Minimum Wages and Consumer Credit: Effects on Access and Borrowing

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Abstract

This paper examines how minimum wages affect lender and borrower interactions with consumer credit markets. We find that higher state minimum wages: increase the supply of unsecured credit, reduce payday loan usage, decrease delinquency, and increase credit scores. Overall, minimum wages reduce borrowing costs and have positive spillover effects on disposable income and liquidity. A back-of-the-envelope of the cost savings indicates that higher minimum wages increase disposable income by 1.3 percent more than implied by estimates of the direct effect on earnings.

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Does minimum wage policy affect lender and borrower interactions in consumer credit markets? Interactions with consumer credit markets play a crucial role in many families' economic wellbeing: borrowing helps families smooth across income or expenditure shocks, access to credit enables wealth- or productivity- enhancing investments, and the size of debt service payments affects disposable income, consumption and saving. Thus, depending on how minimum wages affect credit market interactions, they could either weaken or amplify the policies' intended effect on income and family finances.

In this paper, we examine empirically how state minimum wage policy affects lender and borrower behavior in mainstream unsecured credit markets (for example, credit cards), as well as markets for high-cost alternative credit products (for example, payday loans). We use data on three different aspects of credit markets: direct mailings of credit offers as a measure of lenders' provision of credit supply, survey data on borrowers' usage of high-cost credit, and panel data derived from credit reports to measure borrowing outcomes in mainstream unsecured credit markets.

Our empirical strategy is a fixed effects approach that exploits state-month variation in minimum wage policy, controlling for time-varying state economic conditions. Identification is based on comparing the effects of higher state minimum wage policies on lower-income or less-educated households —that is, those who are most likely to be affected by the policy— with other types of households. By employing comparisons across states, time and household types, our estimates isolate the credit market effects of higher minimum wages on households earning near the minimum wage, controlling for any changes in credit markets experienced by all households in a particular state, as well any changes over time in the overall credit market experiences of lower-income or less-educated households.

Our analysis yields several novel empirical findings. First, higher minimum wages increase the number of credit card offers sent by lenders to low-income households, and increase the favorability of their terms to households. Second, higher minimum wages reduce usage of payday loans and other high-cost alternatives to formal credit. Third, higher minimum wages increase credit card limits, reduce delinquencies, and improve credit scores among less-educated borrowers; these patterns persist one year out among those who obtained access to additional

credit. These findings complement and extend empirical work by Aaronson, Agarwal, and French (2012), which documents the consumption and debt response to minimum wage hikes and shows that low-income families take out loans to purchase cars following an increase in the minimum wage.

Of course, minimum wage policy does not develop randomly across space or time. In order to interpret our results as causal, we must assume states with higher minimum wages do not differ on other dimensions that would have led to improved credit outcomes for lower-income or less-educated workers in the absence of a minimum wage change. To probe this assumption, we conduct a number of robustness tests on our empirical specification, following the insights of Allegretto et al. (2017). In particular, we employ models with regional and parametric trend controls in order to allow for spatial heterogeneity in minimum wage policy, and estimate models with controls for time-varying state-level social policies that might be correlated with minimum wages and credit outcomes. We also estimate models with a lead in the minimum wage to explicitly test for parallel trends among lower-income or less-educated households, across states with higher or lower minimum wages. We find our results are robust to all of these variations in our research design.

A complete accounting of our results reveals that minimum wages reduce borrowing costs for low-income borrowers—increasing borrowers' disposable income above and beyond the policy-mandated wage increase. Our estimates indicate that higher minimum wages reduce payment delinquency and payday borrowing, which are both associated with high fees and interest rates. A back of the envelope estimate suggests the reduction in borrowing costs are substantial: a $1 increase in the minimum wage would save low-income borrowers up to $55 million in fees and interest annually. Because of these reduced borrowing costs, the average effect of higher minimum wages on disposable income (that is, income net of debt service payments) is about 1.3 percent larger than estimates of the direct earnings effect. To our knowledge, this amplification of the income effect of minimum wages via its impact on borrowing costs has not been previously explored.

Our results also indicate a liquidity-enhancing effect of minimum wages operating through increased credit supply. For example, we find that the average borrower's credit limit

increases by $466, which is larger than the typical payday loan and also exceeds what a large share of U.S. families have available in savings to pay for emergencies (PEW 2016; Bhutta and Dettling 2018). This suggests that the changes in credit supply we observe translate to economically meaningful increases in liquidity that could be used to weather future expenditure shocks. And although this increase in credit card liquidity could have harmed borrowers' overall financial well-being if it led those families to accumulate debt burdens they could not manage, we find payment delinquency *falls*.

Our results suggest that higher minimum wages could have persistent, positive effects on a household's financial well-being through improvements in credit records. After all, credit scores and payment histories are key components used in underwriting credit applications for lumpy investments like homes, vehicles or education.[1] Also, credit reports are used to screen rental and job applications, which can directly affect housing affordability and employment. Indeed, a growing literature suggests expanded access to credit can improve labor market outcomes (Carrell and Zinman 2014; Karlan and Zinman 2010), suggesting the possibility of a positive feedback loop.

Our results highlight two unintended, and newly documented, ways that minimum wage policy could spill-over to other areas of policy interest. First, payday borrowing is a central policy concern because of the high costs to borrowers, and a perception that payday lenders exploit financially distressed families. Our results support the notion that payday loan usage reflects lack of income and/or access to cheaper credit, rather than say, borrower irrationality or mistakes. Second, delinquency is costly not just for borrowers, but also to the financial system since lenders must eventually charge off unsecured loans that remain in default. Consistent with recent empirical work by Dobbie and Song (2015) and Hsu, Matsa, and Melzer (2018), our results suggest social policy can bolster financial stability by averting defaults.

The vast majority of the public and academic debate on minimum wage policy concerns the size and nature of disemployment effects, and whether those effects offset earnings gains for employed workers. We do not observe employment status in most of our data and therefore cannot

[1] Several papers analyze the importance of asset ownership (such as vehicles or homes) – which is often financed by borrowing – for labor market advancement and wealth accumulation (for example, Baum 2009; Herbert, McCue, and Sanchez-Moyano 2013)

speak directly to whether disemployment effects exist. But, we might expect individuals who lose their jobs to enter delinquency, so one interpretation of the decline in delinquency we observe is that it is not consistent with widespread disemployment effects among adults. In any case, the evidence we present here suggests that cost-benefit considerations for minimum wage policy should also consider spillover effects on adult families' borrowing costs and liquidity stemming from lender and borrower behavior in credit markets.

The rest of the paper is organized as follows. Section 1 describes the framework we use for understanding how minimum wages affect how low-income households interact with credit markets. Section 2 presents our empirical analysis, including a description of minimum wages in the US, the three datasets we use, empirical strategies, and results. We begin with an analysis of credit card offers, then proceed to usage of alternative financial service credit products like payday loans in survey data, and finally examine credit limits, delinquency, and credit scores using credit report data. We also perform a series of extensions and robustness checks. Finally, we take stock of our results, perform a number of back-of-the-envelope calculations for context, and disentangle the relevant mechanisms and policy implications in section 3.

1. Conceptual Framework and Related Literature

A vast empirical literature in economics is devoted to understanding the effects of minimum wage policy on labor market outcomes of affected workers. The general consensus emerging from this literature is that a substantial majority of adult minimum wage workers experience positive earnings effects following a minimum wage increase.[2] One way we expect minimum wages to affect households' interactions with credit markets is via their effects on household income.

The first empirical paper to establish a link between minimum wage policy and borrowing behavior was Aaronson, Agarwal, and French (2012). They document the income and

[2] The important contributions to this literature are too numerous to adequately review here. Excellent literature reviews include Card and Krueger (1995), Neumark and Wascher (2008), and Belman and Wolfson (2014). This literature is active and contentious, and there are studies that have estimated negative employment effects of the minimum wage. Still, many of those papers have demonstrated effects on younger teen workers only, who do not typically do not interact with credit markets and are therefore omitted from our analyses. Our reading of the consensus results is that minimum wages tend to lift earnings for low income adult workers, at least on average.

consumption response to minimum wage hikes, and find that although both rise following a minimum wage increase, the consumption response is nearly three times larger than the income response. This excess consumption is financed by increases in collateralized debt, mainly via a small number of families making debt-financed vehicle purchases. These patterns best fit a model in which higher minimum wages ease collateral constraints, so that increases in income permit families to accumulate small down payments which can be used for purchases of large durables (vehicles).[3]

In addition to easing collateral constraints, minimum wages might also affect borrowing by expanding the supply of unsecured credit to low-income borrowers. All else equal, lenders are generally willing to extend more credit, and at cheaper terms, to households with higher ability to pay. And if low-income borrowers use their increased earnings to improve their credit records (perhaps by paying down existing debts) this could further increase the supply of credit available to those borrowers. Lenders may also respond to the policy itself, perhaps by assuming that ability to pay will increase for a segment of the population in a particular state.

If minimum wage workers were otherwise credit or liquidity constrained, an increase in credit supply could lead to more borrowing. Indeed, credit and liquidity constraints are a salient feature of minimum wage workers' financial lives; data from the 2001-2013 waves of the Survey of Consumer Finances (SCF) indicate nearly 40 percent of households with adult minimum wage workers are credit constrained (appendix table 1). Some families may not need credit because they have other sources of liquidity, such as savings or family and friends they could turn to in an emergency. However, the SCF data show this is unlikely to be the case for minimum wage workers: the median minimum wage household holds less than two thousand dollars in liquid savings (a tenth of the amount held by the median U.S. household) and only about half of these families report being able to obtain $3,000 from friends and family.

Households who are unable to borrow in traditional credit markets can often still borrow via higher-cost alternative financial service (AFS) credit products, including unsecured debt such as payday loans, and secured debt such as pawn shop loans, auto title loans and "rent-to-own"

[3] Although our paper focuses on unsecured borrowing, appendix table 2 provides comparable estimates of effects on collateralized borrowing using our data and estimation strategy.

furniture agreements.[4] Payday loans and other AFS credit products are offered with minimal underwriting (typically only proof of income or employment is required) and are characterized by very high effective interest rates. If low-income households use these products because they face borrowing constraints in traditional credit markets, an increase in the supply of traditional credit could lead to substitution away from high-cost alternatives to formal credit. Indeed, Bhutta, Skiba, and Tobacman (2015) find that payday borrowers often shop (unsuccessfully) for traditional credit just before taking out a payday loan.

In addition to possibly facing barriers to borrowing in traditional markets, behavioral biases or financial illiteracy might be another possible reason some low-income borrowers might utilize AFS borrowing (Bertrand and Morse 2011; Lusardi and de Bassa Scheresberg 2013). If borrowers are sufficiently present-biased, or have forecasting problems (e.g., Laibson 1997; Skiba and Tobacman 2008; Heidhues and Kőszegi 2010), the relaxation of credit constraints could lead to over-borrowing and a rise in delinquency as borrowers face difficulties servicing their new debt obligations.

For low-income workers who do not need additional credit, increases in the minimum wage might reduce borrowing and delinquency among borrowers with existing traditional or AFS debt, if borrowers are in need of less debt-financed liquidity and/or choose to save new income via debt pay-down. Hsu, Matsa, and Melzer (2018) find that unemployed borrowers use unemployment insurance income to avert mortgage default. Similarly, Agarwal, Liu, and Souleles (2007) and Sahm, Shapiro, and Slemrod (2010) find evidence that borrowers use tax rebates to pay down debts.

Throughout this discussion we have suggested that minimum wages only positively affect income for adults. While useful for simplifying the exposition, our empirical analysis will be reduced form in nature and agnostic about the size and direction of the effects of minimum wages on income. If there are disemployment effects for adults, then income may fall for some workers, and our predictions for the impacts on credit markets would generally work in the reverse for those workers. We would expect these effects to be most evident on measures of

[4] Some states ban payday lending in the period we study. However, Bhutta, Goldin, and Homonoff (2016) find these policies lead borrowers to use alternative AFS credit products, rather than discontinuing borrowing or using traditional credit.

financial distress which are relatively uncommon and typically associated with job loss, such as payment delinquency. Ultimately, the overall reduced form impact of minimum wages on credit markets is an empirical question that we seek to answer.

2. Empirical Analyses

2.1 Minimum Wages

Minimum wage legislation in the United States has a long history, dating back to the early 1900s. While originally adopted by states, the first federal minimum wage was enacted in 1938 with the Fair Labor Standards Act. Since then, the federal minimum wage has grown periodically (though not always at pace with inflation), and various states have adopted minimum wages above the federal level. In this paper, we use monthly state-level minimum wage data from Neumark, Salas, and Wascher (2014), which we update through 2015 using Economic Policy Institute's Minimum Wage Tracker.[5] Table 1 highlights the various state-level changes in the minimum wage during the time period we study in this paper 1999-2015. There is considerable cross-sectional variation in the minimum wage across states and over time during this period, ranging from $5.15 to $10.50. The most recent change in the federal minimum wage became effective July 2009, increasing from $6.55 to $7.25.

2.2 Credit Offers

3.2.1 Data and Empirical Specification

For our first set of analyses, we use information on traditional credit offers obtained from direct mail advertising data from 1999 to 2015 compiled in the Mintel Credit Cards and Mortgage & Loan Databases (henceforth, Mintel). Mintel collects data from a sample of about 1,000 households each month, surveying household socioeconomic characteristics, in addition to compiling information from all mail-based credit and sales advertising, including credit card, mortgage, auto, and unsecured loan offers received by the household during the month.[6] The

[5] The Minimum Wage Tracker can be accessed online at http://www.epi.org/minimum-wage-tracker/.
[6] We limit the sample to households where the head is aged 18-64 in this and all subsequent analysis in order to exclude retirees and younger teenagers. We exclude teenagers under age 18 (despite their prominence in the

data also include the terms of credit when specified by the offers, including interest rates, credit limits and whether a credit card has rewards and an annual fee. For more on the Mintel data as a measure of credit supply, see Han, Keys, and Li (2018).

Our main analyses will focus on credit card offers, since they represent the vast majority of credit offer mailings and are the main source of unsecured credit in traditional credit markets. We will examine various features of credit card offers, including credit limits, interest rates, annual fees, and whether or not the offers are pre-approved (rather than invitations to apply or pre-selected offers). These outcomes are designed to capture the amount of credit supplied (for example, the number of offers, credit limits and pre-approval) and the cost of borrowing (for example, interest rates and fees).

Importantly, the Mintel data include information on household income, household size, and the state of residence, which allows us to identify the subset of households which are likely to have a minimum wage worker. We identify these households, which we call "minimum wage households," using guidance from the previous literature, as those whose household income implies an hourly wage (with full-time, full-year work, adjusted for number of earners) between 60 and 120 percent of the state minimum wage (this is similar to Aaronson, Agarwal, and French 2012).[7] Table 2 summarizes the outcome variables and general socioeconomic characteristics of both the full sample (columns 1-2) and minimum wage households (columns 3-4) in the Mintel data.

One might be concerned that identifying minimum wage households using a range of incomes around the minimum wages leads to mismeasurement of the "treatment group," and one might prefer data which included the hourly wage so that we could precisely identify treated minimum wage households. But even if the hourly wage were available in this dataset, research has shown that there are ripple effects of minimum wages increases on individuals earning more than the minimum wage (e.g., Autor, Manning, and Smith 2016; Dube 2019). Thus, including only minimum wage workers would likely underestimate the number of families who benefit

minimum wage literature) because they typically do not have credit reports and therefore would typically not receive credit offers (nor would they be included in the credit report data we use in subsequent analyses).

[7] The data description in the appendix provides additional details about the construction of the sample, outcome variables, and treatment group for these and all subsequent analyses.

from the policy, and potentially lead our higher income group to be contaminated with affected workers.[8]

We estimate ordinary least squares regressions of the following form:

$$y_{ist} = \beta_1 minwage_{s,t-3} * minwagehousehold_{it} + \beta_2 minwage_{s,t-3} + \beta_3 minwagehousehold_{it} + X_{it} + unemp\,rate_{st} + \gamma_s + \gamma_m + \varepsilon_{it} \quad (1)$$

where y_{ist} is the credit offer outcome of interest for household *i* in state *s* in month *t.* $minwage_{s,t-3}$ is the minimum wage in state *s* in month *t-3* (one quarter prior). We use a three month lag to be consistent with the timing in the credit report data used in section 2.4, which is available quarterly.[9] $minwagehousehold_{it}$ is the indicator for whether or not the household is identified to have a minimum wage worker. X_{it} is a vector of demographic characteristics of the household (education, race/ethnicity, and age group), γ_s is a vector of state fixed effects, γ_m is a vector of month fixed effects. Standard errors are adjusted for clustering at the state level.

In these regressions, the coefficient of interest β_1 captures the conditional effect the state-level minimum wage on credit card offers to minimum wage households. In other words, β_1 describes how a higher minimum wage affects the credit offers received by households who are most likely to be affected by changes in policy because of their incomes. β_2 captures the conditional main effect of state-level minimum wages on credit card offers. We interpret this as the effect of higher minimum wages on households who should not be affected by the policy because of their incomes.[10] In this setting, these households act as a control group, so this coefficient will capture any changes in credit availability that may be correlated with minimum wage policy, such as changes in the general economic environment. The level term $minwagehousehold_{it}$ captures the correlation between minimum wage household status and credit offers. We include the main effect of minimum wage status to facilitate a causal

[8] In the extensions in section 2.5.2 we explore how our estimates change if we employ more flexible specifications of the "treatment group" across a number of dimensions.
[9] Appendix table 3 displays alternative specifications using a one month or twelve month lag of the state minimum wage. Note that this data only covers the continental U.S.
[10] The vast majority of this group is households with higher incomes than those in the minimum wage household group. Henceforth we will refer to these as "higher income households", though a small fraction (under 10 percent) of this group have lower imputed hourly wages than minimum wage workers (below 60 percent of the minimum wage).

interpretation of the interaction term β_1, but do not assign a causal interpretation to the coefficient on the main effect since the level correlation between credit offers and borrower type could be determined by a host of different factors, like average credit scores or home ownership rates.

We also control for time-varying state-level economic conditions that might affect credit offers. In particular, our analysis also includes the state-month unemployment rate ($unemp\ rate_{st}$), drawn from the Bureau of Labor Statistics (BLS) local area unemployment statistics. And our analyses also importantly include state and month fixed effects (γ_s and γ_m). This ensures that the estimated relationship between minimum wages and credit offers is not confounded by time-invariant differences in credit offers to states with higher or lower minimum wages, or national trends in minimum wage levels and credit availability.[11]

3.2.2 Results for Credit Offers

Table 3 presents the results of estimating equation (1) on the outcomes of interest. Column (1) of table 3 presents the result for the number of credit card offers received in the month of the survey. This specification yields a point estimate on the interaction term between minimum wage worker status and the minimum wage (β_1) of 0.117 (with a standard error of 0.040). This indicates that minimum wage workers receive more credit card offers when minimum wages are higher. At the mean, these estimates imply that a $1 increase in the minimum wage would increase the number of credit card offers received by a low-income household by 5.1 percent.

In contrast, we see that the conditional main effect of the minimum wage is small and imprecisely estimated, indicating that higher minimum wages have no effect on the number of offers received by higher-income households. The coefficient on $minwagehousehold_{it}$ indicates that, on average, low-income households receive 2.184 (0.24) fewer credit card offers per month than higher-income households. This is consistent with minimum wage households

[11] In the extensions discussed in section 2.5, we further consider additional controls intended to capture heterogeneity in the local economic environment – such as state-specific time trends and census-division month fixed effects (as suggested by Allegretto, Dube, and Reich 2011) and state-time variation in social safety net generosity and usage.

having relatively less credit available to them. Still, the results in table 3 indicate that typical changes in the minimum wage narrow, but do not erase, the offer gap between higher and lower income households. For example, under a $1 higher minimum wage, minimum wage households would still receive 2.07 fewer offers per month than higher income households. Extrapolating, our results imply that the minimum wage would need to increase by over 18 dollars for minimum wage households to receive as many credit card offers as higher income households.

The rest of table 3 narrows in on the terms included in credit card offers received. The sample sizes vary across columns based on whether a household received any offers which specified each feature since not all offer mailings include identical features (for example, a credit limit, whether or not the card carries an annual fee, or an approval status). All of the outcomes are calculated only for the subsample of offers for which the feature is non-missing.[12] Column (2) examines the dollar amount of credit offered—captured by the mean credit limit—and indicates that higher minimum wages are associated with more credit being offered: under a $1 higher minimum wage, credit limits increase by $1,893 ($360), or 7.3 percent at the mean. Note that the credit offers in our data often list limits that are upper bounds on what a consumer might actually be approved for after further underwriting. Thus, while we consider the sign of the change in offered limits as suggestive of an increase in credit supply, we are less confident that the magnitudes themselves are a meaningful estimate of the *dollar* increase in credit the household might actually access. Indeed, when we look at our credit report data in section 2.4 (where we see approved and realized credit limits), we find considerably smaller, but still positive, increases in credit card limits.

Column (3) examines the fraction of offers that are pre-approved. This is a measure of the strength of the offer, since offers which are not pre-approved can be rescinded upon application. Column (3) of table 3 indicates higher minimum wages are also associated with more pre-approved offers – under a $1 higher minimum wage, the fraction of offers that are pre-approved increases by 2.0 percentage points (0.28 percentage points), or 5.3 percent at the mean. The

[12] Credit card offers typically include a subset of all possible features listed in our data. Whether or not a feature is missing from an offer is not necessarily indicative of the quality of the offer or price of borrowing but rather, how a particular offer campaign happens to be structured and marketed. For additional context, appendix table 4 displays the effects of minimum wages on the probability each of the listed features is non-missing from the offers households received.

conditional main effect of the minimum wage in columns (2) and (3) indicates there is no corresponding effect for higher income workers. And the level terms indicate that minimum wage households, on average, are offered lower credit limits and fewer pre-approved offers. Again, we find that a typical minimum wage increase narrows but does not erase the offer gap between higher and lower income households. Extrapolating, our results imply the minimum wage would need to increase 10 dollars in order for minimum wage households to receive as high of credit limits as higher income households, or over six dollars for minimum wage households to receive as many pre-approved offers as higher income households.

The last three columns of table 3 focus on the cost of borrowing, as captured by the mean purchase interest rate (measured as an annual percentage rate, or APR), the fraction of offers for cards with annual fees, and the fraction of offers for cards with fees and no rewards (since rewards cards can have perks, such as airline frequent flyer miles, which offset the annual fee). Column (4) displays the results for the purchase APR, and column (5-6) displays the results for fees. The estimates for purchase APR are imprecisely estimated, but there is compelling evidence that fees are reduced when the minimum wage is higher. A $1 higher minimum wage is also associated with a statistically significant 4.5 percentage point (0.4 percentage point) increase in the fraction of offers with no annual fee (or 6.5 percent at the mean of the dependent variable), and a 2.4 percentage point (0.4 percentage point) reduction in the number of offers with a fee and no rewards (or 10.1 percent at the mean, though this result is somewhat sensitive to the inclusion of leading values of the minimum wage in section 2.5.1). The level term indicates that on average, minimum wage households tend to face higher interest rates and receive more offers with fees (and no corresponding rewards). As before, the minimum wage would need to increase substantially for the borrowing costs offered to high and low-income borrowers to converge. And as in previous specifications, there is no effect of a change in minimum wages on higher income households.

Our preferred interpretation of these analyses is that they represent unsolicited credit offers, and as such, provide a unique opportunity for studying the availability of credit over time for the populations of interest. The evidence we find suggests minimum wage borrowers have more credit available to them when minimum wages are higher, and the credit that is available is less costly. Because our classification of respondents into minimum wage households will

necessarily be imperfect, these analyses yield effects akin to "intent-to-treat" estimates. Our results are thus likely a lower bound on the causal effect for minimum-wage workers. They are also net of any heterogeneity or non-monotonicity in underlying treatment effects.

2.3 Alternative Financial Service (AFS) Credit Products

3.3.1 Data and Empirical Specification

Data on borrowing via AFS credit products come from the Current Population Survey Unbanked and Underbanked Households Supplement (henceforth, CPS), which has been conducted biennially since 2009 by the Federal Deposit Insurance Corporation in partnership with the U.S. Census Bureau.[13] The data include socioeconomic characteristics of households found in the CPS monthly survey, as well as information on usage of AFS credit products, including payday loans, rent-to-own stores, pawn shops, and auto title loans.[14] Each of these products are high-interest loans that do not require a credit check with one of the main credit bureaus. Usually, only proof of employment and a checking account are required. Payday loans are unsecured small-dollar short-term consumer loans, which usually carry an APR of about 400 percent.[15] Pawn shop loans are also small-dollar short-term loans, but they are secured by personal property (e.g., electronics, jewelry). The effective APR on pawn shop loans is usually about 250 percent, and if a borrower does not pay back the loan, the pawn shop keeps the collateral. Rent-to-own loans are loans for durable goods (e.g. furniture, electronics) that are secured by the good in question, which can be repossessed. The cost of purchasing the goods is typically much higher than if purchased directly, and the implied APRs vary from about 57 percent to 250 percent. Auto title loans are loans secured by a clean auto title, wherein default on the loan results in repossession of the vehicle.

We create indicators for household usage of each product in the past year and merge in state-level minimum wage information for 12 months prior to the survey date. We define a

[13] Information on the supplements can be found at https://www.fdic.gov/householdsurvey/
[14] We follow Bhutta, Goldin, and Homonoff's (2016) harmonization of AFS usage across survey waves to accommodate changes in the questionnaire. Usage of AFS products is based on self-reported usage in the past year, which could be subject to non-classical measurement error if families do not want to report that they use AFS products. This would only be a threat to identification if underreporting were systematically correlated with the minimum wage in the borrower's state.
[15] Bhutta, Goldin, and Homonoff (2016) is the source for all statistics on AFS usage in this paragraph.

household as a minimum wage household if their imputed hourly wage is, as before, between 60 to 120 percent of the state minimum wage. The hourly wage is imputed by summing up total hours worked in a year for a family and dividing family income by total hours worked. Table 4 summarizes the data for the entire sample (columns 1-2) and the subsample of minimum wage households (columns 3-4); 3.0 percent of minimum wage households took out a payday loan, 4.0 percent pawned items at a pawn shop, 2.9 percent rented items from a rent-to-own store, and 1.4 percent took out an auto title loan.

We estimate ordinary least squares regressions of the following form:

$$y_{ist} = \beta_1 minwage_{s,t-12} * minwagehousehold_{it} + \beta_2 minwage_{s,t-12} + \beta_3 minwagehousehold_{it} + X_{it} + unemp\ rate_{st-12} + \gamma_s + \gamma_y + \varepsilon_{it} \quad (2)$$

Where y_{ist} is an indicator for use of an AFS product for household *i* in state *s* in the 12 months prior to the month of the survey (*t*). $minwage_{s,t-12}$ is the minimum wage in state *s* in month *t-12* (one year prior). $minwagehousehold_{it}$ is the indicator for whether or not the household is identified to have a minimum wage worker. X_{it} is a vector of demographic characteristics of the household (education, race/ethnicity, and age group). γ_s and γ_y are vectors of state and year fixed effects. Standard errors are adjusted for clustering at the state level.

The coefficient of interest β_1 captures the conditional effect of state-level minimum wages on usage of AFS credit products by minimum wage households. β_2 captures the conditional main effect of state-level minimum wages on usage of AFS credit products. We interpret this as the effect of higher minimum wages on workers who should not be affected by minimum wage policy. The level term $minwagehousehold_{it}$ captures the correlation between minimum wage household status and use of AFS credit products. As before, we include the main effect of minimum wage household to facilitate a causal interpretation of β_1, but do not assign a causal interpretation to β_3 since the level correlation between use of AFS credit products and borrower type could be determined by many different factors.

3.3.2 Results for Alternative Financial Service Credit Products

Columns (1)-(4) of table 5 displays the results for: taking out a payday loans, pawning items at a pawn shop, renting items from a rent-to-own store, and taking out an auto title loan, respectively. For each outcome, the coefficient on the interaction term (β_1) indicates that higher minimum wages reduce usage of AFS products among minimum wage households. For payday loans and rent-to-own stores, these effects are precisely estimated and indicate a statistically significant decrease in usage of those AFS credit products. The coefficients indicate that a $1 increase in the minimum wage would reduce borrowing by 0.49-0.55 percentage points (0.23-0.27). At the mean of the dependent variable, these represent a reduction in usage of AFS credit products by minimum wage households of 16-19 percent.

In contrast, there is a small and statistically insignificant coefficient on the level term, $minwage_{s,t-12}$ for all four outcomes. This indicates there is no effect of higher minimum wages on usage of AFS credit products for higher income households. The level term, *MinimumWageHousehold* is positive for all of the outcomes (and precisely measured for payday and rent-to-own), indicating that, on average, minimum wage households are more likely than other types of households to use AFS products. While the interaction term shows that higher minimum wages would reduce AFS usage for low-income workers, our results suggest that even rather large increases in the minimum wage would not be large enough to eliminate the usage gap between income groups. For example, minimum wage households are 4.1 percentage points more likely to use a payday loan than higher income households, and a $1 higher minimum wage narrows that gap by only about half a percentage point. If we extrapolated from our results, the minimum wage would need to be nearly 9 dollars higher in order to reduce payday loan usage rates among minimum wage households to the usage rates of higher income households. As with the credit offer analysis, we continue to interpret our results as intent-to-treat net effects, which pool potentially mis-classified households and heterogeneous and/or non-monotonic effects.

2.4 Consumer Credit Outcomes: Credit Limits, Payment Behavior, and Credit Scores

3.4.1 Data and Empirical Specification

Data on credit limits, payment behavior and credit scores come from the Federal Reserve Bank of New York Consumer Credit Panel/Equifax (henceforth, CCP/Equifax).[16] The CCP/Equifax is an individual-level panel dataset of consumer credit reports, obtained from one of the three main credit bureaus in the United States. The data have been collected quarterly since 1999 and consist of a five percent random sample of all U.S. consumers with credit histories. The sampling frame is based on Social Security numbers so that once a consumer establishes a credit history and enters the sample, they remain in the sample continuously until death (even if the consumer has no credit activity in a particular quarter). The sample is refreshed each quarter as new individuals establish credit records. The data include detailed information drawn from credit reports, such as loan balances, credit limits, payment status, and the Equifax Risk Score (a type of credit score).[17]

Our main outcomes of interest are measures of borrower-level credit availability, payment behavior, and overall credit risk.[18] To analyze credit availability, we examine total credit limits across all consumer credit cards.[19] We also separately examine limits for individuals who acquired new card(s) in the past quarter and those without new cards. We make this distinction to examine whether individuals are able to qualify for more credit on their existing cards, or if they take out new higher limit cards (perhaps in response to credit card offer mailings). We examine payment behavior using an indicator for credit card delinquency, defined

[16] Additional information about the dataset can be found in Lee and van der Klaauw (2010).
[17] By design, this dataset only includes individuals who have credit reports and we limit the sample to 18-64 year olds. We also eliminate individuals with thin credit records, defined as being in the sample fewer than 4 quarters. We perform all analyses on a 30% random sample of the dataset, which represents a 1.5% sample of all individuals with credit reports.
[18] We do not examine credit card borrowing or spending directly as in Aaronson, Agarwal, and French (2012) because our data do not have a specific measure of total monthly spending on credit cards.
[19] We winsorize credit card limits at 99% to account for extreme outliers in the data. Winsorizing these values at 95% and 97% yields qualitatively similar results. Individuals without credit cards are coded as having a credit limit of zero.

as being 60 days or more past due on payments and zero otherwise.[20] To analyze overall credit risk, we use borrowers' credit scores (specifically, the Equifax Risk Score). Credit scores are a composite measure of credit risk used by lenders in underwriting. Scores are proprietary and can vary by lender, but are typically determined by payment behavior, credit utilization and length of credit history. Table 6 summarizes the data for these analyses.

Because this dataset is a panel, we estimate individual fixed effects models of the following form:

$$y_{ist} = \beta minwage_{s,t-k} + age_{it} + unemp\,rate_{st} + X_{ct} + \gamma_s + \gamma_m + \gamma_i + \varepsilon_{it} \qquad (3)$$

Where y_{ist} is the credit outcome of interest for individual *i* in state *s* in month *t*. $minwage_{s,t-k}$ is the minimum wage in state *s* in month *t-k*, where *k=3* (one quarter prior) or *k=12* (one year prior). We use a three month lag because the data are at a quarterly frequency, and additionally examine a 12 month lag in order to investigate longer run effects on payment behavior and credit scores. age_{it} is vector of dummies for the age group of person *i*, X_{ct} is a vector of census-block/block-group characteristics (education, race/ethnicity, sex and median income), γ_s is a vector of state fixed effects, γ_m is a vector of month fixed effects, and γ_i is a vector of person fixed effects. We include person fixed effects so that we can interpret β as the effect of within-person changes in the minimum wage on within-person changes in our outcomes, net of any fixed characteristics of the borrower (such as their level of education or race/ethnicity, which are not observed in the data). Standard errors are adjusted for clustering at the state level.

The CCP/Equifax has very rich debt information for each individual over time but limited demographic characteristics; only the individual's age and location of residence are available.[21] To overcome this limitation, we proxy for the demographic characteristics of the sample member by merging to the data the demographic and economic characteristics of the individual's census

[20] 60+ day delinquency is equivalent to three or more cycles of missed payments and is a standard measure of credit card delinquency (see, for example, CFPB 2017). Individuals without credit cards are coded as not in delinquency. Estimation on the subsample of credit card borrowers only yields similar results.

[21] Federal law prohibits lenders from discriminating applications on the basis of race, ethnicity, marital status, national origin, religion, or receipt of public assistance, and these demographic characteristics are not included in the data. Geography is included in the data although discrimination on the basis of geography alone is prohibited.

block (or block-group) of residence (X_{ct}), tabulated from the 2000 Census. Census blocks are typically quite small; for example, in an urban area, they are the equivalent of a single city block. While the US has about 42,000 zip codes, there are over 210,000 census block-groups and 11 million census blocks. As such, we expect the block or block-group characteristics to be a reasonable proxy for the borrowers' own characteristics. We use variables on the race, ethnicity, sex, median income (by age group) and educational attainment of the census block/block-group's inhabitants as control variables in our analyses.[22]

Because the CCP/Equifax does not have borrower income, we cannot directly observe whether an individual's income is consistent with working in a minimum wage job as we can in the Mintel and CPS data used in the previous analyses. Instead, we focus our analyses on borrowers who live in a census-block group with a relatively high fraction of less-educated workers, defined as a block-group in which more than 50 percent of adults over age 25 have less than a high school education.[23] We interpret this as indicative that the borrower herself is, with high probability, a less-educated worker. More generally, this measure suggest she lives in a neighborhood where the cost-of-living is feasible for a less-educated (and typically lower income) borrower. Because this prediction will necessarily be imperfect, as before, these analyses are akin to an "intent-to-treat" analysis.

3.4.2 Results for Credit Availability, Payment Behavior and Credit Scores

Table 7 presents results for the CCP/Equifax data. Columns (1)-(3) examine the effect of the minimum wage on credit availability three months later, as measured by total credit card credit limits. Column (1) indicates that a $1 increase in the minimum wage increases total credit

[22] Race/ethnicity and sex are available at the census block level, while the rest of the variables are available at the block-group level.

[23] Appendix figure 1 plots the regional representation of these types of census blocks, indicating they are diverse and represent all parts of the country. We chose to use the educational composition of the block-group rather than income as in our previous specifications because only the median value of income is available at the block-group level, which is insufficient for describing the income of the entire block-group. In contrast, we observe the full distribution of education for the entire block-group. We merged this measure into the 2001-2013 waves of the Survey of Consumer Finances and estimated a simple regression model on the relationship between our measure and minimum wage status (defined using reported annual earnings and hours worked) and found that living in a block-group where more than 50 percent of the population has less than a high school degree increases the probability of earning the minimum wage by 26 percent.

limits on credit cards held by low-educated borrowers by $466 ($121), or about 7 percent at the mean.

In columns (2)-(3) we then split the sample into those borrowers who did not acquire new credit card(s) and those who did. This allows us to examine whether the changing minimum wage increases limits on existing cards (perhaps after a request from the borrower, or through an lender-initiated increase when one updates their income or one's credit score improves), or if borrowers took out new credit cards (perhaps because of the change in offers demonstrated in table 3). Column (2) displays the results for individuals who did not acquire new cards: a $1 increase in the minimum wage raises credit limits for by $423 ($110). Column (2) displays the results for borrowers who *did* acquire new card(s): the total credit limit increases by $683 ($192), or about 50 percent more than the average effect for all borrowers in column (1).[24] This suggest borrowers appear to be increasing their credit limits via both margins, and that borrowers who acquire new cards increase their total credit limit more.

The effects of minimum wages on credit limits for all three samples are precisely measured at the 0.001 level and represent an economically meaningful increase in liquidity for less-educated borrowers. For context, a recent paper finds that only 51 percent of families in the first quartile of the income distribution have at least $400 in liquid savings (Bhutta and Dettling 2018) and the typical payday loan is $375 (PEW 2016). Since both of these amounts are *less* than the change in the credit limit, we interpret these changes in credit limits as economically large changes in liquidity for borrowers.

Column (4) of table 7 presents the effect of the minimum wage on payment behavior– as captured by missed payments (delinquency) on credit cards three months later. Column (4) indicates credit card delinquency falls by 0.6 percentage points (0.23 percentage points), about 5 percent at the mean, suggesting some previously delinquent borrowers catch up on missed payments when minimum wages rise, or that borrowers are less likely to enter delinquency.[25]

[24] We also examined the effect of the minimum wage on the total number of cards held, which yields a point estimate of 0.04 (0.02).

[25] To account for the possibility that borrowers substitute on-time payments between debts, we also analyzed overall delinquency on housing, auto, credit card or student loan debts, which falls by 0.4 percentage points (with a standard error of 0.14 percentage points).

Column (5) examines credit scores three months later.[26] Since payment delinquency and unused credit limits are components of the score, it is not surprising that column (5) indicates that credit scores also improve: a $1 increase in the minimum wage increases credit scores by about 1.04 points (0.43). While one point is not large relative to the mean credit score of 620.7, a one point change is economically fairly sizeable relative to typical quarterly movements in credit scores. For context, Dobbie et al. (forthcoming) find that the removal of a bankruptcy flag increases credit scores for affected borrowers by 10 points. Not only is their estimate a treatment effect on the treated (whereas ours is an intent-to-treat estimate covering many borrowers who are likely unaffected), but bankruptcy is arguably the most derogatory flag contained in a credit report. As such, we interpret an average credit score improvement of one point in our context to be economically sizeable.

Taken together, the results from columns (4)-(5) suggests that less-educated borrowers would look more attractive to lenders (who underwrite using nearly the same kind of data we use here) following a minimum wage increase, because of their increasing credit scores and improved payment behavior.

Since we are interested both in immediate reactions to a change in the minimum wage, as well as whether borrowers who have access to more credit are able to manage it, columns (6)-(7) examine payment behavior and credit risk measured one year later for the subsample of borrowers who experienced an increase in their total credit limit over the same one year period. Column (6) indicates delinquency declined for this group by 0.5 percentage points (0.15 percentage points), or about 3 percent at the mean. Column (7) indicates that credit scores for borrowers with higher limits also increased by 1.6 points (0.6 points). This suggests borrowers who had access to new liquidity were able to keep up with payments and improve their credit records (at least one year later).

In our previous analyses, we were able to use higher income borrowers as a control group to examine whether minimum wages have an impact on borrowers who are unlikely to be

[26] In this analysis we limit the sample to borrowers who had a credit score in the prior quarter. In separate analysis, we find higher minimum wages lead to a small increase in the probability of having a credit score (coefficient of 0.003 with a standard error of 0.0008). Combining the two results and expanding the analysis in column (5) to individuals without credit scores in the pre-treatment period yields almost identical results.

affected by the policy. While we do not have income in the credit bureau data which would allow for a parallel analysis, we can conduct a quasi-falsification test by repeating the previous analyses using census blocks with high concentrations of residents with a college education (appendix table 5). As before, these are only "intent-to-treat" estimates, and we caution that it is likely that some treated minimum wage workers reside on these blocks as well. Furthermore, if minimum wages pass-through to prices (Aaronson 2001), higher income borrowers could be affected as well. Still, we find that—unlike the analysis of borrowers on less-educated blocks—there is little evidence that increases in minimum wages are associated with changes in credit availability, payment behavior, or credit scores in the short or medium run for borrowers on higher-educated census blocks.[27]

2.5 Extensions and Robustness Checks

3.5.1 Allowing for Time-Varying Heterogeneity

Minimum wage policy is not randomly assigned. Recent research shows that minimum wage policy is highly spatially correlated: states with higher minimum wages tend to be concentrated on the Pacific Coast, the Northeast, and part of the Midwest; tend to be Democratic-leaning; and have higher levels of de-unionization (Allegretto, et al. 2017; Allegretto, Dube, and Reich 2011). That said, in a study of determinants of state minimum wage legislation, Whitaker et al. (2012) finds that adoptions of minimum wage legislation are largely unrelated to recent changes in the state political or economic environment. Still, our results could possibly suffer from omitted variable bias and reflect trends in other policies or economic fundamentals that also differ across states with more generous minimum wage policies. To explore the possibility of time-varying heterogeneity biasing our estimates, we conducted a number of robustness checks on all three sets of analyses.

One potential concern with our identification strategy is the possibility that state minimum wage policy co-varies with the generosity or usage rates of other social safety net policies, so our estimates would capture the effects of other social policies instead of identifying

[27] The possible exceptions are the results on credit limits in the short run, however, the coefficients are considerably smaller in magnitude than in the less educated block sample (about one-tenth as a percent of the mean).

the effects of minimum wage policy. Appendix tables 6-8 panel A examine the robustness of the main results (tables 3, 5, 7) when including additional policy control variables, collected at the state-year level, obtained from the University of Kentucky Center for Poverty Research (including AFDC, SNAP, SSI, EITC, Medicaid, WIC, among others, as described in the table footnotes). Estimates of the effect of minimum wages on minimum wage households' credit supply and AFS usage are nearly identical with or without these policy control variables. For the analysis of credit limits and credit scores, the inclusion of the policy controls lead to estimates that are qualitatively similar to the main results, albeit somewhat smaller in magnitude. Taken together, this exercise suggests that our estimated effects of minimum wages do not merely reflect changes in the generosity of the state's social safety net, but rather, specifically changes in minimum wage policy.

Another potential concern is that the spatial correlation of minimum wage policies might lead the implementation of higher minimum wages to be correlated with general changes in the economic environment across states. Thus, following Allegretto, Dube, and Reich (2011) and Allegretto et al. (2017), we examine the robustness of our results to the addition of division-year fixed effects and state-year trends. Census division-specific time fixed effects are included to allow for arbitrary regional economic shocks. State-specific linear trends are included to control for longer-run growth differences across states.[28] Those results are reported in appendix tables 6-7 panel B for the analysis of credit offers and AFS usage. Again, results are almost identical to our main estimates, with one exception: for AFS usage, including the full set of extra fixed effects reduces the precision of the payday results, although the magnitude of the coefficient is similar. The AFS dataset is considerably smaller than the credit offer dataset, so the degrees of freedom are diminished in this specification.

Finally, if the distribution of state minimum wage policies is non-random, that would pose a challenge for causal interpretation of our generalized difference-in-difference framework, which assumes parallel trends. To probe this assumption, we estimated models which include a one year lead in the minimum wage. In the credit offer and AFS analyses, the lead is also

[28] We omit this robustness check for consumer credit outcomes, as the addition of state-specific time trends and division-year fixed effects is designed for state-level panels, whereas our consumer credit data is an individual-level panel.

interacted with the indicator for "minimum wage household" status. By including a lead, we can capture any pre-existing trends in credit outcomes in states that would implement higher minimum wages one year later. These results are reported in the bottom panels of appendix tables 6-8 for the three sets of analyses.

For 16 of our 17 outcomes, the effect of interest (a one-quarter or year lag of the minimum wage, interacted with minimum wage household status) remains qualitatively the same as our main analysis. And with few exceptions, the interaction between the leading value of the minimum wage and minimum wage household status is imprecisely measured. One exception is the mean purchase interest rate in the credit offer analysis. In the main analyses, we found no effects on this outcome, but here, we find a positive, statistically significant effect on the lag interaction term and a similarly sized, but opposite-signed, effect on the lead interaction term. The net effect of the lead and lag on minimum wage households is essentially zero, so we do not interpret the (newly uncovered) effects on the lagged interaction term as causal.[29] Overall, we find virtually no evidence to support a rejection of parallel trends or that would change our main conclusions based on this analysis.

3.5.2 Defining Exposure to Minimum Wage Policy

Another potential source of bias in our estimates is measurement error resulting from the fact that none of our data directly identifies that a particular person or family was employed at the minimum wage when their state enacted a higher minimum wage. Thus, one might be concerned that our measure of exposure to minimum wage policy is subject to measurement error on a number of dimensions, which vary according to specific limitations of the three data sets that we have used in this study. In this section, we examine if our findings are robust to different methods of constructing of the treatment group.

[29] The interaction term between the lead and minimum wage household is also statistically significant (at the 5 percent level) for the share of credit offers with no fee and no rewards. At 5 percent level of significance, we might expect one of 17 outcomes to show this pattern randomly. And there is no evidence of a similar pre-trend on the share of offers with no fee only. Though we are cautious to assign causality to the pre-trend for these reasons, the sign suggests low income workers were worse off just prior to a minimum wage change. This could be consistent with the fact that many of the minimum wage changes are enacted by automatic pegs to inflation.

First, we examine the sensitivity of our main results to more flexible and expansive definitions of the range of imputed hourly wages that should be considered consistent with minimum wage work. Our main analyses converts household income into an imputed hourly wage by assuming full-year (and in the credit offer analysis, full-time) work, and follows Aaronson, Agarwal and French (2012) in defining an imputed wage between 60 and 120 percent of the state's minimum wage as a "minimum wage household." However, because many workers who earn the minimum wage work only part time (Jardim et al. 2018), there is reason to consider lower income households as potentially treated.[30] Still, because household income will include unearned incomes (e.g., transfers), it is also plausible that a large number of the lowest income households would be unaffected.[31]

In appendix tables 9-10 panel A, we report analyses where we expand the range of wages potentially consistent with minimum wage work to 0-120 percent of the minimum wage. For credit offers, we find similar results that are generally larger in magnitude and more precisely measured to our main analyses. The results also hold for AFS usage, though the effect is smaller in magnitude for payday borrowing, likely reflecting the fact we did not have to make assumptions about hours per week in the CPS (and thus, have already factored in part-time work). Another possibility is that since payday loans require proof of regular income, those results might be particularly sensitive to the inclusion of households with very low incomes.

Next, we provide a more flexible variation of our specification of minimum wage work by including four groupings of imputed wages (0-60, 60-90, 90-120, and 120-180 percent of the minimum wage; where above 180 percent is the left-out category). The results, reported in appendix tables 9-10 panel B, indicate that most of the imputed wage groups (and in many specifications, all of the groups) within our preferred definition of the "treatment group" experience favorable changes in their credit market outcomes when the minimum wage is higher. Furthermore, the differences in the magnitudes of those effects across groups are broadly consistent with what we would expect; that is, the effect of a higher minimum wage is larger for

[30] Families who lost their job because of a minimum wage increase might also fall into the lowest income group.
[31] For families with imputed hourly wages less than 60 percent of the minimum wage, 65 percent of their income is wage income. For families between 60 and 120 percent of the minimum wage, 85 percent of their income is wage income. Authors' calculation from the 2001-2013 Survey of Consumer Finances.

lower-income households (for whom the wage effects would be a larger percentage of their original income).[32]

We can also completely relax all of the assumptions we have made about weeks, hours and/or the number of earners in a household by simply examining household income groups. In panel C of appendix tables 9-10 we examine the effects of higher minimum wages across three income groups: 0-$15,000; $15,000-$30,000, and $30,000-$50,000 per year (where above $50,000 is the left-out category). The results show the effects are concentrated on households in the lowest two income groups, and there is no effect on those making more than $50,000.

Rather than inferring minimum wage work, in the CPS we can instead assign minimum wage household status based on reported hourly wages. Hourly wages are only collected for the outgoing rotation group, which is interviewed zero to three months *after* the time of the AFS usage survey. This discrepancy represents a clear limitation of this analysis. Still, it is useful to confirm the effects hold among hourly workers earning the minimum wage, even if the timing is inconsistent. Appendix table 10, panel D shows the results of this analysis, indicating the main results are robust to assigning only those families where the head or spouse earns exactly the minimum wage as "minimum wage households." If anything, the effects are slightly larger, suggesting perhaps some downward bias due to measurement error in our main estimates.

Because our measures of income are concurrent with the timing of the survey outcomes, rather than the timing of the minimum wage change (either three months or one year before the survey), it is plausible that some families' wages changed, and some families who were treated now earn higher incomes and vice versa. One way to deal with this possibility is to classify families by educational attainment, similar to our approach with the credit report data. When classifying those with less than a high school degree as minimum wage households, our results

[32] For example, at the group means of the independent variables, the results for credit offers (panel B, appendix table 9) indicate that a $1 higher minimum wages increases offered credit limits by 8.4 percent for those earning 90-120 percent of the minimum wage (mean limit is 26,300), compared to a 3.4 percent increase for the 120-180 percent minimum wage group (mean limit is 30,700). Similarly, for payday loan usage (panel B, appendix table 10), a $1 higher minimum wages reduces payday loan usage by 36 percent for those earning 90-120 percent of the minimum wage (mean usage rate is 3 percent), compared to a 25 percent decrease for the 120-180 percent of the minimum wage group (mean usage rate is also 3 percent).

remain, again, similar to our main analyses (panel D of appendix table 9, and panel E of appendix table 10).

For the credit outcomes data, we do not have incomes or educational attainment of individuals so cannot replicate any of the above analysis, but we can instead examine alternative census-block-group characteristics based on other common characteristics of minimum wage workers that can be measured at a fine geographic level (including median incomes, employment in food services/retail, and different education groups, appendix table 11). The results are broadly consistent with those obtained using our preferred subsample, suggesting our subsample is likely reflective of minimum wage workers along a number of dimensions.

3. Discussion

In this section, we explore which mechanisms are consistent with the full set of results, drawing on the conceptual framework outlined in section 1. To summarize, our previous analyses in section 2 indicate that higher minimum wages lead to:

(1) increases in the number of credit card offers and improvements in their terms,
(2) reductions in usage of payday loans and other forms of high-cost credit,
(3) increases in credit limits on credit cards,
(4) improvements in credit scores and reductions in delinquency in the near term,
(5) persistent improvements in credit scores and declines in credit card delinquency one year out among borrowers who had access to more credit because of the change in policy and,
(6) no change in any of these credit outcomes for higher income or higher-educated workers.

We draw a number of conclusions from the full set of results. First, because we find no effects on higher income workers (6), and we found no evidence that we can reject the identification assumptions in section 2.5.1, our preferred interpretation is that of a causal mechanism; that is, that higher minimum wages cause changes in credit supply (1) and borrower usage of credit products (2-5).

Second, because we observe both changes in offers (1) and credit card limits (3), we interpret the credit offer results as representing meaningful changes in credit supply to affected

borrowers. A plausible explanation for this result is that the documented improvements in credit risk (4) would make these borrowers more attractive to lenders. When considering or underwriting potential customers, credit card companies see the same kinds of credit report data that we analyze, and create their own proprietary credit scoring algorithms for generating credit offers. Positive changes in credit scores and payment behavior generally lead to more offers and terms more favorable to borrowers. It is also possible that the lenders respond to the policy itself—perhaps with the belief that changes in minimum wages might affect demand for credit among certain household-types.[33]

Third, because we see reductions in payday borrowing (2) and improvements in credit records for borrowers with access to more credit (5), we interpret our results as a rejection of the hypothesis that these changes in credit supply lead to over-borrowing among low-income households (at least over the time period we observe). More generally, this result is not consistent with extensive present-bias or financial illiteracy among these population (at least on average). Our preferred interpretation of our full set of our results is that they are consistent with widespread (and binding) borrowing constraints faced by these populations, which can be alleviated by income support policy.

Our full set of results indicate that higher minimum wages reduce borrowing costs among low-income borrowers, since no borrowing, or borrowing on a credit card (3), is generally cheaper than payday borrowing (2), and staying current on credit card is cheaper than paying late fees and interest charges (4). To fully understand the potential magnitude of these changes, we conduct several back-of-the-envelope exercises on the potential impact on borrowing costs. PEW (2016) estimates each year 12 million Americans borrow using payday loans. Our point estimates (table 5, column 1) imply that a $1 increase in the minimum wage would lead to 58,800 fewer payday borrowers, who would save $31 million in total fees over the course of

[33] A few pieces of evidence support this notion. First, while lenders do not see income information on households who are not their customers, credit scores are thought to be highly correlated with income (Federal Reserve Board 2007), suggesting lenders could potentially target certain parts of the credit score distribution in states where minimum wage policy has changed. Second, Equifax staff members prepared a report on minimum wages (Cutts, Carlson, and Hart 2014), suggesting minimum wages are relevant to credit reporting agencies. Third, Hsu, Matsa, and Melzer (2014) also find that social insurance affects credit card offers.

year.[34] The vast majority of households do not use payday loans (and therefore would not accrue these savings). Still, on per household basis, this back-of-the-envelope cost savings amounts to $2.55 per minimum wage household, or approximately 0.6 percent of the average income effects of a minimum wage hike estimated in Aaronson, Agarwal, and French (2012).[35]

Our results indicate that credit card limits rise by $466 (table 7, column 1), which is larger than the typical payday loan of $375. This suggests that rather than discontinuing borrowing altogether, former payday borrowers might instead have the option of substituting to credit cards.[36] Bhutta, Skiba and Tobacman (2015) find that most payday borrowers resort to payday loans when their access to traditional credit is lowest (e.g., when little or no liquidity remains on the credit cards they have), and many shop (unsuccessfully) for traditional credit just before they take out a payday loan, suggesting many borrowers would prefer to use a credit card than a payday loan. If instead of payday borrowing, the typical $375 payday loan balance were revolved for the same five months on a subprime credit card, the borrower would still save about $255, which amounts to almost $15 million in savings on borrowing costs in total.[37]

Similarly, the cost-savings of exiting (or not entering) credit card delinquency can also be substantial. For example, a borrower who fails to make payments on the mean credit card balance of approximately $4,000 for at least three billing cycles (which equates to our measure of 60+ day delinquency) on the typical credit card would pay at least $270 in fees and interest.[38] Our point estimates (table 7, col 4) imply that on aggregate, a $1 increase in the minimum wage would lead to about 87,000 fewer low-income credit card borrowers in delinquency, which implies a total savings of $24 million in fees and interest.[39] And although the majority of

[34] The typical borrower takes out a $375 loan, which is rolled over for five months and accumulates $520 in fees. By not borrowing altogether, the former borrower would have an extra $520 in disposable income (income net of debt service costs). Even if the marginal payday borrower is not the typical borrower, a one-time payday borrower would save the $55 fee associated with a typical two-week loan that is repaid in full (PEW 2016), leading to $3.2 million in saved fees.

[35] Aaronson, Agarwal, and French (2012) estimate an average income effect of $250 per quarter.

[36] Bhutta, Skiba, and Tobacman (2015) find that nearly all payday borrowers have credit records, and over 90 percent have a credit score. Thus, our CPS and Equifax samples should overlap, but we have no way of directly testing whether the same borrowers who discontinue using AFS have access to additional credit card liquidity.

[37] The typical subprime card has a purchase APR of about 21 percent and an annual fee of $48. Typical late payment charges are $25 on the first late payment and up to $38 on subsequent late payments (CFPB 2017).

[38] The mean credit card balance is based on a point-in-time balance measure in the credit report data that does not distinguish new spending from revolved balances. The typical credit card purchase APR is 17 percent (CFPB 2017).

[39] Our dataset includes 217,218 credit card borrowers, which is a 1.5 percent random sample (thus representing 14.5 million credit borrowers).

families are not in payment delinquency and would not accrue this savings directly, on a per-household basis these cost savings still amount to about $1.63 per household, or 0.7 percent of the income effect of a minimum wage hike estimated by Aaronson, Agarwal, and French (2012).

Thus, our estimates indicate that the reduction in borrowing costs stemming from an increased minimum wage can be substantial, and increase disposable income above and beyond the pure earnings effect of minimum wage hike – by 1.3 percent for the average minimum wage worker, and by substantially more for borrowers whose behavior is directly affected. For example, for a full-time worker, a $1 increase in the minimum wage generates $865 in income over 5 months. The $470-$520 in savings implied by our estimates from exiting delinquency or forgoing a payday loan are 54-60 percent of the direct income effect.

Declines in delinquency can also reduce bank losses. If an account remains delinquent for a period of time, usually 120 or 180 days, financial regulations require a bank to "charge-off" the debt, or declare it as a loss and send it to collections (either internally or through a third party collection agency). Banks are only able to recover a small fraction of debts that must be charged off, while the remainder is incurred as losses. A good proxy for these recovery rates is the proceeds from sales to third party collection agencies, which on average is about 4 cents on the dollar (Sanchez 2015). Since about 90 percent of borrowers in 60+ day delinquency are still delinquent 180 days later, our delinquency estimates (table 7, column 4) imply $263 million in averted losses for banks.[40]

With respect to the vast literature on employment effects of minimum wage increases, we urge caution that our data do not contain information about employment status, and as such, our results are averaged over adults who could have experienced positive or negative employment (and earnings) effects under higher minimum wages. Still, we might expect individuals who lose their jobs to enter, rather than exit, delinquency; so one interpretation of the decline in delinquency we observe is that it is inconsistent with widespread disemployment effects. In

[40] Among those borrowers who are delinquent for at least three quarters, the mean amount past due is $3,503. Of course, banks can also profit from delinquent borrowers due to fees and penalty interest rates if the borrowers do eventually re-pay their debt. This calculation is only the savings from averted charge-offs.

either case, our results provide new evidence on financial and social benefits of minimum wage policy not accounted for in these debates.

Proponents of minimum wage legislation tout minimum wages as a way to lift households out of poverty by increasing earnings, but critics argue disemployment effects outweigh earnings gains. Our results provide new evidence on additional benefits of minimum wage policy not accounted for in these debates. We show that minimum wages reduce borrowing costs for low-income borrowers, increasing disposable income above and beyond the direct effect on earnings. Our results also suggest that minimum wages have the potential to create persistent long run positive effects on households' well-being, potentially leading to positive feedback loops if minimum wage-induced improvements in credit scores and liquidity lead to improvements in labor market outcomes, which leads to further improvements in credit access, and so on. Though we leave a formal investigation of long run effects of higher minimum to future work, our results hint that minimum wage policy could have persistent positive ripple effects on household welfare and financial health.

More broadly, we show that minimum wage policies can have spillover effects on economic issues relevant for regulatory policy. Payday lending is a growing policy concern due to the perception that such loans are inherently exploitative, and a number of jurisdictions have implemented regulatory policies aimed at consumer protection that limit or ban payday lending. Our results support the notion that consumers may seek payday loans specifically when they lack income and/or access to cheaper credit, suggesting interventions that support family income or expand credit access could be successful in reducing reliance on payday loans. Our results also speak to the interaction between social policy and financial stability. Delinquency is costly not just for borrowers, but also to the financial system, since lenders must eventually charge off unsecured loans that remain in default. Our paper suggests minimum wage policy supports financial stability by averting defaults. Overall, our paper highlights a number of otherwise unexplored ways that minimum wages affect households and the economy through the actions of lenders and borrowers in credit markets.

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Tables and Figures

Table 1: State Minimum Wage Legislation 2000-2015

State	Minimum Wage Jan, 2015	Year(s) Minimum Wage Increased (above Federal)	State	Minimum Wage Jan, 2015	Year(s) Minimum Wage Increased (above Federal)
DC	$9.50	2005, 2006, 2014, 2015	OH	$8.10	2007, 2008, 2009, 2011,2012, 2013, 2014, 2015
WA	$9.47	2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015	AZ	$8.05	2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015
OR	$9.25	2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015	FL	$8.05	2005*, 2006, 2007, 2008, 2009, 2011*, 2012, 2013, 2014, 2015
CT	$9.15	2000, 2001, 2002, 2003, 2004, 2006, 2007, 2009, 2010, 2014, 2015	MT	$8.05	2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015
VT	$9.15	2001, 2004, 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015	MD	$8.00	2007, 2015*
CA	$9.00	2001, 2002, 2007, 2008, 2014	MN	$8.00	2005*, 2014, 2015
MA	$9.00	2000, 2001, 2007, 2008, 2015	NE	$8.00	2015
RI	$9.00	2000*, 2004, 2006*, 2007, 2013, 2014, 2015	WV	$8.00	2006, 2015
AK	$8.75	2003, 2010, 2015	HI	$7.75	2002, 2003, 2006, 2007, 2015
NY	$8.75	2005, 2006, 2007, 2014, 2015	MO	$7.65	2007, 2008, 2009, 2013, 2014, 2015
SD	$8.50	2015	AR	$7.50	2006, 2014
NJ	$8.38	2005, 2006, 2014, 2015	ME	$7.50	2002, 2003, 2004, 2005, 2006
DE	$8.25	2000, 2007, 2008, 2014, 2015	NM	$7.50	2008, 2009
IL	$8.25	2004, 2005, 2010	IA	$7.25	2007, 2008
NV	$8.25	2006, 2007,2010	NC	$7.25	2007
CO	$8.23	2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015	PA	$7.25	2007
MI	$8.15	2006, 2014	WI	$7.25	2005*, 2006*

Observe federal: AL, GA, ID, IN, KS,KY, LA, MS, ND, NH, OK, SC, TN, TX, UT, VA, WY
*Multiple changes in year

Table 2: Summary Statistics for Credit Offer Data

	Full Analysis Sample (N=291,308)		Minimum Wage Household Subsample (N=24,524)	
	Mean	Std. Dev.	Mean	Std. Dev.
Credit Offers				
Number of Credit Card Offers	4.121	4.779	2.285	3.276
Mean Credit Limit	40915	31697	25993	29788
Fraction of Offers Pre-Approved	0.377	0.362	0.377	0.397
Mean Purchase Interest Rate (%)	13.13	3.71	14.46	4.67
Share of Offers with No Fee	0.774	0.328	0.69	0.398
Share of Offers with Fee, No Rewards	0.106	0.264	0.238	0.381
Socioeconomic Characteristics				
Median Income*	55000	47376	17500	7861
High School Dropout	0.072	0.258	0.197	0.398
High School Grad	0.314	0.464	0.405	0.491
Some College	0.227	0.419	0.244	0.429
College	0.254	0.435	0.13	0.336
Post-Graduate	0.133	0.34	0.024	0.154
White	0.863	0.344	0.799	0.401
Black	0.067	0.251	0.115	0.319
Hispanic	0.066	0.249	0.09	0.286
Under Age 25	0.017	0.13	0.038	0.192
Age 25-34	0.137	0.343	0.157	0.364
Age 35-44	0.248	0.432	0.234	0.423
Age 45-54	0.283	0.45	0.252	0.434
Age 55-64	0.315	0.465	0.319	0.466

Notes: Data source is Mintel Comperemedia for 2000-2015. The minimum wage household subsample is households identified as having income consistent with a minimum wage worker. * indicates variable expressed as median rather than a mean.

Table 3: Minimum Wages and Credit Card Offers Received

	(1) Number of Credit Card Offers	(2) Mean Credit Limit	(3) Fraction of Offers Pre-Approved	(4) Mean Purchase Interest Rate	(5) Fraction of Offers With No Annual Fee	(6) Fraction of Offers w/ Fee and No Rewards
Minimum Wage$_{st-3}$*Minimum	0.117**	1893***	0.020***	-0.066	0.045***	-0.024***
Wage Household$_i$	(0.040)	(360)	(0.003)	(0.038)	(0.004)	(0.004)
Minimum Wage$_{st-3}$	0.057	19	-0.001	0.047	0.002	-0.004
	(0.043)	(338)	(0.002)	(0.029)	(0.003)	(0.003)
Minimum Wage Household$_i$	-2.184***	-19857***	-0.124***	1.304***	-0.363***	0.262***
	(0.244)	(1965)	(0.018)	(0.240)	(0.027)	(0.024)
Mean of Dependent Variable						
Full Analysis Sample	4.12	40,915	0.38	13.13	0.77	0.11
Min. Wage Subsample	2.29	25,993	0.38	14.46	0.69	0.24
N	315,832	133,875	221,017	223,079	224,309	219,990

Notes: Data source is Mintel Comperemedia 2000-2015. Displayed are coefficients and standard errors (in parentheses). Minimum Wage Household defined as hourly wage (implied by reported income, adjusted for household size, and full time hours) consistent with minimum wage work, as described in text. Sample includes households with working age adults 18-64, and for columns (2)-(6), households who received offers specifying the feature listed in the column heading. Controls include age-group, sex, race/ethnic group, education group, state, and year-month fixed effects and state-month unemployment rates. Dependent variable means are displayed for all observations used in the regression, as well as the mean for the subsample of observations identified as minimum wage households. Standard errors adjusted to allow for clustering at the state level. *p<0.05, **p<0.01, ***p<0.001.

Table 4. Summary Statistics for Alternative Financial Services Data

	Full Analysis Sample (N=143,655)		Minimum Wage Household Subsample (N=14,241)	
	Mean	Std. Dev.	Mean	Std. Dev.
AFS Borrowing				
Took out a Payday Loan	0.02	0.141	0.03	0.171
Pawned Items at a Pawn Shop	0.022	0.148	0.039	0.194
Rented Items at a Rent-to-own Store	0.015	0.123	0.029	0.169
Took out an Auto Title Loan	0.009	0.093	0.014	0.116
Socioeconomic Characteristics				
Median Family Income*	55000	97714	22500	33091
High School Dropout	0.094	0.292	0.184	0.387
High School Grad	0.274	0.446	0.369	0.482
Some College	0.301	0.459	0.311	0.463
College	0.214	0.41	0.109	0.312
Post-Graduate	0.117	0.322	0.028	0.164
White	0.705	0.456	0.578	0.494
Black	0.111	0.314	0.129	0.335
Hispanic	0.116	0.32	0.224	0.417
Under Age 25	0.06	0.238	0.122	0.327
Age 25-34	0.203	0.402	0.257	0.437
Age 35-44	0.227	0.419	0.223	0.417
Age 45-54	0.263	0.44	0.239	0.426
Age 55-64	0.246	0.431	0.159	0.366

Notes: Data source is Current Population Survey Unbanked/Underbanked supplements 2009, 2011, 2013 and 2015. The minimum wage household sample is defined as households identified as having income consistent with a minimum wage worker. * indicates variable expressed as median rather than a mean.

Table 5: Minimum Wages and Use of Alternative Financial Services

	(1)	(2)	(3)	(4)
	Took out a Payday Loan	Pawned Item at Pawn Shop	Rented Items from a Rent-to-Own Store	Took out an Auto Title Loan
Minimum Wage$_{st-12}$*Minimum Wage Household$_i$	-0.0049*	-0.0053	-0.0055**	-0.0023
	(0.0027)	(0.0038)	(0.0023)	(0.0017)
Minimum Wage$_{st-12}$	-0.0026	0.0016	-0.0009	0.0014
	(0.0025)	(0.0019)	(0.0014)	(0.0026)
Minimum Wage Household$_i$	0.0414**	0.0484	0.0485***	0.0203
	(0.0202)	(0.0296)	(0.0175)	(0.0135)
Mean of Dependent Variable				
Full Analysis Sample	0.0203	0.0223	0.0154	0.0088
Min. Wage Subsample	0.0301	0.0395	0.0294	0.0139
N	157,896	158,001	157,974	74,488

Notes: Data source is Current Population Survey Unbanked/Underbanked Supplements 2009, 2011, 2013 and 2015 (column 4 data is for 2013 and 2015 only). Sample includes households with working age adults 18-64. Displayed are coefficients and standard errors (in parentheses). Min Wage Household defined as total family income divided by total family hours worked consistent with the minimum wages, as described in text. Controls include age-group, sex, race/ethnic group, education group, and state fixed effects and state-month unemployment rates. Dependent variable means are displayed for all observations used in the regression, as well as the mean for the subsample of observations identified as minimum wage households. Standard errors adjusted to allow for clustering at the state level. *p<0.05, **p<0.01, ***p<0.001.

Table 6. Summary Statistics on Credit Report Data

	Mean	Std. Dev.
Credit Report Characteristics		
Credit Card Limit	6752	13982
Delinquent	0.132	0.338
Risk Score	620.6	102.1
Under Age 25	0.101	0.301
Age 25-34	0.284	0.451
Age 35-44	0.274	0.447
Age 45-54	0.213	0.41
Age 55-64	0.127	0.333
Census Block-group Characteristics		
Block Median Income	35154	17706
Share White	0.34	0.34
Share Black	0.174	0.281
Share Hispanic	0.416	0.355
Share Male	0.492	0.07
Share High School Dropout	0.407	0.21
Share High School Grad	0.243	0.087
Share Some College	0.215	0.1
Share College or More	0.089	0.09

Notes: Data source is CCP/Equifax 1999-2015. The sample is all individuals who have ever lived on a Census Block-groups where more than 50 percent of the adult population was a high-school dropout in 2000.

Table 7: Minimum Wages and Credit Card Limits, Credit Risk and Payment Behavior

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total Credit Card Limit (k=3)			Delinquency and Risk (k=3) All Borrowers		Delinquency and Risk (k=12) Borrowers with Higher Limits	
	Full Sample	Individuals Without New Cards	Individuals With New Cards	Delinquent on Credit Card(s)	Credit Score	Delinquent on Credit Card (s)	Credit Score
Minimum Wage$_{st-k}$	466***	423***	683***	-0.006**	1.039*	-0.005**	1.606*
	(121)	(110)	(192)	(0.0023)	(0.4327)	(0.0015)	(0.6138)
Mean of Dependent Variable	6,752	6,059	13,730	0.132	620.7	0.178	640.7
N	11,579,606	10,534,324	1,045,282	11,579,606	11,273,837	3,248,116	3,228,276

Notes: Data source is CCP/Equifax 1999-2015. Sample includes adults 18-64. Displayed are coefficients and standard errors (in parentheses). Columns (1) and (4) are estimated on the entire sample. Column (2) and (3) are estimated on the subsample that did or did not acquire new credit card(s) since one quarter prior, as indicated in the column heading. Column (5) is estimated on the subsample of borrowers with a credit score in both the current and prior quarter. Column (6) is estimated on the subsample of borrowers who have higher total credit card limits in the current period than 12 months prior, and column (7) is estimated on the same sample, but omitting observations with missing credit scores 12 months prior. K refers to the lag on the minimum wage variable, which is three months in columns (1)-(5) and 12 months in columns (6)-(7). Controls includes individual, age-group, state, and quarter fixed effects, demographic and economic characteristics of census-block-group, state-year unemployment rates. Sample is limited to individuals who have ever resided in Census block-group where more than 50 percent of the population over age 25 had no high school degree in 2000. Standard errors adjusted to allow for clustering at the state level. *p<0.05, **p<0.01, ***p<0.001