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State bankruptcy laws and the responsiveness of credit card demand

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ABSTRACT

The responsiveness of credit demand to interest rate changes may vary widely by state due to differences in state bankruptcy and insolvency laws. Bankruptcy exemptions and other state laws insulate borrowers against negative consequences from non-repayment, and so lenient regulations may lead to decreased responsiveness to interest rate increases. Lenient laws also decrease creditors' incentive to lend, and a resulting decrease in loan options will reinforce the inelasticity of credit demand. This paper presents a model that predicts (1) that credit demand is less responsive in states with borrower-friendly, lenient bankruptcy and insolvency laws, and (2) the effects of state laws on demand elasticity will be strongest among borrowers facing credit constraints. Using market experiment data from a large credit card issuer, this paper presents evidence that supports the hypothesis that demand responsiveness and insolvency law leniency are negatively related. Borrowers are more likely to continue using a card in states with lenient exemption and garnishment laws. Borrowers who take up less attractive offers are more likely to be credit constrained; among these borrowers, the impact of exemption laws is much stronger than among the unconstrained group.

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1. Introduction

There is a strong theoretical link between state-level insolvency laws and a borrower's willingness and ability to borrow. State laws not only determine what a borrower submits to creditors in bankruptcy proceedings, but also largely regulate what goods and what proportion of a borrower's income can be seized when the borrower defaults but does not file for bankruptcy. A borrower's cost of debt is lower in states where he bears a lower burden in default. Similarly, a creditor's cost of lending is higher in states with borrower-friendly insolvency laws.

This paper presents a model that predicts that credit card borrowers living in states with lenient insolvency laws will be less responsive to differences in interest rates. The reasons for the lack of interest rate sensitivity are twofold. First, borrowers in these states are more likely to default, and a borrower with a high probability of default will be less responsive to interest rates because he is less likely to pay the full interest owed. Second, the supply of credit will contract in these states due to higher expected default rates, leaving borrowers with fewer alternatives[1]. The model predicts (1) the riskiness of the pool of borrowers who take up a new credit card offer will be a function of state insolvency laws, (2) borrowers in states with less costly default will be less likely to switch to a new card in response to an interest rate increase, and (3) the difference in demand responsiveness described in (2) will be larger for credit-constrained borrowers than for unconstrained borrowers.

The results reported in this article exploit variation in credit supply in a dataset with a quasi-experimental structure. The data was generated based on a series of "market experiments" conducted by a large credit card-issuing bank in the late 1990s. The bank created a mailing list of potential customers with credit histories that were within the range that qualified for pre-approved gold card offers, and these names were randomly assigned to market cells that varied by introductory offer. Individuals who took up the offers were tracked for 18–28 months. Because the bank did not base offers on state of residence, the data offers an opportunity to test whether state laws impact individuals' responsiveness to interest rates and whether the impact of state laws is stronger for individuals who face borrowing constraints.

The primary focus of this paper is the impact of insolvency laws on the probability that an account holder uses the card to borrow in a particular month. The results support the proposition that individuals living in states with lenient homestead exemptions are more likely to be active borrowers. Moreover, individuals who are willing to pay higher interest rates show decreased responsiveness to differences in state laws.

This paper fits into the substantial body of economic work that measures the impact of insolvency laws; the majority of this literature focuses on the impact of these laws on bankruptcy rates. Most insolvency laws fall into one of two major categories: exemption laws and collection laws. Exemption laws, which have federal- and state-level components but are effectively determined by states, specify the amount and value of property a borrower is allowed to keep in a Chapter 7 bankruptcy, the most common type of personal bankruptcy. Exemption laws also restrict the property that can be seized when a borrower has not filed for bankruptcy; hereinafter this article will refer to non-paying borrowers who do not file for bankruptcy as being in a state of "informal bankruptcy[2]." Borrowers who make this choice are subject to collection, which is governed by garnishment and harassment laws. The Fair Debt Collection Practices Act and other federal legislation places some limits on credit collection, and states have instituted a range of harassment laws that add additional restrictions. Most prominent among the various collection regulations are garnishment laws, which determine what percentage of a borrower's wage a creditor can collect directly from an employer. States can set any percentage below the federal maximum of 25%[3].

Researchers have not established a strong empirical link between lenient exemptions and high bankruptcy filing rates. White (1976) and Domowitz and Sartain (1999) show robust, significant positive effects of bankruptcy exemptions on filings, but the bulk of research (Peterson & Aoki, 1984;

[1] Calem and Mester (1995) and Calem, Gordy, and Mester (2006) showed that borrowers with high balances were less able to acquire new credit.

[2] See Dawsey and Ausubel (2013).

[3] See Table 1 for a summary of state garnishment and exemption laws during the relevant time frame.

Table 1
State garnishment, homestead and property exemptions.

State[a]	Garnishment (%)	Homestead[b]	State	Garnishment (%)	Homestead
AK	25	$54,000	MT	25	$40,000
AL	25	$5000	NC	0	$10,000
AR	25	Unlimited	ND	25	$80,000
AZ	25	$100,000	NE	15	$10,000
CA	25	$50,000	NH	0	$30,000
CO	25	$30,000	NJ	10	$15,000
CT	25	$75,000	NM	25	$30,000
DE	15	$0	NV	25	$95,000
FL	25	Unlimited	NY	10	$10,000
GA	25	$5000	OH	25	$5000
HI	19	$20,000	OK	25	Unlimited
IA	25	Unlimited	OR	25	$25,000
ID	25	$50,000	PA	0	$15,000
IL	15	$7500	RI	25	$15,000
IN	25	$7500	SC	0	$15,000
KS	25	Unlimited	SD	20	Unlimited
KY	25	$5000	TN	25	$5000
LA	25	$15,000	TX	0	Unlimited
MA	25	$15,000	UT	25	$8000
MD	25	$0	VA	25	$5000
ME	25	$12,500	VT	0	$30,000
MI	25	$15,000	WA	25	$30,000
MN	25	$200,000	WI	20	$40,000
MO	10	$8000	WV	20	$15,000
MS	25	$75,000	WY	25	$10,000

[a] State laws that applied during the observation period from 1995–1997. For a discussion of the coding of state laws, please see Dawsey and Ausubel (2013).
[b] If a state allows consumers to choose between the federal and state homestead exemption, the table entry is the higher of the federal or state exemption.

Shiers & Williamson, 1987; Lefgren & McIntyre, 2009, for example) has not found a positive relationship between exemptions and individual filing rates at the aggregate level. Note that the mixed results could indicate that lenders restrict the credit supply in states with lenient exemptions. Studies that utilize household-level data which control for borrower characteristics (such as Dawsey & Ausubel, 2013; Lin & White, 2001) have found a significant positive relationship between lenient exemptions and an increased likelihood of bankruptcy. And in this literature, strict garnishment is consistently associated with high bankruptcy filing rates.

This paper also complements the economic literature examining the sensitivity of borrowing to differences in the cost of credit; most of these studies make use of rare opportunities to observe independent variation in credit supply or interest rates. In the secured loan market, both Attanasio, Koujianou Goldberg, and Kyriazidou (2008) and Adams, Einav, and Levin (2009) find that borrowers are unresponsive to changes in interest rates for auto loans. Alan and Loranth (2013) use a randomized market experiment where a subprime lender raised the interest rates of a group of account holders and left interest rates unchanged in a control group. They find that demand among these subprime borrowers is inelastic but not completely unresponsive to changes in interest rates. Gross and Souleles (2002) exploit exogenous variation in credit limits and interest rates to measure demand elasticity and find that constrained borrowers are less responsive to changes in the cost of credit[4].

Few papers examine the specific question of the impact of insolvency law on credit supply and demand elasticities. Fabbri and Padula (2004) found that increased enforcement of loan contracts in Southern Italy resulted in a decreased likelihood that a household would be credit constrained.

[4] A related literature highlights evidence of credit card consumer behavior that violates standard utility optimization assumptions. Cho and Rust (2013) find that, counterintuitively, consumers often opt for more stringent repayment terms even when more lenient terms are no more costly, and Shui and Ausubel (2005) show that consumers' observed choices to take up or switch from credit card offers did not minimize their actual cost of borrowing.

Table 2
Variable definitions.

Variables	Definitions	Key relationships
l_x	Fixed loan amount in period 1 defined by borrower type	
r_I	Incumbent interest rate in initial period	$\frac{\partial r_I}{\partial m_i} \geq 0$
$r_{a,x}$	Competitive interest rate offered to borrower of type x when $l_1 = l_x$	$\frac{\partial r_{a,x}}{\partial m_i} > 0$
$r_{a,0}$	Competitive interest rate offered to borrower of type x when $l_1 = 0$	$\frac{\partial r_{a,0}}{\partial m_i} > 0$
r_c	Lender's opportunity cost of borrowing	
r_s^*	Turning point switch interest rate. Borrowers will switch to a new card if and only if $r_a \leq r_s^*$	$\frac{\partial r_s^*}{\partial m_i} < 0 \; \frac{\partial^2 r_s^*}{\partial m_i \partial r_I} < 0$
r_l^*	Turning point positive borrowing interest rates. Borrowers will choose $l_1 = l_x$ and not $l_1 = 0$ if and only if $r_1 \leq r_l^*$	$\frac{\partial r_l^*}{\partial m_i} > 0$

Gropp, Scholz, and White (1997) use the Survey of Consumer Finance and find a relationship between lenient exemptions laws and the demand and supply of credit. This study relies on the assumption that high-asset individuals are unlikely to be credit constrained, and so their level of borrowing will be determined by their own demand. It reports that low-asset borrowers borrow less in strict exemption states, which could be interpreted as evidence of credit supply effects, and high-asset borrowers borrow more in strict exemption states. Similarly, Berkowitz and Hynes (1999) use Home Mortgage Disclosure Act data to find evidence that increases in exemptions decrease the probability an individual will be denied a mortgage loan.

The paper proceeds as follows: Section 2 presents a theoretical model and its predictions, Section 3 describes the empirical specification and data, Section 4 tests the predictions of the model and Section 5 concludes.

2. Theoretical framework

This section presents a simple three-period model of the relationship between credit card usage and state insolvency laws; this model builds on Dávila (2013). An index of key variable definitions can be found in Table 2.

Borrowers are assumed to receive credit card offers based on past borrowing behavior and observable characteristics. The timing is as follows:

1. Borrowers are endowed with incumbent interest rate r_I and balances l_0 in the initial period. Initial interest rates, balances, and a borrower's type are common knowledge at all times.
2. Creditors send offers to borrowers at the beginning of period 1. Borrowers choose whether to take up a new credit card offer and whether to borrow in period 1.
3. In period 2, borrowers learn their period 2 income and decide whether repay or default.

All balances are assumed to come due in period 2. If a borrower takes up a new card, he pays a "switching fee." A borrower's initial income (y_0) and period 1 income (y_1) are common knowledge at all times. Period 2 income is a stochastic random variable; for simplicity, assume y_2 is distributed uniformly on $[0, y_H]$. Utility is determined according to a concave utility function, with $U(0) = 0$ and $U(y_H) = U_H$. A borrower maximizes expected utility, i.e., the sum of period 0 utility, discounted period 1 utility, and his discounted expected value of period 2 utility:

$$\max_{l_1, S_1} U(y_0 + l_0) + \beta U(y_1 + l_1 - S_1) + \beta^2 E[V(C_2)] \tag{1}$$

where l_t is a borrower's loan balance in period t and S_1 is the switching fee. $S_1 = 0$ if the borrower chooses not to take up a new card and $S_1 = S \in (0, \bar{S}]$ if the borrower takes up a new card; S is common knowledge.

$$V(C_2) = \max_{\varphi \in \{0,1\}} \varphi U\left(C_2^{\text{ND}}\right) + (1 - \varphi) U\left(C_2^D\right) \tag{2}$$

where φ is an indicator for repayment. If a borrower chooses to repay, then $\varphi = 1$. Likewise $\varphi = 0$ if the borrower chooses to default.

Eq. (1) represents the sum of the borrower's expected utility in periods 0, 1 and 2. The first term in (1) represents the utility a borrower receives in the initial period from consumption of his initial income and incumbent loan balance. The second term represents his discounted utility from consumption of his income and first period loan less the switching cost that occurs if he takes up a new card. The third term represents his expected utility from consumption in two possible states of the world, one in which he defaults in period 2 and one in which he repays his loan balance in period 2.

2.1. Expected utility in period 2

Eq. (2) shows the borrower's expected value of consumption in period 2, given that the borrower can choose to either repay his loan or default. Consumption in period 2 for a borrower who chooses to repay the loan is given by

$$C_2^{\mathrm{ND}} = y_2 - l_1 r_1 - l_0 r_1^2 \tag{3}$$

That is, a borrower who chooses to repay the loan in period 2 consumes his income minus total repayment.

Consumption in period 2 for a borrower who chooses to default will depend on his state's laws. Assume that a borrower choosing to default pays any second period income above a legally-established minimum level (m_i), where i indexes the borrower's state of residence. The parameter m_i could be interpreted most directly as the state exemption level, but it will also stand in for the state-determined percentage of borrower's salary that is protected from garnishment. Consumption in period 2 for a borrower who chooses default is

$$C_2^D = \min\{y_2, m_i) \tag{4}$$

The borrower will choose default whenever

$$y_2 < m_i + l_1 r_1 + l_0 r_1^2 \tag{5}$$

Let $R = l_1 r_1 + l_0 r_1^2$ represent total repayment. Note that, as in Dávila (2013), the borrower chooses a "strategic default" when his second period income is sufficient to repay his loan (i.e., greater than) but is less than $m_i + R$.

Period 2 consumption is equal to income when income falls below the minimum m_i. Period 2 consumption is equal to m_i when the borrower repays a portion of the loan. Finally, Period 2 consumption is equal to income less repayment when the borrower repays the full loan. Given that the borrower's second period income is distributed uniformly from 0 to y_H, expected utility in the second period is therefore given by the following:

$$V(C_2) = \frac{m_i}{y_H} E\left[U(y_2) | y_2 \le m_i\right] + \frac{R}{y_H} U(m_i) + \frac{y_H - R - m_i}{y_H} E\left[U(y_2 - R) | y_H \ge y_2 \ge R + m_i\right] \tag{6}$$

The first term represents a borrower's expected utility of consuming his full income multiplied by m_i/y_H, which is the probability his income falls below the legal minimum. The second term represents the borrower's expected utility of consuming the state minimum consumption level multiplied by R/y_H, which is the probability that his income falls between m_i and $m_i + R$. The final term represents the borrower's expected utility of income minus repayment multiplied by $(y_H - R - m_i)/y_H$, which is the probability that the borrower's second period income is greater than $m_i + R$ The borrower's expected consumption increases with m_i. Fig. 1 illustrates the borrower's consumption paths given high and low m_i.

2.2. The consumer's decision

The borrower maximizes his three-period expected utility by first choosing whether to take up a new card (which determines his switching fee) and then choosing loan balances l_1. The following

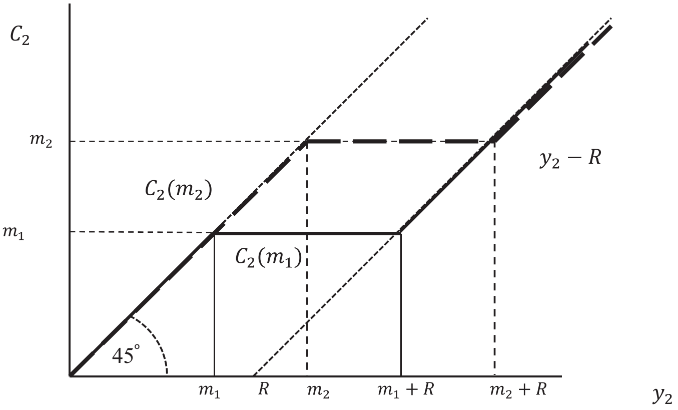

Fig. 1. Consumption under lenient (m_2) and strict (m_1) regulations, given R.

represents his maximization problem:

$$\max_{l_1,S_1} U(y_0 + l_0) + \beta U(y_1 + l_1 - S_1) + \frac{\beta^2}{y_H}\left\{ m_i \int_0^{m_i} U(y_2)\,\mathrm{d}y_2 + (R)U(m_i) + (y_H - R - m_i)\int_{R_1+m_i}^{y_H} U(y_2 - R)\,\mathrm{d}y_2 \right\} \quad (7)$$

The first term represents the borrower's first period utility, the second term represents his second period utility and the third term represents his expected third period utility.

A borrower will only accept an offer if the proposed introductory interest rate is strictly less than the incumbent interest rate: if r_s^* represents the highest interest rate that will induce the borrower to change cards (the "switch rate") and r_I is the borrower's current rate (the "incumbent rate"), then $r_s{}^* < r_I . r_s{}^*$ is defined by the following equation:

$$U(y_1 + l_1 - S) + \frac{\beta}{y_H}\left[\left(l_1 r_s^* + l_0 (r_s^*)^2\right) U(m_i) + \left(y_H - m_i - l_1 r_s^* - l_0 (r_s^*)^2\right) \times \int_{l_1 r_s^* + l_0 (r_s^*)^2 + m_i}^{y_H} U\left(y_2 - l_1 r_s^* - l_0 (r_s^*)^2\right)\mathrm{d}y_2 \right]$$
$$= U(y_1 + l_1) + \frac{\beta}{y_H}\left[\left(y_H - m_i - l_1 r_I - l_0 r_I{}^2\right) \int_{l_1 r_I + l_0 r_I{}^2 + m_i}^{y_H} U\left(y_2 - l_1 r_I - l_0 r_I{}^2\right)\mathrm{d}y_2 \right] \quad (8)$$

The left-hand side of Eq. (8) represents the borrower's utility of switching cards. The right-hand side represents the borrower's utility if he does not switch cards. At the switch rate, the borrower is indifferent and his utility from switching is equal to his utility of not switching.

Proposition 1. The switch rate (r_s^*) is decreasing in m_i and $\partial^2 r_s^* / \partial m_i \partial r_I < 0$.

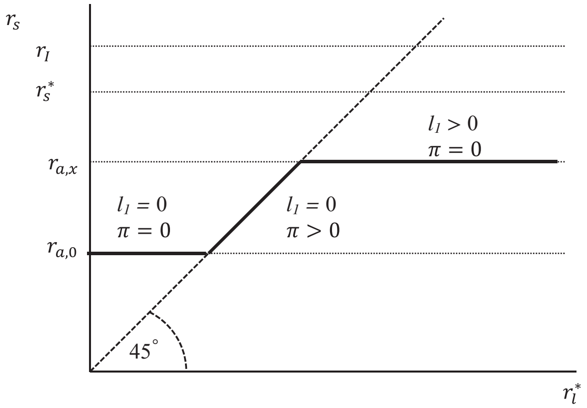

Fig. 2. Optimal interest rate offer.

In other words, an increase in m_i results in a larger wedge between the borrower's current rate and the rate that would induce the borrower to switch[5]. Note further that because $\partial^2 r_s^* / \partial m_i \partial r_I < 0$, as the borrower's incumbent rate increases, the wedge that results from an increase in m_i also grows. The intuition is straightforward: m_i is a form of insurance against the negative effects of borrowing. As a result, the benefit of switching decreases as m_i increases, and so the rate that will induce switching also decreases. The insurance effect is positively related to the incumbent rate, and so the effect of m_i on r_s^* will be greater for borrowers facing higher incumbent rates.

Because this paper is focused on the margin between borrowing and not borrowing, the model will restrict the borrower and creditor to $l_1 \in \{0, l_x\}$, where $l_x > 0$ is common knowledge at all times. The borrower will choose to borrow if his interest rate is sufficiently low. Let r_l^* represent the interest rate that results in exact indifference between choosing 0 and l_x. When $r < r_l^*$, the borrower chooses $l_1 = l_x$ and when $r > r_l^*$, the borrower chooses $l_1 = 0$. r_l^* is defined by the following equation:

$$U(y_1 + l_x - S_1) + \frac{\beta}{y_H}\left[\left(l_x r_l^*\right) U(m_i) + \left(y_H - m_i - l_x r_l^* - l_0 (r_l^*)^2\right) \times \int_{l_x r_l^* + l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_x r_l^* - l_0 (r_l^*)^2\right) \mathrm{d}y_2 \right]$$

$$= U(y_1 - S_1) + \frac{\beta}{y_H}\left[\left(y_H - m_i - l_0 (r_l^*)^2\right) \int_{l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_0 (r_l^*)^2\right) \mathrm{d}y_2 \right] \tag{9}$$

The consumer will only choose $l_1 = l_x$ if the interest rate is low enough that the disutility of repayment in period 2 is not greater than the additional utility that results from increased consumption in period 1.

[5] Intuitively, an increase in m_i decreases the probability of repayment, which results in less responsiveness to differences in interest rates. When m_i is high, a borrower will only switch to a new rate if it is substantially lower than the incumbent rate.

Proposition 2. Willingness to pay for credit increases with the leniency of state laws: $\partial r_l^* / \partial m_i > 0$.
Proof: see Appendix.

2.3. The credit market

Though the lending bank that collected the data used in this article offered randomized introductory interest rates, this model will assume that creditors generally operate according to the principles of profit maximization and competition.

Proposition 3. Creditors will offer higher interest rates in states with higher m_i (more lenient insolvency laws).

In a competitive market and given an opportunity cost of funds (r_c), creditors' offer rate (r_a) must equalize the expected payment and the cost of lending. Given a creditor's offer, the borrower can choose to borrow either 0 or l_x in period 1. If the borrower chooses to borrow l_x, then the break-even interest rate $r_{a,x}$ is defined by the following:

$$F_x(r_{a,x}) \equiv \frac{\left(l_x r_{a,x} + l_0 r_{a,x}{}^2\right)}{y_H}\left[\frac{\left(l_x r_{a,x} + l_0 r_{a,x}{}^2\right)}{2} - m_i\right] + \left(\frac{y_H - m_i - l_x r_{a,x} - l_0 r_{a,x}{}^2}{y_H}\right)\left(l_x r_{a,x} + l_0 r_{a,x}{}^2\right) = \left(l_x r_c + l_0 r_c{}^2\right) \tag{10}$$

$F_x(r_{a,x})$ is defined as the lender's expected repayment if the borrower chooses $l_1 = l_x$, and it is the sum of two terms. The first term represents the creditor's expected repayment when the borrower does not repay the full loan; the second term represents full repayment multiplied by the probability the loan will be fully repaid. Because l_x, l_0, and r_c are known, the right-hand side of the above equation is constant, which means any changes in the left-hand side must be offset: an increase in m_i must result in a compensating increase in $r_{a,x}$. Because more lenient laws decrease both repayment and the probability of repayment, any increase in leniency results in higher interest rates.

If the borrower chooses $l_1 = 0$, then the creditor solves the following for $r_{a,0}$:

$$F_0\left(r_{a,0}\right) \equiv \frac{\left(l_0 r_{a,0}{}^2\right)}{y_H}\left[\frac{\left(l_0 r_{a,0}{}^2\right)}{2} - m_i\right] + \left(\frac{y_H - m_i - l_0 r_{s,0}{}^2}{y_H}\right)\left(l_0 r_{s,0}{}^2\right) = \left(l_0 r_c{}^2\right) \tag{11}$$

Again, an increase in m_i must result in an increase in $r_{a,0}$, and it is also straightforward to show that $r_{a,x} > r_{a,0}$[6]. Intuitively, note that if the borrower chooses $l_1 = l_x$, the probability of non-repayment of both l_1 and l_0 increases, and this cost must be offset by an increase in the interest rate. Creditors choose between $r_{a,0}$ and $r_{a,x}$ based on whether the borrower will choose to borrow or not, depending on the offered rates. Creditors will earn zero profit unless $r_{a,0} < r_l^* < r_{a,x}$. As illustrated in Fig. 2, in this case (and if $r_{a,0}$ and $r_{a,x}$ are less than the turning point switch rate), creditors will charge r_l^* (or $r_l^* + \varepsilon$) to ensure the borrower does not choose $l_1 = l_x$[7] (Fig. 2).

2.4. Summary of theoretical results

The outcome measures used in the following empirical tests describe whether or not a borrower uses the card in a particular month. In the model in Section 2, a borrower is defined as using the card if $l_1 > 0$ (second period borrowing is positive), and l_1 depends on three key interest rate variables: (1) r_a, the interest rate a borrower is offered in a competitive market, (2) r_l^*, the highest interest rate a borrower is willing to pay for a loan in period 1, and (3) r_s^*, the highest interest rate to induce a

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[6] For example, note that if a creditor offered $r_{a,0}$ and the borrower chose $l_1 = l_x$, the creditor would receive an increased repayment of $F_x(r_{a,0}) - F_0(r_{a,0}) = l_x r_c - \frac{(l_x r_{a,0})\left(l_0 r_{a,0}^2\right)}{2}$, which is less than the increased cost of $l_x r_c$.

[7] If $r_s^* < r_{a,0}$, a creditor cannot offer an interest rate the borrower will accept. If $r_{a,0} < r_s^* < r_{a,x}$, creditors will charge r_l^* and borrowers will switch to the new card if $r_l^* < r_s^*$.

borrower to switch to a new card. (1) and (2) increase with m_i, which measures the leniency of states laws (increases in m_i indicate increases in leniency). As discussed above, r_a increases with m_i, which will both increase the attractiveness of a given offer and decrease the likelihood of switching away from an incumbent card; both of these effects serve to increase the likelihood that a borrower in the data is active. r_I^* also increases with m_i, and this effect also serves to increase the probability a borrower is active. And r_s^* decreases with m_i, which serves to decrease the likelihood that a borrower will switch to a new card and increases the likelihood he will remain active on an incumbent card.

In sum, an increase in m_i serves to increase the likelihood a borrower will continue to use a card in the face of interest rate increases. And $\partial^2 r_s^*/\partial m_i \partial r_I < 0$, which means that, for borrowers with very high incumbent rates, higher m_i (more lenient insolvency) results in a larger decrease in r_s^* than for borrowers who have lower incumbent rates. As a result, the impact of state laws on borrowers' sensitivity to interest rate increases will be highest for borrowers with higher incumbent interest rates.

3. Empirical specification and data

This section seeks to address three hypotheses raised in the theoretical section:

1. State insolvency laws will affect borrowers' willingness to switch to a new card and creditors' willingness to lend. As a result, not only will the pool of borrowers vary by the quality of the offer (the classic adverse selection case), but the pool will also vary according to the laws of borrowers' states of residence.
2. Once a borrower has taken up a new card, he will be more likely to use the card if he is subject to lenient regulations.
3. The difference between borrowers who respond to higher interest rates and borrowers who respond to lower interest rates is greater in states with lenient exemptions.

3.1. Data

This analysis utilizes data from a large credit card-issuing bank, collected from 1995 through 1999. The bank generated the data as part of a series of market experiments, which were used to quantify the characteristics of borrowers who responded to different credit card offers. The data used in this article comprises the accounts that responded to four mailings: one in the third quarter of 1995, one in the fourth quarter of 1995, one in the first quarter of 1996, and one in the first quarter of 1997. For each mailing, the bank created recipient lists of between 500,000 and 800,000 individuals, who were grouped randomly into five to six market cells. Within each mailing, there is little variation across market cells ex ante: the mean credit score, revolving balances, card limits, and total income vary by less than one percent. All individuals within a market cell received the same offer, which varied across market cells by introductory interest rates and introductory period duration. Interest rates ranged from 4.9% to 12.9% and the duration of the introductory period ranged from three to sixty months. Response rates ranged from 0.61% to 1.073%.

The dataset records information for the respondents of these offers. The bank recorded detailed information from the credit histories of the 52,422 pre-approved gold card recipients[8], including their cumulative credit limits, balances, and number of loans at the time of solicitation. In addition, the lender also collected data on each individual's monthly borrowing behavior: the amounts they spent on purchases and cash advances, transfers from other cards, total balances, payments, and whether they defaulted, declared bankruptcy, or were informally bankrupt (charged off for long-term delinquency). The dataset includes the borrower's risk credit score, which represents the creditor's prediction of the borrower's probability of default. A description of the offers and interest rate frequencies can be found in Table 3. Crucially, the account holders' zip codes allowed additional controls, including state and

[8] The full dataset consisted of 64,408 accounts, but 11,986 fell below a minimum threshold and were assessed a higher post-introductory rate, leaving 52,422 accounts. All results are robust to inclusion of these accounts, and full results are available on request from the author.

Table 3
Distribution of introductory duration and rate.

	Introductory rate					
Introductory duration	4.9%	5.9%	6.9%	7.9%	12.9%	Total
3	0	0	418	0	0	418
6	7312	13,646	986	1410	0	23,354
8	0	791	0	0	0	791
9	3861	689	759	0	0	5309
10	0	1020	0	0	0	1020
12	8160	9406	475	2055	0	20,069
60	0	0	0	0	1434	1434
Total	19,333	25,552	2638	3465	1434	52,422

county demographic information and state laws[9]. Aside from the credit history information, no additional data was collected from borrowers who did not take up the offer, and geographic information for these recipients was expunged.

The dependent variables are indicators of credit card activity in a particular month. The results of three measures of credit card activity are reported:

Card usage	Card usage is equal to 1 in months where the account holder either used the card for a purchase or cash advance or made a payment
Interest charged	Interest charged is equal to 1 if there are positive interest charges in that month
Active borrowing	An account is defined as active in a month if (1) there are positive interest charges in that month, indicating that the current balance was not paid in full, and (2) there was a payment within the next three months (the last three months of data were dropped)[10]

Other options such as credit card balances or charges are problematic in this context. Card balances in a particular month depend to a small degree on current or recent charges, but are largely determined by behavior in previous months. In addition, a borrower who defaults on his loan might carry unpaid balances for many months. Credit charges will only increase balances if they are not immediately paid. Credit charges net of payments will be positive or negative, depending on the size of the current balance.

3.2. *Borrower characteristics and selection by interest rate*

Table 4 presents summary statistics for borrowers within states with differing insolvency laws. The theoretical model in this paper predicts that borrowers have less access to low interest-rate loans if they are subject to lenient insolvency laws; this is the "supply effect" of insolvency laws. If this impact were to predominate, then the average borrower who took up the credit card offer in lenient exemption states would have characteristics indicative of *lower* default risk. For example, borrowers from lenient exemption states would be expected to have higher incomes and higher credit limits than borrowers from strict exemption states.

However, the model also predicts a demand effect, in which borrowers subject to lenient laws are less likely to switch to lower interest-rate cards. In contrast to the supply effect described above, this

[9] These demographic controls included: the state unemployment rate, percentage of self-employed, percentage of workers in manufacturing, and average transfer payment (constructed from the 1996–2000 March supplement to the Current Population Survey). County level data from the 2000 Census included the percentage divorced adults, high school graduation rate, percentage uninsured, and the county unemployment rate. Full results are available from the author on request.

[10] Other definitions of activity were tested and the results were robust to alternative specifications. For example, including borrowers who made a payment at any time during the observation period did not change the results. The results are also robust to a multinomial structure, where a borrower chooses among active borrowing, no borrowing, and non-repayment (default or bankruptcy).

Table 4
Selected mean borrower characteristics by interest rate and exemption level.

	Low HH[a]	High HH	Difference[b]	Low HH 4.9%	High HH 4.9%	Low HH 5.9%	High HH 5.9%	Low HH 6.9%	High HH 6.9%
Credit score	637.5 (85.42)	636.4 (85.34)	1.038 (1.26)	673.7 (59.39)	673.9 (59.43)	621.7 (89.27)	618.4 (88.16)	597.3 (95.63)	591.5 (94.08)
Credit limit	8119.2 (3345.4)	8061.7 (3323.0)	57.51 (1.78)	9760.4 (3847.8)	9686.5 (3795.0)	7304.5 (2676.8)	7163.3 (2616.4)	6945.8 (2269.4)	6962.0 (2337.5)
Income	51,701.2 (30,396.2)	50,778.3 (31,051.7)	922.8** (3.09)	55,654.1 (28,940.7)	54,609.2 (29,055.0)	50,169.5 (29,026.9)	48,743.4 (30,219.0)	48,128.7 (32,748.8)	47,986.6 (28,113.3)
Number of loans	15.91 (8.393)	16.39 (8.700)	−0.479*** (−5.75)	19.21 (7.911)	19.63 (8.111)	14.60 (8.084)	14.98 (8.406)	12.61 (7.286)	13.10 (7.875)
Total loan balance	9470.5 (13,850.4)	9357.9 (12,473.9)	112.6 (0.90)	11239.5 (15,089.4)	10,961.6 (12,495.4)	8772.2 (11,993.3)	8656.4 (12,235.0)	8123.1 (22,555.2)	8179.5 (10,112.6)
Revolving limits	6695.9 (11,114.0)	6604.2 (10,513.0)	91.74 (0.89)	7295.4 (11,240.4)	6929.0 (9315.9)	6493.0 (10,690.5)	6538.0 (11,534.7)	5837.1 (12,569.6)	6616.3 (9518.9)
Severely delinquent	0.0337 (0.181)	0.0394 (0.194)	−0.00564** (−3.07)	0.0189 (0.136)	0.0224 (0.148)	0.0398 (0.195)	0.0476 (0.213)	0.0601 (0.238)	0.0657 (0.248)
Bankrupt	0.0115 (0.107)	0.0129 (0.113)	−0.00143 (−1.33)	0.00710 (0.0839)	0.00900 (0.0945)	0.0134 (0.115)	0.0143 (0.119)	0.0200 (0.140)	0.0240 (0.153)
N	37,413	15,009	52,422	13,669	5664	18,426	7126	1846	792

Standard deviations in parenthesis except where noted.

** $p < 0.05$.

*** $p < 0.01$.

[a] The high homestead category refers to a homestead exemption above $74,000.

[b] *t*-Test for unequal means in parenthesis.

effect results in a pool where borrowers from lenient exemption states have characteristics indicating *higher* default risk. The intuition is straightforward: borrowers living in strict exemption states respond to interest rates very close to their incumbent rates because the probability of avoiding the interest rate through default is low. Low default-risk borrowers in strict exemption states in particular are likely to switch to a new card even when the offered rate is only marginally better than their current rates. Borrowers living in states with lenient laws will switch to a new card only if the rate is substantially lower than their incumbent rates. As a result, only borrowers facing very high incumbent rates respond to the credit card offer. Thus, given these two potential effects, the pool of borrowers from lenient-law states may have characteristics that indicate higher default risk, lower default risk, or neither.

The summary statistics for selected borrower characteristics in Table 4 and Table 5 present some evidence that the pool of borrowers from states with lenient laws exhibit characteristics that indicate higher default risk than borrowers from states with stricter laws, which would suggest that the demand effects of state regulations predominate. For example, Table 4 reports that borrowers living in states with exemptions below $74,000 have higher credit scores and credit limits, higher average incomes, and fewer loans than borrowers living in states with exemptions above $74,000, though only the differences in income and number of loans are statistically significant. Borrowers living in states with lower homestead exemptions are significantly less likely to become severely delinquent over the observation period and are less likely to declare bankruptcy. This pattern is consistent, for the most part, across market cells. Note that the differences between borrowers from lenient and strict exemption states do not seem to increase with interest rates. For example, the difference in average income is around $142 for borrowers in the 6.9% market cells and is $1045 for borrowers in the 4.9% market cells. Interestingly, the pattern is less consistent in Table 5, which compares the characteristics for borrowers in states with lenient and strict garnishment laws. While credit limits are higher in lenient garnishment states, average incomes are lower. Borrowers from lenient garnishment states are more likely to become severely delinquent but less likely to declare bankruptcy during the observation period.

Note that if the first hypothesis holds and the pools of borrowers vary according to state regulations, a straightforward model that simply measures the relationship between borrower activity and state regulations may overstate or understate borrowers' responsiveness to state laws. Instead, this section will focus on the differential impacts of insolvency laws on consumers' likelihood of borrowing during and after a low-interest introductory period. One way to conceptualize the model is to consider the post-introductory period a "control," given that all borrowers in the sample face the same interest rate in this period. The introductory period is thus the treatment, which creates a quasi-experimental structure. The outcome of interest is the difference between the treated and controlled. This article will address the second and third hypotheses by examining the impact of state laws using a difference in difference approach[11].

The probability that a borrower will use the card during a particular month is modeled as a function of state laws, other state and individual characteristics, and an indicator variable that is equal to 1 if the month occurs during the introductory period. An interaction between state laws and the introductory period dummy is included to allow the calculation of the difference in difference estimate. Given that Hypothesis 3 posits that the impact of state laws on borrower responsiveness increases with interest rates, an additional interaction between interest rates, state laws, and the introductory period dummy was included:

$$\begin{aligned}\text{Prob}\,(\text{Usage}=1) = \Phi\Big[&\beta_1\text{IntroDum}_{it} + \beta_2\text{Law}_{it} + \beta_3\text{IntroDum}_{it}\times\text{Law}_{it} + \beta_4\text{Rate}_i \\ &+ \beta_5\text{IntroDum}_{it}\times\text{Rate}_i + \beta_6\text{Law}_{it}\times\text{Rate}_i + \beta_7\text{IntroDum}_{it}\times\text{Law}_{it} \\ &\times\text{Rate}_i + \beta_8 X_{it}\Big] \qquad (12)\end{aligned}$$

where $\Phi[.]$ is the logistic probability function. X is a vector of borrower and state characteristics, and includes the borrower's credit limit, his credit score, his total loan balance and self-reported income at the time of solicitation. The results that follow also include indicators for the length of the introductory

[11] See Meyer (1995) or Angrist and Krueger (2000).

Table 5
Selected mean borrower characteristics by interest rate and garnishment laws.

	Strict Garn	Lenient	Difference[a]	Strict 4.9%	Lenient 4.9%	Strict 5.9%	Lenient 5.9%	Strict 6.9%	Lenient 6.9%
Credit score	636.8 (85.16)	637.7 (85.77)	−0.929 (−1.21)	672.6 (59.34)	675.6 (59.46)	620.5 (88.63)	621.1 (89.48)	594.6 (96.04)	597.0 (93.94)
Credit limit	8126.8 (3326.3)	8064.0 (3358.8)	62.72* (2.08)	9697.3 (3784.0)	9810.4 (3914.5)	7269.1 (2659.3)	7258.3 (2662.9)	6995.1 (2317.7)	6883.9 (2246.6)
Income	51,175.3 (30,228.3)	51,845.2 (31,136.9)	−669.9* (−2.43)	55,025.6 (29,506.7)	55,894.9 (28,050.1)	49,330.3 (28,525.1)	50,434.5 (30,585.2)	47,965.7 (25,606.0)	48,264.0 (38,461.7)
Number of loans	16.40 (8.458)	15.49 (8.496)	0.910*** (11.98)	19.51 (7.932)	19.02 (8.030)	15.04 (8.164)	14.20 (8.169)	13.12 (7.510)	12.22 (7.380)
Total loan balance	9710.3 (13,816.3)	9013.6 (12,901.6)	696.7*** (5.87)	11,302.3 (13,950.7)	10,913.3 (15,073.7)	8958.3 (12,427.7)	8412.0 (11,481.6)	8573.2 (23,114.9)	7499.1 (12,952.1)
Revolving limits	6780.7 (11,269.3)	6496.4 (10,417.4)	284.3** (2.95)	7276.2 (11,083.1)	7038.5 (10,054.4)	6539.3 (10,920.9)	6455.0 (10,949.7)	6514.4 (13,788.5)	5415.3 (7739.9)
Severely delinquent	0.0352 (0.184)	0.0355 (0.185)	−0.000267 (−0.16)	0.0198 (0.139)	0.0201 (0.140)	0.0415 (0.200)	0.0426 (0.202)	0.0642 (0.245)	0.0583 (0.234)
Bankrupt	0.0131 (0.114)	0.0101 (0.0998)	0.00302** (3.20)	0.00806 (0.0894)	0.00697 (0.0832)	0.0151 (0.122)	0.0115 (0.106)	0.0248 (0.155)	0.0160 (0.125)
N	31,949	20,473	52,422	12,164	7169	15,335	10,217	1574	1064

Standard deviations in parenthesis except where noted.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] *t*-Test for unequal means in parenthesis.

Table 6
Predicted probability of card usage during and post introductory period by exemptions.

	Total			4.9%			6.9%			
	High HH[a] (1)	Low HH (2)	Difference[b] (3)	High HH (4)	Low HH (5)	Difference (6)	High HH (7)	Low HH (8)	Difference (9)	Diff (6.9)–Diff (4.9)[d]
Introductory period	0.715*** (0.00455)	0.710*** (0.00279)	0.00504 (0.00515)	0.764*** (0.00499)	0.757*** (0.00327)	0.00754 (0.00537)	0.652*** (0.00622)	0.650*** (0.00445)	0.00219 (0.00629)	−0.00535 (0.00569)
Post intro period	0.595*** (0.00454)	0.584*** (0.00235)	0.0116* (0.00555)	0.559*** (0.00651)	0.556*** (0.00399)	0.00370 (0.00731)	0.647*** (0.00865)	0.624*** (0.00538)	0.0238* (0.0100)	0.0201 (0.0130)
Difference[c]	0.119*** (0.00497)	0.126*** (0.00328)	−0.00651 (0.00530)	0.205*** (0.00663)	0.201*** (0.00414)	0.00384 (0.00736)	0.00458 (0.00893)	0.0262*** (0.00553)	−0.0216* (0.0102)	−0.0254 (0.0139)

Standard errors in parenthesis.

* $p < 0.10$.

*** $p < 0.01$.

[a] The high homestead category refers to a homestead exemption level of $400,000, while low homestead is an exemption level of 15,000.

[b] The difference in probability between high exemption and low exemption states.

[c] The difference in probability between the introductory and post-introductory period.

[d] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

Table 7
Predicted probability of card usage during and post introductory period by garnishment.

	Total			4.9%			6.9%			
	Lenient (1)	Strict (2)	Difference[a] (3)	Lenient (4)	Strict (5)	Difference (6)	Lenient (7)	Strict (8)	Difference (9)	Diff (6.9)–Diff (4.9)[c]
Introductory period	0.714*** (0.00343)	0.709*** (0.00290)	0.00589 (0.00394)	0.763*** (0.004)	0.756*** (0.00338)	0.00771 (0.00416)	0.653*** (0.00504)	0.649*** (0.00457)	0.00376 (0.00482)	0.00395 (0.00446)
Post Intro period	0.594*** (0.00324)	0.582*** (0.00252)	0.0122** (0.00433)	0.562*** (0.005)	0.553*** (0.00420)	0.00871 (0.00586)	0.641*** (0.00655)	0.623*** (0.00573)	0.0179* (0.00799)	0.0266** (0.00915)
Difference[b]	0.120*** (0.00392)	0.127*** (0.00345)	−0.00633 (0.00421)	0.201*** (0.005)	0.202*** (0.00438)	−0.000999 (0.00598)	0.0121 (0.00676)	0.0262*** (0.00591)	−0.0141 (0.00817)	−0.0131 (0.0113)

Standard errors in parenthesis.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] The difference in probability between strict and lenient garnishment states.

[b] The difference in probability between the introductory and post-introductory period.

[c] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

Table 8
Predicted probability of interest charges during and post introductory period by exemptions.

	Total			4.9%			6.9%			
	High HH[a] (1)	Low HH (2)	Difference[b] (3)	High HH (4)	Low HH (5)	Difference (6)	High HH (7)	Low HH (8)	Difference (9)	Diff (6.9)–Diff (4.9)[d]
Introductory period	0.575*** (0.00489)	0.576*** (0.00286)	−0.000880 (0.00555)	0.643*** (0.00565)	0.643*** (0.00358)	0.000565 (0.00602)	0.498*** (0.00640)	0.500*** (0.00446)	−0.00232 (0.00656)	−0.00289 (0.00628)
Post intro period	0.431*** (0.00468)	0.415*** (0.00232)	0.0157** (0.00573)	0.393*** (0.00642)	0.388*** (0.00391)	0.00537 (0.00720)	0.482*** (0.00916)	0.451*** (0.00531)	0.0312** (0.0106)	0.0258 (0.0133)
Difference[c]	0.144*** (0.00504)	0.161*** (0.00315)	−0.0166** (0.00547)	0.250*** (0.00668)	0.255*** (0.00404)	−0.00480 (0.00747)	0.0158 (0.00923)	0.0493*** (0.00528)	−0.0335** (0.0107)	−0.0287* (0.0144)

Standard errors in parenthesis.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] The high homestead category refers to a homestead exemption level of $400,000, while low homestead is an exemption level of 15,000.

[b] The difference in probability between high exemption and low exemption states.

[c] The difference in probability between the introductory and post-introductory period.

[d] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

Table 9
Predicted probability of interest charges during and post introductory period by garnishment.

	Total			4.9%			6.9%			
	Lenient (1)	Strict (2)	Difference[a] (3)	Lenient (4)	Strict (5)	Difference (6)	Lenient (7)	Strict (8)	Difference (9)	Diff (6.9)–Diff (4.9)[c]
Introductory period	0.570*** (0.00483)	0.569*** (0.00277)	0.000801 (0.00551)	0.638*** (0.0056)	0.636*** (0.00360)	0.00194 (0.0060)	0.493*** (0.00637)	0.493*** (0.00444)	−0.000378 (0.00651)	−0.00232 (0.00617)
Post intro period	0.438*** (0.00475)	0.425*** (0.00236)	0.0129* (0.00581)	0.403*** (0.0065)	0.400*** (0.00399)	0.00237 (0.0073)	0.488*** (0.00950)	0.459*** (0.00560)	0.0288** (0.0109)	0.0265 (0.0137)
Difference[b]	0.131*** (0.00492)	0.144*** (0.0031)	−0.0121* (0.00536)	0.236*** (0.0065)	0.236*** (0.00393)	−0.00042 (0.0073)	0.00525 (0.00939)	0.0345*** (0.00535)	−0.0292** (0.0109)	−0.0288 (0.0147)

Standard errors in parenthesis.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] The difference in probability between strict and lenient garnishment states.

[b] The difference in probability between the introductory and post-introductory period.

[c] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

Table 10
Predicted probability of active borrowing during and post introductory period by exemptions.

	Total			4.9%			6.9%			
	High HH[a] (1)	Low HH (2)	Difference[b] (3)	High HH (4)	Low HH (5)	Difference (6)	High HH (7)	Low HH (8)	Difference (9)	Diff (6.9)–Diff (4.9)[d]
Introductory period	0.578*** (0.00359)	0.574*** (0.00300)	0.00349 (0.00419)	0.649*** (0.00435)	0.639*** (0.00372)	0.00905* (0.00460)	0.498*** (0.00510)	0.501*** (0.00460)	−0.00232 (0.00501)	0.0114* (0.00499)
Post intro period	0.428*** (0.00331)	0.414*** (0.00251)	0.0148*** (0.00447)	0.397*** (0.00495)	0.384*** (0.00412)	0.0132* (0.00574)	0.469*** (0.00675)	0.452*** (0.00572)	0.0173* (0.00841)	0.0306** (0.00956)
Difference[c]	0.150*** (0.00386)	0.161*** (0.00333)	−0.0113** (0.00430)	0.251*** (0.00514)	0.255*** (0.00429)	−0.00419 (0.00602)	0.0288*** (0.00675)	0.0485*** (0.00572)	−0.0197* (0.00847)	−0.0155 (0.0116)

Standard errors in parenthesis.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] The high homestead category refers to a homestead exemption level of $400,000, while low homestead is an exemption level of 15,000.

[b] The difference in probability between high exemption and low exemption states.

[c] The difference in probability between the introductory and post-introductory period.

[d] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

Table 11
Predicted probability of active borrowing during and post introductory period by garnishment.

	Total			4.9%			6.9%			
	Lenient (1)	Strict (2)	Difference[a] (3)	Lenient (4)	Strict (5)	Difference (6)	Lenient (7)	Strict (8)	Difference (9)	Diff (6.9)–Diff (4.9)[c]
Introductory period	0.571*** (0.00351)	0.568*** (0.00292)	0.00252 (0.00416)	0.641*** (0.00435)	0.634*** (0.00374)	0.00776 (0.00456)	0.491*** (0.00508)	0.494*** (0.00458)	−0.00287 (0.00497)	0.0106* (0.00490)
Post Intro period	0.436*** (0.00336)	0.424*** (0.00256)	0.0127** (0.00455)	0.408*** (0.00503)	0.396*** (0.00420)	0.0118* (0.00581)	0.475*** (0.00705)	0.460*** (0.00602)	0.0144 (0.00870)	0.0262** (0.00977)
Difference[b]	0.134*** (0.00379)	0.145*** (0.00325)	−0.0102* (0.00424)	0.233*** (0.0050)	0.237*** (0.00418)	−0.00403 (0.00594)	0.0166* (0.00687)	0.0338*** (0.00580)	−0.0173* (0.00867)	−0.0132 (0.0118)

Standard errors in parenthesis.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$.

[a] The difference in probability between strict and lenient garnishment states.

[b] The difference in probability between the introductory and post-introductory period.

[c] The difference in differences between borrowers responding to 6.9% offers and 4.9% offers.

period, the duration of the observation period, and the age of the account. Observations were weighted by state population at the time of solicitation, and standard errors were clustered at the individual account-holder level.

Define the "treatment gap" as the difference in the probability of activity between the introductory period and the post-introductory period; given that the interest rate is higher during the post-introductory period, the treatment gap should be positive (the probability of being active should be higher during the introductory period). Hypothesis 2 posits that the treatment gap will be smaller for borrowers in lenient insolvency law states than for borrowers in strict insolvency law states. Hypothesis 3 indicates that the difference in the treatment gap should be greater for borrowers who responded to higher interest-rate offers.

4. Results

Tables 6–11 present the primary results of this article. For expositional simplicity, the discussion that follows will compare the 4.9% and 6.9% market cells as representing low and high interest rates. Table 6 shows the predicted probabilities of lenient and strict exemption laws on card usage, which is equal to 1 only if a borrower made a payment or a charge in that month. The first and second rows show that the borrower is less likely to use the card after the introductory period ends. The difference in the predicted probability of using the card is significant for 4.9% introductory-rate borrowers living in high and low homestead exemption states. For these borrowers, who responded to a better credit card offer and are therefore less likely to face credit constraints, homestead exemptions have very little effect: Column (6) shows that the difference in their responsiveness is small. However, for borrowers who responded to the 6.9% offer, borrowers in high homestead exemption states are less responsive to the change in interest rate at the introductory period than borrowers living in low homestead exemption states: Column (9) shows that this difference is marginally significant. Table 7 shows similar results across states with lenient and strict garnishment laws.

While these results are interesting, card usage is a problematic outcome variable: the card usage indicator will equal 1 even if the charges are fully repaid immediately. To more closely capture actual borrowing, Tables 8 and 9 show the results of specifications that measured the impact of state laws on whether interest was charged on the account in a particular month. In the 6.9% pool, there is again a significant difference between the responsiveness of borrowers living in lenient homestead exemption states and the responsiveness of borrowers living in strict homestead exemption states. In this pool, the probability that a borrower from a low exemption state incurs an interest charge is 4.93 percentage points lower after the introductory period ends (Column 7), while the probability a borrower from a high exemption state decrease incurs an interest charge is only 1.58 percentage points lower after the introductory period ends (Column 8). Similarly, Table 9 shows that borrowers from states with strict garnishment laws are also much more responsive to the end of the introductory period in the 6.9% pool, while borrowers from strict and lenient garnishment states do not behave differently in the 4.9% pool.

Finally, Tables 10 and 11 show the results of specifications showing the impact of state laws on active borrowing, where this indicator is equal to if the borrower paid interest and made a payment on the card within three months. Unlike the previous measure, borrowers who never make payments on debt incurred are not misclassified as card users. The results are consistent with the previous specification, though the degree of statistical significance is reduced.

5. Conclusion

The results presented in this article support the three hypotheses posited in the theoretical model. First, the characteristics of borrowers who respond to the randomized offer differ according to the insolvency laws of their state, and there is some evidence that borrowers from strict states have characteristics indicative of lower default risk. Second, borrowers living in lenient exemption states show decreased responsiveness to the changes in the interest rate at the end of the introductory period. Finally, the impact of insolvency laws on a borrower's responsiveness increases with the borrower's introductory interest rate, indicating that the impact of these laws is higher for borrowers who are credit-constrained.

Note that the observation period of this dataset predates two major events which had dramatic implications for the credit card market: the passage of the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA) and the U.S. financial crisis beginning in 2007. The financial crisis led to increased attention to default risk among creditors. The crisis, coupled with improvements in risk assessment and data analysis, could have resulted in increased attention to state insolvency regulations on the part of credit card lenders. However, while BAPCPA left state exemption and garnishment laws largely unchanged, credit card debt is now more difficult to discharge in bankruptcy. As a result, credit card lenders may be less responsive to state laws today than they were in the late 1990s. Recent research shows that, despite technological and legal changes that facilitate search, credit card borrowers tend to hold onto cards even when lower-cost options are available[12]. A potential avenue for future research is the relationship between current borrowers' search behavior and the costs of default determined by insolvency laws.

Appendix A.

r_l^* is defined by the following equation:

$$U(y_1 + l_x - S_1) + \frac{\beta}{y_H}\left[\left(l_x r_l^*\right) U(m_i) + \left(y_H - m_i - l_x r_l^* - l_0\left(r_l^*\right)^2\right)\right.$$

$$\left.\times \int_{l_x r_l^* + l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_x r_l^* - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2\right]$$

$$= U(y_1 - S_1) + \frac{\beta}{y_H}\left[\left(y_H - m_i - l_0\left(r_l^*\right)^2\right) \int_{l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2\right]$$

Holding $U(y_1 + l_x - S_1) - U(y_1 - S_1)$ constant, define the following:

$$W\left(r_l^*, m_i\right) \equiv \frac{\beta}{y_H}\left[\left(y_H - m_i - l_0\left(r_l^*\right)^2\right)\right.$$

$$\times \int_{l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2 - \left(l_x r_l^*\right) U(m_i) - \left(y_H - m_i - l_x r_l^* - l_0\left(r_l^*\right)^2\right)$$

$$\left.\times \int_{l_x r_l^* + l_0 (r_l^*)^2 + m_i}^{y_H} U\left(y_2 - l_x r_l^* - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2\right]$$

[12] Stango and Zinman (2013).

$W(r_l^*, m_i)$ represents the difference in period 2 utility between not borrowing and borrowing. The benefit of borrowing occurs in period 1 (additional consumption in period 1). That benefit is constant, so any change in m_i must be offset by changes in r_l^*.

$$\frac{\partial r_l^*}{\partial m_i} = -\frac{\partial W\left(r_l^*, m_i\right)/\partial m_i}{\partial W\left(r_l^*, m_i\right)/\partial r_l^*}$$

Note that, by the definition of r_l^*, the denominator above must be positive: given that a borrower only borrows when $r < r_l^*$, an increase in r_l^* must decrease utility more when borrowing is positive in period 1. Thus the difference in utility between the state of the world where $l_1 = l_x$ and where $l_1 = 0$ must be increasing.

$$\begin{aligned}
\frac{\partial W\left(r_l^*, m_i\right)}{\partial m_i} = \frac{\beta}{y_H}\Bigg[& -\left(y_H - m_i - l_0\left(r_l^*\right)^2\right) U\left(m_i\right) \\
& - \int_{l_0\left(r_l^*\right)^2+m_i}^{y_H} U\left(y_2 - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2 + \left(y_H - m_i - l_x r_l^* - l_0\left(r_l^*\right)^2\right) U\left(m_i\right) \\
& + \int_{l_x r_l^* + l_0\left(r_l^*\right)^2+m_i}^{y_H} U\left(y_2 - l_x r_l^* - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2 - \left(l_x r_l^*\right) U'\left(m_i\right)\Bigg] \\
= \frac{\beta}{y_H}\Bigg[& -\int_{l_0\left(r_l^*\right)^2+m_i}^{y_H} U\left(y_2 - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2 - \left(l_x r_l^*\right) U\left(m_i\right) \\
& + \int_{l_x r_l^* + l_0\left(r_l^*\right)^2+m_i}^{y_H} U\left(y_2 - l_x r_l^* - l_0\left(r_l^*\right)^2\right) \mathrm{d}y_2 - \left(l_x r_l^*\right) U'\left(m_i\right)\Bigg] < 0
\end{aligned}$$

As a result,

$$\frac{\partial r_l^*}{\partial m_i} = -\frac{\partial W\left(r_l^*, m_i\right)/\partial m_i}{\partial W\left(r_l^*, m_i\right)/\partial r_l^*} > 0$$

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