Consumption Smoothing and Debtor Protections

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Abstract

Asset exemption laws shield debtors' assets from unsecured creditors, both inside and outside of the bankruptcy system. By shielding assets, exemptions provide a form of default insurance, but lenders compensate for the additional losses by raising interest rates. As in the optimal social insurance literature, I derive a sufficient statistic formula for the welfare impact of increasing exemptions. I then estimate the key components of the formula. First, using the PSID, I estimate the change in consumption that occurs when debtors default, which determines debtors' willingness to pay for default insurance. The estimated consumption drop upon default is 5.5%, which when scaled by a coefficient of relative risk aversion of 3, implies that debtors are willing to pay 16.5% over the actuarially fair rate for default insurance. Second, using credit union data and panel variation in U.S. states' exemption levels, I show that higher exemptions increase interest rates (which are paid by debtors in the repayment state) and decrease recoveries on charged-off debt (which are paid debtors in the default state). This increase in interest rates is marked up 320% over what is actuarially fair. Ultimately, since the actual markup substantially exceeds what debtors are willing to pay, lower exemptions would increase welfare.

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1 Introduction

Debtor protection laws can be viewed as one of the largest social insurance programs in the United States. These laws provide consumption insurance by protecting debtors’ assets, income, and privacy from creditors attempting to collect on debts. But, this insurance comes at a cost, as creditors compensate for additional losses by raising interest rates. Thus, debtor protections form a government-mandated default insurance program that is financed by higher interest rates. The default insurance program for unsecured credit, which is the focus of this paper, is large. Around 10% of households have filed for bankruptcy and a greater percentage have defaulted informally.1 At the same time, total credit card debt exceeds $700 billion and consumers pay more than $100 billion in credit card interest each year.2 Given the frequency of default and the size of consumer credit markets, the design of debtor protections can have important effects on welfare.

This paper evaluates the welfare impact of a key form of debtor protection in the United States: asset exemptions. When a debtor defaults, states’ asset exemptions protect certain property from seizure by unsecured creditors. The level of protection varies widely across states, with the total value of state exemptions ranging from less than $10,000 to over $500,000. In this paper, I derive a sufficient statistic formula for the welfare impact of varying the exemption level. Guided by this formula, I estimate the key determinants of the welfare impact and find that, at the current levels, the cost of additional default insurance substantially exceeds what borrowers are willing to pay. The policy implication is that lower exemptions would increase welfare, even in states with already low exemptions.

I begin by adapting a standard model of social insurance from Chetty (2006) to the case of asset exemptions, and use this model to derive a Baily-Chetty sufficient statistic formula for the welfare impact of raising exemptions. I focus on a two-period model, but show

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1Stavins (2000) reports that 8.5% of households have filed for bankruptcy, and more recently, Dobbie et al. (2016) reports that 15% of individuals have filed for bankruptcy based on their calculations in the Federal Reserve Bank of New York’s Consumer Credit Panel/Equifax Data. VISA reports that 55-60% of charge-offs occur without a bankruptcy filing (NBRC, 1997).

2The $100 billion interest rate payments, reported in Akerlof and Shiller (2015), is obtained by multiplying the total credit card debt in 2009 (886 billion) by the average interest rate on revolving credit (0.134). These figures are from tables 1188 and 1190 of the 2012 US Census Bureau Statistical Abstract of the United States.
that a similar sufficient statistic holds in a general, dynamic setting. A borrower can be in one of two states: repayment or default. Raising the exemption level transfers resources from the repayment state to the default state by increasing interest rates and decreasing debt collection in default. The value of this transfer, i.e. borrowers’ willingness to pay for it, depends on the relative marginal utility of consumption in the two states. The cost of the transfer depends on how much raising exemptions causes 1) interest rates to increase (the additional “premium” payments) and 2) repayment rates in default to decrease (the additional “payout” to those who default). If borrowers’ willingness to pay exceeds the cost of higher interest payments (relative to the decrease in debt collection), then raising exemptions would be welfare-improving. The welfare gains formula compares what borrowers are willing to pay for default insurance against the actual cost of generating this insurance with exemptions.\textsuperscript{3}

This welfare gains formula guides my two-part empirical analysis. In the first part, I estimate what borrowers are willing to pay for default insurance. The willingness to pay for insurance can be expressed as borrowers’ coefficient of relative risk aversion multiplied by the drop in consumption that occurs upon a shock (Baily, 1978, Chetty, 2006). Beginning with Cochrane (1991) and Gruber (1997), a number of papers use panel data on household consumption to estimate the drop in consumption that occurs upon job loss or illness.\textsuperscript{4} Using data on food consumption and default from the Panel Study of Income Dynamics (PSID), I apply this technique to determine the drop in consumption that occurs upon default. On average, consumption is 3.6\% lower during the year that a borrower defaults, relative to the prior year. The decline is somewhat larger in low-exemption states (5.5\%) and smaller in high-exemption states (1.9\%), though these differences are not statistically significant. The estimated consumption drop among defaulters is similar when non-defaulters living in the same state and year are used to control for state-year shocks. Additionally, I find no evidence

\textsuperscript{3}I maintain the assumption that exemptions do not affect lenders’ profits. Later, I provide empirical evidence that, supporting this assumption, the magnitudes of the interest rate, debt collection, and default responses are consistent with a model of competitive loan pricing. Specifically, my estimates of the reduction in recovery rates and the increase in the probability of default generate losses that exactly offset the additional revenue from higher interest rates.

that borrowers anticipate default, since there is no decline in consumption during the years before they default.

Scaling the largest estimated consumption drop, 5.5%, by a coefficient of relative risk aversion of 3, implies that borrowers are willing to pay up to a 16.5% markup over the actuarially fair rate for additional default insurance.\(^5\) One potential concern is that exemptions may not affect all defaulters. I test for heterogeneity in the consumption drop among subsets of PSID defaulters who may be more affected by exemptions: homeowners and those with more serious forms of default. The consumption drop upon default among these subgroups is smaller, implying that they place a lower value on additional default insurance. Therefore, the 16.5% willingness to pay for default insurance likely overstates the value of default insurance among those that asset exemptions target. For comparison, the consumption drop upon unemployment is 7-10%, which implies a willingness to pay of 21-30% for unemployment insurance (Gruber, 1997, Kroft and Notowidigdo, forthcoming).

To evaluate the welfare impact, I need to compare this 16.5% willingness to pay to the actual markup (over the actuarially fair rate) of the default insurance generated by raising exemptions. In the second part of the empirical strategy, I estimate the markup. This requires causal estimates of the effect of exemptions on 1) interest rates and 2) recovery rates on defaulted debt. The effect on interest rates captures the additional payments by debtors in the repayment state (insurance premium), and the effect on the recovery rate captures the reduction in payments made in default (insurance payout). These effects, when scaled by the relative probability of repayment, determine the expected increase in premiums relative to payouts, i.e. the markup. If the insurance were actuarially fair, the ratio of premium increases to payout increases would equal one. I construct annual, state-level credit card interest rates and recovery rates on defaulted debt from Credit Union Call Reports for 1994-2004.\(^6\) I estimate difference-in-differences regressions that exploit 65 changes in state

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\(^5\)A coefficient of relative risk aversion of 3 is in the conventional range of estimates, and I later show that the policy implication of the paper holds over a wide range of values for the coefficient of relative risk aversion.

\(^6\)I use data from credit unions because, unlike large commercial banks, credit union data contain interest rates and credit unions are often local lenders, so their financial information reflects state laws. The recovery rate is the share of charged-off non-real estate debt that is eventually recovered through debt collection. These data on interest rates and recovery rates were first used in Fedaseyeu (2015) to examine regulations on debt collectors, such as licensing requirements and criminal penalties.
exemption levels. These regressions show that a 10% increase in exemptions raises interest rates by 4 basis points and reduces recovery rates by 42 basis points, both significant at the 1% level. Supporting the identification strategy, estimates from event-study regressions show that interest rates and recovery rates in treatment and control states followed parallel trends and then diverged sharply once exemptions increased.

With the sample mean default rate of 2.2%, these estimates imply that borrowers must pay a markup of 320% over an actuarially fair transfer for default insurance generated by exemptions. That is, in expectation, debtors pay $4.20 more in higher interest payments for $1 of default insurance generated by raising exemptions. Such a large markup raises concerns that exemptions may affect lenders’ profits, which would violate a key assumption used to derive the welfare gains formula. I address this concern by showing that the markup can be fully explained by moral hazard and adverse selection within a model of competitively priced loans. Specifically, I show that higher exemptions increase the probability of default, and the corresponding losses are large enough to completely offset the additional revenue from the interest rate markup.

The final section of the paper calculates the welfare impact of increasing exemption levels. The 5.5% consumption drop, when scaled by a coefficient of relative risk aversion of 3, indicates that individuals are willing to pay a maximum markup of 16.5%. The estimated responses of interest rate and recovery rates, however, imply that the actual markup generated by raising exemptions is 320%. Since the cost of this form of default insurance exceeds borrowers’ willingness to pay, the policy implication is that lowering exemptions would increase welfare. I conduct a sensitivity analysis and show that this policy implication is robust to variation within the 95% confidence intervals of the estimates. Moreover, this analysis likely understates the costs of raising exemptions, since it ignores other potential creditor responses, such as lowering credit limits or rejecting applicants.

This paper contributes to the literature studying the welfare impact of asset exemptions. Papers in this literature develop structural or quantitative models to examine the welfare impact of bankruptcy and exemptions, but different modeling choices and parameterizations generate conflicting results (Athreya, 2006, Li and Sarte, 2006, Pavan, 2008, Mitman, 2016,
Hintermaier and Koeniger, 2016).\(^7\) In the sufficient statistic approach that I adapt here, the welfare impact depends on only a few high-level statistics and holds in a general class of models. Dávila (2016) derives a sufficient statistic for the optimal level of asset exemptions in bankruptcy and shows that the formula holds in more realistic and general settings. This paper differs in two key ways. First, my model and new formula allow exemptions to benefit debtors who default in or out of bankruptcy. This is critical, as most default and debt collection occur without a formal bankruptcy.\(^8\) Second, I estimate the key determinants of the welfare impact, and some of these estimates differ dramatically from the calibrated values chosen in Dávila (2016). These differences are large enough to reverse the policy implications.

By estimating borrowers’ willingness to pay for default insurance, this paper also contributes to the empirical literature examining the benefits of exemptions and bankruptcy. While I focus on the tradeoffs for consumer credit markets, Mahoney (2015) shows empirically that exemptions provide a form of health insurance and examines the implications for optimal health insurance mandates. Other papers in this literature focus on the benefit of filing for formal bankruptcy (Filer and Fisher, 2005, Dobbie and Song, 2015, Yang, Dobbie, and Goldsmith-Pinkham, 2015). Grant (2010) demonstrates that exemptions provide insurance by showing that increasing exemptions reduces state-level inequality in consumption growth. Adding to this, I separately estimate the drivers of the exemption insurance, higher interest rates and reduced debt collection, and estimate the willingness to pay for this insurance. It is separately estimating these components that allows me to compute the welfare impact of raising exemptions. An additional contribution is that the estimated willingness to pay can be used in cost-benefit analyses of other forms of debtor protections. Since the willingness to pay of 16.5% reflects the value of transferring resources to those in default, regardless of how those resources are transferred, any form of debtor protection (e.g. garnishment restrictions, statutes of limitations on debt) must generate default insurance that

\(^7\)For example, Athreya (2006) finds that higher exemptions increase welfare, while Li and Sarte (2006), which allows for Chapter 13 bankruptcy and general equilibrium effects, finds the opposite. See Livshits (2015) for a recent review and discussion of the dispersion of findings in the literature evaluating the welfare impact of default policy.

\(^8\)In Section 2, I provide evidence that the major impact of exemptions is on debt collection outside of the formal bankruptcy system.
is marked-up less than 16.5% for it to be welfare-improving.

Finally, this paper adds to the empirical literature studying the effect of asset exemptions on interest rates. Several papers have found that auto loan and small business interest rates are higher in states with more lenient exemptions (Gropp, Scholz, and White, 1997, Berkowitz and White, 2004, Berger, Cerqueiro, and Penas, 2011).\textsuperscript{9} My paper differs in that it provides estimates of the effect on credit card interest rates, which are more affected by exemptions than are interest rates on secured loans (e.g. auto loans) since exemptions only protect borrowers from unsecured creditors.\textsuperscript{10} Additionally, while those studies rely on cross-sectional variation, I use panel variation in exemption levels and examine the timing of the interest rate changes using event-study regressions. My estimates are consistent with recent work in Severino, Brown, and Coates (2015), which also uses panel variation in exemption laws. They find a positive effect of exemptions on unsecured consumer loan interest rates and a generally positive but imprecise effect on credit card interest rates.

The paper proceeds as follows. Section 2 describes the role that exemptions play inside and outside of bankruptcy. Section 3 derives the welfare gains formula, which compares borrowers willingness to pay for default insurance to the cost of the insurance generated by raising exemptions. Sections 4 and 5 estimate the components of the welfare gains formula. Section 6 calculates the welfare effect using these estimates and conducts a sensitivity analysis. Section 7 concludes.

\section{Institutional Background}

When debtors default, exemption laws protect specific assets from seizure by unsecured creditors. While federal exemptions are available, the large majority of states have opted out or set their own exemption laws alongside the federal exemptions. This generates substantial variation across states. For example, for an unmarried debtor, Virginia exempts $5,000 in home equity and $6,000 in vehicle equity, while Texas exempts an unlimited amount of home equity and one vehicle, regardless of the value.

\textsuperscript{9}Fedaseyeu (2015) includes exemptions as a robustness check, but since his paper focuses on the regulation of third-party debt collectors, these coefficients are not discussed.

\textsuperscript{10}I show this empirically in Appendix B by estimating the effect of exemptions on auto loan interest rates.
The state exemptions generally apply in both the formal bankruptcy system and the collection process outside of bankruptcy in the state courts. Consumer bankruptcies can be filed under Chapter 7 or Chapter 13. In Chapter 7, which accounts for 70% of consumer bankruptcies, the bankruptcy court sells the debtor’s non-exempt assets and gives the proceeds to creditors. In Chapter 13, exemptions apply indirectly, since creditors must receive at least as much as they would under Chapter 7. Bankruptcy is not the only method of default, however, and there is growing evidence of the importance of default outside of bankruptcy (Dawsey and Ausubel, 2004, Fedaseyeu and Hunt, 2014, Fedaseyeu, 2015). For debtors defaulting outside of bankruptcy, the majority of exemptions still protect debtors’ assets from the collection efforts of unsecured creditors (Hynes and Posner, 2002). If an unsecured creditor sues in state court, he can obtain a judgment that allows special collection actions, including the right to seize assets as payment. Court judgments are common, with almost 5% of credit reports containing a record of a court judgment (Avery et al., 2003). But unsecured creditors with a judgment can only seize assets that are not protected by state exemption laws.

The actual seizure and sale of assets, either through the bankruptcy system or state courts, is rare. 93-96% of Chapter 7 filers have no assets seized, and of the small share that do, the most commonly seized asset is a tax refund (Flynn, Bermant, and Hazard, 2003, Jiménez, 2009). Less is known about seizure outside of bankruptcy, but the available evidence suggests that it is also relatively rare. Hynes (2008) reports that asset seizure, at least in Virginia, is seldom used. A popular guide to dealing with collection actions reports that while collectors may threaten to seize household goods, this threat is rarely carried out (NCLC, 2016). The most important exemption for many households is the homestead exemptions, and while unsecured creditors with a judgment lien can theoretically foreclose, they usually will not (Loftsgordon). Instead, to avoid losses from a foreclosure sale, unsecured creditors will often wait to collect on a judgment lien until the property is sold by the borrower (Leonard, 2015).

Although asset seizure is rare, exemptions can still have a meaningful impact on repayment. Since the deadweight costs of bankruptcy or asset seizure can be high, debtors and creditors have the incentive to negotiate a settlement. The view taken in this paper is that
Seizable assets serve as a threat-point in this negotiation. Consistent with this, a consumer guide advises delinquent debtors that when settling, the “amount you offer to pay should be directly related to what the collector could seize ...” (NCLC, 2016). Similarly, creditors are more likely to accept partial payment if the debtor has few seizable assets (Finlay, 2010). Mahoney (2015) provides empirical support for the importance of these laws in the negotiation process of medical debt, showing that uninsured individuals with fewer seizable assets repay less of the debt. These settlements, asset seizures (or the threat of seizure), and other collection efforts recover a nontrivial share of defaulted debt, particularly when done outside of the formal bankruptcy system. Visa reports that the average recovery rate on debt charged-off without a bankruptcy is 18%, compared to only 3% when a bankruptcy is filed (NBRC, 1997).11 In summary, although assets are rarely seized, they still affect debt collection, especially debt collection that occurs outside of the bankruptcy system. Therefore, to assess the impact of exemptions, it is critical to consider their impact on default and collection both inside and outside of bankruptcy.

3 Model: Exemptions as Social Insurance

In this section, I adapt the social insurance of Chetty (2006) to the case of asset exemptions and derive a sufficient statistic formula for the welfare impact of raising exemptions. Raising exemptions reduces the amount borrowers repay in default. This payment reduction is financed through an increase in the interest rate, which reduces consumption when borrowers repay. In this way, exemptions smooth consumption by transferring resources from the repayment state to the default state. The model produces a formula for the welfare impact of this transfer that compares borrowers’ willingness to pay for default insurance against the cost of generating this insurance by increasing asset exemptions.

This basic trade-off between partial default insurance and the cost of credit is central to most papers examining the welfare impact of default policy.12 Dávila (2016) was the

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11 As another example of the efficacy of collection outside of bankruptcy, in 2013, the bankruptcy courts collected $3.2 billion from Chapter 7 asset cases, while third-party debt collection agencies alone, which excludes in-house collection, recovered over $55 billion (United States Trustees Program Annual Report, FY 2013 and (Young, 2014)).

12 This literature mostly consists of macroeconomic models and a recent review of these papers is Livshits
first paper to apply the sufficient statistic framework to evaluate asset exemptions. He develops a sufficient statistic in a two-period model, then extends it to additional choice variables, multiple contracts, borrower heterogeneity, asymmetric information, and dynamics, then calibrates the model to determine the optimal exemption level. My model differs from Dávila (2016) in two main ways. First, while Dávila (2016) focuses on bankruptcy filers, I use a broader measure of default and allow exemptions to affect borrowers who default without filing a formal bankruptcy. This changes the population that benefits from raising exemptions and requires additional reduced form parameters to evaluate the welfare impact, in particular, the consumption drop among informal defaulters and the effect of exemptions on repayment in informal default. Second, while Dávila (2016) is based on the model of borrowing with default risk in Eaton and Gersovitz (1981), my model adapts Chetty (2006) and so produces a Baily-Chetty sufficient statistic formula that is analogous to those in the optimal social insurance literature. Since the purpose of my model is to guide the empirical analysis, I focus on a simple model that demonstrates the intuition. In Appendix A, I use the arguments of Chetty (2006) to show that a similar welfare gains formula holds in a more general setting with multiple periods and additional choice variables.

**Borrower’s Problem** There are two periods, \( t = 0, 1 \), and a single consumption good. Two periods are necessary to include both borrowing and repayment. In the first period, income is certain and borrowers choose how much to borrow, \( d \). Borrowers also exert costly effort, \( e \), that determines the probability that they will repay their debts in the second period. This effort choice reflects actions that borrowers can take to increase their ability to repay debt, such as purchasing insurance against shocks or adjustment work effort. The units of effort, \( e \), are normalized so that \( e \) is equal to the probability of repayment in the second period. The cost of effort, given by \( f(e, d) \), can depend on the amount of debt one holds. I assume \( f_{ee}, f_{dd}, \) and \( f_{ed} > 0 \) because it is more costly to avoid default as the level of debt \( d \) increases.

In the second period, borrowers enter one of two states: default (low state) or repayment (high state). If borrowers enter the default state, they earn income \( y_l \) and repay some share of their debt at the rate \( q < 1 \). This recovery rate \( q \) reflects that creditors collect some portion of what is owed even when borrowers are unwilling or unable to repay the full amount. For (2015).
example, Visa eventually recovers 18% of credit card debt charged-off without a bankruptcy filing.\textsuperscript{13} If borrowers enter the repayment state, they earn income $y_h$ and repay their full debt plus interest at the rate $r > 0$. I do not model assets and asset seizure, but instead allow exemptions $m$ to influence the recovery rate $q(m)$. This focus on the recovery rate, which captures post-charge-off settlements, is motivated by the evidence that the threat of asset seizure is often used to coerce debtors to repay, but actual asset seizure is rare. Through the response of creditors, exemptions also influence the interest rate $r(m)$.

Borrowers take the interest rate $r(m)$ and the recovery rate $q(m)$ as exogenous and choose their effort and debt to maximize state-independent utility. Indirect utility $V(m)$, written as a function of the exemption level $m$, is equal to the utility from consumption in period 0 plus the expected utility in period 1, minus the cost of effort.

$$V(m) = \max_{e,d} u(c_0) + \{e u(c_h) + (1 - e) u(c_l)\} - f(e, d)$$

(1)

where

$$c_0 = y_0 + d,$$

$$c_h = y_h - (1 + r(m))d,$$

$$c_l = y_l - q(m)d.$$

In period 0, borrowers consume the income endowment, $y_0$, plus the amount borrowed, $d$. In period 1, borrowers the repayment state with probability $e$ and consume income $y_h$ less the amount it takes to repay the debt plus interest $r(m)d$. Alternatively, borrowers default with probability $(1 - e)$ and consume income $y_l$ less the portion of the debt that repaid in default $q(m)d$. I assume the regularity conditions that generate an interior solution with borrowers holding a positive level of debt. Also, note that for default insurance to potentially have any value, it must be that $c_h > c_l$. In Section 4, I test whether this condition holds.

\textbf{Interest Rates and Recovery Rates}

I make four assumptions about creditors and interest rates. First, changes in asset

\textsuperscript{13}This statistic is from NBRC (1997).
exemptions do not change lender profits. This simplifies the welfare analysis by allowing the social planner to consider only borrower welfare. In Section 5, I provide empirical support for this assumption by showing that exemptions do not affect expected returns on credit card loans from credit unions and that the magnitudes of the estimated credit market responses are consistent with a model of competitively priced loans. Second, creditors do not use information on individual effort or the amount borrowed to set interest rates in the interval over which effort and debt respond to changes in exemptions. That is, the interest rate and recovery rate are market prices, so they are not affected by individual effort and debt, but can depend on aggregate demand and effort. Third, I assume that creditors respond to exemptions only by changing the interest rate. This rules out creditor responses that change denial rates, credit limits, or other terms of credit card contracts. The second and third assumptions are needed because of the available data on interest rates and recovery rates, which do not contain borrower characteristics or other lending terms. At the end of this section, I discuss the how relaxing these assumptions will affect the implications of this analysis. Finally, I assume that $r(m)$ and $q(m)$ are smooth.

Planner’s Problem and Welfare Implications

The social planner chooses an exemption level $m$ to maximize the borrower’s expected utility $V(m)$. In standard social insurance problems, such as unemployment insurance, additional benefits are financed through an increase in the tax rate required by the government’s balanced budget constraint. In the asset exemptions setting, additional benefits to defaulters are financed through increased interest rates, with the size of the interest rate increase determined by how creditors respond to changes in exemptions levels.

The change in expected utility from increasing the exemption level is obtained by differentiating $V(m)$ with respect to $m$. Using the envelope conditions,

$$\frac{dV(m)}{dm} = \{-er'(m)u'(c_h)d - (1 - e)q'(m)u'(c_l)d\}.$$  

This welfare change is in units of utility. To obtain a money-metric measure of the welfare gain, I normalize the effect of exemptions by the marginal utility of an additional dollar in
the repayment state \( u'(c_h) \), so that \( \frac{dW(m)}{dm} = \frac{dV(m)/dm}{u'(c_h)} \).

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\frac{dW(m)}{dm} = \left[ \left( \frac{u'(c_l)}{u'(c_h)} - 1 \right) - \left( -\frac{e}{1 - e} \frac{r'(m)}{q'(m)} - 1 \right) \right] T,
\]

(2)

where \( T = -(1 - e)q'(m)d > 0 \) is a scaling factor equal to the total amount of money transferred to those in default. The first term in equation (2), \( \frac{u'(c_l)}{u'(c_h)} - 1 \), is the maximum markup (over the actuarially fair rate) that a borrower would be willing to pay in expected interest payments for a marginal increase in the expected payout in default. For example, if \( \frac{u'(c_l)}{u'(c_h)} - 1 \) equaled 0.2, the borrower would be willing to pay $1.20 in expected interest payments to reduce the expected repayment in default by only $1.14.

The second term, \( -\frac{e}{1 - e} \frac{r'(m)}{q'(m)} - 1 \), is the actual markup of the default insurance generated by increasing asset exemptions. The numerator \( er'(m) \) is equal to the expected increase in interest payments (the insurance premium) and the denominator \( (1 - e)q'(m) \) is equal to the expected reduction in payments made when in default (the insurance payout). If there were no behavioral distortions and creditors set competitive interest rates, the increase in interest rates would exactly offset the reduction in payments, \( -\frac{e}{1 - e} \frac{r'(m)}{q'(m)} \) would equal one, and since the transfer would be actuarially fair, it would be optimal to provide full insurance. Factors such as moral hazard or administrative costs could cause the actual markup to exceed the actuarially fair rate, even while lenders’ profits remain unchanged.15

The terms inside the brackets in equation (2) give the welfare effect of transferring an infinitesimal amount to the default state by increasing exemptions. Whether the welfare impact is positive or negative depends on whether the borrower’s willingness to pay exceeds the cost of the transfer. \( T \) scales this welfare effect by the expected size of the transfer generated by increasing exemptions, \( T = -(1 - e)q'(m)d \), which is the probability of default \((1 - e)\) multiplied by the change in default payments \((-q'(m)d)\). Since \( T > 0 \), it will affect

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14To see this, consider the welfare effect of an insurance policy that pays out an infinitesimal amount in the default state in exchange for premium payments \( t \) in the repayment state: \( \frac{\partial}{\partial b} \bigg|_{b=0} eu(c_h - t(b)) + (1 - e)u(c_l + b) \). The change in utility will be positive if and only if the increase in expected premiums relative to payout, \( \frac{e}{1 - e} \frac{r'(m)}{q'(m)} \), is less than \( \frac{u'(c_l)}{u'(c_h)} \).

15If creditors face the zero-profit condition \((1 - e)q(m) + e(1 + r(m)) = 1 + \tilde{r} \), where \( \tilde{r} \) is the market rate of return, and there is no moral hazard (\( \frac{\partial e}{\partial m} = 0 \)), then differentiating with respect to \( m \) yields \( -\frac{e}{1 - e} \frac{r'(m)}{q'(m)} = 1 \). However, if exemptions cause moral hazard (\( \frac{\partial e}{\partial m} < 0 \)), then it could be greater than 1.
the magnitude, but not the sign, of the welfare impact of exemptions.

Discussion of Extensions and Critical Assumptions

The key features of this welfare formula hold in a much more general setting. In Appendix A, I use the arguments of Chetty (2006) to show that a very similar formula holds in a setting that allows dynamics, additional constraints, and additional choices by the borrower. The only major change to the formula is that the marginal utilities \( u'(c_h) \) and \( u'(c_l) \) in equation (2) are replaced by the average marginal utilities in the two states, and these marginal utilities are weighted by the level of debt. This weighting is because, in the more complicated model, debt varies over time and states, so the impact of raising exemptions in each state will be proportional to the amount of debt held.

The welfare gains formula is somewhat sensitive to altering the assumptions about credit markets, but in many cases the direction of the resulting change can be signed. A more flexible model of interest rates and recovery rates would not dramatically alter the welfare gains formula, but it would change the particular empirical objects \( r'(m) \) and \( q'(m) \) needed for the formula. In this model, I assume that, in the interval over which borrowers behavior responds to exemptions, interest rates \( r(m) \) are not a function of individual choices of effort and debt. This assumption is motivated by the available data, which consists of averages of interest rates and recovery rates. If interest rates depend on how individual actions \( a \) respond to exemptions, then the appropriate interest rate response for equation (2) would be the change in interest rates holding these actions constant, i.e. \( \frac{\partial r(a,m)}{\partial m} \). Similarly, if repayment in default is a function of individual actions, the term in the welfare gains formula would be \( \frac{\partial q(a,m)}{\partial m} \). With regard to changes in the repayment rate, as long as higher exemptions change actions in a way that decreases payment conditional on default, the \( q'(m) \) that I estimate will overstate the benefits to consumers.\(^{16}\) Additionally, this model assumes that creditors respond to changes in exemptions only by altering interest rates. If creditors respond by increasing loan denials or altering other loan terms, the welfare gains formula will not capture these additional costs and, as a result, will understate the true costs of increasing exemptions.

In addition to these assumptions that are particular to the asset exemptions setting, there

\(^{16}\)I estimate \( \frac{dq(a,m)}{dm} \). If \( \frac{\partial q(a,m)}{\partial a} \frac{\partial a}{\partial m} < 0 \), then \( \frac{dq(a,m)}{dm} < \frac{\partial q(a,m)}{\partial m} \) and my estimates would overstate the benefits to borrowers in default.
are the critical assumptions that underly the sufficient statistic approach to social insurance. In having the social planner maximizes the agent’s indirect utility $V(m)$, I assume that the borrower’s problem reflects the true costs and benefits to society. That is, there are no externalities in any of the choices affected by changes to exemption levels. This is violated if, for example, changes in exemptions affect the take-up of other social insurance programs or agents do not make financial decisions optimally.

In the remainder of the paper, I calculate the welfare gain by estimating the key components of equation (2). Section 4 estimates the gap in marginal utility between the default and repayment states using the approach of Gruber (1997). Section 5 estimates $r'(m)$ and $q'(m)$ using data on interest rates and debt collection from credit unions.

## 4 Willingness to Pay for Default Insurance

This section estimates borrowers’ willingness to pay for a marginal increase in default insurance. As discussed in Section 3, the term $\frac{u'(c_i)}{u'(c_h)} - 1$ captures the maximum markup over the actuarially fair rate that borrowers are willing to pay for default insurance. Baily (1978) and Chetty (2006) show that taking a Taylor expansion of $u'$ around $c_h$ yields the approximation:

$$\frac{u'(c_i)}{u'(c_h)} - 1 \approx \gamma \frac{\Delta c}{c_h}(m),$$

where $\gamma = -\frac{u''(c_h)}{u'(c_h)} c_h$ is the coefficient of relative risk aversion evaluated at $c_h$. The intuition for this approximation is that the value of additional insurance depends on the utility value of smoothing consumption ($\gamma$) and the size of the consumption drop being insured ($\frac{\Delta c}{c_h}$). Since this expression is derived by applying envelope theorem, the consumption drop needed to evaluate this expression is the drop in consumption that occurs among the pool of people currently choosing to default (i.e. holding their actions constant). In this section, I estimate the consumption drop upon default. I do not estimate risk aversion, but evaluate the welfare calculations in Section 6 over a range of values for the coefficient of relative risk aversion. The normative implications are not sensitive to variation within the conventional range of

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17 This approximation assumes that the higher order terms (e.g. $u'''$) are negligible.
estimates ($\gamma \leq 5$).

According to this willingness to pay formula, it is only necessary to estimate the average drop in consumption upon default. A causal estimate of the effect of exemptions on consumption is not needed.\textsuperscript{18} The intuition is that the value of additional default insurance depends on the consumption drop upon default, given the existing methods borrowers have of smoothing across this drop. For example, if borrowers already perfectly smooth shocks causing default with private insurance or borrowing, there is no value of providing additional insurance by raising exemptions. Thus, the drop in consumption upon default captures the extent to which borrowers are currently under-insured against shocks causing default, and this determines their willingness to pay.

4.1 Data: Panel Study of Income Dynamics

The Panel Study of Income Dynamics (PSID) from 1991-1996 is well-suited to study changes in consumption upon default, as it contains information about instances of financial distress and a measure of consumption. In 1996, the PSID asked families about financial distress that occurred between 1991 and 1996. Each family reports the year that they missed a bill payment, had a debt collector call, dealt with judicial collection actions (repossession, garnishment, lien), or filed for bankruptcy. In the main analysis, I count the occurrence of any of these events as default, though I later test for heterogeneity using different definitions of default and subsamples of defaulters. Since the goal of the analysis is to estimate the change in consumption upon default, the unit of observation is an instance of default. The main defaulter sample consists of all household heads that report defaulting in some year $t$ but did not default in year $t - 1$.\textsuperscript{19}

The measure of consumption available in the PSID is each family’s annual food expenditure. While focusing on food consumption seems limiting, Chetty (2006) shows that as long as agents make optimal consumption choices, nothing is lost by estimating changes in a single good (food) as long as the risk aversion parameter reflects curvature in utility for

\textsuperscript{18}Kroft and Notowidigdo (forthcoming) highlight a similar point for the case of unemployment benefits.\textsuperscript{19}The PSID only asks about default in years 1991-1996. I drop households that report default in 1991, since I cannot know whether they were in default in 1990.
that good. This is because, although food consumption will experience smaller changes than other goods, this relatively inelasticity is reflected in a higher coefficient of relative risk aversion, so that the product of the percentage change and risk aversion is similar across goods. Following Gruber (1997), I measure consumption as the sum of at-home food expenditure (including food stamps) and out-of-home food expenditure, deflated by the corresponding component of the CPI for the month of the interview. I exclude households with imputed food consumption and households that report a change in food consumption over 300%.

I combine these data from the PSID with states’ asset exemption levels collected from state statutes and various editions of Elias, Renauer, and Leonard (1996-2013), a popular consumer bankruptcy guidebook. For each individual, I sum the homestead and personal property exemptions available in the state during the year he defaulted. If the household head is married and lives in a state that allows married couples to double their exemptions, I double the exemption value. Ideally, I would estimate the drop in consumption upon default separately for each state. However, the relatively small sample and difficulties associated with measuring consumption (e.g. noise, recall error) generate noisy estimates. For this reason, I group individuals into exemption terciles based on the total amount of homestead and personal property exemptions available to them. I refer to these groups as individuals living in low-exemption, mid-exemption, and high-exemption states, although the exemption tercile is a function of both state and marital status.

Table 1 reports descriptive statistics for two groups: PSID respondents who never report an instance of financial distress (non-defaulters), and the analysis sample, which consists of the 1,123 instances of default (defaulters). The first row shows the average change in log

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20 Following Zeldes (1989) and Gruber (1997), I drop households where $\log(c_t/c_{t-1}) > 1.1$ or $< -1.1$ (4% of the sample). Including these households does not affect the results.

21 I thank Jeffrey Traczynski for generously sharing data on exemptions from Traczynski (2011), and in particular, the property exemptions used in this analysis. I collected data on homestead exemptions from editions of Elias, Renauer, and Leonard (1996-2013) and corrected the timing of the changes by referencing historical state statutes. For states that allow individuals to choose between the state homestead exemption and the federal homestead exemption, I use whichever is higher. I code states with unlimited homestead exemptions as $550,000, the maximum exemption level among states without unlimited exemptions during the period 1991-2014. I ignore lot size restrictions. I assume the filer is not a senior citizen. For personal property exemptions, I use the coding of Traczynski (2011).

22 Low-exemption states have total exemptions less than $12,700, mid-exemption states range from $12,700-45,200, and high exemption states have total exemptions above $45,200 (including the unlimited exemption states. To allow for robustness checks on the sample of non-defaulters, the tercile thresholds are determined using the full PSID sample, including both defaulters and non-defaulters.
food consumption. In the sample of non-defaulters, the average change in food consumption is basically zero. In the defaulter sample, however, food consumption drops by 3.6% (0.036 log points). One concern is that this drop may be due to shocks that change the food requirements of the family and are correlated with default, such as divorce or death of a spouse. The second row rules this out by showing that food needs, the PSID’s measure of the household’s food requirements based on household size and composition, does not change among defaulters. The remaining rows of Table 1 show that the sample of defaulters tends to be younger and are more likely to be female, non-white, unmarried and have more unsecured debt than non-defaulters.

4.2 Empirical Strategy: Consumption Change upon Default

The sample statistics in Table 1 show that borrowers experience an average drop in consumption of 3.6% upon default, which would be sufficient to determine the average willingness to pay for default insurance. The purpose of the additional analysis in this section is to investigate how the consumption drop varies with the exemption level and to investigate the sensitivity of the result to additional controls. The sample consists of 1,123 instances of default, indexed by \( i \). I estimate regressions of the form:

\[
\Delta \log C_i = \alpha_L exempt_L^i + \alpha_M exempt_M^i + \alpha_H exempt_H^i + \delta X_i + \tau_i + \varepsilon_i. \tag{3}
\]

\( \Delta \log C \) is the change in the log of consumption and \( exempt_L, exempt_M \) and \( exempt_H \) are indicators for whether an individual is protected by low-, middle-, or high-exemption levels (there is no intercept). \( X \) is a set of individual characteristics (discussed below) and \( \varepsilon \) is the error term. The \( X \) variables are de-meaned so that the \( \alpha \) coefficients capture the average drop in consumption upon default for borrowers in low-, middle, or high-exemption states. I also include (de-meaned) year fixed effects (\( \tau_i \)) in all regressions.

The \( \alpha \) coefficients do not capture the causal effect of exemptions on consumption smoothing. Instead, they capture the combined effect of exemptions’ consumption smoothing benefits and any other factors (e.g. social or private insurance) correlated with exemptions that affect changes in consumption upon default. It is this combined effect, not a causal effect,
that is needed to calculate borrowers’ willingness to pay, as it reflects the extent to which borrowers remain imperfectly insured, given existing methods of smoothing consumption in default.

It is possible that differences in the consumption drops across exemption levels are due to changes in the composition of defaulters. This is not a problem, since the goal is to capture the drop in consumption among the group of borrowers that choose to default. For example, if lenient exemptions cause borrowers to default after even minor consumption shocks, this compositional change decreases the value of providing default insurance. This will be reflected in a smaller average drop in consumption upon default in lenient exemption states. Still, while it is not needed to determine the willingness to pay, I investigate the role of observable compositional changes by including controls for individual characteristics in some regressions. The individual characteristics $X_i$ include the age, sex, years of education, an indicator for white, marital status, number of children, and the change in the log of the food needs of the family. In some specifications, I also add controls for the state unemployment rate and log of state median income at the time of default. All results report standard errors clustered by state.

4.3 Results

Table 2 reports the results from estimating specification (3) on the default sample. The key coefficients are $\alpha_L$, $\alpha_M$, and $\alpha_H$, which capture the average (log) consumption change upon default in low-, mid-, and high-exemption states. Column 1 includes only the exemption tercile indicators and year fixed effects. The estimate of $\alpha_L$ indicates that, in the low-exemption states, consumption drops by an average of 5.6%. For comparison, the mean drop in consumption upon unemployment is 7-10% (Gruber, 1997, Kroft and Notowidigdo, forthcoming). The $\alpha_M$ and $\alpha_H$ estimates indicate that the average drop in consumption is 2.8% in mid-exemption states and 1.9% in high-exemption states, though neither are statistically different from zero. That consumption drops upon default (at least in low-exemption states) demonstrates that borrowers are not fully insured against shocks causing default, so there is potentially a benefit to increasing insurance by raising exemptions. Scaling a 5.5% consumption drop by a coefficient of relative risk aversion $\gamma = 3$ implies that borrowers
would be willing to pay up to a 16.5% markup for this insurance.

Again, the differences in the $\alpha$ estimates capture the combined effect of exemptions, compositional changes, and other factors correlated with exemptions. The remaining columns investigate the role of compositional changes and economic conditions in explaining these estimates. Column 2 adds controls for individual characteristics and column 3 adds controls for state-level economic conditions during the year that the default occurred. If the results were driven by differences in the observable characteristics of borrowers or economic conditions, the estimates of the average consumption drop across exemption terciles would converge after controlling for these variables. Instead, columns 2 and 3 show little change. The estimates in column 3 indicate that the average consumption drop is 5.5% in low-exemption states, 3.2% in mid-exemption states, and 1.9% in high-exemption states, though the drop is only statistically significant in low-exemption states.

### 4.4 Robustness, Anticipation, and Heterogeneity

In this section, I run a series of robustness checks designed to address three potential concerns. The first concern is that there may be omitted variables correlated with exemptions that affect the consumption of all borrowers, not only borrowers in default. The regression in equation (3) already controls for omitted variables that are constant within a household, since the outcome variable is the change in consumption, but there may be state consumption trends or unobserved shocks correlated with the exemption tercile that could bias estimates of changes in consumption. For example, consumption could be trending downward in low-exemption states, and this trend would make it appear as if defaulters were experiencing large drops in consumption. To test this, columns 1-3 of Table 3 report results from regressions on the sample of non-defaulters. If there were general consumption trends or shocks, they would also be apparent in the sample of non-defaulters. Instead, columns 1-3 show that consumption changes among the group of non-defaulters are small and insignificant. Figure 2 presents the estimates of the consumption change for defaulters and non-defaulters living in the three exemption terciles. Columns 4-6 pool the samples of non-defaulters and defaulters and compares the consumption changes among defaulters to the consumption changes among non-defaulters in the same state and year. The specification interacts an indicator for default
with the low-, mid-, and high-exemption terciles to capture the drop in consumption among defaulters relative to non-defaulters, and also includes state×year fixed effects. These results show that the declines in consumption occur only among individuals reporting default.

A second concern is that there is uncertainty about the timing of the changes in consumption and default. One source of uncertainty is the ambiguity about the reference year of the food expenditure questions in the PSID (East and Kuka, 2015). In most years, the PSID asks about food consumption in the average week, and the question is asked immediately after a question about food stamp use in the prior month. For this reason, I follow prior research in assuming that individuals report their consumption during the year of the interview (Zeldes, 1989, Gruber, 1997, East and Kuka, 2015). A second source of uncertainty is that the data on default was asked in 1996 and only contains the calendar year that default occurred, which will not correspond exactly to the timing of the PSID interviews in those years. A third source of uncertainty is due to the potential for borrowers to anticipate default and reduce consumption in advance. For example, Hendren (2015) shows that households reduce consumption in the year prior to a job loss. I show that these issues are not a concern by testing for consumption changes in the years around default. Table 4 reports estimates of the drop in consumption in the years before and after the reported instance of default. Columns 1-3 show that, for borrowers defaulting in year $t$, there is no change in consumption between years ($t-2$ to $t-1$) or ($t$ to $t+1$). Due to missing data and sample attrition, the sample of defaulters included in columns 1-3 changes slightly. To ensure that this is not driving the results, columns 4-6 limit the sample to the 931 defaulters who have full data for the surrounding years and the results are unchanged.

A third concern is that the impact of exemptions may differ across defaulters. If the defaulters more affected by exemptions have a different willingness to pay, it could change the value of exemption-provided default insurance. To investigate this concern, Figure 3 reports the average consumption drop for various subsets of defaulters. First, since the benefit of exemptions is proportional to the amount of debt held, a positive covariance of debt and consumption drops could increase the value of insurance. The (unsecured) debt-weighted
average consumption drop, however, is similar to the average consumption drop, so heterogeneity in the amount of debt will not affect the value of raising exemptions.\textsuperscript{24} Second, it may be that only those with severe delinquencies or those with non-exempt assets benefit from exemption protection.\textsuperscript{25} The figure shows that the groups likely to be more affected by exemptions - severe defaulters (those reporting debt collector calls, judicial actions, or bankruptcy), homeowners, and homeowners with non-exempt home equity - experience little to no consumption drop upon default. Overall, Figure 3 shows that if the impact of exemptions is concentrated among the subsets of defaulters more likely to benefit, this will reduce the value of exemption-generated default insurance.

5 The Cost of Exemption-Generated Default Insurance

This section estimates the cost of the default insurance generated by raising asset exemptions. Equation (2) shows how this cost, \( \frac{e - r'(m)}{1 - e q'(m)} - 1 \), enters the welfare gains formula. In this section, I use difference-in-differences regressions to estimate the causal effect of exemptions on interest rates \( (r'(m)) \) and recovery rates on defaulted debt \( (q'(m)) \).

5.1 Data: Credit Union Call Reports

I use state-level data on average interest rates and defaulted debt recovery rates aggregated from Credit Union Call Reports. Each quarter, all credit unions in the United States must submit a Call Report with financial information such as balance sheets and income statements. These Call Reports are publicly available from the website of the National Credit Union Administration. Credit Union Call Reports were first used to study interest rates and recovery rates in Fedaseyeu (2015), which examined how regulations on debt collectors, such as licensing requirements or criminal penalties, affect credit markets.

\textsuperscript{24}The PSID asks households to report debt from “credit card charges, student loans, medical or legal bills, or on loans from relatives.” This measure should be treated with caution, however, as households are known to significantly underreport unsecured debt (Brown et al., 2011).

\textsuperscript{25}This is not necessarily the case, since the exemption level could affect the equilibrium number and tactics of debt collectors in the state, and therefore also benefit defaulters without non-exempt assets.
One advantage of using credit union data, as argued in Fedaseyeu (2015), is that credit unions are typically local lenders, so their lending practices will reflect state laws. A drawback, however, is that the lending practices of credit unions differ from those of larger banks. Credit union interest rates are slightly lower, with commercial bank credit card interest rates averaging 14.7% between 1994 and 2004, while credit union interest rates average 12.3%. The recovery rates for all commercial banks and credit unions are similar, with average recovery rates of 19.3% and 17.2%, respectively. The recovery rates also exhibit similar patterns over time, as shown in Figure 1. Between 1991 and 2004, credit unions issued 7-10% as much revolving credit as commercial banks.

I use credit union data for the years 1994-2004. I limit the sample to this period for two reasons. First, two shocks, a major bankruptcy reform and a severe recession, may cause the impact of exemptions in the late 2000s to differ from the typical impact of exemptions. The transition to the new bankruptcy system introduced a large, temporary spike in bankruptcies during late 2005. The housing collapse erased a substantial amount of home equity, which would alter the effect of the largest exemption, the homestead exemption. The second concern with the later period is that spatial heterogeneity in credit markets and defaults caused by the bankruptcy reform and recession make estimates from this period noisy and potentially biased. While understanding the impact of the reform and recession on credit markets is important, it is not the focus of this analysis.

I use 4th-quarter Call Reports to construct annual recovery rates on charged-off non-real estate loans. A charge-off occurs when a creditor marks a debt as unlikely to be collected, typically after 120-180 days of delinquency for consumer debts. Recoveries reflect the

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26 I drop the two major national credit unions, Navy Federal Credit Union and the Pentagon Federal Credit Union, from the sample.
27 Source: Author’s calculations from aggregating commercial and Credit Union Call Reports and taking the mean annual recovery rate between 1994 and 2004. These numbers differ slightly from those reported in Table 5, which averages of the state-level recovery rates.
28 Source: Board of Governors of the Federal Reserve System, G.19 series - Consumer Credit. Revolving credit is mostly credit card loans but other types, such as prearranged overdraft plans, are also included.
29 In 2010, 55-65% of homeowners were completely protected by exemptions (Dobbie and Song, 2015).
30 For example, in Pattison (2016), I provide evidence that trends in bankruptcy filings after 2005 were correlated with changes in exemption levels, which would bias difference-in-differences estimates from the post-2005 period.
31 Bank (FFIEC) regulatory accounting requirements state that revolving credit must be charged-off after 180 days of delinquency and installment loans after 120 days - Uniform Retail Credit Classification and Account Management Policy, 65 Fed. Reg. 36903 (June 12, 2000). When loans are charged-off, issuers
amount collected after a debt has been charged-off, and can consist of post-charge-off payments by debtors or revenues from selling the charged-off debt (Furletti, 2003). Therefore, recoveries capture the amount that creditors ultimately collect on debt that is severely delinquent, including collections in and out of bankruptcy. Credit unions report total charge-offs and recoveries and real-estate charge-offs and recoveries separately. Taking the difference, I construct non-real estate charge-offs and recoveries for each credit union.\footnote[32]{} I then aggregate non-real estate charge-offs and recoveries to the state-level and measure the recovery rate in state $j$ as aggregate recoveries divided by aggregate charge-offs.

Credit Union Call Reports also include data on credit card interest rates. Each credit union reports the most common interest rate offered for credit cards and the total number of credit card loans. I aggregate these interest rates to the state level, weighting each credit union’s interest rate by the number of outstanding credit card loans. The summary statistics of the main variables are presented in Table 5. The primary outcomes in the analysis are shown in the first two rows. The mean interest rate on credit card debt is 12.3\% and the average recovery rate on charged-off non-real estate debt is 17.73\%. I combine the interest rates and recovery rates with data on exemption levels.

The credit union interest rates and recovery rates are the empirical counterparts to $r(m)$ and $q(m)$ in the model of Section 3. The data, however, differ slightly from the ideal empirical objects in two ways. First, the ideal empirical object would be the interest rate and recovery rate for a specific borrower, holding all characteristics observable to the lender constant. The actual data, however, is the most commonly charged interest rate and the average recovery rate for borrowers. Second, the ideal data would contain the full schedule of interest rates charged to borrowers with different characteristics, since the effect of exemptions could differ across credit market segments. With only the most common interest rate and the average recovery rate available, heterogeneity across borrowers is not captured.

I sum the homestead and property exemptions available to an unmarried bankruptcy filer reverse the fees and finance charges on the loan in a process called “purification” (Furletti, 2003). Therefore, the charged-off amounts will reflect the unpaid principal (see NCUA 5300 CALL REPORT INSTRUCTIONS - June 2005).

\footnote[32]{These charge-offs are primarily unsecured consumer loans (e.g. credit cards) and vehicle loans. In Appendix B, I estimate a lower bound on the markup of exemptions that takes into account the potential influence and impact on auto loans and show that adjusting for the impact of auto loans does not alter the policy implications.}
under the age of 65 for each state and year, following the procedure discussed in Section 4. Although some states allow doubling of exemptions for a married debtor, my specification uses the log of the exemption level and so the coefficient would not be affected by doubling. Between 1994 and 2004, there were 65 changes among 31 states, and the average (credit union membership-weighted) change is $8,985 or 0.14 log points. Table 4 shows the distribution and timing of changes in the exemption level.

5.2 Empirical Strategy: The Effect of Exemptions on $r(m)$ and $q(m)$

I use the state-level data to estimate the effect of exemptions on interest rates and recovery rates. For state $s$ at time $t$, the regressions are of the following form:

$$y_{st} = \alpha + \eta \ln(E_{st}) + X_{st}/\beta + \delta_s + \tau_t + u_{st}. \quad (4)$$

where $\ln(E_{st})$ is the log of the exemption level. I use the log of a state’s exemption level because it allows the effect of exemptions to diminish as the exemption level rises. A diminishing effect is likely, since as exemptions rise, more debtors will be fully protected. For example, an increase in Virginia’s $5,000 homestead exemption would affect everyone with more than $5,000 in home equity, while an increase in Minnesota’s $390,000 homestead exemption would affect only those with more than $390,000 in equity.

The outcome variable $y_{st}$ is either the interest rate or the recovery rate in state $s$ during year $t$. The coefficient $\eta$ captures the effect of a one log point increase in a state’s exemption level. The state controls, $X_{st}$, contain the 25th percentile of the log income distribution, the log of median income, the log of the home price index from the Federal Housing Finance Agency, and the state unemployment rate. I also include state fixed effects ($\delta_s$) and year fixed effects ($\tau_t$) in all specifications. The error term, $u_{st}$, represents the unobserved state-year shocks that affect interest or recovery rates.

Unlike the previous section, I argue that estimates from these difference-in-differences regressions reflect the causal effect of exemptions. The identifying assumption is the parallel trends assumption: in the absence of an exemption increase, interest rates and recovery
rates in states that increase exemptions and control states would have been parallel. I support this assumption in two ways. First, I argue that the changes in exemptions arise out of a political process that does not depend on states’ lending conditions. Several states and the federal bankruptcy exemptions are adjusted at predetermined intervals, and many states intermittently to adjust for inflation. Other important debtor protection laws, namely wage garnishment restrictions and statutes of limitations on debt, do not change over this period. Additionally, Severino, Brown, and Coates (2015) examines a number of potential predictors of exemption changes, including house prices, state GDP, medical expenditures, the unemployment rate, the political climate, bankruptcy filings, and income growth. Only medical expenditure is found to be statistically significant.

Second, using an event study specification, I support the parallel trends assumption by testing whether trends in treatment and control states were parallel prior to an exemption increase. Since states have multiple exemption increases, a standard event study specification is not appropriate. Instead, I use a multiple event study framework, similar to those in Dube, Lester, and Reich (2010) and Sandler and Sandler (2013), that allows for overlapping events within a state. I estimate the following regression for state \( s \) in year \( t \):

\[
y_{st} = \alpha + \sum_{k=-6}^{5} (\eta_k \Delta \ln(E_{s,t-k})) + \eta_0 \ln(E_{s,t-6}) + X_{st} \beta + \delta_s + \tau_t + u_{st}. \tag{5}
\]

The one-period difference operator, \( \Delta \), produces coefficients \( \eta_k \) that represent the cumulative effect of a one log-point increase in the exemption level \( k \) years later. For example, if the exemption increased by 0.5 log points in a state during 2000, \( \eta_3 \) captures the effect of that increase on state bankruptcies in 2003 (\( \Delta \ln(E_{s,t-3}) = 0.5 \) when \( t = 2003 \) ), while \( \eta_{-3} \) captures the difference in bankruptcies in that state in 1997. The estimates provide evidence about the identification assumption by testing whether the trends were parallel prior to an exemption increase. If interest rates \( y_{st} \) in the treatment and control states are similar prior to an exemption increase, then the coefficients \( \eta_{-6}, \ldots, \eta_{-1} \) will be zero. The coefficients \( \eta_0 \) through \( \eta_5 \) capture the cumulative effect of an exemption increase in the first six years after

\[33\]To produce a balanced panel in this regression, I use exemption data from 1989-2010 even though \( y_{st} \) is only used from 1995-2004.
the increase. Since $\eta_6$ does not use the difference operator, it captures the average effect of the exemption increase in and after year $t + 6$.

### 5.3 Results

Table 6 reports the main results. Columns 1-3 show the effect of changes in exemptions on the interest rate. The estimate in column 1 indicates that a 10% increase in the exemption level raises credit card interest rates by 0.038 percentage points, or 3.8 basis points, and is statistically significant at the 1%-level. Columns 2 and 3 add state-level economic controls and region-year fixed effects for the four Census regions. The estimated effect remains largely unchanged. The magnitude of the preferred specification in column 2 indicates that a 10% increase in the exemption level raises interest rates by 4 basis points. This interest rate effect is in the lower end of the range of estimates found in papers using cross-sectional variation in exemptions (for example, Gropp, Scholz, and White (1997)).

Columns 4-6 repeat the regressions, but with the recovery rate as the outcome. The results across all specifications are similar and the magnitude in column 5 indicates that a 10% increase in the exemption level reduces the recovery rate on charged-off debt by 42 basis points, significant at the 1%-level.

Using the estimates from columns 2 and 4 in Table 6, a 10% increase in the exemption level increases interest rates by 4 basis points and reduces the recovery rate on charged-off debt by 42 basis points. Setting the probability of default equal to the mean credit card charge-off rate from Table 5 ($1 - e = 2.2\%$), and substituting the estimates for $r'(m)$ and $q'(m)$ gives

$$-\frac{e}{1 - e} \frac{r'(m)}{q'(m)} - 1 = 3.23.$$ 

That is, in order to repay $1 less in default, expected interest payments increase by $4.23, so the markup markup of the default insurance generated by asset exemptions is 323%.

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$^{34}$Direct comparison of the estimates is difficult because of the variety of specifications used across papers. The method I use is to compare each paper’s predicted increase in interest rates caused by increasing the exemption level from $5,000 to $50,000, which is effect reported in Gropp, Scholz, and White (1997). Using this method, my estimates predict an increase of 92 basis points, while others find estimates in the range of 23-230 basis points for auto loans and small business loans (Gropp, Scholz, and White, 1997, Berkowitz and White, 2004, Berger, Cerqueiro, and Penas, 2011). The other paper using panel variation, Severino, Brown, and Coates (2015), finds an effect that is similar in magnitude to my estimate.
Figure 5 plots the $\eta_t$ estimates and 95% confidence intervals from the event study specification in equation (5). For both interest rates and recovery rates, the coefficients $\eta_{t-6}, \ldots, \eta_{t-1}$ are small and insignificant, consistent with the parallel trends assumption. In the period $t$, when exemptions increase, interest rates begin to rise. At the same time, the recovery rate on charged-off loans falls sharply in period $t$, and remains low over the next six years.

5.4 Explaining the Markup: The Role of Default

The interest rate markup exceeds the actuarially fair rate by 323%. Such a large markup raises the concern that changes in exemptions affect lenders’ profits. This would be problematic, since a critical assumption in the derivation of the welfare gain formula is that lenders’ profits are unaffected by exemptions, which eliminates any welfare impact on the lenders. An alternative explanation for the markup is that moral hazard and adverse selection change the probability of default, which would generate markup without affecting lender profits. This subsection shows that the observed markup can be fully explained by changes in the probability of default and, therefore, is consistent with the assumption that lenders’ profits are not affected by exemption increases.

I show that the magnitude of the markup is consistent with a model of competitively priced loans. If lenders are competitive and risk-neutral, then the returns from lending satisfy the zero-profit condition

$$(1 - e(m))q(m) + e(m)(1 + r(m)) = 1 + \tilde{r}, \quad (6)$$

where $e$ is the probability of repayment, $q$ is the recovery rate in default, $r$ is the interest rate, and $\tilde{r}$ is the market rate of return. Differentiating this expression with respect to $m$,

$$e'(m)(1 + r(m) - q(m)) + (1 - e(m))q'(m) + e(m)r'(m) = 0. \quad (7)$$

If rates are competitive, the increase in interest rates will exactly offset lenders’ losses due to the increase in the probability of default ($e'(m)(1 + r(m) - q(m))$) and the loss in recovery
in default \((1 - e(m))q'(m)\).

To test whether the observed interest rate change is consistent with this model of lending, columns 1-3 of Table 7 reports difference-in-differences estimates from equation 4 with the credit card default (charge-off) rate as the outcome. The estimates are positive and significant, indicating that higher exemptions increase the probability of default. The point estimates in column 2 implies that a 10\% increase in asset exemptions raises the credit card charge-off rate by 0.035 percentage points, a 1.6\% increase. Using estimates of \(q'(m) = -0.042\), \(e'(m) = -0.0035\) and the sample means for \(e\), \(r\), and \(q\), equation (7) implies that the profit-neutral interest rate increase justified by the change in default and recovery rates is 4.3 basis points. This is similar in magnitude to the actual observed increase of 4 basis points. Thus, the observed changes in default and recovery rates are large enough to explain the increase in interest rates.

Columns 4-6 test whether the resulting change in lender profits is statistically different from zero. I construct the empirical analog to equation (6) for each state \(s\) and year \(t\) as 
\((1 - e_{st})q_{st} + e_{st}(1 + r_{st})\). I multiply this measure by $1,000, so that it gives the expected return from a $1,000 loan. The average return in the sample is $1,098. The estimates in columns 4-6 indicate that exemptions have little effect on this measure of lender returns, consistent with the model of competitive lending. The estimate in column 6 implies that a 10\% increase in exemptions reduces lender profits on a $1,000 by a statistically insignificant $0.08. Together, the results in Table 7 show that the increase in the probability of default can fully account for the observed markup in interest rates and, therefore, is consistent with the assumption that changes in exemptions do not affect lender profits.

6 Calculating the Welfare Impact

In this section, I use the estimates from the two empirical sections to compute the marginal welfare gain from equation (2), which I repeat here:

\[
\frac{dW(m)}{dm} = \left\{ \left( \frac{u'(c_l)}{u'(c_h)} - 1 \right) - \left( -\frac{e}{1 - e q'(m)} - 1 \right) \right\} T,
\]
where \( T = -(1 - e)q'(m)d > 0 \). I first calculate the welfare gain using the point estimates from Sections 4 and 5, then investigate the sensitivity of the result to variation within the 95% confidence interval of these estimates.

### 6.1 Computing the Welfare Gain

Since I estimate the effect of changes in the log of the exemption level, the policy parameter is \( m = \log(\text{exemption}) \). I use the approximation \( \frac{u'(c_l)}{u'(c_h)} - 1 \approx \gamma \frac{\Delta c}{c_h} \). To calculate the welfare formula, I assume that

\[
\frac{\Delta c}{c_h}(m_j) = -\alpha_j \quad \text{for } j = L, M, H
\]

\[
r'(m) = \beta
\]

\[
q'(m) = \gamma.
\]

I use the estimates \( \hat{\alpha}_L = -0.055, \hat{\alpha}_M = -0.032, \hat{\alpha}_H = -0.016, \hat{\beta} = 0.004 \) and \( \hat{\gamma} = 0.042 \). I set the share of borrowers in repayment to one minus the mean credit card charge-off rate so that \( \hat{e} = 0.978 \), and set the level of unsecured debt \( d = 3,391 \), the mean level of unsecured debt held in the PSID sample of defaulters. Since the level of debt enters only through \( T \), choosing a higher level of debt will linearly increase the magnitude of the welfare gain. There is uncertainty about the appropriate value for the coefficient of relative risk aversion, \( \gamma \), so I report the welfare gains for \( \gamma = 1, \ldots, 5 \).

The results from this welfare calculation are reported in Table 8. In low-exemption states, a 10% increase in the exemption level reduces welfare by $0.94-1.00, depending on the coefficient of relative risk aversion.\(^{35}\) If consumers are more risk-averse, smoothing consumption becomes more valuable, but the high costs of transferring resources using exemptions still dominates. Among mid- and high-exemption states, the smaller drop in consumption upon default decreases the benefits of insurance. In these states, a 10% increase in consumption reduces welfare by $0.97-1.02. These results indicate that states would increase welfare by

\(^{35}\)Since welfare is normalized by \( u'(c_h) \), this is $0.94-1.00 evaluated at the marginal utility of those in repayment.
6.2 Sensitivity of the Welfare Gain

The policy implication of the welfare gain calculation is that states would benefit from reducing exemptions. I now investigate the sensitivity of this result to variation in the parameters of the welfare gain formula. Whether higher exemptions raise or lower welfare is determined by the sign of

$$\left[\frac{w'(c_l)}{w'(c_h)} - 1\right] - \left(\frac{e}{1 - e q'(m)} - 1\right),$$

(8)

which gives the welfare impact of an additional dollar of default insurance that generated by exemptions. Using the estimates of this paper, this expression equals $-3.07$, which implies that one additional dollar of exemption insurance is equivalent to a $3.07$ welfare loss.

Table 9 shows that the policy implication is not sensitive to reasonable variation in the estimates of the components. The table reports the assigned values based on the estimates, the 95% confidence intervals of those estimates, and the set of values that would reverse the policy implication. Specifically, the values that would reverse the policy implication and generate a welfare gain are those that cause the expression in (8) to become positive, holding the other parameters fixed at their assigned value. The coefficient of relative risk aversion would have to be above 58 for additional exemption insurance to generate a welfare gain. For the four estimated parameters, the range of values that would generate a welfare gain from increasing exemptions all lie outside of the 95% confidence intervals. Thus, each parameter can be individually varied within its 95% confidence interval without altering the sign of the welfare impact of exemptions.

---

The policy implication differs from the calibration of Dávila (2016), who finds that the optimal exemption level is around $100,000 and, consequently, that most states would benefit from increasing exemptions. In Appendix C, I discuss the source of the differences between our results.
Conclusion

In this paper, I estimate the welfare impact of changing the default insurance provided by asset exemptions. The welfare impact depends on 1) the drop in consumption upon default and 2) the costs of transferring money to those in default using exemptions. I estimate these values in a two-part empirical analysis. In the first part, I show that the drop in consumption upon default among borrowers with little exemption protection is 5.5%. Scaled by a coefficient of relative risk aversion of 3, this estimate implies that borrowers are willing to pay a markup of up to 16.5% over the actuarially fair rate in order to increase consumption in default. In the second part, I use panel variation in state asset exemption laws to estimate the effect of exemptions on interest rates (the “insurance premium”) and recovery rates on defaulted debt (the “insurance payout”). These estimates imply that the additional insurance provided by raising exemptions is marked up 320%. This high markup makes exemptions an expensive method of providing default insurance, and implies that welfare would be improved if states reduced exemption levels.

This analysis investigates the main tradeoff in raising exemptions, but there are a few potential externalities that are not accounted for in this analysis. First, my model allows exemptions to affect lending only through the interest rate and the recovery rate on defaulted debt. Exemptions may also affect the set of loan contracts offered or loan denial rates, and this could make increasing asset exemptions even more costly. Second, my analysis assumes that consumers make financial decisions optimally. There is a growing literature that argues behavioral biases are important in understanding household financial decisions (see Zinman (2014a) and Zinman (2014b) for an overview). If consumers do not make decisions optimally, the analysis in this paper could either overstate or understate the welfare gains of exemptions, depending on the specific behavioral biases of borrowers.

Third, this analysis considers the welfare effect of exemption policy in isolation. In reality, debtor protections exist alongside many other forms of social and private insurance programs. There is evidence that some of these programs interact, as consumers view health insurance, unemployment insurance, and default or bankruptcy as substitutes (Gross and Notowidigdo, 2011, Hsu, Matsa, and Melzer, 2014, Mahoney, 2015). Changes in exemp-
tion policy may reduce or exacerbate externalities in other social insurance programs, and this paper ignores these effects. The interaction of debtor protections and social insurance programs is important, since debtor protections also affects consumers’ ability to self-insure through credit markets. Additional responses of lenders, behavioral biases in borrowing, and externalities on other forms of insurance are three important avenues for future research on the welfare impact of debtor protection laws.
References


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Table 1: Consumption Sample (PSID)

<table>
<thead>
<tr>
<th></th>
<th>Non-Defaulters</th>
<th>Defaulters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ log consumption</td>
<td>.0061</td>
<td>-.036</td>
</tr>
<tr>
<td>Δ log food needs</td>
<td>-.0023</td>
<td>-.0042</td>
</tr>
<tr>
<td>Food consumption (1990$)</td>
<td>4,800</td>
<td>4,321</td>
</tr>
<tr>
<td>Age</td>
<td>46</td>
<td>38</td>
</tr>
<tr>
<td>Female</td>
<td>.24</td>
<td>.38</td>
</tr>
<tr>
<td>Years of education</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>White</td>
<td>.7</td>
<td>.48</td>
</tr>
<tr>
<td>Number of children</td>
<td>.86</td>
<td>1.3</td>
</tr>
<tr>
<td>Married</td>
<td>.62</td>
<td>.43</td>
</tr>
<tr>
<td>Unsecured debt (1990$)</td>
<td>2,407</td>
<td>3,391</td>
</tr>
<tr>
<td>Mortgage debt (1990$)</td>
<td>24,590</td>
<td>13,645</td>
</tr>
<tr>
<td>Observations</td>
<td>20,252</td>
<td>1,120</td>
</tr>
</tbody>
</table>

This table shows descriptive statistics for the 1992-1996 PSID data set. It displays means for a sample of individuals who never reported defaulting (non-defaulters), and the analysis sample, which consists of the observations of defaulters during the period of default.
Table 2: The Consumption Drop Upon Default

<table>
<thead>
<tr>
<th></th>
<th>Default sample</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (1)</td>
<td>Controls (2)</td>
<td>State Controls (3)</td>
</tr>
<tr>
<td>Low-exemption states ($\alpha_L$)</td>
<td>-0.056***</td>
<td>-0.055***</td>
<td>-0.055***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Mid-exemption states ($\alpha_M$)</td>
<td>-0.028</td>
<td>-0.032</td>
<td>-0.032</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.022)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>High-exemption states ($\alpha_H$)</td>
<td>-0.019</td>
<td>-0.017</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Log(median income)</td>
<td>0.018</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemp. rate</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1,123</td>
<td>1,123</td>
<td>1,123</td>
</tr>
<tr>
<td>Year FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1

This table reports regression results from the regression in equation (3) estimated on the sample of default instances. Demographic controls consist of age, sex, years of education, an indicator for white, marital status, number of children, and the change in the log of the food needs of the family, which is a function of family size and age computed by the PSID. Standard errors are clustered by state.
Table 3: Non-Defaulters as a Control Group

<table>
<thead>
<tr>
<th></th>
<th>Non-Defaulters Sample</th>
<th>Pooled Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline Controls</td>
<td>State Controls</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Low-exemption ($\alpha_L$)</td>
<td>-0.005</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Mid-exemption ($\alpha_M$)</td>
<td>0.002</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>High-exemption ($\alpha_H$)</td>
<td>0.004</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Low-exemption × Default</td>
<td>-0.047***</td>
<td>-0.045***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Mid-exemption × Default</td>
<td>-0.017</td>
<td>-0.026</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>High-exemption × Default</td>
<td>-0.015</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Log(median income)</td>
<td>-0.022</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td></td>
</tr>
<tr>
<td>Unemp. rate</td>
<td>-0.002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td></td>
</tr>
<tr>
<td>Demographic controls</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Year FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>State × Year FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Observations</td>
<td>20,363</td>
<td>20,363</td>
</tr>
</tbody>
</table>

Columns 1-3 estimate equation (3) on the sample of individuals who never report financial distress (non-defaulters). Columns 4-6 estimates a difference-in-differences regression by pooling the sample of defaulters and non-defaulters and including state×year fixed effects. The table coefficients for the exemption level interacted with an indicator indicator for default. Demographic controls consist of age, sex, years of education, an indicator for white, marital status, number of children, and the change in the log of the food needs of the family, which is a function of family size and age computed by the PSID. Standard errors are clustered by state.
Table 4: Leads and Lags of the Consumption Change

<table>
<thead>
<tr>
<th>Period relative to default</th>
<th>Full sample of defaulters</th>
<th>Defaulters with a lead and lag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t-2 to t-1</td>
<td>t-1 to t</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Change in consumption</td>
<td>-0.008</td>
<td>-0.036***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Observations</td>
<td>975</td>
<td>1,123</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1

This table reports regression results from estimating equation (3) on leads and lags of the log change in consumption. Columns 1-3 estimate the equation on the full sample of defaulters. Columns 4-6 estimate the equation on the subsample of defaulters for which a lead and lag of the consumption change is available. All specifications include year fixed effects and demographic controls for age, sex, years of education, an indicator for white, marital status, number of children, and the change in the log of the food needs of the family. Additionally, state-year level controls for the log of median income and the unemployment rate are included. Standard errors are clustered by state.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>12.30</td>
<td>0.93</td>
<td>9.56</td>
<td>14.49</td>
<td>550</td>
</tr>
<tr>
<td>Recovery rate, non-real estate debt</td>
<td>17.73</td>
<td>6.44</td>
<td>6.21</td>
<td>48.56</td>
<td>550</td>
</tr>
<tr>
<td>Charge-off rate, credit cards</td>
<td>2.16</td>
<td>0.516</td>
<td>0.88</td>
<td>5.82</td>
<td>350</td>
</tr>
<tr>
<td>Charge-off rate, non-real estate debt</td>
<td>0.91</td>
<td>0.24</td>
<td>0.25</td>
<td>1.91</td>
<td>550</td>
</tr>
<tr>
<td>Exemption level (1990$)</td>
<td>29,424</td>
<td>41,029</td>
<td>3,458</td>
<td>347,069</td>
<td>473</td>
</tr>
</tbody>
</table>

This table shows descriptive statistics of data from 1994-2004 Credit Union Call Reports, aggregated to the state-year level. Observations are weighted by the credit union membership in that state-year. The sample size is smaller for credit card charge-offs because that data is only available after 1997. The exemption statistics exclude the 7 states with unlimited exemptions.
<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(exemption)</td>
<td>0.381***</td>
<td>0.400***</td>
<td>0.306*</td>
<td>-3.235*</td>
<td>-4.182***</td>
</tr>
<tr>
<td></td>
<td>(0.130)</td>
<td>(0.129)</td>
<td>(0.160)</td>
<td>(1.850)</td>
<td>(1.175)</td>
</tr>
<tr>
<td>Log(median income)</td>
<td>-0.457</td>
<td>-0.229</td>
<td></td>
<td>0.727</td>
<td>1.949</td>
</tr>
<tr>
<td></td>
<td>(0.513)</td>
<td>(0.539)</td>
<td></td>
<td>(4.733)</td>
<td>(4.697)</td>
</tr>
<tr>
<td>Unemp. rate</td>
<td>-0.0152</td>
<td>0.00453</td>
<td></td>
<td>-1.746***</td>
<td>-1.206**</td>
</tr>
<tr>
<td></td>
<td>(0.0453)</td>
<td>(0.0535)</td>
<td></td>
<td>(0.581)</td>
<td>(0.578)</td>
</tr>
<tr>
<td>Log(house price index)</td>
<td>-0.197</td>
<td>-0.0778</td>
<td></td>
<td>11.95***</td>
<td>10.11***</td>
</tr>
<tr>
<td></td>
<td>(0.279)</td>
<td>(0.395)</td>
<td></td>
<td>(2.750)</td>
<td>(2.312)</td>
</tr>
</tbody>
</table>

| Observations | 550 | 550 | 550 | 550 | 550 | 550 |
| State and year FE | X | X | X | X | X | X |
| Region-year FE | X | | | | | |

*** p<0.01, ** p<0.05, * p<0.1

This table reports regression results from estimating equation (4). Observations are weighted by credit union membership. Standard errors clustered at the state-level are in parentheses.
This table reports regression results from estimating equation (4) with credit card charge-offs and lender profits as outcome variables. The measure of loan profitability is $e(1 + r) + (1 - e)q$, where $e$ is the share of credit card debt that is not charged-off, $r$ is the credit card interest rate, and $q$ is the recovery rate conditional on charge-off. Observations are weighted by credit union membership. Standard errors clustered at the state-level are in parentheses.
Table 8: Calculation of the Marginal Welfare Gain of Increasing Exemptions

<table>
<thead>
<tr>
<th>Consumption drop $\Delta c(m)$</th>
<th>Low-exemption</th>
<th>Mid-exemption</th>
<th>High-exemption</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.055</td>
<td>-0.032</td>
<td>-0.016</td>
<td></td>
</tr>
</tbody>
</table>

Risk aversion $\gamma$

<table>
<thead>
<tr>
<th>$\gamma$</th>
<th>Low-exemption</th>
<th>Mid-exemption</th>
<th>High-exemption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1.00</td>
<td>-1.01</td>
<td>-1.02</td>
</tr>
<tr>
<td>2</td>
<td>-0.99</td>
<td>-1.00</td>
<td>-1.01</td>
</tr>
<tr>
<td>3</td>
<td>-0.97</td>
<td>-0.99</td>
<td>-1.01</td>
</tr>
<tr>
<td>4</td>
<td>-0.95</td>
<td>-0.98</td>
<td>-1.00</td>
</tr>
<tr>
<td>5</td>
<td>-0.94</td>
<td>-0.97</td>
<td>-1.00</td>
</tr>
</tbody>
</table>

Each cell reports the marginal welfare gains of increasing exemptions by 10% ($dW/db \times 10\%$) calculated from equation (2). The parameters are set to $d = 3, 391, r'(m) = 0.4/100$, $q'(m) = -4.2/100$, and $e = 0.978.$
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Assigned Value</th>
<th>Lower 95% CI</th>
<th>Upper 95% CI</th>
<th>Values Needed for Positive Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk aversion $\gamma$</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>$&gt; 58.7$</td>
</tr>
<tr>
<td>Consumption drop $\frac{\Delta c}{c}$</td>
<td>0.055</td>
<td>0.024</td>
<td>0.086</td>
<td>$&gt; 1.08$</td>
</tr>
<tr>
<td>Interest rate change $r'(m)$</td>
<td>0.400</td>
<td>0.147</td>
<td>0.653</td>
<td>$&lt; 0.11$</td>
</tr>
<tr>
<td>Recovery rate change $q'(m)$</td>
<td>-4.18</td>
<td>-6.48</td>
<td>-1.88</td>
<td>$&lt; -15.26$</td>
</tr>
<tr>
<td>Probability of default $(1-e)$</td>
<td>0.022</td>
<td>0.011</td>
<td>0.032</td>
<td>$&gt; 0.075$</td>
</tr>
</tbody>
</table>
Figure 1: Comparison of Recovery Rates on Charged-Off Loans
Source: Aggregated credit union and commercial bank Call Reports.
Figure 2: Change in Consumption by Exemption Tercile

This figure presents the mean consumption drop upon default and 95% confidence intervals for defaulters living in low-, mid-, and high-exemption states. It also presents the average consumption change for non-defaulters living in those states. The estimated coefficients and 95% confidence intervals are from the regression in specification (3). The “Repayer” results present the estimated coefficients from the same regression estimated on the sample of individuals who never report financial distress (non-defaulters). Both regressions include only year fixed effects and an indicator for whether the respondent lives in a low-, mid-, or high-exemption state.
Figure 3: Heterogeneity in the Consumption Change upon Default

This figure presents the mean and 95% confidence intervals of the change in consumption upon default for subsamples of defaulters. Observations, with the exception of Debt-weighted, are weighted by the PSID family weights for the core sample. Debt-weighted averages are weighted by the amount of unsecured debt. Severe defaulters are those who report a more serious type of financial distress (debt collection actions, judicial actions, or bankruptcy). Non-exempt home equity is the subsample of homeowners that are not fully protected by exemptions. The means in this figure are shown in Table A1.
(a) Size of Exemption Changes

(b) Number of Exemption Changes

Figure 4: Distributions of the size and number of changes in homestead exemptions from 1994-2004.
Figure 5: Annual Effects of Exemption Increases in Year $t$ The cumulative effect of a one percent increase in asset exemptions in period $t$, estimated from a distributed lag model with 6 leads and lags using annual data. The sample period is 1995-2004, with exemption data used from 1989-2010 to allow for 6 leads and lags for each observation. The dotted lines show 95% confidence intervals for standard errors clustered at the state level.
Appendices

A Dynamic Model

In this appendix, I apply the general model of social insurance in Chetty (2006) to the case of asset exemptions. The key assumptions and arguments are taken directly from Chetty (2006) and adapted to the asset exemption setting. One difference in this model is that in the welfare gain formula, marginal utility is weighted by the amount of debt held in each state. This is because exemptions affect the interest rate and recovery rate on debt, so their impact will be proportional to the amount of debt held.

Consider a discrete time dynamic model where an agent lives for \( T + 1 \) periods \( t \in \{0, \ldots, T\} \). Let \( \omega_t \) be the state variable that contains all the information up to time \( t \) necessary to determine the borrower’s debt and behavior. Let \( F_t(\omega_t) \) denote the unconditional distribution function of \( \omega_t \) given information available at \( t = 0 \). I assume \( F_t \) is a smooth function with support \( \Omega \). The borrower chooses consumption \( c(t, \omega_t) \), debt \( d(t, \omega_t) \) and a general vector of other choices \( x(t, \omega_t) \). Utility is time-separable and the flow utility in period \( t \) is \( u(c(t, \omega_t), x(t, \omega_t)) \). Let \( c = \{c(t, \omega_t)\}_{t \in \{0, \ldots, T\}, \omega_t \in \Omega}, d = \{d(t, \omega_t)\}_{t \in \{0, \ldots, T\}, \omega_t \in \Omega}, \) and \( x = \{x(t, \omega_t)\}_{t \in \{0, \ldots, T\}, \omega_t \in \Omega} \) denote the full plan of state-contingent consumption, debt, and other choices for the agent.

Let \( \gamma(t, \omega_t, c, x, d) \) denote the borrower’s repayment status at time \( t \) in state \( \omega_t \). \( \gamma = 1 \) when the borrower repays his debts for that period \((1 + r(m))d(t - 1, \omega_{t-1})\), and \( \gamma = 0 \) when he defaults and pays \( q(m)d(t - 1, \omega_{t-1}) \) instead. Here, \( r(m) \) is the interest rate and \( q(m) \) is the recovery rate on defaulted debt, both of which are functions of the exemption level \( m \). To reduce notation, I often suppress \( (c, x, d) \) in \( \gamma(t, \omega_t, c, x, d) \).

For each period \( t \), the borrower faces the budget constraint

\[
 f(x(t, \omega_t)) - c(t, \omega_t) + d(t, \omega_t) - \gamma(t, \omega_t)[(1 + r)d(t - 1, \omega_{t-1})] - [1 - \gamma(t, \omega_t)]qd(t - 1, \omega_{t-1}) = 0.
\]

The function \( f(x(t, \omega_t)) \) captures the influence of choices other than consumption and borrowing on the budget constraint. For example, labor income and investment income can enter through \( f(x(t, \omega_t)) \). The terminal condition is that the individual cannot borrow in
the final period:

\[ d(T, \omega_T) \leq 0 \quad \forall \omega_T. \]

There are \( N \) additional constraints in each state \( \omega_t \) at time \( t \)

\[ g_{i\omega t}(c, x, d; r, q) \geq \bar{k}_{i\omega t} \quad i = 1, \ldots, N. \]

Let \( \lambda_{\omega, t} \) be the multiplier on the budget constraint in state \( \omega_t \) at time \( t \), \( \lambda_{\omega_T, T} \) be the multipliers on the terminal conditions, and \( \lambda_{g_i, \omega, t} \) be the multipliers on the additional constraints.

The borrower chooses a plan \((c, d, x)\) to

\[
\max \sum_{t=0}^{T} \int_{\omega_t} u(c(t, \omega_t), x(t, \omega_t))dF(\omega_t) + \int_{\omega_T} \lambda_{\omega_T, T}(-d(T, \omega_T))dF_T(\omega_T) \\
+ \sum_{t=0}^{T} \int_{\omega_t} \lambda_{\omega, t} \left\{ f(x(t, \omega_t)) - c(t, \omega_t) + d(t, \omega_t) - \gamma(t, \omega_t)[(1 + r)d(t - 1, \omega_{t-1})] \\
- (1 - \gamma(t, \omega_t))[q_d(t - 1, \omega_{t-1})] \right\} dF_t(\omega_t) + \sum_{i=1}^{N} \sum_{t=0}^{T} \int_{\omega_t} \lambda_{g_i, \omega, t} \left\{ g_{i\omega t}(c, x, d; r, q) - \bar{k}_{i\omega t} \right\} dF_t(\omega_t).
\]

Let \( V(r(m), q(m)) \) be the value of the maximum for a given \((r(m), q(m))\), where \( m \) is the log of the asset exemption level. The planner solves

\[
\max_m V(r(m), q(m)),
\]

taking into account the endogenous responses of the borrowers through \((c, d, x)\). Instead of the balanced budget requirement that typically constrains the government provision of social insurance, they are constrained by how creditors respond to changes in exemption levels through \( r(m) \) and \( q(m) \).

The following assumptions, taken directly from Chetty (2006), ensure that the borrower’s problem has a unique global maximum and the Envelope Theorem applies.

**Assumption 1.** Total lifetime utility \(
\sum_{t=0}^{T} \int_{\omega_t} u(c(t, \omega_t), x(t, \omega_t))dF(\omega_t)
\) is smooth, increasing, and strictly quasiconcave in \((c, x)\).

**Assumption 2.** The set of choices \(\{c, d, x\}\) that satisfy all the constraints is convex.
**Assumption 3.** At the borrower’s optimum, the binding set of constraints does not change in response to a small perturbation in \(m\).

The following assumption guarantees that the value of reducing \(q(m)\) and increasing \(r(m)\) can be determined from the marginal utilities of consumption in the two states.

**Assumption 4.** The feasible set of choices can be defined using a set of constraints such that:

\[
\begin{align*}
   i) \quad & \frac{\partial g_{\omega t}}{\partial r} = \gamma(t, \omega_t) d(t - 1, \omega_{t-1}) \frac{\partial g_{\omega t}}{\partial c(t, \omega_t)} \\
   ii) \quad & \frac{\partial g_{\omega t}}{\partial q} = [1 - \gamma(t, \omega_t)] d(t - 1, \omega_{t-1}) \frac{\partial g_{\omega t}}{\partial c(t, \omega_t)} \\
   iii) \quad & \frac{\partial g_{\omega t}}{\partial c(s, \omega_s)} = 0 \quad \text{if} \quad t \neq s
\end{align*}
\]

This assumption is satisfied, for example, if there is a borrowing constraint when in default:

\[
g_{\omega t} = (1 - \gamma(t, \omega_t)) \left( f(x(t, \omega_t)) - c(t, \omega_t) - qd(t - 1, \omega_{t-1}) \right) \geq 0.
\]

Let \(R\) be the expected amount of time in repayment

\[
R = \sum_{t=0}^T \int_{\omega_t} (\gamma(t, \omega_t)) dF_t(\omega_t)
\]

and \(E\{u'(c_h)d\}\) and \(E\{u'(c_l)d\}\) be the expectation of the debt-weighted marginal utility in the repayment and default states:

\[
E\{u'(c_h)d\} = \frac{\sum_{t=0}^T \int_{\omega_t} \gamma(t, \omega_t) u'(c(t, \omega_t)) d(t - 1, \omega_{t-1}) dF_t(\omega_t)}{\sum_{t=0}^T \int_{\omega_t} \gamma(t, \omega_t) dF_t(\omega_t)}
\]

\[
E\{u'(c_l)d\} = \frac{\sum_{t=0}^T \int_{\omega_t} (1 - \gamma(t, \omega_t)) u'(c(t, \omega_t)) d(t - 1, \omega_{t-1}) dF_t(\omega_t)}{\sum_{t=0}^T \int_{\omega_t} (1 - \gamma(t, \omega_t)) dF_t(\omega_t)}
\]

**Proposition 1.** The marginal value of increasing the exemption level is

\[
\frac{dV}{dm} = -r'(m)RE\{u'(c_h)d\} - q'(m)(T + 1 - R)E\{u'(c_l)d\}.
\]
Proof: Assumptions 1-3 guarantee that the Envelope Theorem can be applied to $V(m)$. Without loss in generality, assume that all $N$ of the constraints bind. Using the envelope conditions associated with individual optimization and differentiating $V(r(m), q(m))$ with respect to $m$ gives

$$
\frac{dV}{dm} = -r'(m) \sum_{t=0}^{T} \int_{\omega_t} \left[ \lambda_{wt} \gamma(t, \omega_t) d(t - 1, \omega_{t-1}) - \sum_{i=1}^{N} \lambda_{gi, wt} \frac{\partial g_{iwt}}{\partial r} \right] dF_t(\omega_t)
$$

$$
- q'(m) \sum_{t=0}^{T} \int_{\omega_t} \left[ \lambda_{wt} [1 - \gamma(t, \omega_t)] d(t - 1, \omega_{t-1}) - \sum_{i=1}^{N} \lambda_{gi, wt} \frac{\partial g_{iwt}}{\partial q} \right] dF_t(\omega_t) \tag{9}
$$

The third part of Assumption 4 implies that, at the borrower’s optimal consumption choice,

$$
\frac{\partial u(c(t, \omega_t), x(t, \omega_t))}{\partial c(t, \omega_t)} = \lambda_{o, t} - \sum_{i=1}^{N} \lambda_{gi, wt} \frac{\partial g_{iwt}}{c(t, \omega_t)} \quad \forall \ t, \omega_t.
$$

Also, the first two parts of Assumption 4 imply that $\forall \ t, \omega_t$,

$$
\sum_{i=1}^{N} \lambda_{gi, wt} \frac{\partial g_{iwt}}{\partial r} = \sum_{i=1}^{N} \lambda_{gi, wt} \gamma(t, \omega_t) d(t - 1, \omega_{t-1}) \frac{\partial g_{iwt}}{c(t, \omega_t)} \quad \text{and}
$$

$$
\sum_{i=1}^{N} \lambda_{gi, wt} \frac{\partial g_{iwt}}{\partial q} = \sum_{i=1}^{N} \lambda_{gi, wt} [1 - \gamma(t, \omega_t)] d(t - 1, \omega_{t-1}) \frac{\partial g_{iwt}}{c(t, \omega_t)}.
$$

Substituting these conditions into equation (9) gives

$$
\frac{dV}{dm} = -r'(m) \sum_{t=0}^{T} \int_{\omega_t} \gamma(t, \omega_t) d(t - 1, \omega_{t-1}) u'(c(t, \omega_t)) dF_t(\omega_t)
$$

$$
- q'(m) \sum_{t=0}^{T} \int_{\omega_t} [1 - \gamma(t, \omega_t)] d(t - 1, \omega_{t-1}) u'(c(t, \omega_t)) dF_t(\omega_t)
$$

and using the definitions of $R$, $E\{u'(c_h)d\}$, and $E\{u'(c_i)d\}$ gives

$$
\frac{dV}{dm} = -r'(m) RE\{u'(c_h)d\} - q'(m)(T + 1 - R) E\{u'(c_i)d\}. \quad \Box
$$
Normalizing $\frac{dV(m)}{dm}$ by the welfare gain from a marginal reduction in interest rates $E\{u'(c_h)d\}$ gives an equation similar to equation (2):

$$\frac{dV(m)}{dm}/E\{u'(c_h)d\} = \left[ \frac{E\{u'(c_l)d\} - E\{u'(c_h)d\}}{E\{u'(c_h)d\}} - \left( -\frac{R}{T+1-R} - 1 \right) \right] (T + 1 - R)q'(m)).$$

This general equation is very similar to the welfare gain formula for the two-period model

$$\frac{dW(m)}{dm} = \left\{ u'(c_l) - u'(c_h) \right\} - \left( \frac{e}{1 - e} q'(m) - 1 \right) \right\} \{-(1 - e)q'(m)d\}.$$

The main difference is that the dynamic model allows exemptions to impact people in various states of the world where they hold different levels of debt. Since the impact of changes in the interest rate and recovery rate is proportional to the level of debt, the dynamic welfare gain formula weights the marginal utility in each state by the level of debt held.

### B Multiple Loan Types and Implications for Welfare Gain

One concern in the analysis is that while I use the credit card interest rate, the recovery rate is computed for all non-real estate loans. This appendix shows that this feature of the data does not affect the policy implication of this paper. Non-real estate loans at credit unions consist almost entirely of unsecured consumer loans (22%) and auto loans (69%). Rough estimates based on the share of credit card debt and non-real estate debt that is charged-off imply that 56% of charged-off non-real estate debt is comprised of unsecured loans, and 44% is comprised of auto loans.

First, I extend the model in the paper to allow for two different types of loans that exemptions may affect differently. When a debtor defaults on an auto loan, the vehicle serving as collateral is repossessed, and exemptions only influence the recovery of the remaining portion of the loan that is not recovered from the sale of the collateral. Let $d_A$ be the unsecured portion of the auto debt (principal less the value of the collateral) and $d_U$ be

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37 The remaining 9% includes all other types of loans, such as partially secured personal loans and member business loans. These figures are for 2002 from NCUA (2002) which compiles totals from the quarterly Credit Union Call Reports.

38 These numbers are obtained by multiplying the shares of unsecured (22%) and auto (78%) loans by their respective charge-off rates of 2.18% and 0.56%. I treat the 9% of loans classified as “Other” as auto loans.
unsecured credit (e.g. credit card debt). Debtors again make repayment effort choices, but choose effort for auto loan repayment $e_A$ and unsecured debt repayment $e_U$ separately, with effort cost given by $f(e_A, e_U)$. To represent the gains from a vehicle, I allow utility in period 0 to depend directly on $d_A$. Borrowers maximize expected utility

$$V(m) = \max_{e_A, e_U, d_A, d_U} \quad u(c_0, d_A) + e_A e_U u(c(1, 1)) + e_A(1 - e_U)u(c(1, 0))$$

$$+ (1 - e_A)e_U u(c(0, 1)) + (1 - e_A)(1 - e_U)u(c(0, 0)) - f(e_A, e_U)$$

where

$$c_0 = y_0 + d_U,$$

$$c(1, 1) = y_{1,1} - (1 + r_A(m))d_A - (1 + r_U(m))d_U$$

$$c(1, 0) = y_{1,0} - (1 + r_A(m))d_A - q_U(m)d_U$$

$$c(0, 1) = y_{0,1} - q_A(m)d_A - (1 + r_U(m))d_U$$

$$c(0, 0) = y_{0,0} - q_A(m)d_A - q_U(m)d_U.$$

With this indirect utility functions, the welfare impact of raising exemptions is

$$\frac{dV(m)}{dm} = -e_A e_U u'(c(1, 1))(r'_A d_A + r'_U d_U) - e_A(1 - e_U)u'(c(1, 0))(r'_A d_A + q'_U d_U)$$

$$- (1 - e_A) e_U u'(c(0, 1))(q'_A d_A + r'_U d_U) - (1 - e_A)(1 - e_U)u'(c(0, 0))(q'_A d_A + q'_U d_U)$$

$$= -e_A e_U u'(c(1, 1))(r'_A d_A + r'_U d_U) - (1 - e_A e_U)\left(\frac{e_A(1 - e_U)}{1 - e_A e_U} u'(c(1, 0))(r'_A d_A + q'_U d_U)\right)$$

$$- (1 - e_A) e_U u'(c(0, 1))(q'_A d_A + r'_U d_U) - \frac{(1 - e_A)(1 - e_U)}{1 - e_A e_U} u'(c(0, 0))(q'_A d_A + q'_U d_U)$$

$$\leq -e_A e_U u'(c(1, 1))(r'_A d_A + r'_U d_U) - (1 - e_A e_U)\tilde{u}'(c)(q'_A d_A + q'_U d_U),$$

where $\tilde{u}'(c)$ is the expected marginal utility in the states where borrowers default. Dividing both sides of the inequality by $u'(c(1, 1))$ gives an expression similar to the welfare gains formula.
where \( \bar{e} = e_A e_U \) and \( \mathbf{T} = (1 - \bar{e})[q'_A d_A + q'_U d_U] \). This expression gives an upper bound for the welfare impact of raising exemptions when exemptions affect auto loans and credit cards differently and borrowers can default on these loans independently.

First, I argue that \( q'_A \approx q'_U \). The accounting guidelines that determine how loans are charged-off makes it likely that the recovery rate for auto loans and unsecured credit card debt is similar. Instead of charging off the entire loan balance, loans with collateral, e.g. auto loans, may be written down to the value of the collateral, less the cost to sell. Thus, the portion of the collateralized loan that is charged-off is unlikely to be secured by collateral, and so will be subject to the same laws and collection efforts used for unsecured credit card debt. If recoveries for charged-off auto loans and charged-off credit card debt are similar, then nothing is lost by using the recovery rate for non-real estate debt instead of the recovery rate for credit card debt and the main analysis in the paper correctly analyzes the welfare impact of exemptions on credit card borrowers.

However, if exemptions also affect interest rates for auto loan borrowers, this may alter the welfare analysis. Since \( q'_A \approx q'_U \), I replace \( q'_A \) and \( q'_U \) with \( q' \) in the above formula to give

\[
\frac{dV(m)/dm}{u'(c(1, 1))} \leq \left[ \left( \frac{\bar{u}'(c)}{u'(c(1, 1))} - 1 \right) - \left( 1 - \bar{e} \frac{r'_A d_A + r'_U d_U}{q'} - 1 \right) \right] T, \tag{10}
\]

where \( d = d_A + d_U \). This upper bound on the welfare impact looks similar to the welfare gains formula in equation (2), but \( r'(m) \) is replaced by the debt-weighted average interest rate increases for auto loans and credit cards. The expected marginal utility in the states where borrowers default \( \bar{u}'(c) \) is actually what is estimated in Section 4, since I estimate the drop in consumption among borrowers who default on any loan.

To compute this bound, I estimate the specification from equation (4) with credit card, new auto loan, and used auto loan interest rates as the outcome. The estimates are reported in Table A2. Columns 1 and 2 show the earlier results for credit card interest rates. Columns

3-6 show that, for new and used auto loans, a 10% increase in exemptions cause a 1.7-2.1 basis point increase in interest rates, which is half the size of the increase for credit cards.

Using these estimates to compute actual markup for the bound in equation 10,

\[
\left( -\frac{\bar{v}}{1 - \bar{v}} r_A d_A + r_U d_U \right) = 161\%,
\]

where \((1 - \bar{v})\) is set to the credit card charge-off rate of 2.18% and \(d_A = 78\%\), which is the share of non-real estate debt made of auto loans. I chose the credit card charge-off rate as the default probability because most borrowers default on credit card debt first, so the credit card charge-off rate likely reflects the share of borrowers who default on any debt. Even if I set \((1 - \bar{v})\) as the sum of the credit card charge-off rate (2.18%) and the auto loan charge-off rate (0.56%), the markup is still 91%. Since the markup (161\%) is substantially above the maximum willingness to pay of 16.5\%, the upper bound on the welfare effect of raising asset exemptions in equation (10) is negative. In reality, since auto loan charge-offs are rare, the actual markup for auto loans will likely be well above this lower bound.

C Comparison with Calibration of Dávila (2016)

The policy implications of my results differ from those of Dávila (2016). The calibration in Dávila (2016) generates an optimal exemption level of $100,000, which implies that most states should raise exemptions to improve welfare. My estimates, however, imply that exemptions are too high and even low-exemption states would benefit from reducing exemptions. The key difference is that, although exemptions in my model affect more people, my estimates of the benefits of raising exemptions are much smaller. First, I find that consumption drops by only 2-5.5\% upon default, relative to a 10\% consumption drop assumed in Dávila (2016). This smaller consumption drop makes insurance less valuable. Second, my estimates imply that raising exemptions has a relatively small effect on the consumption of debtors in default. Dávila (2016) uses the intuitive assumption that a $1 increase in asset exemptions will raise consumption of bankruptcy filers with non-exempt assets by $1. In contrast, a rough calculation using my estimates implies that a $1 increase in exemptions reduces the
average amount debtors in default pay by 0.5 cents. So, although my model allows exemp-
tions to affect a broad set of defaulters, the average effect on an individual defaulter is so
small that the total benefit of raising exemptions is lower.

A small effect of exemptions on repayment is consistent with what is known about the
assets of defaulters. Even Chapter 7 bankruptcy filers with non-exempt assets may not be
affected by changes in exemptions. This is because the large majority of variation in ex-
emptions is from the homestead exemption, while Chapter 7 bankruptcy filers rarely have
non-exempt home equity. Only 4-6% of Chapter 7 cases have any non-exempt assets. More-
over, in a sample of cases with non-exempt assets, only 11% of them had any non-exempt
equity in real estate of any kind, which can include equity in other types of real property as
well as home equity (Jiménez, 2009). This mismatch between the type of assets exempted
and the assets of debtors, as well as frictions in the debt settlement process could explain
why the impact of a $1 increase in exemptions translates into a much smaller reduction in
the amount paid on charged-off debt.

This estimate is obtained by evaluating the estimated effect that a 1% increase in exemptions leads to a
0.046 percentage point decrease in the recovery rate at the mean exemption level of $29,446 and the mean
unsecured debt level of $3,391. Using these values, the raising exemptions by $1 reduces the recovery rate
by \( \frac{0.046}{29,446} \times 3,391 = 0.005 \).
### Table A1: Heterogeneity in the Consumption Drop

<table>
<thead>
<tr>
<th>Consumption Drop:</th>
<th>Average</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defaulters</td>
<td>-.042</td>
<td>1,109</td>
</tr>
<tr>
<td>Defaulters (debt-weighted)</td>
<td>-.035</td>
<td>666</td>
</tr>
<tr>
<td>Renters</td>
<td>-.07</td>
<td>623</td>
</tr>
<tr>
<td>Severe Defaulters</td>
<td>-.021</td>
<td>551</td>
</tr>
<tr>
<td>Homeowners</td>
<td>-.0079</td>
<td>486</td>
</tr>
<tr>
<td>Non-exempt home equity</td>
<td>.0019</td>
<td>236</td>
</tr>
<tr>
<td>Reports unsecured debt</td>
<td>-.044</td>
<td>658</td>
</tr>
</tbody>
</table>

This table reports the mean or median drop in consumption for subsamples of defaulters. Observations, with the exception of Defaulters (debt-weighted), are weighted by the PSID family weights for the core sample. Debt-weighted averages are weighted by the amount of unsecured debt. Severe defaulters are those who report a more serious type of financial distress (debt collection actions, judicial actions, or bankruptcy). Non-exempt home equity is the subsample of homeowners that are not fully protected by exemptions. Reports unsecured debt is equal to one if the household reports positive unsecured debt.
### Table A2: Impact of Exemptions on Credit Card and Auto Loan Interest Rates

<table>
<thead>
<tr>
<th></th>
<th>Credit cards (1)</th>
<th>New auto loans (2)</th>
<th>Used auto loans (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log(exemption)</td>
<td>0.381***</td>
<td>0.400***</td>
<td>0.166*</td>
</tr>
<tr>
<td></td>
<td>(0.130)</td>
<td>(0.129)</td>
<td>(0.0920)</td>
</tr>
<tr>
<td>Log(median income)</td>
<td>-0.457</td>
<td>0.0513</td>
<td>-0.0736</td>
</tr>
<tr>
<td></td>
<td>(0.513)</td>
<td>(0.330)</td>
<td>(0.308)</td>
</tr>
<tr>
<td>Unemp. rate</td>
<td>-0.0152</td>
<td>-0.0706**</td>
<td>-0.0973***</td>
</tr>
<tr>
<td></td>
<td>(0.0453)</td>
<td>(0.0276)</td>
<td>(0.0297)</td>
</tr>
<tr>
<td>Log(house price index)</td>
<td>-0.197</td>
<td>-0.282</td>
<td>-0.193</td>
</tr>
<tr>
<td></td>
<td>(0.279)</td>
<td>(0.190)</td>
<td>(0.201)</td>
</tr>
<tr>
<td>Observations</td>
<td>550</td>
<td>550</td>
<td>550</td>
</tr>
<tr>
<td>State and year FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Observations are weighted by credit union membership. Standard errors clustered at the state-level are in parentheses.