefiting from too lenient a bankruptcy code. One such change now prohibits all debtors with income above state median income from filing for short-term plans. Specifically, the law states that "the applicable commitment period shall be (...) not less than five years, if the current monthly income of the debtor and the debtor's spouse combined, when multiplied by 12, is not less than (...) the median family income of the applicable state." Using the structural model we estimated, we now explore the quantitative effects of such a change on Chapter 13 outcomes.

6.1   Requiring Five-Year Plans for Above Median Income Debtors

Table 8 summarizes the effects implied by requiring debtors with above state median income to file for five-year plans. It should be noted that, following the policy change, debtors who had initially filed for short-term plans, but who no longer have that option, may well decide to exit Chapter 13 altogether rather than file for a five-year bankruptcy plan. Put another way, and recalling equation (2), debtors for whom $V(L = 3) \geq 0$ in the benchmark model

may well have $V(L = 5) < 0$ if forced to make the higher payments implied by a five-year plan. Since we normalized the payoff from resorting to options outside Chapter 13 to zero, these debtors would then exit Chapter 13 bankruptcy. In fact, the model indicates that this effect is somewhat muted in this policy experiment as only one percent of above median income debtors choose to exit Chapter 13 following the policy change.

Interestingly, for the set of debtors targeted by the policy change, the main findings are a decrease in the discharge rate with only a minimal increase in creditor recovery rates. In other words, requiring that above median income debtors all file for five-year plans only makes a financial fresh start less likely for that subset of debtors without necessarily making creditors better off. In particular, the discharge rate falls from 44 percent to 40 percent while the recovery rate rate increases from 28 to 29 percent. The reason for these findings is that debtors concerned by the policy change had already carefully weighed the decision to file for a short-term plan, given the shocks to which they are subjected in bankruptcy, against the likelihood of having their plans confirmed. As they are required to file for five-year plans, these debtors are now committed to a given level of income for basic maintenance over a longer period. As such, they become less able to postpone dealing with unforeseen shocks which, on average, lead to a greater reduction in excess disposable income than if they had been committed to a three-year plan (recall Figure 5). On net, the leftward shift in the distribution of shocks to excess disposable income offsets the fact that debtors are committed to longer plans so that the policy change has little effect on creditor recovery rates. Moreover, because being required to file for a five-year plan exposes debtors to a greater reduction in excess disposable income while in bankruptcy, they become more likely to have their case dismissed (recall that $\theta(\eta, \tau, L, Z, \beta)$ decreases with η) and, therefore, less likely to obtain a discharge.

We should also note that, although the policy change lowers the discharge rate for above median income debtors, findings in the overall sample are not materially affected. This follows from the fact that debtors whose income exceed state median income do not represent a large fraction debtors in Chapter 13. Specifically, these debtors represent 23 percent of the filers in our sample.

6.2   Imposing a Minimum Proposed Recovery Threshold

Because the BAPCPA policy change targeted at above median income debtors proved ineffective in raising their recovery rates, we explore an alternative policy experiment that instead requires these debtors to propose at least a 30 percent recovery rate in order to have their plan confirmed by the court. In other words, we impose that all debtors with above

state median income propose at least the observed mean recovery rate in our sample.

In principle, this policy change does not necessarily force targeted debtors to remain longer in bankruptcy and, therefore, gets around exposing them to the associated fall in excess income as in the BAPCPA experiment above. Table 9, however, suggests that when confronted with this alternative policy change, a nontrivial fraction of debtors (14 percent) now find it optimal not to file under Chapter 13 in the first place. In other words, by requiring a higher proposed recovery threshold in order to obtain confirmation of a case, many debtors find the payoff derived from being in bankruptcy under a given plan, $V(L, Z)$, to be less than that from resorting to an outside option. Accordingly, substantially fewer debtors ultimately obtain a financial fresh start under Chapter 13 (the discharge rate falls from 0.44 to 0.37). In addition, as in the previous policy experiment, the creditor recovery rate remains essentially unchanged. The latter result can be understood in the following way. First, above state median income debtors who were already proposing to repay at least 30 cents on the dollar see their fate (confirmation, discharge, and repayment rates) essentially unchanged by the new policy. Hence, any effect of the policy change on bankruptcy outcomes must come from debtors who were initially proposing less than a 30 percent recovery rate. Second, the latter debtors are precisely those associated with low Chapter 13 recovery rates in the benchmark model; they tend to have high levels of arrears and high levels of debt more generally (and therefore low ratios of excess income to debt). Consequently, the fact that they now opt out of Chapter 13, and are assigned zero (rather than small but positive) recovery rates, has very little effect on overall repayment rates for that population of targeted debtors. Stated differently, the analysis suggests that debtors associated with low proposed recovery rates simply opt out of Chapter 13 if required to propose a higher recovery rate. However, since these debtors repaid very little in the benchmark model, recovery rates for the overall targeted population are left virtually unchanged. In the end, the model suggests that both the new BAPCPA policy in the previous subsection and the hypothetical minimum recovery rate policy studied here make it more difficult for debtors to obtain a financial fresh start without necessarily increasing creditor recovery rates.

6.3   Implications for Overall Recovery Rates

Thus far, our policy experiments have tracked bankruptcy outcomes, and in particular creditor recovery rates, within Chapter 13 bankruptcy only. In computing recovery rates, therefore, we did not particularly focus on debtors who wound up outside Chapter 13 for one reason or another. For some policy experiments, this is not necessarily a problem since the fraction of debtors who opt out of Chapter 13 following a given policy change is small, as

in the case of the new BAPCPA law requiring all above median income debtors to file for five-year plans. In other cases, however, as in the experiment that imposes a minimum proposed recovery threshold to obtain confirmation of a case, the fraction of debtors who then chose not to file for Chapter 13 was sizeable. In addition, recall that some debtors are also dismissed out of Chapter 13 at a later bankruptcy stage. In such cases, debtors may be able to file under Chapter 7 or simply default on their loans. Although our concern in this paper is with understanding what drives Chapter 13 outcomes, a question remains as to what the potential implications of Chapter 13 changes are for overall creditor recovery rates?

To answer this question, it would be ideal to have access, for Chapter 7 debtors, to the kind of detailed micro data we were able to compile for Chapter 13 cases, as well as data regarding debtors for whom state collection laws apply. Such micro data, however, is currently unavailable at this stage. At a more aggregated level, Flynn, Bermant, and Hazard (2003) observe that in approximately 96 percent of Chapter 7 filings, the case closes without any funds being collected by the trustee and distributed to creditors. From the 4 percent of cases that close after disbursement, general unsecured creditors receive about 25 percent of these disbursements, while 36 percent of funds are used cover various costs associated with bankruptcy. In general, studies report a zero percent average return to creditors from Chapter 7 filers. Indeed, this is what motivated BAPCPA to push debtors into Chapter 13 in the first place.

Table 10 presents overall recovery rate calculations based on the assumption that debtors outside Chapter 13 repay either 10 or 20 percent of their debts. The table considers the experiment where above state median income debtors must propose at least a 30 percent recovery rate in order to have their case confirmed by the court. Recall that in contrast to the BAPCPA experiment we considered, this policy experiment was associated with a sizable fraction of debtors no longer choosing to file under Chapter 13. The benchmark model in Table 10 refers to the situation without the policy change but is nevertheless relevant since, even in that case, some debtors are either dismissed by the trustee or voluntarily exit Chapter 13 after initial confirmation. As expected, overall recovery rates increase, both in the benchmark model and in the policy experiment, when debtors outside Chapter 13 repay positive amounts on their debts. This increase, however, remains somewhat contained, even at the extreme where debtors outside Chapter 13 repay 20 cents on the dollar. More importantly, as in Table 9, the policy change is unable to yield a substantive increase, and may even yield a decrease, relative to the higher recovery rates generated in the benchmark model. As before, this result is driven by the fact that debtors who opt out of Chapter 13 were repaying very little in the benchmark model.

7 Concluding Remarks

From court dockets recorded in the state of Delaware between 2001 and 2002, we built and estimated a structural model of Chapter 13 bankruptcy. We found that whether debtors are first-time filers, their arrears at the time of filing, and income in excess of that required for basic maintenance, all significantly affected the distribution of creditor recovery rates. The analysis further underscored the importance of changes in debtors' conditions while in bankruptcy in governing Chapter 13 outcomes, including debtors' ability to obtain a financial fresh start. Our model predicted that the more stringent provisions of Chapter 13 recently adopted into law, in particular those that forced subsets of debtors to file for long-term plans, would not materially affect creditor recovery rates but would potentially make discharge less likely for that subset of debtors. This finding also emerged in the context of alternative policy experiments that required bankruptcy plans to meet stricter standards in order to be confirmed by the court.

References

[1] Aguirregabiria, V., and P. Mira. 2007. "Dynamic Discrete Choice Structural Models: A Survey." Working Paper 297, University of Toronto.

[2] Athreya, K. 2002. "Welfare Implications of the Bankruptcy Reform Act of 1999." Journal of Monetary Economics, 49(8), 1567-95.

[3] Buckley, F., and M.F. Brinig. 1998. "The Bankruptcy Puzzle." Journal of Legal Studies, 27, 187-207.

[4] Chatterjee, S., D. Corbae, M. Nakajima, and J. Rios-Rull. 2007. "A Quantitative Theory of Unsecured Consumer Credit with Risk of Default." Econometrica, forthcoming.

[5] Domowitz, I. and R. L. Sartain. 1999. "Determinants of the Consumer Bankruptcy Decision." Journal of Finance, 54, 403-20.

[6] Eckstein, Z. and K. Wolpin. 1989. "The Specification and Estimation of Dynamic Stochastic Discrete Choice Models." Journal of Human Resources, 24, 562-598.

[7] Elul, R. and N. Subramanian 2002. "Forum-Shopping and Personal Bankruptcy." Journal of Financial Services Research, 21(3), 233-55.

[8] Fay, S., E. Hurst, and M.J. White. 2002. "The Household Bankruptcy Decision." American Economic Review, 92(3), 706-18.

[9] Filer, L.H., and J.D. Fisher. 2005. "The Consumption effects Associated with Filing for Personal Bankruptcy." Southern Economic Journal, 71(4), 837-54.

[10] Flynn, E., Gordon B., and S. Hazard. 2002. "Bankruptcy By the Numbers: Chapter 7 Asset Cases." American Bankruptcy Institute Journal.

[11] Grant, C. 2003. "Evidence on the Effect of US Consumer Bankruptcy Exemptions." Working paper.

[12] Gropp, R., J.K. Scholz, and M.J. White. 1997. "Personal Bankruptcy and Credit Supply and Demand." Quarterly Journal of Economics, 112, 217-51.

[13] Gross, D.B., and N.S. Souleles. 2002. "Explaining the Increase in Bankruptcy and Delinquency: Stigma versus Risk-Composition." Review Financial Studies, 15(1), 319-47.

[14] Keane, M. 2007. "Structural vs. Atheoretical Approaches to Econometrics." Journal of Econometrics, forthcoming.

[15] Han, S. and W. Li. 2007. "Fresh Start or Head Start? The Effect of Filing for Personal Bankruptcy on Labor Supply." Journal of Financial Services Research, forthcoming.

[16] Li, W., and P-D.G. Sarte. 2005. "U.S. Consumer Bankruptcy Choice: the Importance of General Equilibrium Effects." Journal of Monetary Economics, 53, 613-631.

[17] Lin, Emily Y. and Michelle J. White. 2001. "Bankruptcy and the Market for Mortgage and Home Improvement Loans." Journal of Urban Economics, v. 50, iss. 1, pp. 138-62

[18] Livshits, I., J. MacGee, and M. Tertilt. 2007. "Consumer Bankruptcy: A Fresh Start." American Economic Review, forthcoming.

[19] Lin, E.Y. and M.J. White. 2001. "Bankruptcy and the Market for Mortgage and Home Improvement Loans." Journal of Urban Economics, 50, 138-62.

[20] Norberg, S., and A. Velkey. 2007. "Debtor Discharge and Creditor Repayment in Chapter 13." Creighton Law Review 39 (3), 473-.

[21] Porter, K. and T. Twomey. 2007. "Empirical Study of Mortgage Creditors and Services in Bankruptcy Cases." work in progress.

[22] Sullivan, T.A., E. Warren, and J.L. Westbrook. 1989. "As We Forgive Our Debtors." New York: Oxford University Press.

[23] Rust, J. 1994. "Estimation of Dynamic Structural Models, Problems and Prospects: Discrete Decision Processes," in C. Sims (ed.) Advances in Econometrics. Sixth World Congress, Cambridge University Press.

[24] Sullivan, T.A., E. Warren, and J.L. Westbrook. 2000. "The Fragile Middle Class." Yale University Press. New Haven and London.

[25] Warren, E. 2005. "Illness and Injury as Contributors to Bankruptcy." Health Affairs.

[26] Warren, E. 2003. "Who Uses Chapter 13?" in Consumer Bankruptcy in Global Perspective 269, Ian Ramsay ed., Oxford: Hart Publishing.

[27] White M.J. 2001. "Bankruptcy and Small Business. Regulation." 24(2), 18-20.

Appendix A: Derivation of the conditional probabilities associated with recovery rate and discharge outcomes.

There are two basic cases that need to be considered, $C = 0$ and $C = 1$. For ease of presentation, we omit debtors' attributes, Z, and parameters, $\boldsymbol{\beta}$, from the notation in the derivations below. First, when a plan is dismissed outright, it immediately follows that debtors fail to obtain a discharge and that creditors collect nothing under Chapter 13. Hence,

$$P(R, D | C = 0, L) = \begin{cases} 1 & \text{if } R = 0 \text{ and } D = 0 \\ 0 & \text{otherwise} \end{cases}$$

independently of the shocks η and τ.

Next, consider the case of proposed plans that are initially confirmed, $C = 1$, so that

$$P(R, D | C = 1, L) = E_{\eta, \tau}\{P(R, D | C = 1, L, \eta, \tau)\}.$$

When a plan is initially confirmed by the trustee, the debtor begins Chapter 13 in earnest and will likely experience changing circumstances as he goes through the bankruptcy process. As he is subjected to shocks η and τ, a re-evaluation of his plan takes place. The debtor can then exit Chapter 13 and fail to obtain a discharge in two ways: i) his case is dismissed by the trustee, with probability $\theta(\eta, \tau | L)$, or ii) if not dismissed by the trustee, he may voluntarily opt out of Chapter 13 (when $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} < -\min\{X\tau, \frac{B}{1-\phi}\}$). In either case, the observed recovery rate is $R = \frac{X\tau(1-\phi)}{B}$, from which we deduce that $\tau = \frac{BR}{X(1-\phi)}$. It follows that

$$P(R, D = 0 | C = 1, L) = f_\tau\left(\frac{BR}{X(1-\phi)}\right) \frac{B}{X(1-\phi)} \times$$
$$E_\eta \left\{ \begin{array}{c} \theta\left(\eta, \frac{BR}{X(1-\phi)} \Big| L\right) + \left[1 - \theta\left(\eta, \frac{BR}{X(1-\phi)} \Big| L\right)\right] \times \\ 1\left(u_D(Z) - P < -\min\{X\tau, \frac{B}{1-\phi}\}\right) \end{array} \right\},$$

where $P = \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\}$ and $1(.)$ is an indicator function that takes the value 1 when the statement in parenthesis is true.

Should a debtor continue and complete his plan once the shocks η and τ are realized, because the trustee sees no reason to dismiss it and $u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} \geq -\min\{X\tau, \frac{B}{1-\phi}\}$, we observe full debt repayment only if $X\tau + (L-\tau)X\eta \geq \frac{B}{1-\phi}$ or, alternatively, $\eta \geq \frac{B - X\tau(1-\phi)}{(L-\tau)X(1-\phi)}$. Therefore,

$$P(R = 1, D = 1 | C = 1, L) =$$
$$E_{\tau, \eta \geq \frac{B-X\tau(1-\phi)}{(L-\tau)X(1-\phi)}} \left\{ [1 - \theta(\tau, \eta | L)] 1 \left(\begin{array}{c} u_D(Z) - \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\} \geq \\ -\min\{X\tau, \frac{B}{1-\phi}\}, \eta \geq \frac{B-X\tau(1-\phi)}{(L-\tau)X(1-\phi)} \end{array} \right) \right\}$$

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When a debtor carries out his plan in full and $\eta < \frac{B - X\tau(1-\phi)}{(L-\tau)X(1-\phi)}$, the recovery rate will be such that $0 \leq R < 1$. In particular, $R = \frac{X\tau + (L-\tau)X\eta}{B/(1-\phi)}$ so that, in that case,

$$P(R, D = 1 | C = 1, L) =$$

$$E_\tau \left\{ \begin{array}{c} f_\eta \left(\frac{R\frac{B}{1-\phi} - X\tau}{(L-\tau)X} \right) \frac{\frac{B}{1-\phi}}{(L-\tau)X} \left[1 - \theta \left(\frac{R\frac{B}{1-\phi} - X\tau}{(L-\tau)X}, \tau \middle| L \right) \right] \times \\ 1 \left(u_D(Z) - P \geq -\min\{X\tau, \frac{B}{1-\phi}\} \right) \end{array} \right\},$$

where, as before, $P = \min\{X\tau + (L-\tau)X\eta, B/(1-\phi)\}$. This completes the derivation of the likelihood function.

TABLE 1

DATA SUMMARY	
Total Filings	948
Terminated	872
Discharged	385
Dismissed	428
Converted to Chapter 7	59
Open	76

TABLE 2

DESCRIPTIVE STATISTICS	
Fraction of Three-Year Plans*	0.24
Confirmation Rate	0.81
Discharge Rate	0.44
Recovery Rate for Total Debt	
Mean	0.28
Standard Deviation	0.33
Median	0.12

* Three-Year Plans are defined as Plans less than 48 Months

TABLE 3

DESCRIPTIVE STATISTICS					
Exogenous Variable	Mean	Standard Deviation	Median	Minimum	Maximum
ARR_DEBT	0.43	0.31	0.40	0	1
MED_DEBT	0.08	0.27	0.00	0	1
$ASSET\_DEBT$	4.58	6.91	3.14	0.02	132
$TENURE$	5.07	7.86	1.00	0	40
INC_ABOVE	0.23	0.42	0.00	0	1
$REPEAT$	0.22	0.42	0.00	0	1
ATT_EXP	92.30	51.77	108.00	1	165

TABLE 4

MAXIMUM LIKELIHOOD ESTIMATES

Initial Confirmation Probability, $Q(C|L; Z, \boldsymbol{\beta})$

Variable	Estimate	St. Error	T-statistic
L	1.0889*	0.0995	10.9444
ARR_DEBT	-3.1414*	0.3089	-10.1694
MED_DEBT	0.01029	0.2899	0.0036
$ASSET\_DEBT$	-0.0082	0.0211	-0.3886
$PROP\_REC$	0.4840*	0.1730	2.7977
$TENURE$	0.0292*	0.0111	2.6424
INC_ABOVE	0.5138*	0.1810	2.8393
$REPEAT$	-0.6857*	0.1803	-3.8030
ATT_EXP	0.0006	0.0015	0.4505

Log-likelihood: -313.256.

* indicates statistical significance at the 5 percent level.

TABLE 5

MAXIMUM LIKELIHOOD ESTIMATES

Dismissal Probability, $\theta(\eta, \tau, Z, \boldsymbol{\beta})$

Variable	Estimate	St. Error	T-statistic
L	0.2481	0.1570	1.5801
ARR_DEBT	0.5203	0.5338	0.9748
MED_DEBT	-0.0056	0.3614	-0.0154
$ASSET\_DEBT$	0.0383	0.0314	1.2196
DIS_REC	-0.0276	0.5127	-0.0540
$DSMS\_REC$	-0.8687	0.1650	-0.5264
$TENURE$	-0.0039	0.0153	-0.2549
INC_ABOVE	-0.0352	0.2555	-0.1377
$REPEAT$	-0.8707*	0.3331	-2.6136
ATT_EXP	-0.0051*	0.0023	-2.217
η	-4.5171*	1.3289	-3.399
τ	-0.5975*	0.1817	-3.288

* indicates statistical significance at the 5 percent level.

TABLE 6

MAXIMUM LIKELIHOOD ESTIMATES

Variable	Estimate	St. Error	T-statistic
Utility from Discharge			
ASSET	2.8558	2.2958	1.2439
DEBT	0.8664*	0.2209	3.9218
$f_\tau(\tau\|L;\boldsymbol{\beta})$			
β_3^τ	0.4047*	0.0333	12.1700
β_5^τ	0.2928*	0.0156	18.7541
$f_\tau(\eta\|L;\boldsymbol{\beta})$			
$\beta_{0,3}^\eta$	1.6026*	0.2400	6.6774
$\beta_{1,3}^\eta$	1.6833*	0.1795	9.3771
$\beta_{0,5}^\eta$	1.4131*	0.2785	5.0733
$\beta_{1,5}^\eta$	2.2022*	0.3111	7.0781

* indicates statistical significance at the 5 percent level.

TABLE 7

EFFECTS OF CHANGES IN DEBTORS' CONDITIONS

Whole Sample	Benchmark Model	Model Without η and τ
Plan Length		
Fraction Proposing $L = 3$	0.24	0.12
Fraction Proposing $L = 5$	0.76	0.88
Confirmation Rate	0.81	0.82
Discharge Rate	0.41	0.82
Mean Recovery Rate	0.28	0.48

TABLE 8

IMPLEMENTING BAPCPA REQUIRED 5-YEAR PLANS

Above Median Income Debtors	Benchmark Model	Experiment
Fraction No Longer Filing	0.00	0.01
Plan Length		
Fraction Proposing $L = 3$	0.30	0.00
Fraction Proposing $L = 5$	0.70	0.99
Confirmation Rate	0.84	0.85
Discharge Rate	0.44	0.40
Mean Recovery Rate	0.28	0.29

TABLE 9

IMPOSING A 30 PERCENT RECOVERY RATE THRESHOLD

Above Median Income Debtors	Benchmark Model	Experiment
Fraction No Longer Filing	0.00	0.14
Plan Length		
Fraction Proposing $L = 3$	0.30	0.19
Fraction Proposing $L = 5$	0.70	0.67
Confirmation Rate	0.84	0.72
Discharge Rate	0.44	0.37
Mean Recovery Rate	0.28	0.27

TABLE 10

IMPOSING A 30 PERCENT RECOVERY RATE THRESHOLD

	Outside Recovery Rate: *0.10*		Outside Recovery Rate: *0.20*	
Above Median Income Debtors	Benchmark Model	Experiment	Benchmark Model	Experiment
Fraction No Longer Filing	0.00	0.14	0.00	0.14
Initial Dismissal Rate	0.16	0.14	0.16	0.14
Dismissed after Confirmation	0.40	0.35	0.40	0.35
Mean Recovery Rate				
Under Chap. 13	0.28	0.27	0.28	0.27
Overall	0.33	0.32	0.39	0.39

Proposed Plan Length
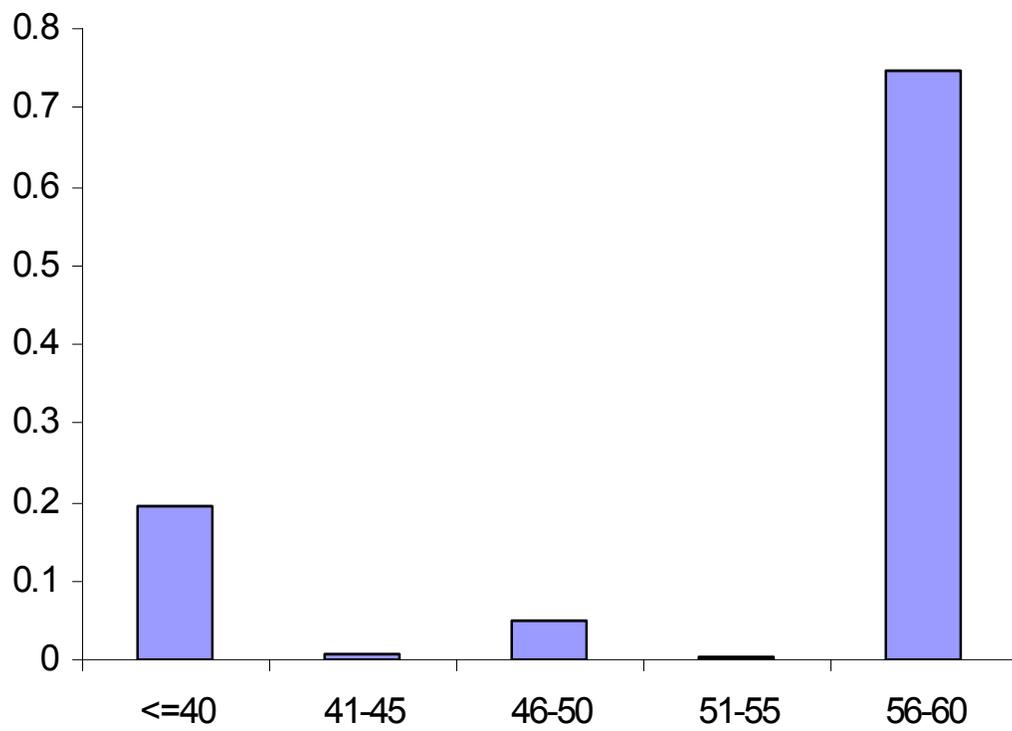
Figure 1: Distribution of Proposed Plan Length

A: Proposed
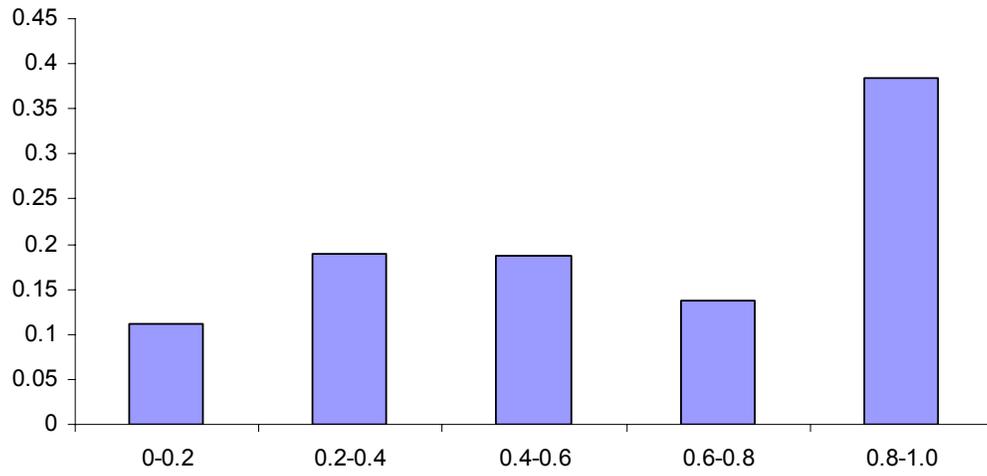
B: Actual
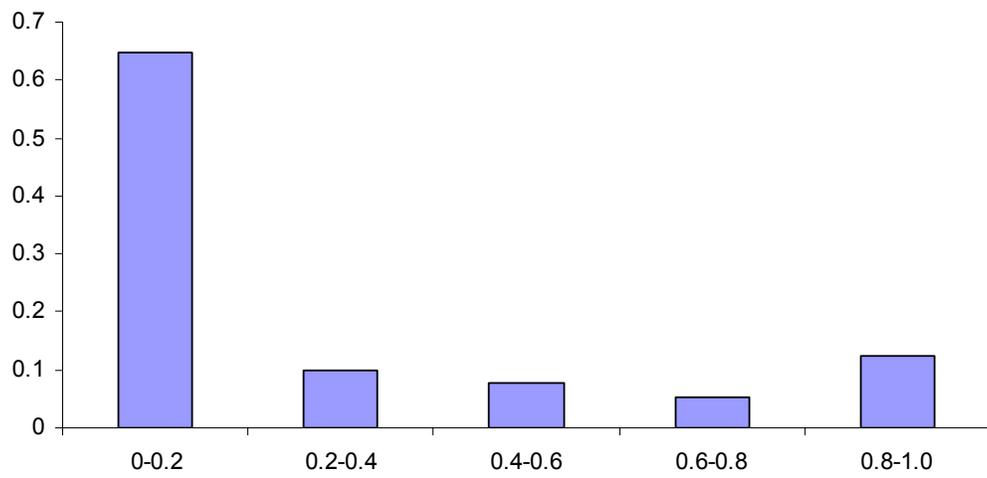
Figure 2: Distributions of Recovery Rates
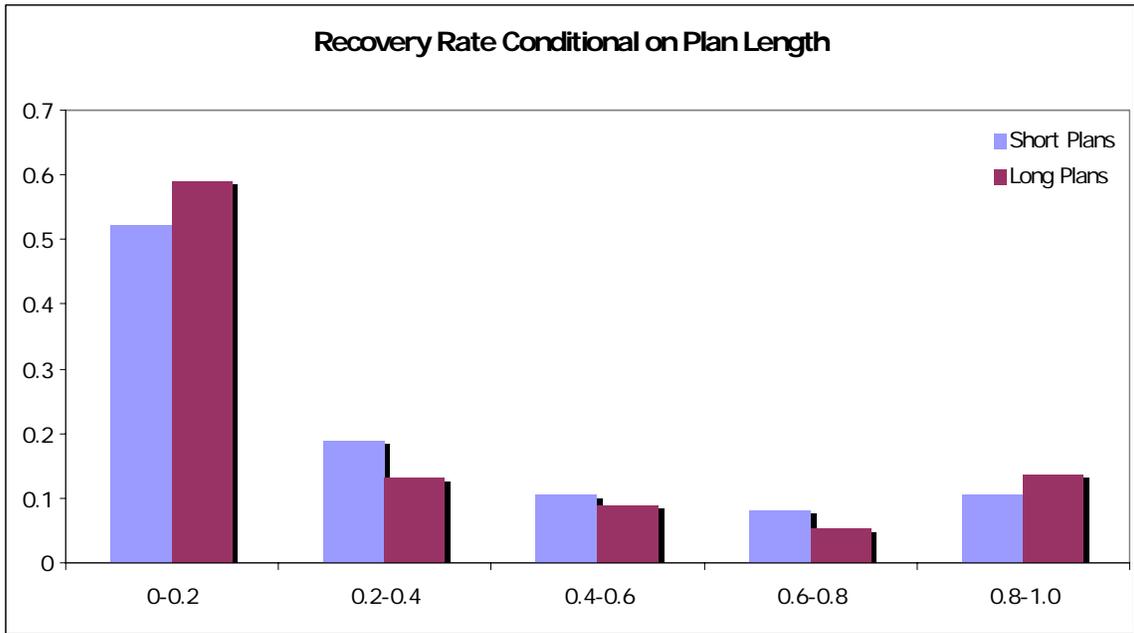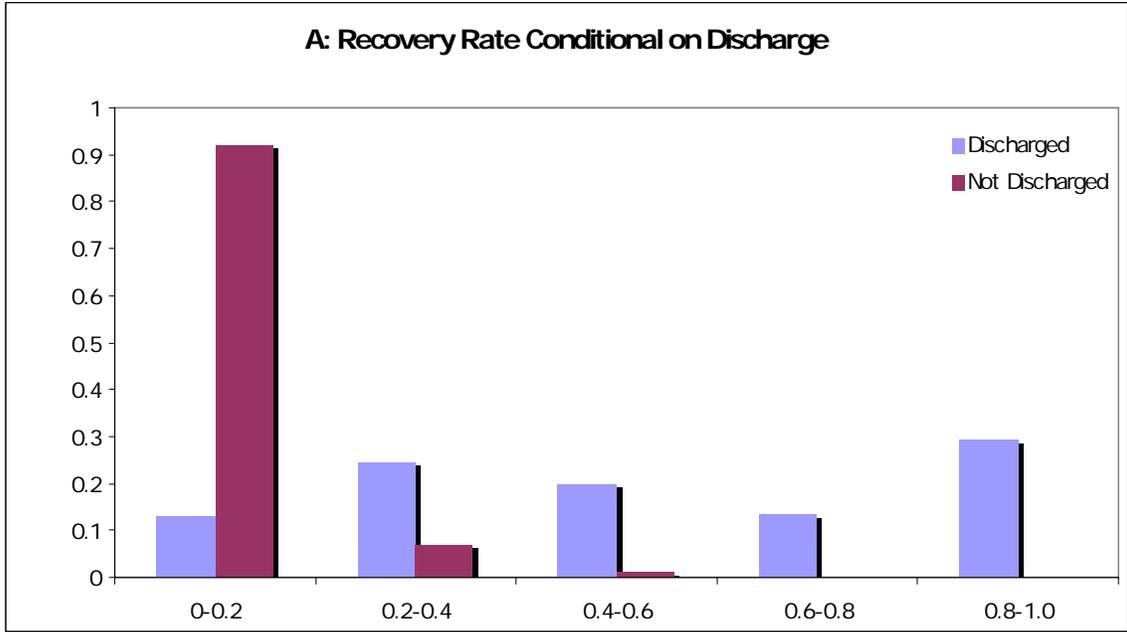
Figure 3: Conditional Distributions of Recovery Rates
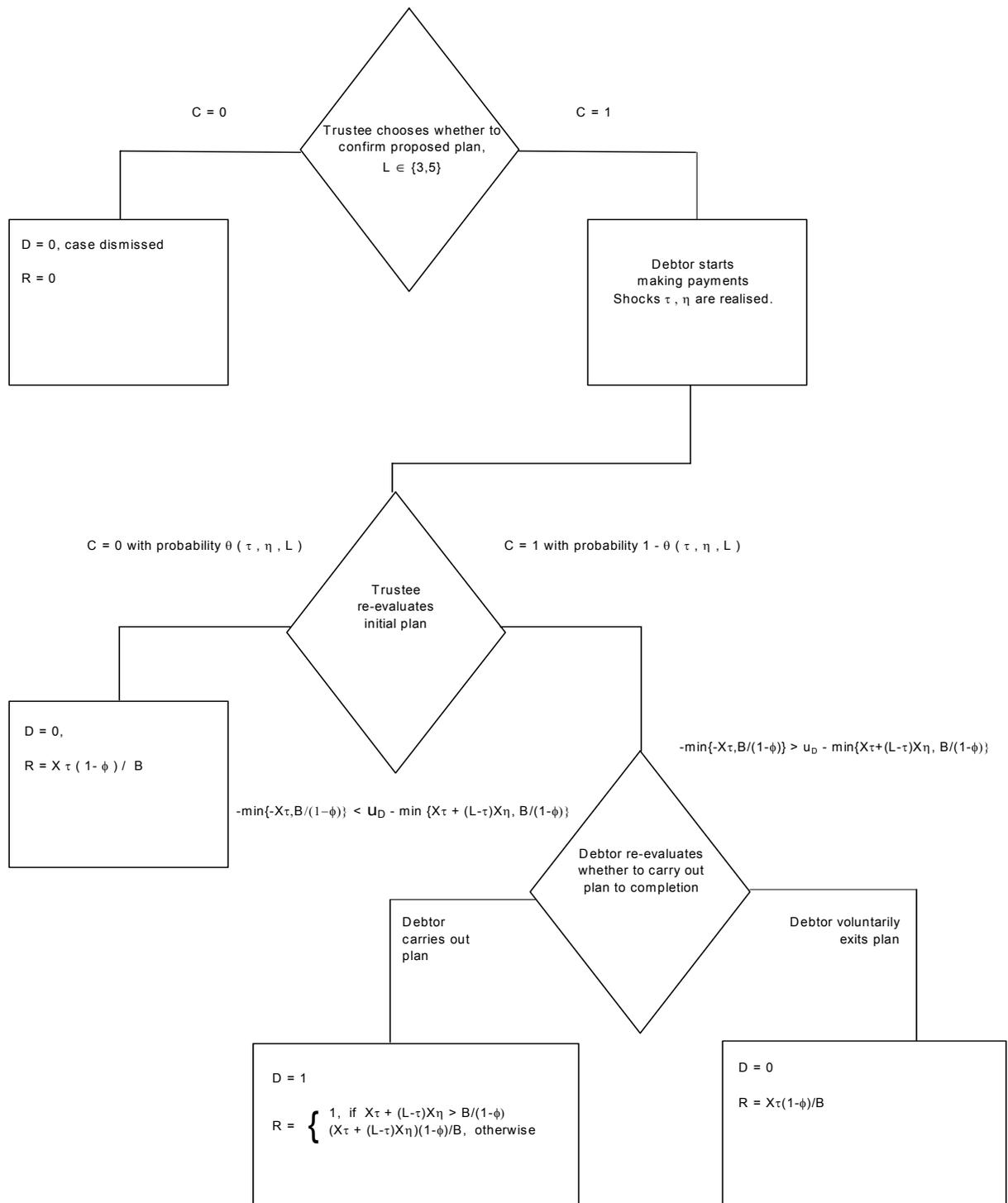
Figure 4: U.S. Personal Bankruptcy Law Under Chapter 13
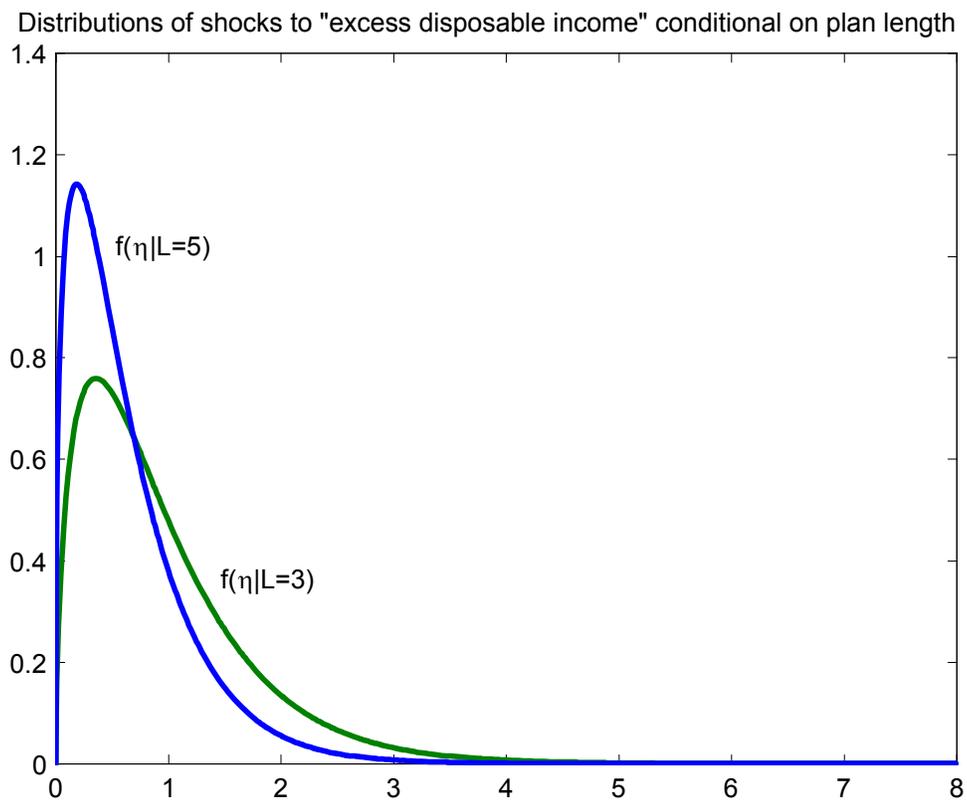
Figure 5: Variations in Debtors' Conditions While in Bankruptcy

Figure 6: Model-Generated Conditional Distributions of Recovery Rates

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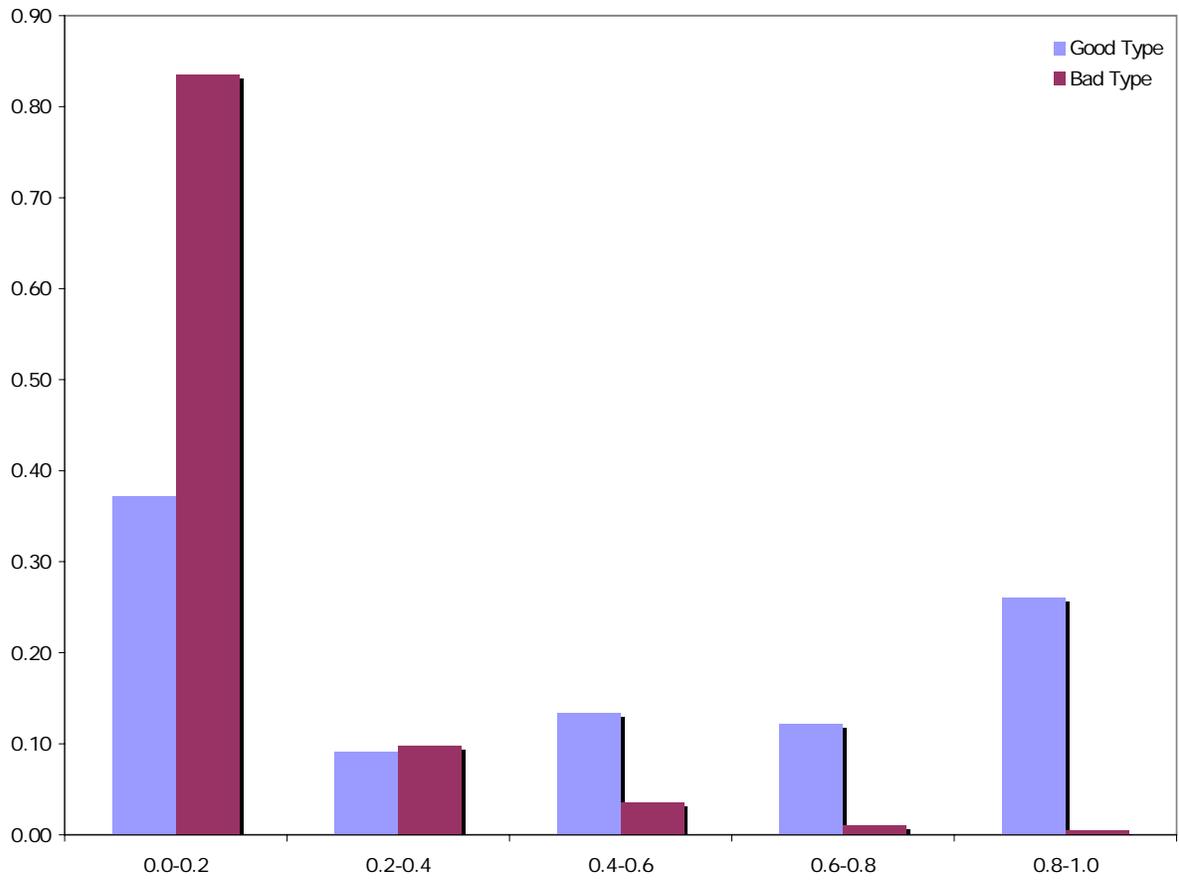
Figure 7: Distributions of Recovery Rates for Extreme Debtor Types
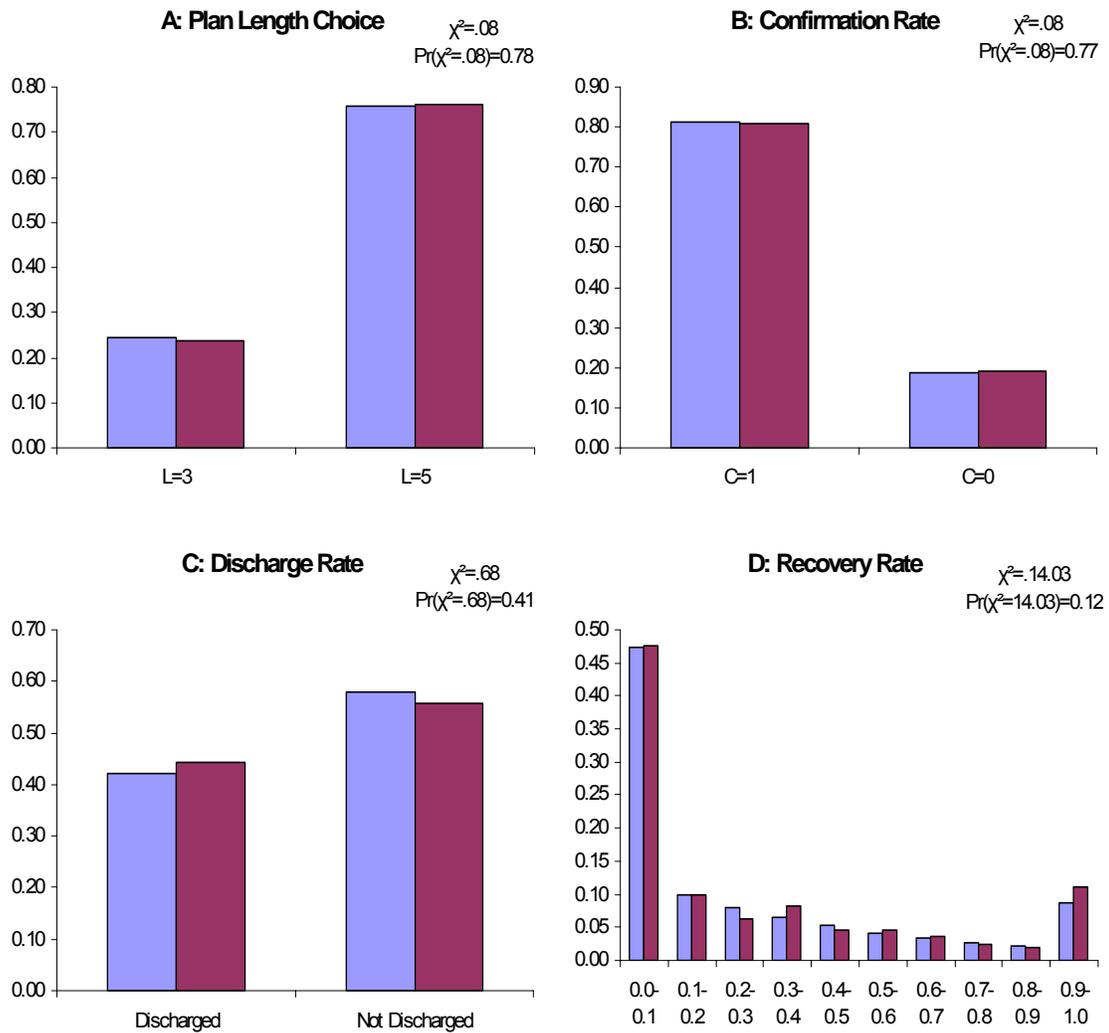
Figure 8: Model Validation: Model (Blue), Data (Red)