FEDERAL RESERVE BANK *of* ATLANTA **WORKING PAPER SERIES**

Losing Public Health Insurance: TennCare Disenrollment and Personal Financial Distress

Laura M. Argys, Andrew I. Friedson,
M. Melinda Pitts, and D. Sebastian Tello-Trillo

Working Paper 2017-6
August 2017

Abstract: A main goal of health insurance is to smooth out the financial risk that comes with health shocks and health care. Nevertheless, there has been relatively sparse evidence on how health insurance affects financial outcomes. The few studies that exist focus on the effect of gaining health insurance. This paper explores the effect of losing public health insurance on measures of individual financial well-being. In 2005, the state of Tennessee dropped about 170,000 individuals from Medicaid, resulting in a plausibly exogenous shock to health insurance status. Both across- and within-county variation in the size of the disenrollment is linked with individual-level credit risk score and debt data to identify the effects. The results suggest that the disenrollment resulted in a 1.73 point decline in credit risk scores for the median individual in Tennessee. There is also evidence of increases in the amount and share of delinquent debt (90 days past due or more) and of increases in bankruptcy risk. These findings are mostly concentrated among individuals who were in relatively worse financial status before the disenrollment and suggest that there are significant negative consequences to current recipients that would need to be considered in the cost and benefit calculations around rollbacks of recent Medicaid expansions.

JEL classification: D14, H75, I13

Key words: Medicaid, public assistance, household finance, debt, bankruptcy

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The authors are grateful for suggestions from David Altig, Charles Courtemanche, Vinish Shrestha, Nicholas Sly, and seminar participants at the Southern Economic Association Meetings, Eastern Economic Meetings, the Agency for Healthcare Research and Quality, the University of Colorado, the University of Virginia, and the Federal Reserve Bank of Atlanta. The views expressed here are the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Laura M. Argys, Department of Economics, CB 181, University of Colorado Denver, P.O. Box 173364, Denver, CO 80217-3364, Laura.Argys@ucdenver.edu; Andrew I. Friedson, Department of Economics, CB 181, University of Colorado Denver, P.O. Box 173364, Denver, CO 80217-3364, andrew.friedson@ucdenver.edu; M. Melinda Pitts, Federal Reserve Bank of Atlanta, Research Department, 1000 Peachtree Street NE, Atlanta, GA 30309-4470, 404-498-7009, melinda.pitts@atl.frb.org; or D. Sebastian Tello-Trillo, 235 McCormick Road, Garrett Hall L031, University of Virginia, Charlottesville, VA 22904, Sebastian.tello@virginia.edu.

I. Introduction

Personal health care costs in the United States can change suddenly with a new diagnosis or accident, in many cases leading to financially catastrophic shocks for households, which can perist for several years. For example, Dobkin et al. (2016) find that a hospitalization is associated with higher balances of debt in collections, an increased rate of bankruptcy, lower credit scores, less access to credit (as measured by credit limits), and less borrowing activity, with these negative outcomes persisting for at least four years after the hospital admission. Additionally, Himmelstein et al. (2005), Zhu (2011), and Ramsey et al. (2013) all find that medical conditions greatly increase an individual's likelihood of entering bankruptcy.

The presence and generosity of health insurance carried by a household has tremendous bearing on the household's ability to weather adverse financial shocks from unforeseen health events. A report by the Commonwealth Fund (Doty et al. 2008) finds that 29 percent of uninsured adults were contacted by a collection agency about an unpaid medical bill, as compared to eight percent of insured adults. The uninsured with medical debt were found to be more likely to spend down their savings, and to report being unable to pay for necessities such as food, heat, or shelter due to their outstanding medical bills. In other words, health insurance provides more than access to medical care; it serves as protection against the substantial financial risk associated with health shocks. Accurate measurement of these financial protection benefits is vital to any policy analysis involving government insurance programs, and to understanding the health insurance sector in general.[1]

As individual financial data has become more readily available to researchers, a literature has emerged attempting to quantify the financial protection benefit of health insurance. A popular strategy for such measurement is to examine the effect of a public health insurance program on the

[1] To put the size of the health insurance sector into perspective, approximately 2.4 trillion dollars, or 13 percent of U.S. GDP was spent via health insurers (both private and public) in 2015 (Martin et al. 2017).

out-of-pocket expenses of the newly insured. Several papers have utilized the rollout of new programs (Finkelstein and McKnight 2008; Engelhardt and Gruber 2011; Finkelstein et al. 2012; Baicker et al. 2013), while Barcellos and Jacobson (2015) took advantage of discontinuities in coverage around an eligibility cutoff. These studies show that the presence of insurance indeed lowers out-of-pocket spending, and the most recent of these studies show that insurance coverage significantly reduces the likelihood of carrying medical debt, the need to borrow to pay bills, the need to use savings to pay bills, and the likelihood of being contacted by a collection agency.

Other studies in this literature have also exploited expansions of public health insurance programs using measures of individual financial well-being from third-party financial records, either through the use of credit report data (Mazumder and Miller 2016; Hu et al. 2016, Brevoort et al. 2017) or publicly reported bankruptcy filings (Gross and Notowidigdo 2011). These studies find that expansions in public health insurance programs decrease the frequency of bankruptcies, lower the amount of debt in collections, and improve credit scores, all of which are an improvement in household finances.

This study adds to the above literature on an important new margin. The entire body of knowledge on this topic is based on the extension of health insurance coverage to new populations. Instead, we examine the impact of a sudden and large-scale Medicaid disenrollment, and, to our knowledge, are the first to study the impact of insurance loss on personal finances. In fact, to our knowledge this study is the first to examine the impact on personal finances of losing any form of public assistance.

Understanding the interplay between insurance loss and personal finance is an important gap in the literature: it may not be as salient to the policy debate to use evidence from an insurance expansion to predict the outcomes from an insurance contraction. Changes in a household's income via new eligibility for a program or cash transfer have been shown to increase that household's

borrowing behavior (Agarwal, Liu, and Souleles 2007; Agarwal and Qian 2014), creating debt that is not discharged if the same program is suddenly taken away and the household becomes unable to meet its debt obligations. This could create asymmetry in the financial impact of losing versus gaining an entitlement. Health insurance may also directly induce asymmetries in personal financial security via changes in patient behavior (and associated risk of an expensive health shock) when insured do not revert to previous behavior when insurance is lost.[2]

In this study, we consider the effect of approximately 170,000 individuals losing public health insurance eligibility throughout Tennessee in 2005. Our study provides the first evidence of the impact of insurance loss on household financial outcomes, and to our knowledge, the first evidence of the impact of the loss of public transfer programs in general on these household financial outcomes. This exercise is particularly relevant for current policy considerations as the population affected by the Tennessee disenrollment is similar to the population impacted by the recent Medicaid expansions under the Patient Protection and Affordable Care Act (ACA), the largest single health insurance expansion in decades (Garthwaite, Gross and Notowidigdo 2014, Appendix Table A1). This makes evidence from the Tennessee disenrollment more plausibly externally valid to a potential ACA Medicaid expansion rollback than evidence from the Massachusetts Reform or the Oregon Medicaid Lottery. Such a rollback was contained in the U.S. House of Representatives' proposed American Health Care Act (AHCA), and in multiple iterations of the U.S. Senate's Better Care Reconciliation Act.

[2] An example of this type of moral hazard is found by Dave and Kaestner (2009) in that after health insurance expansion, smoking increases. Due to the addictive nature of smoking, a complete reversal once health insurance is withdrawn is unlikely.

II. Policy Variation: TennCare's Creation and Eventual Disenrollment

In the early 1990s, Tennessee offered traditional fee-for-service Medicaid to children and family members receiving other welfare programs.[3] During this time, the state experienced annual budget deficits of as much as $250 million, largely driven by increases in Medicaid spending. Additionally, a non-trivial part of Tennessee's Medicaid funding (around $400 million) was provided by a special tax on hospitals and nursing homes scheduled to end by the end of 1994. This pushed Governor McWherter to establish a task force to identify solutions on the affordability of their Medicaid program. In 1993, the task force proposed three options: 1) a tax increase, 2) a reduction of Medicaid provider reimbursement rate or 3) a comprehensive restructuring of the Medicaid system in Tennessee. Given the unpopularity with the first two recommendations the Governor decided to push for the third option.[4]

Reform of the public health care system in Tennessee began with two goals in mind: control cost and expand eligibility. To control cost, the state legislature proposed enrolling all Medicaid beneficiaries in a managed care organization with the expectation that these reforms would significantly reduce expenditures per beneficiary and generate savings that could be used to expand eligibility. There were three main expansions to the eligibility criteria: First, the income eligibility was expanded up to 400% of the Federal Poverty Level (FPL), relative to the previous level of 185% of the FPL; second, the reform made childless adults eligible, a group that until that time had rarely been eligible for public health insurance in the U.S; and third, the expansion covered the "uninsurable," or individuals that had been denied coverage in the private marketplace. These

[3] In the absence of waivers, states were required to provide Medicaid to families receiving Aid to Families with Dependent Children (AFDC), individuals on Supplemental Security Income (SSI) and to pregnant women and infants living at up to 133% of the poverty line (Boben, 2000). In Tennessee, eligibility for AFDC was 43% of the FPL. Eligibility for SSI was 75% of the FPL. The threshold for medically needy was 25% of the FPL. Medicaid covered pregnant woman and infants with family incomes to 185% of the FPL, children ages 1 to 5 with incomes 133% of the FPL, and children born after September 30, 1983, to 100% of the FPL. (Wooldrigde et al, 1996).

[4] For a more detailed timeline of TennCare's implementation, refer to Chang and Steinberg (2014) "TennCare Timeline: Major Events and Milestones from 1992 to 2014"

changes to the health care system in Tennessee and the substantial expansion in coverage became known as TennCare.[5]

By the early 2000s Tennessee saw growing budget deficits driven by the rising cost of the TennCare program.[6] The state initiated a re-verification process in 2002 that initially resulted in a loss of insurance for 200,000 enrollees who did not respond but a court case led to a grace period for coverage and eventually many re-applied and re-qualified for benefits.[7] However, there was a substantial permanent change in November of 2004. At that time Governor Bredesen of Tennessee announced in a press release that given budgetary deficits they expect that "as many as 430,000 enrollees…out of a total of 1.3 million…could lose health coverage" (Bredesen, 2004). Beginning in August of 2005, some enrollees received letters explaining that their TennCare benefits were terminated. There were several margins on which TennCare was to be contracted; the most meaningful was the termination of eligibility for childless adults and the uninsurable. Garthwaite et al. (2014) estimate that 90 percent of the individuals dropped from the TennCare program were childless adults. In Figure 1, we use administrative data from TennCare to show the disenrollment by plotting the number of people enrolled in TennCare over time.[8] The sudden drop in enrollment beginning in 2005 that is visible in Figure 1 will be our primary source of identifying variation in the analyses to follow.

II.A *Mechanisms*

The drop in insurance enrollment possibly caused worsening financial outcomes for individuals in Tennessee. The first-order effect likely occurs through a direct reduction in the

[5] It is important to note that within TennCare, households with incomes below 100% of the FPL did not pay premiums. In contrast, households above 100% of the FPL did pay premiums to maintain coverage. "Premiums were adjusted for income and family size. For those above 200% of the FPL, premiums were also adjusted by whether participants elect high-deductible or low-deductible payment plans." (Wooldridge et al, 1996). For detailed information on premiums set up refer to Table V3 "Summary of Premium Payment Policy" of Wooldridge et al. (1996).

[6] According to Chang and Steinberg (2014), Tenncare faced a $342 million deficit in 2001

[7] There are no good estimates of the actual number of individuals who lost TennCare due to reverification, however figure 1 shows the trends in number of enrolled in the TennCare program.

[8] The state has annual enrollment data of TennCare before 2005 and monthly enrollment data afterwards.

financial protection from health insurance. This hypothesis is backed up by previous studies of the TennCare disenrollment. Ghosh and Simon (2015) found that the disenrollment caused an increase in the uninsured share of hospitalizations, while Heavrin et al (2011) found the same increase among emergency department visits. These results are particularly important in light of recent work by Dobkin et al. (2016), who find that a hospitalization is associated with a higher balance of debt in collection, an increased rate of bankruptcy, lower credit score, less access to credit (as measured by credit limits), and less borrowing activity. We would expect these effects to be more pronounced for hospitalizations without the protection of health insurance. Additional evidence for this mechanism is provided by Ghosh and Simon (2015) and Tello-Trillo (2017), who both find that the disenrollment shifted patients toward more expensive emergency department care – exacerbating the financial shocks from adverse health events.

There is, however, evidence for a behavioral response that could have mitigated the disenrollment's impact on financial outcomes. Garthwaite, Gross, and Notowidigdo (2014) show that the TennCare disenrollment increased employment among the likely disenrolled. A steady income from employment (even without employer provided health insurance) could improve individuals' ability to weather adverse health and financial shocks. The second behavioral response is through moral hazard; individuals who lost health insurance could adopt healthier behaviors, although Tello-Trillo (2017) finds only weak evidence in support of this mechanism for the TennCare disenrollment. For the purpose of this study we explore the effects net of these behavioral responses. This leaves the effect of the disenrollment on financial outcomes as an empirical question.

III. Data

Our data come from two main sources: the Federal Reserve Bank of New York's Consumer Credit Panel/Equifax (CCP) and Tennessee's administrative Medicaid enrollment records. We also use county level unemployment rates obtained from the Bureau of Labor statistics.

III.A. *CCP Data*

The CCP is a five percent nationally representative sample of individuals with credit reports maintained by Equifax. Individuals are observed in a quarterly panel starting in 1999 and continuing to the present (the data are updated quarterly). New individuals are added to the panel over time to maintain its five percent ratio with the national population. In order to be included in the sample, an individual must have both a credit report and a social security number. The CCP data contain a wide array of measures of financial well-being that are available to credit rating companies as well as an individual's date of birth and geographic information at the census block level. For a detailed description of the data and the methodology underlying its creation, see Lee and van der Klaauw (2010).

For the purposes of this study, we sample individuals from the CCP between the first quarter (q1) of 2002 and the fourth quarter (q4) of 2007. All individuals sampled live in Tennessee for the duration of the sampling frame and do not change their county of residence in order to accurately capture the TennCare exposure. Additionally, all individuals sampled remain in the CCP during the sampling frame (no exit due to death or discontinuance of their credit report), and are neither bankrupt nor in severe delinquency during the pre-reform period. Thus, we conduct our analyses on a sample of initially financially-healthy individuals who do not leave the panel or change county of residence for the time-period of analysis.[9]

[9] Approximately half of the sample from the first quarter of 2002 meets these residential and financial requirements.

Using the sample from the CCP, we calculate the following measures of individual financial well-being to use as outcome measures. The first outcome of interest is the credit risk score., which is the internal analog to an individual's FICO credit score. The score ranges from 330 to 830 and is a measure of an individual's probability of being severely delinquent (more than 90-days overdue) in the next 24 months, with higher values representing a better credit risk (i.e. lower risk of delinquency). The exact formula used to calculate the score is proprietary, but in general, it is a point in time calculation based on several measures in a consumer's credit report. We interpret this variable as a summative measure of an individual's general financial well-being.

We also calculate the amount of total debt, share of total debt, number of accounts and share of accounts that are "severely delinquent" for each individual in our sample. Severely delinquent is an industry term for debt that is 90 or more days past due, which is the point at which a creditor can send a collection agency after the debtor. These outcomes are complicated measures of financial health. A change in any one of these variables could represent a change in financial well-being, but could also represent a change in other circumstances. For example, one must carry debt in general to have debt past due, and higher income individuals tend to carry more debt. Therefore, an increase in delinquent debt could be due to increases in income and all debt balances (including delinquent debt), or it could be due to a general decline in financial well-being. The same could be the case for the number of accounts past due. Increases in the shares of debt and accounts that are delinquent could be due to worsening financial well-being, but could also be due to improving well-being where an individual pays down debt and closes some accounts, leaving the delinquent accounts to take on a larger share of total debt or total accounts. Therefore, a worsening of any single one of these measures of levels and shares of severely delinquent debt does not necessarily correspond with worsening individual financial well-being, but we consider a worsening of several or

all of these measures together to be much stronger evidence of a change in individual financial status.

Finally, we construct two binary outcome variables: one variable indicating that an individual has any debt that is severely delinquent and one variable indicating that an individual declared bankruptcy in the past 24 months. We construct our analysis sample such that all individuals selected into the sample have values of zero for these two indicators (no severely delinquent debt and not in bankruptcy during the past 24 months) in the pre-reform period.

Summary statistics for our outcome variables are reported in Table 1 for the full sample and for subsamples based on age and time period (pre- or post-reform). The measures of delinquent debt are not reported in the pre-period as the sample is constructed to look at individuals who were financially healthy before the disenrollment. Table 1 indicates that during the period over which we conduct our analyses, credit risk scores were, on average, improving and those who are Medicare-age eligible tend to be in better financial circumstances than the remainder of the adult population: they have higher credit risk scores, lower measures of delinquent debt, and lower risk of bankruptcy. .

III.B. *Tennessee Medicaid Records*

In order to estimate the intensity of the reform across counties we use administrative data on the number of people enrolled in TennCare. These data, provided by the Tennessee Department of Health, Division of TennCare, offers monthly counts by county and age group of the number of people enrolled in TennCare since 2005.[10] County population data from the Census are used to estimate TennCare enrollment rates.[11]

These data are then used to construct two county level measures of exposure to the TennCare disenrollment. The first measure is the level of TennCare enrollment in a county as of August of 2005. This is the average enrollment rate over the first 6 months of 2005. This variable

[10] The data is publicly available at this site http://www.tn.gov/tenncare/topic/enrollment-data
[11] These data is available at https://www.census.gov/popest/data/intercensal/county/CO-EST00INT-01.html\

measures a county's capacity to disenroll (a county can only disenroll people who are previously enrolled). The level of pre-reform enrollment has the benefit of being plausibly exogenous, with the cost of being an imperfect measure of the true effect of the reform. This source of variation is in line with what has been done in previous studies of insurance expansions and contractions using similar methods.[12] This variable was shown by Tello-Trillo (2017) to be strongly predictive of eventual insurance loss due to the TennCare disenrollment.[13]

The second measure is the rate of decline in TennCare enrollment in a county before and after August 2005.[14] That is, we take the percentage of people in a county enrolled in TennCare in the two quarters prior to disenrollment began in quarter three of 2005 (the first quarters of data availability) and compare this to the county enrollment in the two quarters after the disenrollment was completed in the latter half of 2006. This drop in enrollment serves as a direct measure of the "dose" of the disenrollment on a given county.

As shown in Panel A of Figure 2, there is substantial variation in the pre-reform level of TennCare enrollment across counties in Tennessee. The median county saw 19% of its adult population covered by TennCare, with proportions ranging from 3.3% to 40%. In addition, the median county saw a drop rate of 5.4%, range from 1.2% to 12.9%. As expected, disenrollment, both in numbers of people and percentage of the county population, is substantial and is positively correlated with pre-reform county enrollment levels (see panel B of Figure 2).

[12] Examples includes Finklestein and McKnight 2008), the Massachusetts reform (Miller 2012; Mazumder and Miller 2016), the TennCare disenrollment (Tello-Trillo 2017), and the ACA (Courtemanche, Marton and Yelowitz 2016; Courtemanche et al. 2017a; Courtemanche et al. 2017b; Courtemanche, Friedson, Koller and Rees 2017; among others).

[13] The insurance *expansion* analog of this estimation strategy has shown that pre-reform uninsurance rates are highly predictive of growth in insurance enrollment (Courtemanche, Marton and Yelowitz 2016; Courtemanche et al. 2017a; Courtemanche, Friedson, Koller and Rees 2017).

[14] The decline in TennCare enrollment is expressed as a negative number (the decrease in enrollment multiplied by -1) so that results in our two models are interpreted in the same direction.

IV. Methods

In order to identify the effects of the reform on financial outcomes we use a dose-response strategy that leverages variation of the intensity of the pre-reform enrollment across counties. This strategy is analogous to a difference-in-difference setup but instead of using an untreated control group, we compare across different levels of treatment. We leverage variation across counties in Tennessee based on the "dose" of the reform (TennCare pre-reform enrollment rate) to infer the likelihood of an individual being dropped from coverage in each county. We estimate the following equation using ordinary least squares (OLS) for the adult, non-Medicare-age eligible population (ages 21-64).

$$Y_{icqy} = \gamma_0 + P_i + Y_y + Q_q + Age_{iqy} + UR_{cq} + \beta_1 During + \beta_2 Post + \beta_3 TPRE_c \times During + \beta_{DR} TPRE_c \times Post + \epsilon_{icq} \quad (1)$$

Where Y_{icqy} is a financial outcome for individual i, living in county c, during quarter q and year *y*. The model above includes a set of individual fixed-effects P_i, year fixed effects (Y_y), quarter fixed effects (Q_q), and age fixed effects (Age_{iqy}) as well as the county's quarterly unemployment rate.[15] The reform is split into two periods: the implementation period ($During$) identifies quarters between the third quarter of 2005 and the second quarter of 2006, when the TennCare disenrollment was in process, and the post-implementation period, $Post$, which includes quarters after the TennCare disenrollment was complete, from the second quarter of 2006 through the end of our sample period in the last quarter of 2007. The coefficient of interest in this regression is β_{DR}, our "dose response" estimator, is the coefficient on the variable interacting a county's TennCare

[15] County fixed effects are unnecessary as individuals do not change census block of residence and individual fixed effects are included. Results from all models estimated in this study are robust to the inclusion or exclusion of the unemployment rate, as well as the inclusion or exclusion of individual fixed effects.

pre-reform enrollment rate (*TPRE*) with the indicator variable for the post-period.[16] This coefficient captures the effect of the reform by differencing outcomes across counties with differing enrollment rates before reform. The identifying assumption is that in the absence of the reform, financial outcomes of individuals from high-enrollment rate counties would have evolved similarly to outcomes of individuals from low-enrollment rate counties.

The outcomes we examine in our models are the aforementioned continuous variables for credit risk score, the amount and share of debt that is severely delinquent, and the number and share of severely delinquent accounts. We also estimate discrete-time hazard models for two binary outcome variables: a binary indicator of having any severely delinquent debt, and a binary indicator for incurring a bankruptcy in the past 24 months.

V. Results

V.A. *Results based on the Pre-reform TennCare Enrollment Rate*

Results for analyses using the pre-reform TennCare county enrollment rates are reported in Table 2. Each column represents a separate regression of the impact of the TennCare reform on each of the financial outcomes discussed above. We report the coefficients of interest (the pre-reform TennCare enrollment rate multiplied by an indicator for either the period during TennCare disenrollment or the post-reform period), the standard errors adjusted for clustering at the county level (Tennessee has 95 counties), and the number of observations. Our main coefficient of interest measures the impact of the reform on the average individual who was enrolled in TennCare prior to the changes in policy. In order to compare to the effect of the TennCare reform to other policy changes, two alternative measures are calculated. The first measure reflects the effect on the average individual across Tennessee regardless of pre-reform enrollment status. The second reflects the

[16] The inclusion of county fixed-effects, by including individual fixed effects for our sample of non-movers, removes the need to include the county TennCare drop rate directly.

impact of the reform for the average person in the median county. [17] These values illustrate results in a way that is similar in terms of interpretation to an average treatment effect. However, these median effects should be interpreted with caution; though these values help to quantify the overall effect of the reform on the population as a whole, the impact of the reform was most likely tightly concentrated among those who lost TennCare eligibility.

Estimates from the DR model indicate that increased exposure to TennCare decreased credit risk scores in the post-reform period, with a coefficient of -21.25. This suggests that an individual covered by TennCare insurance before the disenrollment would see their credit risk score drop by just over 20 points following the reform. For the median individual in Tennessee, this translates to a drop of 3.1 points. This is actually quite a large drop; for context, the change in the average FICO score during the Great Recession (October 2006 to the peak of the unemployment rate in October 2010) was four points (a drop from 690 to 686).[18]

Additional outcomes also provide evidence of a negative shock received by these counties, which reinforces the idea that changes in these outcomes reflect a deterioration in financial stability rather than a change in income or other mechanisms. We find that for the median individual from pre-reform to the post-reform period, severely delinquent debt increases by $110, or by about $750 for the average individual who was enrolled in TennCare before the reform. We also see increases in the share of debt that is severely delinquent, the number of delinquent accounts and share of delinquent accounts. Finally, our estimates indicate an increase in the probability of becoming severely delinquent on any account of 0.3 percent and an increase in the probability of bankruptcy of 0.1 percentage points for both the median person and for a person living in the median county.

[17] In table 2, we use these two numbers to re-interpret our coefficients. First, the median pre-reform TennCare enrollment rate across all individuals of ages 21-64 (0.1470) and the median pre-reform TennCare coverage rate for the population of ages 21-64 across all counties (0.1913).

[18] FICO data can be found at http://www.fico.com/en/blogs/risk-compliance/us-credit-quality-rising-the-beat-goes-on/

Although we focus on the impact of the TennCare disenrollment on individual financial outcomes in the post-reform period in this discussion, we also report coefficients for the impact during the TennCare disenrollment. These effects are generally smaller than the effects in the post-reform period, as expected, as there was only partial disenrollment in that time period and a shorter period of time during which individuals might experience health shocks and accumulate medical debt. In general, the effects during the disenrollment are about half the size of the post-reform effects, with the exception of the hazard models of the probability of becoming severely delinquent and on filing for bankruptcy, which are somewhat larger during the disenrollment. It should be noted that this pattern of results from the hazard models likely reflects the fact that the most financially vulnerable experience severely delinquent debt and bankruptcy more quickly. Once this occurs, these individuals are then removed from the estimation sample and no longer appear in the post-reform period.[19]

V.B. *Heterogeneity of Results*

The results discussed above show that losing health insurance and the financial protection it provides is harmful to individual financial well-being. The effects shown are best interpreted as the impact on the median person in the population and are analogous to an average treatment effect. However, the true effect of the disenrollment was likely concentrated among those who were most directly affected. We explore this important heterogeneity in two ways, first by exploring differences in the implied effect of the disenrollment based on the "dose" received by different counties, and second by exploiting differences across individuals' pre-reform creditworthiness.

[19] The model for continuous outcomes was also estimated for those who were severely delinquent or bankrupt in the pre-reform period. The results are qualitatively similar, with the negative impact of the reform being felt earlier in the disenrollment process for these more financially at-risk individuals.

V.B.1 *Heterogeneity across Counties*

Figure 3 is a histogram showing the heterogeneity in implied average effect of the disenrollment by county on credit risk scores based on the DR model. The bars show the frequency (in percent of all counties) of the reduction in credit risk scores (measured along the x-axis) for the average county residents' exposure to the post-reform drop in enrollment. The vertical green line represents the effect for the county with the median pre-reform enrollment, and the dark curve is an Epanechnikov kernel smoothed probability distribution for counties having an effect of the reported magnitude.[20] The histogram shows that although most counties had effects somewhat similar to the median county, there is a long left tail to the distribution. Counties with high pre-reform Tenncare enrollment saw a decrease in credit risk scores for the average resident in the county of approximately 7 points, which is almost twice the size of the effect for the median county.

V.B.I *Heterogeneity by Initial Credit Status*

To further examine heterogeneity in the impact of the TennCare disenrollment, the sample is divided into sub-populations based on credit risk score during the first quarter of the sampling frame. Individuals are divided into three categories based on Fannie Mae's creditworthiness cutoffs for credit scores that are used to assign individuals more or less preferential interest rates (Fannie Mae 2017). The distribution of these categories within our sample is reported in Table 3. Given that the sample used in analysis is selected to be financially healthy in the pre-period, the largest group is the least risky category (R3) and the smallest group is the most risky category (R1). On average, the population as a whole has improving creditworthiness as measured by these categories.

[20] Histograms for the remainder of the DR model estimates have a similar distribution.

Results for the DR model broken out by initial risk category are reported in Table 4.[21] The first panel reports results for the riskiest group (R1), the middle panel for R2, and the bottom panel reports results for the least risky group (R3). The differences in the results based on pre-reform creditworthiness are striking. Individuals in the riskiest two categories had average effects from the reform that were much larger in magnitude than those with better initial creditworthiness. For example, the *Post* DR coefficient for the *Credit Risk Score* regression is more than three times larger in magnitude for category R1 than for R3. There are a number of possible explanations for this pattern of results: a greater proportion of individuals in the bottom categories were directly impacted by the reform, those that were impacted experienced financial shocks of a greater magnitude, or those with higher credit risk scores were better able to smooth their consumption (or some combination of the three). It is interesting to note that the coefficient on the amount of delinquent debt and the number of accounts is negative for the riskiest categories, although the shares of each significantly increased. This likely reflects the difficulty of someone with a low credit risk score obtaining credit and therefore unable to accumulate large amounts of debt, as mentioned previously. These results suggest that the TennCare Medicaid disenrollment had a much larger adverse impact on the overall financial well-being of the part of the population that was financially fragile prior to the reform.

VI. Robustness Analysis and Extensions

In this section, we test the validity of our main results by estimating the effects of the TennCare reform on detailed measures of financial distress, examining the underlying assumptions of the DR model, comparing estimates for sub-populations divided by age, and examining the magnitude of the effects specifically for those disenrolled during the TennCare reform.

[21] Results for the other models produced comparable results and are available upon request.

VI.A *Subprime Mortgage Crisis*

The time-period of our analysis also includes the beginning of the crisis in the subprime mortgage lending markets. A relatively large share of the subprime loans that originated in 2006 and 2007 became delinquent or were foreclosed upon in only a few months (Demyanyk and Hemert 2009). While Mayer et al. (2008) found that these subprime loans were concentrated in areas with high levels of growth, including Florida, California, Nevada, and the area around Washington, DC, they also found that the loans were concentrated in areas with moderate credit scores and with more black and Hispanic residents. Because Tennessee has a disproportionately higher black population than the nation as a whole and it is expected that those on Medicaid would have weaker credit histories there is concern that a concurrent rise in subprime loans could be driving the previous results. If this was the case, then mortgage loans would be the primary driver of these results and the impact would be less generalizable to different time periods. In order to test this theory, we reproduced the same debt variables as in Tables 2 and 3, but for three categories: mortgages (including installment and revolving), auto loans, and non-mortgage revolving debt. These results are shown in Table 5.

The results suggest that the subprime crisis is not the driver of these results, as the largest and most precise estimates are in the auto and revolving debt categories. This is not altogether surprising: homeownership rates in the lower income categories, such as those that would qualify for Medicaid, are much lower than upper income categories (Segal and Sullivan 1997).

VI.B *Event Study*

We also extend our analysis by performing an event-study with our main outcome, credit risk score. This allows us both to map out the differences in pre-trends between high- and low-pre-reform enrollment counties and to visualize adverse financial outcomes during and after the TennCare reform. The event study model follows our main specification, however we replace the

interaction of the pre-reform TennCare enrollment rate and during/post with an interaction of the pre-reform rate and year-quarter specific indicators for all of our analysis period, excluding the first quarter of 2002. Namely our specification is:

$$Y_{icqy} = \gamma_0 + P_i + Y_y + Q_q + Age_{iqy} + UR_{cq} + \beta_1 During + \beta_2 Post + \Sigma_{t=2002Q2}^{2007Q4} (\beta_t \times TPRE_c \times I(Year.Quarter = t)) + \epsilon_{icq} \quad (2)$$

We plot the results from this specification in Figure 4. The vertical axis shows the coefficient on $TPRE_c \times I(Year.Quarter = t)$, or the effect of the pre-reform enrollment rate on credit-risk score. Thus, the horizontal red line shows a zero effect. The vertical red line is the beginning of the post-reform period. There is no obvious pre-period trend (although there is noticeable seasonality), followed by a striking continual drop in credit risk scores once the reform is enacted.

VI.C *Differential Dose Response*

It could be the case that the pre-reform level of enrollment in TennCare is correlated with some unobserved time variant characteristics of the county and thus our coefficient of interest, β_{DR}, may be biased. Therefore the analysis is expanded to allow for a different source of variation.

There is a plausible control group within each county that allows for an additional layer of variation to control for county-specific time variant characteristics. This group consists of Medicare-age eligible individuals over the age of 65. Even though individuals in the older group could still be affected by reduced TennCare eligibility, if they were also dually eligible for Medicare, the likelihood of losing health insurance completely due to the reform is substantially reduced. Thus, we leverage the fact that individuals age 21 to 64 were the group most affected by this reform and compare them to individuals age 65 and older.

Figure 5 provides evidence via self-reports of health insurance coverage across the two age groups in Tennessee using data from the Center for Disease Control's Behavioral Risk Factor

Surveillance System (BRFSS) data. These data confirm that the population between the ages of 21 and 64 report a striking loss of health insurance at the time of the TennCare reform in 2005. In contrast, the older population, over the age of 65, demonstrate no such decline. These patterns reflect the fact that even if some older individuals lost TennCare eligibility, they did not remain uninsured for long, likely reporting Medicare coverage.

The impact of the TennCare reform on this older group is also tested directly by replicating the dose response model in equation one for the Medicare-age eligible population (ages 65 and over). Those results, shown in Appendix Table A1, support the notion that there is no relationship between TennCare Disenrollment and the financial health of the Medicare-age eligible population.

Using this additional margin of variation across age groups, we introduce a new "differential dose response" specification (analogous to a triple difference model) which compares adults aged 21 to 64 to individuals 65 and older within the same county and then comparing the differences in their financial outcomes across counties with high and low pre-reform enrollment rates.[22] This specification mitigates the potential confounding mechanism driven by the fact that counties that are prone to have worse financial outcomes might also have higher (or lower) rates of disenrollment from TennCare. We estimate the following equation using OLS:

$$
\begin{aligned}
Y_{icqy} = \beta_0 + P_i + Y_y + Q_q + Age_{iqy} + UR_? + \; & Q_q \times I(21 \le Age < 65)_i \\
& + \; + Y_y \times I(21 \le Age < 65)_i + C_c \times I(21 \le Age < 65)_i + \beta_1 During \\
& + \beta_2 Post + \; \beta_3 TPRE_c \times During + \beta_4 TPRE_c \times Post \\
& + \beta_5 \, TPRE_c \times During \times I(21 \le Age < 65)_i \\
& + \beta_{DDR} TPRE_c \times Post \times I(21 \le Age < 65)_i + \epsilon_{icqy}
\end{aligned}
$$

[22] Our comparison of non-elderly adults to the elderly in the context of the TennCare disenrollment follows work by Ghosh and Simon (2015) who made the same comparison in a triple differences framework to look at hospitalization outcomes.

The indicator variable ($I(21 \leq Age < 65)_i$) takes the value of 1 if the individual is in the adult age treatment group (21 to 64) versus the Medicare-age eligible control group (65 and older). This captures the baseline differences between these two age groups. The model also includes any two-way combination of the county fixed-effects, quarter fixed-effects, year fixed-effects and age-indicator variable. The $During$ and $Post$ variables are both interacted with $TPRE$. Finally, the interaction between $Post$, the age indicator, and $TPRE$, provides us with the main coefficient of interest: β_{DDR}. Given our set of fixed effects, β_{DDR}, the differential dose-response estimator, compares the difference in outcomes between the adult and elderly group in a specific county, and how that differential changes before and after the reform across differences in TennCare pre-reform enrollment rates. The identifying assumption is that in the absence of the disenrollment, the *difference* in outcomes between non-elderly adults and the elderly would have evolved similarly after the reform across counties.

The DDR model, which is shown in Table 6, finds similar results to the DR model. Again, exposure to the disenrollment (via higher levels of pre-reform enrollment) causes lower credit risk scores; in this case, the coefficient is slightly smaller in magnitude (-16.782), resulting in the median resident of Tennessee ages 24-64 seeing a decrease of 2.5 points compared to credit risk scores among those age 65 and older. The DDR coefficients of the models of delinquent debt were all positive, and statistically significant at conventional levels. Results for the risk of carrying any severely delinquent debt were almost four times as large as that found by the first model and more precisely estimated.

Additionally, the DDR model also detects a statistically significant increase in the risk of bankruptcy of 0.4 percentage points for the average individual where the DR model found a 0.1 percentage point increase. For context, for 2008, the most recent year of available data from the

American Bankruptcy Institute, Tennessee had an annual bankruptcy rate of 7.64 per 1,000, or a 0.191 percent risk of individual bankruptcy in a given quarter.[23]

There is the potential that the differential dose response analysis is simply picking up differences in financial behavior between older and younger age groups and is not reflective of trends related to Medicaid coverage. To test this theory, the sample was restricted to those within ten years of the age 65 Medicare cutoff in either direction, thus creating a more homogeneous sample in terms of both health and financial stability. Table 7 presents the results from this estimation. The differences between the Medicare-age eligible group and the under-65 group are not as large, but the results are consistent in sign with the analysis of the full sample and precisely estimated.[24] This suggests that either the impact of TennCare disenrollment was mitigated for this group or that the ability to weather financial shocks is higher. Regardless, this supports the finding that the differential dose response is picking up the impact of the disenrollment and not just cohort differences.

VI.D. *Effects on the Financial Well-being of the Disenrolled.*

In the final model, we seek to estimate the magnitude of the impact on financial outcomes of the TennCare reform for the disenrolled. To meet this goal, we estimate the model described in equations (1) and (2) by replacing the pre-reform TennCare enrollment rate with the number of individuals disenrolled during the implementation of the reform. The result of estimating these models are reported in table 8 (DR) and table 9 (DDR). The direction of these impacts are in keeping with results reported in the original model. The magnitudes, however, are much larger; an expected pattern considering that the model in tables 8 and 9 is intended to provide a measure of the effect only on the disenrolled, not all individuals with exposure to TennCare.

[23] Bankruptcy data can be found at http://www.abi.org/newsroom/bankruptcy-statistics?page=17

[24] Ideally one would also perform a falsification test on a different time period. Given the timing of available data, the only possible falsification exercise would use 2003 as a false disenrollment date. This, however, is not a clean test due to the recertification in 2002-2003.

Results from the DR model suggest that disenrolled individuals experience a decline in credit risk scores of over 45 points and an increase in the probability of being severely delinquent of 4.2 percentage points during the reform and 2.5 points after the reform. The DDR results are mostly larger, with the typical disenrolled individual seeing a drop in their credit score of over 60 credit score points. In addition, disenrolled individuals are 5.7 percentage points more likely to have severely delinquent debt and face a 2 percentage points increase in the likelihood of bankruptcy, both of these on top of large declines in individual financial risk during the period in which the reform was taking place.

VII. Conclusion

This study provides the first evidence of the impact of loss of insurance on individual financial well-being. It appears that loss of health insurance and its associated financial protection has large consequences for those affected. Our preferred dose response model suggest that losing Medicaid eligibility reduces credit risk scores and increases the presence, share and number of accounts that are severely delinquent. These effects are substantial enough to increase the likelihood of bankruptcy.

Two questions follow naturally from our results: 1) how do these effects compare to those from similar studies that examine expansions of insurance? and 2) what is the effect on an individual who is directly impacted by disenrollment? In other words, what is the expected financial impact on an individual who suffers insurance loss due to the reform?

The closest study to ours in terms of methods and data is by Mazumder and Miller (2016), who use the same data source (the CCP) to analyze the effect of the Massachusetts insurance expansion on financial outcomes. They estimate that a 1 percent increase in coverage in a county increased that county's credit risk scores by approximately 0.34 points. Our DR model based on the

drop in coverage finds that the median county (which had a median drop of coverage of 3.87 percentage points across all individuals) experienced a decline in the average credit risk score of approximately 1.8 points. If we assume (as Mazumder and Miller did) that the effect is roughly linear, this translates to a 1 percent decrease in coverage in a county decreasing that county's average credit risk score by 0.46 points. This is a slightly larger estimate, which is suggestive of asymmetry in losing versus gaining insurance, but could also possibly reflect differences in the affected populations.

The second question is more difficult to answer, as the available data do not distinguish those who lost insurance from those who did not. The best estimate of the impact on an individual who loses coverage is the point estimate for the DR estimator using the enrollment drop dose-response variable, which is the effect for the average individual if the entire county drops from insured to uninsured. This number is by no means a perfect estimate of the effect on an individual, but is the best estimate that we can offer with the data available. This estimate implies that the individual impact of insurance loss is severe, greatly decreasing credit risk scores and greatly increasing bankruptcy risk. These effects not only directly influence individual financial well-being, but there is an indirect effect as well; worse credit risk scores will result in worse offered terms for any borrowing activities and less access to credit. In addition, holding severely delinquent debt has also been linked to other poor health outcomes, including mortality (Argys et al 2017).

Our estimates provide evidence that removing Medicaid should not solely be viewed as eliminating affordable access to healthcare, but should also be seen as potentially removing an important layer of financial protection from its enrollees. The results point out the effects of the disenrollment net of all the possible responses from the individual, providers and organizations that provide uncompensated care. We identify significant negative consequences to the financial well-

being of current recipients that would need to be considered in the cost and benefit calculations around rollbacks of recent Medicaid expansions.

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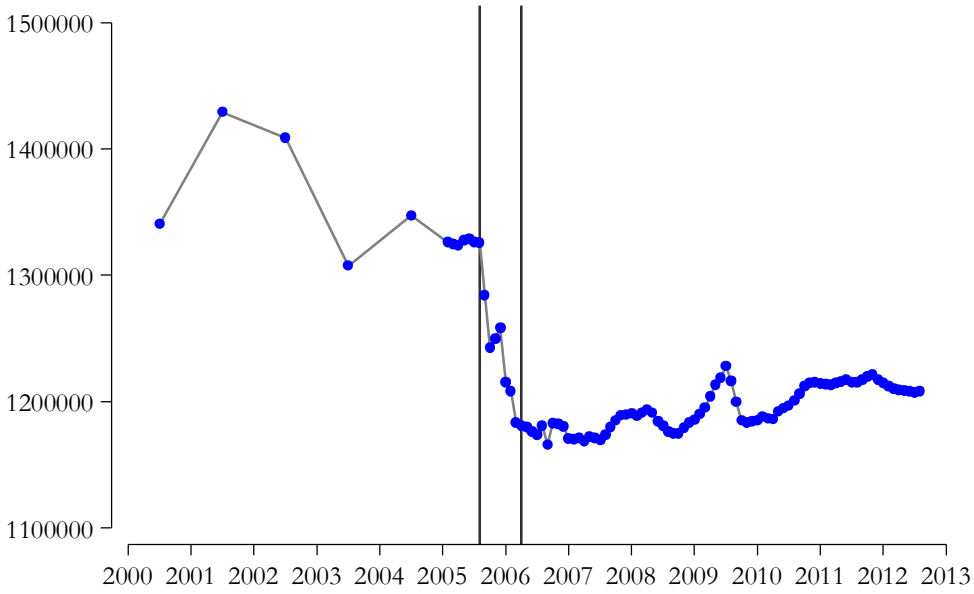
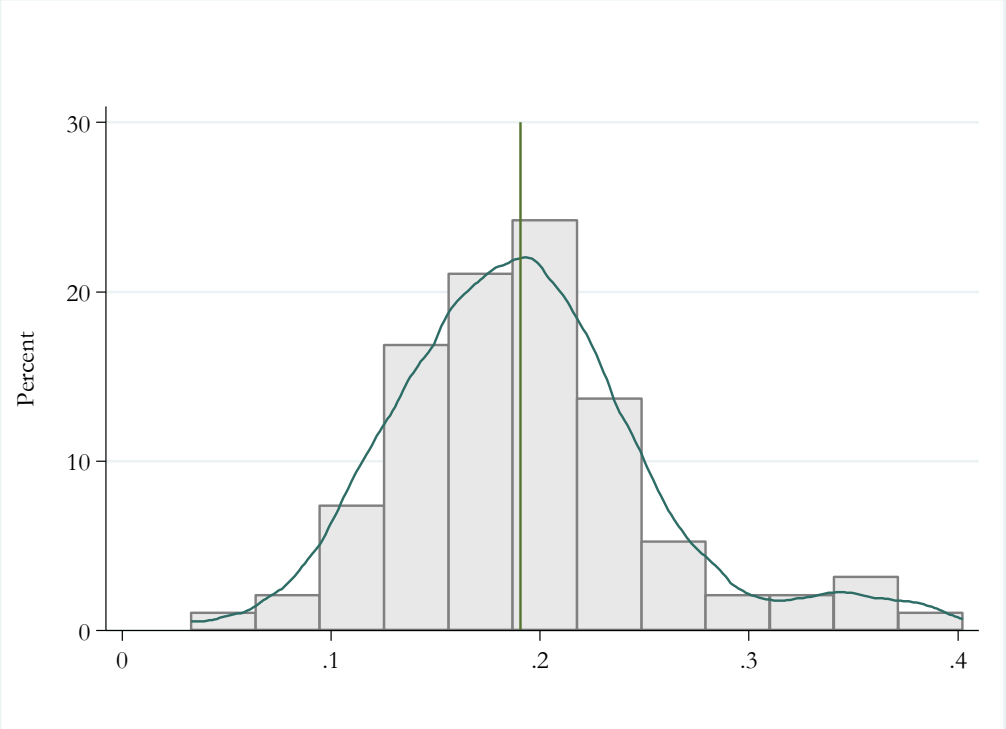
Figure 1: TennCare Enrollment 2000-2013



Source: http://www.tn.gov/tenncare/news.shtml

Figure 2: Variation in TennCare Enrollment and Disenrollment across Counties

Panel A: Enrollment Variation



Panel B: Disenrollment Variation

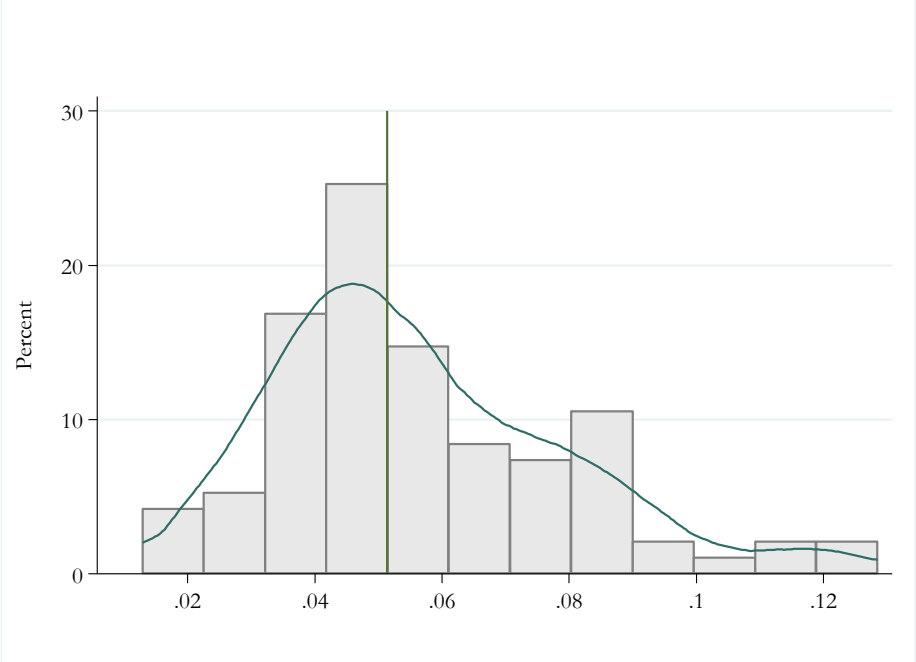


Figure 3: Distributions of Effects of Disenrollment on Credit Scores

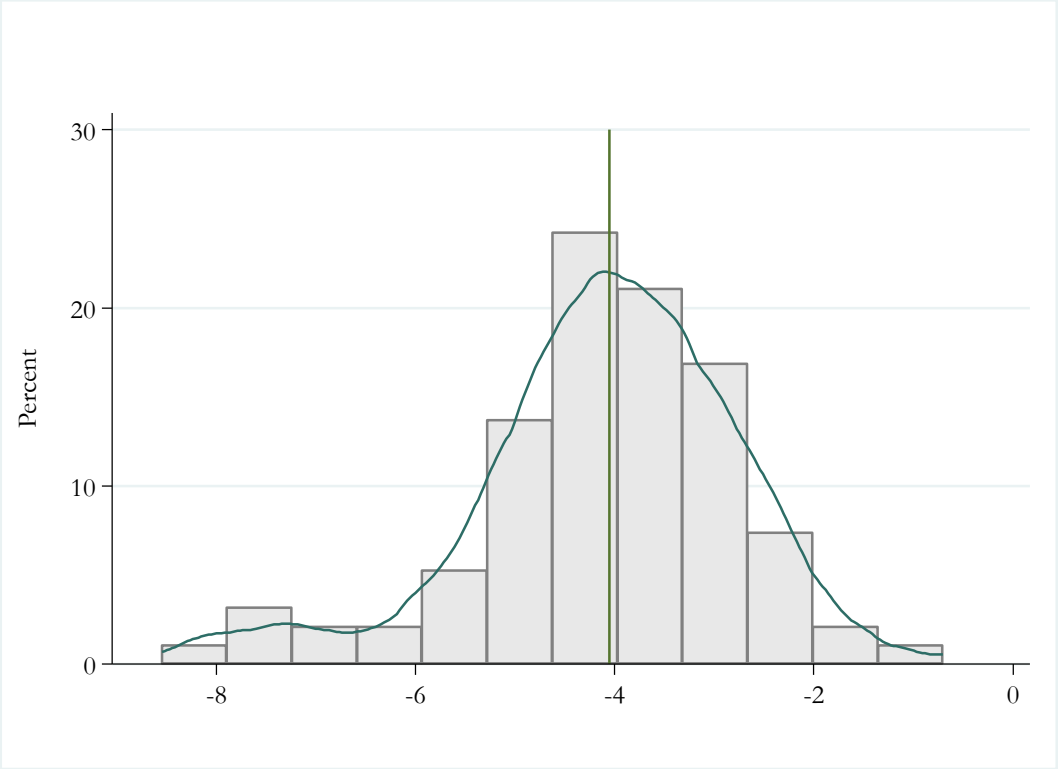
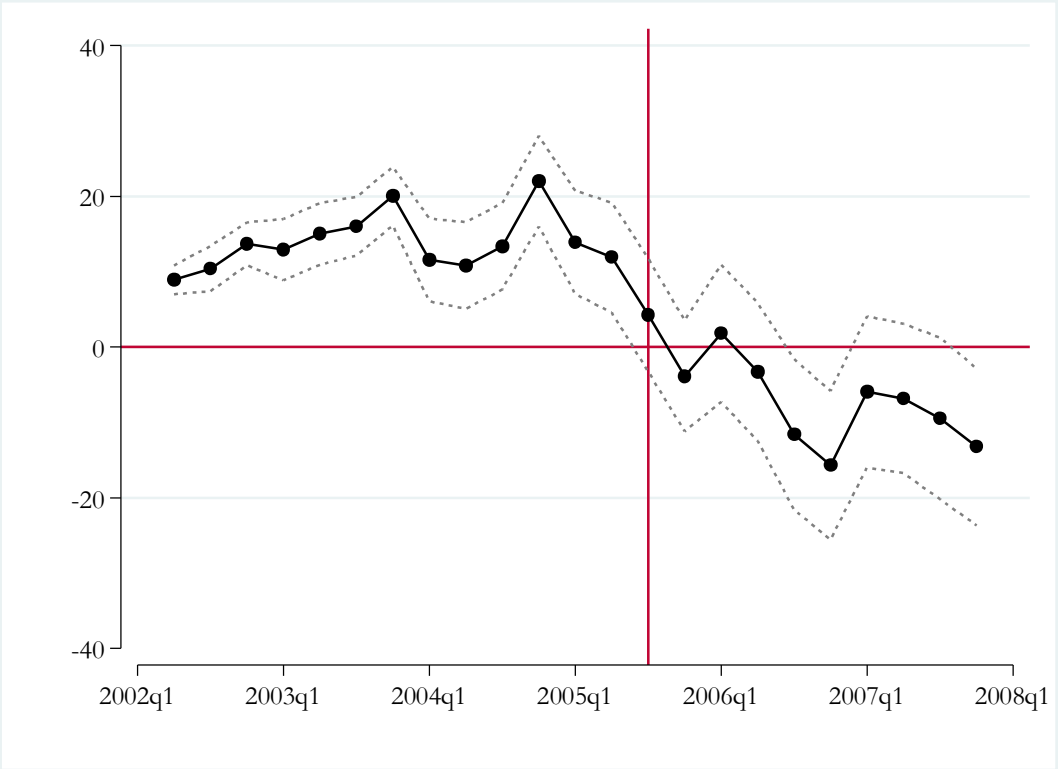


Figure 4: Event Study: Credit Risk Score



Data Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Figure 5: Uninsured rates by age groups

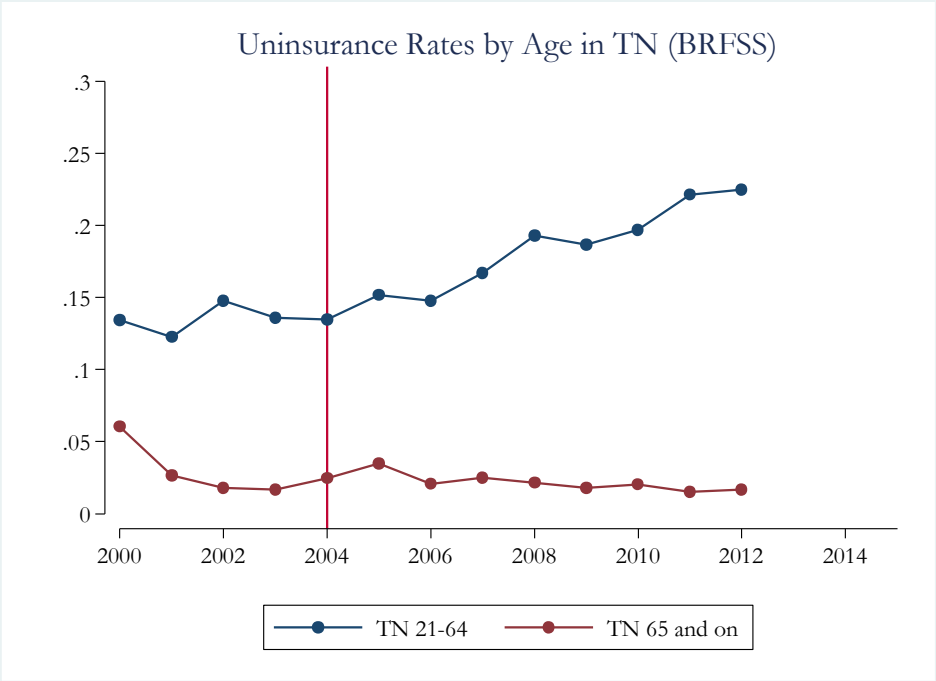


Table 1. Sample Summary Statistics

	All Ages		21-64		65 +	
	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform
Credit (Risk) Score	735.4724	742.7972	724.3943	732.4465	768.612	773.7608
	(-66.7486)	(-77.1577)	(-68.2456)	(-80.8814)	(-48.8412)	(-53.9783)
Severely Delinquent Debt	-	428.1885	-	520.0002	-	153.5362
		(-6856.577)		(-7737.719)		(-2905.65)
Share of Debt that severely delinquent	-	0.0118	-	0.0132	-	0.0079
		(-0.0963)		(-0.1008)		(-0.0812)
Number of Delinquent Accounts	-	0.057	-	0.0685	-	0.0226
		(-0.4537)		(-0.5051)		(-0.238)
Share of Delinquent Accounts	-	0.0126	-	0.0146	-	0.0065
		(-0.0897)		(-0.0964)		(-0.0653)
Severe Delinquency	-	0.029	-	0.0339	-	0.0144
		(-0.1678)		(-0.1809)		(-0.1193)
Bankruptcy 24 Months	-	0.0078	-	0.0093	-	0.0033
		(-0.0878)		(-0.0958)		(-0.0576)
Number of Individual-year observations	1,644,846	822,423	1,232,756	616,378	412,090	206,045
Number of Individuals	117,489	117,489	88,054	88,054	29,435	29,435

Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 2. Dose Response (DR) Model of the Effect of Disenrollment on Financial Outcomes: Sample of Adults 21-64

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
Pre-Reform TennCare Rate x During (DR)	-10.72***	175.2	0.020***	0.065***	0.022***	0.025***	0.007***
	(3.195)	(232.6)	(0.004)	(0.019)	(0.004)	(0.004)	(0.002)
Pre-Reform TennCare Rate x Post (DR)	-21.25***	749.37*	0.049***	0.150***	0.050***	0.017***	0.004**
	(4.548)	(414.31)	(0.007)	(0.044)	(0.008)	(0.004)	(0.002)
N x T	2,113,296	2,113,296	2,113,296	2,113,296	2,113,296	2,093,798	2,107,876
Post DR x 0.1470 (Median PRTR across individuals)	-3.124	110.157	0.007	0.022	0.007	0.003	0.001
Post DR x 0.1913 (Median PRTR across Counties)	-4.065	143.354	0.009	0.029	0.010	0.003	0.001

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, year and quarter fixed effects, as well as controls for local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. The number of individuals (N) for the elderly group is 31,629. Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 3. Share of Sample by Fannie Mae Risk Categories

Credit Risk Score Category	Credit Risk Score (R) Range	All Ages		21-64		65 +	
		Pre-Reform	Post-Reform	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform
R1	330≤R1<660	0.1447	0.1351	0.1791	0.1649	0.0417	0.0457
		(0.3518)	(0.3418)	(0.3834)	(0.3711)	(0.1999)	(0.2088)
R2	660≤ R2< 740	0.2831	0.2165	0.3209	0.246	0.1698	0.1281
		(0.4505)	(0.4118)	(0.4668)	(0.4307)	(0.3755)	(0.3342)
R3	R3≥740	0.5723	0.6485	0.5	0.5891	0.7885	0.8262
		(0.4947)	(0.4774)	(0.5)	(0.492)	(0.4084)	(0.3789)

Notes: Standard deviations in parentheses Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 4. Dose Response (DR) Model of the Effect of Disenrollment on Financial Outcomes by Initial Credit Score Category: Sample of Adults 21-64

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
Panel A (DR) Credit Score CategoryR1 (N=18,856)							
Pre-Reform TennCare	-27.576***	-1223.864*	0.028*	-0.003	0.033**	0.029*	0.005
Rate x During (DR)	(6.833)	(564.385)	(0.014)	(0.051)	(0.012)	(0.011)	(0.006)
Pre-Reform TennCare	-40.341***	-819.172	0.067**	-0.038	0.056*	0.012	-0.001
Rate x Post (DR)	(10.959)	(1227.033)	(0.023)	(0.111)	(0.022)	(0.009)	(0.005)
N x T	452,544	452,544	452,544	452,544	452,544	439,633	449,929
Panel B (DR) Credit Score Category R2 (N=29,278)							
Pre-Reform TennCare	-19.064**	86.430	0.013*	0.025	0.012*	0.011	0.009*
Rate x During (DR)	(5.995)	(333.197)	(0.006)	(0.022)	(0.006)	(0.007)	(0.004)
Pre-Reform TennCare	-38.363***	54.031	0.030**	0.079*	0.032***	0.012**	0.003
Rate x Post (DR)	(8.184)	(377.990)	(0.009)	(0.037)	(0.008)	(0.004)	(0.002)
N x T	702,672	702,672	702,672	702,672	702,672	697,570	700,438
Panel C (DR) Credit Score Category R3 (N= 39,920)							
Pre-Reform TennCare	-8.658*	325.052**	0.006***	0.036***	0.005**	0.011***	0.001
Rate x During (DR)	(3.432)	(96.204)	(0.002)	(0.010)	(0.001)	(0.003)	(0.001)
Pre-Reform TennCare	-12.689***	489.889**	0.013***	0.070***	0.012***	0.004	0.001
Rate x Post (DR)	(3.642)	(156.314)	(0.003)	(0.016)	(0.003)	(0.002)	(0.001)
N x T	958,080	958,080	958,080	958,080	958,080	956,595	957,509

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, year and quarter fixed effects, as well as controls for local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259.
Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 5. Dose Response (DR) Model of the Effect of Disenrollment on Different Financial Outcomes: Sample of Adults 21-64

	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts
Panel A (DR) All Mortgages				
Pre-Reform TennCare Rate x During (DR)	-165.833	0.0003	-0.0004	-0.00002
	(179.077)	(0.002)	(0.002)	(0.002)
Pre-Reform TennCare Rate x Post (DR)	119.534	0.006*	0.006	0.006*
	(312.974)	(0.003)	(0.003)	(0.003)
N x T	2,113,296	2,113,296	2,113,296	2,113,296
Panel B (DR) All Auto Loans				
Pre-Reform TennCare Rate x During (DR)	77.491***	0.005***	0.007***	0.005***
	(20.811)	(0.001)	(0.002)	(0.001)
Pre-Reform TennCare Rate x Post (DR)	146.170***	0.012***	0.015***	0.012***
	(34.825)	(0.002)	(0.003)	(0.002)
N x T	2,113,296	2,113,296	2,113,296	2,113,296
Panel C (DR) All Revolving				
Pre-Reform TennCare Rate x During (DR)	325.092**	0.025***	0.050***	0.020***
	(133.234)	(0.005)	(0.010)	(0.003)
Pre-Reform TennCare Rate x Post (DR)	577.511*	0.052***	0.089**	0.028***
	(278.612)	(0.010)	(0.028)	(0.006)
N x T	2,113,296	2,113,296	2,113,296	2,113,296

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, year and quarter fixed effects, as well as controls for local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 6. Differential Dose Response (DDR) Model of the Effect of Disenrollment on Financial Outcomes: Sample of All Adults

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
Pre-reform TennCare Rate x Age 21 to 64 x During (DDR)	-12.461***	589.352***	0.019***	0.091***	0.022***	0.028***	0.006***
	(2.100)	(102.855)	(0.002)	(0.012)	(0.003)	(0.002)	(0.001)
Pre-reform TennCare Rate x Age 21 to 64 x Post (DDR)	-16.782***	1098.312***	0.029***	0.154***	0.034***	0.021***	0.008***
	(3.705)	(254.349)	(0.005)	(0.026)	(0.005)	(0.003)	(0.001)
N x T	2,819,736	2,819,736	2,819,736	2,819,736	2,819,736	2,797,691	2,813,622
DDR x 0.1470 (Median Pre-Reform TennCare Rate for All Individuals)	-2.467	161.452	0.004	0.023	0.005	0.012	0.004
DDR x 0.1913 (Median Pre-Reform TennCare Rate for All Counties)	-3.210	210.107	0.006	0.029	0.006	0.016	0.005

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, county, year and quarter fixed effects, as well as controls for dwelling type and local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. The number of individuals (N) for the elderly group is 31,629. The number of individuals for the DDR model is 124,888.
Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 7. Differential Dose Response (DDR) Model of the Effect of Disenrollment on Financial Outcomes: Sample of Adults 55-74

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
Pre-reform TennCare	-6.333***	189.605	0.011***	0.046***	0.010***	0.013***	0.002
Rate x age 55-64x	(2.259)	(117.811)	(0.003)	(0.015)	(0.003)	(0.002)	(0.002)
During (DR)							
Pre-reform TennCare	-8.364**	407.052	0.012*	0.052*	0.012*	0.010***	0.003
Rate x Post (DR)	(3.712)	(267.559)	(0.007)	(0.030)	(0.007)	(0.003)	(0.002)
N x T	1,184,808	1,184,808	1,184,808	1,184,808	1,184,808	1,178,881	1,182,745

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, county, year and quarter fixed effects, as well as controls for dwelling type and local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. The number of individuals (N) for the elderly group is 31,629. The number of individuals for the DDR model is 124,888.
Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 8. Dose Response (DR) Model of the Effect of Disenrollment on Financial Outcomes (Using County Rate of Dropping off TennCare): Sample of Adults 21-64

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
TennCare Drop Rate x During (DR)	-33.719***	-494.336	0.038***	0.076	0.043**	0.042*	0.012
	(7.533)	(750.884)	(0.014)	(0.089)	(0.017)	(0.022)	(0.008)
TennCare Drop Rate x Post (DR)	-46.459***	-2516.951	0.072	0.124	0.075	0.025769*	0.002083
	(14.137)	(2832.204)	(0.045)	(0.202)	(0.046)	(0.015)	(0.006)
N x T	2,113,296	2,113,296	2,113,296	2,113,296	2,113,296	2,093,798	2,107,876
DR x 0.0387 (Median TennCare Drop for All Individuals)	-1.798	-97.406	0.003	0.005	0.003	0.002	0.000
DR x 0.0550 (Median TennCare Drop for All Counties)	-2.555	-138.432	0.004	0.007	0.004	0.002	0.001

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, county, year and quarter fixed effects, as well as controls for dwelling type and local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. The number of individuals for the DDR model is 124,888. Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table 9. Differential Dose Response (DDR) Model of the Effect of Disenrollment on Financial Outcomes (Using County Rate of Dropping off TennCare): Sample of All Adults

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
TennCare Drop Rate x Age 21 to 64 x During (DDR)	-50.075***	868.815	0.061***	0.235***	0.063***	0.095***	0.023***
	(7.037)	(744.323)	(0.008)	(0.053)	(0.011)	(0.007)	(0.004)
TennCare Drop Rate x Age 21 to 64 x Post (DDR)	-63.186***	469.775	0.082***	0.322**	0.082***	0.057***	0.023***
	(11.337)	(1901.048)	(0.018)	(0.125)	(0.023)	(0.009)	(0.004)
N x T	2,819,736	2,819,736	2,819,736	2,819,736	2,819,736	2797691	2813622
DDR x 0.0387 (Median TennCare Drop for All Individuals)	-2.445	18.180	0.003	0.012	0.003	0.002	0.001
DDR x 0.0550 (Median TennCare Drop for All Counties)	-3.475	25.838	0.005	0.018	0.004	0.003	0.001

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, county, year and quarter fixed effects, as well as controls for dwelling type and local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the 21-64 group is 93,259. The number of individuals (N) for the elderly group is 31,629. The number of individuals for the DDR model is 124,888. Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*

Table A1. Dose Response (DR) Model of the Effect of Disenrollment on Financial Outcomes: Sample of Medicare-Age Eligible

	Credit (Risk) Score	Severely Delinquent Debt	Share of Debt that is Severely Delinquent	Number of Delinquent Accounts	Share of Delinquent Accounts	Having Any Severely Delinquent Debt (Hazard Model)	Bankruptcy in the Past 24 Months (Hazard Model)
Pre-Reform TennCare Rate x	7.569	-284.978*	-0.011***	-0.031***	-0.005	-0.005	-0.001
During (DR)	(4.910)	(145.736)	(0.004)	(0.011)	(0.004)	(0.004)	(0.002)
Pre-Reform TennCare Rate x	-8.017	-174.355	0.006	0.002	0.011	0.003	-0.001
Post (DR)	(5.787)	(200.332)	(0.006)	(0.021)	(0.006)	(0.003)	(0.001)
N x T	706,440	706,440	706,440	706,440	706,440	703,893	705,746
DR x 0.1470 (Median Pre-Reform TennCare Rate for All Individuals)	-1.178	-25.630	0.001	0.000	0.002	0.000	0.000
DR x 0.1913 (Median Pre-Reform TennCare Rate for All Counties)	-1.534	-33.354	0.001	0.000	0.002	0.001	0.000

Notes: Standard errors are clustered at the county-level (95 counties). All models were estimated using the HDFE command in STATA, and include individual, age, year and quarter fixed effects, as well as controls for local unemployment rate. {***} p<0.01 {**}p<0.05 {*}p<0.10. The number of individuals (N) for the Medicare age eligible group (age 65 and older) is 31,629. Source: *Federal Reserve Bank of New York Consumer Credit Panel/Equifax*