The Impact of Social Insurance on Household Debt *

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Abstract

This paper investigates how the expansion of social insurance affects households' accumulation of debt. Insurance can reduce reliance on debt by lessening the financial impact of adverse events like illness and job loss. But it can also weaken the motive to self-insure through savings, and households' improved financial resilience can increase access to credit. Using two quasi-experimental research designs, we estimate the causal effect of expanded insurance on household debt, exploiting the staggered expansions of one of the largest US social insurance programs: Medicaid. We find that expanding Medicaid increased credit card borrowing by 2.2%. Decomposing this effect in a model of household borrowing, we show that increased credit supply in response to households' improved financial resilience fully accounts for this rise in borrowing and contributed to 17% of the total welfare gains of expanding Medicaid.

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1 Introduction

In 2016, credit card debt became the most widely held form of household debt in the US, surpassing mortgages on primary residences (held by 43.9% versus 41.9% of households).[1] By the end of 2019, total credit card debt reached $927 billion. Despite its scale and ubiquity, *access* to credit cards varies significantly with household income.[2] The usage of credit card debt has an inverted U-shaped relationship with income: rising with income for households with below median income and decreasing for households with above median income (see Figure 1). Among households below the federal poverty line, more than two thirds do not own a credit card.[3] A key reason credit card lenders limit unsecured credit to low-income households is that they are more likely to default when faced with adverse financial shocks such as job loss or illness. In turn, the welfare costs to households of a lack of insurance against such shocks may be compounded as it limits their ability to smooth consumption using unsecured credit.

This paper investigates how changes in social insurance impact households' use of unsecured debt. Social insurance provides households a safety net against adverse financial shocks. In doing so, insurance enhances households' *financial resilience* – the ability of households to cope with adverse financial shocks. Insured households are less likely to default on their debt,[4] incentivizing lenders to provide greater access to credit. With better access to credit, insured households can use debt to better stabilize their consumption in the face of adverse events, even events that are not directly targeted by the insurance program.

The hypothesis that social insurance leads to a higher level of household debt may seem counterintuitive. When insurance reduces out-of-pocket health expenditures, households face less pressure to rely on debt to cover these expenses. Consistent with this, prior research finds that expanding Medicaid eligibility reduces medical debt, delinquency, and payday loan borrowing.[5] But the impact of expanded health insurance on credit card debt usage and access is less well understood. Household not currently facing health expenses may also change their borrowing in response to insurance as a result of improved financial resilience.

The main contribution of this paper is to estimate the equilibrium effects of expanding social insurance on household debt and welfare and quantify the channels shaping these responses. We focus on expansions of Medicaid, a program that currently provides health insurance to nearly 20% of the US population. First, using two quasi-experimental research designs, we estimate that expanding Medicaid *increased* households credit card borrowing and overall household debt. Next, we build and estimate a structural heterogeneous-agent

[1] These figures come from the 2016 Survey of Consumer Finances (SCF), as reported in Bricker et al. (2017).

[2] The $927 billion figure comes from the Federal Reserve Bank of New York's Quarterly Report on Household Credit, using data from their 2019 Q4 Consumer Credit Panel.

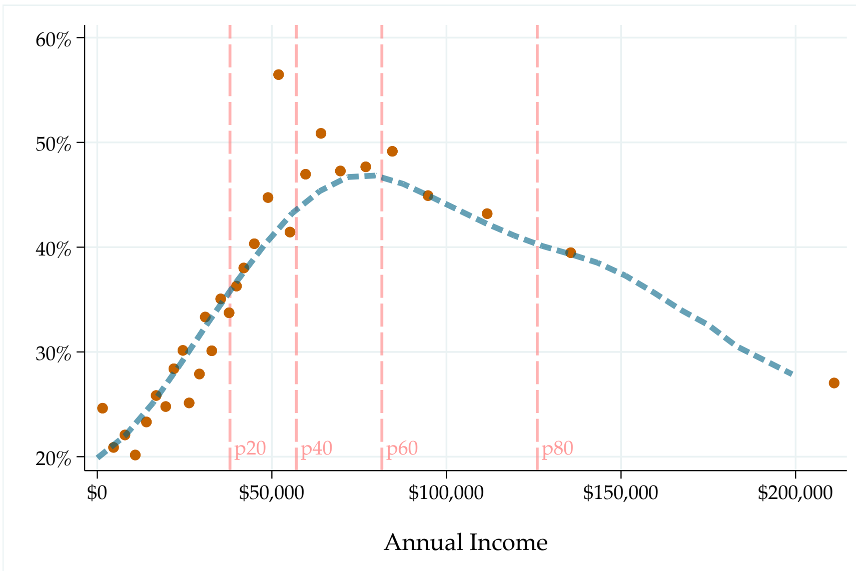
[3] Authors' calculations using survey data from the Survey of Income and Program Participation (SIPP) and the Panel Study of Income Dynamics (PSID).

[4] See, for example, Gross and Notowidigdo (2011); Gallagher, Gopalan and Grinstein-Weiss (2019b).

[5] See Allen, Swanson, Wang and Gross (2017); Hu, Kaestner, Mazumder, Miller and Wong (2018); Miller, Hu, Kaestner, Mazumder and Wong (2018).

model with credit card debt. The model allows us to decompose the impact of expanded health insurance coverage on debt into credit demand and credit supply channels. We find that credit supply fully accounts for the increase in credit card debt. Additionally, 17% of the welfare gains from expanding Medicaid come from an increase in credit supply. Our findings indicate that social insurance can improve households' financial resilience, and that overlooking credit market responses to social policies can overlook important welfare benefits.

Figure 1: Share of Households with Credit Card Debt (2017)



Notes: This figure plots a binscatter of the share of households with a non-zero amount of credit card debt. Data come from the 2017 PSID.

Our first empirical analysis uses state-level data and exploits the staggered expansion of Medicaid across US states under the Affordable Care Act (ACA).[6] We use this variation in an instrumental variables strategy, instrumenting for the insured share of a state's population with an indicator for whether or not the state has expanded Medicaid. We estimate the effect of health insurance coverage on credit card debt per capita. We find a positive and significant effect of the fraction of households with health insurance on the total amount of credit card debt. An increase of 1 percentage point in the share of insured households leads to an increase of 1.4% in the total amount of credit card debt. The first stage implies that expanding Medicaid reduced the number of uninsured households by 1.6 percentage points, resulting in an increase of 2.2% in the total amount of credit card debt. This amount corresponds to $20.4 billion dollars in credit card debt at the national level.

Our second empirical analysis employs a new identification strategy to estimate the causal effect of Medicaid eligibility on household debt at the county-level. We employ a treatment-intensity difference-in-difference design. This approach exploits variation across counties and

[6] Some states, such as Minnesota expanded Medicaid as early as 2010. 34 states have also adopted the expansion in various years since, including Maine as recently as 2019.

expansions in the impact on eligibility of adopting the Medicaid expansion. This granular variation makes it possible to use state-time fixed effects to net out potentially confounding factors correlated with states' adoption of the expansion. This new approach requires weaker identification assumptions than our first strategy. Namely, identification requires that household borrowing would have evolved in parallel – across locations with high versus low changes in eligibility – if Medicaid had not expanded.

We estimate that a one percentage point increase in the share of households eligible for Medicaid increases household debt to income 0.85 percentage points. This corresponds to a 0.49% increase in total household debt. Given a 10.38% average increase in eligibility following an expansion, our results imply that expanding Medicaid increased total household debt by 5.04%. Together, our findings of positive effects on household debt indicate that either a reduced precautionary savings motive or increase in credit supply drove the equilibrium borrowing response.

We then construct a heterogeneous-agent model in which households have access to credit card debt. Households face idiosyncratic income shocks as well as idiosyncratic expenditure shocks. They can save using a risk-free asset or borrow via credit card debt, which they can decide not to repay. Households incur debt both by choosing credit card borrowing and as a result of experiencing expenditure shocks that they are unwilling or unable to cover on impact. The interest rate paid on credit card debt is endogenous and depends on the probability households do not pay their owed debt.

The treatment of credit card debt in our model is a hybrid of one-period and long-term debt used in the literature on consumer bankruptcy and sovereign debt. When households are in a non-delinquent state, they must roll over their debt that period. That is, credit card debt must be repaid in full to avoid delinquency. However, households have the option not to repay their debt and enter a delinquent state. In that state, they cannot take on more debt before paying their current debt in full.[7] After a stochastic amount of time, households in a delinquent state get a haircut on their debt. Since financial intermediaries who hold claims to delinquent debt are not repaid immediately, the pricing of debt has a long-term component to it.

The delinquency option on debt allows us to capture a key aspect of the data. The relationship between having credit card debt with respect to income follows an inverse U-shape, as displayed in Figure 1. Less than 25% of households with less than $25,000 annual income have any credit card debt. This share goes up to 50% for households with an annual income of $70,000, and declines as household income goes up. If debt was always repaid in full, as in a standard Aiyagari (1994) economy, households with the lowest income level would be the ones with the most debt. The delinquency option, together with the endogenous credit supply, restricts low-income households' access to credit.

[7] While households cannot choose to take on more debt in the delinquent state, uninsured expenditure shocks add to the households' total debt.

Capturing the inverse U-shape relationship between income and credit card debt is important for studying policies that target households with certain income, such as Medicaid. This is because such social insurance policies can give low-income households better access to credit. We introduce Medicaid into the model as a policy that covers a fraction of households' expenditures shocks for households below a certain income threshold.

Health insurance policies affect the aggregate level of credit card debt through three channels. First, the direct effect of more generous health insurance is increasing households' disposable income. Households can achieve the same consumption levels while borrowing less. Therefore, the direct effect of health insurance is a reduction in debt levels.

The second channel is through credit demand. Health insurance affects the demand for credit by households even if credit terms remain unchanged. The reduction in medical expenditures household face reduce their precautionary savings motive, and as a result, increases their borrowing. On the other hand, households are more likely to repay their debt in the future. This results in a higher marginal cost of borrowing, which induces them to reduce borrowing. So the effect of the credit demand channel is theoretically ambiguous.

The third channel is the credit supply channel. The reduction in delinquency rates leads to lower interest rate spreads in equilibrium. Lower interest rates induce households to take on more credit, leading to an increase in the aggregate level of credit card debt.

Consistent with our empirical findings, our model predicts that the expansion of Medicaid leads to an overall increase of 1.3% in credit card debt. The model allows us to decompose this impact into the different channels. We find that both the direct channel and the credit demand channel reduce the aggregate level of credit card debt. These two channels result in a reduction of 1.6%. The overall increase in credit card debt is solely due to the credit supply channel, which results in an aggregate credit card debt rise of 3.9%.

We use our model to study the welfare benefits associated with the expansion of Medicaid. We find that the policy is equivalent to a permanent increase in consumption of 29 basis points. 17% of the welfare gains are due to the reduction in interest rate spreads households face on their debt. This result suggests policy makers should take into account the effect social insurance has on credit supply. Disregarding the credit supply channel would substantially underestimate the welfare gains social insurance programs have.

This paper contributes to four strands of literature by bringing a new macroeconomic perspective to the effects of social insurance. First, prior empirical microeconomic research finds that expanding Medicaid eligibility reduced medical debt and borrowing for households experiencing costly health events. We build on this literature by focusing on a broader population, including people not currently experiencing an adverse shock, and by studying general equilibrium credit market consequences.

First, we build on prior empirical microeconomic research by focusing on the impact of Medicaid on credit card borrowing. This literature finds that expanding Medicaid reduces medical debt, missed debt and bill payments, reliance on expensive alternative credit sources such as payday loans, and debt in collections (Allen, Swanson, Wang and Gross, 2017; Hu, Kaestner, Mazumder, Miller and Wong, 2018; Miller, Hu, Kaestner, Mazumder and Wong, 2018; Gallagher, Gopalan and Grinstein-Weiss, 2019b; Goldsmith-Pinkham, Pinkovskiy and Wallace, 2020b). Reduced debt and delinquency improved FICO scores after expansions, leading to lower interest rates on credit card offers (Brevoort, Grodzicki and Hackmann, 2017) and increased mortgage application approval rates (Célérier and Matray, 2017). Our focus on borrowing complements the related analysis of Gallagher, Gopalan and Grinstein-Weiss (2019a) on saving. The authors find health insurance access increases saving among households not experiencing financial hardship, while reducing it among those experiencing hardship. More (or less) saving implies does not generally imply higher (or lower) gross or net borrowing.[8] Together, our findings are informative about the joint dynamics of borrowing and saving. Additionally, the model incorporates these various channels, decomposes their importance, and provides a new look at the general equilibrium impact on the amount and distribution of household debt and welfare.

Second, we add to a large macroeconomic literature on heterogeneous agent models with uninsurable risk (Bewley, 1986; Aiyagari, 1994; Huggett, 1993). This literature highlights how precautionary savings play a key role in shaping the macroeconomy. Our work studies how insurance provision can reduce the precautionary savings motive and traces the macroeconomic implications. We take a partial equilibrium approach, i.e., the risk-free rate in the economy is taken as given. So our approach is similar to the work of Imrohoroğlu (1989), Zeldes (1989), and Deaton (1991). Hubbard, Skinner and Zeldes (1995) who also study how social insurance affects precautionary savings motive. We build on this work by taking into account the impact social insurance has on the endogenous debt pricing schedule.

Third, our model builds on the macroeconomic literature on consumer bankruptcy and default (e.g., Chatterjee, Corbae, Nakajima and Ríos-Rull, 2007; Livshits, MacGee and Tertilt, 2007; Mitman, 2016). This literature focuses on the drivers of default, in particular the role of bankruptcy policy. We study a policy that does not directly target bankruptcy or default: public health insurance. This policy can reduce default and increase both credit access and borrowing.

Finally, our work is related to a recent literature that investigates the relationship between household debt and the macroeconomy. This literature finds that increases in household debt can portend macroeconomic downturns and financial crises (Jordà, Schularick and Taylor, 2015, 2016; Mian, Sufi and Verner, 2017; Gomes, Grotteria and Wachter, 2019; Mian, Sufi and Verner, 2020). By focusing on *how* institutional features such as social insurance affect borrowing across households, this paper sheds new light on the relationship between household debt and the macroeconomy. In particular, a high *level* of household debt can indicate that

[8] In contrast to standard models of consumption and saving, household borrowing presents a "credit card puzzle" in that households tend to hold both high-interest credit card debt and low-interest savings simultaneously Gross and Souleles (2002). This behavior is consistent with a motive to maintain a liquidity buffer in the presence of incomplete markets (Telyukova, 2013; Druedahl and Jørgensen, 2018).

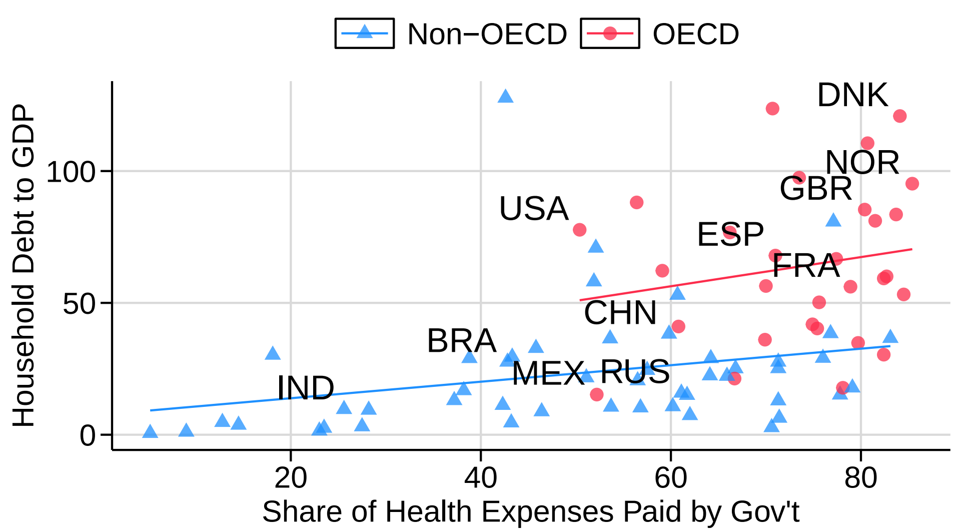
households are well-insured and financially resilient.

This paper is organized as follows. Section 2 presents background on the Medicaid expansions and the empirical analysis of the impact of expansions on credit card debt. Next, Section 3 presents the model. Section 4 analyzes policy counterfactuals on debt (its distribution and aggregate level) as well as welfare. We decomposes the effect of expanding health insurance on borrowing into its direct impact on debt for households experiencing adverse shocks and its general equilibrium impacts through credit demand and supply. Section 5 concludes.

2 The Effect of Social Insurance on Household Debt: Evidence from Medicaid Expansions

Cross-country evidence suggests that at the macro-level social insurance may overall increase borrowing. Figure 2 plots the ratio of household debt to GDP versus the share of total health expenses paid by the government, a proxy for social insurance provision, across countries. Countries with more generous insurance have significantly higher levels of household debt. On the top right corner are the Scandinavian countries, which have both a high provision of social insurance and high levels of household debt. Through the lens of our hypothesis, one reason Scandinavian households take on higher levels of debt is because they are more financially resilient – they are better insured against adverse events.

Figure 2: Household Debt and Social Insurance Across Countries



Notes: Data come from the IMF Global Debt and WHO Global Health Observatory data repository.

This section estimates the effect of increased social insurance on household debt. We study one of the largest expansions of the US social safety net in recent decades: the expansion of Medicaid under the Affordable Care Act (ACA). We present results from two empirical strategies.

The first is an instrumental variables strategy that is a variant of a widely-used approach that uses state-level variation in the timing of the expansions.[9] This approach allows us to study the impact on credit card debt per capita, for which we currently have only state-level data. The second is a new approach that uses *within-state* variation in the impact of expansions on Medicaid eligibility. We use this second strategy to estimate the impact of eligibility for Medicaid on household debt-to-income at the county-level. The new approach offers econometric advantages and facilitates investigating heterogeneity in the impact of the expansions. Under both approaches we find a positive and statistically significant effect of expanding health insurance on household debt.

2.1 Background and Data

Medicaid Expansions. Medicaid is a joint state and federal program that offers low-income households free or low-cost health insurance. In 2019, 64.7 million individuals received health insurance through Medicaid, nearly 20% of the US population. Medicaid spending totaled $597.4 billion in 2018, comprising 16% of aggregate health expenditures. To qualify for Medicaid, a household must have income below a specified threshold.[10]

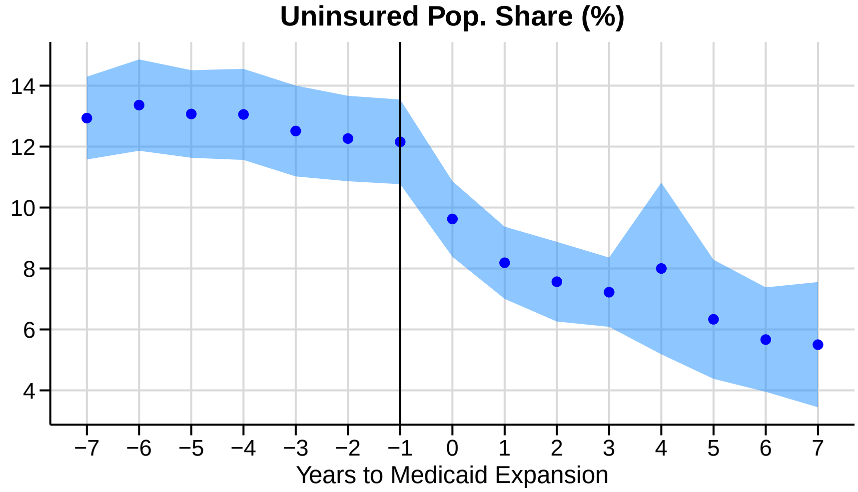
The ACA expanded Medicaid in participating states by requiring states to set the income eligibility threshold to at least 138% of the federal poverty level (FPL) for *all* adults. Participating states receive federal funds to support the costs of the Medicaid expansion. Prior to the ACA, only a handful states offered Medicaid to adults aged 64 or under without dependents. The eligible population expanded significantly in adopting states; on average the uninsured population fell by over 50% in expansion states within five years of adoption (see Figure 3).

Participating in the expansion is optional, and the timing of adoption varied significantly across time (see Figure 4). 2014 was the most common year of adoption, but some states opted to expand as early as 2010. As of 2019, 34 states have expanded Medicaid eligibility under the ACA, with Idaho, Nebraska, and Utah set to expand in 2020. The staggered adoption of Medicaid expansions creates quasi-experimental variation in access to health insurance. The staggered nature makes it possible to compare states within the same time period that differ in whether or not they expanded Medicaid eligibility.

[9] See for example Frean, Gruber and Sommers (2017); Hu, Kaestner, Mazumder, Miller and Wong (2018); Leung and Mas (2018); Ghosh, Simon and Sommers (2019); Averett, Smith and Wang (2019).

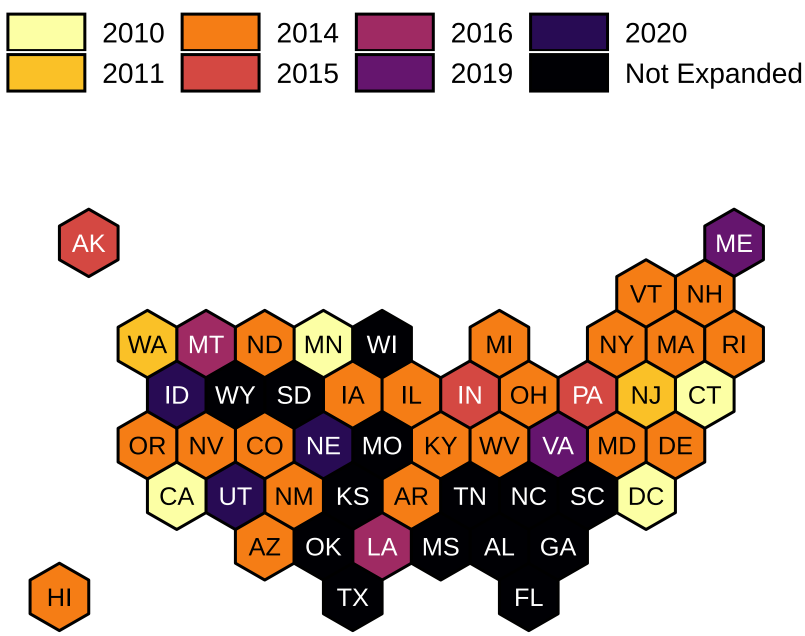
[10] Several states also use an asset-based means test in addition to the income threshold to determine eligibility. For a state to expand Medicaid under the ACA, they were required to remove any asset-based means tests.

Figure 3: Uninsured Rate Pre vs. Post Expansion



Notes: This graph plots the average uninsured population for states that eventually expanded Medicaid. Each point is an average across states for a given number of years relative to the expansion. The shaded area is a 95% confidence interval.

Figure 4: Medicaid Expansion Dates



Notes: Dates come from the Kaufman Family Foundation.

2.2 State-Level Analysis of Credit Card Borrowing

2.2.1 Empirical Strategy: Instrumental Variables

The goal of our analysis is to estimate the causal effect of health insurance coverage on credit card borrowing. Specifically, we estimate the following model:

$$\ln(\mathrm{CC}_{s,t}) = \mathrm{Insured}_{s,t}\beta + X_{s,t}\gamma + \theta_s + \tau_t + \varepsilon_{s,t} \tag{1}$$

where $CC_{s,t}$ is credit card debt per capita, $\text{Insured}_{s,t}$ is the share of the population with health insurance, and $X_{s,t}$ is a vector of controls. The indexes s and t denote state and time, respectively. Our coefficient of interest is β. Directly estimating (1) directly with OLS would likely yield biased estimates understating the true value of β. We anticipate a negative bias because credit card borrowing is countercyclical – people use it to smooth out shocks in downturns – while insurance coverage is procyclical – likely due to the widespread reliance on employer-provided insurance.[11]

Identification. To identify the causal effect of insurance coverage, we use an instrumental variables strategy. For each observation we construct an indicator for whether or not state s has expanded Medicaid as of time t (denoted $1[\text{Expanded}]_{s,t}$). We instrument for the insured share of the population with this indicator in a two-stage least squares (TSLS) estimation. Formally, our first stage is

$$\text{Insured}_{s,t} = 1[\text{Expanded}]_{s,t}\pi + X_{s,t}\widetilde{\gamma} + \widetilde{\theta}_s + \widetilde{\tau}_t + \eta_{s,t}. \tag{2}$$

This approach exploits the staggered timing of the Medicaid expansions to obtain plausibly exogenous variation in insurance coverage. The staggered timing means that we can use time fixed effects to absorb macroeconomic trends, such as the recession and recovery, that also affect borrowing and insurance coverage. Additionally, by using state fixed effects we can net out the effect of any persistent cross-state differences related to borrowing and insurance coverage. The key identifying assumption, the exclusion restriction, is that expanding Medicaid only affects credit card debt through health insurance coverage. In practice, this assumption requires that the timing of expansions is unrelated to other events affecting credit card debt.

Data. We build an annual state-level panel dataset, where credit card debt per capita and insurance coverage rates are our primary variables of interest. The panel includes all 50 states and DC. The sample spans 2003 to 2017, making for 765 observations in total. The American Community Survey (ACS) is the underlying data source for our state-level measures of the insured population share. To measure credit card debt per capita, we use the Federal Reserve Bank of New York's state-level aggregates of their Consumer Credit Panel (CCP). The CCP's credit aggregates are calculated from a 5% random sample of individual-level credit bureau data. We obtain state-level control variables from the ACS and National Income and Product Accounts (NIPA). Our control variables are the unemployment rate, log population, log house prices, annual house price growth, and annual GDP growth (measured at the state-level).

[11] In our sample, health insurance coverage is positively correlated with GDP (both measured at the state-level), with a correlation coefficient of 0.10. Credit card debt is negatively correlated with GDP, with a correlation coefficient of -0.05. The correlations strengthen and retain the same sign after partialing out state and time fixed effects.

2.2.2 Results: The Effect of Health Insurance Coverage on Debt

We find that increased health insurance coverage leads to more credit card debt per capita. Table 1 presents estimation results for the second and first stage, as well as OLS estimates. Our preferred specification (column 4) implies that a one percentage point increase in the insured share of the population leads to 1.41 percentage point increase in credit card debt per capita.

Our preferred specification is column 4, which includes a variety of controls as well as state and time fixed effects. Including state fixed effects helps absorb persistent differences across states that are related to both insurance coverage and credit card borrowing. The time fixed effects account for time-varying factors like the recession and recovery that also impacted credit card debt and insurance coverage.

An especially useful control is state-level GDP growth because it helps address a measurement limitation in the CCP data. The CCP's measure of credit card debt reflects credit card balances, which includes both revolving and non-revolving balances. Revolving balances reflect actual borrowing – i.e. unpaid balances on which the borrower pays interest. Total balances might conflate spending and borrowing. Controlling for state-level GDP helps account for state-level changes in aggregate spending, which means our estimates more likely reflect a response driven by borrowing rather than spending.

Table 1: Effect of Insurance Coverage on Credit Card Borrowing

	TSLS				OLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	2nd Stage: outcome = $\ln(CC)_{s,t}$				outcome = $\ln(CC)_{s,t}$			
$\text{Insured}_{s,t}$	-2.60***	-1.79***	2.69***	1.41***	-2.00***	-1.05***	-0.76***	0.06
	(0.29)	(0.31)	(0.78)	(0.35)	(0.15)	(0.16)	(0.14)	(0.09)
	1st Stage: outcome = $\text{insured\%}_{s,t}$							
$1[\text{Expanded}]_{s,t}$	5.05***	3.37***	2.61***	1.56***				
	(0.31)	(0.20)	(0.38)	(0.19)				
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Year FE			✓	✓			✓	✓
State FE		✓		✓		✓		✓
Stage 1 F	262.05	287.67	46.97	65.8				
Observations	765	765	765	765	765	765	765	765

Notes: Time-varying, state-level controls include the unemployment rate, log(population), log(house prices), annual house price growth, and GDP growth. All nominal variables and their growth rates are computed in real 2010 dollars. Coefficients are scaled so that 2nd stage estimate describes approximately the percent change in credit card debt associated with a 1% change in the insurance rate. The 1st stage coefficient reflects the percentage point increase in insurance coverage associated with adopting the Medicaid expansion. Statistical significance: 0.10^{+}, 0.05*, 0.01*, 0.001***.

In the first stage of the preferred specification, we estimate that expanding Medicaid increased the insured share of the population by 1.56 percentage points on average. Combined, the first and second stage estimates imply that expanding Medicaid increased credit card borrowing by 2.2 percentage points. The first stage F-statistic is 65.8 in the preferred specification, which is well above the threshold of 10, indicating that bias due to weak instruments is unlikely. Additionally, the analogous OLS estimate is 0.06, which is much smaller than our TSLS estimate of 1.41. This suggests that if there is bias due to weak instruments, if any our estimate would understate the effect of insurance on borrowing. The 1.56% increase in coverage is smaller than the 6.4% average change post-expansion visible in Figure 3. The estimated growth in coverage induced by expanding medicaid diminishes as we add state and time fixed effects (columns 1-4 in Table 1). This is because states that opted to expand Medicaid on average had a smaller uninsured population. Additionally, insurance was generally growing over this time period in response to other incentives such as the ACA tax penalty for lacking health insurance.

The point estimate implies expanding Medicaid had an economically significant effect on credit card debt. By means of a back-of-the-envelope calculation (assuming a uniform treatment effect across debt levels), the estimated 2.2 percentage point increase corresponds to a $20.4 billion increase in credit card debt.[12] The estimate implies that the overall 6.4% rise in insurance coverage following the expansions increased credit card debt 9.02%, corresponding to a $83.65 billion increase in credit card debt.

Our finding of a positive effect on credit card borrowing suggests that the credit demand and supply channels dominate the "direct" effect of increased health insurance. Insurance incentivizes borrowing through a credit demand channel by reducing households' precautionary savings motives. Additionally, insurance can increase credit supply by reducing households' default risk, which in turn increases creditors' expected returns and incentivizes lending. Together, these two forces result in a positive relationship between borrowing and insurance coverage. In contrast, the "direct" effect on households using insurance likely implies a negative relationship between borrowing and insurance coverage. When insurance reduces the share of medical expenses borne by households, these directly affected households may now incur less medical and credit card debt than they otherwise would have.

Comparison to Prior Evidence on Financial Outcomes. By testing whether the credit demand and supply channels can dominate in equilibrium, we build on prior work analyzing partial equilibrium effects of expanded health insurance access. The key mechanism underlying these channels is that insurance enhances financial resilience, incentivizing both borrowing and lending. Prior work documents that insurance access significantly reduces default and medical expenses, suggesting that insurance can significantly enhance financial re-

[12]This is calculated relative to the aggregate amount of credit card debt in 2019 of $927 billion.

silience.[13] In support of the credit supply channel, Brevoort et al. (2017) estimates that the reduction in delinquencies induced by the Medicaid expansions led to improvements in credit card terms worth $520 million per year.

Analyses of savings behavior suggest that Medicaid eligibility on average can reduce savings, but increase them for households experiencing financial hardship. Gallagher et al. (2019a) estimates that newly eligible households on average either reduced or left savings out of tax refunds unchanged. But this masks heterogeneity among those whose precautionary savings motive decrease and those experiencing adverse financial events (e.g., households reporting skipping meals for financial reasons), as the latter group on average increased savings. This suggests the average response to insurance access may differ from the direct effect.

Our analysis builds on this work by focusing on borrowing rather than saving. Many households simultaneously hold both high-interest credit card debt and low-interest savings (Gross and Souleles, 2002), which presents a "credit card puzzle" for standard models of consumption and saving. This may be driven by a liquidity motive to avoid states of the world in which the household has no liquid savings and no access to additional credit card borrowing.[14] It is not obvious if gross borrowing would always rise when households reduce gross savings, as households might reduce borrowing if they were doing so in order to maintain a target level of gross savings. This makes our analysis of borrowing complementary to Gallagher et al. (2019a), and together informative about the joint dynamics of borrowing and saving.

2.3 County-Level Analysis of Medicaid Eligibility and Household Debt

2.3.1 Empirical Strategy: Treatment-Intensity Difference-in-Difference

There are several important limitations to empirical strategies using only the state-level variation in the timing of Medicaid expansions, motivating a new empirical strategy that we introduce here. Inference can be more challenging as the aggregate nature of a state-level shocks leads to less variation across households. Additionally, pre-existing differences in states' economies and Medicaid programs resulted in Medicaid expansions under the ACA having significantly different impacts on Medicaid eligibility. Rich within-state heterogeneity in treatment underlies the binary state-level adoption indicator. This granular variation in treatment intensity can improve statistical precision and support heterogeneity analyses estimating treatment effects in sub-populations. In terms of identification, bias can arise in state-level analyses when the timing of states opting into Medicaid in non-random or correlated with other economic events. Many of the later Medicaid expansions occurred after the election of a Democratic governor or by ballot measure, which can coincide with other major

[13] For example, expanded access to Medicaid and Medicare reduce delinquency and collections (for medical and non-medical debt), unpaid bills, out-of-pocket medical expenses, and bankruptcy filings (Gross and Notowidigdo, 2011; Finkelstein et al., 2012; Barcellos and Jacobson, 2015; Hu et al., 2018; Gallagher et al., 2019b; Goldsmith-Pinkham et al., 2020a).

[14] For liquidity-based explanations of the credit card puzzle, see Telyukova (2013), Druedahl and Jørgensen (2018), and Fulford (2015).

state-level changes in policies.

Approach. These limitations motivate our novel use of a treatment-intensity difference-in-difference approach to estimate the causal effect of Medicaid Eligibility on household debt. This approach exploits rich heterogeneity in the impact of Medicaid expansions on eligibility. The granular nature of this data also makes it possible to include state-year fixed effects, which help net out the effect of other state-level trends that affect household borrowing.

This difference-in-difference strategy exploits heterogeneity across counties and expansions in the impact of adopting the Medicaid expansion. Geographic variation in the change in the eligible share of the population was driven by differences in states' pre-ACA Medicaid income limits and differences in the distribution of income within locations. Expanding under the ACA required states to raise the income eligibility limit to 138% of the federal poverty level for all adults aged 64 or less. This primarily impacted adults without dependents, who generally faced stricter income limits prior to the expansion. All else equal, counties in states with a lower pre-ACA limit (for adults with no dependents) experienced a larger rise in the eligible population. The impact of expansions also differed within and across states due to variation in distribution of income among low-income households. Counties with more households whose income fell between the pre and post ACA eligibility limits, all else equal, experienced a larger rise in eligibility.

Our approach compares borrowing in counties with larger versus smaller changes in eligibility before and after expanding Medicaid. We estimate

$$\text{DTI}_{c,t} = 1[\text{Adopted}_{s,t}]\alpha_1 + \Delta\text{Elig}_c\alpha_2 + \Delta\text{Elig}_c \times 1[\text{Adopted}_{s,t}]\beta + \kappa_c + \tau_t + \xi_{s,t} + \varepsilon_{s,t} \tag{3}$$

where $\text{DTI}_{c,t}$ is the ratio of household debt-to-income (DTI) in county c in year t. The variable $1[\text{Adopted}_{s,t}]$ indicates whether state s has adopted the Medicaid expansion as of year t. Our measure of treatment intensity is ΔElig_c, which denotes the change in the percentage of the population eligible for Medicaid, induced by the Medicaid expansion, in county c. We estimate this specification using OLS.

The coefficient of interest is β, which captures the effect on borrowing of a ΔElig_c% increase in the Medicaid-eligible population. This specification exploits variation in both the timing and impact of the Medicaid expansions. The county fixed effect nets out persistent differences in borrowing across counties that experienced high versus low changes in eligibility. The time fixed effect accounts for impact of macroeconomic trends on borrowing. A key strength of this specification is that we can also include state-year fixed effects, which absorbs the effect of other time-varying state-level factors influencing household borrowing.

Identification. Our approach to identification makes use of both variation in the timing and intensity of the change in Medicaid eligibility induced by the adoption of expansions. Variation in the eligible population share comes from two sources. First, state-level differences in pre-expansion Medicaid income eligibility thresholds resulted in greater *rises* in eligibility where pre-expansion threshold were *lower*. Adopting the expansion brought states up to a common threshold of 138% of the federal poverty level. Second, variation in the distribution of income among low-income households also shapes the treatment intensity of Medicaid expansions. Counties with a larger mass of low-income households concentrated just under the 138% threshold, all else equal, experienced larger increases in eligibility.

Additionally, by estimating the *change* in the relationship between eligibility and borrowing before versus after a state's expansion, we exploit variation in the timing of treatment. The difference-in-difference aspect of the regression means that we can account for persistent differences in places that would tend to have a larger versus smaller treatment effects induced by expanding Medicaid. Because we have within-state variation in treatment intensity, we can compare households in the same state policy environment but with different exposure to one specific policy change: Medicaid eligibility.

The key identifying assumption for this empirical strategy is that household borrowing would have evolved in parallel – across locations with high versus low changes in eligibility – if Medicaid had not expanded. Intuitively the identifying assumption boils down to treatment intensity being uncorrelated with other factors *changing* at the time of the expansion. The identifying assumption would be violated if another event coinciding with expansions systematically affected counties with high versus low changes in eligibility differently.

Data. Our measure of household DTI is calculated as the county-level sum of credit card, residential mortgage, and auto debt divided by the sum of income. We obtain this data from the Board of Governors of the Federal Reserve System.[15] To calculate our treatment intensity measure we use data on income and Medicaid eligibility rules. We obtain Medicaid income eligibility limits from the Kaiser Family Foundation (KFF).[16] To calculate eligibility, we use data on the distribution of income within ZIP codes from the US Internal Revenue Service's Statistics on Income (IRS SOI).[17]

Summary Statistics. Table 2 presents county-level summary statistics. In the average county, 18.4% of households are eligible for Medicaid while 22.9% of the population is enrolled. The enrollment figure is higher because the denominator is population, and households enrolled in Medicaid are more likely to have children (making their households larger than the average). The average increase in the eligible share of the population, from the year before to the

[15] Source: https://www.federalreserve.gov/releases/z1/dataviz/household_debt/county/map. The county-level debt measures are calculated from individual-level data available in the Federal Reserve Bank of New York's Consumer Credit Panel.

[16] Data on income limits is available for parents from 2002-2020 at: https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents. Data on income limits for adults that are non-elderly, non-disabled, and with no dependents is available for 2011-2020 at: https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-other-non-disabled-adults.

[17] The ZIP-level income data are available at: https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-statistics-zip-code-data-soi.

year of the expansion, is 10.4 percentage points.

The impact on eligibility varied significantly; its standard deviation was 11.5 percentage points. Compared to the average increase of 10.4%, the median rise was 2.6%. Appendix Figure A.1 displays county-level maps of changes in the eligible population for several states. Household debt averages 174.8% of income, and also varies significantly across counties (with a standard deviation of 87.3%).

Table 2: County-Level Summary Statistics

Variable	Mean	SD	25^{th}	50^{th}	75^{th}	N
Pop. Enrolled in Medicaid (%)	18.4	6.6	13.9	17.9	21.9	9,741
Pop. Eligible for Medicaid (%)	22.9	11.0	10.2	26.9	31.7	12,991
ΔElig_c (%)	10.4	11.5	0.0	2.6	21.5	12,886
DTI (%)	174.8	87.3	116.6	162.0	211.8	12,978
Average AGI ($000s)	65.7	24.2	49.9	60.1	72.4	12,991

Notes: The first two variables are the share of the county population enrolled in and eligible for Medicaid (respectively). The next variable, ΔElig_c is the change in the share of county population eligible for Medicaid from the year prior to the year after expansion. DTI is the ratio of household debt (mortgage, auto, and credit card) to income. Average AGI is the county-level average of households' adjusted gross income (AGI). Nominal variables are CPI-adjusted to be in terms of 2010 dollars. All statistics are calculated using population weights, where population is measured using the number of tax returns filed in the county.

2.3.2 Results: The Effect of Medicaid Eligibility on Household Debt

We find that expanding Medicaid eligibility increases household debt. Table 3 reports results from estimating the treatment-intensity DID specified in equation (3). Our preferred specification (column 3) includes state-year and county fixed effects. The point estimate of column 3 implies that a one percentage point increase in the share of the population eligible for Medicaid leads to a 0.85 percentage point rise in households' DTI. Dividing this point estimate by the average DTI of 174.83% implies that a one percentage point rise in the eligible population share leads to a 0.49% increase in household debt. The positive effect of Medicaid eligibility on household debt is consistent with either increased credit supply or a reduced precautionary savings motive (and increased credit demand) resulting from households' improved financial resilience.

Take-Up. To what extent does a rise in Medicaid eligibility lead to a rise in enrollment? Take-up can be less than 100% simply due to low-income households already having insurance, for example, by receiving it through an employer and or as a young adult through a parent's insurance. Additionally, stigma, inattention, misperceived ineligibility, and complexity in the sign-up process can also deter participation.[18]

[18] See for example Aizer (2003); Currie (2004); Baicker, Congdon and Mullainathan (2012); Desmond, Laux, Levin, Huang and Williams (2016); Wright, Garcia-Alexander, Weller and Baicker (2017).

Table 3: Effect of Medicaid Eligibility on Household DTI

	(1)	(2)	(3)
$\text{Adopted}_{s,t} \times \Delta\text{Elig}_c$	0.27	0.53	0.85*
	(0.18)	(0.54)	(0.43)
$\text{Adopted}_{s,t}$	5.40+		
	(3.03)		
ΔElig_c	-11.80***	-11.92***	
	(2.35)	(2.42)	
$\ln(\text{income}_{c,t})$	-12.84*	-12.72*	-11.69*
	(5.13)	(5.20)	(5.69)
State × Year FE		✓	✓
County FE			✓
Observations	12,873	12,873	12,873
R^2	0.18	0.19	0.97

Notes: The outcome variable is county-level household debt-to-income (DTI) in percentage points. The change in eligibility (ΔElig_c) is scaled in percentage points, so its point estimate correspond to the percentage point change in DTI for a given percentage point change in eligibility. Our county-level measure of income is the (demeaned) log of the average adjusted gross income (AGI) reported in the IRS SOI data. We weight observations by the number of households (measured as the number of tax returns filed in the county each year). All specifications include state and year fixed effects. Standard errors are clustered by county. Statistical significance: 0.10+, 0.05*, 0.01*, 0.001***.

We employ our treatment-intensity DID strategy to estimate the average take-up rate of the Medicaid expansions under the ACA. We obtain county-level data on Medicaid enrollment from the American Community Survey (ACS). An estimate of a positive effect, especially one similar to prior estimates of take-up, helps validate our empirical strategy. Table 4 reports our estimates. Column 3's estimate implies a take-up rate of 19%: for every 100 newly-eligible people, 19 enrolled in Medicaid. This estimate is similar in magnitude to estimates from expansions to pregnant women in the 1980s (Currie and Gruber, 1996) and low-income parents (Busch and Duchovny, 2005) of 34% and 15%, respectively. Multiplying the average change in eligibility (10.4%) by the point estimate implies that the average expansion increased the share of the population enrolled in Medicaid by 1.97 percentage points (an 8.61% rise in enrollees).

Table 4: Effect of Medicaid Eligibility on Medicaid Enrollment (Take-Up)

	(1)	(2)	(3)
$\text{Adopted}_{s,t} \times \Delta\text{Elig}_c$	0.02**	0.20***	0.19***
	(0.01)	(0.05)	(0.02)
$\text{Adopted}_{s,t}$	-0.76***		
	(0.22)		
ΔElig_c	1.05***	0.93***	
	(0.17)	(0.18)	
$\ln(\text{income}_{c,t})$	-2.60***	-2.62***	-1.24***
	(0.53)	(0.54)	(0.29)
State × Year FE		✓	✓
County FE			✓
Observations	9,667	9,667	9,667
R^2	0.65	0.66	0.99

Notes: The outcome variable is county-level Medicaid enrollment, measured as the fraction of population enrolled in Medicaid (in percentage points). The change in eligibility (ΔElig_c) is scaled in percentage points, so its point estimate correspond to the percentage point change in the Medicaid enrollment for a given percentage point change in eligibility. Our county-level measure of income is the (demeaned) log of the average adjusted gross income (AGI) reported in the IRS SOI data. We weight observations by the number of households (measured as the number of tax returns filed in the county each year). All specifications include state and year fixed effects. Standard errors are clustered by county. Statistical significance: 0.10^{+}, 0.05*, 0.01*, 0.001***.

3 Model

In this section, we develop an incomplete-markets heterogeneous-agents model with health expenditure shocks, credit delinquency, and health insurance. Households face idiosyncratic income shocks as well as idiosyncratic health expenditure shocks. They can save and borrow using a one-period non-state-contingent asset, and can choose not to repay their debt obligations. After reneging on their debt obligations, their debt enters a delinquent state, and the household is excluded from financial markets and suffers a utility loss. In every period, delinquent debt can stochastically get a haircut, i.e., be reduced by some percent. Households can exit the delinquency state by repaying their debt.

Credit to households is supplied by credit card companies. These companies have access to funds at the risk-free interest rate, which households take as given. The assumption that the risk-free rate is constant, rather than the aggregate net supply of debt, allows us to study how different policies affect the aggregate stock of household debt in the economy. We assume that credit card companies are risk neutral and behave competitively so that the spread they charge on a household's loan is such that their expected profits equal zero.

We use the model to study the effects of different insurance policies on the aggregate stock of debt, wealth inequality, and welfare.

3.1 Household problem

There is a continuum of measure one of households in the economy, denoted by $i \in (0,1)$. Household's i income at time t is denoted by y_{it} and evolves according to a compound Poisson process:

$$\ln y_{it} = \begin{cases} \rho \ln y_{it-1} + \epsilon_{it}^{y} & \text{w.p.} \quad \lambda_y, \\ \rho \ln y_{it-1} & \text{w.p.} \quad 1-\lambda_y. \end{cases} \tag{4}$$

where λ_y is the probability that an income shock arrives in a period. If such shock does not arrive, the household's income does not change. Given an income shock, the household income follows an AR(1) process, where ρ is the degree of persistence and ϵ_{it}^{y} is an idiosyncratic income shock with mean zero and variance $\sigma_{\epsilon,y}^2$.

In addition to income risk, households are subject to stochastic medical expenditure shocks, denoted by m_{it}. The stochastic expenditure shocks follow a log-normal distribution with mean μ_e and variance σ_e^2.

Households medical bills are partially covered by their health insurance. We allow insurance to vary exogenously with the household income. Health insurance covers a share of the medical bill due. We denote the share of medical bills the households have to pay out-of-pocket as $o(y_{it})$. Note that the out-of-pocket share depends only on the current household income, as we assume insurance varies only with household income.

Each household has access to non-state-contingent one-period debt, denoted by b_{it}. A negative value of b_{it} represents household savings. In the beginning of each period, the household can choose to repay or renege on its debt obligations. The household's decision to repay debt depends on their total debt, their level of income, and the size of their current medical bill. Households face an interest rate schedule for the amount of borrowing they choose, which we denote by $r(b', y)$.[19] The price of debt is denoted by $q(b', y) = \frac{1}{1+r(b',y)}$. We denote the total amount of repayments owed by the household by $\tilde{b}_{it} = b_{it} + o(y_{it})m_{it}$. Note that $\tilde{b}$ is the relevant state variable from the perspective of the household.

At the beginning of each period, a household learns its current income and medical expenditure shock, and then chooses whether to repay its debt or to renege and declare delinquency. It's present discounted value is denoted by $V(\tilde{b}, y)$, where $\{\tilde{b}, y\}$ are its individual state variables. This value function is given by the max between the present discounted value of repaying debt obligations, denoted by $V^r(\tilde{b}, y)$, and the value of reneging and declaring delinquency, denoted by $V^d(\tilde{b}, y)$:

$$V(\tilde{b}, y) = \max\left\{V^r(\tilde{b}, y), V^d(\tilde{b}, y)\right\}. \tag{5}$$

Conditional on the decision to repay its debt obligations, the recursive problem of the

[19] The size of medical bill does not appear in the interest rate schedule as it is independent across periods.

household with total debt obligations $\tilde{b}$ and income y is given by

$$V^r(\tilde{b}, y) = \max_{c,b'} u(c) + \beta \mathbb{E} V\left(b' + o(y')m', y'\right), \tag{6}$$
$$\text{s.t.} \qquad c + \tilde{b} \le y + q(b', y)b',$$

where $u(\cdot)$ is the utility of the household from consumption, which is assumed to be strictly increasing, concave, and continuously differentiable. The household's discount factor is β.

When a household reneges on its debt obligations, the debt moves into a delinquency state. A household with debt in a delinquency state cannot save or borrow, and suffers a utility cost ξ. At the end of the period, the household receives a stochastic haircut on its debt obligations. The haircut, denoted by δ, is assumed to follow a compound Poisson process. With probability, λ_δ, the household receives a positive haircut. Conditional on a haircut, the share of debt forgiven follows a Beta distribution with shape parameters α_1 and α_2. The value of the household in the delinquent state is given by

$$V^d(\tilde{b}, y) = u(y) - \xi + \beta \mathbb{E} V\left((1-\delta)\tilde{b} + o'(y')m', y'\right). \tag{7}$$

The timeline in every period is as follows. First, the household learns its current income and medical bill. Then, it decides whether to repay its outstanding debt obligations or not. If it decides to repay its debt obligations, it chooses the level of consumption and borrowing. If it decides to renege on its debt obligations, it consumes its income, suffers a utility loss, and at the end of the period has a chance of drawing a stochastic haircut rate.

We denote the delinquency policy function of a household with total debt obligations $\tilde{b}$ by

$$d(\tilde{b}, y) = \mathbb{1}\left[V^r(\tilde{b}, y) < V^d(\tilde{b}, y)\right], \tag{8}$$

where $\mathbb{1}$ is the indicator function. The function $d(\tilde{b}, y)$ equals 1 when the household defaults. When indifferent, we assume the household repays its debt obligations.

3.2 Credit supply

Credit to households is supplied by risk-neutral credit card companies. Perfect competition among these companies ensures an expected zero-profits condition holds in equilibrium. We assume credit card companies have unlimited access to funds at the risk-free interest rate, which we denote by r^f.

Debt in the economy is a hybrid of short-term and long-term debt. Debt is of short-maturity in nature, as households need to repay their debt obligations in the following period. However, when debt becomes delinquent, credit card companies do not receive payments within that period. Instead, they need to wait until the household decides to repay its debt. Either because it received a haircut, or because its income level changes so that it decides to repay.

The zero-profits condition that pins down the price of debt, $q(b', y)$, is

$$q(b',y)(1+r_f) = \left[1 - \mathbb{E}\left(d(b'+o(y')m',y')\right)\right] \\ + \mathbb{E}\left[d(b'+o(y')m',y')(1-\delta')q\left((1-\delta')(b'+o(y')m'),y'\right)\right]. \tag{9}$$

That is, the credit companies equate the cost of their loan (LHS) with its return (RHS). The return from the loan is the sum of two parts. If the debt does not go delinquent, the credit company receives its full face value. If the debt goes delinquent, which happens with probability $\mathbb{E}\left(d(b'+o(y')m',y')\right)$, then the creditor is left with a claim on a delinquent debt. The worth of such claim, following a possible haircut, is given by $(1-\delta')q\left((1-\delta')(b'+o(y')m'),y'\right)$. The fixed point function $q(\cdot)$ that solves equation (9) is the debt pricing schedule.

Proposition 1. *Given a default policy function, $d(\tilde{b}, y)$, there exists a unique pricing schedule $q(b', y)$ which satisfies equation* (9)*.*

3.3 Stationary Equilibrium

We denote the joint distribution of households across total debt obligations and income levels at the beginning of the period, after the expenditure shock realization, by $\Lambda\left(\tilde{b}, y\right)$. Four components characterize the law of motion for this joint distribution: (i) the borrowing decision of households – $b'(\tilde{b}, y)$, (ii) the debt pricing schedule – $q(b', y)$, (iii) the household's default decision – $d(\tilde{b}, y)$, and (iv) the exogenous processes of income, expenditure shocks, and haircuts. The law of motion for the joint distribution is defined as follows. For all Borel sets $\mathcal{B} \times \mathcal{Y} \subset \mathbb{R} \times \mathbb{R}^+$,

$$\Lambda'\left(\mathcal{B}\times\mathcal{Y}\right) = \int_{m'}\int_{y'\in\mathcal{Y}}\int_{\mathscr{B}\left(\tilde{b},y,m'\right)} d\Lambda(\tilde{b},y)dF(y'|y)dG(m') \\ + \int_{\delta}\int_{m'}\int_{y'\in\mathcal{Y}}\int_{y,((1-\delta)\tilde{b}+o(y')m')\in\mathcal{B}} \mathbb{1}\left[d\left(\tilde{b},y\right)\right] d\Lambda(\tilde{b},y)dF(y'|y)dG(m')dH(\delta)\,, \tag{10}$$

and

$$\mathscr{B}\left(\tilde{b},y,m'\right) = \left\{(\tilde{b},y) \quad \text{s.t.} \quad d\left(\tilde{b},y\right)=0 \quad \text{and} \quad b'\left(\tilde{b},y\right)+o(y')m' \in \mathcal{B}\right\},$$

where $F(\cdot)$, $G(\cdot)$, and $H(\cdot)$, are the CDF of the different exogenous variables. In the stationary equilibrium, the distribution $\Lambda(\tilde{b}, y)$ is constant over time. The definition of the stationary Markov-perfect equilibrium is as follows.

Definition 1 (Equilibrium)**.** *A stationary Markov-perfect equilibrium is given by a default policy function $d(\tilde{b}, y)$, a borrowing policy function $b'(\tilde{b}, y)$, a debt pricing schedule $q(b', y)$, and a joint distribution of households across total debt and income levels, $\Lambda(\tilde{b}, y)$ such that*

1. *The default and borrowing policy functions solve the household's problem given the debt pricing schedule.*

2. *The debt pricing schedule satisfies the zero-profits condition,* (9)*.*

3. *The joint distribution of households across debt and income levels is stationary.*

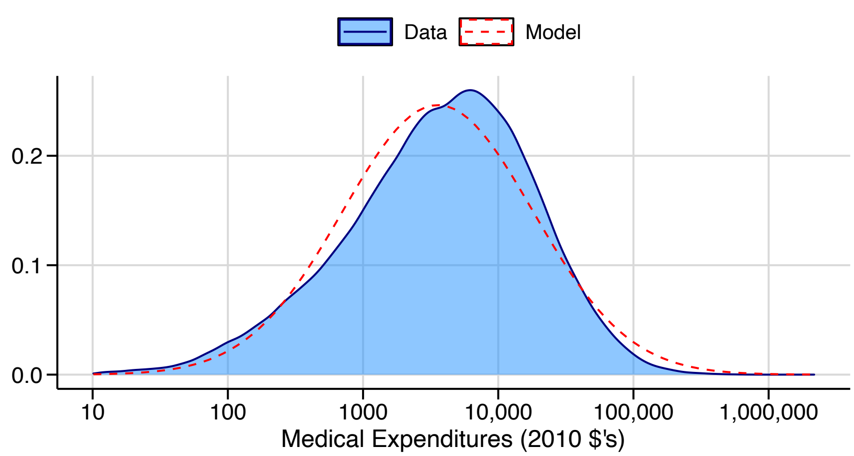
3.4 Calibration

We calibrate the risk-free interest rate in the economy to 2%. There are five sets of structural parameters in the model, in addition to the risk-free rate. First, there are three preference parameters - the discount factor β, the CRRA γ, and the disutility of delinquency ξ. Second, there are three haircut process parameters - the axrrival rate of haircuts λ_δ, and the two shape parameters of haircuts α_1 and α_2. Third, there are three parameters governing the income process - the arrival rate of income shocks λ_y, the persistence of income ρ, and the variance of income shocks $\sigma^2_{\epsilon,y}$. Fourth, there are two parameters governing the health expenditure process - its log mean μ_e and variance σ^2_e. Finally, we need to calibrate the out-of-pocket share function $o(y)$.

We proceed as follows. We use the Medical Expenditure Panel Survey (MEPS) to calibrate the parameters governing health expenditure shocks and the out-of-pocket function. We then calibrate the income process, preference, and haircut parameters to match several features of credit card debt in the data.

Health expenditure and insurance parameters. We calibrate the mean log expenditure and its variance to match the distribution of annual medical expenditure of families in the MEPS data, which covers the 2000-2017 period. This results in a mean expenditure of 8% of median income and a variance of 2.62. We present the calibrated distribution relative to the data one in Figure 5. The calibrated parameters imply that a medical expenditure one s.d. above the average equals 40% of median income. Recall that the expenditure shocks, both in the data and in the model, are not the amounts that households have to pay out-of-pocket.

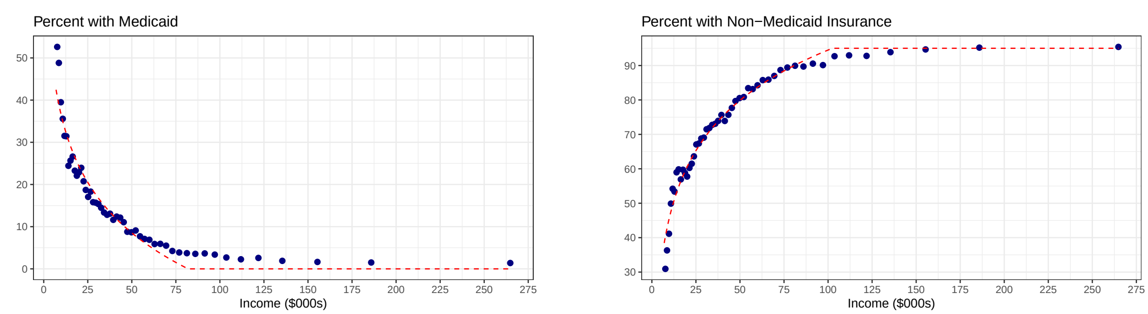
Figure 5: Distribution of annual medical expenditure



Notes: Data source - Medical Expenditure Panel Survey (MEPS).

The MEPS dataset contains also information on households' income, insurance type, and out-of-pocket expenditures. To construct the out-of-pocket share as a function of income we proceed in two steps. First, we split insurance types into three categories: (i) Medicaid, (ii) uninsured, and (iii) other insurance. We approximate the share of households insured in each category by income level using a log-linear function. These shares and the log-linear approximation is presented in Figure 6. Second, we compute the average out-of-pockets share in each insurance type. The average out-of-pocket share in Medicaid is 6.8%, 27.5% under other insurance types, and 63% for the uninsured. We combine the two steps to have obtain the out-of-pocket share along the income distribution. The advantage of this two-step approach relative to directly estimating the out-of-pocket share along the income distribution is that we can conduct counterfactuals in which we change the share of households under each insurance type.

Figure 6: Health insurance type along the income distribution



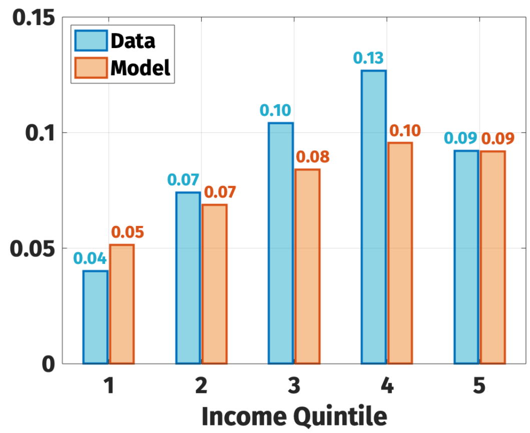
Notes: Data source - Medical Expenditure Panel Survey (MEPS). The figures present binscatter plots of the data in blue, and the model fit in dashed red lines.

Income, preference, and haircut parameters. (*Preliminary*) There are nine remaining structural parameters: the income process parameters ($\lambda_y, \rho_y, \sigma^2_{\epsilon,y}$), preference parameters (β, γ, ξ) and the haircut parameters ($\lambda_\delta, \alpha_1, \alpha_2$). Our initial calibration targets the distribution of credit card debt across households of different income levels. This results in the following parameterization. An income shock arrives on average every 2.3 years ($\lambda_y = 0.42$). The income shock persistence is 0.88 (ρ_y) and the volatility of the innovation is 7.3% ($\sigma^2_{\epsilon,y}$). The calibrated discount rate is 0.92 (β), which induces households to borrow. The disutility of delinquency is 0.34 (ξ), and the coefficient of relative risk aversion is 3 (γ). Finally, the annual probability of a haircut is 0.92 (λ_d), and the shape parameters of the Beta distribution of haircuts are 1.7 and 9 (α_1, α_2).

3.5 Equilibrium properties

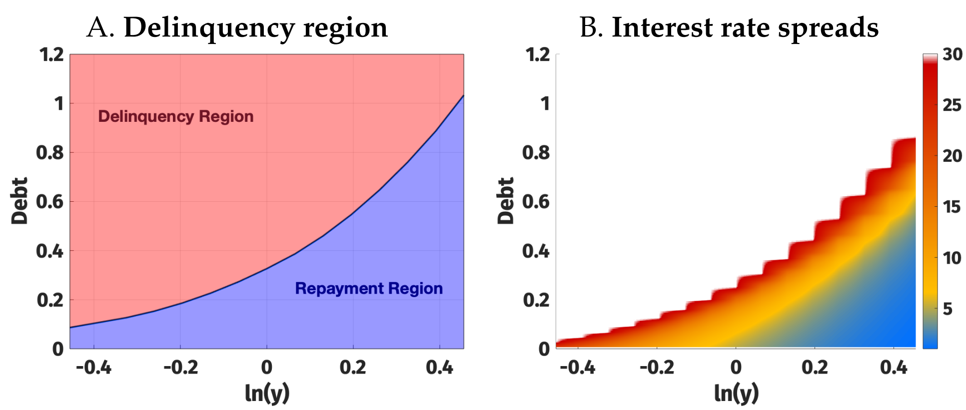
We solve the model globally, and compute the stationary distribution across income and debt levels. Panel A of Figure 8 presents the regions of the state space where households choose to repay or renege on their debt obligations. In general, lower income implies a lower debt threshold, above which households do not repay their debt. Because the utility function is concave, low-income households are more tempted not to repay their debt and increase their contemporaneous consumption. As a result, low-income households cannot maintain a high level of debt.

Figure 7: Credit card debt along the income distribution



Notes: Data source - Panel Study of Income Dynamics (PSID)

Figure 8: Equilibrium properties



Notes: This figure presents the regions where households choose to repay their debt or go delinquent.

The probability of delinquency affects the interest rate spreads households face. Panel B of Figure 8 presents the interest rates spreads households face in equilibrium. The horizontal axis is the current income level of the households and the vertical axis represent the debt obligations promised to be repaid in the following period. Because high-income households are less likely to renege on their debt obligations, they face lower interest rate spreads. In a similar fashion, low-income households face very high interest rate spreads.

The interest rate schedule faced by low-income households effectively limit their access to credit. Policies that reduce the delinquency probability of these households expand their credit access by lowering these interest rate spreads. We now turn to study the effects of one such policy - the expansion of Medicaid.

4 The Effect of Social Health Insurance on Household Debt and Welfare

In this section we study how different health insurance policies shape the distribution of debt across households in the economy, and study their welfare implications. We start by studying the channels through which health insurance policy can affect households' accumulation of debt. We then study the effect of Medicaid expansion in our model. The policy broadens Medicaid health insurance and increases the share of insured households by 1.56%. This is the increase we identified Medicaid expansion had in our state-level empirical analysis.

4.1 Theoretical analysis

We model health insurance as a change in the out-of-pocket share of medical expenditure households of different income levels face, $o(y)$. A more generous health insurance policy corresponds to a reduction in the out-of-pocket share different households pay for medical shocks.

Health insurance policy affects households' accumulation of debt in several ways. The direct effect of more generous health insurance is increasing households' disposable income. Households can achieve the same consumption levels while borrowing less. Therefore, the direct effect of health insurance is a reduction in debt levels. To study the indirect channels, consider the household's optimality condition with respect to debt accumulation, which is given by

$$u'(c)\frac{\partial\left(q(b',y)b'\right)}{\partial b} = \beta\mathbb{E}\mathbb{1}_{V^r \geq V^d} u'\left(c(b'+o(y')m',y')\right) + \beta\mathbb{E}\mathbb{1}_{V^r < V^d} V_1^d\left(b'+o(y')m',y'\right) \quad (11)$$

The household equated the benefits from borrowing (LHS) to the costs of borrowing (RHS). By increasing debt obligations, b', the household increases its current funds by $\frac{\partial(q(b',y)b')}{\partial b}$. Note that the household internalizes how its borrowing decision affects the interest rate it pays on debt. There are two potential costs of borrowing. If the household repays its debt in the following period ($V^r \geq V^d$), the marginal cost of debt obligations is simply the marginal utility of consumption. Alternatively, if the household goes delinquent ($V^d > V^r$), the household's cost of debt obligations are $\frac{\partial V}{\partial \tilde{b}}$.

The first indirect channel through which social insurance affects household debt is a reduction in the *precautionary savings motive*. A reduction in $o(y')$ reduces the volatility of out-of-pocket medical expenditure, o(y')m'. This results in a lower volatility of future consumption. If the utility function features prudence ($u'''(\cdot) > 0$), as it does in our calibration, then such reduction in volatility results in a smaller cost of borrowing. The reduction in the marginal cost of borrowing induces households to take on more debt. That is, through the precautionary savings channel, social insurance raises household debt levels.

The second indirect channel is the *debt aversion* channel. Borrowing is more costly in the states where households repay their debt obligations. Debt is less costly in the delinquency state as households expect to pay it only in the future, and potentially after a haircut. More generous insurance policy raises the probability of repayment, $\mathbb{E}\mathbb{1}_{V^r \geq V^d}$, as medical expenditures that would have pushed households into delinquency are now partially insured. The increase in the repayment probability increases the cost of borrowing, as households are more averse to debt when they are more likely to repay it. Therefore, through the debt aversion channel, social insurance reduces household debt levels.

Both the precautionary savings motive and the debt aversion channels do not depend on lenders changing their behavior. That is, they do not depend on the supply side of loans. We refer to the combined effect of these two channels as the *credit demand* channel.

The final indirect channel is the *credit supply* channel. The reduction in delinquency probability induces lenders to lower interest rate spreads, $q(b', y)$. This raises the benefits from debt obligations b'. For each unit of consumption promised to be repaid in the following period, households receive more units of consumption in the current period. This induces households to increase their debt obligations. So, through the credit supply channel, social insurance increases household debt levels.

Overall, the effect of social insurance on the aggregate level of household debt is ambiguous. The direct channel as well as the debt aversion channel lead to a reduction in debt levels, while the precautionary savings motive and the credit supply channels lead to an increase in debt levels. We now turn to study the expansion of Medicaid in our model, and quantitatively asses the strength of the different channels.

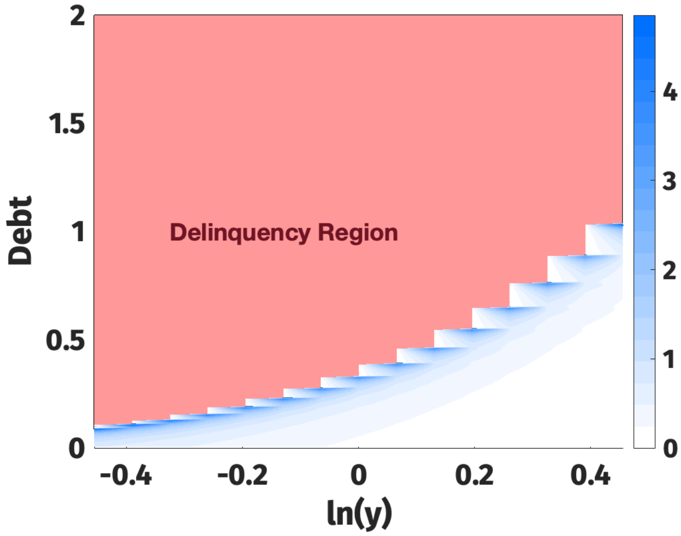
4.2 Medicaid expansion

Our benchmark specification assumes that the share of households covered by Medicaid insurance is log-linear in income. Low-income households are more likely to be covered by Medicaid. In this section we consider a policy that mimics the expansion of Medicaid as part of the Affordable Care Act in the data. We change the intercept of the Medicaid coverage function, so that an additional 1.56% of households are covered by Medicaid. This magnitude corresponds to our empirical estimate for the effect of Medicaid expansion on the share of insured households. We solve the model and compute the stationary distribution. We assume out-of-pocket share of the Medicaid policy remains unchanged at a rate of 6.8%.

The expansion of Medicaid reduces the delinquency probability of households, as health expenditure shocks that would push households into the delinquency region are not partially covered by their health insurance. This results in lower interest rate spread in equilibrium. The reduction in equilibrium spreads as a result of the policy is plotted in Figure 9. Households who are close to the delinquency region are now facing interest rate spreads up to 5 percentage points lower relative to the interest rate spreads before the expansion of Medicaid.

The reduction in interest rate spreads affects households who tend to be close to the default frontier. So, it primarily affects the behavior of low- and medium-income households.

Figure 9: Reduction in interest rate spreads due to policy



Notes: This figure presents the reduction in equilibrium interest rate spreads in percentage points.

Table 5: Decomposing the effect of Medicaid expansion

	Total impact	Direct impact	Credit demand	Credit supply
Total level of debt	**+1.32%**	**-1.14%**	**-1.43%**	**+3.9%**
Total welfare	**+0.18%**	**+0.15%**	**+0.0001%**	**+0.03%**

High income households, who often do not hold any debt, are less affected by the expansion of Medicaid.

The expansion of Medicaid in our model leads to a long-run increase of 1.33% in credit card debt. Consistent with our empirical findings, the overall impact on credit card debt is positive. While the expansion of Medicaid reduces the amount of medical debt, its total impact on household debt is also positive. The policy increases household debt by 0.86%.

Our model allows us to decompose the effect Medicaid expansion has on credit card debt to the three theoretical channels we laid out in the previous subsection: the direct channel, the credit demand channel, and the credit supply channel. The decomposition results are summarized in Table 5.

To get the direct impact of Medicaid expansion, we keep the debt pricing schedule as well as policy functions of households as they are prior to the expansion. The only change we consider here is the change to the out-of-pocket share of medical expenditure, $o(y)$. The direct impact of the policy on debt is a decline of 1.14% in the aggregate level of credit card debt.

The credit demand channel is computed by keeping the debt pricing schedule at its levels prior to the expansion of Medicaid but allowing households to re-optimize given the original pricing schedule. The credit demand channel reduces the aggregate level credit by an additional 1.43%. This implies that the debt aversion channel is much stronger than the precautionary savings channel.

Finally, the credit supply channel is computed by updating also the debt pricing schedule so that financial intermediaries make zero profits. The reduction in interest rates, which can be seen in Figure 9, leads to a large increase in credit card debt. The credit supply channel raises the aggregate level of credit card debt by 3.9%, dominating over the cumulative effect of the direct and the credit demand channels.

Our model allows us to study also the welfare impact of the policy. As we assume the policy is not budget-neutral, we expect all households to be better off. The model is useful in studying how important are the different channels in driving welfare, as well as comparing the welfare benefits across different households. Following Chatterjee et al. (2007), we calculate welfare by computing what is the percentage drop in consumption in all periods following the expansion of Medicaid which would make households indifferent between implementing and not implementing the policy. On average, the policy leads to a welfare benefit of 29 basis points in consumption equivalent terms. That is, the average household in the economy is willing to incur a 0.29% drop in consumption in all periods so that Medicaid expansion remains in place. In terms of wealth, on average, households are willing to pay a one-time payment of 94% of the median income in order to implement an expansion of Medicaid starting from the following period.

Our model allows us to decompose the effects of the Medicaid expansion to the three channels. The results are presented in the second row of Table 5. The reduction in out-of-pocked medical expenditure accounts for the majority of welfare benefits. This is expected - we assumed households do not pay any cost to implement the policy. The direct channel accounts for 83% of the welfare gains.

The credit demand channel has only negligible welfare effect. This is simply the envelope theorem. Households were optimizing their borrowing decision prior to the policy. So adjusting their borrowing decision following the policy can only lead to second-order welfare gains.

Unlike the credit demand channel, the credit supply channel leads to sizable welfare benefits, 0.03% out of a total of 0.18%. That is, 17% out of the total welfare gains of the expansion of Medicaid can be attributed to the reduction in interest rate spreads households pay. This result suggests policy makers should take into account the impact of social insurance policies on the supply of credit. Disregarding the effect of social insurance on the supply of credit understates its welfare benefits.

5 Conclusion

This paper investigates how social insurance affects household debt. We exploit the staggered expansions of Medicaid as a source of quasi-experimental variation in households' access to health insurance. Using an instrumental variables strategy, we estimate that a one percentage point increase in health insurance coverage leads to a 1.4% increase per capita credit card debt. Our estimates imply that expanding Medicaid (to non-elderly adults with no dependents) on average increased credit card debt by 2.2% ($20.4 billion dollars in terms of aggregate debt).

Our paper builds on prior empirical work by focusing on general equilibrium channels and both macroeconomic and distributional outcomes. We develop a heterogeneous-agent model where households face permanent and transitory differences in their income, health expenditure shocks, and incomplete markets. Households incur debt both by choosing how much to borrow on a credit card and as a result of health expenditure shocks. Using the model, we explore the impact of expanding health insurance.

While insurance can help households avoid taking on debt when experiencing adverse events like job loss and illness, it can also increase borrowing by enhancing households' financial resilience. Insurance softens the financial impact of adverse events, making it easier to avoid default and/or states of the world in which consumption is extremely low. In doing so, insurance can dampen households' precautionary savings motive and raise lenders' expected returns, increasing both credit demand and supply. Our empirical evidence suggests that these credit demand and supply channels dominate the direct impact on borrowing in equilibrium. Our model is also able to match this finding. Our findings suggest that institutions like social insurance can have an important impact on the quantity and distribution of household debt as well as welfare.

References

Aiyagari, Rao S., "Uninsured Idiosyncratic Risk and Aggregate Saving," *The Quarterly Journal of Economics*, 1994, *109* (3), 659–684.

Aizer, Anna, "Low take-up in Medicaid: Does outreach matter and for whom?," *American Economic Review (Papers and Proceedings)*, 2003, *93* (2), 238–241.

Allen, Heidi, Ashley Swanson, Jialan Wang, and Tal Gross, "Early Medicaid Expansion Associated with Reduced Payday Borrowing in California," *Health Affairs*, 2017, *36* (10), 1689–1776.

Averett, Susan L., Julie K. Smith, and Yang Wang, "Medicaid expansion and opioid deaths," *Health economics*, 2019, *28* (12), 1491–1496.

Baicker, Katherine, William J Congdon, and Sendhil Mullainathan, "Health insurance coverage and take-up: Lessons from behavioral economics," *The Milbank Quarterly*, 2012, *90* (1), 107–134.

Barcellos, Silvia Helena and Mireille Jacobson, "The Effects of Medicare on Medical Expenditure Risk and Financial Strain," *American Economic Journal: Economic Policy*, 2015, *7* (4), 41–70.

Bewley, Turman, "Stationary Monetary Equilibrium with a Continuum of Independently Fluctuating Consumers," *Contributions to Mathematical Economics in Honor of Gérard Debreu*, 1986, *79.*

Brevoort, Kenneth, Daniel Grodzicki, and Martin B. Hackmann, "Medicaid and Financial Health," Working Paper, National Bureau of Economic Research 2017.

Bricker, Jesse, Lisa J. Dettling, Alice Henriques, Joanne W. Hsu, Lindsay Jacobs, Kevin B. Moore, Sarah Pack, John Sabelhaus, Jeffrey Thompson, and Richard A. Windle, "Changes in U.S. Family Finances from 2013 to 2016: Evidence from the Survey of Consumer Finances," *Federal Reserve Bulletin*, 2017, *103* (2), 1–42.

Busch, Susan H and Noelia Duchovny, "Family coverage expansions: impact on insurance coverage and health care utilization of parents," *Journal of health economics*, 2005, *24* (5), 876–890.

Célérier, Claire and Adrien Matray, "Public Health Insurance, Access to Credit, and Wealth Accumulation," 2017.

Chatterjee, Satyajit, Dean Corbae, Makoto Nakajima, and José-Víctor Ríos-Rull, "A Quantitative Theory of Unsecured Consumer Credit with Risk of Default," *Econometrica*, 2007, *75* (6), 1525–1589.

Currie, Janet, "The Take Up of Social Benefits," Technical Report, National Bureau of Economic Research 2004.

_ **and Jonathan Gruber**, "Saving Babies: The Efficacy and Cost of Recent Changes in the Medicaid Eligibility of Pregnant Women," *Journal of Political Economy*, 1996, *104* (6), 1263–1296.

Deaton, Angus, "Saving and Liquidity Constraints," *Econometrica*, 1991, *59* (5), 1221–48.

Desmond, Brian S, Molly A Laux, Carolyn C Levin, Jiaxin Huang, and Brent C Williams, "Reasons why individuals remain uninsured under the Affordable Care Act: experiences of patients at a student-run free clinic in Michigan, a Medicaid expansion state," *Journal of community health*, 2016, *41* (2), 417–423.

Druedahl, Jeppe and Casper Nordal Jørgensen, "Precautionary Borrowing and the Credit Card Debt Puzzle," *Quantitative Economics*, 2018, *9* (2), 785–823.

Finkelstein, Amy, Sarah Taubman, Bill Wright, Mira Bernstein, Jonathan Gruber, Joseph P. Newhouse, Heidi Allen, Katherine Baicker, and Oregon Health Study Group, "The Oregon Health Insurance Experiment: Evidence from the First Year," *Quarterly Journal of Economics*, 2012, *127* (3), 1057–1106.

Frean, Molly, Jonathan Gruber, and Benjamin D Sommers, "Premium subsidies, the mandate, and Medicaid expansion: Coverage effects of the Affordable Care Act," *Journal of Health Economics*, 2017, *53*, 72–86.

Fulford, Scott, "How Important is Variability in Consumer Credit Limits?," *Journal of Monetary Economics*, 2015, *72*, 42–63.

Gallagher, Emily A., Jorge Sabat Radhakrishnan Gopalan, and Michal Grinstein-Weiss, "Medicaid and Household Savings Behavior: New Evidence from Tax Refunds," *Journal of Financial Economics*, 2019.

_ , Radhakrishnan Gopalan, and Michael Grinstein-Weiss, "The Effect of Health Insurance on Home Payment Delinquency: Evidence from ACA Marketplace Subsidies," *Journal of Public Economics*, 2019, *172*, 67–83.

Ghosh, Ausmita, Kosali Simon, and Benjamin D. Sommers, "The Effect of Health Insurance on Prescription Drug use Among Low-Income Adults: Evidence from Recent Medicaid Expansions," *Journal of Health Economics*, 2019, *63*, 64–80.

Goldsmith-Pinkham, Paul, Adrien Auclert, and Will Dobbie, "Macroeconomic Effects of Debt Relief: Consumer Bankruptcy Protections in the Great Recession," Working Paper 2020.

_ , Maxim Pinkovskiy, and Jacob Wallace, "The Geography of Financial health," 2020.

Gomes, Joao, Macro Grotteria, and Jessica A. Wachter, "Forseen Risks," 2019.

Gross, David B. and Nicholas S. Souleles, "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data," *Quarterly Journal of Economics*, 2002, *117* (1), 149–185.

Gross, Tal and Matthew J. Notowidigdo, "Health Insurance and the Consumer Bankruptcy Decision: Evidence from Expansion Medicaid," *Journal of Public Economics*, 2011, *95* (7), 767–778.

Hu, Luojia, Robert Kaestner, Bhashkar Mazumder, Sarah Miller, and Ashley Wong, "The Effect of the Affordable Care Act Medicaid Expansions on Financial Wellbeing," *Journal of Public Economics*, 2018, *163*, 99–112.

Hubbard, R Glenn, Jonathan Skinner, and Stephen P Zeldes, "Precautionary saving and social insurance," *Journal of political Economy*, 1995, *103* (2), 360–399.

Huggett, Mark, "The Risk-Free Rate in Heterogeneous-Agent Incomplete-Insurance Economies," *Journal of Economic Dynamics and Control*, 1993, *17* (5–6), 953–969.

Imrohoroğlu, Ayşe, "Cost of business cycles with indivisibilities and liquidity constraints," *Journal of Political economy*, 1989, *97* (6), 1364–1383.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor, "Betting the House," *Journal of International Economics*, 2015, *96*, S2–S18.

_ , _ , and _ , "The Great Mortgaging: Housing Finance, Crises and Business Cycles," *Economic Policy*, 2016, *31* (85), 107–152.

Leung, Pauline and Alexandre Mas, "Employment Effects of the ACA Medicaid Expansions," *Industrial Relations*, 2018, *57*, 206–234.

Livshits, Igor, James MacGee, and Michele Tertilt, "Consumer Bankruptcy: A Fresh Start," *American Economic Review*, 2007, *97* (1), 402–418.

Mian, Atif, Amir Sufi, and Emil Verner, "Household Debt and Business Cycles Worldwide," *The Quarterly Journal of Economics*, 2017, *132* (4), 1755–1817.

_ , _ , and _ , "How Does Credit Supply Expansion Affect the Real Economy? The Productive Capacity and Household Demand Channels," *Journal of Finance (forthcoming)*, 2020.

Miller, Sarah, Luojia Hu, Robert Kaestner, Bhashkar Mazumder, and Ashley Wong, "The ACA Medicaid Expansion in Michigan and Financial Health," Working Paper 2018.

Mitman, Kurt, "Macroeconomic Effects of Bankruptcy and Foreclosure Policies," *American Economic Review*, 2016, *106* (8), 2219–2255.

Telyukova, Irina A., "Household Need for Liquidity and the Credit Card Debt Puzzle," *Review of Economic Studies*, 2013, *80* (3), 1148–1177.

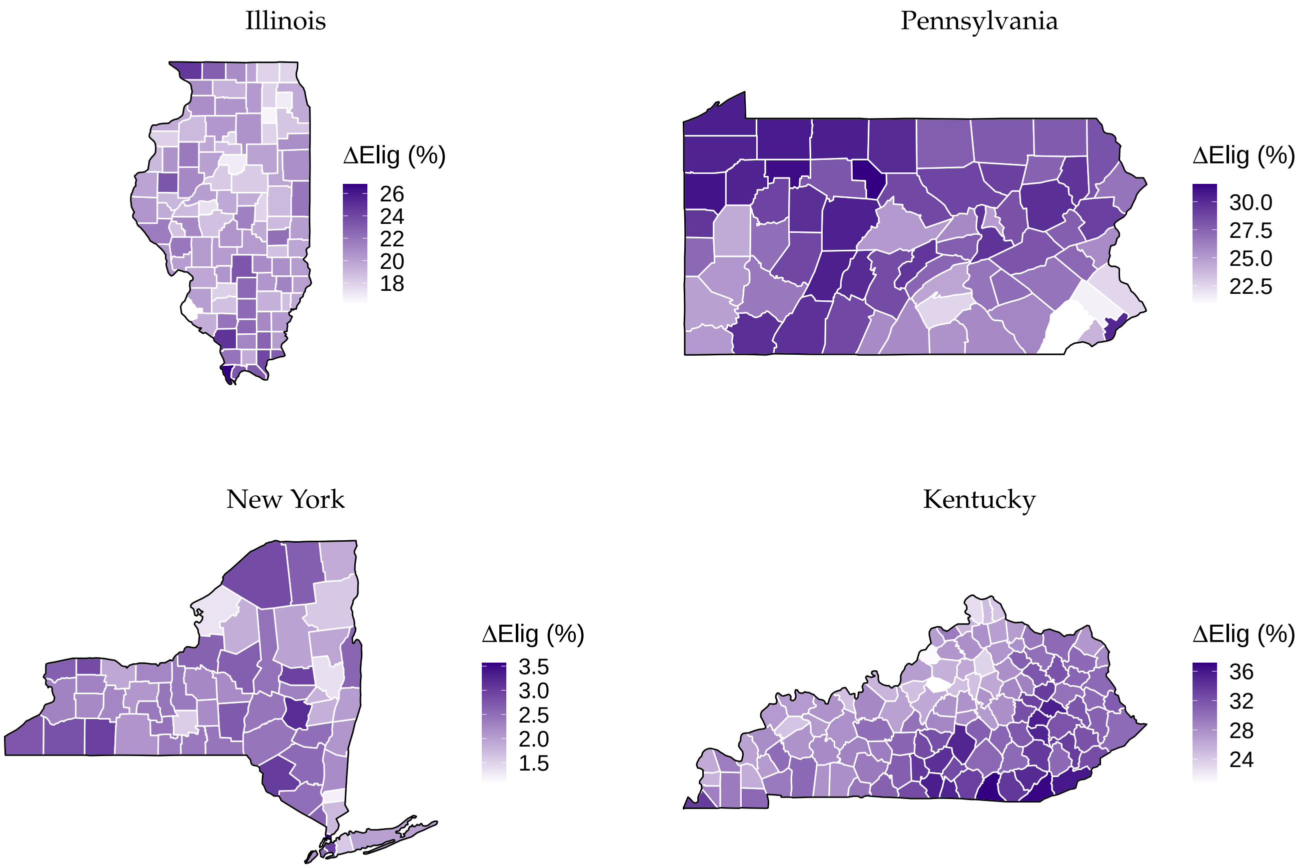
Wright, Bill J, Ginny Garcia-Alexander, Margarette A Weller, and Katherine Baicker, "Low-cost behavioral nudges increase Medicaid take-up among eligible residents of Oregon," *Health Affairs*, 2017, *36* (5), 838–845.

Zeldes, Stephen P, "Optimal consumption with stochastic income: Deviations from certainty equivalence," *The Quarterly Journal of Economics*, 1989, *104* (2), 275–298.

Appendix

A Additional Figures

Figure A.1: County-Level Variation in Impact of Expansions on Eligibility



Notes: These maps display the change in the share of households eligible for Medicaid. The change is measured from the year prior to the state's expansion of Medicaid to the year of the expansion.