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Essays on Finance, Labor, and Group Inequality

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Essays on Finance, Labor and Group Inequality

by

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Committee in charge:

Associate Professor Gustavo Manso, Co-chair
Assistant Professor Christopher Palmer, Co-chair
Professor Ross Levine
Professor Hilary Hoynes

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Abstract

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This dissertation consists of two chapters centered on the interplay between financial markets and labor market institutions, and that emphasize how this interplay affects group inequality (i.e., inequality with respect to race, gender, socioeconomic status, etc.). Two main themes are recurrent in this work: (i) that firms' and lenders' distress risks spillover to workers and households; and (ii) that, conversely, frictions or interventions in the labor market create financial distortions. Taken together, these two ideas imply that the relationship between financial and labor markets can generate instability, as their reciprocal feedback tends to generate responses that are either cyclical or that amplify existing market frictions. Furthermore, by focusing on interventions in either labor or financial markets, this dissertation speaks to the distributional implications of this type of instability. In each of the chapters, we first rely on careful institutional analysis of the labor and financial forces at play (and their connection to macro labor and financial markets), and then proceed to use reduced form methods to assess the substantive economic questions of interest arising from those settings.

In the first chapter, "Incarceration and Access to Credit," we evaluate the effects that carceral institutions have on access to credit, how incarceration obscures the information lenders use to screen borrowers, and how lack of access to credit impacts recidivism. When individuals are incarcerated, they lose their jobs and their ability to repay debts is impaired while in prison. These effects directly impact their ability to get credit. In addition to that, however, it creates an information problem for lenders, as they are unable to recover the true default probability of a formerly incarcerated loan applicant. Lenders can partially correct for information distortions if they are aware of an applicant's criminal record, but this correction would be incomplete: Lenders cannot recover distortions due to heterogeneity in the effects of incarceration, neither can they completely correct on average as they cannot distinguish among different types of sentence.

The case of incarceration highlights how a labor market institution can amplify information asymmetries problems present in the allocation of credit. But it also highlights a

feedback effect: the interplay between the credit market and labor market amplifies a failure of the criminal justice institution to reduce crime, namely that incarceration increases individuals' likelihood of recidivism. We show that when individuals are unable to access durable goods or smooth consumption due to credit frictions they are more likely to engage in criminal activity. But this effect is even stronger when the lack of access to credit stems from incarceration itself.

In the second chapter, "How Corporate Debt Perpetuates Labor Market Disparities?," we take a new approach to address an old but important question: what drives the large magnitude of fluctuations in employment? Previous work has focused on explaining wage rigidities by exploring variations in the wage determination process, by studying labor institutions, or by studying cultural norms. We study, instead, the role corporate debt plays in determining equilibrium wages and unemployment. The idea is simple: a worker's wage reflects the job security of her employment match *vis-à-vis* how valuable the outside option of being unemployed or working for another firm is. When aggregate financial leverage increases, it affects both components in conflicting directions: (1) unemployment risk goes up and, consequently, the firm must increase wages to keep the worker; and (2) the value of the outside option goes down, driving wages downwards, as unemployment risk increases for other firms as well.

When economic conditions are poor (i.e., low labor market tightness), the outside option of the worker is weak, which means that wages are mostly determined by the value of employment. In this case, increases in aggregate financial leverage resulting in higher unemployment risk decrease the future value of employment and since there is no offsetting effect through the outside option, wages must go up— and so will unemployment. In constrast, when economic conditions are good (high labor market tightness), the outside option of the worker is high. This means that when aggregate financial leverage increases, any increase in wages resulting from higher unemployment risk will be offset by decreases in the outside option of the worker since unemployment risk is affecting other firms as well. Wages will go down— and so will unemployment. The three take-aways on the dynamics of capital structure, wages, and unemployment are these: (1) leverage dampens fluctuations in wages (wages go up when economic conditions are poor, and vice versa); (2) leverage amplifies unemployment fluctuations (unemployment goes up, when it is already high, and vice versa); and (3) labor market tightness predicts changes in leverage.

Since the trade-off between compensation for unemployment risk and a weaker outside option arises from a general equilibrium framework, this paper can reconcile seemingly conflicting evidence in Corporate Finance. In an influential paper, Matsa (2010) finds that collective bargaining agreements lead to higher financial leverage. The finding, which has been documented in several other settings as well, has been interpreted as evidence of strategic use of corporate debt as a bargaining tool. However, Graham and Harvey (2002) provide survey evidence that CFOs give very little weight to bargaining with workers when making capital structure decisions. Our work reconciles both findings. Policies that affect the outside option of the worker will have an impact on capital structure. As we discussed, a higher outside option means that increases in the aggregate financial leverage will decrease

wages leading to higher financial leverage in equilibrium. Leverage does affect bargaining with workers but it does not need to operate in a strategic manner.

The fact that stronger outside options lead to higher levels of financial leverage and that capital structure amplifies fluctuations in unemployment has important redistributive implications. When increases in the cost of labor are a result of employment regulations, the outside option of the worker increases and in equilibrium firms issue more debt, mitigate the regulatory costs, and weaken the regulation's intended objectives by increasing unemployment risk. Consistent with this, we find that firms increased corporate debt following the passage of anti-discrimination regulation during the Civil Rights Movement. We document that increases in corporate debt disproportionately exposed minority workers to higher levels of unemployment risk.

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Chapter 1

Credit-Driven Crime Cycles: Incarceration and Access to Credit[1]

The United States has the largest incarcerated population in the world. Around 3.4 percent of the U.S. adult population has been incarcerated.[2] While the U.S. has only about 4 percent of the world's people, it contains about 20 percent of its carceral population.

Incarceration imposes substantial direct and indirect costs to society. Total correction spending is the second-fastest growing federal budget item in the U.S. behind Medicaid (Henrichson and Delany, 2012). Estimates of the fiscal costs of the combined federal, state, and local expenditures on all justice-related programs, which include policing and judicial services, exceeded $228 billion in 2007. There are also indirect costs stemming from loss of human capital and lost income. An ex-incarcerated person is significantly more likely to remain jobless (Visher et al., 2011), have lower lifetime earnings (Sabol, 2007), and develop criminal skills while incarcerated (Bayer et al., 2009). Furthermore, more periods of unemployment and lower incomes will tend to limit a person's access to credit and the benefits associated with smoothing consumption and potentially undertaking such productive investments as starting a business. Despite the importance of credit markets for welfare, there are yet no assessments of the effects of incarceration on access to credit.

In this paper, we evaluate the impact of incarceration on access to credit and the implications of access to credit on recidivism. Specifically, there are four interrelated components to our analysis. First, we analyze the impact of incarceration on an individual's post-release credit scores and likelihood of obtaining auto or home loans. Second, we examine the mechanisms linking incarceration with access to credit by examining (a) the inability to service debts while incarcerated, (b) the reduction in income following incarceration, and (c) discrimination by lenders toward convicts. Third, we demonstrate how changes in an individual's observable credit traits following incarceration—credit scores and income—obscure the ability of lenders to draw accurate inferences about unobservable features when making credit

[1] Based on joint work with Abhay Aneja.

[2] Shannon, Uggen, Thompson, Schnittker, and Massoglia (2010).

allocation decisions. This informational friction shapes credit allocation decisions, the average performance of loans given to ex-convicts, and the degree of adverse or advantageous selection into the pool of convicts seeking credit. Finally, we evaluate how access to credit influences recidivism.

The first component of our analysis is to causally assess the impact of incarceration on ex-convicts' access to credit. Our identification strategy exploits institutional features of the court system. After criminal charges are filed against a defendant, cases are randomly assigned to judges with the intent of facilitating an equal workload. Judges, however, are heterogeneous; they have different propensities to incarcerate. Since the judge the defendant is assigned to is strongly predictive of ultimate incarceration status, we can use judge fixed effects as instruments for incarceration. Exploiting this exogenous variation in the likelihood of being incarcerated arising from quasi-random assignment of cases recovers the causal effects of incarceration for individuals at the margin of release. This instrumental variables (IV) research strategy is similar to that used by Kling (2006), Aizer and Doyle (2015), and Mueller-Smith (2015), to estimate the impact of incarceration and bail in the United States. Using this design we show that ex-convicts face a drop of between 42 to 69 points in their credit scores, reductions in their auto loan financing of between 24 and 45 percent, and declines in mortgages of 14–16%.

The second component of our analysis is to examine the mechanisms that link incarceration with access to credit. First, the most direct mechanism through which incarceration affects the post-release credit opportunities of an ex-convict is by incapacitating her to service her debt while confined. Although this incapacitation is temporary, it affects the credit history of the borrower, which leads to harsher terms of credit in the future. To assess incapacitation we exploit exogenous variation in the intensive margin of incarceration, sentence length. Each year in carceral confinement leads to a drop of 47 points in credit score, meaning that the intensive margin accounts for approximately half of the total deterioration of credit scores due to incarceration.[3] This deterioration of credit scores due to longer sentences is consequential, as lower credit scores increase the cost of borrowing due to higher interest rates (Furletti, 2003) and decreased likelihood of being approved for a loan. A back-of-the-envelope calculation shows that a drop of 50 points in credit scores can lead to an increase of up to 4 percentage points in interest rates.

Second, incarceration affects access to credit through changes in income. Sending individuals to jail/prison dampens their labor market prospects in many ways: (i) incarceration generates human capital depreciation indirectly by forcing the individual out of the labor force, and, potentially, as a direct effect of incarceration itself (e.g., Bayer et al., 2009); (ii) removal from the labor force—i.e. falling off the job ladder—weakens a former convict's negotiation benchmark, which takes time and effort to build; and (iii) labor market discrimination (either because of taste or statistical discrimination) reduces their ability to bargain and obtain outside offers. We find support for each of these labor market mechanisms. We

[3] In Section (1.5) we discuss alternative channels that may also explain the connection between sentence length and lower credit scores.

first show that ex-convicts' income is reduced by 18 to 39 percent. As we distinguish between sources of labor income loss, we find that approximately 29.4 percent is due to depreciation of human capital, 23.5 percent of the loss of income is due to removal from the labor force, and 47.1 percent is due to labor market discrimination.

Third, ex-inmates may face discrimination when applying for credit in the same way that they can be discriminated against in the labor market. Discrimination can arise for many reasons; it can be the result of stigma, statistical discrimination, or it can inadvertently occur due to, for example, the use of algorithms and computerized systems by the lender. We use two approaches to assess discrimination in lending. First, we look at the performance of borrowers on probation, accounting for pre-trial detention rates, since these borrowers would have a criminal record, but they would not be affected by depreciation of human capital or removal from the labor force. This yields an estimate of the effects of credit market discrimination *and* the downstream effects of labor market discrimination on credit and, hence, provides an upper bound on the amount of discrimination in lending. Second, following the literature on adverse selection and positive correlation tests (Chiappori and Salanié, 2000), we test for the presence of advantageous selection in the allocation of credit—which would arise if ex-convicts are stigmatized by lenders. Using both methods, we find that there is very little evidence that the reduction in access to credit is due to discrimination in lending.

We next turn to the third component of our analysis: How do changes in an individual's observable credit traits following incarceration, such as credit scores and income, create informational asymmetries between lenders and ex-convicts that adversely distort the allocation of credit? Because of imperfect information, when lenders use observable credit traits to make credit allocations they must also make inferences about unobservable credit traits. When an individual's characteristics that lead to her conviction are related to credit traits unobservable to the lender, changes in an individual's observable credit traits following incarceration create a mismatch between the ex-convict's *real* and the *inferred* unobservable credit traits. Using our random judge assignment design, we decompose the effects of being incarcerated into an exogenous component and a residual component summarizing the unobservable characteristics that lead to a conviction. Because of the legal underpinnings of American criminal law, this summary measure of unobservables can be interpreted as a measure of criminal intent which we will henceforth refer to as the *criminal type* of the individual.[4] We then show that this criminal type is relevant to the lender: criminal type is positively correlated with pre-conviction credit traits such as credit history, likelihood of having a mortgage, and estimated income. Supplied with a measure of observable criminal traits to the lender (conviction) and another of unobservable criminal traits (criminal type), we can evaluate whether informational frictions are distorting lenders' ability to assess post-conviction loan performance. We discover the following: Conviction does not predict better

[4]This decomposition has legal underpinnings— we exploit the general requirement in American criminal law that proof of both (i) commission of a criminal act and (ii) existence of a criminal intent are necessary conditions for a conviction.

(or worse) loan performance, but criminal type does. Individuals with high criminal type experience fewer defaults, foreclosures, and bankruptcies. The inability of lenders to account for the better unobservable credit traits of high criminal types prevents them from providing high criminal type borrowers with more credit flows as supported by their lower default risk. With respect to income, we summarize the interpretation of this finding as follows: *Distortions in the labor markets can generate informational frictions in credit markets by obscuring information about relevant characteristics of the borrower that are unobservable to the lender and happen to be correlated with labor market income.* In studying this relationship between incarceration, criminal type, and credit, this paper more broadly relates to the literature on externalities in economies with incomplete markets and imperfect information (Greenwald and Stiglitz, 1986).

Finally, we turn to the last component of our analysis: Do restrictions on access to credit triggered by incarceration increase the likelihood of recidivism? We can address this question by exploiting discontinuities in credit limits that naturally occur due to conventional lending practices (Agarwal et al. 2017). These practices frequently appear in the form of "rules of thumb" whereby borrowers with similar observables are lumped together to receive the same terms of credit;[5] for example, borrowers with credit scores between 700 and 704 might be considered to be equally risky, but more risky than borrowers with credit scores between 705 and 709. Naturally, these credit limit discontinuities lend themselves to a regression discontinuity design (RDD). By supplementing our random judge assignment with this RDD, we show that lack of access to credit following incarceration increases recidivism by 15–20 percent, with lower effects for individuals with no previous arrests. In this regard, our paper shows the role played by credit constraints in fostering crime.

The paper is structured as follows. In the Section 1.1, we describe our data and setting. Section 1.2 describes our research design and overall empirical framework. In Section 1.3, we provide our main results– namely, the causal effects of incarceration on access to credit. In Section 1.4, we evaluate heterogeneity in the incidence of incarceration costs across individuals with varying pre-conviction income and proclivity towards crime. We analyze the mechanisms leading to lower credit access in Section 1.5. In Section 1.6, we evaluate loan performance and the resulting advantageous selection. Section 1.7 assesses how lack of access to credit leads to recidivism. In Section 1.8 we conclude.

1.1 Data & Summary Statistics

Setting: Harris County, Texas

The setting for our study is Harris County, Texas—the third largest county in the United States. Harris County includes the city of Houston as well as several surrounding municipal-

[5]Screening borrowers is costly. The optimality of "rules of thumb" has been properly assessed by Agarwal et al. 2017).

ities. Its residents are economically and demographically diverse, which is reflected in the study population. Two court systems operate in Harris County: the Criminal Courts at Law (CCL) and the State District Courts (SDC). The fifteen CCLs have jurisdiction over cases involving misdemeanor charges and serve slightly more than 4,500 cases per court per year. These cases include traffic violations, DUI offenses, drug possession, non-aggravated assault, and similarly less serious criminal offenses. The 22 district courts handle felony cases and serve over 1,500 cases per court per year.

Importantly for our purposes, after criminal charges are filed against a defendant, a case is randomly assigned to a courtroom within Harris County. This method of case assignment is administered by the Harris County District Clerk and is intended to facilitate an equal workload burden across judges.

Data

This project uses multiple sources of administrative and survey data. First, our main explanatory variable is exposure to the criminal justice system. We use information on defendant and crime characteristics, judge/court assignment, as well as sentencing outcomes that have been acquired from the Harris County District Clerk's Office. Initial filings of felony and misdemeanor charges between 1985 and 2012 are included in the data regardless of final verdict. We started with data for approximately 2 million unique defendants. The data contains detailed information for each criminal arrest for which there is a court appearance: name, date of birth, alleged offense(s), attorneys involved, judge assigned to the case, and other characteristics. Case-level data from Harris County also allow us to measure whether a defendant received a carceral sanction, a fine, or was simply released with no incarceration. The defendant-level data include information on each defendant's name, gender, ethnicity, date of birth, and address of residence.

We merged our criminal record criminal history data with individual credit bureau files that contain detailed credit history information from Equifax, one of the three major credit bureaus in the United States. This individual-level data is quite rich, including information on the borrower's credit score, the size of loans received, and monthly payments. We also observe other liabilities of borrowers, such as their auto loans, installment loans, and credit cards. Due to the Equifax credit bureau's requirements to preserve the anonymity associated with an individual credit history (under federal law), we were required to comply with very strict anonymity guidelines regarding individual credit history observations. For this reason as well as cost considerations, we made the following restrictions to our data: first, we randomly choose a sample of 200,000 individuals. We then removed all geographic identifiers. Finally, we remove all specific criminal offense data, aside from data on whether a person is charged with a minor marijuana-related offense. Note that while we cannot explore how these traits like individual geography and offense correlate to credit-outcomes, we can still use this data to test our exogeneity assumptions. Equifax used the name, date of birth, and address (at a particular point in time) to match our criminal incident files to individual credit

data. Equifax then provided us with anonymized research files with credit characteristics appended. The anonymized files removed all identifying information, and instead included the coarsened categories related to crime offense, age, gender, and race.

Let us start by describing those variables of interest pertaining to the incarceration state in our reduced merged sample. Out of a sample of approximately 143,000 individuals, 73.3 ever obtain a conviction, and of those, 12.8 percent received a probation only. Recidivism stands at 39 percent. When excluding repeat offenders, the average probability of getting an indictment across all courts in any given year is around 66 percent. From all cases, 22 percent are brought to court on account of a felony, while the remaining are only for misdemeanors. Figure (1.2) describes the age distribution for the sample and at the time of indictment. The distribution of age for crimes is highly skewed towards a younger population with the median age of individuals at case resolution of 30. The sample median age is closer to the state's, standing at 35 years old against 33.9 for Texas. The percentage of blacks and Hispanics in the sample is 38 percent and 22 percent respectively, compared against the 18.9 percent and 40.8 percent Harris County has according to the 2010 Census. This means that blacks are overrepresented in the correctional system while Hispanics are underrepresented. However, Hispanic underrepresentation is partly explained by its increasing share in the population over the last few decades.[6] From those arrested, the incarceration rates are 23.6 percent and 18.1 percent compared against 19.4 percent for Caucasians, indicating that Blacks are overrepresented in their probability of being incarcerated. Women make up 27 percent of all the defendants brought to court.

The average credit score for the sample is 575. Figure (1.3), Panel A, shows the distribution of credit scores for individuals charged with a felony or misdemeanor but that were not convicted. Panel B shows the distribution of credit scores for a convicted individual post-release. Panel C shows the distribution of credit scores for a convicted individual while incarcerated. The mean average credit score is similar in the first two populations, convicts and non-convicts, both groups observed after sentence. The mean credit score is visibly, and expectedly, lower for the population behind bars at the time of the credit report. The percentage holding loans is noticeably different between convicts and non-convicts; it stands at 45 percent for those found guilty and 52 percent for those acquitted. The percentage of individuals with mortgage loans in the sample stands at 13 percent. Similarly, 25 percent of the sample have auto loans. Credit card debt averages $3,844 for the 32 percent of the sample that has a credit card account.

1.2 Empirical Research Design

We begin by considering a basic empirical strategy with no concerns about endogeneity. For person i who is arrested, consider a model that relates an outcome such as credit score, Y_i,

[6] Hispanic population made up 32.9 percent of the population in 2000.

to an indicator variable for whether the person has ever been incarcerated ($Incarcerated$):

$$Y_{it} = \beta_0 + \beta_1 Incarcerated_{it} + \beta_2 X_i + \epsilon_{it} \tag{1.1}$$

where X_i is a vector of control variables, including current incarceration status, and ϵ_i is the error term. We are interested in the post-release effects of incarceration, which are captured in β_1.

To ascertain the impact of incarceration on credit-related outcomes, the researcher must address the problem of correlation between incarceration and factors such as severity of the crime, criminal history, and characteristics of the person that are also likely to be correlated with credit utilization and history (for example, poor access to employment). Control variables will likely be unable to fully correct this problem, since there are likely unobservable characteristics of either the alleged offender or the individual that are correlated with both the probability of incarceration and future outcomes related to credit. For example, in the case of employment, it is most likely that unobservable characteristics are negatively correlated with incarceration, biasing OLS estimates of β_1 downwards. On the other hand, the process of incarceration generates a selection bias whereby individuals with higher criminal type and better unobservables are more likely to be incarcerated. For example, since, holding income constant, individuals with high taste for crime or criminal type are more likely to engage in criminal activity, the amount of income needed to dissuade a high criminal type individual from engaging in criminal activity will be higher than for an individual with low criminal type. Post-conviction, this will generate a positive correlation between criminal type and unobservables that will bias OLS estimates upwards (we formalize this intuition in Appendices A.1 and A.2).

Our empirical strategy resolves these concerns using a method that is becoming increasingly common in applied econometrics. We measure the tendency of a randomly assigned judge to incarcerate as an instrument, Z, for person's i's ultimate incarceration status. Essentially, we compare credit outcomes for individuals assigned to judges who have different propensities to incarcerate, and interpret any difference as a causal effect of the change in incarceration associated with the difference in these propensities. Our set up can be viewed as utilizing marginal cases where the judges may disagree about the custody decision, a margin of particular policy relevance.

In terms of mechanics, for each individual, we construct an instrument that corresponds to the "incarceration propensity" of each judge. We define the instrument for each individual i as a leave-out mean for judge $j(i)$:

$$Z_{j,(i)} = \frac{1}{n_{j(i)} - 1} \sum_{k!=i}^{n_{j(i)}-1} \widetilde{Incarcerated}_k \tag{1.2}$$

Here, $n_{j(i)}$ is the total number of cases seen by judge j; k indexes an individual's case seen by judge j where $\widetilde{Incarcerated}$ is equal to 1 if a person was sentenced to jail/prison. Thus, the instrument is the judge's incarceration rate among cases based on all the judge's other

cases. The two-stage least-squares estimator is a Jackknife Instrumental Variable Estimator (JIVE) that is used in similar papers on the effects of criminal justice processes.

Using this instrument, we can proceed to test the first-stage relationship between judge assignment and whether a person charged with a crime receives a sentence involving confinement (jail or prison term). We estimate the following equation for person i assigned to judge $j(i)$ using a linear probability model:[7]

$$Incarcerated_{it} = \beta_0 + \beta_1 Z_{j(i),t} + \beta_2 X_{it} + \eta_{it}. \tag{1.3}$$

We can verify that our instrument is reasonable in the sense that sentencing outcomes are affected by our instrument, but initial case/offender characteristics are uncorrelated with $\widetilde{Incarcerated}$. We evaluate whether the observed caseloads are statistically equivalent, and we conduct an F-test of the joint significance of the coefficients in β. We repeat this procedure with sentencing outcomes to establish a baseline of the instrument relevance based on average courtroom differences. Table (2) shows the results of this exercise.

Criminal Types

Individuals are randomly assigned to courtrooms. We can exploit this to compute a proxy for criminal intent. The intuition is as follows: If an individual is incarcerated in a court with low proclivity towards incarceration there is less reasonable doubt than if the individual is incarcerated by a stricter court. Formally we construct:

$$\xi_{it} = Incarcerated_{it} - (\hat{\beta}_0 + \tau_t + \hat{\beta}_1 Court_i \otimes \tau_t) \tag{1.4}$$

The approach is similar to the one followed in some empirical literature assessing adverse selection, e.g. Einav, Jenkins and Levin (2012). A large positive ξ means that an individual was convicted despite being randomly assigned to a lenient courtroom. Conversely, a small negative ξ says that an individual was found not guilty in a courtroom that is relatively more likely to send defendants to jail or prison. Although, having a high criminal type does not imply engaging more in criminal activity —other factors like income and age strongly affect this likelihood— as a matter of robustness, we show in Appendix (A.2) that criminal type is indeed correlated with past criminal history, future dispositions after first arrest, and future dispositions regardless of past criminal history.

[7] We condition on the individual being released from a carceral institution. Alternatively, we can instrument jointly for ever having been in jail or prison, $Incarcerated_{it}$, and a dummy for currently being in jail or prison, $InPrison_{it}$, using a fixed effects specification:

$$\begin{aligned} Incarcerated_{it} &= \pi_0 + \tau_t + \pi_1 Court_i \otimes \tau_t + \epsilon_{it} \\ InPrison_{it} &= \pi_0' + \tau_t + \pi_1' Court_i \otimes \tau_t + \epsilon_{it}'. \end{aligned}$$

Legal Foundations for the Interpretation of Residual

Criminal cases generally adhere to the doctrine of *mens rea*, meaning that it is in general necessary to show intent in the commission of a crime. Salmond (1924) provides what is generally considered the classic definition of *mens rea* for common law countries:

> The general conditions of penal law liability are indicated with sufficient accuracy in the legal maxim, *Actus non facit reum, nisi nisi mens sit rea-* the act alone does not amount to guilt; it must be accompanied by a guilty mind. That is to say, there are two conditions to be fulfilled before penal responsibility can rightly be imposed[...] The material condition is the doing of some *act* by the person to be held liable[...] The formal condition, on the other hand, is the *mens rea* or guilty mind with which the act is done. It is not enough that a man has done some act which on account of its mischievous results the law prohibits; before the law can justly punish the act, an inquiry must be made into the mental attitude of the doer.

At the moment of making a decision to convict an individual, courts look at both the acts and the "criminal-type" of the individual. In a criminal case, the verdict is usually rendered by a jury, and occasionally by the judge. But even when a trial is by jury, the judge still directs the jury on process, including *mens rea* or guilty mind.

Following randomization, we interpret the residual as being a proxy for "guilty mind" or our criminal type. An individual sentenced to carceral confinement in a court that generally is lenient towards its accused either has faced clearer proof of a criminal act or a higher assessment of the "guilty mind" of the accused. Since juries are case specific, appreciation of the facts should not be persistent inside a particular courtroom and, thus, we interpret the extensive margin of a judge's propensity to incarcerate as differences in her standard for a finding of *mens rea*.

Estimation of Income

We don't have information on income. However, we can estimate income from IRS zip-code level income data and the Survey of Consumer Finances.[8] We can leverage the Survey of Consumer Finances to estimate the probability of belonging to an income percentile bracket given the distribution of total loan amount. Using Bayes' rule, the probability of having income i given loan l, $f_{I|L}(i|l)$, is given by

$$f_{I|L}(i|l) = \frac{f_{L|I}(l|i)f_I(i)}{\int f_{L|I}(l|i)f_I(i)di}$$

In our computation, we divide loan amounts into deciles and income into quartiles matching the IRS Data. IRS data provides income distributions by zipcode. Finally, we estimate income by multiplying each income probability given loan amount times average income for

[8] Our approach is similar to Coibion, Gorodnichenko, Kudlyak, and Mondragon (2016).

each income percentile for each zipcode. The estimate of income for an individual in zipcode z, with IRS income distribution i_z^{IRS} and loan decile l_z, is given by

$$i^{Est} = E[i|l_z] = \sum f_{I|L}(i|l_z) i_z^{IRS}$$

We validate our measure of income by comparing against the results derived in Mueller-Smith (2016), hereafter MS. In Table (4.A) column (1), we compare our estimates of lost income against those obtained by MS. We find that following incarceration log income decreases by -.38 points which is very close to his estimate of -.42. Despite both estimates being drawn from the population with criminal records in Harris County, our samples are different. To begin with, our sample is restricted to individuals that have a credit record. This implies a higher degree of attachment to the formal economy. In contrast, MS documents that the incarcerated population in his sample is only weakly attached to the formal labor force. As a consequence, there are two important differences between his estimates and ours we must highlight. First, our estimates are slightly lower than his are since our estimates do not consider the effects on marginal entrants that fail to enter the formal labor force as a result of incarceration. As we will discuss in Section 1.5, this is not a statistical artifact; when we further restrict our sample to reflect full adherence to the credit markets, our estimate significantly lowers. Second, as the volatility introduced by weak adherence to the formal labor sector is vastly reduced in our sample, our estimates are more precise. Taken together, these two differences indicate our results should be interpreted as a lower bound in the decrease in income resulting from incarceration.

1.3 Causal Effects of Incarceration on Access to Credit

An important theme of this paper is that incarceration has effects that extend beyond loss of income. A household's natural response to a drop in income is to reduce consumption. Beginning with Zeldes (1989a), multiple papers have emphasized the impact of liquidity constraints on an individual's response to income shocks. Insofar as individuals are less able to borrow than their willingness and ability to pay suggest, they will be facing additional liquidity constraints. Owing to liquidity constraints, increasing consumption is unfeasible, at least in part, until the arrival of a positive income shock. For goods that require commitment, even the mere risk of lack of liquidity is enough to make consumption of the committed good—durable goods in the context of this paper—suboptimal.[9] In this section we begin our exploration of the effects incarceration has on restricting access to credit for ex-inmates by focusing on the change in their credit scores and their access to financing two important

[9]Support for the role of liquidity constraints in understanding consumption dynamics has been provided in many studies including but not limited to Zeldes (1989b), Jappelli (1990), Aiyagari (1994), Jappelli et al. (1998), Kaplan and Violante (2014) and Jappelli and Pistaferri (2014).

durable goods, namely, automobiles and housing.

Credit Score and Terms of Credit

Credit scores are a summary measure of creditworthiness and take into account payment history, credit utilization, inquiries, and credit length of the borrower.[10] The largest components in calculating credit scores are payment history, with a 35 percent weight, and credit utilization, with a weight of 30 percent. When individuals are sentenced to incarceration, their ability to service debt is affected and, hence, their payment history will suffer. Likewise, if an individual's income decreases due to incarceration, her credit credit utilization will go up as she substitutes lost income with debt (Sullivan 2008; Hurd and Rohwedder 2013; Herkenhoff, Phillips, and Cohen-Cole 2017). This means that the credit score for a formerly incarcerated individual is likely to go down.

We show that this is indeed the case in Table (6). Columns (2)–(8) show that as a consequence of incarceration, credit scores for former inmates decrease 42 to 68 points relative to their pre-incarceration levels. This effect is larger the higher the criminal type of the individual (Figure 1.6). In columns (6)–(8) we also see the estimates of the interaction between incarceration and pre-incarceration credit scores. None of the specifications capture a statistically significant and sizable effect of the interaction of pre-incarceration credit score and incarceration, suggesting that the additional drop in credit scores experienced by high criminal types does not operate through unobservables that determine higher credit scores but through other mechanisms. Indeed, we will show in Section 1.4 that income for high criminal types is differentially more affected by incarceration than income for low criminal types. Since the addition of an interaction term of pre-incarceration credit scores times conviction does not materially change the general effect due to incarceration, this suggests that incarceration's effects on credit scores are relatively independent from the pre-incarceration borrower's credit history and hovers around a 50–point drop in credit score.

A lower credit score has been connected to lower access to credit, higher interest rates, and generally worse terms of credit. Furletti (2003) estimates that for pre-recession credit card holders, the difference in charge yield between a borrower with good credit and a subprime borrower (below 620) hovers around 8 percent. A drop of 50 points in credit score can lead to an increase in charge yields of up to 4 percent. Using the estimates from Furletti, the drop of around 50 points in credit score due to incarceration implies that an individual of a moderately good 725 credit score would have to pay an additional 1.5 percent in charge yields as a consequence of going to prison. The effect is stronger for a borrower with 700 credit score, who would have to pay an additional 3 percent. And as pre-incarceration credit scores go down, the additional charge yield goes up.

[10]Source Equifax. For details, see https://www.equifax.com/personal/education/credit/score/how-is-credit-score-calculated.

Since, as we mentioned previously, the population we are studying is selected in terms of participation in the credit markets, our results of the real costs of financial exclusions are more likely to serve as a lower bound to the total effect. Outright exclusion from access to credit may potentially increase the cost of credit further, as they may be forced to turn towards more expensive sources of credit (e.g., payday lenders) and informal moneylenders should they face an unexpected financial shock. These effects might have other far-reaching consequences, as for example, Dobbie and Song (2015) show on the deterioration of future economic and health outcomes that comes from lack of debt relief for borrowers.

Effects on Access to Durable Goods

In this subsection we evaluate the effects of access to credit on consumption of durables. We first explore the effect incarceration has on auto loans, regarding car purchases as a proxy for durable consumption generally. Afterwards we proceed to evaluate the effects on housing, whose place in the literature is *sui generis*. Durable goods, especially housing, are also thought of as investments. As such, when evaluating the effects of incarceration on auto loans and housing we are able to draw comparisons with estimates of consumption out of housing and non-housing wealth.

Auto Loans

DiMaggio, Kermani, and Ramcharan (2017) analyze adjustable rate mortgages originated before the Great Recession. Exploiting automatic resets of interest rates every five years, they show that households increase monthly car purchases by about \$150.[11] They also find that households voluntarily delever following this cash pass-through. Their finding is meaningful, as it reflects how monetary policy passes-through to households and affects their consumption choices. How do households respond when instead they experience a negative shock to their income?

Detachment from labor markets due to incarceration is likely to generate negative shocks to income, as shown by previous work. We will address this point carefully on Section 1.5. Table (7), columns (5) to (11) present our results. Incarceration generates more than 24 percent decrease in car loans and a 14–28 percent drop in total auto debt. In columns (7) and (8) we estimate a linear probability model to obtain the likelihood of an individual having an outstanding balance on an auto loan account conditional to a sample of borrowers having at least one other type of loan (i.e., individuals highly attached to the credit market). We find that incarceration leads to a drop of 34–45 percent for individuals highly attached

[11] Different from other types of durables, about 80 percent of car buyers use indirect financing through their dealership. It is auto dealers who are the creditor in most transactions. (Davis, 2012). This detachment from conventional credit markets, coupled with a high ratio of new car sales to total auto sales (DiMaggio, Kermani, and Ramcharan 2017), make auto purchases a suitable measure of consumption.

to credit markets. The inability to have auto loan credit has deep consequences. Lack of transportation potentially restricts an individual's ability to get or keep a job and even to bargain wages.[12] In addition, difficulty getting a car loan makes a borrower vulnerable to predatory lenders.[13]

In Section 1.7, we will show that lack of access to credit increases the probability of recidivism. An interesting question arises from the interaction between credit, consumption, and recidivism. Extrapolating the findings of DiMaggio, Kermani and Ramcharan (2017), if the behavior of ex-convicts following expansionary monetary policy mirrors our results, we can expect monetary policy to play a role in crime. This, however, remains an open question.

Access to Housing

The importance of housing for welfare has been evaluated extensively in the literature (e.g., Hoynes and McFadden 1997, Green and White 1997, DiPasquale and Glaeser 1999). Lack of affordable housing has been extensively linked to higher levels of stress, deterioration of health outcomes, and lower levels of educational attainment for children. Some papers have documented the role credit frictions play in the consumption of housing (e.g., Fuster and Zafar 2016).

Table (7) shows the effect of incarceration on the probability of having a mortgage loan. Estimates for the effect of incarceration on mortgages show a decline of 14–16 percent in the likelihood of having a mortgage. All effects control for credit scores. In column (1), we present the ordinary least squares (OLS) estimates of incarceration on probability of having a mortgage loan for the full sample, which contains individuals that may or may not have other loans (i.e., individuals that might be only loosely attached to the formal credit market). The OLS drop is only 8 percent. Using our instrumental variable strategy we obtain a coefficient of 15 percent in column (2). The estimate does not change significantly when we restrict to those borrowers with other loans and add controls (columns 3 and 4).

Reductions in access to housing have effects beyond suboptimal consumption. As we mentioned before, housing affects health and economic outcomes. Homeowners are less likely to move frequently than renters,[14] which provides families and, especially, children with more stability. Relatedly, home stability has been linked to better health and education outcomes especially for children. Homeownership also helps households to accumulate wealth in the form of equity, and the threat of losing that wealth potentially disincentivizes reengaging in criminal activity. By reducing their income and their access to housing, mass incarceration might force families into poorer neighborhoods, overcrowding affordable housing and placing together the poor with those with criminal proclivity and criminal experience, as

[12]Hall and Krueger (2012) have shown that roughly one third of wages are bargained (as opposed to posted wages). Fewer outside options reduces the bargaining position of these workers.

[13]The issue of subprime auto lending has received attention by Congress and the CFPB. See, for example, *United States. Cong. House* (2009).

[14]National Association of Realtors Research Division (2006).

ethnographic work has documented (Desmond, 2016). An increase in demand for different segments of the population increases might have the consequence of inflating equilibrium prices relative to a world without a large incarceration state because the labor market adjusts income downwards following an incarceration spell. Hence, part of that overcrowding might lead to increases in prices for affordable housing and further increases in the charge yield for low income borrowers—a point outside the scope of this paper that deserves future research.

A difficulty when evaluating housing consumption is that housing is a commitment good and adjusting its level of consumption is costly (e.g., Shore and Sinai 2010). A household may not find it optimal to sell their house and buy a smaller one following small transitory losses in income but when facing or anticipating a large income loss, the household may find it optimal to actually adjust their housing consumption. Ex-convicts face a permanent loss of income following incarceration that would induce them to reduce their housing consumption.

As a benchmark, it is useful to review what the literature has said about consumption out of housing wealth and out of nonhousing wealth. Using aggregate data, Carroll, Otsuka, and Slacalek (2010) estimate an immediate marginal propensity to consume out of each additional dollar in housing wealth of 2 cents and then rises to 9 cents. Case, Quigley, and Shiller (2005) estimate the MPC from housing wealth to be between 3 to 4 percent, while their estimates of the MPC out of nonhousing wealth are small and insignificant. Poterba (2000) provides an overview and surveys earlier literature on consumption out of stock market wealth and suggests a consensus of about 3 percent. These effects are not even across time. Focusing on consumption out of total wealth, Ludvigson and Steindel (1999) find an effect of 4 percent, but that effect is only 2.1 percent in the post 1986 sample. In general, studies find that the marginal propensity to consume out of changes in housing wealth is generally higher than for changes in nonhousing wealth. In our specification, the drop in mortgages is lower than the drop in auto loans by a factor of 1.5 to 3. This is consistent with the evidence of earlier work on consumption out of housing and non-housing wealth using aggregate data.[15]

[15]Studies using microdata, have found more varied effects, however. Using the UK Family Expenditure Survey, Campbell and Cocco (2007) find MPCs out of housing wealth of 6 percent for young homeowners and 11 percent for older homeowners. In contrast, Disney, Gathergood, and Henley (2010) and Attanasio, Blow, Hamilton, and Leicester (2008) argue that the apparent effects of housing wealth on consumption are due to omitted factors, e.g. revision of financial expectations or changes in the value of housing collateral. Particularly, Disney, Gathergood, and Henley (2010) find that the MPC out of housing wealth decreases to 1 percent after controls for future financial conditions are included, suggesting that financial conditions play a first-order role on the relationship between housing wealth and consumption.

1.4 Heterogeneous Effects

Heterogeneity in income may naturally play a role in borrowers' decisions. Not only that, heterogeneity can also be correlated with many traits that determine an individual's willingness to pay and, hence, her default risk. Likewise, differences in unobservable traits can also be predictive of criminal behavior. When heterogeneity determining default risk is intertwined with heterogeneity determining crime decisions, an ex-convict's criminal type will also be correlated with her default risk. Through its heterogeneous effect across criminal types, incarceration will differentially affect the ability of lenders to evaluate the default risk of an ex-convict borrower. In this section, we explore the role that both income heterogeneity and criminal-type heterogeneity play in determining the effects of incarceration on access to credit.

Heterogeneous Effects Across Income

In this subsection we assess the heterogeneous response of individuals in response to incarceration across varying levels of income. To begin with, recall that incarceration may affect an individual's income by destroying her negotiating capital and through stigma that successfully reentering the (formal) labor force. Both these effects are stronger for individuals with higher income, through destruction of a higher negotiating benchmark and by lowering the wage by productivity unit. Empirically this implies that individuals with higher pre-incarceration income will show a larger drop in income than individuals with low pre-incarceration income. To test for this, we jointly instrument for incarceration and income times incarceration:

$$Y_{i,post-trial} = \beta_0 + \beta_1 \widehat{Incarcerated}_{it} + \beta_2 \widehat{Incarcerated_{it} \times Y_{i,pre-trial}} + \eta_{it} \tag{1.5}$$

$$s.t. \quad \begin{cases} Incarcerated_{it} = \pi_0 + \pi_1 Court_i \otimes \tau_t + \pi_2 Court_i \otimes (\tau_t \times Y_{i,pre-trial}) + \tau_t + \epsilon_{it} \\ Incarcerated_{it} \times Y_{i,pre-trial} = \pi'_0 + \pi'_1 Court_i \otimes \tau_t + \pi'_2 Court_i \otimes (\tau'_t \times Y_{i,pre-trial}) + \tau'_t + \epsilon'_{it} \end{cases}$$

If we think that individuals with high income lose more negotiating capital, for example, theory would suggest that π_2 should be negative (see Appendix A.1 for a more careful analysis on this). We show that pre-incarceration high income earners are indeed affected the most after being released from incarceration. To implement this, we limit our sample to those with pre-incarceration estimated income. We then jointly instrument for $Incarceration$ and $Incarceration \times$ pre-trial income according to the specification above. Table (5) shows our results. In columns (1), the interaction of incarceration and pre-incarceration income shows a strong negative effect with a drop of .26 percent per additional percentage of income in 2006. In column (2), we limit our sample to the post-incarceration period only to obtain a placebo specification. The interaction here compares post-trial income in 2006 against post-trial income in 2013. Unsurprisingly there is a weakly positive effect. Columns (3)–(6) show alternative specifications with different controls and show that the estimate of the interaction of 2006 income and incarceration for individuals incarcerated after 2006 is consistently in the range of 25 to 30 percent. These results are consistent with our hypothesis and consistent as

well with the evidence that low earners are less dependent on labor markets and that going to jail or prison has lower effects on their negotiating benchmark.

Heterogeneous Effects by Criminal Type

Conditional on conviction, individuals with high criminal types are more likely to have higher incomes pre-conviction and face steeper drops in credit afterwards as a result of their deflated labor income. The intuition, which we formalize in Appendix A.1, is that an individual with high taste for crime (the criminal type) needs more incentives –income, in this case–to be dissuaded than an individual with low taste for crime. This has important implications, as many of these individuals with high criminal type may be forced from salaried employment into other activities. Naturally we can think about increases in recidivism. Another option finds recent support on the work of Levine and Rubinstein (2017), who find that individuals with high ability and with some criminal history tend to become (better) entrepreneurs.

As we explained, we should expect the pre-conviction average income of ex-convicts to increase with their criminal type (Remark 2 in Appendix A.1 and figure A1 in Appendix A.2.1). This should translate into high criminal type individuals having greater drops in credit outcomes. This is confirmed by our results. In Figures (1.6)-(1.9) we can see that high criminal type individuals have a greater drop in credit scores and probabilities of having loans, auto loans, and mortgages. In Figure (1.6), we see that the effect on credit score recovers slightly with time, especially after seven years, when most marks of default disappear from the credit record. Recover is not complete, however, as lower income makes it harder to sustain lower levels of utilization (e.g., DiMaggio, Kermani and Ramcharan 2017). Likewise, loan approval also improves over time. However, we can see that effects on access to durables are more permanent, consistent with the fact that consumption of durables requires higher levels of wealth accumulation.

There are several reasons why individuals with high criminal type are more affected than individuals with lower type. First, as we have emphasized, on average high criminal types have higher pre-incarceration income. Their greater drops in credit metrics can be just reflecting a bigger fall off the job ladder. But it might be also be that the deterioration of their human capital is greater as well. As was documented by Bayer et al. (2009), individuals not only lose skills while incarcerated, they build criminal capital as well. Individuals with high criminal type might just be more susceptible to exposure to other criminals. The fact that this population is more adversely affected has important consequences for reentry, this because their contribution to crime can be greater and the loss to society of human capital can also be greater.

1.5 Obstacles to Credit Access

Limits to credit access are driven by many factors. While incarcerated, households are unable to pay their debts resulting in a poorer credit history. Employers will conduct background checks on prospective employees, many of them finding it harder to find employment ex-post. Another possibility is that banks conduct background checks on households and infer a lower willingness to pay from part of the formerly incarcerated individual. We test for all of these in this section.

Along our analysis, we will compare the changes in credit access for individuals who went to jail or prison with individuals who got probation. Doing this exercise serves several purposes. Individuals that faced probation instead of jail/prison will not face incapacitation, are less likely to lose their employment, and hence, are less likely to face discrimination in hiring since they do not need to reenter the labor market. They will also not experience deterioration of human capital for time spent outside the labor force. They might experience a reduction in their bargaining position with their employer through a hampered ability to exploit outside options but are less likely to lose the gains due to their negotiating benchmark predating conviction.[16] Yet, a conviction appears in the criminal record regardless of the sentence. Furthermore, knowledge of the sentence requires additional in-depth inquiry which increases the search cost for a criminal background check.

Since the effects on ex-convicts on probation would reflect substantially less distortions on their labor market income and credit scores but still would reflect discrimination in both credit and labor markets, we regard any effects on probation to be an upper bound on the total effect of discrimination. In Section 1.6, we will show that there is little evidence that these effects come from the discrimination in credit, suggesting that these effects operate chiefly through labor market discrimination. In the ensuing subsections we compare the effects on access to credit for the population with a conviction and a carceral sentence along with those with only a probation sentence.

Incapacitation

Inability to re-pay debts leads to the decrease in credit for the formerly incarcerated. A worse credit history will lead to lower credit scores and worse terms of credit, as we discussed in Section 1.3, even in the absence of income effects or differential screening in the credit markets. To test for the immediate effects of incapacitation on credit history, we focus on the effects of incarceration on credit score *during* the individual's period of incarceration.

Take a look at Table (8). In columns (1) through (3), we show the effects of a conviction on credit scores. We focus on a population with disposition dates after 2006. Doing so allows us to control for pre-incarceration income while mitigating concerns about potential endogeneity arising from the estimation of pre-incarceration income that may cause it to become

[16]The negotiating benchmark and the flow of outside options are important determinants of wages in job-ladder model of wages. See Jarosch (2017)

a bad control. The results show that on average credit scores go down by about 65 points. Upon closer examination, we can see that about half of this drop comes as a consequence of time spent incarceration while the other half comes as a direct consequence of going to either jail or prison. This is shown in column (2). The coefficient of sentence length indicates there is a loss of around 47 points for each year incarcerated in addition to an immediate drop of about 28 points. This suggests that individuals who are incarcerated face challenges in repaying their debt both at the onset of their sentence and that the effects are compounded as the length of the sentence increases. In contrast, obtaining a probation indictment (column 3) shows virtually no change in credit scores with a statistically insignificant drop of around 1 point, which is expected as individuals facing probation do not usually lose their jobs. These effects are similar to those on labor income (columns 4 through 6) that we will discuss in the following subsections.

Labor Income and Credit Screening Process

Creditors not only underwrite based on credit reputation (i.e., credit scores) but also based on credit capacity. Credit capacity is generally captured by debt to income ratios and, as such, will be affected not only by reductions in income but also when a borrower replaces income with debt. That borrowers replace income with debt has been well-documented in the literature. Sullivan (2008) uses an indirect approach to show that unemployed households increase their unsecured debt by 11 to 13 cents per dollar following a decrease in labor income. He shows that this response is driven by households with low assets but not by those at the lowest decile of the asset distribution. Using the RAND American Life Panel, Hurd and Rohwedder (2013) note that 18 percent of unemployed households report using credit cards or borrow money to replace income. These dynamics are analogous to the seminal consumption smoothing findings of Gruber (1997). Using the Panel Study of Income Dynamics (PSID), he shows that following periods of joblessness, unemployment insurance helps smooth consumption across the unemployment spell.

To understand the link between incarceration and labor income, it is worthwhile to expand briefly on how negative shocks impact workers' earnings. Slack or loose labor market conditions can reduce the workers' equilibrium compensation and their ability to get rehired after a job loss. Losing a job affects the job ladder position of a worker. And finding a productive worker-employer match takes time as it does finding an employer providing high levels of job security. Hence, the loss of a job implies not only the loss of income, but the loss of salary as a negotiating benchmark, and the loss of a high quality employer-employee match. Reincorporating into the labor force would begin with a poor match relative to the pre-job loss match, in the sense of working for a less productive or less secure employer. All of this means that after a job loss it will require time and effort to restore a pre-job loss working conditions. Evidence shows that, as a consequence of job displacements, workers face permanent reductions in lifetime earnings (Jacobson, Lalonde, and Sullivan, 1993). Similarly, reductions in lifetime earnings are also the result of depreciation of human capital

during the time a worker has spent outside the labor force. When an individual is sent to jail or prison, she must face all these negative consequences. And when inmates are released and reenter the labor market, discrimination in the labor markets at the time of rehiring can amplify these losses. In this paper, we argue that each of these mechanisms directly affects ex-inmates, and we will provide estimates of their effects.

Many papers have established the link between crime and labor market conditions. For example, Raphael and Winter-Ebmer (2001) show that crime is tightly linked to changes in the unemployment rate. Many others have assessed the impact of incarceration on future labor market income and on employment. Most recently, MS shows that labor income is adversely affected after incarceration. The labor market effects of incarceration may bear resemblance with the literature on the cost of a job loss. For example, in a seminal paper, Jacobson, Lalonde, and Sullivan (1993) using longitudinal data on displaced and non-displaced workers found that following displacement workers suffer long-term losses of around 25%. Several other papers have also documented large losses to workers' wages following displacement (Schoeni and Dardia 2003; Couch and Placzek 2010; von Wachter, Song, and Manchester 2009). More recently, Sullivan and von Wachter (2009) and Handwerker and von Wachter (2010) have shown that the effects of displacement are not restricted to labor income but also extend to mortality and homeownership levels, respectively. Similar to the job displacement literature, the effects of incarceration extend beyond income, with effects on mortality documented by MS, while we documented effects on access to housing in Section 1.3.

Using our estimate for income (as described in Section 3), Table (4) provides our estimates for income loss following incarceration. Our results are in line with the MS estimate of -.42. However, MS estimates are marginally insignificant while ours are very strong. The reason is important to understand. Low-income defendants are less likely to participate in the formal labor market even in the absence of incarceration, a point also made by MS. Our population, however, is that of those who have credit and who are, presumably, more tightly attached to the formal labor force.

Depreciation of human capital, falling off the job ladder, or discrimination in the labor markets should all affect the labor income of high earners more so than that of low earners. Inability to repay debts is not the only consequence of longer incarceration spells. As sentence length increases so does unemployment spell. This leads to depreciation of skills. But it is not only that skills depreciate during time incapacitated, some research has also argued that *criminal capital* is formed in jail or prison (Bayer et al., 2009). In order to test for whether incarceration affects credit outcomes by deteriorating human capital, we focus on variation in the length of the sentence. Workers who are incarcerated for a short time will presumably lose less human and social capital than those staying for longer periods of time. As loss of negotiating benchmarks and discrimination affect all individuals who are incarcerated in a similar manner, we can again exploit the variation in the sentence length to obtain estimates of the loss of income due to deterioration of human capital.

Table (8), columns (4)–(6) shows our results. In column (5), we see that the effect

of being incarcerated, independently of sentence length is a drop of 12 percent of income. There is also a loss of income of around 5 percent for each year spent in jail or prison. For a mean average sentence length of around six months, this means that being incarcerated accounts for 82.8 percent of the income loss. Let us emphasize that these estimates are for a population relatively attached to the formal labor force that also is incarcerated for two years or less. Still, these results suggest that the effects of incarceration have deeper consequences for income than deterioration of human capital does.

We would further like to roughly assess what the contributions of falling off the job ladder are *vis-à-vis* stigma in the labor markets. Under the assumption that discrimination only operates through the labor market (we will rule out discrimination in the credit market in Section 1.6), we can take the effect of a conviction for the population on probation as our estimate of the effect of discrimination on income. As we mentioned earlier, individuals sentenced to probation do not have to leave their employment but their record does show a conviction, making it harder to get other employment offers. In column (6) we can see that individuals on probation face an expectedly smaller drop in income, of a magnitude of around 8 percent. This makes up 66.6 percent of the 12 percent loss of income due to being incarcerated. Overall, this implies that about 23.5 percent of the loss in income is due to loss of negotiating capital and employee-employer match, 47.1 percent is due to labor market discrimination and 29.4 percent is due to depreciation of human capital. Another way of looking at this is that individuals who go to jail or prison have an income loss twice the size of those on probation, and the reductions in credit reflect this in more than one way—in the lenders' evaluation of ability to pay and also their inference about willingness to pay.

Voluntary Delevering?

Given the fact that former inmates experience a decline in income, it is natural to ask whether the reduction in credit they experience is a completely voluntary decision. A difficulty in answering this question lies in disentangling the reduction in credit that is demand versus supply driven. That is, as a consequence of lost income, ex-convicts may seek less debt voluntarily, but they may be also facing harsher terms of credit. When individuals are released from carceral confinement and reenter the labor force, their income is generally lower than their preconviction income. Of itself, this will cause a decrease in the borrowing capacity of the individual, which will be internalized by both the lender and the borrower. Evidence suggests that in response to negative income shocks individuals may reduce their consumption (for evidence on a positive income shock see Parker et al. (2013) and Johnson, Parker and Souleles (2006)). There is also evidence that borrowers' *expectations* about home values prior to the Great Recession were an important driver of the crisis (see Adelino, Schoar and Severino, 2017). This evidence points to the possibility that ex-convicts are borrowing less due to lower income or low expectations of income growth but not because of lower access to credit. In a different finding, DiMaggio, Kermani and Ramcharan (2017) find that,

following a permanent *positive* income shock, households delever—which points out that frictions play a bigger role when income is lower and prevent lower levels of borrowing.

To test for this, we analyze the search effort the borrower must exert to get a credit account. This is operationalized by evaluating the change in credit inquiries normalized by the total number of credit accounts due to incarceration. Owing to Equifax data, information about both, credit inquiries and credit accounts, is readily available for our analysis. An increase in inquiries would point out that borrowers are not delevering voluntarily. However, since borrowers can be discouraged from applying for loans if they expect to be rejected, a decrease in inquiries would be inconclusive. Similarly, because of search costs, any estimates we obtain would be biased downwards, which implies our test provides a conservative assessment of whether delevering occurs in part because of lack of access to credit.

We present our results in Table (9). Incarceration leads to an increase of between .54 and .97 additional inquiries per credit account. The results are unsurprising, but highlight that reductions in access to credit are not a purely voluntary development from the borrower's perspective. To be clear, this does not imply that there is not some voluntary delevering, but we interpret it as evidence that supply side considerations are the main driver of restricted access to credit.

Screening and Stigma

Formerly incarcerated individuals may face harsher conditions obtaining credit if creditors believe the criminal record is informative about the individual's ability or willingness to pay. Even when income information is available, the bank could interpret the individual's criminal history as evidence of lower ability to repay. This could be so if the individual faces higher levels of unemployment risk following incarceration—i.e., if unemployed, she will be less likely to get another job. Similarly, the bank might use criminal history to assess the "character" of the borrower—if proxying "character" based on criminal history signals low or high willingness to pay relative to other borrowers with the same observables.

We will refer to the event of (1) borrowers with criminal history getting less credit than borrowers with the same observables while (2) defaulting at an equal or lower rate as "stigma." As can happen with deflated labor incomes due to criminal history, stigma sends lenders a wrong signal about the borrowers willingness to pay. And also as it happens with labor incomes, stigma operates as a friction in the credit markets that generates advantageous selection of borrowers. In contrast with deflated labor incomes, which affect the creditors' decision to lend by muddling the inference made about the *unobservables*, stigma operates not through unobservables but *through the observability* of criminal history. Therefore a finding of no advantageous selection based on criminal history but a finding of advantageous selection based criminal type would suggest that stigma is not driving restricted access to credit and instead lack of access to credit is operating through the labor market.

To fully test for stigma, we need to delve into an analysis of performance and advantageous selection. We will carefully undertake that analysis in the next section. For now, let us consider an alternative approach. We can make an upper-bound assessment of the presence of stigma in lending by analyzing the performance of individuals put on probation. Let us recall from our discussion at the beginning of this section that an individual sentenced to probation gets a conviction in their criminal record, but faces no removal from the labor force, no incapacitation to pay debts, and no depreciation of human capital due to being incarcerated. As we discussed previously and can see in Table (8), individuals facing probation have virtually nonexistent effects on credit scores (a statistically insignificant less than one point reduction) and their drop in income is less than half that of individuals sent to jail or prison. Thus, the performance effects due to muddling of unobservables we obtain for individuals on probation will be significantly smaller than for those individuals who are incarcerated, but the performance effects due to stigma must be the same for both groups. This makes the loan performance of individuals on probation a conservative assessment of the presence of stigma in lending.

Our results are in Table (10). In columns (5) and (8) we can see that individuals that underwent probation have about the same probability of 30-day default and bankruptcy, respectively, that individuals found not guilty have. Contrast this against columns (1) and (4) for individuals who are incarcerated, whose 30-day default is 41 percent lower and likelihood of bankruptcy is 11 percent lower. For individuals who underwent probation, we could potentially only find some evidence of stigma in their 60- and 90-day default rates. Columns (6) and (7) show that they are less likely to default at 60 or 90 days than individuals found not guilty by 7 and 10 percent, respectively. Yet these numbers include the effect of unobservables muddled by lower income. We take this as evidence of low levels of stigma in lending and proceed to make a more in-depth analysis now in this following section.

1.6 Informational Distortions, Selection, and Lender's Role

Lenders screen borrowers in part by looking at their credit scores and labor income. These variables inform the lender about the default risk each borrower represents. However, because credit history and labor market income are reduced by incarceration, the informational content of screening on these traits is distorted— and by "distortion," we mean that the unobservables that explain the same income and credit scores for an individual who goes to jail or prison will differ from those of an individual who does not. For instance, if the lender only observes income, performance conditional on income does not only capture ability to pay but also those unobservables determining willingness to pay that happen to be correlated with income— grit, for example. In the context of employment discrimination, by paying less to workers that have been incarcerated, employers are effectively not only adding noise

to the signaling value of income, but changing the signal altogether.

Lenders may plausibly be aware of these informational distortions.[17] If they are, they may naturally be inclined to correct for the distortions as it would be profitable for them to do so. Lenders could correct at two levels: (i) they could correct for the *average* informational distortion due to incarceration; and (ii) they could correct for *heterogeneity* in the informational distortion (we documented the heterogeneous effects of incarceration in Section 1.4). To correct for an average informational distortion, it suffices to know the criminal history of the applicant. Since criminal history is verifiable to the lender, we will refer to this as correcting on observable information, and, as such, we can test whether lenders are able to correct for the average portion of the informational distortion. To correct for heterogeneity in the informational distortion, the lender needs to account, directly or indirectly, for characteristics of the applicant that explain both incarceration and default risk. This information is plausibly unavailable to the lender and, thus, we will refer to this as correcting on unobservable information.

In contrast with criminal history, the criminal type of the borrower is both unobservable and unverifiable to the lender. The econometrician, however, can proxy for it as per Sections 1.2 and 1.4. This gives us a test of whether informational distortions still pass through to the screening process because of heterogeneity in informational distortions. The average individual with a high criminal type will have better pre-conviction unobservables than the average non-convicted individual. As we documented in Section 1.4, when individuals with high criminal type are incarcerated, their income and credit scores experience a larger than average drop. Since the lender cannot account for this, we should expect a negative correlation between default risk and criminal type. If that is the case, this means that informational distortions are passing through to the screening process. These heterogeneous effects must be absent for applicants who were sentenced to probation, as their income and credit scores are only mildly affected by a conviction.

In summary, in the following subsections we test the following:

(1.6) Performance of Former Inmates: We test whether former inmates default at lower rates than non-convicted individuals. In the previous section, we saw individuals that undergo probation default at similar rates to non-convicted individuals, partly because they are less affected by the correctional system.

(1.6) Correction of Informational Distortions for Observationally Equivalent Borrowers: We test for whether the lender can use criminal history to mitigate asymmetric information problems. Since the lender cannot costlessly distinguish between types of conviction—i.e., jail/prison vs. probation—a correction intended to benefit former inmates will create or exacerbate an adverse problem for individuals who underwent probation. This is because the observables (credit scores and income) of individuals who underwent probation were not equally affected by the correctional system.

(1.6) Correction of Heterogeneity in Informational Distortions: The lender should not be able to correct based on criminal types since this information is unobservable to the

[17] For a sample loan application asking for criminal history, see Appendix A.3.

lender. Hence, high criminal type individuals that were incarcerated should perform better than non-convicted individuals with similar observable information. This would not be the case for high criminal type individuals that underwent probation since their observables are only slightly affected.

Performance of Former Inmates

First we only look at performance of loans given to the formerly incarcerated, without regard to adverse selection problems which we leave for the next subsection. As we have documented (and we also formalize in Appendix A.1), following conviction, workers are expected to be paid less than what their set of characteristics warrants. Since many of these characteristics are unobservable at the time of a request for credit, the lender might be unable to properly screen for the default probability of the loan. If that is the case, conditional on obtaining a loan, we might see better performance for borrowers that have been formerly incarcerated. In this subsection we establish that indeed formerly incarcerated individuals default at lower rates than non-convicts, leaving the discussion of selection for the next subsection.

In Table (10) we present our results. Columns (1) through (4) present the loan performance of individuals going to jail/prison (columns (5)–(8) present results on individuals sentenced to probation, see Subsection 1.5 for a discussion). Individuals who went to jail or prison experience 41 percent, 30 percent, and 20 percent less 30-day, 60-day, and 90-day delinquencies, respectively, than individuals found not guilty. This better performance might be due to several reasons: pricing, statistical discrimination, stigma, and suboptimal lending due to information frictions (i.e., muddling of unobservables).

Can the Lender Correct for Informational Distortions?: Testing for Adverse and Advantageous Selection

Lenders could discriminate against felons because of stigma. But formerly incarcerated individuals' ability to repay might be hampered by lower job prospects. Lenders will take that into consideration when granting credit. As we mentioned before, in this paper we regard stigma as discrimination based on criminal history that is not supported by loan performance. Different from statistical discrimination, stigma in lending is a friction in the sense that it prevents profitable lending. Consequently, loans given by lenders that discriminate against former inmates because of stigma should have advantageous selection—i.e., better borrowers given conditional on screening criteria—as their lending decision would be orthogonal to the repayment ability of the inmate. Conversely, if lenders simply statistically discriminate in response to the lower repayment ability of the individual, the lender should face no advantageous selection and possibly some degree of adverse selection.

We test for the presence of adverse selection by following the positive correlation test of selection introduced by Chiappori and Salanié (2000).[18] The intuition of the test is simple: For observationally equivalent borrowers (observationally equivalent to the lender), a positive correlation between incarceration and default means that there is an asymmetric information problem that systematically explains both incarceration and default. Hence, a positive correlation between defaults and incarceration, conditioning on observables, implies adverse selection when lending to former inmates. Conversely, if this correlation is negative, there is advantageous selection when lending to former inmates, conditioning on observables. Our tests in this section are in the same spirit of *outcome tests* proposed by Becker (1957, 1993)[19] to detect taste discrimination in lending against minorities and that have gained traction in the analysis of discrimination in other settings, mostly policing (Goel, Rao and Shroff 2016, 2017; Ayres 2002; Knowles, Persico and Todd 2001).

Selection and Incarceration

Following Chiappori and Salanié (2000), we implement the test of selection in the form of a bivariate probit:

$$Incarcerated_{it} = \mathbb{1}(X_{it}\beta + \nu_{it} > 0) \tag{1.6}$$

$$default_{it} = \mathbb{1}(X_{it}\gamma + \eta_{it} > 0) \tag{1.7}$$

where $Incarcerated_{it}$ is equal to 1 if the individual has been formerly incarcerated at time t, and $default_{it}$ is equal to 1 if the individual has defaulted and 0 otherwise. The $default_{it}$ variable can refer to defaults during the past 30, 60, or 90 days, or to bankruptcy. The intuition behind the test is that, if there is adverse selection, the unobservables that lead to being incarcerated ν_{it} must be correlated with the unobservables that lead to default η_{it}. Conversely, for a correlation coefficient between ν_{it} and η_{it}, ρ, a negative and significant value signifies advantageous selection. In competitive markets ρ must be weakly positive (Chiappori and Salanié 2000, 2013). In our context, a negative ρ will reflect frictions preventing competitive lending. Thus, since both stigma and muddled information prevent optimal lending, they should imply a negative ρ. Hence, ρ gives us an upper bound in the level of stigma faced by ex-incarcerated borrowers, and we can take a ρ close to zero as evidence of lack of stigma. Positive and significant ρ suggests the presence of adverse selection.

[18] For an application of this test in an analysis of asymmetric information in lending markets, see Crawford, Pavanini, and Schivardi (2017).

[19] "[...T]he correct procedure for assessing whether banks discriminate [...] is to determine whether loans are more profitable to blacks (and other minorities) than to whites. This requires examining the default and other payback experiences of loans, the interest rates charged, and so forth. If banks discriminate against minority applicants, they should earn *greater* profits in the loans actually made to them than on those to whites. The reason is that discriminating banks would be willing to accept marginally profitable white applicants who would be turned down if they were black." (Becker 1993. Emphasis his.)

Table (11) columns(1) and (2) summarize our results. We focus on the correlation, ρ, between residual traits ν leading to defaults and residual traits, η, leading to a conviction. We showed in previous sections that convicted individuals are less likely to get loans. What Table (11) shows is that when lenders screen based on observable information (credit scores, income, age) residual traits do not explain differences in default rates which is inconsistent with lenders stigmatizing formerly incarcerated individuals. Column (1), which describes screening based on credit scores, shows a correlation ρ very close to zero for all defaults during the last 30, 60 and 90 days, and also for bankruptcies. Column (2) describes screening based on credit scores and estimated income, and also shows a correlation ρ very close to zero for defaults during the last 30, and 60 days, and for bankruptcies, but finds some evidence of adverse selection at the 90-day defaults metric.

Favorable Discrimination?

As we stated before, ρ contains information of both stigma and muddled information. A ρ close to zero not only implies that the likelihood of stigma is low, but also that there might be active effort from lenders to reduce the informational distortion generated by incarceration. Looking at individuals that underwent incarceration in Table (11) is insufficient to reach this conclusion. However, we can use the same approach we have used in previous sections of exploiting the equal observability of conviction for individuals sentenced to either incarceration or probation, whereas the income and credit scores are more deteriorated for the former. If lenders are making an effort to resolve the information distortion, we should see evidence of adverse selection for individuals sentenced to probation. Results are in columns (5) and (6) of Table (11). From column (5) we see that, after the lender screens based on credit scores, performance for individuals with probation sentences is worse. They exhibit strong positive correlation between conviction and 30-day, 60-day, and 90-day delinquencies and, also, a strong positive correlation with bankruptcy. That is, by lending to individuals sentenced to probation, lenders are facing adverse selection. The finding subsist after we account for the lender screening also on income, as column (6) also finds strong positive correlations ρ for all default measures.

Our results in this subsection suggest that there is little evidence of discrimination in the credit markets. On the contrary, there is some, albeit weak, evidence of favorable treatment by lenders. Formerly incarcerated individuals are less likely to get a loan than those not incarcerated, but they are only marginally less likely to default than those not confined. And when we extend the analysis to individuals sentenced to probation, we find that there is adverse selection, consistent with the idea that lenders can use observable information, the criminal record, to correct informational asymmetries arising from frictions in the interplay between labor markets and incarceration. In contrast with this subsection where we evaluated the role of potentially observable information, in the next subsection, we evaluate the

role of unobservable information to further show how labor frictions generated by incarceration spill over to credit markets.

Can the Lender Correct for Heterogeneous Distortions?: Selection and Criminal Types

As we discussed in Section 1.4 (and Appendices A.1 and A.2), average pre-incarceration income is increasing in criminal type. We have also shown that losses in credit scores and overall access to credit are greater for higher criminal types. Following our discussion in Subsection 1.2, the estimated residual of formerly incarcerated status on court-year fixed effects captures the propensity of individual to crime. As in the last section, we run a correlation test à la Chiappori and Salanié (2000), but we include court-year fixed effects as controls in our specification:

$$Incarcerated_{it} = \mathbb{1}(\beta_0 + \tau_t + \beta_1 Court_i \otimes \tau_t + X_{it}\beta + \nu_{it} > 0) \quad (1.8)$$

$$default_{it} = \mathbb{1}(\beta_0 + \tau_t + \beta_1 Court_i \otimes \tau_t + X_{it}\gamma + \eta_{it} > 0) \quad (1.9)$$

where the main difference between equations (1.6-1.7) and (1.8-1.9) is the inclusion of court-year fixed effects. The inclusion of the fixed effects lets the residual ν_{it} be our estimate of criminal type.

The interpretation of a correlation is different from the previous section. A positive correlation means that high criminal types are less likely to repay, lending support to using criminal history as a proxy for "character" at least in the lending context. A negative correlation, however, would suggest that high criminal types have better repayment ability, which is consistent with our findings thus far and the analytical framework put forward in Appendix A.1.

Table (11) reports our results. As we explained in the heterogeneity results in Section 1.2, high criminal types are comparatively less likely to receive loans than the overall incarcerated population. We want to know if this differential access to credit arises due to informational distortions. To make that inquiry, we now take a look at columns (3) and (4). Different than in the previous subsection, we consider the performance of a loan taking into consideration both incarceration and criminal type. When criminal type is considered, loans substantially overperform (ρ <0) relative to their unincarcerated counterparts in all categories—30-, 60-, 90-day delinquencies as well as bankruptcy. In column (4) we see a similar pattern for all default measures except 90-day defaults. These results highlight that the lenders in unable to fully correct for informational distortions and that heterogeneity in the effects of incarceration on applicants are unaccounted for when allocating credit.

To further assess whether it is informational distortions which cause a negative correlation between residual traits explaining defaults and criminal type, we look at individuals that underwent probation instead of incarceration as a sort of placebo test. This is so because

probation has a smaller effects on the individual's income and no effects on credit scores. Using column (7) and (8) we can see whether heterogeneity affects loan performance for individuals that faced probation instead of incarceration. It doesn't. This is consistent with the fact that since probation virtually no effects on its underlying population, it does not exhibit either differential effects across individuals with different criminal types and there should be no informational distortions.

These results are also consistent with our conceptual analysis in Appendix A.1 and provide additional evidence of the spillover effects from frictions in the labor market to credit. Labor income and credit scores are proxies for both ability and willingness to pay of a prospective borrower. When there is a disconnect between the information contained in the proxy, income or credit score, and the characteristics of interest, ability + willingness, banks will under provide credit to borrowers with a criminal history.

We have shown repeatedly that incarceration not only affects the access to credit of ex-inmates, but that the effects are stronger for high criminal types. Presumably, if under more favorable conditions individuals engaged in crime, all else equal, after facing lower access to credit the likelihood of reengaging in crime must be high, especially for high types. This begs the question: Does lack of access to credit lead to recidivism? We approach this question in this following section.

1.7 Lack of Access to Credit and Recidivism

In general equilibrium, reduction in credit access has an intricate effect on crime. On the one hand, reduction in future credit access may act as a deterrent. On the other hand, for the formerly incarcerated, it is easier to recidivate. Since the incentives are stronger for the high crime-types, who are also ex-ante richer on average, formerly high income ex-convicts will crowd out credit for the poor, further increasing their incentives of engaging in criminal activity.

Yet, evidence on the deterrence effect of punishment is mixed. On the one hand, the threat of incarceration has strong deterrent effects (Levitt 1996). On the other, studies have failed to show deterrence effects stemming from longer sentences (Lee and McCrary 2017) or the death penalty (Donohue and Wolfers 2009). Under the assumption that the threat of death has a higher order effect than the threat of worsened access to credit, we should expect the deterrence effect of lack of access to credit to be nil. Still, death penalty affects different populations relative to the overall correctional system, so this assumption might not be relevant. A more relevant assumption would be to claim that the threat of longer sentences has a higher order effect than the threat of worse credit access but, while relevant, this one might not hold true.

Recognizing that there might still be general equilibrium effects at play, we will abstract from these, and analyze instead whether lack of access to credit increases the likelihood of

recidivism for the formerly incarcerated. To do so, we exploit an approach set forward on Agarwal et al. (2017). We exploit discontinuities in credit limits for borrowers. Before proceeding to our estimation equation, we find it useful to provide some context on the modeling practices of the lenders.

Estimation and Validity of Credit Limit Discontinuities

When setting out credit limits, lenders establish their tolerance for risk of default given observables. Lower credit scores generally imply a higher likelihood of default. A common practice of banks is to set out credit limits based on cutoff scores, wherein a borrower just below the cutoff score would receive a different credit limit than a borrower just above the cutoff (FDIC, 2007). Agarwal et al. (2017) show that this process can be optimal when there are fixed costs to determine the optimal contracting terms for similar borrowers.

Even though documentation of the general practices of lenders is readily available, specific lenders and precise cutoffs are unobservable to the researcher and must be estimated. Following closely the procedure set forth in Agarwal et al. (2017), we average credit limits by 5-point risk score bins while restricting our sample to borrowers with credit above 600 (credit scores below 620 are generally considered subprime). From Figure (1.10), we can identify candidate credit score discontinuities. To formally detect these discontinuities, we run threshold regressions following Hansen (2000):

$$\begin{aligned} \log(CL) &= \delta_1 CS + \eta \quad \text{if } CS \leq \gamma \\ \log(CL) &= \delta_2 CS + \eta \quad \text{if } CS > \gamma \end{aligned} \tag{1.10}$$

where CL is the credit limit, and the credit score, CS, is both the regressor and the threshold variable used to split the sample into two groups or regimes. Our credit limit discontinuity is the estimate of our threshold, γ.[20] We sequentially estimate the remaining credit limit discontinuities by performing threshold tests in each of the regimes.[21] Following this procedure we obtain six quasi-experiments in the form of credit limit discontinuities at credit scores of: 625, 665, 700, 735, and 770. The results of the LM test for the presence of a discontinuity are shown in Figure (1.11). To our list of quasi-experiments we add 640 and 655 based on our reading of Figure (1.10). We pool our seven credit limit quasi-experiments to perform a regression discontinuity analysis in the next section.

In Figure (1.12), we show the behavior of applicant characteristics around the pooled cutoff, $\bar{\gamma}$. Panels A and B show credit outcomes—in particular, in credit limits and, to a lesser extent, number of credit accounts—are smoothly increasing in credit score except at the cutoff where there is a discontinuous jump. Panel C and D show applicant characteristics typically taken into account during the credit process—estimated income and age are expectedly positively correlated with credit score but exhibit no discontinuous jump, remaining

[20] Endogeneity of the estimate γ is not a concern as threshold estimates are super-consistent.

[21] A more rigorous approach can be found in Gonzalo and Pitarakis (2002).

smooth at the cutoff. In Panels E and F, we show applicant characteristics related to their past criminal history—conviction and sentence—and both are also smooth around the cutoff.

First Stage

Since assignment to each side of the cutoff may depend on other applicant characteristics we implement our estimated credit limit discontinuities in a fuzzy RD research design. In addition, since we are interested in assessing the effects of credit on recidivism, we must supplement our fuzzy RD design with the random judge assignment strategy we have followed thus far for the rest of the paper. We can implement both simultaneously in instrumental variable form. Following Calonico, Cattaneo, and Titiunik (2014), we estimate the optimal bandwidth h to be 12 credit score points. The first stage takes the form:

$$\begin{aligned} CL_{it} = \beta_0 + \beta_1 \widehat{Incarcerated}_{it} + \beta_2 RD_{it} + \beta_3 \widehat{Incarcerated}_{it} \times RD_{it} + \\ \beta_4 CS_{i,pre-trial} + \beta_5 \widehat{Incarcerated}_{it} \times CS_{i,pre-trial} + \beta_6 RD_{it} \times CS_{i,pre-trial} + \\ \beta_7 \widehat{Incarcerated}_{it} \times RD_{it} \times CS_{i,pre-trial} + \epsilon_{it} \end{aligned}$$

where $RD = \mathbb{1}[CS_{i,pre-trial} > \gamma]$. We have allowed the relationship between pre-trial credit scores, CS, and credit limit, CL, to vary above and below the cutoff, and also to vary for formerly incarcerated and never incarcerated individuals. We are interested in β_2 and β_3.

The results of the estimation are reported in Table (12) Panel A. Column (1) reports OLS results whereby an individual with pre-trial credit scores above the cutoff will still enjoy a higher credit limit after incarceration. Instrumental variable estimation shows this is not the case. Columns (2) to (4) show that the drop in credit limit for a former convict with pre-trial credit scores above the cutoff is between \$4,360 to \$6,960 higher than for a former convict with pre-trial credit scores below the cutoff. This is natural, as individuals with more available credit have more opportunity to default on their debt and, consequently, to adversely affect future borrowing ability.

2SLS Estimates

We are interested in assessing whether reductions in credit increase a formerly incarcerated individual's likelihood of recidivating. To that end, we compute 2SLS estimates based on the following specification:

$$\begin{aligned} Recidivism_{it} = \beta_0 + \beta_1 \widehat{Incarcerated}_{it} + \beta_2 \widehat{CL}_{it} + \beta_3 \widehat{Incarcerated}_{it} \times \widehat{CL}_{it} + \quad (1.11) \\ \beta_4 CS_{i,pretrial} + \beta_5 \widehat{Incarcerated}_{it} \times CS_{i,pretrial} + \beta_6 \widehat{CL}_{it} \times CS_{i,pretrial} + \\ \beta_7 \widehat{Incarcerated}_{it} \times \widehat{CL}_{it} \times CS_{i,pretrial} + \epsilon_{it} \end{aligned}$$

(1.12)

where each regressor

$$\widehat{X} \in \{\widehat{Incarcerated}, \widehat{CL}, \widehat{Incarcerated} \times \widehat{CL}, CS, \widehat{Incarcerated} \times CS, \widehat{CL} \times CS, \widehat{Incarcerated} \times \widehat{CL} \times CS\}$$

is instrumented jointly using court fixed effects and credit limit discontinuities as instruments. This is:

$$\begin{aligned} X_{it} = {} & \pi_0 + \pi_1 RD_{it} + \pi_2 CS_{i,pretrial} + \pi_3 Court_i \otimes \tau_t + \pi_4 Court_i \otimes (\tau_t \times RD_{it}) \\ & + \pi_5 CS_{i,pre-trial} \times RD_{it} + \pi_6 Court_i \otimes (\tau_t \times CS_{i,pretrial}) \\ & + \pi_7 Court_i \otimes (\tau_t \times CS_{i,pre-trial} \times RD_{it}) + \epsilon_{it}. \end{aligned}$$

Our results are shown in Table (12) panel B. Columns (2)–(4) show our results using IV estimation. A decrease in pre-trial credit limit of about $1,000 increases recidivism by 1.37–1.46 percent. Combining these estimates with the changes in credit limit from Panel A, we estimates that going to jail or prison increases the likelihood of recidivating by 15.2–19.6 percent relative to individuals with high credit limit, and by 3.8–5.3 percent relative to the individuals with low credit limit. As a comparison, the U.S. Sentencing Commission (2016) found that 49.3 percent of offenders were arrested again within eight years of being released from incarceration or being placed on probation. In our sample that number is 40 percent. These numbers have two implications: (i) increasing access to credit reduces criminal activity; and (ii) removing access to credit is more damaging than not having had credit at all. For individuals with no previous criminal history, the effects are expectedly smaller. The likelihood of recidivating stands by 1.5–5.5 percent relative to individuals with high credit limits, but it decreases by .8–1.6 percent relative to the individuals with low credit limits, suggesting that for individuals with no previous criminal history there are permanent gains to having had high credit limits in the past.

These results are consistent with the findings of Raphael and Winter-Ebmer (2001) that increases in unemployment have positive and significant effects on property crime rates and with those of Gruber (1997) on the importance of consumption smoothing during unemployment spells, and Herkenhoff, Phillips, and Cohen-Cole (2017) who find that credit allows individual to take on better matches. These are also consistent with the findings of Garmaise and Moskowitz (2006), who find that bank concentration increases property crimes. Lack of access to credit diminishes the efficacy of incarceration in deterring crime.

1.8 Conclusion

In this paper we have shown that incarceration decreases future access to credit. We demonstrate that there is little evidence of discrimination in the credit markets but that, in contrast, there is strong evidence that access to credit is hampered by: (i) inability to pay creditors

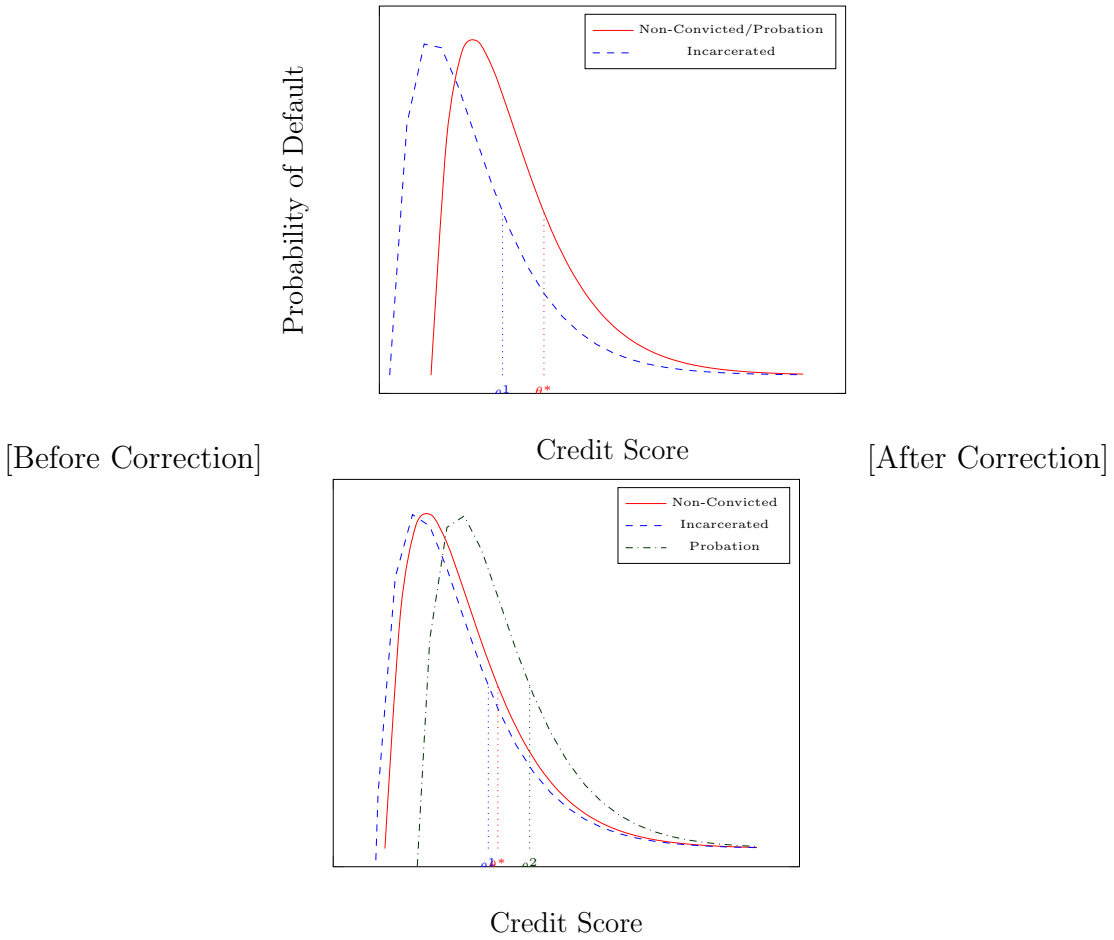
while confined; and (ii) poor labor market outcomes after reentry. Restricted access to credit due to incarceration significantly reduces the ex-incarcerated's durable consumption.

We show that labor market effects spill over to credit markets, and that this has the consequence of amplifying the negative labor market shocks to workers. The interconnection between labor and credit markets amplifies challenges the ex-inmates already have when reentering the labor force following release from jail or prison. This is the case because the need of to smooth consumption and consume durables is impaired by the lender's inability to observe some individual traits of the borrower and because frictions in the labor market obfuscate the signaling value of income and credit history. In summary, crime policy and labor market practices can generate frictions in the credit market as it aggravates an incompleteness problem.

Conversely, we also showed that lack of access to credit aggravates the problem of recidivism. Formerly incarcerated individuals are 15–20 percent more likely to recidivate following a decrease in credit. This effects is stronger for individuals that have a previous criminal history. This finding—together with our findings on how the inability of lenders to accurately assess default risk for high criminal type individuals—suggests that recidivism is compounded by the fact that individuals with high criminal types are more affected by incarceration than are individuals with low criminal types. Access to credit plays an important role in shaping the dynamics of crime.

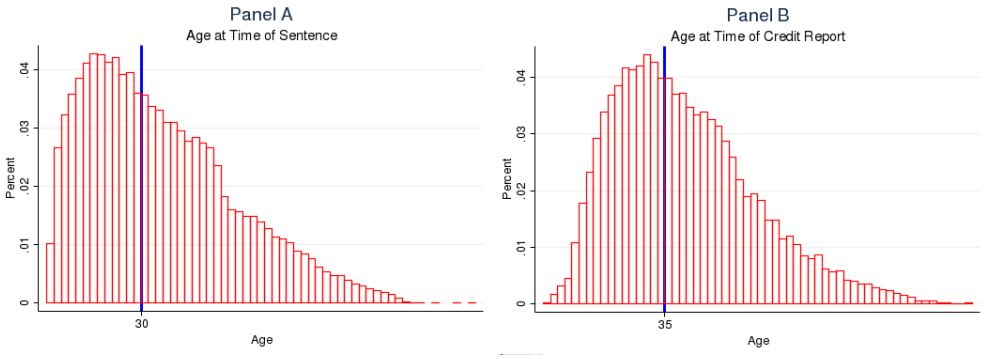
Our findings have important welfare implications. As we have shown, lack of access to credit leads to higher levels of recidivism. Other studies have also shown that credit constraints lead to loss of human capital (Hai and Heckman, 2017), and that restricting access to credit harms poor households (Zinman, 2010). Overall, our findings suggest further reentry efforts are necessary to alleviate the consequences generated by the interplay of credit constraints and the carceral state.

Figure 1.1: Hypothetical Lender Correction for Informational Distortions



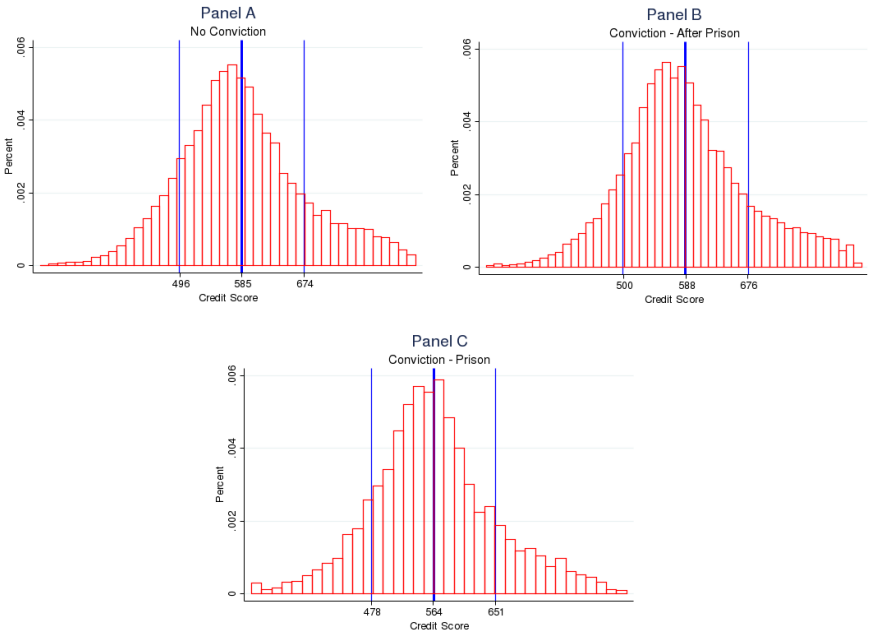
NOTES: This figure shows hypothetical distributions of default by credit score (holding income and other observable traits equal) for: (1) non-convicted individuals; (2) convicted individuals who are sentence to incarceration; and (3) convicted individuals who are sentenced to probation. Panel (a) shows the default probability distribution after trial but with no adjustment by lenders. The default distribution for individuals who go to jail or prison shifts to the left as their inability to service debt while incapacitated obscures their true default probability post-release. Individuals who undergo probation do not face this challenge and, hence, their default distribution equals that of non-convicted borrowers. For a fixed credit score threshold θ^*, the lenders will forgo profits by not lending to formerly incarcerated individuals with credit scores between θ^1 and θ^*. Panel (b) shows the default probability after lenders adjust for incarceration effects. Lenders can only see a conviction and cannot distinguish between incarceration and probation. As a result, both the default distribution for the formerly incarcerated and for those that went on probation shifts to the right. By doing so, lenders are able to recover profits from the ex-incarcerated population. However, they endure losses stemming from individuals that went on probation ($\theta^2 > \theta^*$).

Figure 1.2: Age Distribution at Time of Sentence and of Credit Report



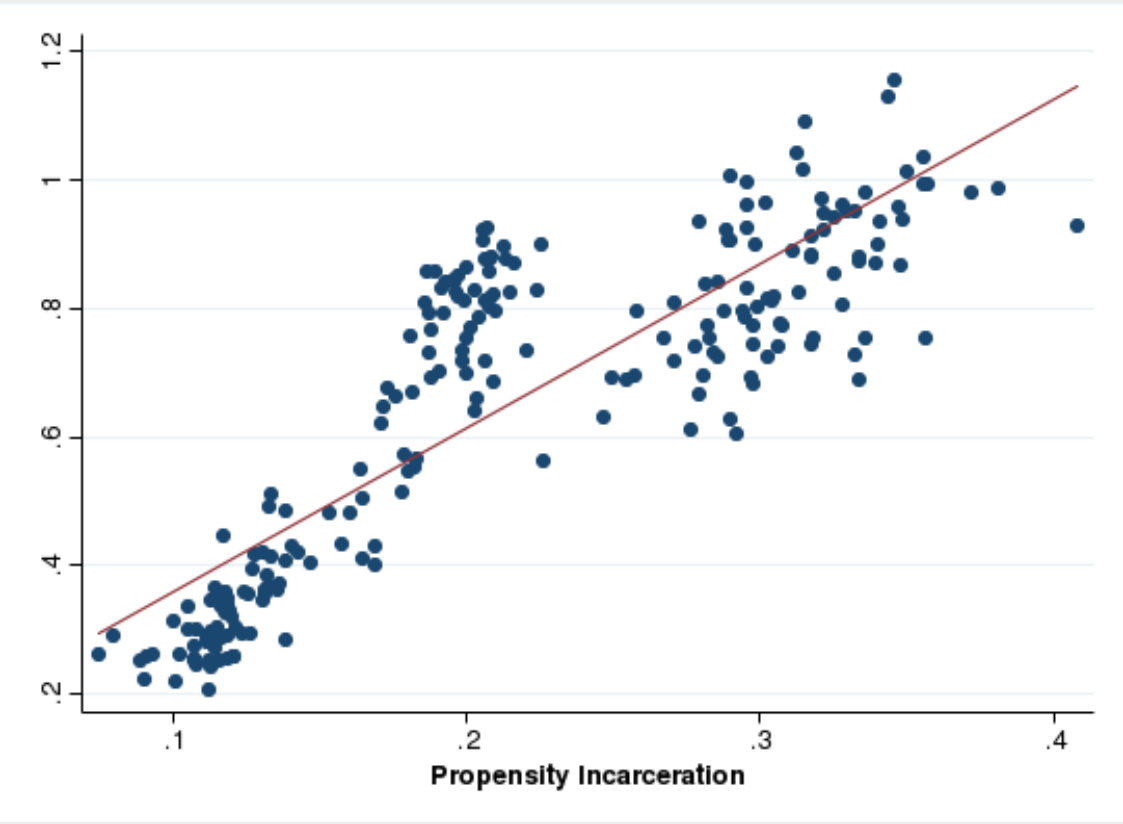
NOTES: This figure is shows the distribution of age for the sample. Panel A shows the distribution of age at the time of sentence. The median age at case resolution is 30 years old. Panel B shows the sample age distribution at the time of credit report, which has a median of 35.

Figure 1.3: Distribution of Credit Score



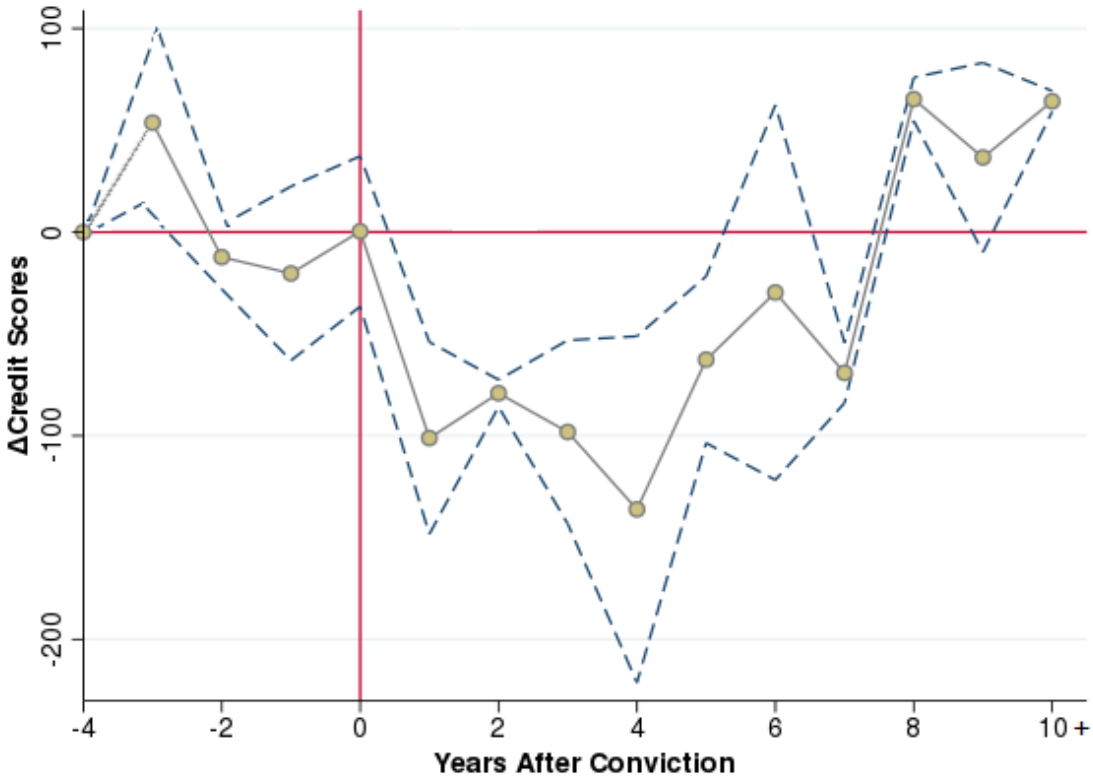
NOTES: This figure shows the credit score distribution for individuals not convicted, individuals formerly incarcerated, and individuals incarcerated at the time of credit report. All credit scores are taken after case resolution.

Figure 1.4: Relevance of Instrument



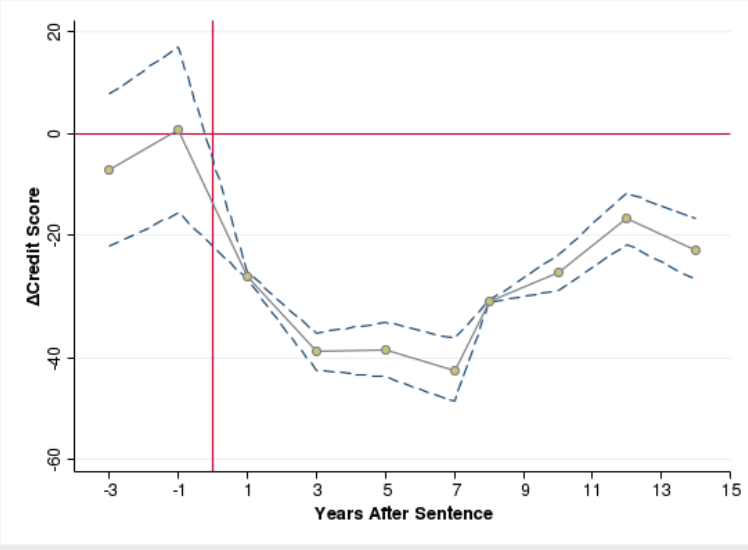
NOTES: This figure is plots conviction against judge harshness. Judge harshness in the leave-one-out mean of incarcerating for the assigned court at the year of disposition (verdict and sentence). To construct the binned scatter plot, we regress incarceration on year of disposition fixed effects and calculate residuals. We take the average of residuals and judge harshness by each court-year bin.

Figure 1.5: Event Study of Incarceration on Credit Scores



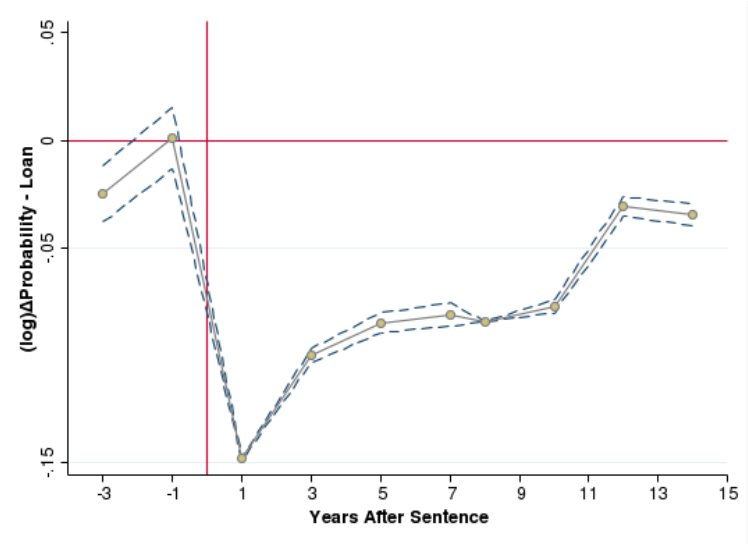
NOTES: This figure presents event study estimates for the impact of incarceration on credit scores. To construct the plot, we jointly instrument for each year before or after the year of incarceration using court-year fixed effects.

Figure 1.6: Heterogeneous Effects of Incarceration on Credit Score by Criminal Type



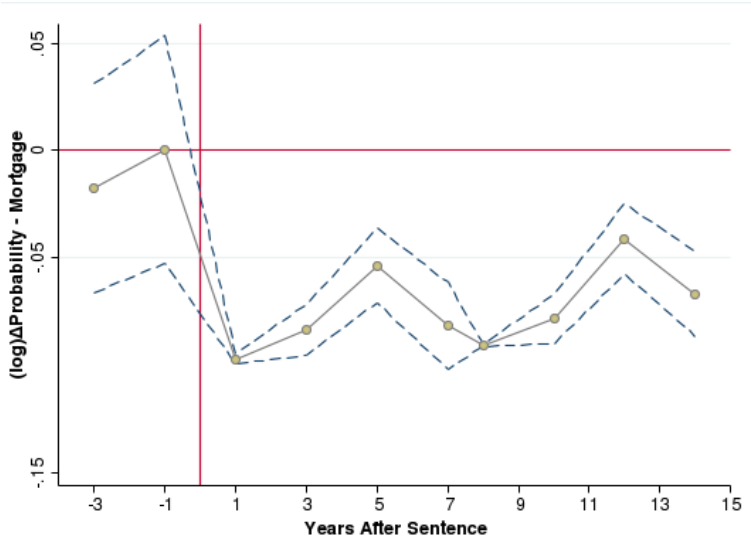
NOTES: This figure shows the effects of incarceration on credit scores by criminal type. Criminal types are computed according to equation (1.4). The plot shows the coefficient of the interaction of years since conviction × criminal type.

Figure 1.7: Heterogeneous Effects of Incarceration on Having a Loan by Criminal Type



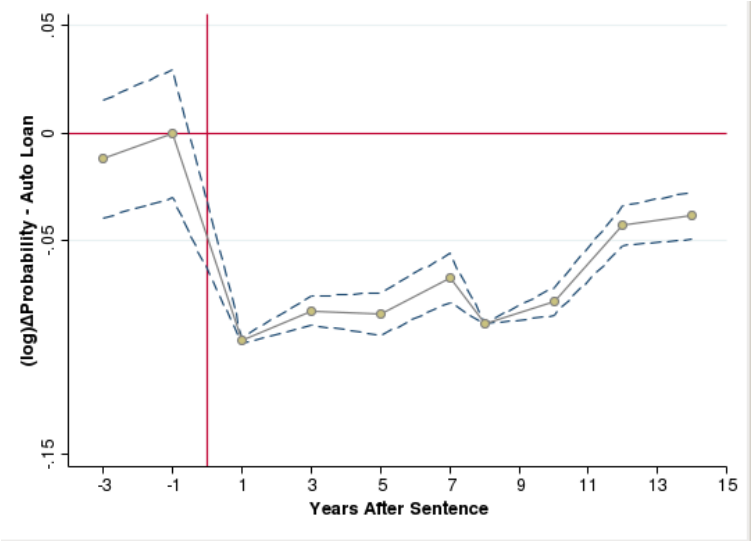
NOTES: This figure shows the effects of incarceration on loan approval by criminal type. Criminal types are computed according to equation (1.4). The plot shows the coefficient of the interaction of years since conviction × criminal type.

Figure 1.8: Heterogeneous Effects of Incarceration on Mortgage Loans by Criminal Type



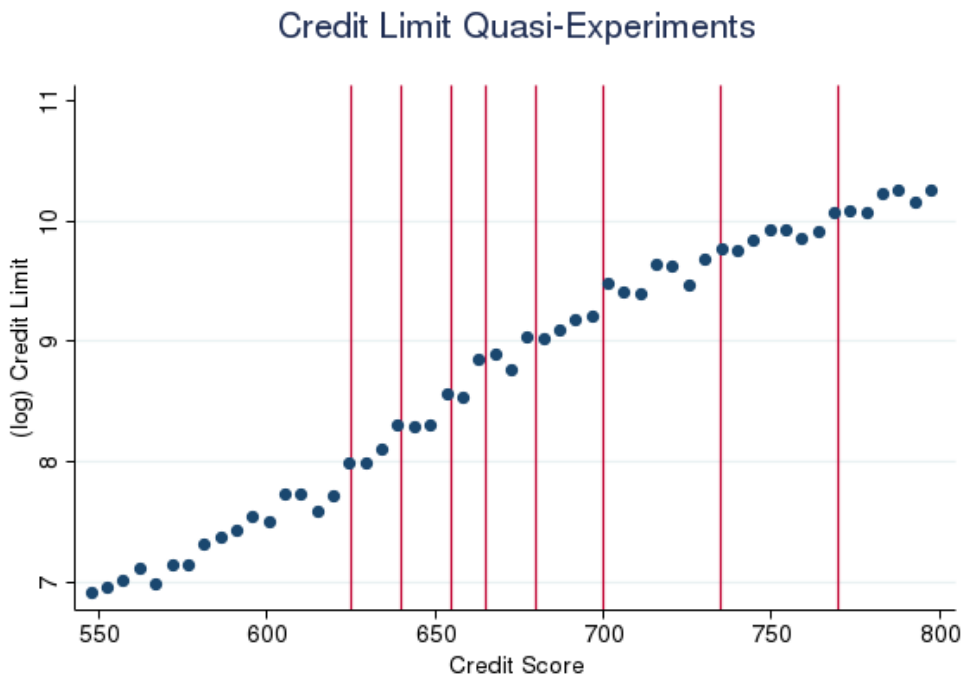
NOTES: This figure shows the effects of incarceration on probability of having a mortgage by criminal type. Criminal types are computed according to equation (1.4). The plot shows the coefficient of the interaction of years since conviction × criminal type.

Figure 1.9: Heterogeneous Effects of Incarceration on Auto Loans by Criminal Type



NOTES: This figure shows the effects of incarceration on probability of obtaining an auto loan by criminal type. Criminal types are computed according to equation (1.4). The plot shows the coefficient of the interaction of years since conviction × criminal type.

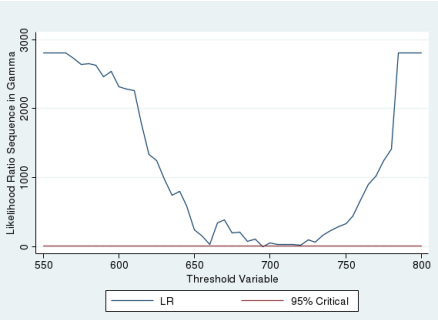
Figure 1.10: Credit Limit Quasi-Experiments



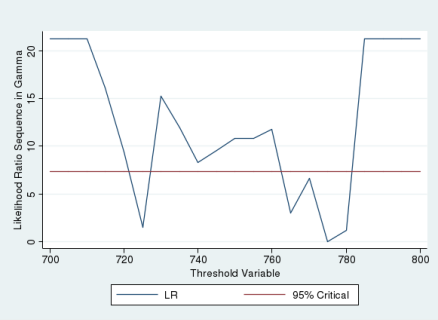
NOTES: This figure is plots (log) Credit Limit against credit scores. To construct the binned scatter plot, we construct 5-point credit scores bins and take the average credit limits for each. The red lines indicate credit limit discontinuities for prime borrowers (credit score > 620).

Figure 1.11: Tests for Credit Limit Discontinuities

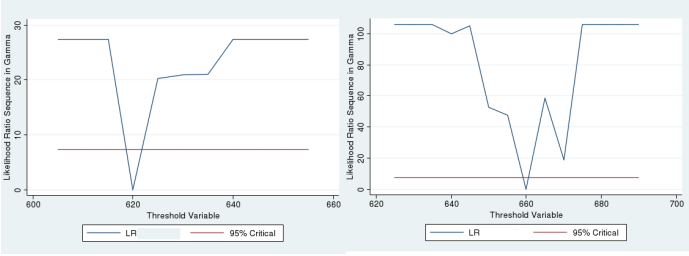
Panel A: Hansen Test For Global Threshold (γ_{global})



Panel B: Hansen Test For Upper Thresholds ($\gamma_{global} < \gamma$)

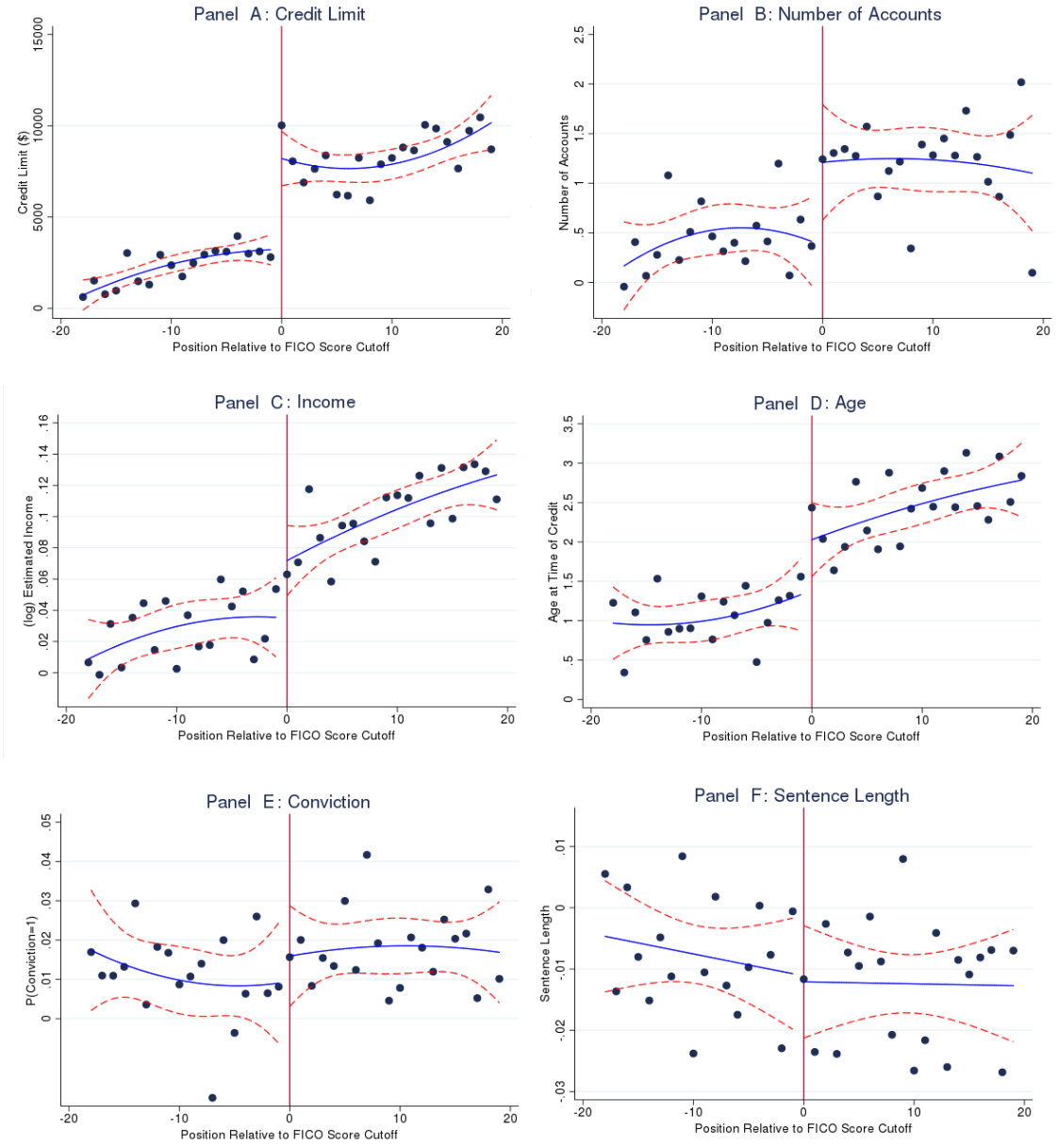


Panel C: Hansen Test For Lower Thresholds ($\gamma_{global} > \gamma$)



NOTES: This figure shows LM estimates for likelihood of presence of discontinuity following Hansen (2000) as implemented in equation (1.10). The Y axis shows the likelihood ratio of a discontinuity occurring in credit scores. The likelihood ratio crossing through the red line indicates with 95% confidence, there is a discontinuity. Panel A shows the main discontinuity (global) in credit scores. Panel B shows additional discontinuities above the global discontinuity. Panel C shows additional discontinuities below the global discontinuity.

Figure 1.12: Borrower Characteristics Around Credit Limit Quasi-Experiments



NOTES: This figure shows borrower characteristics around the credit score discontinuity. To construct the scatter plot we pool all the discontinuities together and average at each credit score point above or below the cutoff. The optimal bandwidth for the sample, following Calonico, Cattaneo and Titiunik (2014), is 12. Panel A and B plot credit outcomes around the discontinuity. Panel C and D plot borrower characteristics typically used by lenders. Panel E and F show characteristics related to criminal history.

Table 1: Summary Statistics

Panel A: Summary Statistics

	Mean	Median	SD
General:			
Age	36.19	34.00	10.33
% Female	0.27	0.00	0.44
% Black	0.38	0.00	0.49
% Latino	0.22	0.00	0.41
Credit:			
Credit Score	575.12	569	82.99
Loans	0.47	0.00	0.50
(Log) Estimated Income	10.18	10.08	0.52
Loan Amt	55,285	22,241	95,730
Mortgages	0.13	0.00	0.34
Auto Loans	0.25	0.00	0.43
Incarceration:			
Age Sentence	31.39	29.00	10.01
Misdemeanor (out of Total Cases)	0.78	1.00	0.41
Lesser Offense (out of Felonies)	0.22	0.00	0.42
Recidivism (out of Convicted)	0.39	0.00	0.49
Probation (out of Convicted)	0.28	0.00	0.45
Sentence Length in Years (out of Incarcerated)	0.46	0.16	0.56

Panel B: Post-Sentence Summary Statistics

	Not Convicted			Convicted		
	Mean	Median	SD	Mean	Median	SD
General:						
Age	36.02	35	9.02	37.59	36	10.55
% Female	0.29	0.00	0.46	0.25	0.00	0.43
% Black	0.42	0.00	0.49	0.38	0.00	0.48
% Latino	0.17	0.00	0.38	0.23	0.00	0.42
Credit:						
Credit Score	576	571	84	579	572	83
Loans	0.52	1.00	0.50	0.45	0.00	0.50
(Log) Estimated Income	10.23	10.13	0.52	10.18	10.08	0.52
Loan Amt	60,682	25,568	86,572	54,496	22,726	78,683
Mortgages	0.14	0.00	0.35	0.13	0.00	0.33
Auto Loans	0.29	0.00	0.46	0.24	0.00	0.43
Incarceration:						
Age Sentence	30.09	29	8.78	30.78	29	10.24
% Misdemeanor	0.81	1.00	0.39	0.80	1.00	0.40
% Recidivism	0.40	0.00	0.49	0.40	0.00	0.49

NOTES: Statistics for our sample. Panel A provides descriptive statistics for the whole sample. Traits include demographic information (age, gender, race, and ethnicity), credit information, and information pertaining to justice-related events. Panel B provides the same information *after* sentence, and it is separated by individuals convicted and not convicted.

Table 2: Top 10 Offenses in Sample

Criminal Offense	%
DWI 1st Time Offender	33.20
Driving While Lic. Suspended	10.47
Assault-Family Member	6.12
Theft $50-$500	8.13
Assault-Bodily Injury	3.42
DWI 2nd Time Offender	3.13
Posession Controlled	2.38
Substance Less than 1G*	
Unlawfully Carrying a Weapon	1.71
Failure to Stop & Give Info	1.29
Theft $500-$1,500	1.25
Total	71.30

NOTES: This table reports the prevalence of the top ten most frequent offenses for our sample. Felonies are presented in bold. All others are misdemeanors. * denotes state jail felony.

Table 3: Relevance of Instrument By Outcome Variable

Panel A:	Demographic Outcomes
Age	1.93
Female	1.96
Caucassian	1.98
Black	1.99
Latino	1.71
Panel B:	Prison Outcomes
Conviction	9.44
Prison	13.48
Sentence Length	112.56
Probation	11.98
Probation Length	36.02

NOTES: This table reports F-statistics for the first-stage regression of outcomes onhe instrument. F-statistics for demographic outcome variables are reported in Panel A, while those for incarceration outcomes are reported in Panel B. Naturally, model fit is better for outcomes under the direct control of the court.

Table 4: Incarceration on Estimated Income of Borrower Population

	Full Sample		Income in 2006		No Income in 2006	
	(1)	(2)	(3)	(4)	(5)	(6)
Incarcerated	-.38***	-.39***	-.21***	-.18***	-.27***	-.33***
	(.11)	(.08)	(.07)	(.05)	(.06)	(.06)
N	63,968	13,238	51,947	8,900	12,021	4,338
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	No	Yes	No	Yes	No
Restrictions	N/A	Sentence>2006	N/A	Sentence>2006	N/A	Sentence>2006

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports instrumental variable (IV) estimates of the effects of incarceration on income. Column (1) presents the estimates for the full sample. Column (2) restricts the sample to individuals with a conviction after 2006 whose credit outcomes are measured in 2013. Column (3) reports estimates for individuals with estimated income in 2006. Column (4) reports estimates for individuals with estimated income in 2006 and a conviction after 2006 whose outcomes are measured in 2013. Column (5) reports estimates for individuals with no estimated income in 2006, but estimated income measured in 2013. Column (6) reports estimates for individuals with no estimated income measured in 2006, and a conviction after 2006 whose credit outcomes are measured in 2013. Errors clustered at the court × year of disposition level.

Table 5: Incarceration on Estimated Income of Borrower Population

	(1) IV	(2) Placebo	(3) IV	(4) IV	(5) IV	(6) IV
Incarcerated x 2006 Income	-.26***	.17*	-.28***	-.25***	-.30***	-.28***
	(.07)	(.09)	(.07)	(.07)	(.07)	(.07)
Incarcerated	-.10***	-.07***	-.12***	-.10***	-.07	-.14***
	(.03)	(.02)	(.03)	(.02)	(.05)	(.03)
Credit Score	.00***	.00***		.00***		
	(.00)	(.00)		(.00)		
2006 Income	.87***	.66***	.89***	.87***	.89***	.90***
	(.01)	(.08)	(.01)	(.01)	(.01)	(.01)
Sentence Length					.01	
					(.01)	
N	28,807	24,378	28,807	28,807	28,807	28,807
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes
Age	No	No	No	No	No	Yes
Race	No	No	No	Yes	Yes	Yes
Restrictions	Sentence>2006	Sentence<2006	Sentence>2006	Sentence>2006	Sentence>2006	Sentence>2006

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports instrumental variable (IV) estimates of the effects of incarceration and (incarceration × 2006 income) on 2013 income. Columns (1) and (3)-(6) restrict to individuals with disposition (verdict and sentence) issued after 2006. This restriction allows us to compare the effect of incarceration on 2013 income accounting for heterogeneity in 2006 income. As a placebo check, column (2) restricts to individuals with disposition before 2006, such that changes in income between 2006 and 2013 do not account for incarceration. $Incarcerated$ and $Incarcerated \times Income2006$ are jointly instrumented according to equation (1.5). Errors clustered at the court × year of disposition level.

Table 6: Incarceration on Credit Score Measures

	Full Sample		Prime Borrowers					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	IV	IV	IV	IV	IV	IV
Incarcerated	-12.10***	-53.71***	-68.69***	-41.73***	-54.61***	-62.38***	-55.54***	-45.77***
	(1.35)	(8.33)	(7.02)	(5.39)	(9.57)	(4.12)	(11.30)	(12.35)
Incarcerated × Credit Score 2006						.03	-.10	-.20
						(.12)	(.22)	(.27)
Credit Score 2006					.93***	.94***	.94***	.91***
					(.01)	(.01)	(.01)	(.02)
Income 2006					5.25***		5.25***	3.00***
					(.45)		(.46)	(.62)
N	67,115	67,115	20,889	20,889	7,654	13,159	7,654	7,654
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	Yes	No	No	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports OLS and IV estimates of the impact of incarceration on credit scores. Columns (1) and (2) estimate the effects on the full sample while columns (3)-(8) estimate the effects on prime borrowers (credit scores ≥ 600). $Incarcerated$ and $Incarcerated \times CreditScore2006$ are jointly instrumented in a similar manner to equation (1.5). Errors clustered at the court × year of disposition level.

Table 7: Incarceration on Financing of Durables

	P(Mortgage=1)				P(Auto Loan=1)				Auto Loan Amount		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OLS	IV	IV	IV	OLS	IV	IV	IV	OLS	IV	IV
Incarcerated	-.08***	-.15***	-.16**	-.14**	-.13***	-.24***	-.34***	-.45***	-.08***	-.14***	-.28**
	(.01)	(.02)	(.06)	(.06)	(.01)	(.03)	(.03)	(.03)	(.02)	(.03)	(.13)
Credit Score	.00***	.00***	.00***	.00***	.00***	.00***	.00***	.00***	.00***	.00***	.00***
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
N	67,115	67,115	18,110	18,110	67,115	67,115	22,879	18,110	20,357	20,357	10,222
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Race	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Income	No	No	No	Yes	No	No	No	Yes	No	No	Yes
Other Loans	N/A	N/A	Yes	Yes	N/A	N/A	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports OLS and IV estimates of the effect of incarceration on the probability of obtaining a mortgage or auto financing loan using a linear probability model, as well as for the effect of incarceration on auto loan amount conditional on obtaining such a loan. Columns (1)-(4) present estimates on the probability of obtaining a mortgage loan. Columns (5)-(8) shows estimates on the probability of obtaining an auto loan. Columns (9)-(11) condition on individuals having an auto loan, and show the estimates of incarceration on the (log) size of the loan. Errors clustered at the court × year of disposition level.

Table 8: Effects of Incarceration by Conviction Type

	Credit Scores			(log) Income		
	(1)	(2)	(3)	(4)	(5)	(6)
Incarcerated	-68.39***	-28.81***		-.17***	-.12	
	(10.11)	(7.88)		(.05)	(.09)	
Probation			5.05			-.08***
			(12.88)			(.03)
Sentence Length		-46.90***			-.05*	
		(10.15)			(.03)	
Income 2006				.88***	.87***	.82***
				(.01)	(.01)	(.01)
N	56,219	52,654	48,737	13,815	13,815	9,912
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes
Age	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of incarceration on credit scores and estimated income by type of conviction. Columns (1)-(2) and (4)-(5) restrict to individuals that receive carceral sentences, while Columns (3) and (6) restrict the sample to individuals that were convicted but sentenced only to probation. Columns (1)-(3) estimates the effects of conviction on credit scores. Columns (4)-(6) estimates the effects of conviction on estimated income for individuals with disposition (verdict and sentence) during years after 2006. Columns (2) and (5) control for sentence length for formerly incarcerated individuals. Offenses are propensity score reweighted to account for pre-trial detention rates. Errors clustered at the court × year of disposition level.

Table 9: Effects of Incarceration on Search for Credit

	Full Sample					Prime Borrowers				
	(1) OLS	(2) IV	(3) IV	(4) IV	(5) IV	(6) OLS	(7) IV	(8) IV	(9) IV	(10) IV
Incarcerated	.17***	.91***	.97***	1.16***	.83***	-.03*	.41**	.33**	.50***	.49***
	(.03)	(.14)	(.16)	(.16)	(.19)	(.01)	(.16)	(.16)	(.17)	(.19)
Income 2006			-.54***	-.40***	-.36***			-.35***	-.18***	-.16***
			(.02)	(.02)	(.02)			(.01)	(.02)	(.02)
CreditScore	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
N	84,002	84,002	22,160	22,160	22,160	36,300	36300	9278	9278	9278
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Race	No	No	No	No	Yes	No	No	No	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports OLS and IV estimates of the effects of incarceration on the inquiries to accounts ratio. Columns (1) through (5) report estimates for individuals independently of their credit scores. Columns (6) through (10) report estimates for individuals with prime credit (credit scores≥600). To control for pre-incarceration income, columns (3)-(5) and (8)-(10) restrict the sample to individuals with disposition (verdict and sentence) years after 2006. Errors clustered at the court × year of disposition level.

Table 10: Effects on Performance

	(1) 30d	(2) 60d	(3) 90d	(4) Bankruptcy	(5) 30d	(6) 60d	(7) 90d	(8) Bankruptcy
Incarcerated	-.41***	-.30***	-.20***	-.11***				
	(.04)	(.04)	(.05)	(.03)				
Probation					.01	-.07***	-.10***	.01
					(.04)	(.03)	(.02)	(.04)
Credit Score	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***	-.00***
	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)	(.00)
N	24,380	24,380	24,380	24,380	9,932	9,932	9,932	9,932
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports IV estimates of the effects of incarceration on defaults within either 30, 60, or 90 days after payment is due, as well as bankruptcy discharge for individuals sentenced after 2006. Columns (1)-(4) report estimates for individuals sentenced to incarceration while columns (5)-(8) report estimates for individuals sentenced to probation. Controls include age, race and pre-incarceration income. Offenses are propensity score reweighted to account for pre-trial detention rates. Errors clustered at the court × year of disposition level.

Table 11: Adverse Selection in Loan Performance (Outcome Test)

η \ ν	**Selection Test** $\rho = corr(\eta, \nu)$							
	Prison				Probation			
	Observables		Unobservables		Observables		Unobservables	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Default Last 30 days	-.007	-.007	-.030**	-.056***	.039***	.019	-.009	-.018
	(.009)	(.014)	(.012)	(.019)	(.015)	(.018)	(.013)	(.018)
Default Last 60 days	-.008	-.006	-.046***	-.032***	.042***	.027*	-.009	.007
	(.007)	(.008)	(.010)	(.009)	(.014)	(.014)	(.015)	(.015)
Default Last 90 days	-.008	.028***	-.015	.039***	.059***	.074***	.052***	.081***
	(.008)	(.009)	(.010)	(.010)	(.016)	(.014)	(.016)	(.015)
Bankruptcy	-.002	.000	-.074***	-.069***	.074***	.0638***	-.003	-.007
	(.016)	(.013)	(.017)	(.018)	(.028)	(.024)	(.029)	(.026)
N	58,317	51,150	58,317	51,150	27,797	25,053	27,797	25,053
Age Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Court-Year FX	No	No	Yes	Yes	No	No	Yes	Yes
Credit Score	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimated Income	No	Yes	No	Yes	No	Yes	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports bivariate probit estimates of the correlation (ρ) between residuals explaining conviction (η) and residuals explaining default (ν). The sample of convicted individuals can be either formerly incarcerated (columns 1 through 4) or formerly in probation (columns 5 through and 8). Default can be either 30, 60, or 90 days defaults, or bankruptcy. Columns (1)-(2) and (5)-(6) control for observable information to the bank (credit scores, age). To assess the correlation between criminal type (unobservable to the lender) and default. In columns (3)-(4) and (7)-(8) we control for court year fixed effects making η a proxy for criminal type. Errors clustered at the court $\times$ year of disposition level.

Table 12: Effects of Access to Credit on Recidivism

	All				No Previous Arrests			
	(1) OLS	(2) IV	(3) IV	(4) IV	(5) OLS	(6) IV	(7) IV	(8) IV
	Panel A: First Stage (Credit Limit/$1,000)							
Incarcerated x Discontinuity	-4.02**	-13.5***	-11.1***	-12.5***	-3.56	-2.93	-2.06	-6.36
	(1.71)	(4.00)	(4.08)	(4.39)	(2.42)	(5.30)	(5.08)	(6.02)
Discontinuity	6.19***	6.54***	6.11***	8.14***	6.17***	6.01***	5.56***	7.77***
	(.768)	(.900)	(.920)	(.970)	(.999)	(1.06)	(1.03)	(1.12)
Incarcerated	-2.18	-2.02	-2.07	-3.88	-2.64	-2.42	-1.95	-2.97
	(1.42)	(3.11)	(3.21)	(3.63)	(1.87)	(3.61)	(3.42)	(4.97)
	Panel B: 2SLS							
Incarcerated x Credit Limit	.00123	.0145**	.0137**	.0146**	.00213**	.00728*	.00718*	.00868*
	(.000946)	(.00657)	(.00657)	(.00662)	(.000903)	(.00411)	(.00416)	(.00446)
Incarcerated	-.0632**	.484***	.488***	.461***	.937***	.303***	.305***	.305***
	(.0287)	(.111)	(.108)	(.110)	(.0277)	(.0667)	(.0666)	(.0672)
Credit Limit	-.000624***	-.00691***	-.00608***	-.00681***	-.000324**	-.00266***	-.00257***	-.00263***
	(.000170)	(.00191)	(.00196)	(.00188)	(.000142)	(.000838)	(.000873)	(.000902)
N	11,359	11,359	11,359	11,359	6,816	6,816	6,816	6,816
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Age	No	No	No	Yes	No	No	No	Yes
Race	No	No	Yes	Yes	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table presents regression discontinuity (RD) estimates of the effects of credit limits on future crime. The regression discontinuity is implemented jointly with random judge assignment within a 2SLS framework according to equation (1.11). Panel A shows the first-stage results of credit limit discontinuities and incarceration on credit limits. Panel B shows the main effects of credit limit, incarceration and incarceration times credit limit on recidivism. Columns (1) through (4) show results for all individuals regardless of previous criminal history. Columns (5) through (8) show results for individuals with no previous criminal history. Errors clustered at the court × year of disposition level.

Chapter 2

How Corporate Debt Perpetuates Labor Market Disparities?[1]

2.1 Introduction

Do labor market policies generate unemployment volatility? Who bears this unemployment risk? And what are the channels of transmission? Many of the formal models addressing unemployment volatility[2] have focused on explaining wage rigidities by exploring variations in the wage determination process (Shimer 2004; Hall & Milgrom 2008; Gertler & Trigari 2009). Concurrently, the empirical literature has focused on the role that labor institutions (Blanchard & Wolfers 2000) and cultural norms (Bewley 1999) play in explaining unemployment and wage dynamics.

In this paper we take a different approach. We argue that capital structure or financial leverage decisions play an important role in determining a firm's decisions about employment.[3] This is consequential, as for workers, job security is an important attribute of their employment. If a firm has made investments that did not payoff and must lay off workers or, alternatively, if it has taken on too much debt and creditors are forcing reorganization, the workers will consider these layoff risks when negotiating their compensation. From the interplay between the firm choice of capital structure, employment, and wages, we will concentrate on two main insights: (1) that capital structure decisions lead to lower wage volatility and

[1] Based on joint work with Abhay Aneja.

[2] The assessment of unemployment volatility goes back to at least the *General Theory*—see, for example, Keynes' discussion of involuntary unemployment in Chapter 2. In recent times, the work of Shimer (2005) has sparked renewed interest on the topic.

[3] Financial leverage is the ratio of debt to shareholders equity; it reflects the degree to which a firm uses borrowed money to fund its operations. The soundness of a business enterprise is tightly linked to its ability to meet its obligations to creditors. Of course, the ability to meet its obligations depends on both the debt ratio (financial leverage) and other operating costs, including wages (operating leverage). For that reason, financially distressed firms resort to restructuring in order to avoid being forced into bankruptcy by creditors (Jensen 1989). This often includes layoffs (Ofek 1993; Kang & Shivdasani 1997). Hence, corporate default risk affects workers directly.

higher unemployment volatility in the economy, and (2) that given certain incentives, this unemployment volatility can be distributed unequally across different groups of workers.

In equilibrium how workers internalize corporate default risk is unclear. Layoff risk as a result of corporate default not only affects the value of employment to the worker, but also her valuation of unemployment– this is, her outside option or negotiation benchmark. We argue that the effect of financial leverage on wages will crucially depend on workers internalizing layoff risk when negotiating their compensation, and that workers may internalize this risk in two different ways: (1) they will demand a wage premium when the value of unemployment (the outside option) is low— when the outside option is poor, job security is more valuable; or (2) they will accept a lower wage–and reduce unemployment risk and the firm's operating leverage– when the outside option is high— because higher equilibrium *aggregate* financial leverage reduces the value of the outside option more than firm-specific financial leverage affects the value of job security. Whether workers receive a wage premium or discount, as well as the size of the premium/discount, will depend on the prevailing labor market conditions. Through changes in the wage (and more precisely on the wage bill), labor market conditions will also affect the debt-ratio of the firm.

In other words, we can recognize that layoff risk is driven by a systemic component, the risk that affects the wage component common to all firms, and an idiosyncratic component, the risk that affects the job security specific to one firm. A worker that is hired during tight economic conditions adheres higher value to being unemployed which translates to a higher wage. Since this higher wage stems from a higher outside option, she is also more affected by changes in aggregate economic conditions. In contrast, a worker that is hired during downturns has a lower value of unemployment (a lower outside option) and her compensation is more dependent on the future payoff of keeping employment. Thus, a worker that has internalized tight market conditions on her wage has more incentive to protect employment than a worker hired during a downturn. Conversely, a worker hired during a downturn has higher incentives to demand additional compensation for lack of job security.

Our work is consistent with several key facts established recently. First, Giroud & Mueller (2016) show that counties with more highly levered firms experience more layoffs in response to consumer demand shocks. This finding is robust to productivity differences across firms. Second, economic conditions at the firm level play a significant component for layoff decisions relative to worker-specific or macro-driven risk. Davis et al (2006) document that two thirds of layoffs are concentrated in firms shrinking by more than 10% within a quarter, with more than a fifth coming from firms that shut down. In addition, Schmieder & von Wachter (2010) find that workers hired at higher wages due to tighter labor market conditions experience higher risk of layoff.

The notion of compensating workers for layoff risk dates back to at least Adam Smith.[4] A straightforward application of this standard argument to the use of financial leverage in

[4]The Wealth of Nations, Book I, Chapter 10, paragraphs 14-19. Paragraph 15 states, for example: *"Employment is much more constant in some trades than in others[...] The high wages of those workmen, therefore, are not so much the recompence of their skill, as the compensation for the inconstancy of their employment."*

firms can be readily found in the Corporate Finance literature. For example, work by Titman (1984) and Agrawal and Matsa (2013) suggests that workers need to be compensated for the additional unemployment risk arising from a higher debt to equity ratio. Nevertheless, recent work in Corporate Finance has also shown that firms use financial leverage strategically to improve their bargaining position against workers (Matsa 2010) and other stakeholders (Towner 2015). Workers, in particular, have a role to play in ensuring the survival of the firm since higher wages imply less available funds to pay creditors. These two mechanisms are at odds. Yet, to the best of our knowledge, there is no work either in the Labor or Corporate Finance literature, attempting to discern when workers must be compensated for the increased risk of unemployment arising from higher debt ratios or when workers are willing to bargain their wages down to reduce the risk of unemployment. Part of the contribution of this paper is characterizing this wage-unemployment risk trade-off.

An important implication of the relationship between labor markets and debt is that it disrupts labor market policies. In the particular case of anti-discrimination regulation, protection increases economy-wide wages and employment for minority workers, increasing the value of their outside option and, per our previous argument, leading to increases in the equilibrium financial leverage of firms. This means that beneficiaries of redistributive legislation will face greater unemployment risk, partially offsetting the policy intended gains. This implication extends to other policies—for example, minimum wage regulation— making it an important mechanism in the analysis of labor market disparities.

What we do

We follow a multi-step approach that will help us assess the relationship between firm financial policy and labor market conditions. An important aspect of this approach is demonstrating the non-linear effect of labor markets on firm debt depending on the state of the business cycle.

In the first part of the paper, we present a simple search-theoretic framework à la Mortensen-Pissarides depicting this trade-off. In the model, firms have incentives to choose a level of debt different from zero because of tax shields and distress costs. This will endogenously determine the financial leverage in the economy. This will end up affecting the layoff risk of the worker and, hence, the continuation value of her employment claim. As noted before, the layoff risk faced by the worker operates through two mechanisms. First, financial leverage directly affects the layoff risk for a worker inside a firm, which we refer to as idiosyncratic risk. Second, increases in the capital structure of a firm will affect the job-finding probability of unemployed workers generating a systemic risk that would reduce the value of unemployment. An increase in the idiosyncratic distress risk will be compensated to the workers but an increase in the systemic risk will ensue a reduction in the wage. Importantly, which of the two mechanisms dominates will depend crucially on the job-finding probability.

This tension between idiosyncratic and systemic layoff risk generated by firms' financial decisions gives the job-finding probability a gate-keeping role as to whether layoff risk ensues higher or lower compensation for the worker. That gate-keeping role of the job finding

probability produces many dynamics documented in the labor and finance literatures. For instance, this tension provides firm level micro-foundations that contribute to explaining sources of wage rigidity. A high job finding probability makes it cheaper for firms to exploit the benefits of debt, leading to high financial leverage and a lower equilibrium wage than in an environment without layoff risk arising from firm financial distress. Conversely, when the job finding probability is low firms most compensate workers for taking on higher layoff risk, generating a wage higher than in an environment that does not incorporate firm financial distress.

The framework is necessary in many respects. First, it provides a clear theoretical foundation connecting seemingly disparate economic phenomena;[5] second, it allows us to locate non-linearities in our treatment effects arising due to changing labor market conditions over the business cycle;[6] third, it helps determine *ex ante* other economic factors that may confound our empirical estimates (in other words, it helps identify the appropriate conditioning variables) like the job-finding probability; and finally, it provides guidance as to the main mechanisms generating our results. In summary, the theoretical framework will help us navigate the potential pitfalls that can arise from projecting a business cycle phenomenon with potentially many non-linearities into a linear empirical setting.

In the second part of the paper, we move to empirically assess the role financial leverage plays in shaping the labor markets. We perform two types of analyzes. First, we causally test that the main variable of interest, corporate debt, reacts to changes in a major labor market institution—a property we will call *responsiveness*. Second, identifying the true effect of labor market conditions on corporate debt, however, requires us to account for the possibility of non-linear effects across the business cycle. In light of non-linear effects, any causal estimate of how labor market regulation affects financial policy will be internally valid but usually local. Therefore, we proceed to show that (i) financial leverage and labor market tightness co-move– thus showing that this relationship remains strong at the aggregate level; (ii) that changes in labor market tightness predict future changes in firm-specific leverage out-of-sample; and (iii) that financial leverage explains differences in who bears the burden of unemployment.

The empirical setting for our causal analysis will exploit the passage of labor market regulation during the Civil Rights Era of the 60's and early 70's. Using this setting provides us with several conceptual advantages. First, it allows us to create an understanding of how finance impacts the efficacy of anti-discrimination regulation. This matters because of the distributional consequences targeted by anti-discrimination regulation. Thus, by studying the Civil Rights Era we can more neatly trace distributional effects and attempt to delineate a clearer picture behind the question "Who bears this unemployment risk?" Second, this period possesses historical significance of a dual nature. The Civil Rights movement is one of the most important economic periods of the 20th century. The impact of the labor market reforms enacted during this era is well-documented (Donohue & Heckman 1991; Chay 1998;

[5]See, for example, Varian(1992) discussing the role of theory in this regard.

[6]See, for example, Cartwright (2010) discussing RCTs under the probabilistic theory of causality.

Aneja & Avenancio-León 2017). But also, during that period, firms began relying on more debt at a previously unseen, and to this date unexplained, pace (Graham et al. 2015).

Studying this period also provides methodological advantages. First, because changes increasing the cost of labor has a negative effect on employment, it is difficult to obtain variation in the total wage bill faced by the firm. Using anti-discrimination regulation allows us to circumvent this issue by focusing on the relative wage bill change across two groups of workers–in this setting, black and white workers. Second, the value of unemployment to a worker is tightly-connected to the probability of obtaining employment in another firm–again, her outside option. It is well documented that the job-finding probability fluctuates with the business cycle (Shimer 2011). As we mentioned, this presents a difficulty if the relationship we are trying to test is tied to business cycle fluctuations, and, hence, non-linear in nature. A setting where the primary source of policy variation is the time-series component will lead to under-rejection of the null of no change in financial leverage by: (i) averaging out business cycle non-linearities in the response to a policy change, and (ii) by letting those non-linearities inflate the standard errors. Civil Rights Era reforms occurred during a period with historically high job finding probability, allowing us to circumvent excessive noise in our estimation.

We estimate that the passing of anti-discrimination regulation leads to an increase in leverage of about 29 basis points per each percentage of minority workers. Since minority workers' wages increased by about 13% and employment by about 12%, a back of the envelop calculation shows that wage increases between the 1950's and 1970's accounted for between 35 and 60% of the increase in debt issuance during that same period. The increase in leverage increased the unemployment risk of workers—employment growth is substantially lower in highly leveraged firms during periods of high unemployment. In addition, the burden of unemployment risk in highly-leveraged firms is not shared equally across worker groups. Our results highlight that during periods of high unemployment for whites, leveraged firms are more likely recover in terms of their employment levels. The same is not true when black unemployment rates are high (employment growth remains negative overall), implying that the risk burden of leverage is not shared equally by different groups of workers.

After exploring the influence of financial leverage on unemployment volatility and unemployment risk, we turn to assess the role of the job-finding rate in understanding the variation in capital structure across firms. To do so, we explore the out-of-sample explanatory power of job finding probability measures on the change in capital structure following Lemmon, Roberts & Zedner (2008). A central tenet in the study of Corporate Finance is what determines the choice of capital structure or financial leverage. Following decades since Modigliani and Miller (1957) seminal work, there is still significant unexplained empirical variation capital structure across firms. A few decades ago, Myers (1984) pushed forward the debate and coined the term capital structure puzzle. Significant progress has been generated by the literature since then, and we now know taxes, informational asymmetries, and agency costs all affect the choice of capital structure. Yet, still today, what explain the cross-industry (Lemmon, Roberts & Zedner, 2008) and time-series variation in capital structure (DeAngelo and Roll, 2015) still eludes us. As we will show, variations in the job finding probability

play an important role in explaining both cross-industry variation and time-series variation in capital structure. This adds to our current set of theories that help to conditionally explain the choice of capital structure. Importantly, since our mechanism is based on a general equilibrium framework, as opposed to using game-theoretic foundations, these results are consistent with survey evidence showing that CFOs make their capital structure decisions focusing mostly on financial flexibility rather than on increasing the firm's bargaining power *vis-à-vis* workers (Graham & Harvey 2002), reconciling a seeming contradiction between survey findings and causal estimates (Matsa 2010 and following papers).

2.2 An Equilibrium Labor-Debt Relationship

From the Firm Balance Sheet to Unemployment

There is now a large body of empirical work relating labor markets with corporate leverage. Bronars & Deere show evidence that firms use debt to increase the bargaining position of shareholders against unions. Using variation in state level collective bargaining laws, Matsa (2010) shows that firms with higher collective bargaining coverage increase have higher leverage. Relatedly, firms operating in states with high unemployment insurance exhibit the same behavior (Agrawal & Matsa 2013). Similar results have been found regarding other stakeholders (Towner 2015). One of the main goals of this research paper is to show that corporate leverage plays a crucial role in the labor dynamics of race. As does collective bargaining, racial disparities in employment rates also operate through a firm balance sheet channel.

At a more micro level, the bargaining literature has provided supporting evidence of the mechanisms driving the interaction between the firm and the labor market. Hall & Krueger (2012) found evidence supporting bargaining for wages inside firms. Using a detailed dataset on wages in the airline industry, Benmelech et al (2012) show that firms in financial distress obtain more wage concessions. At a microtheory level, Stole & Zwiebel (1996) put forward a framework characterizing intra-firm bargaining between workers and employers, where workers bargaining power decreases as hiring increases since the marginal product of labor of each additional employee goes down. At a macro level, Cahuc & Wasmer (2001) have shown that Stole & Zwiebel (1996) findings still hold under search-theoretical frameworks of the labor market while Monacelli et al (2011) incorporate debt into a search-frictions employment model.

We contend that part of the increase of the unemployment rate among regulation-affected workers results from shifts in labor market equilibrium and an increase in labor risk due to corporate leverage and intra-firm bargaining positions. By shifting the labor market equilibrium, changes in corporate leverage play an influential role in explaining patterns of unemployment and labor force disparities. Besides shifting the labor market equilibrium, corporate leverage has an effect on employment by increasing unemployment risk. An increase in leverage reduces the size of equity relative to debt, which increases the probability

of default. That probability of default reduces the present value of employment cash flows decreasing the value of employment. Empirically, Giroud & Mueller (2015) find that firms that tightened their debt-capacity exhibited a larger decline in employment in response to adverse demand shocks.

Our choice of framework is driven by both pragmatic and conceptual reasons. First, the Mortensen-Pissarides framework has a long tradition in labor economics and offers the substantive advantage of explaining unemployment as a separate object from participation in the labor force. Second, from a corporate finance perspective, there is by now extensive evidence that changes in labor policy affect capital structure decisions one way or the other. Yet, survey evidence (Graham & Harvey, 2002) documents that the main concern of CFOs when setting capital structure policy regards sustaining access to external funds and their position vis-à-vis creditors (e.g. financial flexibility and credit ratings); in contrast, bargaining with workers finds little or no support as a policy factor taken in consideration by CFOs when setting capital structure policy. This evidence suggests that if labor market conditions have an effect in capital structure, such effect must arise from changes in the equilibrium outcomes rather than from strategic behavior.

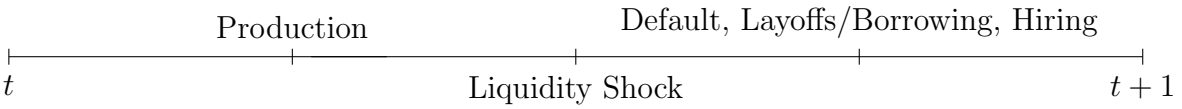
Environment Description and Timing of Events

We consider an economy where firms adjust through a productive margin, employment, and through a non-productive margin, choice of capital structure. While capital structure does not directly affect production, it does affect profits by enabling benefits in the form of tax shields, distress costs if the firm undergoes financial hardship, or changes in wages as is central to this paper. Denote firm employment by n. The firm produces according to a function $f(n)$ that is both increasing and concave in employment, i.e. $f'(n) > 0$ and $f''(n) < 0$. In order to get employees, the firm must post vacancies at a flow cost γ. Matches arise according to $m(u, v)$ which is increasing and concave function of both unemployed workers (u) and vacancies (v), and exhibits returns to scale. The arrival rate for workers is defined as $\frac{m(u,v)}{u} \equiv m(\theta)$, where $\theta = \frac{v}{u}$ is the labor market tightness. The hiring rate per vacancy is defined as $\frac{m(u,v)}{v} = \frac{m(\theta)}{\theta} \equiv q(\theta)$. The arrival rate of job offers for workers is increasing in labor market tightness, $m_\theta(\theta) > 0$, while the hiring rate decreases with labor market tightness, $q_\theta(\theta) < 0$. The separation rate, or the exit rate from employment to unemployment, is exogenous and equal to δ if the firm does not default, and δ^D if the firm does. The wage for each group is determined by (Nash) bargaining between the employer and each employee. Search on the job is not allowed.

The firm holds total debt B and can issue additional debt, ΔI. In doing so, the firm considers the tax rate, τ and distress costs c. The probability of default, λ, is endogenous and depends on the firm's profits and on the total debt. We will address the determination process of λ in section 2.2. The discount rate, r, is exogenous. The prevailing interest rate, R, incorporates the probability of default, λ, and, thus generally differs from the discount rate. Financial markets are competitive which implies lending earns zero profits. Hence

$e^R(1-\lambda) = e^r$ and $R = r - log(1-\lambda)$.

The timeline of the event is as follows:



At time t, the firm engages in production and makes a decision to post additional vacancies and borrow additional debt. During the production phase, the firm receives an interim mean zero liquidity shock[7], ϵ_t, that is independently and identically distributed across time and orthogonal to the firm attributes. The firm defaults if it is unable to service debt. If the firm defaults, it incurs in distress costs c, suspends hiring efforts, and is unable to claim tax benefits from debt. The separation rate changes from δ to δ^D. Suspending hiring efforts can be thought of as stop interviewing candidates or stop receiving applications because during their search workers realize the firm is in distress as in Brown & Matsa (2013). If the firm does not default, it issues new debt, continues hiring and collects tax benefits. Separations stay at δ and the firm incurs in no distress costs.

Job Creation and Equilibrium Debt

The firm maximizes the total surplus for investors- both bondholders and equity holders. Total surplus consists of production net of wages plus tax benefits from debt minus distress costs minus the flow cost of maintaining unfilled vacancies. The firm problem solves:

$$rV(n,B) = \max_{v,\Delta I}\{f(n) - w(n,B)n + \tau RB(1-\lambda) - \lambda cB - (1-\lambda)v\gamma + \frac{dV}{dt}\}$$

$$= \max_{v,\Delta I}\{f(n) - w(n,B)n + \tau RB(1-\lambda) - \lambda cB - (1-\lambda)v\gamma + V_n\dot{n} + V_\theta\dot{\theta} + V_B\dot{B}\} \quad (2.1)$$

where employment and debt satisfy the laws of motion, $\dot{n} = (1-\lambda)q(\theta)v - \delta(1-\lambda)n - \lambda\delta^D n$ and $\dot{B} = \Delta I$, respectively. The first and second term are standard. The third and fourth terms, represent the tax shield advantage and distress costs, respectively. The fifth term represents the hiring cost if the firm survives.

We want to find relationships characterizing job creation and borrowing in equilibrium. The first order conditions with respect to each groups' employment and firm debt yield:

$$V_n(n,B) = \frac{\gamma}{q(\theta)} \quad (2.2a)$$

$$V_B(n,B) = 0 \quad (2.2b)$$

[7]We refer to liquidity shock as a short-run solvency or non-economic financial shock. See, for example, Maksimovic & Titman (1991), Andrade & Kaplan (1998), Phillips & Sertsios (2012).

$V_n(n, B)$ is the marginal value to the firm of adding an additional worker from group i whereas $V_B(n, B)$ is the value to the firm of increasing total debt by \$1. Equation (2.2a) is standard and signifies that the marginal value of adding one employee must equal the search cost of making the match. Equation (2.2b) states that the marginal cost of an additional dollar of debt must equal zero; which is to say, different from hiring, there are no costs or benefits to *issue* debt. We can see, however, that there are benefits and costs to having debt, like there are benefits and costs to employment. Use the envelope condition and the fact that the market steady state satisfies, $\dot{\theta} = \dot{n} = 0$, and obtain:

$$V_n(n, B) = \frac{f'(n) - w(n) - \frac{\partial w(n)}{\partial n} n}{r + \delta(1 - \lambda) + \lambda\delta^D} \tag{2.3a}$$

$$V_B(n, B) = \frac{-\frac{\partial w(n)}{\partial B} n + \{\tau R(1 - \lambda) - \lambda c\} + \{(\tau B(1 - R)) - (cB - \gamma v)\}\frac{\partial \lambda}{\partial B}}{r} \tag{2.3b}$$

Equations (2.3a) and (2.3b) tell us how the *levels* of debt and employment affect the firm. Equation (2.3a) differs from the standard model in two regards. First it incorporates, the Stole & Zwiebel (1996) insight that all workers wages are determined at the marginal value of the marginal worker. This effect is referred to as intra-firm bargaining and is reflected by the term $-\frac{\partial w(n)}{\partial n} n$. The second aspect to notice is that the marginal value of a worker internalizes the unemployment risk faced by workers. This is given by the term in the denominator $(\delta(1 - \lambda) + \lambda\delta^D)$. A higher distress risk, λ leads to lower hiring value for the firm which can be interpreted as distress risk being transferred to the workforce in the form of unemployment risk.

Equation (2.2a) states that the value of a filled vacancy must equal the cost of filling it, while equation (2.3a) states it must equal its marginal revenue. Equating them yields the familiar job creation condition:

$$\frac{f'(n) - w(n) - \frac{\partial w(n)}{\partial n} n}{r + \delta(1 - \lambda) + \lambda\delta^D} = \frac{\gamma}{q(\theta)} \tag{2.4}$$

We also want to know the value of debt in relation to employment cost. From eqs. (2.2b) and (2.3b), the equilibrium condition for debt is given by:

$$\{\tau R(1 - \lambda) - \lambda c\} + \{(\tau B(1 - R)) - (cB - \gamma v)\}\frac{\partial \lambda}{\partial B} = \frac{\partial w(n)}{\partial B} n \tag{2.5}$$

Equation (2.5) states that the tax benefit of debt plus the savings in hiring costs if the firm fails minus distress costs and tax benefits foregone must equal the change in the equilibrium wage bill resulting from debt increases. From a trade-off theory of capital structure point of view, the left hand side of equation (2.5) captures the trade-off between taxes and distress costs, while the right hand side term dampens or amplifies the effect according to market conditions. This is meaningful. A capital structure chosen to account for static distress costs and tax shields will still exhibit fluctuations stemming from changes in job market

conditions. We will explore more carefully the change in wages with respect debt increases in section (2.2).

Wage Determination

Equations (2.4) & (2.5) provide general relationships governing the creation of jobs and the issuance of debt, and its relationship with wage and employment. They say little, however, about the wage formation process, which matters if we are to understand the role of capital structure in the labor markets. The costs associated with search puts workers and the firm in a position of dual monopoly. When a match is formed it produces a quasi-rent that must be distributed according to a bargaining protocol. Many protocols have been suggested in the last few years, e.g. Hall & Milgrom (2008). For simplicity, we will conform to tradition and adopt Nash bargaining (Pissarides, 2000).

Let W and U denote the present-discounted value of the expected income stream of employed and unemployed workers, respectively. Let β denote the bargaining power of a worker. Then, by the Nash-sharing rule[8]:

$$\beta V_n(n, B) = (1 - \beta)(W - U) \tag{2.6}$$

The value of employment and unemployment to the worker follow:

$$rW = w + \big((1 - \lambda)\delta + \lambda\delta^D\big)(U - W)$$
$$rU = b + m(\theta)(1 - \lambda)(W - U)$$

Plugging these into equation (2.6) and using equations (2.3a) yields the partial first order differential equations:

$$w(n) = (1 - \beta)rU + \beta[f'(n) - \frac{\partial w(n)}{\partial n}n]$$

Assume a simple Cobb-Douglas production function of the form $f(n) = n^\alpha$ for $\alpha \in (0, 1]$. We follow Cahuc et al. (2001) in incorporating Stole & Zwiebel (1996) intra-firm bargaining into a search-theoretical framework. The compensation profile set by the firm takes the form:

$$w(n) = (1 - \beta)rU + \int_0^1 z^{\frac{1-\beta}{\beta}} \alpha n^{\alpha-1} z^{\alpha-1} dz = (1 - \beta)rU + \frac{\beta\alpha}{1 - \beta + \alpha\beta} n^{\alpha-1}$$
$$= (1 - \beta)b + \beta\frac{\gamma}{q(\theta)}(1 - \lambda)m(\theta) + \frac{\beta\alpha}{1 - \beta + \alpha\beta} n^{\alpha-1} \tag{2.7}$$

This yields a wage that is dependent on the value of the unemployment claim and the marginal product of adding an additional worker. Wages are also related to the level of

[8]The Nash-sharing rule stems from maximizing $(W - U)^\beta V_n^{1-\beta}$.

labor market tightness in the economy. From equations (2.2a) and the sharing rule (2.6), the worker demands:

$$w(n) = \frac{\beta}{1-\beta}\frac{\gamma}{q(\theta)}[r + (\delta + m(\theta))(1-\lambda) + \lambda\delta^D] + b \tag{2.8}$$

Jointly, equations (2.7) and (2.8) provide the market equilibrium wage. Our analysis highlights that the equilibrium wage level in the labor market depends on the total hiring level, n. $\alpha - 1$ being negative indicates that the marginal product of additional workers is decreasing; so, the equilibrium wage decreases as the total number hired increases. The second expression indicates: (1) if hiring costs (γ) increase, wages go up, (2) with higher (worker) discount rates, wages go down because the worker's continuation value of a work claim increases, and (3) if the separation rate (i.e., the likelihood of losing your job) increases, the equilibrium wage goes up.

By combining these two we relate the equilibrium tightness with the equilibrium employment for each group:

$$\Big(\frac{\alpha}{1+\alpha\beta-\beta}\Big)n^{\alpha-1} = \frac{\gamma}{q(\theta)}[\frac{1}{1-\beta}(r + \delta(1-\lambda) + \lambda\delta^D) + \frac{\beta}{1-\beta}m(\theta)(1-\lambda)] + b \tag{2.9}$$

So far our setup contains a five-tuple $(n, \theta, w, B, \lambda)$ in three equations (Equilibrium Debt eq. 2.5, Job Creation eq. 2.4, and Wage Equation 2.8). We know unemployment in the steady state must satisfy $\dot{u} = (\delta(1-\lambda) + \lambda\delta^D)(1-u) - m(\theta)(1-\lambda)u = 0$, which yields:

$$u = \frac{\delta(1-\lambda) + \lambda\delta^D}{(\delta + m(\theta))(1-\lambda) + \lambda\delta^D}. \tag{2.10}$$

Equilibrium & Financial Distress Risk

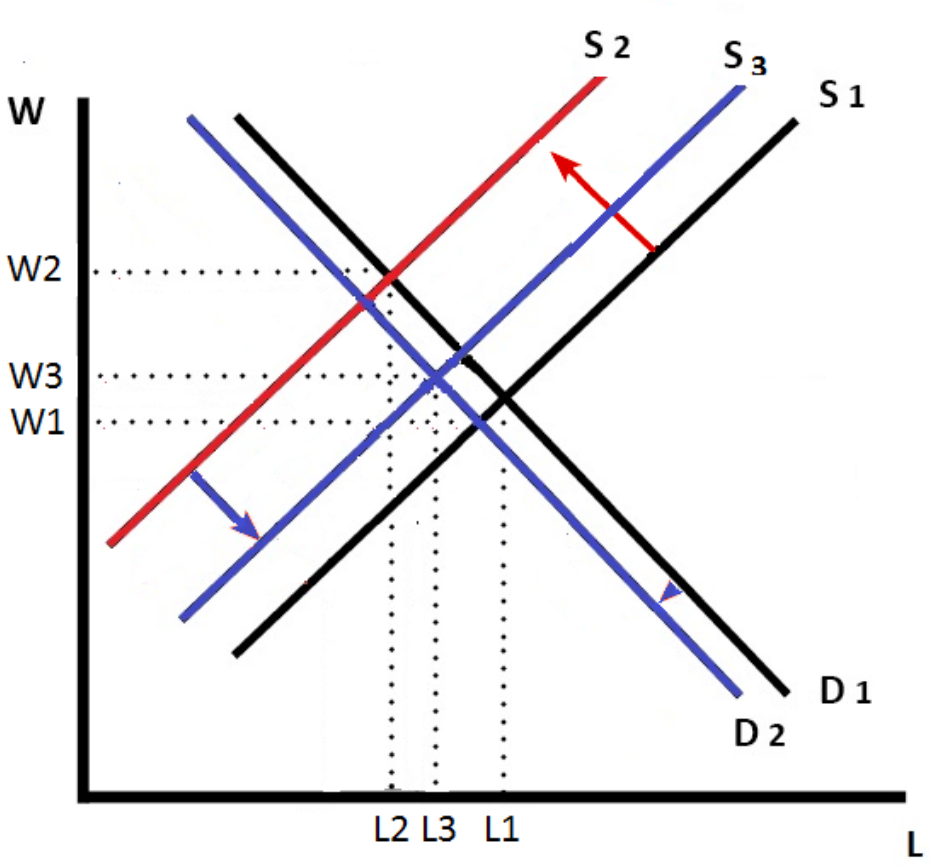
Definition: An *equilibrium* consists of a tuple of employment, labor market tightness, wage, total debt, and distress risk $(n, \theta, w, B, \lambda)$ satisfying free entry of firms, competitive financial markets and equations and equations (2.5, 2.4, 2.8 & 2.10).

Since the equilibrium has only four conditions for five variables, infinitely many combinations constitute an equilibrium for varying levels of distress risk. To select an equilibrium, we specify a determination process for distress risk. We will define financial distress risk as the probability that a firm optimizing production is unable to service debt:

$$\lambda = P(\epsilon \leq RB - \Pi^*)$$

The equilibrium of this decentralized economy shares the same efficiency concerns of the canonical MP model. We discuss in appendix B.4.

Figure 2.1: Labor Market Equilibrium with Financial Leverage



Wage Leverage Relationship

The relationship between wages and leverage deserves careful attention. Differencing the wage equation (2.8) with respect to debt yields:

$$\frac{\partial w}{\partial B} = \frac{\gamma}{q(\theta)} \frac{\beta}{1-\beta} \frac{d\lambda}{dB} \left(\delta^D - m(\theta) - \delta\right) \tag{2.11}$$

The interpretation of these equation is useful in our context. Shimer (2012) has documented that fluctuations in the labor markets arise predominantly from the job finding probability while the exit probability (separation rate) is fairly stable- hence, we will concentrate our analysis on the former. When $m(\theta) + \delta > \delta^D$ there is a trade-off between costs associated with higher debt and gains arising from bargaining with workers. Notice that a high job finding probability increases the value of being unemployed by making the worker's

outside option more attractive. An increase in equilibrium distress risk reduces the value of being employed, of course, but it also reduces the unemployment value (her outside option) for the worker. If the job finding probability is high the reduction in the value of unemployment is higher than the drop in the value of employment, and hence equilibrium wage will decrease. Conversely, if the job finding probability is low distress risk has little effect on the outside option of the worker and, as a consequence, reducing the continuation value of employment will require paying a higher wage. So the first thing we must observe from this equation is the importance of the job finding probability.

The importance of the job finding probability comes in two flavors. First, there is a direct effect: increases in the job finding probability must be associated with more debt issuance. We will explore this more in detail in sections (2.3) and (2.5). Second, there is what we loosely refer to as its "gate-keeping" function. The job finding probability regulates whether there is compensation for unemployment risk or reduction in their compensation. This gate keeping role leads us to the second important observation about the relationship between leverage and wages: it amplifies unemployment volatility and dampens fluctuations in wages. When the job finding probability is high, unemployment is low[9], and increases in debt reduces compensation for workers, leading to even lower unemployment. Conversely, a low job finding probability comes during periods of high unemployment and through the debt channel implies even higher unemployment. This amplification effect increases the volatility of unemployment. The amplifying effect of downturns due to leverage was clearly seen during the Great Recession (see, for example, Giroud & Mueller 2016). This channel provides a new theoretical micro-foundation for wage inertia.[10]

A related third point is more subtle. The response of wages to increases in leverage also affects the financial flexibility of firms (which is what CFOs mostly care about; see Graham and Harvey, 2002). Intuitively, a firm is interchanging operating leverage and financial leverage. Formally, assume for tractability shocks to the liquidity of the firm follow a Type I Extreme Value Distribution[11]. For $\epsilon \sim \text{Gumbel}(0,1)$, $P(\epsilon \leq x) = e^{e^{-(x+c_\gamma)}}$, where $c_\gamma \approx .577$ is the Euler-Mascheroni constant. Hence, the distress risk is given by $\lambda(B) = e^{e^{-(BR-\Pi+c_\gamma)}}$. After taking derivatives and rearranging:

$$\frac{d\lambda}{dB} = \frac{f_\lambda}{1 - Bh_\lambda}\Big(\frac{\partial w}{\partial B}N + R\Big) \tag{2.12}$$

where f_λ is the density function of the Gumbel distribution, and h_λ is the hazard rate which falls between 0 and 1 for the Gumbel distribution. We can see the default rate is mitigated by the response of wages to debt increases.

Equation (2.12) together with equation (2.5) jointly determine the equilibrium level of debt in the economy. Eq. (2.12) states, again, the change in distress risk should become

[9]Recall, $m(\theta)$ is increasing in labor market tightness and the Beveridge curve has a slope close to -1.

[10]For other relevant work generating wage rigidities see: Hall & Milgrom (2008), Christiano et al. (2016), and Eliaz & Spiegler (2013).

[11]We follow a line of work that applies tools drawn from discrete choice models, such as Kline (2008), Artuc et al. (2010), Kennan & Walker (2011) and Godorow-Reich (2014).

Figure 2.2: Monthly Job Finding Rate

Source: Hobijn & Sahin (2007). Job-Finding and Separation Rates in the OECD. Federal Reserve Bank of New York Staff Report.

smaller as the job finding probability increases. We would expect the benefits of bargaining to be more salient when the matching rate, $m(\theta)$ is the highest. Shimer (2005) and Hall (2005) provide estimates of the job finding rate all the way back to 1968. It happens that the job finding rate during that period is the highest recorded.

Multiple Groups

In order to talk about the distribution of unemployment risk and the role leverage plays in it we must consider a framework with at least more than one group of workers. Cahuc et al. (2008) provide a useful framework for the analysis of labor markets in the context of search and match models à la Mortensen-Pissarides with vacancies assigned across multiple groups. This is particularly useful in the context of profiling and leads to an analysis analogous to the segmented labor markets literature. This literature has provided a large body of empirical research that documents persistent divisions among American workers: divisions by race, sex, education, industry, etc. In the segmented markets literature groups seem to operate in different labor markets, with different working conditions, different promotional opportunities, different wages, and different market institutions.[12] With respect to race, for

[12]For a review of segmented labor markets, see Taubman and Wachter (1984).

example, racial/ethnic minority workers are present in secondary, subordinate primary and independent primary segments; as a result, they often face distinct segments within those submarkets. Certain jobs are "race-typed," segregated by prejudice and by labor market institutions.

With this in mind, we now consider an economy where workers differ only along a non-productivity dimension, $i \in \{a, b\}$ under which they can be tagged. Each dimension contains an identical continuum of infinitely lived workers of measure one. The employer interviews candidates with full information of their type, or equivalently, posts vacancies (v_i) for each group. The production function with $n = n_a + n_b$ workers is $pf(n)$, with $f'(n) > 0$ and $f''(n) < 0$. The matching function, $m(u, v)$ is increasing and concave in both unemployed workers (u) and vacancies (v), and has constant returns to scale. The arrival rate for workers is defined as $\frac{m(u,v)}{u} \equiv m(\theta)$, where $\theta = \frac{v}{u}$ is the labor market tightness. The hiring rate per vacancy is defined as $\frac{m(u,v)}{v} = \frac{m(\theta)}{\theta} \equiv q(\theta)$. The arrival rate of job offers for workers is increasing in labor market tightness, $m_\theta(\theta) > 0$, while the hiring rate decreases with labor market tightness, $q_\theta(\theta) < 0$. The wage for each group is determined by bargaining between the employer and each employee of all groups. While the flow cost of posting a vacancy, γ_i and labor market tightness might differ across groups, the marginal product of labor is the same for each worker. The rest of the environment follows subsections [2.2]-[2.2].

Following a straightforward extension to the preceding subsections[13], the equilibrium obeys:

$$\frac{f'(n_a + n_b) - w_i(n_i) - \frac{\partial w_i(n_b+n_a)}{\partial n_i} n_i - \frac{\partial w_b(n_b+n_a)}{\partial n_i} n_{-i}}{r + \delta(1-\lambda) + \lambda\delta^D} = \frac{\gamma_i}{q(\theta_i)} \qquad \text{(Job Creation)}$$

$$\tau(r + \lambda + rR) + (\gamma_a v_a + \gamma_b v_b)\frac{\partial \lambda}{\partial B} - (c + \tau B(1-R))\frac{\partial \lambda}{\partial B} = \frac{\partial w_a(n_b + n_a)}{\partial B} n_a + \frac{\partial w_b(n_b + n_a)}{\partial B} n_b \qquad \text{(Equilibrium Debt)}$$

$$w_i(n_a + n_b) = \frac{\beta_i}{1 - \beta_i}\frac{\gamma_i}{q(\theta_i)}[r + (\delta + m(\theta_i))(1-\lambda) + \lambda\delta^D] + b \qquad \text{(Wage Equation)}$$

$$u_i = \frac{\delta(1-\lambda) + \lambda\delta^D}{(\delta + m(\theta_i))(1-\lambda) + \lambda\delta^D}. \qquad \text{(Steady State)}$$

When thinking about multiple groups, the job creation condition states that changes in the employment of one group will affect both groups because the marginal productivity of the marginal worker decreases.

As before, the wage equation and job creation condition can be combined to yield the equilibrium tightness:

[13]See appendix B.5 for details

$$(\frac{\alpha}{1+\alpha\beta-\beta})(n_a+n_b)^{\alpha-1} = \frac{\gamma_i}{q(\theta_i)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta^D)+\frac{\beta}{1-\beta}m(\theta_i)(1-\lambda)]+b \text{ (Equilibrium } \theta)$$

In appendix B.5 we show that group b being discriminated against is equivalent to $\gamma_b > \gamma_a$. From these relationships we can derive some basic properties of an environment with discrimination. These properties will be particularly important in the context of our calibration.

Proposition 1: Let group b be discriminated against in hiring or employment relative to group a. Then:

(i) *Unemployment Differential:* Unemployment for group a is strictly lower than unemployment for group b. This is, $u_b - u_a > 0$.

(ii) *Wage Gap:* The equilibrium wage for group a is higher than the equilibrium wage for group b.

(iii) *Unemployment Volatility:* The unemployment volatility for group b is higher than the unemployment volatility for group a.

Relationship (Equilibrium θ) also reflects that in equilibrium policies about employment and policies about debt are taken jointly. Since $\alpha < 1$, an increase in distress risk λ implies an increase in employment. In the context of a firm responding to employment regulation that increases the cost of labor, this relationship states that adjustments through the debt policy margin can mitigate the response through the employment channel.

What about differential employment response amongst groups? That will depend in the sensitivity of each labor market tightness to hiring. As it happens, the group with lowest bargaining power has higher labor market tightness sensitivity to hiring.

Proposition 2: Let $L_b^i > L_b^j$ be the minority workforce size under different scenarios i, j. Let there be a policy change P such that the flow cost of posting a vacancy for both groups is equated. This is, for $\gamma_b^t > \gamma_a^t$, $P : (\gamma_a^t, \gamma_b^t) \to (\gamma^{t+1}, \gamma^{t+1})$. Then, $B_i^{t+1} > B_j^{t+1}$.

In other words, leverage is higher when the minority share of the workforce is higher.

This proposition gives us a clear mapping to anti-discrimination regulation. As we show in the appendix, costs arising from discrimination can be rewritten as increases in the flow cost of posting a vacancy. Variation in the relative size of the minority workforce can be constructed at the industry level. The passage of Civil Rights Era regulation gives us a clear setting where we are able to test the responsiveness of leverage to changes in the labor market. To this we proceed in the following section.

2.3 Historical Context: Capital Structure and Changes in Labor Market Conditions

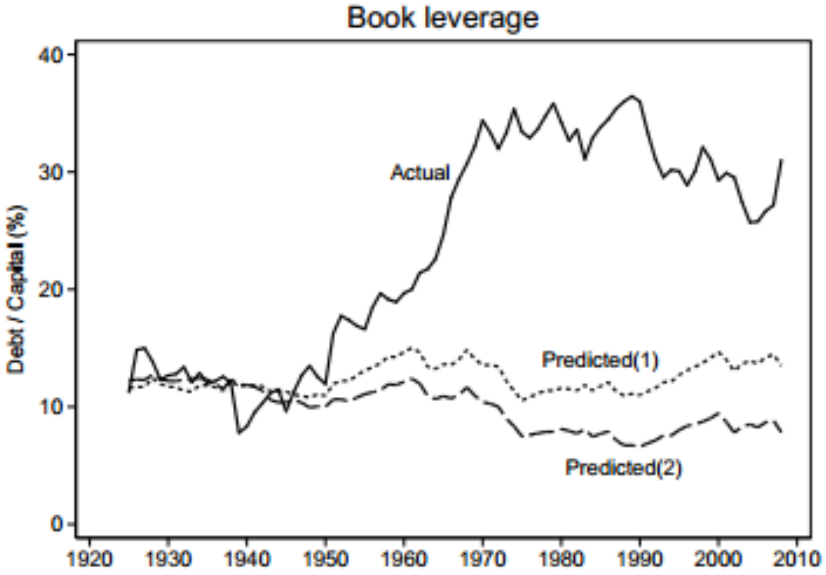
The main goal of this section is to evaluate the responsiveness of capital structure to changes in labor market conditions. We begin, in subsection 2.3.1, by providing historical context as to the changes in aggregate corporate debt and workers real earnings along the 20th century. In subsection 2.3.2 we describe our empirical setting, which is the civil rights era regulation, and provide stylized facts specific to the setting.

A New Era of Corporate Indebtedness

The period from the late 1940s through the 1970s witnessed the largest recorded increase in the use debt of corporate debt. Recent research by Graham et al. (2015) document that from 1945 to 1970, aggregate leverage tripled. However, no research has been able to provide a coherent explanation for these strong trends. To this point, Graham and co-authors state that "none of the average or aggregate characteristics change over the century in a way that would support greater debt capacity or higher optimal leverage." They proceed to proclaim state that "any explanation for these secular trends in financial policy must come from sources of variation not central to the existing capital structure literature."

Figure 2.3: Book Leverage

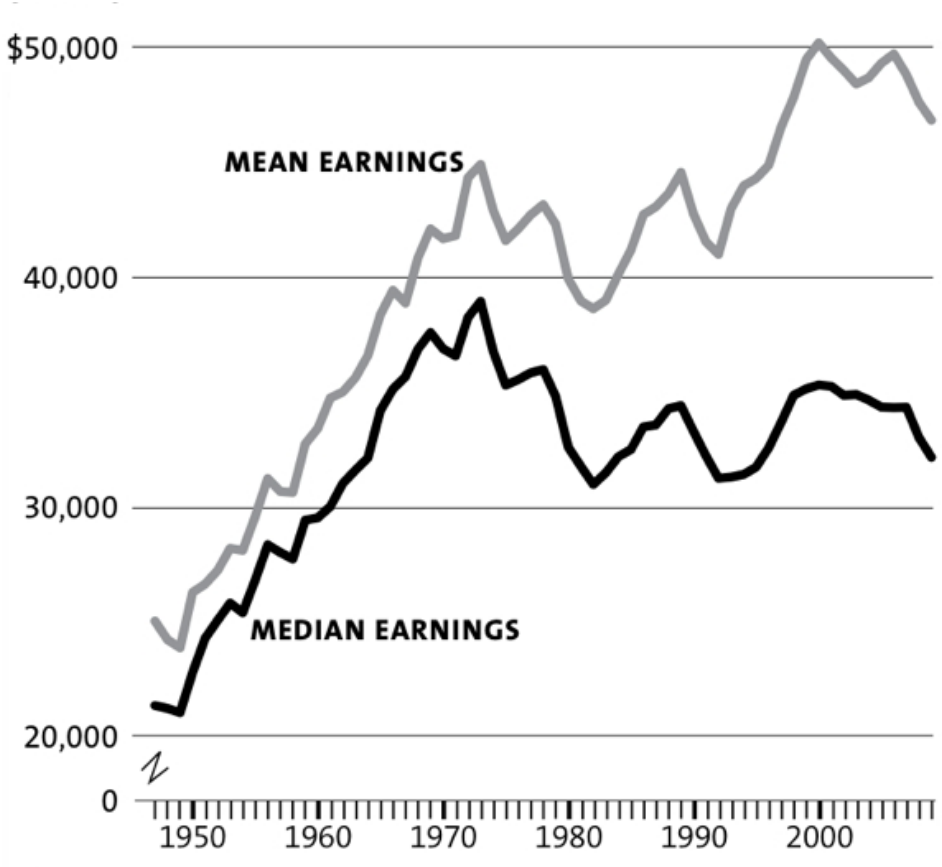
This figure is borrowed from Graham et al. (2015). Book Leverage exhibits a dramatic increase during the period following the passage of the Civil Rights Act and Voting Rights Act.



In this paper, we take up their implied call to further investigate and uncover the determinants of this increase in the use of debt. As it happens, there is another important trend that showcases a similar behavior during this period. Changes in labor productivity via adoption of new technology and increases in skill and education led to unprecedented growth in the real earnings of workers. From the late 40s to the 70s workers' average earnings increased at a pace of about 25% per decade (Greenstone & Looney, 2011). During the early 70's, however, this growth in earnings halted, very much like the explosion in the use of corporate debt did.

Figure 2.4: Real Annual Earnings for Men

This figure is borrowed from Greenstone & Looney (2011). Real earnings nearly double from 1950 to 1975. Earnings in $ 2009.



Given these tandem trends, it is natural to ask: is there a relationship between workers' earnings and reliance on corporate debt? From a theoretical standpoint, our framework suggests a clear "yes." From equation (2.7) any increase in productivity leads to higher wages, and, in equilibrium higher labor market tightness. This will lead to a change in debt policy according to the wage-leverage relationship (2.11). Empirically, exploring this relationship

quantitatively is a tougher proposition- we need to address issues of (i) identification; (ii) non-linearities; and (iii) aggregation. This very last issue we will address in section (2.5). For now it suffices to say that if there is indeed a relationship between the trends depicted in Figures 3 and 4, it is one strong enough to be easily accessible to the naked eye and, as such, must co-movement between key labor and debt variables must survive aggregation.

As for the first two issues, first, we need an identification strategy to more tightly link the relationship between changes labor market conditions and firm debt policy. But, second, in doing so we need to be attentive of the non-linearities arising from fluctuations in the business cycle. As we characterized in equation (2.11) changes in the labor market tightness delve into changes in the response of wages to changes in corporate debt. Estimators capturing average treatment effects may present a blurred picture of what is happening if we are not to choose a setting with careful regard to business cycle movements. Fortunately, during the last years of workers' earnings increases and of corporate debt expansion, arguably the most comprehensive labor reform of the 20th century was passed in the form of bundles of anti-discrimination regulation.

Anti-discrimination regulation implied wage increases to minority workers and, to some extent, these wage increases constituted transfers of wage income from whites to blacks. These effects provide us with an ideal setting to test our hypothesis. Moreover, the 60s and early 70s displayed low unemployment rates and high job finding probabilities making our evaluation of the effect of anti-discrimination policies on corporate leverage more clear.

Civil Rights Regulation & The Distributional Impact of Corporate Debt

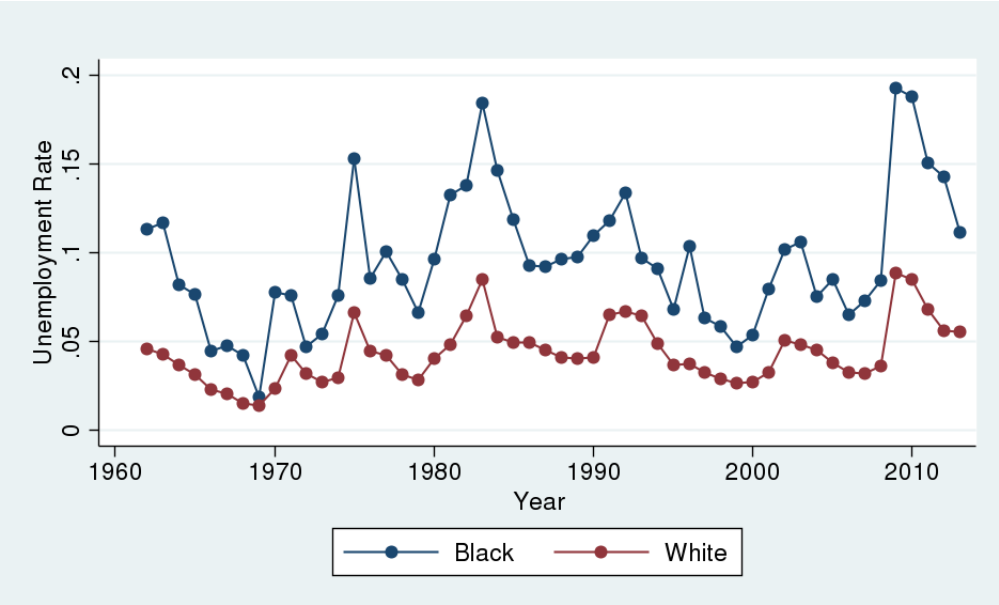
Besides the benefit of using the passage of anti-discrimination regulation as the setting for testing the relationship between leverage and wages, analyzing the response of firms to mandated equal pay regulation is inherently important, and currently understudied. There are numerous laws at both the state and federal level that have increased the pay of minority worker groups, such as the Equal Pay Act (mandating equal pay across genders) and the American with Disabilities Act (mandating equal treatment of disabled workers). Yet, there has been little study of how firms respond to such institutional changes to the labor market, and in turn, how firms' strategic behavior can affect the beneficiaries of legislation.

We seek to understand such firm behavior in the context of increased wages for black workers following the Civil Rights revolution–a period during which both the Civil Rights Act and Voting Rights Act increased the wages of black workers by law. Understanding firm behavior in response to legislation targeted at equalizing the workplace for minorities is important given that the last 70 years have been characterized by racial disparities in labor market performance. Black unemployment rate being roughly twice the overall unemployment rate since the 1960s (Figure 2.5).

As we document, firms' financial decision-making is yet another factor that may contribute to the labor market performance of different groups of workers, in our setting white

Figure 2.5: Unemployment Rates by Race

This figure plots the unemployment rates by race from 1962 to 2012 for male workers between the ages of 25 to 55. Unemployment rates are computed from CPS.

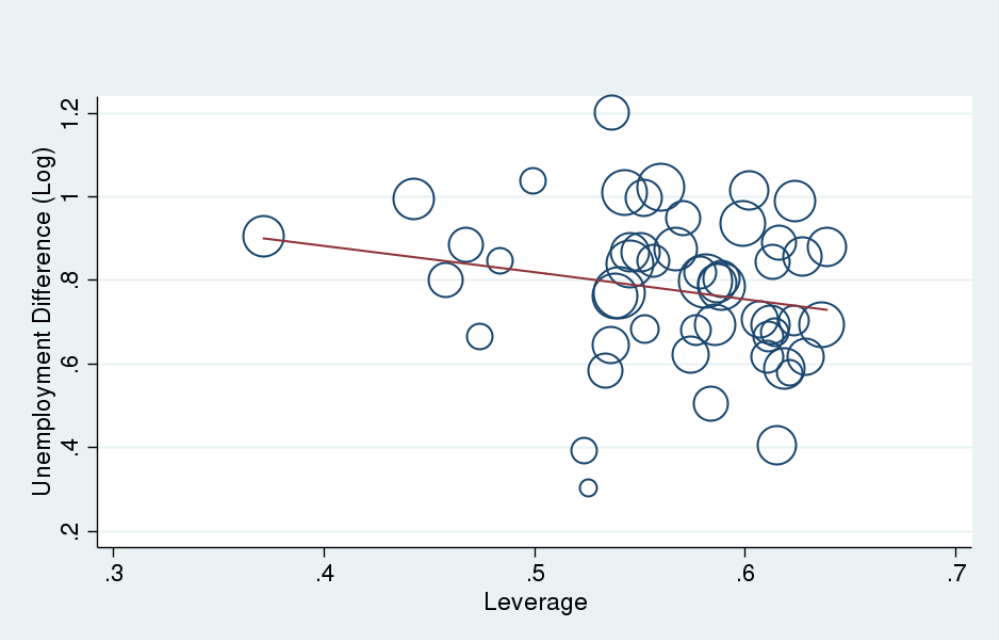


and black workers. A casual examination of overall firm debt levels and race-specific employment rates (Figure 2.6) suggests that low levels of firm debt in the economy is correlated with high black-white unemployment differentials. This is consistent with Proposition 2 and we will causally test this relationship in next subsection. For now, it should be remarked that this is important because it suggests that blacks face a trade-off between the probabilities of job arrival and job destruction, as corporate structure is tightly linked to the probability and costs of firm distress (Wruck, 1990) and to unemployment risk (Giroud & Mueller, 2015). We provide an explanation for this observed relationship between highly leveraged firms and reduced employment gaps between whites and blacks. Previous work suggests that firms incur debt in response to increases in the bargaining power of workers (Matsa, 2010). We argue here along similar lines that firms will respond similarly to labor market institutional changes that increased the wages of black workers (such as Title VII of the Civil Rights Act and political re-enfranchisement that occurred through the Voting Rights Act).

Corporate financing decisions may have implications for the relative labor market outcomes of different groups of workers, primarily for the unemployment risk each group bears. Disproportionate levels of unemployment risk are an important undocumented source of structural challenges black workers face. These differences are still prevalent today when unemployment differentials between blacks and whites are 20% higher in industries with lower levels of leverage (Figure 2.7). The findings we document in this section are not of pertinence only to the study of race in the labor market, but the insight translates to any

Figure 2.6: Unemployment Differences by Leverage

This figure illustrates the relationship between the log difference of the unemployment rate between black and white workers against the average firm leverage. Firm leverage is computed from Compustat. Unemployment differences are constructed using data from CPS. Marker weights reflect black unemployment rate.



instance in which multiple workers may be affected, adversely or not, by regulation. As such, these changes in financial policy have distributional consequences for the real economy.

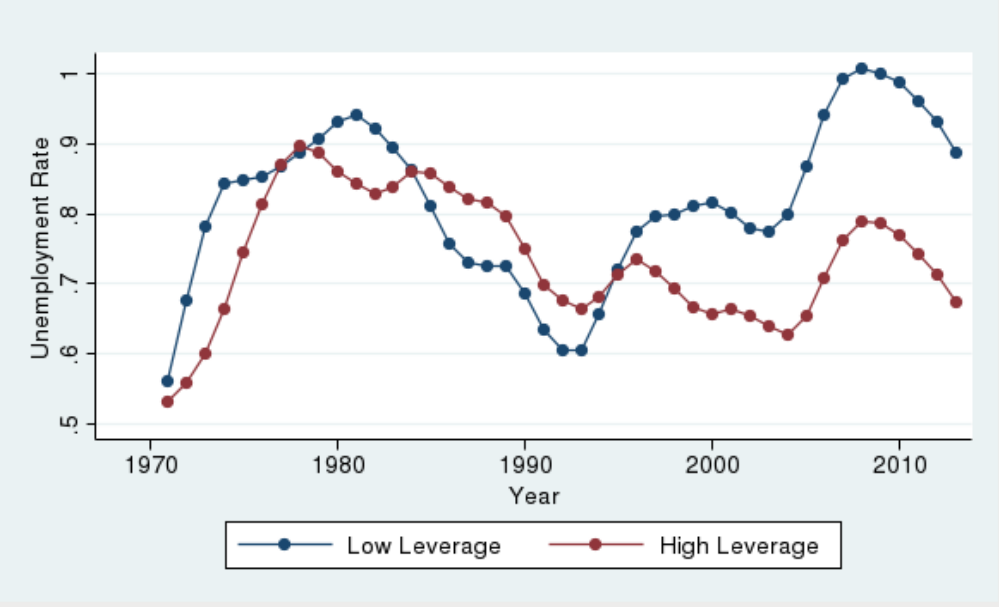
2.4 Empirical Framework & The Responsiveness of Corporate Debt

To study the relationship between unemployment risk and corporate debt we are required to confront this question: "Is corporate debt responsive to changes in the wage bill?" Answering this question presents some difficulties, though. First, as we remark throughout the paper, the relationship between wages and leverage depends on business cycle conditions, so we must be attentive to those. We will come to this soon enough in the Data subsection. The second difficulty is finding the right setting: we need exogenous variation not in the wage nor in employment, but in the total *wage bill* (the product of the two).

First, think about the reasoning. From our theoretical framework, in particular from the equilibrium debt condition, we know that changes in debt will stem from changes in the wage bill. Ideally, we could test this relationship using an unanticipated shock that increases wages. Understanding the impact of such a change, however, will only help us to the extent

Figure 2.7: Unemployment Differential for Low and High Leverage Industries

This figure plots the trend in (log) unemployment differential between black and white workers for industries in the top and bottom quartile of corporate leverage after removing firm fixed effects. The series is obtained from the CPS and Compustat. The trend is an HP filter of the annual data with smoothing parameter 6.25.



we can hold everything else constant. Since the underlying causes of wage increases often have an offsetting effect on employment, finding variation in the wage bill is difficult.

Next, let us consider an alternative. Beyond looking directly at changes in the overall wage bill, we can use variation that amounts to reallocation in the wage bill between two groups of workers: when the overall wage bill is going down, there is one group of workers for which the wage bill either goes up or goes down at a lower rate than the average (depicted in Figure 2.8). Changes in anti-discrimination policy could give us a way around this problem through Proposition 1: the passage of anti-discrimination regulation reduces both the unemployment differential and the wage gap between minority and majority workers which leads to an unequivocal relative increase in the wage bill for firms in industries with a higher minority share of the workforce.

To that end, we exploit the sharp increase in relative and absolute wages observed after the civil rights revolution of the 1960s. Important studies in labor economics document the impact of anti-discrimination laws (in particular, Title VII of the 1964 Civil Rights Act) on observed improvements in black wages over the second half of the twentieth century. Additionally, we show in a previous paper that the grant of political power bestowed by the Voting Rights Act of 1965 also had the effect of improving black wages.

To begin, we provide evidence that it is indeed true that the wage gap is decreased

and that there are differential reductions in unemployment differentials according to the relative size of the minority workforce. To also convince readers of the impact of black voting rights on labor market outcomes, we provide evidence of the VRA's effect on black wages in Table 2.8. We then proceed to test our main specification of interest- this is, that leverage is differentially responsive to changes in anti-discrimination regulation depending on the minority share of the workforce.

We test our theory by examining the effects of both the VRA and Title VII on the use of corporate debt. We expect that laws that raise minority wages will have the greatest impact on firm borrowing within industries that have a high presence of minority workers. The empirical specification is thus the following:

$$Lev_{ist} = \alpha + \beta_1 CRL_{st} + \beta_2 CRL \times ShareBlack_{st} + X'_{ist}\gamma + \eta_i + \xi_t + \epsilon_{ist} \tag{2.18}$$

In this empirical model, *CRL* indicates the presence of either the VRA or Civil Rights Act, Title VII (in other words, a "Civil Rights Law" - hence, "CRL") in state s and year y. The key variable of interest, however, is *CRL* $\times$ *Share Black*, or the interaction between the presence of civil rights legislation and the black share of labor in a given industry. Given our theoretical discussion above, we expect laws that raise minority wages to have the greatest impact on firm borrowing within industries that have a high presence of minority workers. η_i and ξ_t are firm and state year fixed effects, respectively. All regressions include robust standard errors clustered at the state level. X is a vector of state and firm-level control variables.

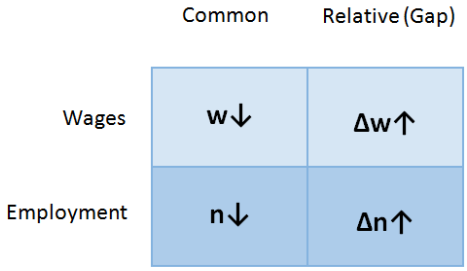
In our primary specification, we focus on book leverage instead of market leverage. Our choice is based on two documented facts in the empirical Corporate Finance literature. First, from a comprehensive survey looking at over 4,000 firms, Graham & Harvey (2002) have documented that CFOs make capital structure decisions looking at book leverage. Practitioners fear that, due to daily fluctuations in the value of debt and equity, having market leverage targets would require constant rebalancing. This is consistent with Welch (2004) findings that most variation in market leverage ratios are not a product of debt policies but of fluctuations in market values as US Corporations do not issue or repurchase debt and equity in response to these changes.

Data

To analyze the impact of labor market regulation on firms' financial policies, and in turn the effects on the macroeconomy, we combine data from several sources. First, we match state-level data on civil rights legislation with firms' balance sheet and income statement information from Compustat. Our main source of firm data is the widely-used Compustat database. The sample includes all firms with nonmissing observations for debt, total assets, market value, and the financial controls (listed below). This leaves us with 260 firms in states covered by Section 5 of the Voting Rights Act and 1,323 in states not covered.

Figure 2.8: Breakdown of Effects in Proposed Testing Scenario

This figure breaks down the effect of a policy change that increases the overall cost of labor but increases the relative wage bill for one group of workers. The first column refers to the overall (or common) effect to all workers, and the second column refers to the *relative* increase in the wages and employment of one particular group.



Summary statistics are presented in Table I. We then match our firm data to industry-race compositions, which are constructed using labor market information from the US Current Population Survey (CPS), and in particular the 4-digit NAICS industry code. We similarly construct industry-specific education and "years of experience" variables, by race, that are matched to Compustat firms (again using the CPS). These industry-specific variables are measured in the year 1960 – to provide us with pre-existing industry differences that are unaffected by treatment. The final sample includes all firms (excluding financials and utilities) with non-missing observations, which amounts to about 14,415 firm-years over the 1961-1982 period. Summary statistics are reported in Table I.

We analyze all firms over the period from 1961 through 1982. These years are chosen deliberately. As our model suggests (by the wage-leverage relationship), the level of responsiveness of leverage to regulation depends on labor market conditions. Because the job-finding rate varies at different points of the business cycle, we choose our dates of analysis to comprise a full business cycle. 1961 and 1982 are official business cycle "trough" dates as determined by the National Bureau of Economic Research. As we will show, however, our results are invariant to the choice of start and end dates.

Additional Data Sources

We also use two additional sources of data to quantify the penetration of civil rights era changes such as VRA enfranchisement. First, we use the number of civil rights-related protests for each state and year between 1960 and 1990. The results Table(2.8) suggest that after the passage of the VRA, corporate leverage is increased differentially more in industries with higher black participation when the number of protests is high. Second, we use data on racial violence as demonstrated by black lynchings by white citizens. During the civil rights era, one strategy employed to intimidate supporters of civil rights legislation was lynching. Consequently, lynching deteriorated the effectiveness of black enfranchisement and workplace

economic gains by keeping blacks from organizing socially, politically, or economically. [14] We use data on intensity of lynching to generate mitigating variation in the implementation of the VRA and Title VII. Table (2.8) shows that after the passage of the VRA, industries with high rates of black participation exhibited a lower increase in corporate leverage if the number of lynchings was high.

Antecedent Results: Effects on Employment and Wages

We begin with discussion of how firm debt relates to a firm's total wage bill. The equilibrium debt condition in Equation 2.5 highlights how corporate debt is tied to both components of the wage bill: total wages and overall employment. Firm borrowing decisions can be influenced by changes in either component. In the context of anti-discrimination regulation (which affects racial groups differently), we care not only about the absolute changes in a firm's wages/employment, but also in the compositional changes across groups.

First, we confirm that the labor market regulation we exploit indeed increased the cost of labor for firms. To this end, we evaluate the effect on wages using the empirical strategy developed in Aneja and Avenancio-leon (2017). The results are presented in Table 2, and demonstrated the marked impact of the VRA on wages–to the tune of a 12-13% increase in relative black wages. Importantly, this effect is driven almost entirely by the increase in black wages; white wages are virtually unchanged. To alleviate concerns of endogeneity, we also compare the estimates here to estimates from our related paper, using recently-released administrative Decennial Census data to evaluate the labor market effects of the Voting Rights Act. In that paper, we utilize a cross-county border county design to reduce concerns about endogeneity. As suggested by Table 2B, the border-county design confirms that the estimates are similar to results using full state-year samples. Given that there are no qualitative differences in the state and border county estimates, we are confident that the VRA had an important impact on at least one major component of firm labor.

Proposition 2 highlights how the impact of anti-discrimination laws for black workers will depend on the relative sizes of black and white workers in the labor market. In particular, this type of regulation should reduce the unemployment disparities more in places where minorities comprise a greater share of the labor force. To test this formally, we estimate the following regression:

$$\%\Delta employees_{ist} = \alpha + \beta_1 VRA_{st} + \beta_2 VRA \times ShareBlack_{sjt} + \gamma X_{it} + \eta_i + \xi_t + \epsilon_{ist} \quad (2.19)$$

[14] The gravity and seriousness of lynching is demonstrated by the following quote:

> Nationally, Presidents John F. Kennedy and his successor, Lyndon B. Johnson, were opposed to lynching. Johnson was also bale to push through Congress a series of civil rights measures in the 1960s which aided the advancement of some blacks in American society. Although Congress showed some sensitivity to black issues and concerns with the passage of the 1965 Voting Rights Act and other civil rights bills during this period, an anti-lynching bill was not one of them.

where $\%\Delta employees_{ist}$ is the firm-level percentage change in employees, VRA_{st} is a dummy marking the application of the Voting Rights Act Section 5, and $VRA \times ShareBlack_{sjt}$ interacts VRA_{st} with the industry racial composition. $ShareBlack_{st}$ is absorbed in this regression. Table 3 shows the estimation results. Consistent with Proposition 1, $\beta_2 > 0$ meaning that as the black share of the labor supply increases, so does employment. The increase is of about 12 basis points per percent increase in the black labor share. In contrast, the baseline effect of VRA, β_1, is negative reflecting the additional costs of complying with the regulation. These effects, along with the effects on wages, are consistent with Proposition 1 and figure 2.8, paving the way for clear directional predictions of the effects of the policy change on corporate debt.

Recall that the Equilibrium Debt condition (Equation 2.5) shows that debt will change if the total wage bill changes. In other words, firm debt will decrease if and only if the firm's total wage bill declines. As such, we evaluate the effect the passage of anti-discrimination regulation has on overall employment for our sample of firms from Compustat. Table 3 shows that the effect of the VRA on total firm employment is negative. From Table 3, we can see that there is an overall reduction in total employment after the passage of the law. This reduction is partially offset by relatively higher minority employment. However, the marginal effect of an additional percent increase of black workers in a given industry is positive. In other words, the component common across industries is negative, and the relative component is positive. This statistical fact provides an interesting testable implication: we expect leverage to go down overall in states affected by passage of the VRA, but *increase* in black-concentrated industries.

These initial results on wages and employment have the following consequences for leverage based on our theoretical framework: (1) since wages for majority-group workers are stable and employment decreases, the leverage will decline as a result of anti-discrimination laws for all firms; and (2) this reduction will be off-set as we move to industries with higher minority labor participation, as both their relative wages and relative employment increases at a faster rate than the baseline effect. We test these predictions in the next subsection.

Main Results: Impacts on Firm Leverage

Proposition 2 of the model suggests that when firms increase wages paid to workers that are part of a minority group, this firm should increase its borrowing. We test this prediction in a context where a policy shock increased the wages of a minority subpopulation–namely, black workers. As shown above, the passage of the Voting Rights Act in 65 increased black wages both in absolute relative terms between 1965 and 1990. Having established this empirical fact, we now show that firm borrowing also responded to the passage of the increased cost of black labor.

We begin with our main results. The main prediction we test is that these laws (in particular, the stronger effect of anti-discrimination laws) have an impact on debt usage. We test this predidction using the primary empirical specification, Equation 2.18, discussed

above. The core results are presented in Table 2.8. Firm-level leverage is the outcome variable.

Given the theoretical discussion above, we expect an exogenous increase in minority wages to have the strongest impact on firms within the most heavily-affected industries–i.e., industries with a high presence of minority workers. As such, $VRA \times ShareBlack$ is the coefficient of interest. Column (1) of Table 2.8 indicates that in states subject to civil rights legislation (which increases black wagesin this case, the VRA), increasing the fraction of blacks in an industry by 1 percent is associated with approximately 14 basis points increase in leverage. The impact of the VRA within heavily minority industries on leverage is also robust (slightly larger in magnitude, in fact) to the inclusion of state-year fixed effects, which allows us to account for unobserved state-specific shocks that may affect firm leverage (Column (2)). The results are even stronger when including controls for within-industry race-specific education averages and state population (with state and year fixed effects). These results are presented in Column (3) and indicate an 180-basis point increase in leverage for the minority-heavy industries. Collectively, these results give us confidence giving us confidence that firms are indeed changing their corporate policy after the VRA, and thhat the results are not being driven by time-varying state characteristics that may affect firms debt-taking differently.

We also explore sources of heterogeneity in the effects of the civil rights regulation on financial leverage. First, we explore how firm leverage may respond differentially to legal changes depending on levels of latent racial hostility within the workfoce, which would tend to increase the flow cost of black worker hires. To this end, we exploit variation in racial lynch-mob violence across the South (i.e., the practice of killing primarily blacks by hanging). Tolnay and Beck describe the use of lynching in the South as a method of social control by whites.[15] Political historians similarly suggest a prominent role for lynching for both voter intimidation and labor coercion (Kousser, 1974). Moreover, both historical and recent econometric research suggesting that economic competition between white and black labor throughout the pre-civil rights era (Christian, 2015).

Given this evidence, we take the historical presence of lynching as a measure of (potentially latent) pressure on blacks not to vote. The presence of racial threat (as proxied by lynching) curtails mobilization resulting from civil rights laws such as the Voting Rights Act and Title VII. This in turn leads to weaker operationalization of political and economic rights, resulting in weaker effects on wages. Consequently, we should observe weaker effects on corporate leverage in areas where racial hostility is high.

Turning to Table 6, this is indeed what we observe. As in our main results, the coefficient on $VRA \times ShareBlack$ is positive and significant, indicating that civil rights laws affecting black wages have a strong effect on firm balance sheets. However, our primary coefficient of interest in this regression is $Lynch \times VRA \times ShareBlack$, which suggests in Column (1) that 1 additional lynching now reduces this effect by 2.9 basis points. The results in general hold with and without firm-level controls that may affect leverage.

[15] And importantly, lynchings were not crime control.

We also exploit heterogeneity in minority activism that may increase civil rights legislation's effect on black wages. Presumably, this would have the opposite on firms as racial hostility. In particular, places that were more politically active in the civil rights movement may be relatively more affected by laws such as the VRA and Title VII, given that both of these laws require private action to achieve economic effects (or perhaps even activism). For example, protests may exert pressure on government, thus to the operationalization of civil rights. Hence, upward wage pressure will be higher when protests are higher. As a result, corporate leverage will be increased more.

The results indicate that areas that are relatively more "activated" by civil rights laws indeed observe differentially greater levels of firm debt, consistent with our main results. In Table **??**, Column (1), the primary variable is now $Protests \times VRA \times ShareBlack$. The results indicate that areas with civil rights political activism (i.e., civil rights protest events) produce an additional positive effect on top of the VRA in black-heavy industry– an additional protest increases this effect by 5.5 basis points. These results hold when accounting for firm-specific traits as well as state-year fixed effects (Columns (2) and (3)).

Effects on Profitability

A reasonable alternative channel for us to consider is whether the VRA affects corporate structure through its effects on firm profitability unrelated the labor market. If so, we would expect to see profitability itself change. We provide evidence that this is not the case by examining its effect on three variables- net margin, EBITDA margin, and return on assets. The net margin, defined as net income over revenue, is a measure of profitability for each dollar earned. Ebitda margin is an equivalent measure excepts that it adds back to net income interest and taxes paid as well as depreciation and amortization. By adding back interest and taxes Ebitda margin measures the profitability that is translated to multiple stakeholders and not only shareholders. The importance of these measures is that they can point out changes in operational efficiency of the firm. Returns on assets, net income divided by total assets, on the other hand, allows to measure efficiency changes in the assets being managed. Changes in return on assets might be associated with capital-skill complementarity and decrease if lower skilled workers are being hired.

Table 7 provides results from the baseline specification, where each of the above measures is the outcome variable, instead of corporate leverage. The results in Columns (1)-(3) confirm that there are virtually no effects of the VRA in highly-affected industries on firm profitability. We interpret these results as increasing our confidence in the proposition labor market regulation affects leverage.

Interaction with Other Financial Channels

Financial Flexibility and Earnings Retention Policy

As we have stressed and is documented by Graham and Harvey (2002), preserving financial flexibility is an important concern to CFOs. As the firm becomes riskier, a higher capital structure may limit access to external funds both in the form of equity and debt. We can test whether the firm is indeed perceived as riskier by looking at the cost of debt to the firm. We use the interest expense to total debt ratio, as our measure for interest rate expense. A higher interest expense to total debt ratio indicates that bondholders are charging higher interest rates and might be regarding the firm as riskier. In column (5) of table 7, we can observe that after passage of anti-discrimination regulation, firms with more black workers are perceived as riskier, paying around 1.7 more basis points per black worker percentage.

Do firms exert efforts to retain financial flexibility while still internalizing the labor market reaction to debt i.e. meeting the equilibrium debt condition? Recall from Figure 2.10 that from a wage perspective, an increase in debt is equivalent to a reduction in equity, i.e. financial leverage, the ratio of debt to equity, increases. DeAngelo and DeAngelo (2007) makes the case that firms may pay substantial dividends to limit internal funds for insiders while maintaining financial flexibility. Their argument is about controlling agency costs but carries through to employment. If access to funds is threaten by increases in debt ratio, firms may want to adjust through other margins. Instead of increasing financial leverage, firms may resort to change their dividend payout policy.

The dividend payout is defined as dividends divided by net income. It is a measure of the proportion of money being paid out to shareholder in contrast with how much is reinvested. A higher dividend payout ratio indicates the firm is maximizing dividend payment, consistent with our model. Recent work has shown that the dividend payout policy does internalize labor market conditions. In a recent paper, for example, Pezone (2017) argues that dividend payout policies are affected by labor market conditions and unemployment risk. In column (4) of Table 7, we see a similar effect.

Leverage and Short-Term Liquidity

A naive interpretation of our results is that increases in debt come not as a result of optimal firm policy but as a result of the firm being financially constrained. After an increase in the cost of labor, the story goes, firms lack the working capital needed to keep operations ongoing and as a result must borrow. While, this direct effect interpretation is *prima facie* reasonable, it fails to account for the fact that financially constrained firms have less access to borrowing to begin with. Therefore, if firms are simply responding optimally to their optimization program, firms whose financial constraint is slack should be borrowing more. And if firms are simply responding to cash shortfalls, financially constrained firms should be borrowing the most, instead. This juxtaposition of effects lends itself for a simple test.

We can measure the firms' ability to meet its short term obligations by the *current ratio*, which is to say, the ratio of assets that are due within one year to the liabilities that are also

due within one year. A high current ratio means that the firms' financial constraint is slack, while a low current ratio means the opposite, that firms may have trouble meeting their obligations. The current ratio is widely used in practice and is the most general liquidity ratio.

Both current assets and current liabilities are available in Compustat. We compute the current ratio for each firm as:

$$CR = \log(CurrentAssets) - \log(CurrentLiabilities)$$

To run our test we do the following. First, we sort firms by current ratio and run regression (2.18) for the lowest and highest current ratio quartiles. The results are in Table 11. We see that most of the responsiveness of leverage to black workforce concentration comes from high current ratio firms in over a 4-to-1 margin.

Interaction with Other Labor Market Channels

Leverage and Complementarity between Skill and Capital

One line of thought argues that the differences in employment between minority and majority workers are due to differences in skill composition. If white workers are more skilled than their black counterparts, increasing the cost of hiring white workers through anti-discrimination laws would lead to substituting white workers with capital, not with black workers. Thus, if firms are optimizing with respect to differences in productivity, industries with high elasticities of substitution between skill and capital would increase leverage to increase investment. In contrast, if firms are increasing leverage because of changes in the labor market, and not with the purpose of financing investment, industries with low capital-skill complementarities, those that are less able to mitigate the cost of labor regulations, should increase leverage the most. We proceed to test these hypotheses.

We follow the literature on complementarity between skilled and unskilled workers and assume the production function exhibits constant elasticity of substitution. In particular the functional form we adopt for this analysis is:

$$Y = A[aN^{\sigma} + (1-a)S^{1-\sigma}]^{\frac{1}{\sigma}}$$

where Y represents output, and skilled, S, and non-skilled labor, N, are the two factors of production. From this functional form it follows that a higher σ indicates greater substitutability while complementarity is suggested by lower values of σ. To examine capital-skill complementarity we can extend this production function to include a third input: capital (K). We do so by adopting a two level CES function. In particular, we use:

$$Y = A[aQ^{\rho} + (1-a)N^{1-\rho}]^{\frac{1}{\rho}}$$

$$Q = [bK^{\theta} + (1-b)S^{1-\theta}]^{\frac{1}{\theta}}$$

Under this specification, there is capital-skill complementarity if and only if $\rho > \theta$.

The intensity of use of skilled versus unskilled labor can be obtained from CPS. Using measures of schooling we classify individuals with 12 or fewer years of schooling as unskilled workers, and those with 16 or more years as skilled. We map the use of skilled and unskilled workers by industry and year to the broader US Commerce Department industry classification. This allows us to overcome insufficient data problem. We merge this classification to Compustat and use sales as our measure of output and total assets as our measure of capital. We follow the same approach using routine versus cognitive non-routine tasks instead of intensity of skill measured by education. In doing this we use the Dictionary of Occupational Titles (DOT) by occupation following Autor et al. (2003).

As we can observe in Table 10, the relative change in leverage for industries with high share of minority workers is positive for both, industries with high and low capital-skill complementarity. But is even higher in industries with low capital-skill complementarity which is consistent with a labor-driven theory of corporate debt.

Leverage and the Job Finding Probability

We have seen that corporate debt is responsive to changes in labor policy. Unfortunately, focusing on the average treatment effects misses all the heterogeneity in the response of corporate debt to wages. In the wage-leverage relationship we saw that the response of wages to changes in debt depends on the prevailing labor market conditions during the business cycle- a point we have been emphasizing constantly. More precisely, when the job finding probability is low, increasing debt requires compensating workers for the higher levels of distress risk in the form of a higher wage. When the job finding probability is high the opposite happens, equilibrium wages go down after increases in debt. If the threshold point at which the job finding probability passes from too low to too high changes across firms we should expect to see heterogeneous responses to changes in labor policy.

To assess the amplifying or mitigating effects of the job finding probability we proxy for the job-finding probability at the industry level using aggregate level job finding probabilities from CPS and cross-industry estimates from Hall (2005a). Time series estimates of the job finding probability at an industry level are unavailable during our time period.[16] However, the ordering of industries by job finding probability changes little over time. Thus, we proxy for the job finding probability at the industry level by using the product of the global job-finding probability time series and the cross-industry estimates of the job finding probability. This is, our job finding probability measure is:

$$JFR_{it}^{proxy} = JFR_i \times JFR_t$$

We then create a dummy indicating whether the JFR^{proxy} is above or below median and proceed to estimate:

[16]Estimates of the job finding probability at an industry level can be constructed after 1994. We will use these in our out-of-sample tests in the next section to show that changes in the job finding probability predict changes in leverage.

$$Lev_{ist} = \alpha + \beta_1 VRA_{st}\mathbb{1}^{+}_{med} + \beta_2 VRA_{st}\mathbb{1}^{-}_{med}$$
$$+\beta_3 VRA \times ShareBlack_{st}\mathbb{1}^{+}_{med} + \beta_4 VRA \times ShareBlack_{st}\mathbb{1}^{-}_{med} + X'_{ist}\gamma + \eta_i + \xi_t + \epsilon_{ist} \quad (2.20)$$

where $\mathbb{1}^{+}_{med} = \mathbb{1}(JFR^{proxy}_{it} \geq median_{JFR})$ and $\mathbb{1}^{-}_{med} = \mathbb{1}(JFR^{proxy}_{it} < median_{JFR})$ are sets of dummies indicating whether the job finding probability is above or below median, respectively. The results are presented in Table 10. During periods with high job finding probability firms increase debt by more than 30 basis points per percent share of black labor force. In contrast, during periods of low job finding probability the increase in debt per percent share of black labor force is around 20 basis points.

Now that we know firm debt is responsive to changes in labor market policies and labor market conditions, and that we have singled out the interaction between leverage and the job finding probability as a culprit behind unemployment fluctuations, we proceed to evaluate two sine qua non relationships in our argument. In the following section we evaluate whether changes in the job finding probability Granger cause changes in firm debt; in other words we seek the answer to the question: "Do changes in the job finding probability predict changes in leverage?" This we will do with a view to answering whether, during downturns, leverage predicts lower employment growth- hence contributing to unemployment risk.

2.5 Out of Sample Co-movement of the Job Finding Probability and Financial Leverage

How predictive are labor market conditions of movement in leverage? To this point, we have emphasized the role that the job-finding probability plays in determining how labor market conditions translate into changes in firm debt. In Section 5, we demonstrate lower job finding probabilities translate to relative decreases in leverage following the passage of labor regulation. A natural question to ask, though, is if the relationship between the job finding probability and leverage universally predictive? In other words, do labor market conditions have predictive value out of sample? Moreover, does employment-leverage co-movement hold in the aggregate? In this subsection we use "Flow of Funds" data produced by the Federal Reserve Bank of St. Louis to test the co-movement of the job-finding probability and changes in financial leverage at the firm and aggregate level.

Firm Level Co-movement

Equation [2.11] states that changes in the job finding probability should explain changes in debt-equity ratio. We also want to make sure the explanatory power of the job finding probability survives the inclusion of controls shown to explain variation in capital structure.

In that regard, we follow Lemmon, Roberts & Zender (2008) and include as controls: size, market-to-book ratio, tangibility, profitability and an indicator for dividend paying firms.

We compute the job-finding probability by industry-year based on data from the CPS, following Shimer (2012). Assume the arrival rate of job offers follows a Poisson process with rate $f_t \equiv -log(1 - F_t)$, we construct the job finding probability measure, F_t, as:

$$F_t = 1 - \frac{u_t - u_t^s}{u_{t-1}}$$

where u_t is the unemployment rate at time t, and u_t^s is the short term unemployment rate at time t (workers unemployed for less than one period). In the CPS, unemployed workers are asked how long they have been unemployed. We take as our measure of short-term unemployment the number of workers unemployed for four weeks or less.

Our results are shown in table 11. A 1% increase in the job finding probability is associated with around 5 to 6 basis points change in leverage in the next quarter. The results are robust to the inclusion of several firm-level controls such as size, market-to-book ratio, tangibility, profitability and an indicator for dividend paying firms and different fixed effects (industry, firm, year). Moreover, the inclusion of the job finding probability as a factor has little effect on the magnitude of other controls, suggesting that the variation captured is largely orthogonal to those.

Aggregate Level Co-movement

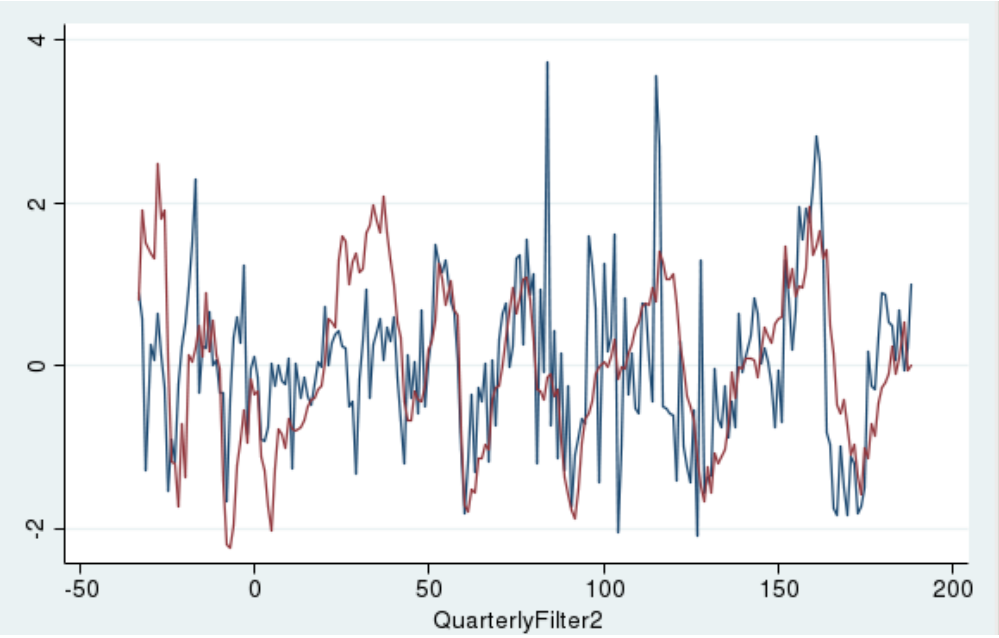
If financial leverage is useful in explaining features of the labor market in aggregate, we would the core relationship shown above to hold at the aggregate level. To show this is in fact the case, we present evidence on the relationship between the job finding probability and changes in debt holds at the national level. We compute the job-finding probability series from CPS. The debt flow series comes from flow of funds data. We apply an hp filter of 10,000 to detrend the data. The remaining series exhibit a correlation of .212 which is over 50% the size of the correlation between productivity and the job-finding probability, unemployment, or vacancies. In figure [2.9] we adjust the series by their standard deviation.

2.6 Who Suffers the Burden of Unemployment Risk?

One of the core takeaways from the theoretical analysis above is that leverage is an important conduit for unemployment risk. When discussing the role of financial leverage on unemployment risk it helps to see what the firm's employment response is following periods of high unemployment. As we have mentioned, Giroud & Mueller (2016) have shown that following consumer demand shocks, counties exhibited more layoffs where prevalence of highly leverage firms was high. We should expect that response to be generalizable to business cycle fluctuations and be salient after changes in unemployment rates. We follow

Figure 2.9: Aggregate Co-movement of Job-Finding Probability and Debt Flow

Source: Job-Finding probability series constructed from CPS. Debt Flow series from Flow of Funds data. Both adjusted by their standard deviation.



an approach similar to Hoynes et al (2012) and run regressions of the form:

$$\%\Delta employees_{ist} = \alpha + \beta_1 Lev_{it} + \beta_2 UR_{st} + \beta_3 UR_{st} \times Lev_{it} + \eta_i + \xi_t + \epsilon_{ist} \tag{2.21}$$

and

$$\begin{aligned} \%\Delta employees_{ist} = \alpha + \beta_1 Lev_{it} + \beta_2 UR_{st} + \beta_3 BlackUR_{st} + \beta_4 WhiteUR_{st} \\ +\beta_5 UR_{st} \times Lev_{it} + \beta_6 BlackUR_{st} \times Lev_{it} + \beta_7 WhiteUR_{st} \times Lev_{it} + \eta_i + \xi_t + \epsilon_{ist} \end{aligned} \tag{2.22}$$

where UR_{st} is the total unemployment rate by year and state, $BlackUR_{st}$ is the black unemployment rate, and $WhiteUR_{st}$ is the white unemployment rate, all of them computed by year and state; Lev_{it} is the financial leverage of each firm at each year; η_i denote firm fixed effects; and ξ_t denote time fixed effects. Unemployment rates by race, state and year are retrieved from the Current Population Survey (CPS).

This estimation strategy speaks to the sensitivity of employment growth to leverage over the business cycle. The first regression equation captures the firm's employment response following changes in unemployment and the extent to which financial leverage amplifies or mitigates that response. The second regression equation decomposes that response by race.

Table 12 shows our results. In Panel A, we can see that, following increases (decreases) in unemployment, firm level employment growth decreases (increases) more in firm with high leverage which is consistent with our discussion of the wage-leverage relationship and captures the unemployment risk associated with high levels of leverage. What is more interesting is that most of the correlation of unemployment with employment growth stems from its connection with financial leverage. This effects subsist after applying varying levels of fixed effects. In Panel B, we decompose this effects by black and white unemployment. The interpretation of this is: "when black or white unemployment is high, are firms and firm employment recovering or worsening?" As before, the interaction of unemployment and financial leverage has a high negative correlation with employment growth. A key difference, though, is that this correlation is not the same for black and white unemployment. The correlation between the interaction of black unemployment and leverage, and employment growth is close to zero, whereas the correlation between the interaction of white unemployment and leverage, and employment growth largely offsets the beta form Leverage $\times$ Unemployment. This is partly driven by firms with high black share of its labor force having more leverage. It also suggests that when white unemployment is high, firms are already on its way to recovering.

2.7 Discussion

To summarize briefly, our conceptual framework highlights several connections between labor and financial markets. This is an important contribution given that these findings of these two fields are not often considered in a unified manner. This paper suggests a link between the two. Our main empirical findings can be summarized as: (1) corporate debt responds to exogenous changes in the price of labor (Tables 4-9), (2) these leverage responses hold at both the micro level as well as in aggregate (Tables 10-11), and are heterogeneous across the business cycle, and (3) these policy-induced shifts in firm leverage increase unemployment risk and can lead to the redistribution of labor income (across groups) (Table 12). We now briefly discuss four main implications that can inform future research.

I. Wage Growth and Increase in Debt. Our results that wage growth in the economy affects firm balance sheets. This findingboth the context and the substantive result– implicates long-run trends in corporate debt. Our results show that the substantial changes to the wage structure from 1950-1970 is linked to the tripling of firm debt during that period. Annual earnings increased from $21 to $39 thousand, and a back of the envelop calculation suggests that approximately 60increases in workers' compensation.

While analyze the within-firm variation, however, this has significant downstream consequences (some of which we highlight below). Because workers in part determine debt, they also affect incentives to default. As such, fluctuations in the value of a worker may in turn increase distress costs and risk. This highlights a connection between firms balance sheets and aggregate employment. This connection also may have implications for understanding

the declining share of labor in GDP (an empirical regularity across many countries). For example, to the extent reduced labor costs decrease distress risks, reduced leverage can help explain the cyclicality of the labor force. For example, Schoefer (2015) documents how manufacturing industries, which demonstrated the largest decrease in the labor share of income, exhibited the largest declines in employment cyclicality.

II. The Job Finding Probability and Cyclicality of Debt. As documented in section 2.5, debt is highly responsive to changes in the job finding probability. The responsiveness of debt to changes in the job finding probability works as an amplifying effects to shocks in the economy. The heterogeneous role of the job-finding probability has important implications for understanding the role of financial leverage as a risk propagation mechanism within the business cycle. When the job-finding rate is high, debt issuance by firms will reduce pay but also reduce unemployment. On the other hand, when the job-finding rate is low, high leverage will drive workers to demand higher compensation leading to increases in unemployment. Although related, this mechanism is different from the fact that during economic downturns firms are more likely to fail. This nuance has implications for how and what labor policies are targeted during recessions. Thus, similar to what Giroud and Mueller (2016) suggest, firm-specific safety net policies may make sense during periods of high unemploymentfor example, policy should perhaps target firms concentrated in heavily leveraged industries. This targeting, our mechanism suggest, should be sensitive to the state of the business cycle.

III. Corporate Debt-Driven Distributional Effects of Unemployment Risk. The leverage-employment relationship also bears on broader questions about labor market inequality. Leveraged-related distress costs are borne disproportionately by the intended beneficiaries of redistributive policies. Protective labor laws that increase wages can also potentially increase corporate debt, which increases unemployment risk for targeted workersthus highlighting how capital structure can potentially stifle income redistribution. This highlights an unanticipated Catch-22 that minority workers face with respect to progressive labor policy: wage and employment benefits come at the expense of greater within-firm employment uncertainty. This trade-off potentially applies in a wide array of settings: workers may the beneficiaries of targeted labor legislation, but still end up facing greater unemployment risk if firms respond by increasing debt. This can perversely lead workers to face a lower value of their employment claim, an important implication of the wage-debt relationship.

Policymakers should thus consider how increasing the take-home pay of certain workers may ultimately reduce long-run earnings by increasing unemployment risk. This policy trade-off implicates a myriad of targeted labor market regulations being evaluated by labor economists to today. These include anti-discrimination protections (Chay 1998), minimum wages (Dube et al., 2013), wrongful- discharge laws (Autor et al., 2006). Discussions about targeted laws governing the labor marketand particular those laws that aim to improve the economic status of specific marginalized groupsshould consider firm responses in their designs. Our findings suggest that when determining the burden of legislation on workers, one

should consider whether increased bankruptcy costs of firm debt mean that the redistributive benefits of active labor market interventions are partially offset by firm debt response.

IV. Trends in Minority Labor Market Performance: A related empirical policy implication of note based on our analysis is the influence of corporate policy over patterns of labor market inequality. As we show in Section 7, the burden of unemployment risk that is linked to corporate debt is not shared equally between whites and blacksduring periods of high unemployment, heavily-leveraged firms respond by employing more white workers, but not more black workers. This finding ties our work to generations-old debate about what factors have influenced black-white disparities in employment over the past century. Compared to whites, Blacks labor-force participation rate have been persistently lower and their unemployment rate persistently higher since the 1970s (after civil rights laws were passed).

While academic research to this point emphasizes both demand- and supply-based explanations for racial employment disparities,[17] our findings suggest that policy makers should also consider the role of firm debt. In terms of policy, our findings again underscore the previous policy point that policymakers should consider the firm responses ex ante in the design of remedial labor laws that target wages. The general relationship between labor protections and corporate leverage by extension means that certain blacks have borne the increased burden of unemployment risk in recent decades. The reemergence of labor market disparities with respect to income (for example, see Bayer and Charles, 2017) has led to renewed discussions about labor market policies that eliminate labor market disparities. Given the possibility for firms to transmit any demand-side regulations into unemployment risk, policymakers should incorporate these costs to black workers when considering the benefits of anti-discrimination vis- -vis, for example, interventions that focus on the supply-side (for example, increasing presence of racial minorities in STEM fields).

2.8 Conclusion

We set out to study the response of capital structure to changes in labor policy during this period for several reasons. First, as documented by Graham et al. (2015), most of the changes capital structure during the 20th century occurred during this period. While there is no shortage of studies documenting effects associated with recessions and financial panics and their underlying causes, there is less work targeted towards regime shifts that at first glance cause few direct observable changes to the economy. The changes that happened during the second half of the 20th century may have carried dormant risks in the form of increased levels of financial leverage that are important to understand for today's economy. Second,

[17]Supply-based explanations include rising employer demand for skills and declining industrialization/unionismboth of which account only part for the deterioration in employment rates and earnings observed among young Blacks (Holzer 1999). Other factors include residual labor-market discrimination as well as spatial factors (Miller, 2016).

understanding the dynamic between capital structure and the labor markets has important consequences for the differential employment conditions between blacks and whites. These conditions exhibit cyclical behavior akin to that of unemployment fluctuations.

Our work makes a few concrete contributions. First, it connects the role of financial distress with labor markets. Second, it provides a novel yet simple mechanism for explaining different phenomena in the labor markets: low wage volatility, high unemployment fluctuations. Third, we contribute to the corporate finance literature by characterizing the influence of the job finding probability on the firm choice of capital structure and showing how the corporate capital structure and other firm financial policies has been shaped by significant social changes in the 20th century. And lastly, by virtue of our setting, this paper contributes to the literature on the long lasting effects of the Civil Rights Movement regulation in the macro-economy; specifically, while previous work on anti-discrimination laws have focused exclusively on worker outcomes, we examine how firms respond to such laws, and argue that firm responses can also affect minority outcomes.

Figure 2.10: Equity-Debt Substitution and Risk

This figure illustrates the value of the Equity, Debt and Employment claims as risk-taking changes. The value of equity increases with higher risk taking, while the value of debt and employment decreases as risk increases.

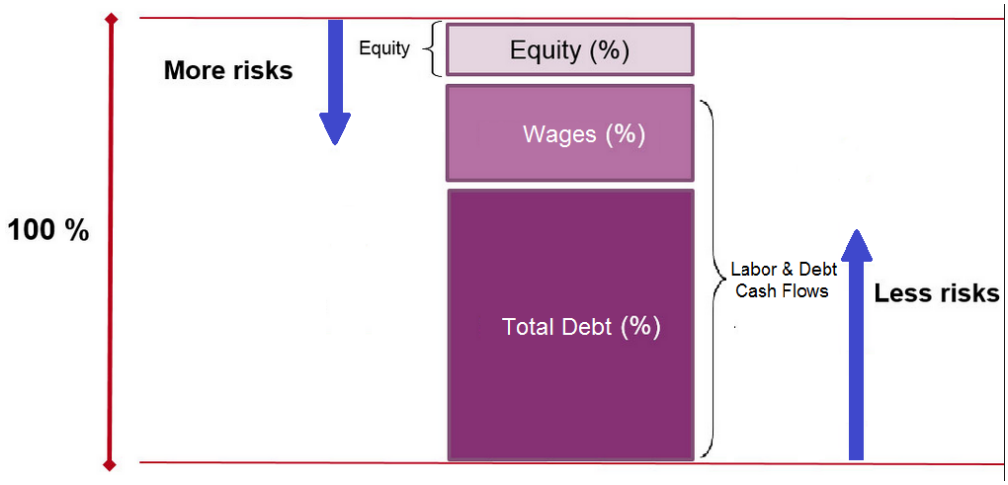
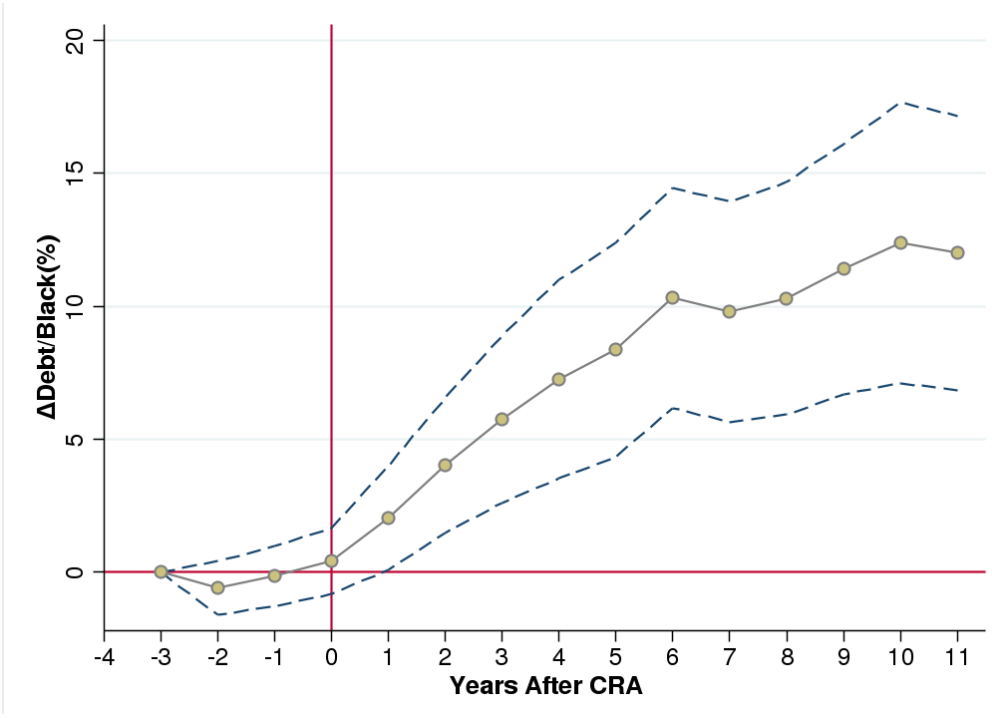


Figure 2.11: Effects of Civil Rights Act on Debt and Leverage

The figure plots the impact of the Voting Rights Act on Corporate Leverage per proportion of black workers. The lines represent a 95% confidence interval when clustering at the state-level. We consider a 10 year window spanning 5 years before the passage of the VRA to 5 years after its passage.



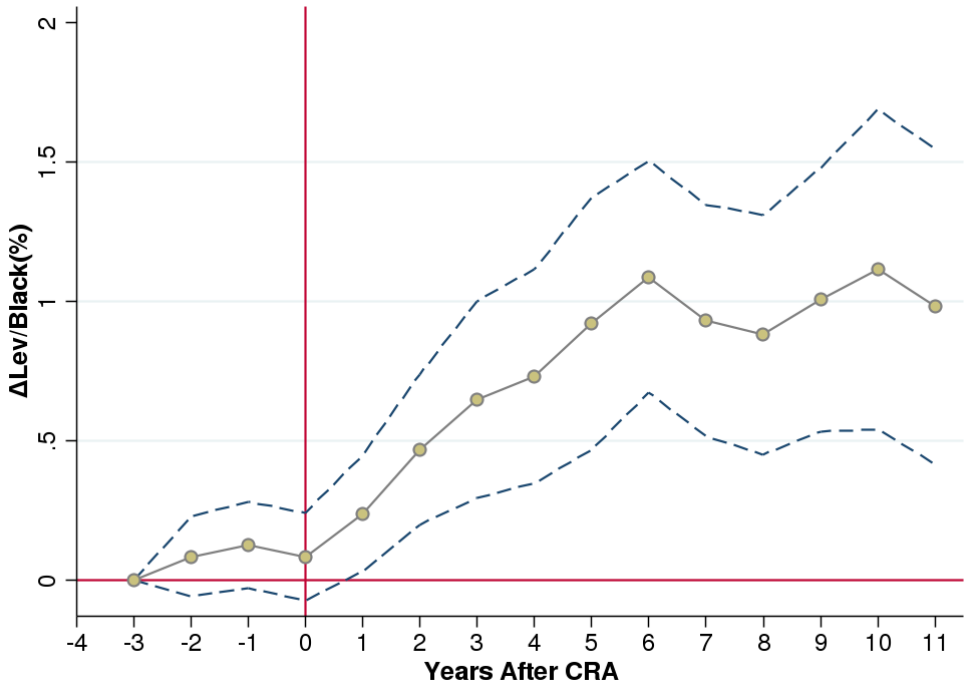
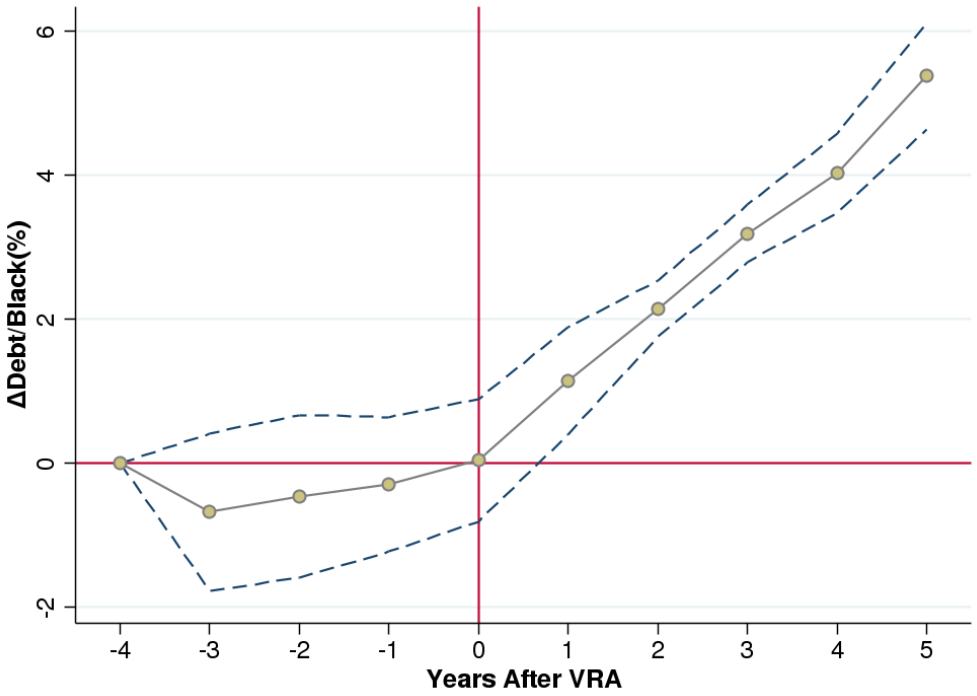


Figure 2.12: Effects of Voting Rights Act on Debt and Leverage

The figure plots the impact of the Voting Rights Act on Corporate Leverage per proportion of black workers. The lines represent a 95% confidence interval when clustering at the state-level. We consider a 10 year window spanning 5 years before the passage of the VRA to 5 years after its passage.



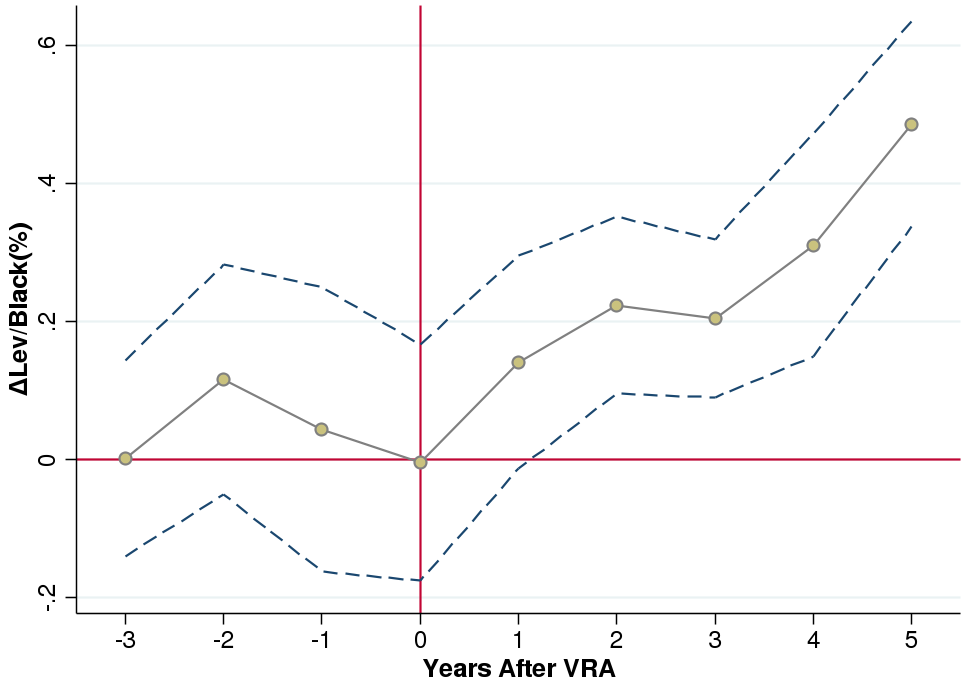


Figure 2.13: Effects on Texas and Arizona

The figure plots the impact of the Voting Rights Act on Corporate Leverage per proportion of black workers on Texas and Arizona. Since the limits to voting restrictions did not come into play in these states until after 1972, the effect in 1966 should be weak, while the effect on 1973 should be stronger.

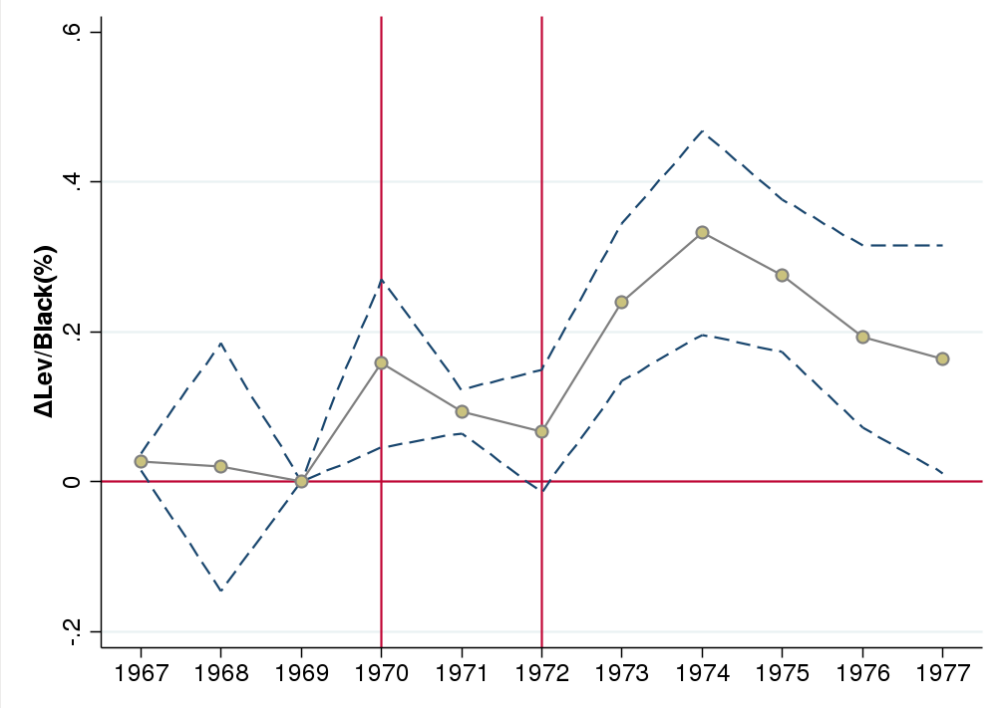


Table 1: Sample Statistics

Panel A: Worker Traits

	(1) VRA			(2) Non VRA		
	Observations	Mean	Std Dev	Observations	Mean	Std Dev
Education	179068	12.88	3.29	1017339	13.16	3.05
Potential Experience	179068	22.06	12.31	1017339	22.38	12.28
Wage and salary income	179068	34683.88	38148.86	1017339	34293.02	39328.51
Observations	179068			1017339		

Panel B: Financial Variables

	VRA					Non VRA				
	Mean	SD	25th	Median	75th	Mean	SD	25th	Median	75th
Book Leverage	0.55	0.19	0.42	0.55	0.67	0.54	0.19	0.41	0.54	0.66
Market Leverage	0.51	0.25	0.32	0.51	0.71	0.52	0.24	0.32	0.53	0.71
Market-to-Book	1.55	1.57	0.60	1.03	1.94	1.50	1.57	0.58	0.97	1.78
ROA	0.05	0.15	0.03	0.06	0.09	0.04	0.14	0.02	0.05	0.08
Log Sales	4.68	2.06	3.50	4.65	5.91	4.54	2.08	3.08	4.49	5.90
Fixed Assets(%)	0.64	0.35	0.38	0.63	0.94	0.57	0.32	0.34	0.55	0.78
Cash/Short Term Investments	59.59	330.07	1.37	5.24	18.59	39.66	183.77	1.00	4.03	18.08
Total Assets	794.68	3751.16	29.03	81.75	297.26	569.11	2062.38	19.11	68.27	269.5
Firms	260					1323				
Firm-Years	2341					12074				

NOTES: Sample statistics for states subject or not subject to section 5 of the Voting Rights Act. Panel A provides descriptive statistics obtained from the Current Population Survey (CPS). Traits include education levels, potential experience, and wages. Panel B provides descriptive statistics for firms retrieved from Compustat. Book leverage is debt (long term and short term debt) over debt + equity. Market leverage is debt over debt+ market value (market price times shares outstanding). Market to book is market value over total assets less longterm debt plus deferred taxes and investment tax credits. Total assets is in millions ($). Return on assets (ROA) is net income over total assets. Fixed assets is property, plant and equipment scaled by total assets. The unit of observation is firm-year.

Table 2: Voting Rights Act on Wages

Panel A: Effect on Wages

	(1) Wage Residual	(2) Education	(3) Wage	(4) Income
VRA	.1324***	1.8736***	.3027***	.2829***
	(.0258)	(.2381)	(.0383)	(.0354)
White x VRA	-.1371***	-2.0719***	-.2496***	-.2486***
	(.0262)	(.1001)	(.0227)	(.0207)
N	1009252	1009252	1009252	1009252
R^2	.0109	.0902	.5118	.5040

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Comparison of Effects: Border Sample v. Full Sample

Source: Avenancio-Leon & Aneja (2017)

	(1) Interior Counties	(2) Border Counties	(3) Difference
White x VRA	-.075***	-.09***	-.011
	(.01)	(.029)	(.008)
N	3770000	670000	670000
R^2	.034	.01	.01

All regressions control for individual education, years worked, and squared(years worked).
All regressions include year and county-race fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, and human capital measures. Data comes from CPS. Column (1) presents the estimates on wages after controlling for Mincerian traits. Column (2) reports estimates on education. Column (3) reports effects on wages. Column (4) reports effects on income. All columns use state and year fixed effects. Errors clustered at the state level.

Table 3: Voting Rights Act on Firm Level Employment Growth

	(1)	(2)	(3)	(4)
VRA × Proportion Black	.1208*	.1356*	.0664	.0811
	(.0666)	(.0740)	(.1174)	(.1173)
VRA	-.0158*		-.0238	
	(.0085)		(.0162)	
N	13728	13728	13728	13728
Firm FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	Yes
Industry-Year FX	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Column (1) presents the estimates controlling for total firm employment. Column (2) controls for firm employment and size. Columns (1) & (2) control for state and year fixed effects. Columns (3) & (4) control for state × year fixed effects. Columns (1)-(3) include firm fixed effects. Errors clustered at the industry level.

Table 4: Voting Rights Act on Corporate Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VRA x Proportion Black	.2910***	.3105***	.2851***	.3017***	.1265	.3037***	.3087*
	(.0700)	(.0672)	(.0220)	(.0200)	(.0789)	(.1068)	(.1586)
VRA	-.0531***	-.0574***				-.0539***	
	(.0080)	(.0087)				(.0094)	
Employment		.0002		.0003			-.0001
		(.0004)		(.0005)			(.0005)
Total Assets		.0000***		.0000***			.0000**
		(.0000)		(.0000)			(.0000)
N	14295	14295	14145	14145	13828	14295	13828
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	No	Yes	Yes	Yes	No	Yes
Industry-Year FX	No	No	No	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	No	Yes
Trends	No	No	No	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Errors clustered at the state level.

Table 5: Comparison of CRA and VRA on Corporate Leverage

	(1)	(2)	(3)	(4)
VRA x Proportion Black	.1420**	.1759	.1305***	
	(.0619)	(.1410)	(.0083)	
CRA x Proportion Black				.3710***
				(.1326)
VRA	-.0326***	-.0554*	-.0054	
	(.0060)	(.0282)	(.0209)	
CRA				-.0397
				(.0248)
Firm Employment	-.0000	-.0001	.0005*	-.0001
	(.0003)	(.0003)	(.0003)	(.0003)
Total Assets	.0000***	.0000***	.0000***	.0000***
	(.0000)	(.0000)	(.0000)	(.0000)
N	14417	13060	3281	12331

Standard errors in parentheses
Errors clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act and the Civil Rights Act Title VII, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. All columns control for firm employment, size, and year and firm fixed effects. Errors clustered at the state level.

Table 6: Voting Rights Act on Corporate Leverage

	(1)	(2)	(3)	(4)	(5)
Prot × VRA × Prop Black	.0055***	.0037**	.0028		
	(.0014)	(.0016)	(.0018)		
Lynch × VRA × Prop Black				-.0029***	-.0024***
				(.0001)	(.0002)
VRA × Proportion Black	.3113**	.3030***	.2011**	.9469***	.7265***
	(.1256)	(.1114)	(.0994)	(.0350)	(.0453)
VRA	-.0926	-.1369*	.0000	.0866***	.1680***
	(.0696)	(.0734)	(.)	(.0207)	(.0319)
Protests	.0003	.0005	.0014***		
	(.0003)	(.0004)	(.0000)		
Protests × Prop Black	.0111	.0228	.0338***		
	(.0208)	(.0241)	(.0022)		
Protests × VRA	-.0018	-.0024	.0047***		
	(.0016)	(.0018)	(.0001)		
Lynchings × VRA				-.0004***	-.0006***
				(.0001)	(.0001)
Lynchings × Prop Black				.0000	.0000
				(.)	(.)
Firm Employment		-.0001			.0004
		(.0003)			(.0004)
Total Assets		.0000***			.0000***
		(.0000)			(.0000)
N	12259	11354	12259	3217	2958

Standard errors in parentheses
Errors clustered at the state level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, the number of lynchings predating the passage of VRA and corporate leverage. All firm level measures come from Compustat. Black employment by industry comes from CPS. All column controls for firm employment, and state, year and firm fixed effects. Errors clustered at the state level.

Table 7: Effects of Voting Rights Act on Firm Level Measures

Panel A: Profitability

	(1) ROA	(2) ROA	(3) Net Earnings(%)	(4) Net Earnings(%)	(5) EBITDA(%)	(6) EBITDA(%)
VRA x Proportion Black	-.0236*	-.0272***	-.1005***	-.1395***	.0309	.0053
	(.0139)	(.0065)	(.0224)	(.0495)	(.0661)	(.0330)
VRA	-.0001		-.0012		-.0114*	
	(.0031)		(.0040)		(.0059)	
N	14275	14126	14271	14122	14219	14070
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	Yes	No	Yes
Controls	No	Yes	No	Yes	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Debt Management

	(1) Interest(%)	(2) Interest(%)	(3) Retained Earnings(%)	(4) Retained Earnings(%)
VRA x Proportion Black	.0424***	.0384***	11.1528***	10.2060**
	(.0050)	(.0026)	(3.7549)	(4.4459)
VRA	-.0056***		-1.6463**	
	(.0009)		(.7646)	
N	13973	13823	14266	14117
Firm FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	Yes
Controls	No	Yes	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, the number of lynchings predating the passage of VRA and profitability measures of the firm. All firm level measures come from Compustat. Black employment by industry comes from CPS. All column controls for firm employment, and state, year and firm fixed effects. Errors clustered at the state level.

Table 8: Voting Rights Act on Corporate Leverage by Capital Skill Complementarity

	(1) High	(2) High	(3) High	(4) Low	(5) Low	(6) Low
VRA x Proportion Black	1.8417***	1.4639***	2.0433***	.2274***	.1584**	.1540
	(.3179)	(.2451)	(.3509)	(.0704)	(.0689)	(.1170)
VRA	-.2003***		-.1957***	-.0462***		-.0467**
	(.0452)		(.0455)	(.0158)		(.0180)
Employment			.0007			-.0004
			(.0006)			(.0004)
Total Assets			.0000***			.0000**
			(.0000)			(.0000)
N	5149	4926	5149	9075	8900	9075
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	No	Yes	No
Controls	No	No	Yes	No	No	Yes
Trends	No	No	Yes	No	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Errors clustered at the state level.

Table 9: Voting Rights Act on Corporate Leverage by Current Ratio

	(1) High	(2) High	(3) High	(4) High	(5) Low	(6) Low	(7) Low	(8) Low
VRA x Proportion Black	5.8000***	5.6646***	7.8091***	5.8022***	-.0421	-.2279*	-.3041	.0428
	(1.4425)	(1.5688)	(.2349)	(1.6140)	(.0919)	(.1325)	(.2041)	(.1125)
VRA	-.3918***	-.3850***		-.3806**	.0507*	.0625**		.0397
	(.1048)	(.1116)		(.1481)	(.0261)	(.0241)		(.0500)
N	1859	1859	1663	577	2795	2795	2552	721
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	No	Yes	No	No	No	Yes	No
Controls	No	Yes	No	No	No	Yes	No	No
Trends	No	Yes	No	No	No	Yes	No	No
Restricted Sample	No	No	No	Yes	No	No	No	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Errors clustered at the state level.

Table 10: Voting Rights Act on Corporate Leverage by Job Finding Probability

	(1)	(2)	(3)	(4)	(5)	(6)
VRA x Black—JFR Low	.1907***	.2148***	.2136***	.1615	.2202**	
	(.0551)	(.0524)	(.0230)	(.1152)	(.0835)	
VRA x Black—JFR High	.3359***	.3523***	.3559***	.3040***		.3112***
	(.0929)	(.0921)	(.0547)	(.1008)		(.1072)
VRA—JFR Low	-.0584***	-.0640***	.0127	-.0614***	-.0674***	
	(.0087)	(.0091)	(.0123)	(.0110)	(.0190)	
VRA—JFR High	-.0459***	-.0500***	.0000	-.0476***		-.0418***
	(.0143)	(.0149)	(.)	(.0159)		(.0119)
N	13306	13306	13133	13306	6790	6391
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	No	Yes	No	No	No
Controls	No	Yes	Yes	Yes	No	No
Trends	No	No	No	Yes	No	No
Restricted Sample	No	No	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Errors clustered at the state level.

Table 11: Predictive Power of Job Finding Probability on Debt Issuance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JFR		.0558***	.0625***	.0554***	.0633***	.0581***	.0745***	.0559***	.0328**
		(8.11)	(8.84)	(4.75)	(8.91)	(4.96)	(8.51)	(7.64)	(2.46)
Profitability	-.3160***		-.3185***	-.3150***	-.3191***	-.3153***	-.1499***	-.3164***	-.1445***
	(-15.28)		(-15.39)	(-15.25)	(-15.40)	(-15.25)	(-5.77)	(-15.15)	(-5.56)
Log(Sales)	-.0068***		-.0072***	-.0068***	-.0074***	-.0070***	-.0204***	-.0094***	-.0211***
	(-7.27)		(-7.74)	(-7.31)	(-7.94)	(-7.48)	(-9.40)	(-8.65)	(-9.69)
Size	.0058***		.0067***	.0058***	.0060***	.0051***	.0242***	.0078***	.0223***
	(6.77)		(7.78)	(6.64)	(6.79)	(5.73)	(10.09)	(7.57)	(8.73)
Market-to-Book	-.0062***		-.0062***	-.0062***	-.0062***	-.0062***	-.0109***	-.0062***	-.0108***
	(-9.94)		(-9.94)	(-9.99)	(-9.99)	(-10.04)	(-12.41)	(-9.97)	(-12.33)
Tangibility	.0327***		.0300***	.0304***	.0285***	.0291***	.0544***	.0370***	.0556***
	(12.73)		(11.53)	(11.70)	(10.93)	(11.13)	(4.92)	(10.23)	(4.96)
Dividend Payer					.0108***	.0098***	.0202***	.0123***	.0182***
					(7.13)	(6.47)	(7.11)	(7.98)	(6.40)
Industry median lev.					-.0065	-.0060			
					(-1.35)	(-1.25)			
N	349532	349532	349532	349532	349532	349532	348825	349532	348825
Adj. R^2	.0062	.0002	.0064	.0081	.0065	.0081	.0244	.0067	.0257
Firm FX	No	No	No	No	No	No	Yes	No	Yes
Year FX	No	No	No	Yes	No	Yes	No	No	Yes
Industry FX	No	No	No	No	No	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports estimates of ordinary least squares regressions relating passage of the Voting Rights Act, the participation rate of black workers, and corporate leverage. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Errors clustered at the state level.

Table 12: Effects of Aggregate Unemployment and Leverage on Firm Level Employment Growth

Panel A: Heterogeneous Effects of Leverage on Firm Employment Growth by Aggregate Unemployment

	(1)	(2)	(3)	(4)
Leverage x Unemployment	-.6738**	-.6668**	-.8623***	-.8358***
	(.2994)	(.3162)	(.2893)	(.3065)
Leverage	-.1837***	-.1862***	-.1918***	-.1954***
	(.0132)	(.0128)	(.0131)	(.0132)
Unemployment Rate	.0304		.0001	
	(.1248)		(.1253)	
Total Assets	.0000	.0000	.0000	.0000
	(.0000)	(.0000)	(.0000)	(.0000)
N	42797	42548	42130	41865
Firm FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	Yes
Industry-Year FX	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Heterogeneous Effects of Leverage on Firm Employment Growth by Aggregate Black & White Unemployment

	(1)	(2)	(3)	(4)	(5)
Leverage x Unemployment	-1.9404*	-1.8986	-1.6414	-1.8455	-2.5562***
	(1.1398)	(1.1663)	(1.2247)	(1.3184)	(.6915)
Leverage x White Unemp	1.2405	1.2149	.7561	1.0215	2.4083***
	(1.1761)	(1.1996)	(1.2410)	(1.3281)	(.7755)
Leverage x Black Unemp	.0745*	.0766**	.0570	.0648	.0585
	(.0394)	(.0361)	(.0450)	(.0452)	(.0425)
Leverage	-.1835***	-.1850***	-.1940***	-.1968***	-.0870***
	(.0142)	(.0136)	(.0141)	(.0140)	(.0058)
Unemployment Rate	-.0732		-.1940		
	(.2505)		(.2262)		
White Unemployment	.1162		.2184		
	(.2416)		(.2399)		
Black Unemployment	-.0012		-.0137		
	(.0209)		(.0178)		
Black Population					.0000
					(.)
Mean Education					.0090***
					(.0024)
Mean Wage					-.0707***
					(.0181)
Mean Education Black					-.0013
					(.0018)
Total Assets	.0000	.0000	.0000	.0000	-.0000
	(.0000)	(.0000)	(.0000)	(.0000)	(.0000)
N	40521	40293	39842	39588	40719
Firm FX	Yes	Yes	Yes	Yes	No
Year FX	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	Yes	No	Yes	Yes
Industry-Year FX	No	No	Yes	Yes	No

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

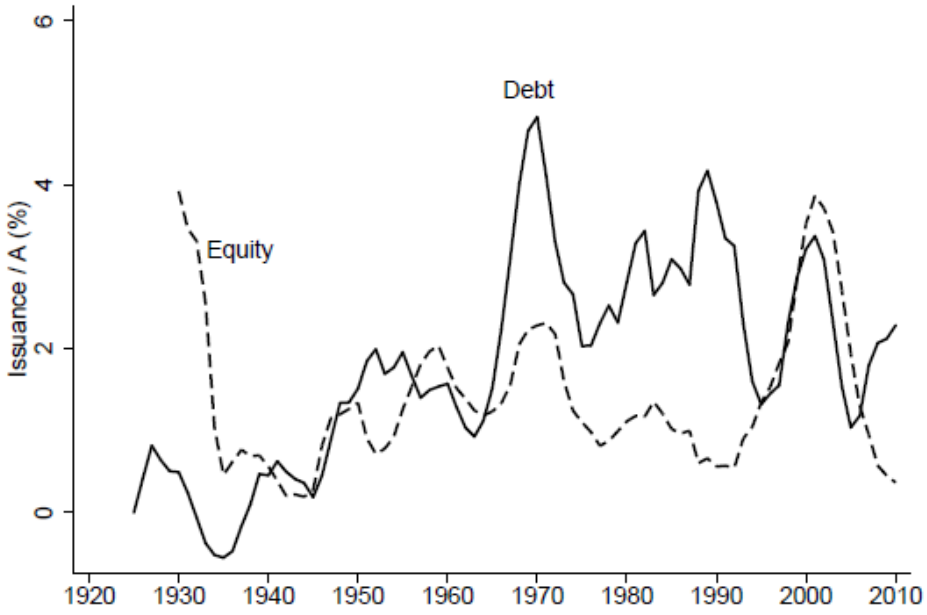
NOTES: This table reports estimates of ordinary least squares regressions relating firm-level employment growth to firm leverage and aggregate unemployment. In Panel A, the unemployment rate is the overall rate at the state level; in Panel B Black and White Unemployment are the group-specific rates, also measured at the state level. Unemployment by industry comes from CPS. Errors clustered at the state level.

Figure 2.14: Monthly Job Finding Rate

Source: Hobijn & Sahin (2007). Job-Finding and Separation Rates in the OECD. Federal Reserve Bank of New York Staff Report.

Figure 2.15: Debt and Equity Issuance (% of Assets)

This figure is borrowed from Graham et al. (2015). Debt issuance exhibits a dramatic increase during the period following the passage of the Civil Rights Act and Voting Rights Act.



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Appendix A

Chapter 1 Appendix

A.1 Spillover of Labor Market Distortions into Credit Markets: Institutional Overview and Conceptual Framework

The Institution of the Carceral State in the U.S.

There has been significant empirical research on the collateral consequences of exposure to the criminal justice system. In economics, much of this work has focused on the employment effects of the criminal justice system. Pager (2003) uses a series of experimental in-person audit studies of entry-level jobs in Milwaukee and New York City, respectively. In these studies, résumés reflecting equivalent schooling and work histories were assigned to pairs of trained testers, with one tester in the pair receiving a criminal record condition; the member of each pair receiving this condition alternated each week. The results from both cities indicate that employers strongly disfavored job seekers with a criminal record (with reductions in callbacks of 30-60 percent).

In another recent paper that uses a design similar to ours, Aizer and Doyle assess the consequences of incarcerating juveniles on future outcomes, such as high school completion and adult criminal outcomes. Several recent studies have also analyzed employment consequences using administrative data linking court or correctional records to earnings data obtained from state unemployment insurance (UI) systems. Grogger (1995), for example, uses UI earnings data and California court records to study the impact of arrests on labor market outcomes. He reports reductions in employment of around 5 percent and earnings losses of 10–30 percent. MS uses the same geographical context as us, and documents how both the extensive and intensive margins of incarceration significantly affect employment over the life-cycle of a criminal offender.

Distortion of Labor Income

As we just mentioned, previous studies have shown that a criminal record creates a substantial barrier to obtaining employment. To fix ideas, in the next two subsections we provide a simple framework with the purpose of illustrating the interconnection between income, criminal types and borrower screening. For simplicity, we abstract away from depreciation of human capital and loss of negotiating benchmark, but the intuition we explore here extends to those cases.

Consider a two-period simple screening model of labor supply and crime. Firms freely enter the market. Workers inelastically supply one unit of labor in each period for a wage w e where a worker's productivity is denoted by $e \in [\underline{e}, \bar{e}]$. There are hiring costs γ that include the cost of screening and conducting background checks on criminal history. Workers and firms commit only to one-period contracts, and matches are separated afterwards. Private information about the worker's productivity coupled with hiring costs gives rise to endogenous discrimination against ex-convicts. Firms must break even from hiring a worker:

$$P\mathbb{E}[e|X] - w\mathbb{E}[e|X] - \gamma = 0$$

where P is the output per efficiency unit and X is a vector of screening characteristics that include background checks on a worker's criminal history. The competitive wage offered by the firm is:

$$w = P - \frac{\gamma}{\mathbb{E}[e|X]}$$

this is, wages are increasing with expected worker's productivity.

There are two periods in the lifetime of a worker, youth and maturity, and we denote each period by the subscript $t \in \{Y, M\}$. The discount factor is one. Agents engage in crime only when they are young. Denote by w^c the competitive wage of a worker with a record of criminal history. Their utility at period 2 is given by:

$$\begin{aligned} U_M^n(e) &= \frac{1}{2}\log(w\ e) \\ U_M^c(e) &= \frac{1}{2}\log(w^c\ e) \end{aligned}$$

In period 1, some agents engage in criminal activity. The felicity value of engaging in criminal activity, χ, is drawn from a uniform distribution on $[\underline{\chi}, \bar{\chi}]$ and is independent of ability. If agents choose to engage in crime they

can be apprehended with probability μ, and they would lose all labor income and go to jail or prison. Consumption in jail or prison is c_P. The lifetime utility at period 1 is given by:

$$U_Y(e) = \max\left\{\log(w\ e), (1-\mu)[\chi + \log(w\ e)] + \mu\frac{\log c_P + \log w^c e + \phi(w^c - w)}{2}\right\} \tag{A.1}$$

where $\phi(w)$ is increasing in wages and denotes potential gains or losses due to access to credit. Equation (A.1) implies that the agent could engage in criminal activity if and only if $e \leq \frac{c_P w^c}{w^2}\exp\{2\frac{1-\mu}{\mu}\chi + \phi(w^c - w)\}$— this is, high types are less likely to engage in crime. Hence, it is weakly profitable for the firm to screen on criminal history and consequently, $w^c \leq w$:

Remark 1: *Average wages for workers with criminal histories are less than or equal to average wages. The inequality is strict for low enough prison consumption, c_P.*

From equation (A.1) we also know that in order for high ability individuals to engage in crime they must have a high criminal type. Hence, conditional on conviction, the expected ability of an individual is no longer independent of criminal type:

Remark 2: *Conditional on conviction, the expected value of ability for individuals with a criminal record increases with criminal type. This is, $e(\chi) \equiv \mathbb{E}^c[e|\chi]$ is increasing in χ.*

The intuition of Remark 2 is simple, it says that conviction induces a positive selection bias. As an example, one might think that giving a million dollars to an individual would dissuade her from stealing if her motive is poverty more so than if her reason for stealing is kleptomania. This finding is important if we want to understand the bias of the OLS estimator. When criminal type and ability are ex-ante uncorrelated, the OLS estimator will exhibit positive bias (see Appendix A.2 for details), since criminal type and ability are positively correlated ex-post. Of course, there may exist unobserved factors driving an ex-ante negative correlation between criminal type and ability but, in order to have negative bias in the OLS estimator, the bias induced by these factors must exceed the ex-post positive bias that arises due to selection.

Spillover into Credit Markets

Lenders face borrowers with characteristics ν. Characteristics include income and credit history, for example, but exclude traits that are private information of the borrower, like repayment character and criminal type. Let L denote total loan amount. To a borrower with observable characteristics ν, lenders offer a contract $\psi = (L, \nu)$ and choose the number, a_ψ, and price, q_ψ for each contract so as to maximize profits:

$$\pi = \sum_{\psi\in\Psi}(1-p_\psi)a_\psi q_\psi - \sum_{\psi\in\Psi} a_\psi L_\psi$$

where p_ψ is the probability that contract ψ defaults. In frictionless competitive markets, the expected profit of each contract must equal zero

$$\mathbb{E}[\pi^\psi|\nu] \equiv \mathbb{E}[(1-p_\psi)a_\psi q_\psi - a_\psi L_\psi|\nu] = 0.$$

Now consider the case when the only relevant observable characteristic is income, i.e. $\nu \equiv Income$. We can assess the performance of two individuals with the same income but different criminal histories—$\nu_c = w_c e_c$ and $\nu_{\neg c} = we$, with $\nu_{\neg c} = \nu_c$. Productivity, e and criminal type, χ, are unobservable to the lender. When there is no relationship between unobservables and default probability p_ψ—i.e., $Cov(p_\psi, e) = Cov(p_\psi, \chi) = 0$— ability to pay is the only determinant of default. This implies that lending to an ex-felon or an individual with no convictions yields the same performance:

$$\mathbb{E}[\pi^\psi|\nu_c] = \mathbb{E}[\pi^\psi|\nu_{\neg c}] = 0$$

which says that it is irrelevant for the lender to discriminate between individuals with and without a criminal history. Now consider the case where individuals with higher ability also default less, $Cov(e, p_\psi) < 0$. This can happen, for example, if more responsible individuals both develop more skills and care more about honoring their credit agreements, i.e. their willingness to pay. Then,

$$w > w_c \implies e_c > e \implies \mathbb{E}[\pi^\psi|\nu_c] > \mathbb{E}[\pi^\psi|\nu_{\neg c}]$$

which states that, holding income constant, lending to formerly incarcerated individuals has better performance. We can extend this logic to criminal types. By Remark 2, *post-conviction* there is a positive correlation between ability and criminal types, and hence formerly incarcerated individuals with high criminal type should exhibit the best performance.

There cannot be advantageous selection on observable characteristics. Since criminal history is public information, lenders should face no advantageous selection from lending to formerly incarcerated individuals. Conversely, if stigma[1] is not competed away in the market, we should find evidence of advantageous selection. We summarize as follows:

Remark 3: *In the absence of stigma, lending to applicants with a criminal record should not lead to advantageous selection for the lender. In contrast, criminal type may provide selection advantages or disadvantages to the lender. If ability is a better predictor of creditworthiness than criminal type, high criminal types must be advantageous to the lender.*

[1]By stigma we refer to a set of beliefs about a group or individual that are unsupported by evidence or that when applied lead to outcomes inconsistent with those same beliefs. In the present context, stigma would manifest itself on the form of lower access to credit *and* better repayment history outcomes on the part of the formerly incarcerated.

A.2 Criminal Types and OLS Bias

The naive relationship we want to explore is given by:

$$Y = \beta Incarcerated + \nu$$

where $Cov(\nu, Incarcerated) \neq 0$. Decompose ν into an intensive margin component $\hat{\xi} = Incarcerated - \widehat{Incarcerated}$— which captures factors such as severity of crime and intent, and its orthogonal component, η. This will implement a control function version of 2SLS:

$$Y = \beta Incarcerated + \gamma\hat{\xi} + \eta \tag{A.2}$$

$$= (\beta + \gamma) Incarcerated - \gamma \widehat{Incarcerated} + \eta \tag{A.3}$$

As usual with this type of control function, η is uncorrelated with $Incarcerated$ and $\hat{\xi}$. The bias on the OLS estimate is given by:

$$\begin{aligned} \hat{\beta}_{OLS} - \beta &= \tfrac{Cov(Y,Incarcerated)}{Var(Incarcerated)} - \beta = \gamma \tfrac{Cov(\hat{\xi},Incarcerated)}{Var(Incarcerated)} + \tfrac{Cov(\eta,Incarcerated)}{Var(Incarcerated)} \\ &= \gamma \left\{ 1 - \tfrac{Var(\widehat{Incarcerated})}{Var(Incarcerated)} \right\} \end{aligned} \tag{A.4}$$

Importantly, we can interpret equation (A.2) as the effect of criminal type on Y conditional on incarceration and, hence, invoke Remark 2 of the conceptual framework above. As we know from Remark 2, conditional on $Incarcerated$, $\hat{\xi}$ can be positively correlated with ability, and if ability is correlated with higher credit scores, we may expect γ to be positive. This makes the bias positive. This type of bias is one of selection post assignment to treatment and, conditional on the assignment being random, can be overcome by using assignment as an instrument in the same spirit of a randomized trial with partial compliance.[2]

Columns (1) and (5) in Table (A.2.1) show the OLS regression of credit scores and log income on incarceration. The estimates are lower than our IV estimates, suggesting that γ is positive. In columns (2) and (6) we show the OLS estimates for equation A.3. Since $\gamma\{1 - \frac{Var(\widehat{Incarcerated})}{Var(Incarcerated)}\} < \gamma$, controlling for $\widehat{Incarcerated}$ drives β_{OLS} closer to zero than in columns (1) and (5). In columns (3)–(4) and (7)–(8), we show the Control Function estimates (equation A.2) which show that, as expected, $\hat{\xi}$ is positively correlated with credit scores and log income, respectively.

Table A.2.1: Correlation between Criminal Types and Number of Arrests

	Credit Scores				(log) Estimated Income			
	(1) OLS	(2) OLS	(3) CF	(4) CF	(5) OLS	(6) OLS	(7) CF	(8) CF
Incarcerated	-12.10***	-4.64***	-59.15***	-61.80***	-.16***	-.11***	-.54***	-.58***
	(1.20)	(1.28)	(3.68)	(4.40)	(.01)	(.01)	(.03)	(.04)
Residual$_{IV}$/Criminal Type			54.51***	55.90***			.44***	.46***
			(3.91)	(4.37)			(.03)	(.04)
Incarcerated$_{IV}$		-54.51***				-.44***		
		(3.91)				(.03)		
Sentence Length				2.83**				.04***
				(1.33)				(.01)
	(2.63)	(3.72)	(3.72)	(4.06)	(.02)	(.03)	(.03)	(.03)
N	67,115	67,115	67,115	58,707	31,592	31,592	31,592	27,795
Year Disposition	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Credit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
controls	No	No	No	No	No	No	No	No

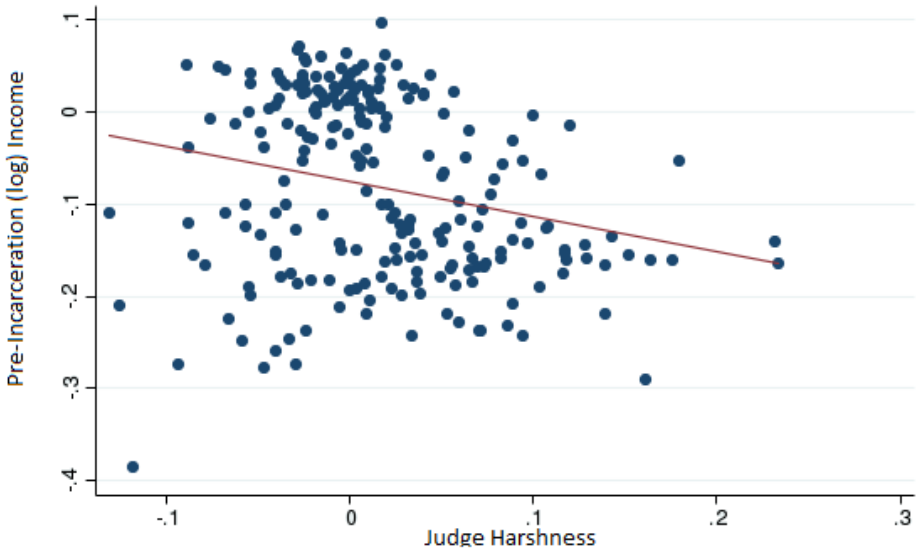
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

[2]See, Chapter 4.4.2, Angrist and Pischke (2009).

NOTES: This table presents OLS and Control Function (CF) estimates of the effect of incarceration on credit scores and (log) estimated income. Columns (1) and (5) presents the OLS results. Comparing equations (A.3) and (A.4) indicates that controlling for the instrumented incarceration $Incarcaration_{IV}$ should increase the bias of the OLS estimate upwards. Columns (2) and (6) control for instrumented incarceration and reflect this upward bias. Columns (3)-(4) and (7)-(8) show the control function estimates of incarceration on access to credit. As predicted by the theory in this subsection, controlling for the first stage residual of incarceration on court-year fixed effects is positive as it reflects the bias induced by the correctional system documented in Remark 2 above. Errors clustered at the court $\times$ year of disposition level.

Criminal Types

Figure A1: Pre-Conviction Income Conditional on Future Incarceration by Judge Harshness



NOTES: This figure plots pre-incarceration income for incarcerated individuals against judge harshness. Judge harshness in the leave-one-out mean of incarcerating for the assigned court at the year of disposition (verdict and sentence). To construct the scatter bin plot, we average 2006 income for individuals with year of conviction after 2006 by court-year. We plot against each court-year's judge harshness.

Table A.2.2: Correlation between Criminal Types and Number of Arrests

	(1) Before	(2) After	(3) After 1st Arrest	(4) Before	(5) After	(6) After 1st Arrest
Crime Type Measure	.10***	.13***	.07***	.05***	.08***	.04**
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
Income 2006	-.23***	-.25***	-.14***	-.24***	-.26***	-.15***
	(.02)	(.02)	(.02)	(.02)	(.02)	(.02)
CreditScore	-.12***	-.12***	-.09***	-.13***	-.13***	-.09***
	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
N	58,643	58,643	40,569	58,643	58,643	40,569
Year Disposition	No	No	No	Yes	Yes	Yes
Age	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table presents OLS estimates of the relationship between criminal type and arrests. As a matter of comparison, recidivism in our sample is 40%. Columns (1) and (4) presents the relationship between criminal type and past arrests. Columns (2) and (5) present the relationship between criminal type and future arrests. Columns (3) and (6) present the relationship between criminal type and future arrests conditional on individual being arrested for the first time. Errors clustered at the court $\times$ year of disposition level.

A.3 Sample Loan Application Form with Criminal History Inquiry

2013-14 LOAN APPLICATION

PLEASE MAIL THIS APPLICATION ALONG WITH YOUR COMPLETED, SIGNED PROMISSORY NOTE
Awards are distributed on a first come basis – based on the date the application packet is determined to be complete.
Failure to respond or submit required documentation will delay the completed application date.

PLEASE READ THE GUIDELINES & TERMS OF AGREEMENT FOR ELIGIBILITY CRITERIA (located at www.wtac.wa.gov/alp)			
Last Name:	First Name: MI		SSN:
Address:	City:	State:	Zip:
Driver's License #:	State:	Phone:	
Ethnicity (optional) ☐ African-American ☐ Asian-Pacific Islander ☐ Vietnamese ☐ Korean ☐ Alaskan Native ☐ White Caucasian ☐ Filipino ☐ Chinese ☐ Other			
☐ Male ☐ Female	Birth date:	Email (required):	
How long have you lived in Washington state? years	If less than five, previous state of residence:		
Are you a U.S. Citizen ☐ Yes ☐ No	If no - VISA Type: ☐ I-151 ☐ I-551 ☐ I-551C *See Guidelines & Terms of Agreement for eligible non U.S. citizen requirements.*	Visa Number:	

Contacts: Provide two contacts with addresses different from your own and different from each other that will always know your current address. The first contact should be a relative but not a spouse.

	Contact One:	Contact Two:
Name		
Permanent Address		
City, State, Zip Code		
Area Code/Telephone		
Relationship to Recipient		

Are you delinquent on any Federal/State debts? ☐ No ☐ Yes (example: Federal Income Tax, Student Loans) If yes, submit a Cosigner Application Form.	
Are you delinquent on child support payments?	☐ No ☐ Yes If yes, submit a Cosigner Application Form.
Have you filed a Bankruptcy in the last seven years?	☐ No ☐ Yes If yes, submit a Cosigner Application Form.

A Credit Report and Criminal Background Check will be run upon submission of your application. Applicants with derogatory credit history will be required to submit a Cosigner Application Form. If you believe you have poor credit history you may submit a Cosigner Application Form along with your application to expedite the loan application process.

Are you receiving unemployment benefits? ☐ Yes ☐ No	Do you have dependents? ☐ Yes ☐ No If yes # of dependents: (do not count spouse as a dependent)
Current work status: **Working :** ☐ full time ☐ part time	**Not Working:** ☐ but looking for work ☐ not looking work
2012 Adjusted Gross Income $ From your most current Federal Income Tax Form If you did not file in 2012, write 0 in the blank above.	Current monthly Gross Income $ Spouse's Monthly Gross Income $ Total monthly gross income $ *Do not count unemployment benefits as income* *Be sure to check the Financial Need Criteria Chart in the Guidelines and Terms of Agreement to make sure you do not exceed the annual income eligibility criteria. (To calculate, take your current total income above - multiply times 12 = annual income.)*

Page 1 of 3

Criminal History Background Information:

You must fill out this section accurately and completely, **disclosing all convictions and/or pending criminal charges including any felony or misdemeanors.** Please be aware that the nature, severity and intentionality of a criminal conviction or pending criminal charge may be a factor in you obtaining employment in this industry which negates the purpose of this loan which is to gain training and skills for a career in the Aerospace Industry.

"Crime" includes a misdemeanor, felony or a military offense. "Convicted" includes, but is not limited to, having been found guilty by verdict of a judge or jury, having entered a plea of guilty or nolo contendre, or having been given probation, a suspended sentence or a fine. You may exclude misdemeanor traffic citations.

Please note – if you do not check the box above and criminal history is found on your background report it will result in your application being removed from further review. You may submit a statement regarding the circumstances.

☐ No ☐ Yes I have been convicted of a crime, had a judgment withheld or deferred, or are currently charged with committing a crime.

☐ No ☐ Yes I have been convicted of a felony or a robbery. **If yes – stop here** – you are not eligible.

☐ No ☐ Yes I have been convicted of theft or shoplifting in the last seven years. **If yes – stop here** – you are not eligible.

☐ No ☐ Yes I am or have been a registered sex offender. **If yes – stop here** – you are not eligible.

☐ No ☐ Yes I have had more than 1 (one) DUI in the last five years. **If yes – stop here** – you are not eligible.

I agree that the WSAC may conduct a criminal history background check. To the best of my knowledge, the information provided on this form is true and complete. I understand that falsification or omission of information constitutes grounds for not receiving this loan. I also understand that if I do receive this loan, regardless of my ability to find employment in the Aerospace industry, I am obligated to repay this loan plus interest to the State of Washington per my signed Agreement.

Confidentiality
All persons receiving and reviewing criminal background information regarding an individual shall maintain strict confidence to the extent permitted by the Washington Student Achievement Council. Information and records gathered or created in the course of criminal background reviews will be securely maintained by this office in a locked file.

Applicant Signature *Printed Name* *Date*

Before you mail this application:

- ***Make a copy for your records.***
- ***If mailing via the U.S. Postal service consider using a return receipt for documentation that the application was mailed and delivered, or use an alternate method of delivery that can provide documentation of delivery and tracking if lost. Remember loans will be made on a first come first served basis.***

Mail completed Application AND Promissory Note and any other required documents (listed on our website: www.wsac.wa.gov/alp) to:
WSAC/ALP PO Box 43430 Olympia WA 98504-3430

Faxed copies of the application are not accepted. For questions contact: alp@wsac.wa.gov or (360) 596-4817

A.4 Randomization

Court Rules of Case Assignment

LOCAL RULES OF THE HARRIS COUNTY CIVIL COURTS AT LAW
[...]
RULE 3. FLOW OF CASES 3.1.1 Filing and Assignment. Upon being filed, a case in the county civil courts at law shall be **assigned randomly** to the docket of one of the courts. Once assigned to a court, a case will remain on the docket of that court for all purposes unless transferred as provided in Rule 3.2.

3.2 Transfer
3.2.1 Prior Judgment. Any claim for relief based upon a prior judgment shall be assigned to the court of original judgment.
3.2.2 Nonsuit. If a case is filed in which there is a substantial identity of parties and causes of action as in a nonsuited case, the later case shall be assigned to the court where the prior case was pending.
3.2.3 Consolidation. A motion to consolidate cases shall be heard in the court where the lowest numbered case is pending. If the motion is granted, the consolidated case will be given the number of the lowest number case and assigned to that court.
3.2.4 Severance. If a severance is granted, the new case will be assigned to the court where the original case pends, bearing the same file date and the same number as the original case with a numeric suffix designation; provided, however, that when a severed case has previously been consolidated from another court, the case shall upon severance be assigned to the court from which it was consolidated.
3.2.5 Agreement. Any case may be transferred from court to another court by written order of the Administrative Judge of the County Civil Courts at Law division or by written order of the judge of the court from which the case is transferred; provided, however, that in the latter instance the transfer must be with the written consent of the court to which the case is transferred.
3.2.6 Presiding for Another. In cases where a court presides for another court, the case shall remain pending in the original court, except as follows: 1) in any hearing on a motion for contempt, the judge who issued the order which is claimed to have been disobeyed must preside over the motion for contempt, except as otherwise provided in Sec. 21.002, Tex.Gov.Code. and 2) in any hearing on a temporary restraining order, temporary injunction or writs of mandamus and certiorari, the judge who issues the order thereby consents pursuant to 3.2.5 for the case to be transferred from the original court.
3.2.7 Improper Court. If a case is on the docket of a county civil court at law by any manner other than as prescribed by these rules, the Administrative Judge of the County Civil Courts at Law or Administrative Judge of Harris County shall transfer the case to the proper court. (**Emphasis Ours**)
[...]

Test of Randomization

To further test whether assignment of judge is independent of defendant's characteristics we run the following specification:

$$JudgeHarshness_{j(i)t} = \beta_0 + \beta_1 PreSentenceTrait_{it} + \tau_t + \epsilon_{ijt} \tag{A.5}$$

Comparing the results effects of several defendant's characteristics with judge harshness (on average .152) reflects no economically significant effects on being assigned to a less harsh judge. This holds true for demographic characteristics (like gender or race), economic characteristics (like income and credit score) or the power of the attorney (measured by the size of her clientele).

Table A.4.1: Test of Randomization

Pre-Sentence Trait	(1) Judge Harshness	(2) Baseline Mean	N
Judge Harshness	1	.152	129,721
	(.)	(.051)	
Minority	.000849**	.598	129,721
	(.000284)	(.490)	
Female	.000087	.291	129,721
	(.000489)	(.454)	
Age	.000006	34.25	129,721
	(.000021)	(12.48)	
Attorney's Clientele	-.000005***	412.02	129,721
	(.000001)	(503.80)	
Pre-Incarceration Credit Limit	-.000000***	5,337	35,474
	(.000000)	(43.2)	
Pre-Incarceration Number of Accounts	-.000117**	11.33	35,474
	(.000029)	(10.42)	
Pre-Incarceration Credit Score	-.000007**	523.37	35,474
	(.000001)	(190.48)	
Pre-Incarceration (log) Income	-.002147***	5.60	23,660
	(.000288)	(.529)	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

NOTES: This table reports OLS estimates of equation A.5 for various pre-sentence traits. Column (1) presents the OLS coefficients. Column (2) shows baseline means for each trait to allow comparison. Errors clustered at the court × year of disposition level.

Appendix B

Chapter 2 Appendix

B.1 Robustness

Table B.1.1: Effects by Level of Unionization

This table reports estimates of leverage on employment growth instrumenting for corporate leverage using passage of the Voting Rights Act and black participation rate. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Column (2) controls for firm employment and size. Columns (1), (3) & (5) control for state and year fixed effects. Columns (2), (4) & (6) controls for state × year fixed effects. All columns include firm fixed effects.

	(1)	(2)	(3)	(4)
VRA x Proportion Black	.1516*	.3116***	.2147***	.3076***
	(.0823)	(.0699)	(.0000)	(.0218)
VRA	-.0223	-.0560***		
	(.0159)	(.0092)		
N	1350	12945	1087	12789
Firm FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes
State-Year FX	No	No	Yes	Yes
High Union Membership	Yes	No	Yes	No

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.1.2: Effects Excluding 1972 States

This table reports estimates of leverage on employment growth instrumenting for corporate leverage using passage of the Voting Rights Act and black participation rate. Corporate leverage, firm employment and total assets come from Compustat. Black employment by industry comes from CPS. Column (2) controls for firm employment and size. Columns (1), (3) & (5) control for state and year fixed effects. Columns (2), (4) & (6) controls for state × year fixed effects. All columns include firm fixed effects.

	(1)	(2)	(3)	(4)	(5)	(6)
VRA x Proportion Black	.2358**	.2477	.2712***	.2874***	.2364**	.2712***
	(.0938)	(.1839)	(.0283)	(.0726)	(.0840)	(.0292)
VRA	-.0546***	-.0367			-.0321	
	(.0082)	(.0381)			(.0276)	
N	14113	13069	13964	12920	3304	3291
Firm FX	Yes	Yes	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FX	No	No	Yes	Yes	No	Yes
Texas	Yes	No	Yes	No	Yes	Yes
Arizona	No	Yes	No	Yes	Yes	Yes
South Only	No	No	No	No	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

B.2 Discrimination Regulation Costs

Search Costs and Statistical Discrimination

"[A] portion of equal opportunity law has been directed at preventing employers from relying on race or sex as proxies for productivity in making hiring decisions. Employers wish to use these proxies because they provide cheap, albeit imperfect, information about the quality of workers. Spending more money to select the workforce would presumably yield a more productive set of employees, but employers would forsake these gains in a non-Title VII world because they are outweighed by the added costs. But since these higher search costs have already been included in our estimates of antidiscrimination costs, any resulting productivity gains from these higher search costs must be considered as well."

B.3 Workers, Job Security, and Firms' Financial Stability: Anecdotal Evidence

Fraud litigation provides ample anecdotal evidence of the role financial stability plays in the employees decision to accept a job and a level of compensation. Although the anecdotal evidence from legal cases is highly selected (allegation of wrongdoing; case brought to court; for most cases, case evaluated in appeals), it does provide insight into the bargaining process between employers and employees. Although laws protecting against fraud vary from state to state, and hence the outcome of the case, the statement of facts is virtually the same: financial strength of the company, job security, firms financial outlook recurrently appear as important factors in the decision to accept a job offer. Misrepresentation of these facts supersedes employment at will and is generally against the law.

Sample Statement of Facts and View of the Court

Lazar v. Superior Court, 12 Cal. 4th 631 (Cal. 1996), in finding that misrepresentation about the financial condition of a firm constitutes cause for action for fraud, reads:

> In response to Lazar's [employee] concerns, Rykoff [employer] made representations to Lazar that led him to believe he would continue to be employed by Rykoff so long as he performed his job and achieved goals. [] *Rykoff further represented that the company was very strong financially and anticipated solid growth and a stable, profitable future.* In particular, Rykoff represented that the department in which Lazar would work was a growth division within the company and that Rykoff had plans to expand it. []
>
> Lazar asked for a written employment contract, but was refused. Rykoff stated a written contract was unnecessary because "our word is our bond." In or about February 1990, Lazar accepted Rykoff's offer of employment on terms including the foregoing.
>
> Rykoff's representations to Lazar regarding the terms on which he would be retained, Rykoff's financial health and Lazar's potential compensation were false and, when making them, Rykoff's agents knew they were false. Rykoff had in

> the immediately preceding period experienced its worst economic performance in recent history, and the company's financial outlook was pessimistic. In fact, Rykoff was planning an operational merger that would eliminate Lazar's position. Rykoff had no intention of retaining Lazar so long as he performed adequately. Instead, Rykoff secretly intended to treat Lazar as if he were an "at will" employee, subject to termination without cause. (Italics ours)

The courts view on financial stability and employment at-will is more clearly stated in Clement-Rowe v. Mich. Health Care Corp., 538 N.W.2d 20 (Mich. Ct. App. 1995):

> Today's employment market is both tenuous and difficult. Nearly all employment is at-will. The economic well-being and financial stability of a potential employer is an important factor in accepting a job offer. Consequently, an employer who succeeds in asserting its economic health to attract qualified employees knowing the assertions are untrue may not later hide behind an at-will employment contract. Neither may it be permitted to avoid liability after omitting to disclose, when asked, known economic instability which later leads to economically-based layoffs.

v

Sample of Cases

Federal Conti v. Pneumatic Prod. Corp., 977 F.2d 978 (6th Cir. 1992) Clay v. Koch, No. C95-1289-FMS, 1996 U.S. Dist. LEXIS 10677 (N.D. Cal. Jul. 22, 1996) Longnecker v. Ore Sorters, Inc. 634 F. Supp. 1077 (N.D. Ga. 1986) Varity Corp. v. Howe et al. (94-1471), 516 U.S. 489 (1996)

California Lazar v. Superior Court, 12 Cal. 4th 631 (Cal. 1996) Lenk v. Total-West., Inc., 108 Cal. Rptr.2d 34 (Cal. Ct. App. 2001)

Colorado Austin v. U.S. West, Inc. 926 P.2d 181 (Colo. Ct. App. 1996)

Florida Williams v. Peak Resorts Int'l., Inc., 676 So.2d 513 (Fla. Dist. Ct. App. 1996)

Indiana Tutwiler v. Snodgrass, 428 N.E.2d 1291 (Ind. Ct. App. 1981)

Massachusetts

Webber Y. Frelonic Corp., No. 92-1437, 1994 Mass. Super. LEXIS 28 (Mass. Super. Ct. Oct. 7, 1994)

Michigan Jabour v. Hollowell v. Career Decisions, Inc., 298 N.W.2d 915 (Mich. Ct. App. 1980) Clement-Rowe v. Mich. Health Care Corp., 538 N.W.2d 20 (Mich. Ct. App. 1995) McCreery v. Seacor, 921 F. Supp. 489 (D. Mich. 1996) Ciraulo v. AT&T Info. Sys., Inc., No. 95-CV-71166-DT, 1996 U.S. Dist. LEXIS 16929 (E.D. Mich. Oct. 23, 1996) Hord v. Envtl. Research Inst. of Mich., 617 N.W.2d 543 (Mich. 2000) Sneyd v. Int'l Paper Co., 142 F. Supp. 2d 819 (E.D. Mich. 2001)

New York Doehla v. Wathne Ltd. Inc., No. 98- CIV-6087-CSH, 2000 WL 987280 (S.D.N.Y Jul. 17, 2000) **North Carolina** Wilson v. Popp Yam Corp., 680 F. Supp. 208 (W.D.N.C. 1988) **Ohio** Rice v. Cleveland Telecomm., No. 58926, 1991 Ohio App.

LEXIS 3577 (Ohio Ct. App. Jul. 18, 1991) **Oklahoma** Stehm v. The Nordam Group Inc., 170 P.3d 546 2007 OK CIV APP 94 **Pennsylvania** Lokay v. Lehigh Valley Coop. Farmers, Inc., 492 A.2d 405 (Pa. 1985) Titelman v. Rite Aid Corp., No. 00-2865, 2001 U.S. Dist. LEXIS 24049 (E.D. Pa. Nov. 9, 2001)

Texas Stephanz v. Laird, 846 S.W.2d 895 (Tex. App. 1993)

B.4 Efficiency

In this section we corroborate that the Hosios (1990) condition for efficiency holds in our model. We follow the standard treatment in the literature. The social planner maximizes the total surplus in the economy- this is, she sets to maximize total production plus the outside value of the unemployed less search costs. Note that the social planner is indifferent as of how the proceeds of production are distributed and, hence, wages are not part of the social planner's objective.

$$\max_{u,\theta} \int_0^\infty e^{-rt}[f(n) + ub - \lambda c - (1-\lambda)\theta u\gamma]dt$$

s.t.

$$\dot{u} = [\delta(1-\lambda) + \lambda](1-u) - (1-\lambda)\theta q(\theta)u$$

From the Hamiltonian

$$H := e^{-rt}[f(n) + ub - \lambda c - (1-\lambda)\theta u\gamma] + \mu\{[\delta(1-\lambda) + \lambda](1-u) - (1-\lambda)\theta q(\theta)u\}$$

we obtain the Euler equations that, together with the law of motion for unemployment above, define the optimal path for optimal unemployment and market tightness:

$$H_\theta = -e^{-rt}(1-\lambda)u\gamma - \mu(1-\lambda)uq(\theta)\big(1-\eta(\theta)\big) = 0 \tag{B.1}$$

and

$$H_u = -e^{-rt}[f'(n) - b(1-\lambda)\theta\gamma] - \mu[\delta(1-\lambda) + \lambda + (1-\lambda)\theta q(\theta)] = \dot{\mu} \tag{B.2}$$

From (B.1) it follows that:

$$\mu = -\frac{e^{-rt}\gamma}{q(\theta)\big(1-\eta(\theta)\big)}$$

and

$$\dot{\mu} = r\frac{e^{-rt}\gamma}{q(\theta)\big(1-\eta(\theta)\big)}$$

Plugging these into (B.2)equations yields:

$$\big(1-\eta(\theta)\big)\{f'(n) - b + (1-\lambda)\theta\gamma\} - \frac{\gamma}{q(\theta)}[\delta(1-\lambda) + \lambda + (1-\lambda)\theta q(\theta) + r] = 0 \tag{B.3}$$

Note that this equals equation 2.10 if and only if $\eta(\theta) = \beta$, which is exactly the standard Hosios (1990) condition in the literature.

B.5 Framework with Multiple Groups

The value function of the firm solves:

$$rV(n_b, n_a, B) = \max_{v_b, v_a, \Delta I} \{ f(n_b + n_a) - w(n_b + n_a)n_b - w(n_b + n_a)n_a$$

$$+\tau RB(1-\lambda) + (1-\lambda)\big(\tau R\Delta I - (v_a + v_b)\gamma\big) + \frac{dV_b}{dt} + \frac{dV_a}{dt} + \frac{dV_B}{dt}\}$$

$$= \max_{v_b, v_a, \Delta I} \{ f(n_b + n_a) - w_b(n_b + n_a)n_b - w_a(n_b + n_a)n_a \tag{B.4}$$

$$+V_{n_b}[q(\theta_b)v_b - \delta n_b] + V_{n_a}[q(\theta_a)v_a - \delta n_a]\} - (v_a + v_b)\gamma + \Delta I + V_{\theta_b}\dot{\theta_b} + V_{\theta_a}\dot{\theta_a} + V_B\dot{B}$$

where δ denotes the separation rate[1] and employment and debt satisfy the laws of motion, $\dot{n_i} = (1-\lambda)q(\theta_i)v_i - \big(\delta(1-\lambda) + \delta^D\lambda\big)n_i$ and $\dot{B} = \Delta I$, respectively.

The first term captures revenue from production. The second and third terms are the wages paid to each worker group. The wages for each group–say, group a–depend on the number of *both* types of workers hired $(n_a + n_b)$ because we assume diminishing marginal returns to labor and constant productivity across worker types. The fourth and fifth terms are hiring costs and borrowing costs, respectively.

We want to find relationships characterizing job creation and borrowing in equilibrium. The first order conditions with respect to each groups' employment and firm debt yield:

$$J_{n_b}(n_b, n_a, B) \equiv V_{n_b}(n_b, n_a, B) = \frac{\gamma}{q(\theta_b)} \tag{B.5a}$$

$$J_{n_a}(n_b, n_a, B) \equiv V_{n_a}(n_b, n_a, B) = \frac{\gamma}{q(\theta_a)} \tag{B.5b}$$

$$J_B(n_b, n_a, B) \equiv V_B(n_b, n_a, B) = -\tau R \tag{B.5c}$$

$J_{n_i}(n_b, n_a, B)$ is the marginal value to the firm of adding an additional worker from group i whereas $J_B(n_b, n_a, B)$ is the value to the firm of increasing total debt by \$1. Using the envelope condition and the fact that the market steady state satisfies, $\dot{\theta_i} = 0$ $\dot{n_i} = 0$, we obtain:

[1] We take the separation rate as exogenous in this section.

$$J_{n_b}(n_b, n_a, B) = \frac{f'(n_b + n_a) - w(n_b) - \frac{\partial w_b(n_b+n_a)}{\partial n_b} n_b - \frac{\partial w_a(n_b+n_a)}{\partial n_b} n_a}{r + \delta(1-\lambda) + \delta^D \lambda} \tag{B.6a}$$

$$J_{n_a}(n_b, n_a, B) = \frac{f'(n_b + n_a) - w(n_a) - \frac{\partial w_a(n_b+n_a)}{\partial n_a} n_a - \frac{\partial w_b(n_b+n_a)}{\partial n_a} n_b}{r + \delta(1-\lambda) + \delta^D \lambda} \tag{B.6b}$$

$$J_B(n_b, n_a, B) = \frac{-\frac{\partial w_a(n_b+n_a)}{\partial B} n_a - \frac{\partial w_b(n_b+n_a)}{\partial B} n_b + \tau(r+\lambda)(\tau B(1-R) - c + \gamma(v_a + v_b)}{r} \tag{B.6c}$$

We can obtain the job creation condition for each group from (2.2a-b) and (2.3a-b):

$$\frac{pf'(n_b + n_a) - w(n_i) - \frac{\partial w_i(n_b+n_a)}{\partial n_i} n_i - \frac{\partial w_b(n_b+n_a)}{\partial n_i} n_{-i}}{r + \delta(1-\lambda) + \lambda\delta^D} = \frac{\gamma}{q(\theta_i)} \qquad \text{(Job Creation)}$$

The value of employment and unemployment to the worker follow:

$$rW^i = w_i + \delta(U^i - W^i)$$
$$rU^i = b + m(\theta_i)(W^i - U^i)$$

Plugging these into equation (2.6) and using equations (2.3a-b) yields the partial first order differential equations:

$$w_i(n_a, n_b) = (1-\beta) r U_i + \beta[pf'(n_b + n_a) - \frac{\partial w_a(n_b + n_a)}{\partial n_i} n_a - \frac{\partial w_b(n_b + n_a)}{\partial n_i} n_b]$$

Assume a simple Cobb-Douglas production function of the form $f(n_b, n_a) = (n_b + n_a)^\alpha$ for $\alpha \in (0, 1]$. We follow Cahuc et al. (2007) in incorporating Stole & Zwiebel (1996) intra-firm bargaining into a search-theoretical framework. The wage equation takes the form:

$$w_i(n_a, n_b) = (1-\beta) r U_i + \int_0^1 z^{\frac{1-\beta}{\beta}} \alpha (n_a + n_b)^{\alpha-1} z^{\alpha-1} dz = (1-\beta) r U_i + \frac{\beta\alpha}{1 - \beta + \alpha\beta} (n_a + n_b)^{\alpha-1}$$

This yields a wage that is dependent on the value of the unemployment claim and the marginal product of adding an additional worker. Wages are also related to the level of labor market tightness in the economy. From equations (2.2a-b) and the sharing rule (2.6), we obtain:

$$w_i(n_a + n_b) = \frac{\beta_i}{1 - \beta_i} \frac{\gamma}{q(\theta_i)} [r + (\delta + m(\theta_i))(1-\lambda) + \lambda\delta^D] + b \qquad \text{(Wage Equation)}$$

By combining these two we relate the equilibrium tightness with the equilibrium employment for each group:

$$(\frac{\alpha}{1+\alpha\beta_i-\beta_i})(n_a+n_b)^{\alpha-1} = \frac{\gamma}{q(\theta_i)}[\frac{1}{1-\beta_i}(r+\delta(1-\lambda))+\frac{\beta_i}{1-\beta_i}m(\theta_i)(1-\lambda)]+b \text{ (Equilibrium } \theta)$$

Discrimination

There is many ways in which discrimination can be thought about within a search frictions environment with multiple groups. Discrimination can occur at the hiring or at the operation level. When there is discrimination there is a cost associated in hiring a worker from one of the two groups. Without loss, assume discrimination is against group b. The cost can come from taste in hiring or that it is harder to find the right talent for the position (statistical discrimination). Let that cost be denoted by d. Then, the value function of the firm solves:

$$rV(n_b,n_a,B) = \max_{v_b,v_a,\Delta I}\{f(n_b+n_a)-w(n_b+n_a)n_b-w(n_b+n_a)n_a$$

$$+\tau RB(1-\lambda)+(1-\lambda)\big(\tau R\Delta I-(v_a+v_b)\gamma\big)-dv_b+\frac{dV_b}{dt}+\frac{dV_a}{dt}+\frac{dV_B}{dt}\}$$

Which leads to the first order condition for group b:

$$J_{n_b}(n_b,n_a,B) \equiv V_{n_b}(n_b,n_a,B) = \frac{\gamma+d}{q(\theta_b)} \equiv \frac{\gamma_b}{q(\theta_b)} \tag{B.10}$$

This says that discrimination in hiring is isomorphic to having higher flow cost of posting a vacancy, $\gamma_b > \gamma_a$, for the group discriminated against.

When discrimination is at the operation level, there is a flow cost of operations per group b worker employed, n_b. This leads to the following optimization problem for the firm:

$$rV(n_b,n_a,B) = \max_{v_b,v_a,\Delta I}\{f(n_b+n_a)-w(n_b+n_a)n_b-w(n_b+n_a)n_a-dn_b$$

$$+\tau RB(1-\lambda)+(1-\lambda)\big(\tau R\Delta I-(v_a+v_b)\gamma\big)+\frac{dV_b}{dt}+\frac{dV_a}{dt}+\frac{dV_B}{dt}\}$$

After taking the envelop condition and following the same steps as in the previous subsection, the compensation profile for group b is:

$$w_b = (1-\beta)b-\beta d+\beta\frac{\gamma}{q(\theta)}(1-\lambda)m(\theta)+\frac{\beta\alpha}{1-\beta+\alpha\beta}(n_a+n_b)^{\alpha-1}$$

which leads to the following equilibrium tightness condition:

$$(\frac{\alpha}{1+\alpha\beta-\beta})(n_a+n_b)^{\alpha-1} = \frac{\gamma}{q(\theta_b)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_b)(1-\lambda)]+b+d. \quad \text{(Equilibrium } \theta\text{)}$$

Now we can proceed to show some properties about the relative labor conditions of both groups.

Proposition 1: Let group b be discriminated against in hiring or employment relative to group a. Then:

(i) *Unemployment Differential:* Unemployment for group a is strictly lower than unemployment for group b. This is, $u_b - u_a > 0$.

(ii) *Wage Gap:* The equilibrium wage for group a is higher than the equilibrium wage for group b.

(iii) *Unemployment Volatility:* The unemployment volatility for group b is higher than the unemployment volatility for group a.

Proof: (i) (a) Consider the case of discrimination in hiring. It follows that $\gamma_b > \gamma_a$. Using the equilibrium tightness conditions for both groups a and b we obtain:

$$\frac{\gamma_a}{q(\theta_a)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_a)(1-\lambda)] = \frac{\gamma_b}{q(\theta_b)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_b)(1-\lambda)] \quad \text{(B.12)}$$

Since $\gamma_b > \gamma_a$ and $m(\theta)$ and $\frac{1}{q(\theta)}$ are increasing functions of θ, it must follow that $\theta_a > \theta_b$. Therefore:

$$u_b = \frac{\delta(1-\lambda)+\lambda\delta^D}{(\delta+m(\theta_b))(1-\lambda)+\lambda\delta^D} > \frac{\delta(1-\lambda)+\lambda\delta^D}{(\delta+m(\theta_a))(1-\lambda)+\lambda\delta^D} = u_a$$

The same arguments follow under discrimination in employment.

(ii) From (i) $\theta_a > \theta_b$. Consider equation (B.12). Since $\theta_a > \theta_b$ and $m(\theta)$ is increasing, it follows that $\frac{\gamma_a}{q(\theta_a)} < \frac{\gamma_b}{q(\theta_b)}$. Therefore:

$$w_a = \frac{\beta}{1-\beta}\frac{\gamma_a}{q(\theta_a)}[(r+\delta(1-\lambda)+\lambda\delta_D)+m(\theta_a)(1-\lambda)]+b$$

$$= \frac{\gamma_a}{q(\theta_a)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_a)(1-\lambda)]+b-\frac{\gamma_a}{q(\theta_a)}(r+\delta(1-\lambda)+\lambda\delta_D)$$

$$= \frac{\gamma_b}{q(\theta_b)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_b)(1-\lambda)]+b-\frac{\gamma_a}{q(\theta_a)}(r+\delta(1-\lambda)+\lambda\delta_D)$$

$$> \frac{\gamma_b}{q(\theta_b)}[\frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)+\frac{\beta}{1-\beta}m(\theta_b)(1-\lambda)]+b-\frac{\gamma_b}{q(\theta_b)}(r+\delta(1-\lambda)+\lambda\delta_D)$$

$$= \frac{\beta}{1-\beta}\frac{\gamma_b}{q(\theta_a)}[(r+\delta(1-\lambda)+\lambda\delta_D)+m(\theta_b)(1-\lambda)]+b = w_b$$

where in the third equality we use equation (B.12) and in the inequality se used the fact that $\frac{\gamma_b}{q(\theta_b)} > \frac{\gamma_a}{q(\theta_a)}$.

(iii) From the job creation condition, an increase in productivity p entails an increase in labor market tightness and hence employment. Recall that equilibrium unemployment satisfies:

$$u = \frac{\delta(1-\lambda)+\lambda\delta^D}{(\delta+m(\theta))(1-\lambda)+\lambda\delta^D}$$

Since $m(\theta)$ is concave in θ, and $\theta_a > \theta_b$, it suffices to show that the elasticity of θ_b with respect to changes in productivity is higher than the elasticity of θ_a. Equivalently, we must show that $\frac{\frac{d\theta_a}{\theta_a}}{\frac{d\theta_b}{\theta_b}} < 1$. It suffices to show that $\frac{\theta_a}{\theta_b}$ converges to a constant from above.

Consider again equation (B.12). Define $A_0 = \frac{1}{1-\beta}(r+\delta(1-\lambda)+\lambda\delta_D)$ and $A_1 = \frac{\beta}{1-\beta}(1-\lambda)$ and recall that $q(\theta) = \frac{m(\theta)}{\theta}$. Equation (B.12) can be rewritten as:

$$\frac{\gamma_b}{\gamma_a} = \left(\frac{m(\theta_b)A_1+A_0}{m(\theta_a)A_1+A_0}\right)\frac{\theta_a}{\theta_b}$$

The left-hand side of the equation is greater than 1 courtesy of our assumption, $\gamma_b > \gamma_a$. The term in parenthesis is smaller than one since $m(\theta)$ is increasing and $\theta_a > \theta_b$. Hence, $\frac{\theta_a}{\theta_b} > \frac{\gamma_b}{\gamma_a}$. Since $m(\theta)$ is concave, an increase in θ_a implies an increase in θ_b of at least equal proportion. In the limit, as $\theta_a \to \infty$, $\frac{m(\theta_b)A_1+A_0}{m(\theta_a)A_1+A_0} \to 1$ and $\frac{\theta_a}{\theta_b} \to \frac{\gamma_b}{\gamma_a}$. □

Proposition 2: Let $L_b^i > L_b^j$ be the minority workforce size under different scenarios i, j. Let there be a policy change P such that the flow cost of posting a vacancy for both groups is equated. This is, for $\gamma_b^t > \gamma_a^t$, $P : (\gamma_a^t, \gamma_b^t) \to (\gamma^{t+1}, \gamma^{t+1})$. Then, $B_i^{t+1} > B_j^{t+1}$.

Proof: We proceed in three steps. First, we show that leverage increases with hiring. Second, we show that the smaller the difference between the flow cost of posting a vacancy for each group, the smaller will be the difference in labor market tightness between each group. Third, we show that the labor market tightness sensitivity to hiring determines the change in hiring and that this sensitivity changes with the size of the workforce.

(i) To show that leverage increases with hiring, consider the job creation and equilibrium debt conditions. Differentiating the job creation condition with respect to B and rearranging, yields:

$$\frac{\partial}{\partial n_i}\Big(\frac{\partial w_a(n_b+n_a)}{\partial B}n_a + \frac{\partial w_b(n_b+n_a)}{\partial B}n_b\Big) = -\frac{\gamma}{q(\theta_i)}(\delta^D-\delta)\frac{\partial\lambda}{\partial B}$$

which is always negative. This means that the higher the level of employment, the higher the downward pressure on wages. It follows from the equilibrium debt condition that leverage must increase with hiring.

(ii) Consider equation (B.12). An flow cost equating policy $P(\gamma_a^t, \gamma_b^t) = (\gamma^{t+1}, \gamma^{t+1})$ implies that either θ_a decreases, θ_b increases or a combination of the two. From the job creation condition for group a, an increase in flow cost from γ_a to γ entails a reduction in group a employment. By the Stole & Zwiebel bargaining protocol, a reduction in group a employment means that the firm will be hiring at a higher marginal value. This implies, by the job creation condition of group b that employment for group b will increase. How much will employment in group a decrease and employment in group b increase will depend on the sensitivity of labor market tightness to hiring for each group.

(iii) Recall that total employment for group i is given by:

$$n_i = \frac{(1-\lambda)m(\theta_i)L_i}{(\delta + m(\theta_i))(1-\lambda) + \lambda\delta^D}$$

Implicitly differencing and rearranging yields:

$$\frac{dm(\theta)}{dn} = \frac{(\delta + m(\theta))(1-\lambda) + \lambda\delta^D}{L(1-\lambda)u}$$

which goes to zero as L increases. Since $m(\theta)$ is monotonically increasing in θ, $\frac{d\theta}{dn_i} < \frac{d\theta}{dn_j}$ for $L_i > L_j$.

When the minority group has a relatively larger share of the workforce, the minority labor market tightness sensitivity to hiring is lower while the majority labor market tightness sensitivity to hiring is higher. This implies, by (ii), that employment for the minority group will increase relatively more when its share is relatively larger and, conversely, the majority group will decrease relatively less. This implies a higher equilibrium employment. Since employment is higher, by(i), leverage is relatively higher when the minority group has a larger share of the workforce. □