Is Marriage for White People? Incarceration, Unemployment, and the Racial Marriage Divide

Elizabeth M. Caucutt, Nezih Guner, Christopher Rauh*

October 2018

Abstract

The black-white differences in marriages in the US are striking. While 83% of white women between ages 25 and 54 were ever married in 2006, only 56% of black women were: a gap of 27 percentage points. Wilson (1987) suggests that the lack of marriageable black men due to incarceration and unemployment is responsible for low marriage rates among the black population. In this paper, we take a dynamic look at the Wilson Hypothesis. We argue that the current incarceration policies and labor market prospects make black men riskier spouses than white men. They are not only more likely to be, but also to become, unemployed or incarcerated than their white counterparts. We develop an equilibrium search model of marriage, divorce and labor supply that takes into account the transitions between employment, unemployment and prison for individuals by race, education, and gender. We estimate model parameters to be consistent with key statistics of the US economy. We then investigate how much of the racial divide in marriage is due to differences in the riskiness of potential spouses. We find that differences in incarceration and employment dynamics between black and white men can account for half of the existing black-white marriage gap in the data.
JEL Classifications: J12, J,21, J64,
Key Words: Marriage, Race, Incarceration, Inequality, Unemployment.

---

* *Affiliations*: Elizabeth M. Caucutt: University of Western Ontario, ecaucutt@uwo.ca. Nezih Guner: CEMFI, nezih.guner@cemfi.es. Christopher Rauh: University of Montreal, CIREQ, christopher.raphael.rauh@umontreal.ca. Guner acknowledges support from European Research Council (ERC) Grant 263600 and from the Spanish Ministry of Economy and Competitiveness (ECO2014-54401-P). The title is a play on Banks (2011). We thank our discussant at the CMSG at McGill University, Alejandro Badel, and seminar and workshop participants at the SAEe Girona, RES Meetings in Brighton, Barcelona GSE Summer Forum, EEA Meetings in Geneva, University of Barcelona, University of Cambridge, EUI, HCEO Workshop on Human Capital Formation, Family Economics at the University of Chicago, ECARES-ULB, Macroeconomics Across Time and Space Conference at Philadelphia Fed, University of Bonn, SED Edinburgh, NY Fed, VCU, McMaster, Insper, PUC Rio, McGill, Carlos III Madrid, NBER SI EFMM, and University of Laval.

1 Introduction

The black-white differences in marriages in the US are striking. Never-married white women between ages 20 and 44 are about three times more likely to get married than never-married black women (Raley et al 2015). As a result, just before the recent crisis in 2006, while 83% of white women between ages 25 and 54 were ever married, only 56% of black women were, a gap of 27 percentage points. A similar picture emerges if we look at women who are currently married, instead of ever married. While 67% of white women between ages 25 and 54 were currently married, only 34% of black women were, a gap of 33 percentage points. The differences between black and white households and family structure have been a concern for policy makers for a long time. In his famous report, Moynihan (1965) saw a clear link between family structure and growing social problems, such as poverty and crime, among the black population. Today, the growing racial gap in marital status of the US population has led some researchers to question whether marriage is only for white people (Banks 2011).

This dramatic racial gap in marriage matters, because marital structure has important implications for the living arrangements and well-being of children. In 2014, 71% of births among black women were to those who were unmarried, while the fraction of out-of-wedlock births among white women was much lower, just 29% (Hamilton et al 2015). In 2015 about 54% of black children lived with a single mother, while the share of white children living with a single mother was about 22%.[1] Differences in family structure are a contributing factor to differences in economic resources. In 2006, 33% of black children were living below the poverty line, while only 14% of white children were.[2]

A growing body of literature suggests that the conditions under which children grow up matter for their well-being as adults. Carneiro and Heckman (2003) and Cunha, Heckman, Lochner and Masterov (2006), among others, show that differences between children appear at very early ages and that the family environment plays a significant role in generating these differences. Neal and Johnson (1996) and Carneiro, Heckman, and Masterov (2005a,b) show that pre-labor market conditions can account for most of the wage gap between black and

[1]The US Census data on the Living Arrangements of Children, Tables CH2 and CH3. https://www.census.gov/data/tables/time-series/demo/families/children.html.

[2]The US Census data on Historical Poverty Tables: People and Families - 1959 to 2015. Table 3. http://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-people.html

white men.[3] Since Neal and Johnson (1996), others have tried to uncover the factors that account for the different initial conditions that black and white children face. Badel (2010), for example, builds a model of neighborhood and school choice by parents and shows that segregation by race into separate neighborhoods has an important impact on the achievement gap between black and white children. Chetty et al (2018) document that black Americans have substantially lower rates of upward mobility and higher rates of downward mobility than whites, leading to large income disparities that persist across generations. There is also a large literature that documents the effects of family structure on children (McLanahan and Sandefur 2009 and McLanahan, Tach, and Schneider 2013). Gayle, Golan and Soytas (2016) point to the importance of differences in family structure by race for intergenerational mobility. They build and estimate a model of intergenerational mobility where parents invest goods and time into the human capital accumulation of their children. Their results indicate that differences in family structure between black and white parents play a key role in accounting for differences in children's outcomes. However, they take differences in family structure as exogenous.

Why do black individuals marry at lower rates than white individuals? Wilson (1987) suggests that characteristics of the black male population, and in particular the lack of marriageable black men due to high rates of unemployment and incarceration, are an important factor contributing to the black-white differences in marital status. This is usually referred to as *the Wilson Hypothesis* in the literature. Others, e.g. Murray (1984), point to the adverse effects of the welfare state that provides incentives for single motherhood.

Early empirical work investigating the Wilson Hypothesis, such as Lichter et al (1992) and Wood (1995), exploits variations across geographic locations in the availability of marriageable men, but fails to find significant effects that could explain the racial marriage gap. On the other hand, Charles and Luoh (2010), which follows a similar approach, find strong negative effects of incarceration rates of men on both the likelihood of women ever getting married and the quality of their husbands. In a recent paper, Autor, Dorn and Hanson (forthcoming) also show that local trade (China) shocks that reduce male economic conditions reduce marriage and fertility.[4] Despite a growing empirical literature and public

[3]For a quantitative analysis on the importance of initial conditions versus life-cycle shocks, see Keane and Wolpin (1997), Storesletten, Telmer and Yaron (2004), and Huggett, Ventura and Yaron (2011), and for the racial gap in particular, see Rauh and Valladares-Esteban (2018).

[4]Other papers study how the sex ratio, the number of men for each woman, affects marriage outcomes,

interest, there have been very few attempts to account for differences in black and white marriage rates within an equilibrium model of the marriage market. Keane and Wolpin (2010) try to understand differences in schooling, fertility and labor supply outcomes of black and white women. Their estimates suggest that black women have a higher utility cost of getting married than white women and that this difference might reflect the characteristics of the available pool of men. Their analysis is silent on why black women might have a higher utility cost of getting married. Seitz (2009) builds and estimates a dynamic search model of marriage to study how much the lack of marriageable black men, as reflected in a low sex ratio, affects the marriage gap between white and black women. She finds that differences in the sex ratio by race can account for about one-fifth of the racial marriage gap. Her analysis, however, abstracts from unemployment and incarcerations risk.

In this paper, we take a *dynamic* look at the Wilson Hypothesis in order to better understand the sources of the contemporaneous racial marriage gap. Our analysis differentiates between the lack of opportunities for black women to meet black men and their decision to enter into a marriage. Given current incarceration policies and labor market prospects, black men are riskier spouses than white men. They are more likely to be, and to become unemployed or incarcerated than their white counterparts. As a result, marriage is a risky investment for black women (Oppenheimer 1988).

Since the 1970s and 1980s, there have been two major developments disproportionately affecting the riskiness of black men as spouses. First, there has been a large withdrawal of major industries from the inner cities due to skill-biased technological change and globalization, leaving many low skilled men without jobs. Between 1980 and 2000, the US lost 2 million manufacturing jobs and the decline has accelerated significantly since 2000 (Charles, Hurst and Schwartz 2018). These losses have been most pronounced for those with low levels of education. Batistich and Bond (2018) find that Japanese import competition in the 1970s and 1980s was associated with skill upgrading in manufacturing and generated a shift of employment from low skilled blacks to high educated whites. As a consequence, black men in 2006, between ages 25 and 54, are less likely to be employed, 60% vs. 85%, and more likely to be unemployed, 7.3% vs. 3.6%, than their white counterparts.[5]

e.g. Angrist (2002) and Chiappori, Fortin and Lacroix (2002). The basic idea is that a high (low) sex ratio improves marriage prospects for women (men) as well as their bargaining power within marriages.

[5]Bayer and Charles (2018) study the recent trends in black-white earnings differentials. Fryer (2011) provides an overview of racial inequality in the US. Western (2006), Neal and Rick (2014), and Lofstrom

The second major development is the drastic increase in incarceration. Almost 11% of black men between ages 25 and 54 are incarcerated in 2010. This is more than five times as high as the incarceration rate for white men of the same age. Cumulative effects of incarceration on the lives of less educated black men are very large. For black men born between 1965 and 1969, the cumulative risk of imprisonment by ages 30 to 34 was 20.5%, compared to only 2.9% for equivalent white men (Western 2006). For black men with less than high school education, the cumulative risk was close to 60%. It is not surprising that missing black men get so much media attention (Wolfers, Leonhardt and Quealy 2015).[6]

We develop an equilibrium model of marriage, divorce and labor supply that takes into account the transitions between employment, unemployment and prison. We consider the impact currently unemployed and incarcerated men have on marriage rates, as well as the role the possibility of becoming unemployed or incarcerated in the future plays. The modeling strategy is built upon recent structural/quantitative models of household formation, such as Regalia and Ríos-Rull (2001), Caucutt, Guner and Knowles (2002), Voena (2015), Fernandez and Wong (2014), Greenwood, Guner, Kocharkov, and Santos (2016), Goussé, Jacquemet and Robin (2017), Chiappori, Costa Diaz and Meghir (2017), and Low, Meghir, Pistaferri and Voena (2018).[7]

In each model period, single men and women, who differ by productivity are matched in a marriage market segmented by race. They decide whether or not to marry taking into account what their next best option is. Husbands and wives also decide whether to stay married and whether the wife works in the labor market. There is a government that taxes and provides welfare benefits to poor households. As in Burdett, Lagos and Wright (2003), men in our model move exogenously among three labor market states (employment, non-employment and prison).[8] Black and white individuals differ along three key dimensions: First, there are more black women than black men, so the sex ratio for the black population is not one. Second, black men are much more likely to go to prison than white men. Third,

and Raphael (2016) document the effects of the prison boom of recent decades on the economic prospects of the black community.

[6]Western (2006), Neal and Rick (2014), and Lofstrom and Raphael (2016) document the effects of the prison boom of recent decades on the economic prospects of the black community.

[7]Doepke and Tertilt (2016) and Greenwood, Guner and Vandenbrouke (2017) review this literature.

[8]While in our model criminal activity is not a choice, our paper is also related to the large literature, going back to Becker (1968), on the economics of crime. See, among others, Imrohoroglu, Merlo and Rupert (2000) and Lochner (2004). Guler and Michaud (2018) study persistence of criminal behavior within a dynamic general equilibrium model with overlapping generations.

black men are also more likely to lose their jobs. Because there are more black women than black men and a large number of black men are in prison, single black women might not meet anyone in the marriage market. Furthermore, because black men are more likely to go to prison or lose their jobs, meetings, even when they take place, are less likely to be converted into marriages, and existing marriages are more likely to end in divorce.

We estimate the model parameters to be consistent with key marriage and labor market statistics by gender, race and educational attainment for the US economy in 2006.[9] Without imposing racial differences in taste parameters, our model is able to generate a racial marriage gap of 24 percentage points for currently married and a difference of about 21 percentage points for ever married women. We then investigate how much of the racial divide in marriage in the model is due to differences in the sex ratio and the riskiness of potential spouses. Balancing the sex ratio between black women and men reduces the black-white marriage gap by about 20%. Differences in employment and incarceration rates account for half of the marriage gap. Finally, putting together all three pieces of the Wilson Hypothesis (eliminating black-white differences in the sex ratio, incarceration transitions, and unemployment transitions) closes more than 80% of the racial-marriage gap. The remaining gap is largely accounted for by differences in educational attainment.

We also study effects of different public policies on the racial marriage gap. We first ask how "The War on Drugs" in the US might have affected the structure of black families. To address this question, we construct hypothetical prison transitions for black men that remove individuals with drug-related offenses from the prison population. We find that this accounts for around 4% of the black-white marriage gap, which is close to half of the effect of eliminating black-white differences in incarceration. We then look at the effects of more generous welfare programs and find that the effects are small. Increasing welfare payments by 25% for single, non-working women reduces the marriage rate for both white and black women, but it has a very small effect on the racial marriage gap.

2 Incarceration, Unemployment and Marriage

In Table 1, we document the marital status of women by race since 1970 using data from the 1970-2000 US Censuses and the 2006 and 2013 American Community Survey (ACS). In

[9] We focus on 2006 in order to exclude labor-market issues during the Great Recession.

1970, 94% of white women between 25 and 54 were ever married. This measure was lower for black women in 1970, 89%. While there was a racial marriage gap back in 1970, it was small (5% points). Since 1970, the fraction of ever-married women fell for both races. By 2013, only 79% of white women were ever-married, a 15 percentage-point decline from 1970. The drop for black women, however, was more pronounced. In 2013, only 50% of black women were ever married, a decline of 39 percentage points. In Table 1, we also report the gap in the fraction of women who are currently married, which has also been widening significantly since 1970.

Table 1: Marital Status of Women by Race, 1970-2013 (%)

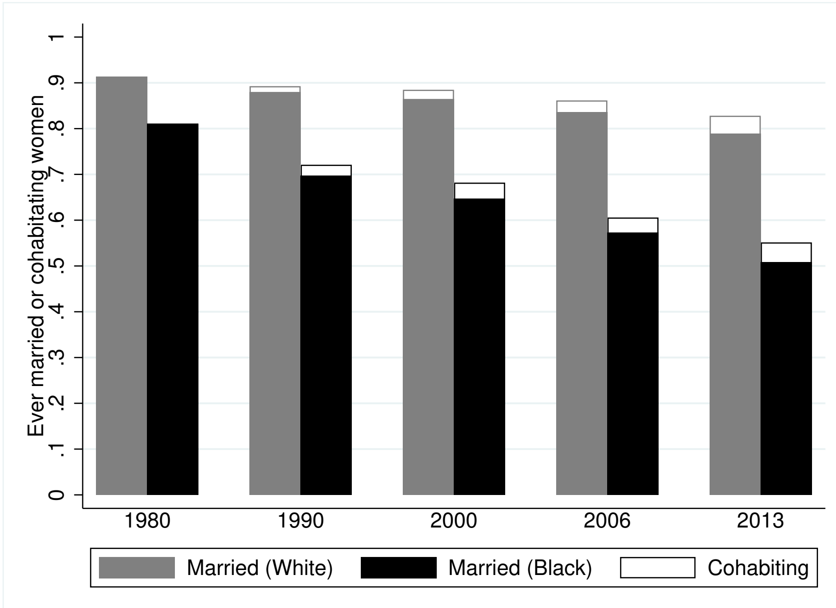
	Ever Married		Currently Married		Divorced		Divorced or Separated	
	Black	White	Black	White	Black	White	Black	White
1970	.89	.94	.65	.87	.08	.05	.24	.07
1980	.80	.91	.51	.79	.15	.10	.29	.13
1990	.68	.88	.41	.72	.17	.13	.28	.16
2000	.64	.86	.39	.69	.17	.15	.25	.17
2006	.56	.83	.34	.67	.15	.15	.23	.18
2013	.50	.79	.30	.61	.14	.15	.20	.18

The story in Table 1 does not change if we incorporate currently cohabiting couples.[10] Figure 1 shows the fraction of women between 25 and 54 who have ever married or are currently cohabiting. While cohabitation mutes the decline in marriage to some extent, the marriage gap between black and white women hardly changes.

Black individuals marry later and divorce more than white individuals. However, the lower marriage rate among the black population is primarily due to lack of entry into marriage rather than higher marital instability. The left panel of Figure 2 shows the fraction of ever-married women by different ages in 2006-2007 (Copen et al 2012). While almost 90% of white women were married by age 40, only 64% of black women were ever married by that age. As a result, the median age at first marriage is higher for black women than it is for white women. In 2010, black women married four years later than their white counterparts, 30 versus 26.4 years, while in 1970 the median age at first marriage was about 24 years for both black and white women. Before 1970, black women were marrying at an earlier age than white women (Elliot et al 2012).

[10] Unfortunately, we do not observe whether someone cohabited previously.

Figure 1: Ever Married or Cohabiting Women

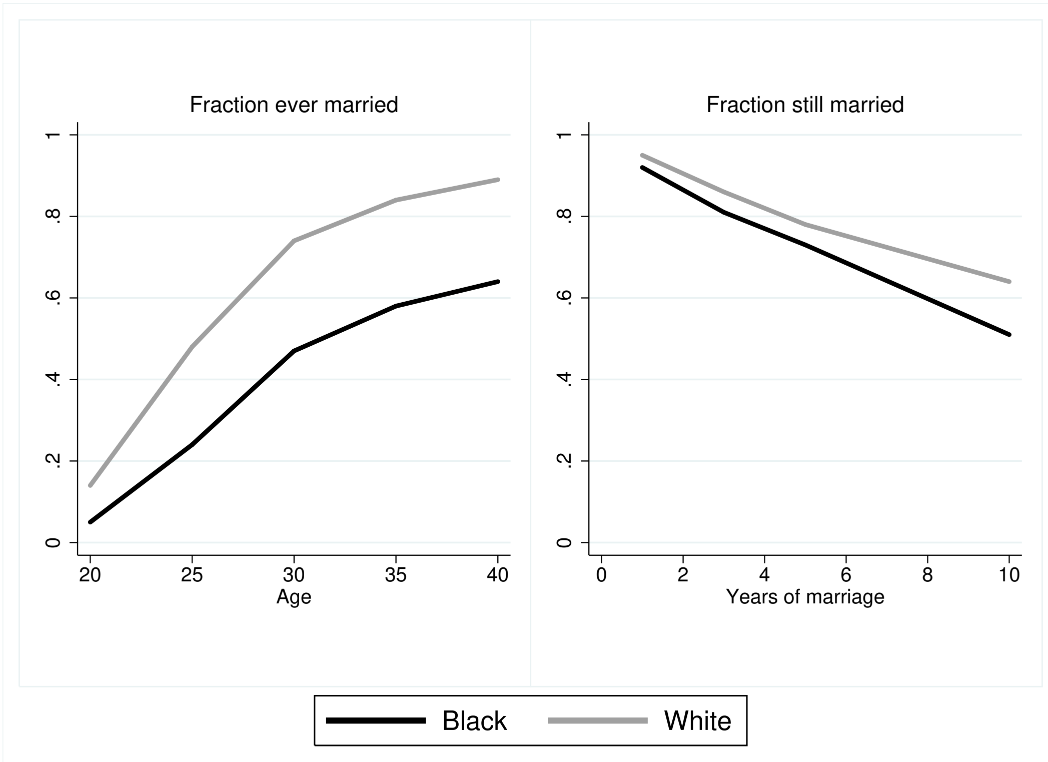


Although black couples are more likely to divorce, differences in divorce rates are less pronounced than differences in entry into marriage. The right panel of Figure 2 shows the fraction of marriages that remain intact given different years of marriage in 2002 (Goodwin et al 2010). After 5 years of marriage, about 22% and 27% of white and black women had a divorce, respectively. As a result, durations of black and white marriages are also comparable; the median duration for first marriages that end in divorce was 8.3 years for black women and 7.9 years for white women in 2009. However, upon divorce, black women are again less likely to remarry. The median duration until remarriage after divorce was 4.7 years for black women and 3.6 for white women (Kreider and Ellis 2010).

In a press conference in 1971, President Richard Nixon declared illegal drugs as public enemy number one, which the media popularized as the "War on Drugs". In 1982, President Ronald Reagan officially announced the War on Drugs leading to a substantial increase in anti-drug funding and incentives for police agencies to arrest drug offenders. As part of the Comprehensive Crime Control Act of 1984, the Sentencing Reform Act and the Asset Forfeiture Program were introduced, of which the latter permitted federal and local law enforcement agencies to seize assets and cash under the suspicion of being related to illegal drug business.[11] The Sentencing Reform Act as well as the subsequent Anti-Drug Abuse

[11] Baicker and Jacobson (2007) find that police agencies responded by increasing drug arrest rates.

Figure 2: Fraction Ever Married Women by Age (left panel) and Fraction Still Married Women by Duration of Marriage (right panel)



Act of 1986 included penalties such as mandatory minimum sentences for drug distribution. The federal criminal penalty for crack cocaine relative to cocaine was set to 100:1, which disproportionately affected poor black, and in particular, urban, neighborhoods. It was not until the Fair Sentencing Act of 2010 that this disparity was reduced to 18:1. In 1994 President Bill Clinton endorsed the "three strikes and you're out" principal, which led to multiple states adopting laws that sentenced offenders to life for their third offense (West, Sabol and Greenman 2010). Neal and Rick (2016) show that these changes in policies causally increased incarceration. State prisoners held for drug offenses in 2006 nearly match the number of total state prisoners for any offense in 1980 (264,300 vs 304,759 (BJS 1981)).[12] A criminal record makes it difficult to find a job after time in prison. As a result, the unemployment rate among black men has also soared (Page 2007).

Table 2 shows the fraction of men between 25 and 54 who are incarcerated or not employed (i.e. unemployed or out of the labor force). In 1970, about 17% of black men and 7.4% of

[12] 95% of prisoners are held in state rather than federal correctional facilities.

white men were either in prison or unemployed. By 2013, these numbers had risen to around 40% of black men and 17.5% of white men. During this period, there was a more than four-fold increase in the fraction of black men who were incarcerated (from 2.1% to 9%) and a nearly twofold increase in the fraction of black men who were non-employed (from 15% to 31%).

Table 2: Incarceration and Non-employment of Men by Race, 1970-2013

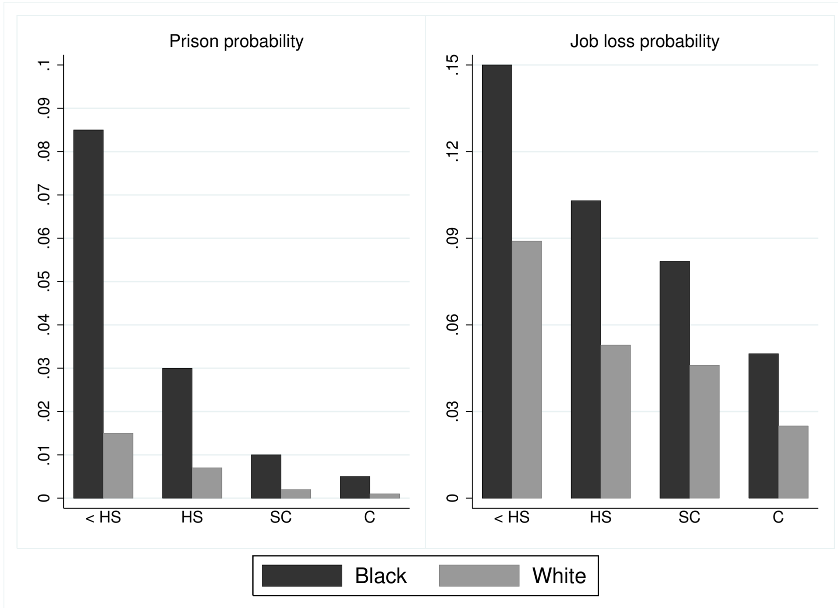
	Incarceration		Non-employment	
	Black	White	Black	White
1970	.021	.003	.146	.071
1980	.027	.003	.220	.098
1990	.066	.010	.240	.096
2000	.096	.014	.291	.118
2006	.091	.013	.272	.129
2013	.090	.015	.309	.160

The numbers in Table 2 reflect very significant differences in the risk of incarceration between black and white men. Figure 3 shows the probability that a man between 25 and 54 goes to prison (left panel) or loses his job (right panel) in a given year. A black man with less than a high school (with a high school) education has an 8.5% (3%) chance of going to prison. The risk is about 1.5% (0.7%) for a white man with the same level of education. Black men with less than a high school (with a high school) education face a 15% (10%) probability of losing their jobs compared to 9% (5%) for equally educated white men.

To gain a better understanding of the relationship between incarceration and marriage, we turn to state level data. The left panel in Figure 4 shows the relationship between the racial differences in incarceration rates and marriage rates across US states in 2006. The states in which there is a larger racial gap in incarceration rates, such as Pennsylvania and Wisconsin, are also the ones in which we observe a high racial gap in marriage. The effects are even stronger if we look at the black-white differences in non-employment rates, as can be seen in the right panel of Figure 4.

The negative relationships in Figure 4 could be due to racial differences in preferences for marriage. In the left panel of Figure 5, we add a time dimension to the cross-sectional dimension by taking the difference in difference between the increase in incarceration rates of black and white men between 1980 and 2006 by state and the difference in difference in

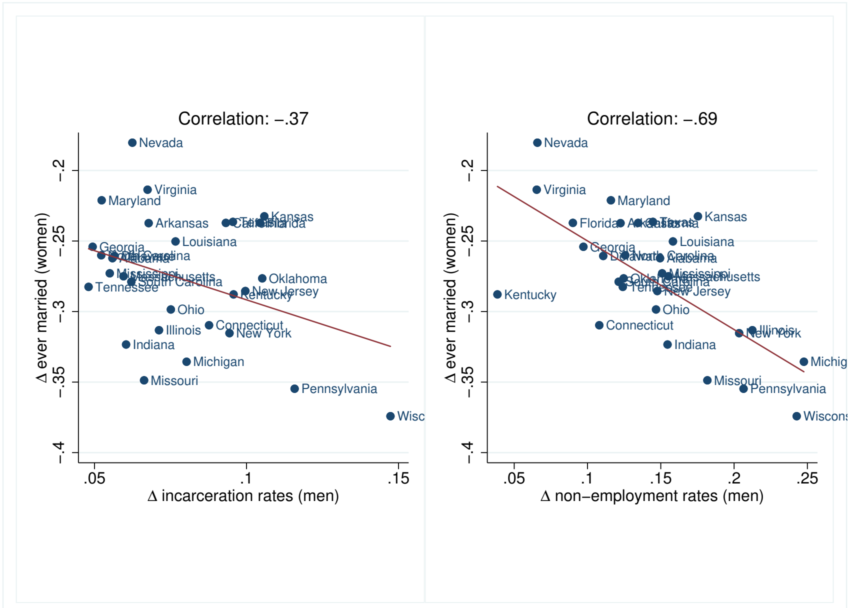
Figure 3: Probability of Going to Prison (left) or Losing Job (right) for Men in a given Year



black versus white women who are ever married. We find that the negative relationship between incarceration and marriage still holds, even when removing any traits by race that are constant over time. In Pennsylvania, for instance, the incarceration rate of black relative to white men increased by more than 8 percentage points, and during the same time period the likelihood of ever being married for black relative to white women fell by around 23 percentage points. In the right panel of Figure 5, we look at non-employed men. Again there remains a strong negative relationship between the increase in non-employment of men versus the decline of ever married women.[13] In Section 6, we investigate whether a calibrated version of our model economy is able to generate an elasticity of marriage rates with respect to incarceration rates that is in line with the evidence provided in Figure 5.

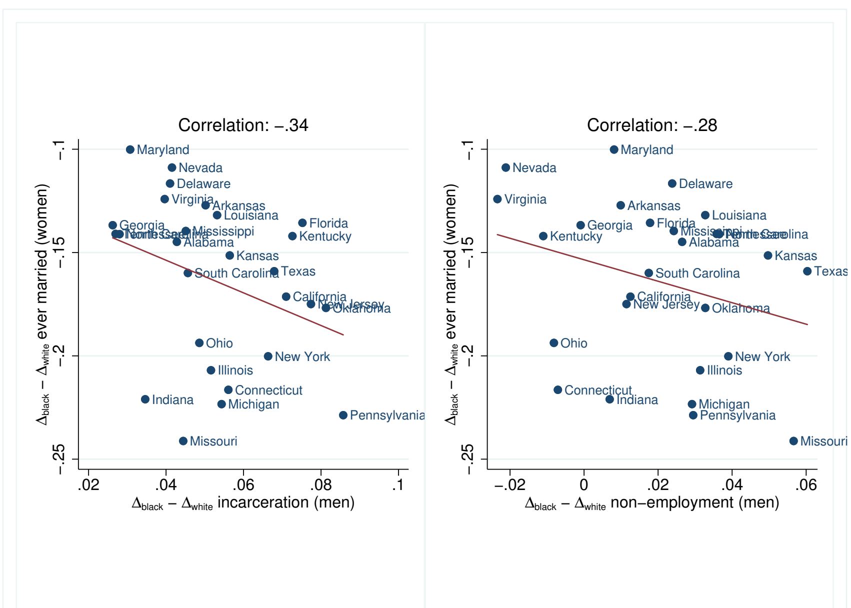
[13]In Appendix Figure F1, we look at the relationship of both incarceration and non-employment together versus ever married women and find the same patterns.

Figure 4: Black-White Differences in 2006 in Marriage, Incarceration, and Non-employment



Notes: The x-axis shows the difference of black and white men in the incarceration rate in the left panel and the non-employment rate in the right panel. The y-axis shows the difference in ever married black and white women in both panels.

Figure 5: Black-White Differences in Changes in Marriage, Incarceration, and Non-employment between 1980 and 2006



Notes: The x-axis shows the difference in difference of black and white men from 1980 to 2006 in the incarceration rate in the left panel and the non-employment rate in the right panel. The y-axis shows the difference in difference from 1980 to 2006 in ever married black and white women in both panels.

3 The Economic Environment

We study a stationary economy populated by a continuum of men and a continuum of women. Let $g \in \{f, m\}$ denote the gender of an individual. Individuals also differ by race, black or white, indicated by $r \in \{b, w\}$. Individuals face a constant probability of survival each period, ρ. Those who die are replaced by a measure $(1-\rho)$ of newborns. Agents discount the future at rate $\widetilde{\beta}$, so $\beta = \rho\widetilde{\beta}$ is the discount factor taking into account the survival probabilities. Among individuals who enter the model economy each period, the sex ratio (men/women) is assumed to be one for the white population and it is assumed to be less than one for the black population.

Individuals are born with a given education level: high school dropout, high school graduate, some college, or college graduate. We denote the education level of a woman by x and that of a man by z. The education level is a permanent characteristic of an individual that remains constant over his/her life and maps directly into a wage level. Wages differ by gender, race and education and are denoted by $\omega_m^{z,r}$ and $\omega_f^{x,r}$. Each period, individuals also receive a persistent earnings shock denoted by $\varepsilon \in \mathcal{E} \equiv \{\varepsilon_1, \varepsilon_2, ..., \varepsilon_{N_\varepsilon}\}$.

Individuals participate in labor and marriage markets. At any point in time, men are in one of three labor market states: employed (e), non-employed (u) or in prison (p). Women do not go to prison.[14] They are employed (e) or non-employed (u). Single women and single men, who are not in prison, meet each other in a marriage market and decide whether to get married. Because some men are in prison, and the sex ratio can be less than one, there are more women than men in the marriage market. This imbalance is potentially larger for black men and women. As a result, some single women do not meet anyone in the marriage market. Let S and M denote single and married individuals, respectively.

Due to the underlying heterogeneity and individual decisions, some households in the model are married couples, while others are made up of a single-man or a single-woman. In some married households both the husband and the wife work, while in others one or both members are non-employed, yet in others the husband is in prison. Similarly, some single women work, while others don't, and some single men might be in prison. Among individuals who work some are lucky and enjoy a high ε, while others are unlucky and have

[14]According to Bureau of Justice Statistics, only about 7% of prison and 9% of jail populations were women in 2013 (http://www.bjs.gov/content/pub/pdf/cpus13.pdf).

a low ε.

3.1 Labor Markets and Prison Transitions for Men

There is an exogenous Markov process for men among the three labor market states, (e, u, p), which depends on their race and education.[15] Men do not make a labor supply decision, whenever they are employed they supply hours exogenously. Hours are denoted by $\overline{n}_m^{S,r}$ and $\overline{n}_m^{M,r}$, for single and married men, respectively.

Let $\Pi^{z,r}(\lambda', \varepsilon'|\lambda, \varepsilon)$ be the probability that a man with current labor market status $\lambda \in \{e, u, p\}$ and labor market shock ε moves to state (λ', ε') next period. These transitions depend on education (z) and race (r). We construct the transitions in three steps. First, let $\Lambda^{z,r}(\lambda'|\lambda)$ be the transition matrix for labor market status λ:

$$\Lambda^{z,r}(\lambda'|\lambda) = \begin{array}{c c} & \begin{array}{ccc} p & u & e \end{array} \\ \begin{array}{c} p \\ u \\ e \end{array} & \begin{pmatrix} \pi_{pp} & \pi_{pu} & \pi_{pe} \\ \pi_{up} & \pi_{uu} & \pi_{ue} \\ \pi_{ep} & \pi_{eu} & \pi_{ee} \end{pmatrix} \end{array},$$

which determines how men move between employment, non-employment, and prison.

Next, we define a transition matrix for idiosyncratic productivity shocks ε, given by:

$$\Upsilon_m^{z,r}(\varepsilon'|\varepsilon) = \begin{array}{c c} & \begin{array}{ccccc} \varepsilon_1 & \varepsilon_2 & \cdots & \varepsilon_{N_\varepsilon} \end{array} \\ \begin{array}{c} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_{N_\varepsilon} \end{array} & \begin{pmatrix} \pi_{11} & \pi_{12} & \cdots & \pi_{1N_\varepsilon} \\ \pi_{21} & \pi_{22} & \cdots & \pi_{2N_\varepsilon} \\ \vdots & \vdots & \vdots & \vdots \\ \pi_{N_\varepsilon 1} & \pi_{N_\varepsilon 2} & \cdots & \pi_{N_\varepsilon N_\varepsilon} \end{pmatrix} \end{array},$$

where $\pi_{i1} + \pi_{i2} + ... + \pi_{iN_\varepsilon} = 1$ for each i. An employed man becomes unemployed with probability π_{eu} or goes to prison with probability π_{ep}. With the remaining probability, he stays employed and draws a new productivity shock according to $\Upsilon_m^{z,r}(\varepsilon'|\varepsilon)$. Finally, we assume that all men who move from prison to employment receive ε_1 (the lowest wage shock), while those who move from unemployment to employment draw ε from a distribution denoted by $\widetilde{\Upsilon}_m^{z,r}(.)$.

[15]We don't allow the Markov process to vary by whether an individual has previously been to prison, because we can't identify such differences due to data limitations.

The composite of these three steps yields $\Pi^{z,r}(\lambda', \varepsilon'|\lambda, \varepsilon)$:

$$\Pi^{z,r}(\lambda', \varepsilon'|\lambda, \varepsilon) = \begin{array}{c} \\ p \\ u \\ \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_{N_\varepsilon} \end{array} \begin{array}{c} \begin{array}{cccccc} p & u & \varepsilon_1 & \varepsilon_2 & \cdots & \varepsilon_{N_\varepsilon} \end{array} \\ \begin{pmatrix} \pi_{pp} & \pi_{pu} & \pi_{pe} & 0 & \cdots & 0 \\ \pi_{up} & \pi_{uu} & \pi_{ue}\widetilde{\Upsilon}^{z,r}_m(\varepsilon_1) & \pi_{ue}\widetilde{\Upsilon}^{z,r}_m(\varepsilon_2) & \cdots & \pi_{ue}\widetilde{\Upsilon}^{z,r}_m(\varepsilon_{N_\varepsilon}) \\ \pi_{ep} & \pi_{eu} & \pi_{ee}\pi_{11} & \pi_{ee}\pi_{12} & \cdots & \pi_{ee}\pi_{1N_\varepsilon} \\ \pi_{ep} & \pi_{eu} & \pi_{ee}\pi_{21} & \pi_{ee}\pi_{22} & \cdots & \pi_{ee}\pi_{2N_\varepsilon} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \pi_{ep} & \pi_{eu} & \pi_{ee}\pi_{N_\varepsilon 1} & \pi_{ee}\pi_{N_\varepsilon 2} & \cdots & \pi_{ee}\pi_{N_\varepsilon N_\varepsilon} \end{pmatrix} \end{array}.$$

Upon getting out of prison, a man moves to unemployment with probability π_{pu} or gets a job with probability π_{pe}. If he gets a job, then his productivity shock is equal to ε_1. Similarly, an unemployed man goes to prison with probability π_{up} or finds a job with labor market shock ε_j with probability $\pi_{ue}\widetilde{\Upsilon}^{z,r}_m(\varepsilon_j)$. Finally, an employed man with current productivity shock ε_i goes to prison with probability π_{ep} or becomes unemployed with probability π_{eu}. Otherwise, he moves to another labor market shock ε_j next period with probability $\pi_{ee}\pi_{ij}$.

A man who has spent time in prison faces a wage penalty. Let $P \in \{0, 1\}$ denote whether a man has ever been in prison and $\psi^r(P)$ be the associated wage penalty, where $\psi^r(0) = 1$, and $\psi^r(1) < 1$.[16] Earnings of a married (or single) man of type-z with productivity shock ε and prison history P are given by $\omega^{z,r}_m \varepsilon \psi^r(P)\overline{n}^{M,r}_m$ (or $\omega^{z,r}_m \varepsilon \psi^r(P)\overline{n}^{S,r}_m$).

3.2 Labor Market Transitions for Women

Because women do not go to prison, each period they are either employed (e) or non-employed (u). Unlike men, women make a labor force participation decision. We assume that each period a non-employed woman receives an opportunity to work with probability $\theta^{x,r}$ in which case she decides whether to work. Each period an employed woman faces a probability $\delta^{x,r}$ of losing her job and becoming non-employed. Employed women who maintain their jobs also decide whether to work. Women who work supply $\overline{n}^{S,r}_f$ or $\overline{n}^{M,r}_f$ hours, which depend on their marital status and race.

Like men, each period women receive a productivity shock ε. If a married (or single) woman decides to work, her earnings are given by $\omega^{x,r}_f \varepsilon \overline{n}^{M,r}_f$ (or $\omega^{x,r}_f \varepsilon \overline{n}^{S,r}_f$). As long as a

[16] Waldfogel (1994) and Western (2006) document the wage and employment penalties suffered by ex-convicts, while Kling (2006) shows that conditional on conviction, the length of incarceration has no additional impact. Our model assumptions are consistent with these findings, i.e. the extensive margin of incarceration brings a wage penalty that is independent of the intensive margin.

woman is employed, her productivity shock ε follows a Markov process denoted by $\Upsilon_f^{x,r}(\varepsilon'|\varepsilon)$. When a non-employed woman becomes employed, she draws a new productivity shock from $\widetilde{\Upsilon}_f^{x,r}(\varepsilon)$.

Working is costly for a woman and her family. If a woman does not work, then she (if she is single) or both she and her husband (if she is married) enjoy a utility benefit q. We assume that q is distributed among women according to $q \sim Q(q)$. Women draw q at the start of their lives and it remains with them forever. This captures additional heterogeneity in female labor force participation decisions.[17] The labor supply decision of a woman depends on her education level, her marital status and her husband's characteristics, her current labor market shocks, as well as her value of staying at home.

3.3 Marriage and Divorce

We assume that there is a marriage market in which single people from each race meet others of the opposite sex of the same race.[18] Some women do not meet a man, because some men are in prison. Furthermore, when individuals enter into the model, there are more black women than men. As a result, a woman meets a man with probability $\kappa^{x,r} < 1$. Within each marriage market, a person of race r and gender g meets someone with the same education with probability $\varphi_g^{x,r}$ and meets other singles, from the education distribution of current singles, randomly with the remaining probability $1 - \varphi_g^{x,r}$. The φ parameters capture forces, such as residential segregation or network effects, that give rise to assortative mating by education but that are not explicitly modeled here.[19]

Upon meeting, couples observe a permanent match quality γ, with $\gamma \sim \Gamma(\gamma)$. The value of γ remains constant as long as the couple remains married. Couples also observe a transitory match quality shock ϕ, with $\phi \sim \Theta(\phi)$. Unlike γ, couples draw a new value of ϕ each period. Along with γ and ϕ, individuals observe their partner's permanent education and home value characteristics, i.e. z, x, and q, their labor market status λ (which can be e, u or p), labor

[17]Guner, Kaygusuz and Ventura (2012) and Greenwood et al. (2016) follow a similar strategy to model female labor force participation.

[18]We abstract from inter-racial marriages. In 2006 only 0.3% of white husbands had black wives and 9.6% of black husbands had white wives. Chiappori, Oreffice and Quintana-Domeque (2016) provide an empirical analysis of black-white marriage and study the interaction of race with physical and socioeconomic characteristics. Wong (2003) estimates a structural model of inter-racial marriages, and factors behind the low level of black-white marriages in the US.

[19]Fernandez and Rogerson (2001) follow a similar strategy to generate positive assortative mating.

market shocks ε, as well as the prison history of the man P at *the start of a period*, and decide whether to get married based on this information. A marriage is feasible if and only if both parties agree. Once marriage decisions are made, labor market status and labor market shocks for *the current period* are realized, and agents, married or single, make consumption and labor supply decisions.

Because labor market status and labor market shocks are revealed only after marriage decisions are made, people decide whether to marry based on the expected value of being married conditional on their own and their partners' current labor market status and labor market shocks. After getting married, the husband or the wife might lose his/her job or draw a better or worse wage shock, or the husband might go to prison.

Each period, currently married couples decide whether to get divorced. This decision is also made based on all available information at the start of the period. Divorce is unilateral, and if a couple decides to divorce, each party suffers a one-time utility cost, η. Note that given this information structure, a wife whose husband ends up in prison in a period can opt for divorce only at the start of the next period.

Finally, we assume that married couples must finance a fixed consumption commitment, $\underline{c}(x, z)$, each period. This consumption commitment captures expenditures, such as the fixed cost of a larger house and basic furniture, or costs associated with children, that a married couple cannot avoid. This model feature follows Santos and Weiss (2016) and Sommer (2016). Santos and Weiss (2016) suggest that an important factor for the decline and delay of marriage in the US was the rise in idiosyncratic labor income volatility. In their model, consumption commitments make marriage less attractive when there is higher income volatility. In Sommer (2016), consumption commitments lower fertility in the face of higher idiosyncratic income risk. In the current model, consumption commitments play a similar role. Black individuals, who face more labor market uncertainty, both in terms of transitions to unemployment and prison as well as productivity shocks, will tend to marry less frequently to avoid incurring this fixed cost.[20]

[20] Chetty and Szeidl (2007) study how consumption commitments affect risk preferences and show that they amplify risk aversion. Using data from the CEX they document that more than 50% of the average household budget is hard to change in the face of moderate income shocks.

3.4 Government

There is a government that taxes labor earnings at a proportional rate τ and finances transfers to households. These transfers depend on pre-tax, household income. Let $T_f^S(Y)$, $T_m^S(Y)$ and $T^M(Y)$ denote the transfers received by single women, single men and married couples with total pre-tax household income Y, respectively. We assume that these transfer functions take the following form (where we suppress the dependence on gender and marital status)

$$T(Y) = \begin{cases} b_0 \text{ if } Y = 0 \\ \max\{0, b_1 - b_2 Y\} \text{ if } Y > 0. \end{cases}$$

If a household has zero earnings, they receive b_0. If they have positive earnings, transfers decline at rate b_2. As a result, there is an income level above which transfers are zero.

4 Household Problems

4.1 Single Women

We begin by developing the household decision problems facing single people and couples, after all uncertainty in a period is realized, and households are making their labor supply decisions. These value functions depend on current utility and the value of starting next period either single or married before marriage markets take place and before any uncertainty is realized. We define these start-of-period value functions in the next section. The within period (post-marriage decision and after all uncertainty is realized) value functions are denoted as V, while the start of period (pre-marriage market and before all uncertainty is realized) value functions are denoted as $\tilde{V}$. Because marriage markets are segmented by race, we do not indicate explicitly the race of an individual with the understanding that meeting probabilities; wages, hours worked, and exogenous labor market and prison transitions for men; and arrival of employment opportunities and job destruction probabilities for women differ by race.

Consider the problem of a single woman whose state is given by $\mathcal{S}_f^S = (x, q, \varepsilon)$, and employment draw, λ. If $\lambda = e$, she can choose to work $\overline{n}_f^S$ or not to work. If $\lambda = u$, she is non-employed and does not have any labor income. A single woman's pre-tax labor income is given by $Y_f^S = \omega_f^x \overline{n}_f^S \varepsilon$, if she works and by $Y_f^S = 0$, if she does not. Given government transfers, a single woman's after tax-and-transfer income is $Y_f^S(1-\tau) + T_f^S(Y_f^S)$. Finally, if she does not work, she enjoys the utility of staying home, q.

At the start of the next period, she enters the marriage market. The value of being in the marriage market at the start of the next period depends on her state, $\mathcal{S}_f^S$, and her employment status, λ'. This is denoted by the value function $\widetilde{V}_f^S(\mathcal{S}_f^S, \lambda')$. As will become clear below, $\tilde{V}$ depends on the distribution of single men that are available in the marriage market next period. Given $\widetilde{V}_f^S(\mathcal{S}_f^S, \lambda')$, the value of being a single woman in the current period is given by

$$V_f^S(\mathcal{S}_f^S, \lambda) = \max_{n_f^S}\{\frac{c^{1-\sigma}}{1-\sigma} + \chi_{(n_f^S=0)}q + \beta\widetilde{V}_f^S(\mathcal{S}_f^S, \lambda')\},$$

subject to

$$c = Y_f^S(1-\tau) + T_f^S(Y_f^S)\ ,\ n_f^S = \begin{cases} \in \{0, \overline{n}_f^S\} \text{ if } \lambda = e \\ 0 \text{ if } \lambda = u \end{cases}\ ,\ \lambda' = \begin{cases} e \text{ if } n_f^S > 0 \\ u, \text{ otherwise} \end{cases},$$

where χ is an indicator function such that $\chi_{(n_f^S=0)} = 1$, and Y_f^S is defined as above. Note that her labor market status at the start of next period, λ', is determined by her current labor market status, λ, and her labor supply decision this period. If $\lambda = u$, then $\lambda' = u$ as well. If $\lambda = e$ and she decides to work, then $\lambda' = e$, otherwise, $\lambda' = u$.

4.2 Single Men

A single man's state is given by $\mathcal{S}_m^S = (z, \lambda, \varepsilon)$ and his prison history indicator, P. A single man makes no decisions. If $\lambda = e$, he works $\overline{n}_m^S$ and earns pre-tax income $Y_m^S = \omega_m^z \overline{n}_m^S \psi(P)\varepsilon$. His consumption is then, $c = Y_m^S(1-\tau) + T_m^S(Y_m^S)$, where the second term represents transfers from the government. Recall that criminal history results in a wage penalty of $\psi(P) < 1$, if $P = 1$. If a man is unemployed, he does not work, $Y_m^S = 0$, and his only income comes from government transfers. Finally, when a man is in prison we assume that he consumes an exogenously given level of consumption c_p.[21] Then the value of being a single man in the current period, once uncertainty is realized, is given by

$$V_m^S(\mathcal{S}_m^S, P) = \frac{c^{1-\sigma}}{1-\sigma} + \beta\widetilde{V}_m^S(\mathcal{S}_m^S, P'),$$

subject to

$$c = \begin{cases} Y_m^S(1-\tau) + T_m^S(Y_m^S) \text{ if } \lambda \neq p \\ c_p \text{ if } \lambda = p \end{cases} \quad \text{and } P' = \begin{array}{l} 1 \text{ if } \lambda = p \\ P \text{ otherwise,} \end{array}$$

[21]Because we do not conduct any normative analysis, and also do not finance c_p by taxes, its specified level does not matter for the quantitative analysis.

where Y_m^S is defined as above, and $\widetilde{V}_m^S(\mathcal{S}_m^S, P')$ is the value of starting next period as a single man, which will depend on the distribution of single women next period. Note that if a man is in prison this period, $\lambda = p$, then next period P' is 1 (regardless of his criminal history). Otherwise, $P' = P$ and his criminal record is not updated.

4.3 Married Couples

The problem for a married couple, with all uncertainty resolved, depends on their current state $\mathcal{S}^M = (x, q, \varepsilon_f; z, \lambda_m, \varepsilon_m; \gamma, \phi)$, which combines the characteristics of the wife, (x, q, ε_f), those of the husband, $(z, \lambda_m, \varepsilon_m)$, their match qualities γ and ϕ, the wife's employment status, λ_f, and the husband's prison history indicator, P. We assume that a married household maximizes the weighted sum of utilities, with exogenous weight on the woman given by μ.

The only decision a married couple makes is whether the wife works, and this is relevant only when $\lambda_f = e$. This decision, along with the husband's employment/prison status determines household pre-tax income, Y^M. If the wife works, she contributes, $\omega_f^x \overline{n}_f^M \varepsilon_f$. If the husband works, he contributes, $\omega_m^z \overline{n}_m^M \psi(P)\varepsilon_m$. Consumption for each household member is then given by $c = \frac{1}{1+\xi}(Y^M(1-\tau) + T^M(Y^M) - \underline{c})$, where $0 \leq \xi < 1$ captures economies of scale in household consumption. Note, if the husband is in prison then $\xi = 0$, and the husband consumes c_p. Whatever the labor market status of the couple is (even if the husband is in prison), the non-incarcerated wife still pays the fixed cost $\underline{c}(x, z)$. Whenever the wife does not work, both the wife and the husband enjoy q.

At the start of each period, a married couple decides whether to get divorced. Recall that couples make their marriage/divorce decisions after they observe the new value of the match quality, ϕ, but before their labor market statuses update. Let $\widetilde{V}_g^M(\mathcal{S}^M, \lambda_f', P')$ for $g \in \{f, m\}$ be the value of being married at the start of the next period, with an option to divorce.

The problem of a married couple in the current period is:

$$\max_{n_f^M} \left[\mu \frac{c_f^{1-\sigma}}{1-\sigma} + (1-\mu)\frac{c_m^{1-\sigma}}{1-\sigma} + \chi_{(n_f^M=0)} q + \gamma + \phi + \mu\beta E_{\phi'} \widetilde{V}_f^M(\mathcal{S}^M, \lambda_f', P') + \right.$$
$$\left. (1-\mu)\beta E_{\phi'} \widetilde{V}_m^M(\mathcal{S}^M, \lambda_f', P') \right],$$

subject to

$$c_f = \frac{1}{1+\xi}\left[Y^M(1-\tau) + T^M(Y^M) - \underline{c}(x,z)\right] \text{ where } \xi = 0 \text{ if } \lambda_m = p,$$

and

$$c_m = \begin{cases} c_p, \text{ if } \lambda_m = p \\ c_f, \text{ otherwise} \end{cases}, n_f^M = \begin{cases} \in \{0, \overline{n}_f^M\} \text{ if } \lambda_f = e \\ 0 \text{ if } \lambda_f = u \end{cases},$$

$$P' = \begin{cases} 1 \text{ if } \lambda = p \\ P \text{ otherwise} \end{cases}, \text{ and } \lambda_f' = \begin{cases} e \text{ if } n_f^M > 0 \\ u, \text{ otherwise} \end{cases},$$

where Y^M is defined as above. Note that the labor market status of the wife at the start of next period is determined by her employment status and labor supply choice in the current period. The prison history indicator for the husband at the start of next period is updated if the husband is in prison that period. Let the value functions for wives and husbands associated with this problem be given by $V_f^M(\mathcal{S}^M, \lambda_f, P)$ and $V_m^M(\mathcal{S}^M, \lambda_f, P)$, respectively.

4.4 Start-of-the-Period Values

Consider now the value of being a single woman at the start of a period and participating in the marriage market. A single woman meets a single man with probability κ^x, observes his start-of-the-period state, i.e. $\lambda_m \in \{e, u, p\}$, ε_m, and P. Upon a match, the couple draws γ (the permanent match quality) and ϕ (the transitory match quality). Then they decide whether to get married. A marriage is only feasible if both parties agree. Note that κ^x is an endogenous object, which depends on the fraction of single men who are in prison.

Let $EV_f^M(x, q, \lambda_f, \varepsilon_f; z, P, \lambda_m, \varepsilon_m; \gamma, \phi)$ be the expected value of entering into a marriage for a woman *before* the labor market shocks are updated, and let the function $I_m(.)$ indicate whether this marriage is acceptable for the man. Finally, let $\Omega(z, P, \lambda_m, \varepsilon_m)$ be the distribution of single men in the marriage market, which is an *endogenous* object. In the marriage market, a woman of type x, meets a man of the same type, $x = z$, with probability φ_f^x, and matches randomly with probability $(1 - \varphi_f^x)$.

The value of being a single woman at the start of the period (before the matching takes place) is then given by:

$$\begin{aligned}\widetilde{V}_f^S(x,q,\lambda_f,\varepsilon_f) \;=\;& (1-\kappa^x)EV_f^S(x,q,\lambda_f,\varepsilon_f)+ \\ & \kappa^x\varphi_f^x \sum_{P,\lambda_m,\varepsilon_m,\gamma,\phi} \max\{EV_f^M(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\ & I_m(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi), \\ & EV_f^S(x,q,\lambda_f,\varepsilon_f)\}\Gamma(\gamma)\Theta(\phi)\Omega(z,P,\lambda_m,\varepsilon_m|z=x)\} \\ & +\kappa^x(1-\varphi_f^x)\sum_{z,P,\lambda_m,\varepsilon_m,\gamma,\phi} \max\{EV_f^M(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\ & I_m(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi), \\ & EV_f^S(x,q,\lambda_f,\varepsilon_f)\}\Gamma(\gamma)\Theta(\phi)\Omega(z,P,\lambda_m,\varepsilon_m)\}.\end{aligned} \tag{1}$$

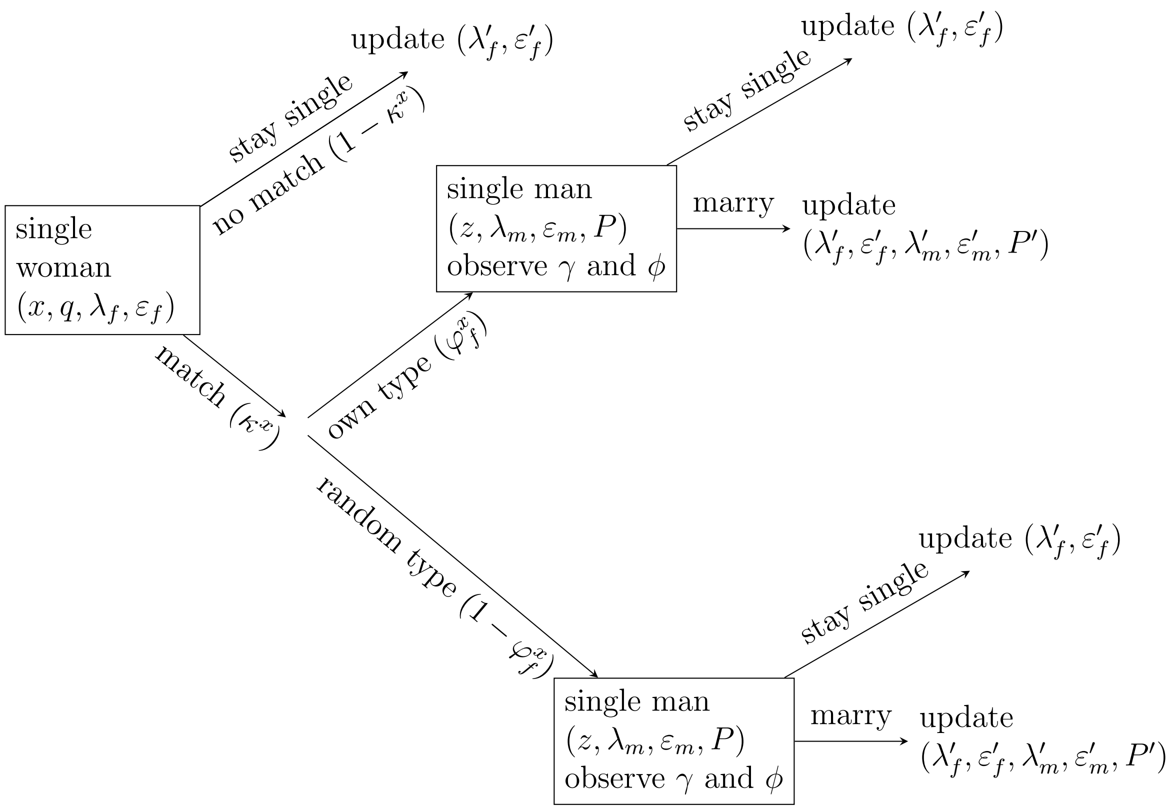
Figure 6 illustrates the decision tree behind the value function in Equation 1. The expected value of being single, $EV_f^S(x,q,e,\varepsilon_f)$, depends on how labor market, λ_f, and wage shocks, ε_f, evolve next period. Similarly, the expected value of being married to a type-$(z,P,\lambda_m,\varepsilon_m)$ man with match qualities γ and ϕ, $EV_f^M(x,q,u,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi)$, depends on how labor market and wage shocks for both parties evolve. We detail these functions as well as the remaining start of period value functions, $\widetilde{V}_m^S, \widetilde{V}_f^M$, and $\widetilde{V}_m^M$ in Appendix A.

5 Quantitative Analysis

The quantitative analysis focuses on black and white non-hispanics and non-immigrants between ages 25 and 54. We fit our model economy to US data for 2006. We assume that the length of a model period is one year. In this section, we describe how we construct the key model inputs: distribution of population by race and education, wages, hours worked and most importantly transitions between employment, non-employment and prison for men. We also present the details of the welfare system. In the next section, we discuss our calibration strategy and compare the benchmark economy with the data.

We assume that there are four types (education groups): less than high school (<HS), high school (HS), some college (SC), and college and above (C). Table 3 shows how the population is distributed across gender, and education within each race based on the 2006 US American Community Survey (ACS) from the Integrated Public Use Microdata Series (King 2010). The fractions for each race sum to one in Table 3. In the benchmark economy, 88% of the population are white and the rest are black. Based on Table 3, where 46.5% of the

Figure 6: Decision tree for single women



black population is male, we assume that when individuals enter into the model economy, there are 0.87 (46.5/53.5) black men for each black woman, or there are 15.2% more black women than black men (53.5-46.5)/46.5. The sex ratio for the white population is set to 1. This exogenous sex ratio, together with single men who are in prison determines $\kappa^{x,r}$, the probability that a single woman meets a man in the marriage market.

White individuals on average are more educated than black individuals, and women are more educated than men. The college-education gap between black women and men is particularly striking. About 10% of the black population consists of college-educated women while only 6.5% are college-educated men. This gap is smaller for white women and men (17% versus 15.5%).

Wages Table 4 shows hourly wages in the data, which map directly to $\omega_f^{x,r}$ and $\omega_m^{z,r}$ for $r \in \{b, w\}$ in the model. We compute mean hourly wages conditional on gender and race from the 2006 American Community Survey (ACS). We then normalize mean hourly wages for each group by the overall mean of hourly wages in the economy ($20.70). For each

Table 3: Distribution of Population

	Black			White	
	Women	Men		Women	Men
< HS	5.64	6.57	< HS	2.53	3.38
HS	22.67	22.84	HS	17.76	19.72
SC	14.95	10.54	SC	12.96	11.35
C	10.26	6.52	C	16.82	15.48
Total	53.53	46.47	C	50.07	49.93

gender and education level, white individuals have greater average hourly wages than black individuals. Men have higher wages than women, but the gender wage gap is much smaller for the black population than it is for the white population.[22]

Table 4: Hourly Wages

(normalized by mean wages)

	Black		White	
	Women	Men	Women	Men
<HS	0.496	0.561	0.510	0.682
HS	0.624	0.757	0.654	0.900
SC	0.710	0.846	0.796	0.993
C	1.062	1.183	1.200	1.679

Hours Worked Table 5 shows hours worked per week from the ACS 2006 (conditional on working) by gender, race and marital status. White men tend to work more than black men, irrespective of marital status. For women the relationship flips with marital status as black married women tend to work more hours than white married women.

Table 5: Usual Hours Worked per Week

(conditional on working)

	Black			White	
	Women	Men		Women	Men
Single	38.8	40.5	Single	39.8	42.8
Married	39.3	43.5	Married	36.7	46.0

[22]See Neal (2004) for an analysis of racial differences in the gender wage gap.

5.1 Incarceration

Despite the large prison population, data on prison stocks and flows is rather scarce.[23] The available data does not allow us to directly identify transitions by race and education for the entire prison population. The most detailed and reliable survey is the 2004 Survey of Inmates in State and Federal Correctional Facilities (SISCF), which is an extensive and representative survey of inmates providing a snapshot of the composition of prisoners at one point in time. We provide a detailed description of the SISCF in Appendix B. We restrict our sample to imprisoned men aged 25 and 54 who entered into a state or federal prison within the past year before being surveyed. As can be seen in Appendix Table B1, the average prisoner in our sample is about 36 years old. Indeed, despite the common belief that crime is mainly a young man's activity, Appendix Figure B1 shows that the age distribution of inmates is surprisingly flat between ages 20 and 50. The average education of inmates is rather low. In state prisons, for example, almost 90% of inmates have at most a high school degree. The average sentence length of inmates in our sample is about 6.4 years for those in state prisons and about 9.4 years for those in federal prisons. We present the distribution of sentence lengths in Appendix Figure B3. Finally, as can be seen in Appendix Figure B4 the most common charges, in particular for black men, are related to drugs.

In order to approximate transitions into and out of prison for men, we follow an approach similar to Pettit and Western (2004). First, using the 2004 SISCF, we compute the fraction of prisoners between ages 25 and 54 who were admitted within the last 12 months for each level of education and race. However, we don't know whether a person entered into prison from employment or unemployment. As a result, we assume that these probabilities are equal. Second, we multiply these shares by the total number of admissions to state and federal prisons in 2004, which we obtain from the Bureau of Justice Statistics (BJS). This approach assumes the SISCF is representative of total admissions in 2004. Third, using the Current Population Survey (CPS) and the number of people for each race and level of education obtained in the second step, we compute the fraction of a given race and level of education who were admitted to prison in 2004.

The results are reported in Table 6, and are used to calibrate $\pi_{up} = \pi_{ep}$ for each race and

[23] Due to data limitations, we can only consider state and federal prison but not transitions into and out of jail (which generally hosts individuals with sentences of less than one year).

Table 6: Yearly Probability of Going to Prison, Men 25-54

Education	Black	White
< HS	.085	.015
HS	.030	.007
SC	.010	.002
C	.005	.001

education level. Black men are about five times more likely to transition into prison within each education category.

Next we calibrate π_{pp}, the probability a man in prison stays in prison. Using the SISCF, we find that the average sentence length of black and white men between ages 25 and 54 who were admitted to state prison in 2004 is around 6 years.[24] However, most sentences are not fully completed. According to the National Corrections Reporting Program from the BJS, the average share of sentences in terms of time served was 49% in 2004 for men, which suggests that the average time spent in prison is 3 years.[25] Given that one model period is one year, the average prison stay is three model periods. Therefore, for both white and black men we set $\frac{1}{1-\pi_{pp}} = 3$ or $\pi_{pp} = 0.67$. We also assume that π_{pp} is independent of an individual's education.

Finally, using the survey on Religiousness and Post-Release Community Adjustment in the United States 1990-1998 (Sumter 2005), we compute the probabilities of moving to employment or non-employment upon release from prison, by race. In the data, white men are slightly more likely to transit directly into employment. In particular, conditional on being released, a white inmate has a 43.6% chance of moving to employment and a 56.4% chance of moving to unemployment. For a black inmate, the probabilities are 37.5% and 62.5%, respectively. As a result, because a white inmate has $1 - \pi_{pp} = 1 - 0.67$ probability of being released, his chances of moving from prison to employment and unemployment are given by $\pi^w_{pe} = (1 - 0.67) \times (0.436) = 0.144$ and $\pi^w_{pu} = (1 - 0.67) \times (1 - 0.436) = 0.186$, respectively. For a black inmate, the chances are $\pi^b_{pe} = (1 - 0.67) \times 0.375 = 0.124$ and $\pi^b_{pu} = (1 - 0.67) \times (1 - 0.375) = 0.206$, respectively. Again, due to data limitations, these probabilities are assumed to be independent of education.

[24] The great majority (86%) of prisoners are in state prison.

[25] See http://www.bjs.gov/index.cfm?ty=pbdetailiid=2056.

5.2 Labor Market Transitions of Men

We compute the transition matrix for men $\Lambda(\lambda'|\lambda)$ based on data on labor market transitions by exploiting the Merged Outgoing Rotation Group (MORG) of the CPS. We consider two states, employment ($\lambda = e$) and non-employment ($\lambda = u$). The latter comprises both unemployment and out of the labor force. The resulting yearly transition matrices are shown in Table 7 for the years 2000-2006.

Table 7: Yearly Employment Transitions of Men, 2000-2006

		Black		White	
		e	u	e	u
< HS	e	.850	.150	.911	.089
	u	.157	.843	.195	.805
HS	e	.897	.103	.947	.053
	u	.244	.756	.309	.691
SC	e	.918	.082	.954	.046
	u	.328	.672	.368	.632
C	e	.950	.050	.975	.025
	u	.354	.646	.478	.522

For men, we then combine the estimates for employment transitions with transition probabilities in and out of prison in order to complete the labor market transition matrices between the three states, i.e. employed ($\lambda = e$), non-employed ($\lambda = u$), and prison ($\lambda = p$). Consider a black man who is a high school drop-out (second quadrant of the top of Table 7). According to Table 6, his probability of going to prison is 0.085. As we mentioned above, we assume this is the same whether he is employed or unemployed as we do not have information to separate the two, i.e. $\pi_{ep} = \pi_{up} = 0.085$. We also know that the chances a black man leaves prison is .67. Given he leaves prison, he is nonemployed with probability .625 and employed with probability .375. So, for all black men $\pi_{pe} = 0.124$ and $\pi_{pu} = 0.206$. Putting all these pieces together, and noting that the transition matrix for u and e considers only the non-prison population and therefore needs to be multiplied by the share of population not transitioning into prison in a given year, which for a black high school dropout is 0.915, we have:

$$
\Lambda_m^{<HS,b}(\lambda'|\lambda) = \begin{array}{c} \\ p \\ u \\ e \end{array} \begin{array}{c} \begin{array}{ccc} p & u & e \end{array} \\ \begin{pmatrix} .670 & .206 & .124 \\ .085 & .771 & .144 \\ .085 & .137 & .778 \end{pmatrix} \end{array}.
$$

We repeat this procedure for other education types as well as for whites to obtain the corresponding matrices, which are reported in Appendix C.

5.3 Wage Shocks

We construct the transition matrix $\Upsilon^{z,r}(\varepsilon'|\varepsilon)$ in the following way. We interpret ε as deviations from the mean, i.e. when $\varepsilon = 1$, the individual has mean earnings. We again use data from the Merged Outgoing Rotation Group (MORG) from the CPS for the years 2000-2006 to compute yearly earnings transition probabilities by gender, race and level of education to construct transition matrices $\Upsilon^{z,r}(\varepsilon'|\varepsilon)$ for those who are employed. We also construct a productivity distribution for those agents who move from unemployment to employment and use this to calibrate $\widetilde{\Upsilon}^{z,r}(e)$.

We assume that ε takes five values. These five levels represent wage changes, relative to the mean, that are more than -17.5%, between -17.5% and -5%, between -5% and 5%, between 5 and 17.5%, and more than 17.5%, respectively in the data. We then set $\varepsilon_1 = 0.75, \varepsilon_2 = 0.9, \varepsilon_3 = 0, \varepsilon_4 = 1.10, \varepsilon_5 = 1.25$.[26]

The transition matrix for black high school dropout men, for example, takes the following form

$$
\Upsilon_m^{<HS,b}(\varepsilon'|\varepsilon) = \begin{array}{c} \\ \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{array} \begin{array}{c} \begin{array}{ccccc} \varepsilon_1 & \varepsilon_2 & \varepsilon_3 & \varepsilon_4 & \varepsilon_5 \end{array} \\ \begin{pmatrix} .365 & .282 & .200 & .094 & .059 \\ .104 & .377 & .251 & .126 & .142 \\ .042 & .170 & .420 & .231 & .137 \\ .052 & .117 & .240 & .403 & .188 \\ .043 & .148 & .174 & .113 & .522 \end{pmatrix} \end{array}.
$$

For a high school dropout black man, if $\varepsilon = \varepsilon_1$, he earns about 25% less than the mean for his type. In this case, there is a 37% chance that he will again face the same shock next

[26]Given that for some categories we do not have large sample sizes, we drop the top and bottom 0.5% of observations within each year, degree, race, and gender in order to prevent outliers from affecting the wage bins.

period, while there is a 6% chance that next period his wage will be 25% above the mean wage for his type. Using the outlined procedure, we compute matrices for each gender, race, and level of education. Tables C1 and C2 in Appendix C show the resulting transitions for all cases.

5.4 Government

We use the 2004 wave of the Survey of Income and Program Participation (SIPP) to approximate a welfare schedule as a function of labor earnings for different household types, $T_f^s(Y), T_m^s(Y)$, and $T^m(Y)$. The SIPP is a panel surveying households every three months retrospectively for each of the past three months.[27] We compute the average amount of welfare, unemployment benefits, and monthly labor earnings corrected for inflation for each household. The welfare payments include the main means-tested programs (except Medicaid), namely Supplemental Social Security Income (SSSI), Temporary Assistance for Needy Families (TANF formerly AFDC), Supplemental Nutrition Assistance Program (SNAP formerly food stamps), Supplemental Nutrition Program for Women, Infants, and Children (WIC), and Housing Assistance.[28]

Using the monthly household average as the unit of observation, we first compute the average amount of the sum of welfare and unemployment benefits received by households with zero labor earnings. This allows us to pin down b_0. Then, via ordinary least square estimation, we estimate the slope and intercept of the sum of welfare and unemployment benefits as a function of positive labor earnings by household type and determine b_1 and b_2. Table 8 reports the resulting estimates. A single woman that is not working, for example, receives benefits that are about 16% of mean earnings, which is more than single male or married households receive.[29] Figure 7 presents the welfare schedule graphically, where both household income and benefits are reported as a fraction of mean per capita earnings in the economy.

[27] The sample covers the time period from February 2004 to January 2008. Restricted to black and white household heads aged 25-54, the sample spans 911,273 observations across 34,367 households. Per household, there are between 1 and 48 monthly observations with an average of nearly 27 monthly observations.

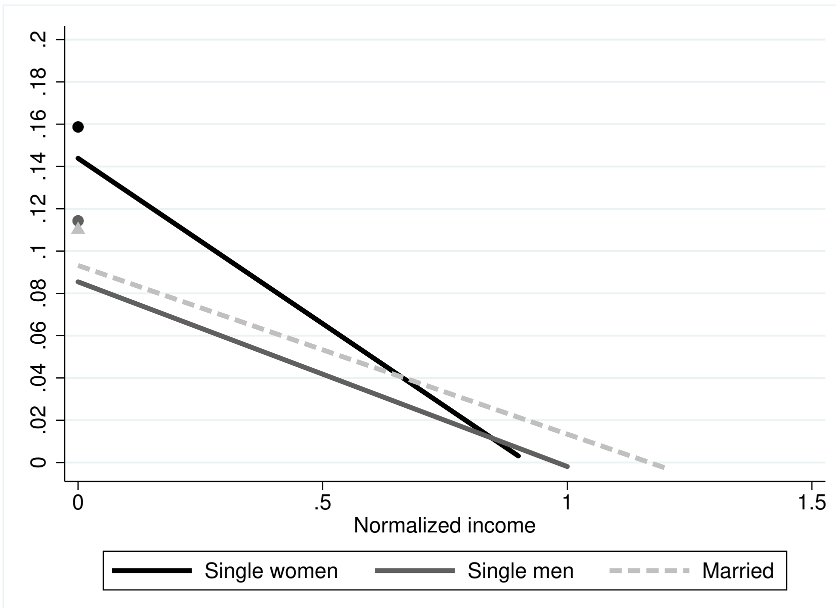
[28] The SIPP only provides information of whether households received Housing Assistance but no information about value or amounts. We use the methodology of Scholz, Moffitt and Cowan (2009) to impute the value of receiving Housing Assistance. For all other transfer programs the SIPP provides information on the actual amount received. See Guner, Rauh and Ventura (2018) for estimates of effective transfer functions for the US economy.

[29] Using data from the ACS 2006, we compute mean per capita earnings to be $37,632.

Table 8: Welfare Functions

Parameter	Description	Married	Single men	Single women
b_0	Benefit when not working	0.11	0.11	0.16
b_1	Intercept when working	0.09	0.07	0.14
b_2	Slope when working	-0.07	-0.07	-0.14

Figure 7: Welfare Functions



6 Benchmark Economy

The focus of this paper is to take a new look at the Wilson Hypothesis: Are the low rates of marriage among the black population driven by the lack of marriageable black men, via a skewed sex ratio, and their high rates of incarceration and unemployment? In the model economy, we capture differences in the sex ratio between the black and white population by assuming that each period more black women enter the model economy than do black men so that there are 15.2% more black women than black men. The numbers of white women and men are roughly equal. A skewed sex ratio implies that single black women are less likely to meet someone in the marriage market. This is exacerbated by more black men being incarcerated, and therefore out of the marriage market, than white men. However, this is only one part of the story. Even if a black woman meets a black man, she is less willing to form a household than is a white woman. Black men, in particular black men with low educational attainment, have very high rates of incarceration and non-employment. As a result, a black man who looks like a suitable partner today can turn into a less-than-ideal partner in the future. This risk makes black women less likely to enter into marriage, even if they meet a potential partner.

Our estimation takes place in two steps. We first select several parameters based on available evidence or set them to standard values in the literature. These parameters are listed in Table 9. Let β (the subjective discount factor) be 0.96, a standard value in macroeconomic studies.[30] All the targets for the estimation are calculated for individuals between ages 25 and 54, which corresponds to an operational lifespan of 30 years. We set $(1-\rho) = 1/30 = 0.033$, so that individuals in the model also live 30 years on average. We set $\sigma = 2$, again a standard value in macroeconomic studies. Using the OECD equivalence scale, we set $\xi = 0.7$, so that a second adult in a household counts 30% less than the first one. We assume that husbands and wives have equal weights in the household, i.e. $\mu = 0.5$. Finally, based on Western (2006), the earnings penalty after prison is set to $\psi(P) = .642$ for white men, and $\psi(P) = .631$ for black men.

Table 9: Parameter Values (a priori information)

Parameter	Description	Value
β	discount factor	0.96 (standard)
ρ	survival	$1/(1-\rho) = 30$
σ	curvature	2 (standard)
ξ	economies of scale	0.7 (OECD scale)
μ	weight on woman	0.5
$\psi(P)$	wage penalty for prison	0.642 (white men), 0.631 (black men)

In order to proceed with the estimation of the remaining parameters, we make several functional form assumptions. We assume that the values of q are drawn from a flexible Gamma distribution with parameters α_1 and α_2, and set $\alpha_2 = 1$.[31] We assume that both $\gamma \sim \Gamma(\gamma)$, the permanent match quality shock, and $\phi \sim \Theta(\phi)$, transitory match quality shock come from normal distributions with parameters $(\mu_\gamma, \sigma_\gamma)$ and (μ_ϕ, σ_ϕ) with $\mu_\phi = 0$. We set $\underline{c}(x,z) = c_0 + c_1\overline{Y}(z,x)$, where $\overline{Y}(z,x)$ is the mean income for all (x,z) couples. Finally, note that given the distributions of men and women in the economy, the probability of matching with his own type for a man, $\varphi_m^{z,r}$, determines directly the probability of matching with her

[30] See, e.g., Prescott (1986).

[31] Hence, $q \sim Q(q) \equiv q^{\alpha_1 - 1}\frac{\exp(-q/\alpha_2)}{G(\alpha_1)\alpha_2^{\alpha_1}}$, where $G(\alpha_1)$ represents the gamma function.

own type for a woman, $\varphi_f^{x,r}$.

As a result, we have 31 parameters to be determined:

$$\{\underbrace{\eta, c_0, c_1, \varphi_m^{z,w}, \varphi_m^{z,b}}_{\text{marriage}}, \underbrace{\theta^{x,w}, \delta^{x,w}, \theta^{x,b}, \delta^{x,b}}_{\text{women's labor market}}, \underbrace{\alpha_1, \mu_\gamma, \sigma_\gamma, \sigma_\phi}_{\text{heterogeneity-shocks}}\}.$$

The income tax rate, $\tau = 1.8\%$, is set to achieve a balanced government budget, i.e. tax revenues are equal to government spending on transfers. The share of the US GDP that is spent on the means-tested programs, which we include in $T_f^s(Y), T_m^s(Y)$, and $T^m(Y)$ schedules, was about 1.3%, while another 0.4% of GDP was spent on unemployment benefits. Our equilibrium tax rate is very close to this sum.[32]

The labor market parameters for women include education and race-specific job destruction and arrival rates. A non-employed white women with education x, for example, gets a job offer with probability $\theta^{x,w}$, and decides whether to accept it. Similarly, an employed white women with education x loses her job with probability $\delta^{x,w}$. A woman, in particular a married woman, who gets an offer can still choose not to work, so the θ parameters can differ from unemployment to employment transitions in the model. It is also the case that a married woman might quit her job and become non-employed even if her job is not destroyed by the exogenous shock, δ. Single women, on the other hand, are much less likely to decline job offers or quit their jobs. Therefore, we set these parameters, $(\theta^{x,w}, \delta^{x,w}, \theta^{x,b}, \delta^{x,b})$, directly to the unemployment to employment, and employment to unemployment transitions of single women between ages 25 and 54, using the Merged Outgoing Rotation Group (MORG) of the CPS for the years 2000-2006. These parameters are displayed in Table 10.

Table 10: Calibrated Parameters

(labor market transitions, women)

	Job arrival θ		Job destruction δ	
	Black	White	Black	White
<HS	.16	.15	.20	.15
HS	.24	.24	.12	.08
SC	.32	.30	.10	.07
C	.51	.48	.04	.04

The remaining 15 parameters, $\mathbf{\Theta} = \{\eta, c_0, c_1, \varphi_m^{z,w}, \varphi_m^{z,b}, \alpha_1, \mu_\gamma, \sigma_\gamma, \sigma_\phi\}$ are chosen to match:

[32] The number on means-tested programs is based on CBO (2013), Tables 1 and 3 and Figure 2. The number on unemployment insurance is from the OECD database on Public Employment Spending, https://data.oecd.org/socialexp/public-unemployment-spending.htm.

1. Marital status of population by race, gender, and education level (Table 12, 16 moments).

2. Fraction of women married by ages 20, 25, 30, 35, and 40, by race (top panel of Table 13, 10 moments).

3. Fraction of marriages that last 1, 3, 5, and 10 years by race (bottom panel of Table 13, 8 moments).

4. The degree of marital sorting by education by race (Table 14, 32 moments).

5. Labor market and prison status by race, education level, and marital status for men, and employment/unemployment transitions by race, education level, and marital status for women (Table 15, 64 moments).

Let $\mathbf{M}$ represent the vector of these 130 moments. A vector of the analogous 130 moments can be obtained from the steady state of the model. The moments for the model are a function of the parameters to be estimated. Let $\mathcal{M}(\mathbf{\Theta})$ represent this vector of moments, where $\mathbf{\Theta}$ denotes the vector of 15 parameters to be estimated. Define the vector of deviations between the data and the model by $\mathbf{G}(\mathbf{\Theta}) \equiv \mathbf{M} - \mathcal{M}(\mathbf{\Theta})$. Minimum distance estimation picks the parameter vector, $\mathbf{\Theta}$, to minimize a weighted sum of the squared deviations between the data and the model, i.e.,

$$\widehat{\mathbf{\Theta}} = \arg\min \mathbf{G}(\mathbf{\Theta})'\mathbf{W}\mathbf{G}(\mathbf{\Theta}). \tag{2}$$

The estimated parameter vector $\widehat{\mathbf{\Theta}}$ is consistent for any semi-definite matrix $\mathbf{W}$. We set $\mathbf{W}$ equal to the identity matrix. The variance covariance matrix for $\widehat{\mathbf{\Theta}}$ is consistently estimated as

$$var(\widehat{\mathbf{\Theta}}) = \left[D(\widehat{\mathbf{\Theta}})'\mathbf{W}D(\widehat{\mathbf{\Theta}})\right]^{-1} D(\widehat{\mathbf{\Theta}})'\mathbf{W}\widehat{\mathbf{Q}}\mathbf{W}D(\widehat{\mathbf{\Theta}}) \left[D(\widehat{\mathbf{\Theta}})'\mathbf{W}D(\widehat{\mathbf{\Theta}})\right]^{-1}, \tag{3}$$

where $D(\widehat{\mathbf{\Theta}})$ is a matrix of partial derivatives of the moments included in $\mathcal{M}(\mathbf{\Theta})$ with respect to the parameters included in $\mathbf{\Theta}$, and $\widehat{\mathbf{Q}}$ is an estimate of the variance-covariance matrix of the moments in the data.[33]

[33] When we estimate $\widehat{\mathbf{Q}}$, we include both variance and covariance terms for moments that come from the same data set. The covariance terms involving different data sets are naturally zero. Our procedure follows, among others, Llull (2018), equation A42.

6.1 Estimated Parameters and Model Fit

Table 11 contains the estimated parameters, together with their standard errors and 95% confidence intervals. Three probabilities for men matching with their own type, $\varphi_m^{<HS,b}$, $\varphi_m^{<HS,w}$ and $\varphi_m^{SC,w}$, consistently approach zero in the minimization. As a result, their values were set to zero, and they were not included in the minimization. For another probability, $\varphi_m^{SC,b}$, the 95% confidence interval includes zero as well. All other parameters are rather tightly estimated and are significantly different from zero.

Table 11: Estimated Parameters

Parameter	Description	Value	SE	[95% CI]
η	Divorce cost	28.679	4.8861	[19.102, 38.256]
c_0	Cost of a married household	0.021	.0015	[0.018, 0.024]
c_1	Proportional cost of a married household	0.008	.0012	[0.006, 0.010]
α_1	Shape parameter of home stay gamma distrib	7.060	.7539	[5.582, 8.538]
μ_γ	Mean of γ draw	-5.487	.4917	[-6.451, -4.523]
σ_γ	Standard deviation of γ draw	11.103	1.2737	[8.607, 13.599]
σ_ϕ	Standard deviation of ϕ draw	15.083	2.1590	[10.851, 19.315]
$\varphi_m^{<HS,b}$	Prob of meeting own type (black, <HS)	0.000	-	-
$\varphi_m^{HS,b}$	Prob of meeting own type (black, HS)	0.364	.0175	[0.330, 0.398]
$\varphi_m^{SC,b}$	Prob of meeting own type (black, SC)	0.027	.0181	[-0.008, 0.062]
$\varphi_m^{C,b}$	Prob of meeting own type (black, C)	0.125	.0398	[0.047, 0.203]
$\varphi_m^{<HS,w}$	Prob of meeting own type (white, <HS)	0.000	-	-
$\varphi_m^{HS,w}$	Prob of meeting own type (white, HS)	0.375	.0059	[0.363, 0.387]
$\varphi_m^{SC,w}$	Prob of meeting own type (white, SC)	0.000	-	-
$\varphi_m^{C,w}$	Prob of meeting own type (white, C)	0.542	.0131	[0.516, 0.568]

Tables 12 to 15 compare the model and the data. Table 12 shows the measure of the population that is married by gender, race, and education. We compute marital status by gender, race, and level of education using the ACS 2006. White men and women of all levels of education are more likely to be married than their black counterparts. The model generates a racial-marriage gap that is smaller than the data. In the data 67% of all white women and 34% of all black women between ages 25 and 54 are married: a gap of 33 percentage points. The gap is 24 percentage points in the model, 60% vs. 36%. If we consider ever married women, instead of currently married, a similar picture emerges. The racial gap among ever married women is 27 percentage points in the data and 21 percentage points in the model. In the data, the racial gap in currently married women is larger for less educated women. The model also captures this feature well. Both in the model and the data, for example, the gap is 32 percentage points among women with less than a high school education. For both races, the model matches the fact that the fraction of married population increases by education. The education marriage gradient is, however, steeper in the model than it is in the data, especially for black women.

Table 12: Fraction Married (model vs (data))

	Education	Black	White
Women	<HS	.17 (.21)	.49 (.53)
	HS	.31 (.31)	.58 (.65)
	SC	.38 (.35)	.61 (.65)
	C	.59 (.42)	.68 (.68)
	All	.36 (.34)	.60 (.67)
Men	<HS	.20 (.25)	.44 (.48)
	HS	.39 (.38)	.56 (.58)
	SC	.51 (.47)	.60 (.62)
	C	.63 (.53)	.68 (.69)

The top panel of Table 13 shows the probability of marriage for black and white woman by a given age in the model and in the data. The probability of first marriage for women comes from data from the 2006-2010 National Survey of Family Growth (NSFG), as reported in Copen et al (2012). In the model, we compute how long it takes for women in a new birth cohort to marry. In the data, 74% of white women are married by age 30, compared to only 47% of black women. The model does well matching these statistics, although it slightly underestimates the speed of entry into marriage for white women. The bottom panel of Table 13 contains the probability that a marriage remains intact after a certain number of years. The probability of the first marriage remaining intact comes from data from the 2002 NSFG, as reported in Goodwin, Moshe and Chandra (2010). As Table 13 shows, black marriages on average dissolve at a faster rate, although racial differences in marital dissolutions are less pronounced than racial differences in entry into marriage.[34] The model again does a good job replicating the divorce dynamics that we observe in the data. For white marriages, the probability of survival is matched well for the first five years, but becomes slightly higher than it is in the data afterwards.

[34] In the model, with no memory beyond the last period, there is no distinction between first and subsequent

Table 13: Marriage Dynamics for Women (model vs (data))

Married by	20	25	30	35	40
Black	.05 (.05)	.28 (.24)	.45 (.47)	.58 (.58)	.67 (.64)
White	.10 (.14)	.46 (.48)	.67 (.74)	.80 (.84)	.87 (.89)

Duration	1 year	3 years	5 years	10 years
Black	.90 (.92)	.75 (.81)	.65 (.73)	.50 (.51)
White	.94 (.95)	.85 (.86)	.79 (.78)	.67 (.64)

Table 14 shows the marriage matrix by education, which serves as an indicator of assortative mating in the model and the data. We compute a marriage matrix in terms of education for the black and white population aged 25-54 using the 2006 ACS. Both in the data and the model, white individuals are more likely to marry assortatively than black individuals. The sum of the terms in the diagonal (which measures the fraction of marriages that are formed by households with the same level of education), for example, is 0.51 for the black population and 0.55 for the white population in the data. The model reproduces this pattern but underestimates the level of assortative mating among black individuals. The sum of the diagonal terms in the model is 0.44 for the black population and 0.53 for the white population. In particular, in the model, too many low educated black men marry high educated black women, lowering the level of assortative mating.

Table 15 contains the data and model moments on employment, non-employment and prison status for men, and on employment transitions for women by race, marital status, and education. To compute labor market status and prison status we use the ACS 2006 and restrict the sample to individuals aged 25-54. Men do not make any labor supply decision in the model and the transition matrix between employment states is exogenously given. Yet, because marriage decisions are endogenous, the model still needs to match the joint distribution of marital and labor market states. A key result in Table 15 is the fact that the model is able to generate a significant fraction of black men with less than high school education who are married and are in prison. In the data, about 14% of married black men with less than high school education are incarcerated. In the model, 18% of them are. Not surprisingly, single men are more likely to be in prison. About 21% and 28% of single black men with less than high school education are in prison in the model and the data,

marriages. Therefore, we compute this moment for all marriages.

Table 14: Assortative Mating by Race and Education (model vs (data))

Black				
	Wife			
Husband	<HS	HS	SC	C
<HS	**.001 (.018)**	.010 (.039)	.018 (.013)	.037 (.004)
HS	.013 (.029)	**.236 (.245)**	.116 (.126)	.089 (.063)
SC	.020 (.005)	.076 (.070)	**.102 (.117)**	.076 (.067)
C	.014 (.002)	.041 (.027)	.050 (.046)	**.105 (.128)**
White				
	Wife			
Husband	<HS	HS	SC	C
<HS	**.001 (.013)**	.013 (.025)	.019 (.008)	.016 (.002)
HS	.014 (.019)	**.205 (.205)**	.091 (.095)	.059 (.055)
SC	.014 (.004)	.069 (.070)	**.090 (.089)**	.056 (.065)
C	.010 (.001)	.047 (.042)	.058 (.068)	**.237 (.240)**

respectively.

For women, we focus on probabilities of staying employed, $prob(EE)$ and non-employed, $prob(UU)$. As we have noted above, we use the observed values of $1 - prob(UU)$ and $1 - prob(EE)$ for single women to select the probability of finding and losing a job, $\theta^{x,r}$ and $\delta^{x,r}$ (which are indicated with bold numbers in Table 15). For single women, the differences between what we impose with $\theta^{x,r}$ and $\delta^{x,r}$ and resulting transitions are negligible, because single women almost always take a job opportunity and almost never quit their jobs. The situation is different for married women, for whom there is an active extensive labor supply decision. The model has a role to play in matching these transitions for married women. As Table 15 shows, married women, black or white, generally are more likely to stay non-employed than their single counterparts, and the model captures this well. This is not surprising, because married women can be more picky and decline job offers as they are able to rely on their husband's income. However, this difference is less important for less educated households. The model also does well with respect to employment to employment transitions. Both in the data and in the model, more educated single women are more likely to stay employed than their married counterparts.

Moreover, in Table 16 we show that the model correctly generates the fact that white married women are less likely to be employed than white single women, but that the reverse is true for black women, despite not directly targeting these facts. In the model 66% of single

Table 15: Labor Market and Marital Status (model vs (data))

		Blacks				
Educ	Marital St.	Men (Stock)			Women (Transition)	
		E	U	P	EE	UU
< HS	Single	36 (.29)	.43 (.43)	.21 (.28)	.79 (**.80**)	.84 (**.84**)
	Married	.48 (.57)	.34 (.29)	.18 (.14)	.77 (.83)	.85 (.86)
HS	Single	.57 (.56)	.34 (.32)	.09 (.12)	.87 (**.88**)	.76 (**.76**)
	Married	.71 (.78)	.23 (.18)	.06 (.04)	.87 (.91)	.76 (.71)
SC	Single	.72 (.71)	.24 (.22)	.04 (.07)	.89 (**.90**)	.68 (**.68**)
	Married	.81 (.85)	.17 (.13)	.02 (.02)	.88 (.90)	.70 (.70)
C	Single	.81 (.82)	.17 (.16)	.02 (.02)	.95 (**.96**)	.50 (**.49**)
	Married	.89 (.92)	.10 (.07)	.01 (.01)	.92 (.95)	.58 (.65)

		Whites				
Educ	Marital St.	Men (Stock)			Women (Transition)	
		E	U	P	EE	UU
< HS	Single	.60 (.54)	.36 (.38)	.06 (.08)	.85 (**.85**)	.85 (**.85**)
	Married	.71 (.75)	.26 (.23)	.03 (.02)	.79 (.86)	.87 (.84)
HS	Single	.78 (.74)	.19 (.22)	.03 (.04)	.92 (**.92**)	.76 (**.76**)
	Married	.86 (.90)	.12 (.10)	.02 (.00)	.88 (.91)	.79 (.79)
SC	Single	.85 (.82)	.15 (.17)	.00 (.01)	.93 (**.93**)	.70 (**.70**)
	Married	.91 (.92)	.09 (.07)	.00 (.01)	.88 (.92)	.76 (.76)
C	Single	.93 (.89)	.07 (.11)	.00 (.00)	.95 (**.96**)	.53 (**.52**)
	Married	.96 (.96)	.04 (.04)	.00 (.00)	.85 (.95)	.66 (.75)

black women work, compared to 76% of married black women, while for white women 74% of single women work, compared to 69% of married white women.

Table 16: Employment Rate of Women by Marital Status (model vs (data))

	Single	Married
Black	.66 (.68)	.76 (.74)
White	.74 (.78)	.69 (.72)

How does the benchmark economy generate the racial-marriage gap? One important factor is the matching opportunities captured by the endogenous variable $\kappa^{x,r}$ in the model. Black women face lower matching probabilities for two reasons. First, as we document in Table 15, more black men are in prison than white men, and the gap is larger for those with low education. In any period, just under 2% of single white men are in prison, and hence out of the marriage market, while 10% of single black men are incarcerated. Second, the uneven sex ratio for the black population implies more black women than men. The probability that a single black woman matches with a single black man is equal to the measure of single women minus the missing men divided by the measure of single women. This probability is decreasing in the number of missing men and the number of married women. In the extreme case, if all men are married, the remaining single women have no chance of finding a match. In the benchmark economy, the sex ratio differences imply a probability of a single black woman meeting a match of around 0.76, while the probability is 1 for white women. Adding the prison population to the number of missing black men, this probability declines to 0.68 for single black women. For single white women, who are only impacted by the small population of single white men in prison, this probability is around 0.98. Not being able to meet a man is only part of the story. Conditional on meeting a man, black women are less likely to enter into marriage than are white women. These differences reflect higher incarceration and unemployment probabilities for black men.

Another important element of the model is the effect of prison history (ex-convicts) and transitions (entry into prison) on marital transitions. Due to the wage penalty, $\psi(P)$, men with a prison history face lower wages. In the model, any single man who experiences a prison shock is not in the marriage market and stays single. For white single men who are not in prison, those with a prison history marry with probability 0.07, while those without a prison history marry with probability 0.10. For black single men these numbers are 0.06 and 0.08. The gap is smaller for black men, because a larger fraction of them are in prison and, all else equal, women have less to gain from waiting for a man without a criminal background. In the model economy, married men who go to prison can remain married while they complete their prison term. However, the probability of divorce increases significantly once a husband becomes incarcerated. For married white men, those in prison divorce with probability 0.11, compared to just under 0.03 for those who are not in prison. For black married men, these numbers are 0.13 and 0.05, respectively.

6.2 Identification

Given our estimation strategy, it is not possible to associate individual parameters in $\mathbf{\Theta}$ with individual statistics in $\mathcal{M}(\mathbf{\Theta})$. Yet, particular targets play relatively more important roles in identifying certain parameters, which is critical for identification. In this section, we provide a discussion of these relationships.

We first note that the probability that a man matches with his own education type, $\varphi_m^{x,r}$, is almost entirely determined by the assortative marriage targets in Table 14. In Tables D1-D4 in Appendix D, we show what the benchmark economy looks like under random matching, i.e. when we keep all parameters at their estimated values but set $\varphi_m^{x,r} = 0$. Under random matching, the model clearly cannot generate the degree of positive assortative mating that we observe in the data (Table D3). However, it has little problem matching all other targets.

We next focus on the remaining parameters, $\{\eta, c_0, c_1, \alpha_1, \mu_\gamma, \sigma_\gamma, \sigma_\phi\}$, and simulate the benchmark economy when we increase each parameter by half of its standard deviation while keeping all other parameters at their benchmark values. We then check how much each moment in Tables 12-15 changes. If a target is particularly helpful identifying a given parameter, then changes in that parameter should generate larger changes in the corresponding target. The results are presented in Figures D1-D5 in Appendix D.2 using heat maps where darker areas indicate larger percentage changes relative to the benchmark values.

Consider first the mean and the standard deviation of the permanent match quality distribution, μ_γ and σ_γ. The model requires a permanent match quality distribution with a relatively low mean ($\mu_\gamma = -5.487$) and high standard deviation ($\sigma_\gamma = 11.103$). Individuals have an incentive to wait until they find the right match. Therefore, entry into marriage, especially among black women (Figure D4), and the fraction of married population, especially among low educated black women (Figure D1), help us pin down these parameters. Similarly, the fractions of low educated (<HS or HS) white and black men who are married to different types of women also helps us determine these parameters (especially σ_γ). In the model, men, especially black men, with low education are very unattractive husbands, hence a good permanent match quality is key in order for them to marry as much as they do in the data. It is important to note that while the matching parameters $\varphi_m^{x,r}$ mainly affect targets in Table 14, these targets are sensitive to other parameters and also contribute to how they are identified.

The standard deviation of the transitory match quality distribution, $\sigma_\phi = 15.083$, affects marriage dynamics (Figure D4), i.e. both entry and exit from marriages. The divorce cost, on the other hand, not surprisingly, mainly affects the duration of marriages. The parameter α_1 determines how much a household values a women staying at home. As a result, changes in α_1 have a direct affect on labor market transitions of married women (Figure D2). Indeed, given the parsimonious modeling of home production (which only has one parameter), the overall fit in Table 15 is very good. This parameter, however, also affects how many married men are employed and unemployed (Figure D3). While labor status is not a choice for men, marriage is, and a higher value of α_1 makes marriage more attractive for men who are employed and can afford to have a non-working wife.

Finally, married couples in the model economy face a fixed cost of marriage, $\underline{c}(x,z) = c_0 + c_1\overline{Y}(z,x)$. Part of this fixed cost is a function of the average income of couples with the same education levels (c_1), and part is a pure fixed cost (c_0). In the benchmark, the proportion of this cost to average household income for similar couples ranges from 5.5% for low educated white couples to 2.7% for high educated white couples. For black couples, these costs are proportionally higher, 6.4% for low educated couples to 3.3% for high educated couples. This reflects the fact that c_0 has a bigger bite for low income households. These costs are important for matching the education-marriage gradient for both the black and the white population (Figure D5). They also play an important role in matching entry into marriage at early ages, because they make forming a household more expensive (Figure D4). Indeed, in the extreme case of removing all fixed costs while holding all other parameters fixed, we have many more marriages and the education-marriage gradient flattens, i.e. there is much less of a marriage gap between more and less educated individuals.[35] Looking across black and white individuals, the gradient is about half the size in terms of percentage-point differences in marriage rates between high school dropouts and college graduates.

6.3 Prison and Marriage - Model vs. Micro Evidence?

The benchmark economy is able to generate racial differences in marriage and labor supply behavior that are in line with the data. One element driving the racial-marriage gap is racial differences in prison transitions. If we eliminate these differences, there will be fewer black men in prison and black men become less risky spouses, both of which result in more marriages. A natural question is whether the model-implied relationship between incarceration and marriage is consistent with available evidence? To answer this question, we turn to cross-state evidence in the US and micro studies that exploit this variation.

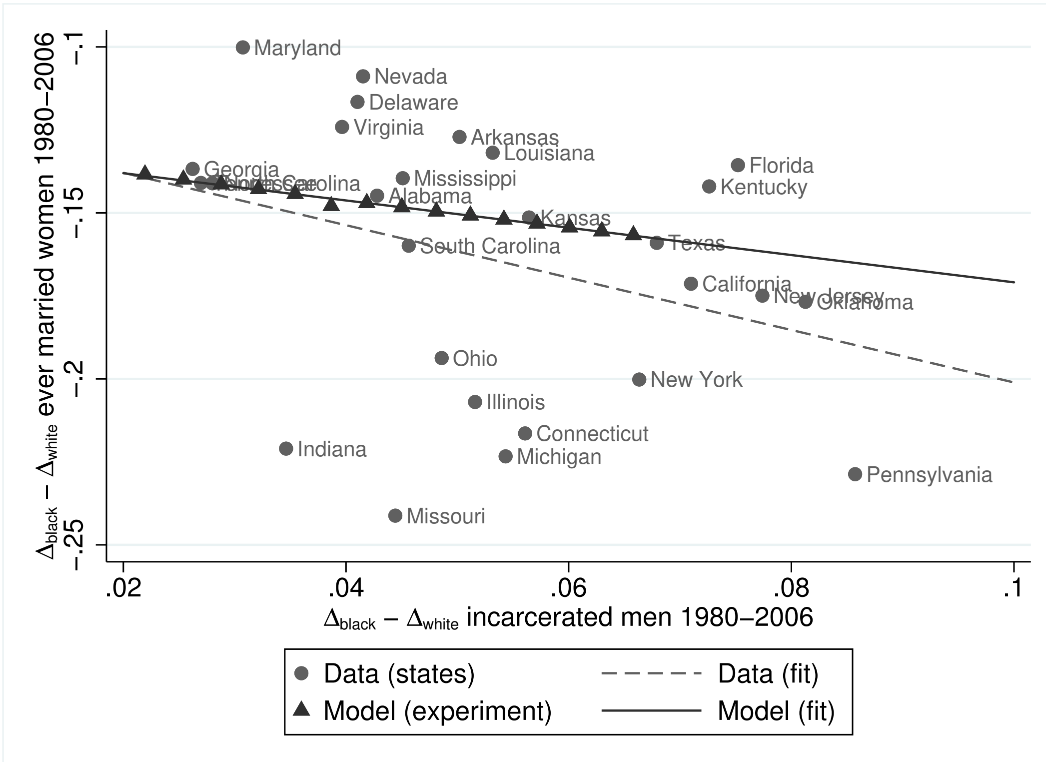
Figure 8 shows the relationship between black and white incarceration and marriage rates

[35]In this exercise 76% of white women and 61% of black women are married, where in the benchmark those numbers are 60% and 36%, respectively.

from 1980 to 2006 and indicates that increases in incarceration rates are associated with lower marriage rates. To construct this elasticity in our model, we conduct the following experiment. We decrease the probabilities of going to prison for black and white men, i.e. we reduce the parameters $\pi^r_{ep} = \pi^r_{up}$, in small percentage steps, and for each new value of $\pi^r_{ep} = \pi^r_{up}$, we recalculate $\Lambda^r(\lambda'|\lambda)$ and solve our model economy (keeping all other parameters fixed). This procedure implies a series of counterfactual levels of marriage. We then compare the relationship between incarceration and marriage implied by our model with the same relationship implied by the US historical experience. In the data, we take the difference in differences between black and white individuals in 1980 and 2006 across US states, whereas for the model we take the difference in differences between black and white individuals in the benchmark model versus the outcomes that result from the stepwise reductions in $\pi^r_{ep} = \pi^r_{up}$.

Figure 8 shows the results of this experiment. The dashed line is the regression line as in Figure 5 with a slope of -0.78, i.e. a one percentage point increase in male incarceration is associated with a 0.78 percentage point decline in women ever marrying. This estimate is comparable to the elasticity of -1.1 identified by Charles and Luoh (2010, Table 1). The model does remarkably well as the model-implied relation between incarceration and marriage behavior is comparable with what we observe in the data. The solid line is the model-implied elasticity of -0.41. Hence, the model-implied elasticity of marriage decisions with respect to incarceration seems quite reasonable and, and if anything, is on the lower side. There are clearly other changes over time that impact marriage decisions that we do not model.

Figure 8: Black-White Differences in Changes in Incarceration versus Marriage (Model vs Data)



Notes: The x-axis shows the difference in difference of black and white men in the incarceration rate. The y-axis shows the difference in difference in ever married black and white women.

7 Understanding the Racial Marriage Gap

In this section, we study how much the different components of the Wilson Hypothesis, the sex ratio and the dynamic impacts of the prison and employment transitions, contribute to the racial marriage gap. The first column in Table 17 contains the measures of married black women and men by education, along with the measures of all married black women in the benchmark economy. The last column gives the same measures for white women and men. In between, we show the impacts of various changes.

The first exercise (column 2 of Table 17) is to set the sex ratio equal to 1 for black men and women. This increases the measures of married black women at all education levels. The increase is driven by the meeting probabilities of black women rising from roughly 0.68 in the benchmark to around 0.90. The measure of married black women in the population

Table 17: Accounting for the Black-White Marriage Gap - Wilson Hypothesis

(Fraction Married)

		Black	Sex Ratio	Emp	Prison	White
Women	<HS	.17	.21	.31	.19	.49
	HS	.31	.37	.41	.35	.58
	SC	.38	.44	.48	.40	.61
	C	.59	.63	.64	.60	.68
	All	.36	.41	.45	.38	.60
Men	<HS	.20	.18	.29	.24	.44
	HS	.39	.37	.50	.42	.56
	SC	.51	.49	.61	.52	.60
	C	.63	.61	.72	.64	.68
$\Delta^f_{b,w}$ accounted for			21.2%	38.4%	10.4%	
90% Confidence Interval			[19.8, 21.6]	[37.3, 39.5]	[10.0, 11.2]	

rises from 0.36 to 0.41, closing just over 20% of the marriage gap between black and white women. Note that this result is consistent with Seitz (2009), who finds that differences in the sex ratio by race accounts for about one-fifth of the racial marriage gap. In our exercise, the measures of married black men fall, even though the absolute number of marriages rise. This is because there are now more black men in the population.

In the next two exercises, we investigate the dynamic implications of the Wilson Hypothesis. We first give black men the employment transitions of white men. This means black men transit in and out of unemployment at the same rates as do white men. The rates continue to depend on education, but no longer on race. There are fewer unemployed black men, and a lower risk that any given black man will become unemployed. Column 3 of Table 17 shows that this change drives large shifts in the measures of married black women and men, with the greatest impact on the least educated. The measure of married black women who are high school dropouts increases 14 percentage points. Note that the measures of black men missing or in prison stay the same, so the impact of this exercise is not via changes in matching probabilities, but through the fact that more matches now end in a marriage.[36] Overall, the marriage gap between white and black women is reduced by

[36]Indeed, when there are fewer men than women in the population, an increase in the measure of married individuals makes matching less likely for women.

38.4%.[37]

The last component of the Wilson Hypothesis that we consider is racial differences in incarceration. Here, we give black men the prison transitions of white men. As in the employment exercise, the rates depend on education, but no longer on race. Because education distributions differ by race, there will still be differences in incarceration. The probability of a black woman meeting a man in the marriage market rises as fewer black single men are in prison. The risk associated with having a husband end up in prison also falls. Column 4 of Table 17 shows that the measure of black men and women married rises, but not by as much as in the previous two exercises. Equating prison transitions accounts for just over 10% of the racial marriage gap.

In Table 18, we consider the impacts of the various changes in conjunction with one another. It is clear that there are interactions. It is not the same to increase matching probabilities in an environment in which men are still very risky versus one in which they are also more marriageable. Similarly, making prison a less likely event is more important when black men are also more likely to find jobs. In all cases, changes in combination have greater impacts than changes in isolation. When the sex ratio is equalized between black men and women, and both employment and prison transitions are equalized between black and white men, more than 80% of the racial marriage gap is accounted for. Interestingly, in this case there are more married college educated black women than college educated white women.

We have investigated sex ratio differences, and differential transitions in employment and incarceration as components of the Wilson Hypothesis that could generate the racial marriage gap. Black men also tend to have lower education levels than white men. In a separate experiment, we equalize the education distribution of black men to that of white men. Note that changing the education distribution changes the measure of black men who are employed, who are in prison and who have a history of prison as these processes are a function of education. Because more educated men are more likely to marry, this

[37]When computing the share of ever married black women we find that this increases from 0.63 to 0.69 under the simulated scenario. Given the corresponding decline in non-employment by black men from 0.25 to 0.15, the associated elasticity of ever married women vis à vis male non-employment is -0.61. Similarly, the cross-state evidence in Figure 5 suggests an elasticity of -0.52. As a further comparison, Autor et al (2018) find that a one standard deviation increase of import penetration through Chinese exports increased non-employment amongst men by 1.54 percentage points and reduced the share of ever married women by 1.16 percentage points, which if we simply take the ratio we get a comparable elasticity of -0.75.

Table 18: Accounting for the Black-White Marriage Gap - Wilson Hypothesis Interactions

(Fraction Married, Black)

		Black	Sex Ratio Emp	Sex Ratio Prison	Emp Prison	Sex, Emp Prison	Educ	White
Women	<HS	.17	.38	.24	.36	.44	.22	.49
	HS	.31	.49	.41	.45	.54	.34	.58
	SC	.38	.55	.46	.51	.58	.41	.61
	C	.59	.69	.65	.66	.70	.62	.68
	All	.36	.51	.44	.48	.55	.39	.60
Men	<HS	.20	.27	.22	.38	.36	.17	.44
	HS	.39	.49	.41	.55	.54	.37	.56
	SC	.51	.59	.51	.63	.60	.49	.60
	C	.63	.72	.62	.73	.73	.61	.68
$\Delta^f_{b,w}$ accounted for			65.5%	33.4%	52.7%	82.1%	13.6%	
90% confidence interval			$[64.0, 66.5]$	$[31.7, 34.0]$	$[52.2, 53.6]$	$[80.8, 83.2]$	$[13.2, 13.8]$	

compositional shift pushes aggregate marriage rates up. However, the propensity of black men to marry conditional on education level falls. This is driven by the marriage market. A man of a given education level who is single looks identical to the equivalent man in the benchmark economy. But, women now know there are better matches available. Consistent with the idea that the pool of marriageable black men has improved, the propensity of black women to marry conditional on their own education level rises. Therefore, the shift in the education distribution for black men increases aggregate marriage rates of black women from 0.36 to 0.39. This closes 13.6% of the racial marriage gap.[38]

In Tables 17 and 18, we also report how robust our findings are to variations in the estimated parameters. To this end, we follow Krinsky and Robb (1986) and assume that our parameters come from a multivariate normal distribution with means as reported in Table 11 and with the estimated variance-covariance matrix from Equation (3). We take 100 draws from this multivariate normal distribution, and for each draw, i.e. for each set of parameters, compute the benchmark economy, run each of the experiments in Tables 17 and 18, and compute the percentage of the marriage gap explained. We then order these percentage changes and cut the bottom and top 5%, leaving us with a 90% confidence interval for each policy exercise. The message that emerges from this exercise is that even if the parameters adjust in a way that is consistent with the variance-covariance matrix, our main conclusions

[38]In separate experiments we equalize wage levels and shocks across black and white men finding that these do not contribute to the racial marriage gap.

are robust.

In summary, we find that the Wilson Hypothesis provides a powerful and robust explanation for the racial marriage gap. In particular, the dire prospects that black men face in the labor market seem to be an important obstacle to family formation amongst the black population.

7.1 The Role of Policy

We next turn to the effects of harsher sentencing and the War on Drugs on the formation of black families by conducting two experiments. First, we reduce the average prison term from three to two years, and then to one year by reducing the probability of remaining in prison from 0.67 to 0.50 and 0, respectively. Second, we simulate the economy while removing transitions into prison for drug offenses in the SISCF. In particular, we ignore prisoners who have a drug-related offense and recalculate the transitions presented in Table 6. The resulting transitions are shown in Table E1.[39]

The results of these experiments are presented in Table 19. We find that reducing the average time in prison has an effect on marriage. If men spend two years on average, or only one year with certainty, the racial marriage gap is closed by 4.4% and 10.2%, respectively. For the War on Drugs experiment (incarcerating fewer men) we find that the gap is diminished by 3.7%. In a separate experiment, we eliminate the wage penalty for men with a prison history. There is a slight increase in marriage for high school drop out black men and women, closing the gap by 1.9%. Again note that our conclusions do not change within the 90% confidence interval for these policy exercises.

Lastly, we consider marriage responses when welfare transfers b_0 are reduced or increased for single women without any income. In the first experiment we reduce the amount to 75% of the benchmark value and find only a small change in the aggregate measures of black and white women who are married, reducing the gap by 0.6%. In the second experiment, the corresponding amount of welfare benefits is increased to 125% of the benchmark value. This increase reduces the measures of black and white married women by one percentage point each, so that we have 35% of black woman and 59% of white women married. These small

[39] In Table E1, we also present results when we ignore prisoners who have *only* drug offenses. This generates a smaller change in probability of going to prison. As a result, the aggregate effect on the marriage gap is also small (2.5%, rather than 3.7%).

Table 19: Policy Experiments and the Black-White Marriage Gap

	Educ.	Black	Average term		War on	Welfare		White
			2 years	1 year	Drugs	75%	125%	
Women	<HS	.17	.18	.19	.18	.17	.16	.49
	HS	.31	.33	.36	.33	.32	.30	.58
	SC	.38	.39	.41	.39	.37	.37	.61
	C	.59	.59	.60	.59	.60	.58	.68
	All	.36	.37	.39	.37	.36	.35	.60
Men	<HS	.20	.23	.27	.21	.19	.19	.44
	HS	.39	.41	.43	.41	.39	.37	.56
	SC	.51	.51	.52	.51	.49	.50	.60
	C	.63	.63	.63	.63	.63	.62	.68
$\Delta^f_{b,w}$ accounted for			4.4%	10.2%	3.7%	0.6%	-1.8%	
90% confidence interval			$[3.5, 4.7]$	$[9.7, 10.4]$	$[3.6, 4.0]$	$[0.3, 1.6]$	$[-2.6, -1.6]$	

changes, to both black and white women's marriage rates, indicate that welfare payments and transfers contribute to marriage decisions, but play a minor role in determining the racial marriage gap.

8 Concluding Remarks

A racial marriage gap of 33 percentage points is wide. In this paper, we study the potential drivers of this gap. Changes in US labor markets in recent decades left many low-skilled workers jobless. The number of people behind bars has increased so much that the US now holds 25% of the world's prison population, while only accounting for about 5% of the world's population. Both the decline in low-skilled jobs as well as the era of mass incarceration have disproportionately affected black communities, and in particular black men. We investigate whether the current bleak labor market prospects of black men and the considerable risk of being incarcerated can explain why so many black women are choosing not to marry. Using an equilibrium model of marriage, divorce and labor supply that takes into account the transitions between employment, unemployment, and prison, we are able to disentangle and quantify the key contributors to the racial marriage gap.

We conduct a range of counterfactual experiments within our calibrated model, in which we assign labor market and prison characteristics of white men to black men. We find that the higher likelihood black men face in terms of incarceration can account for one-tenth of the racial marriage gap. Adding differences in employment transitions narrows the aggregate gap by half. Putting together all three pieces of the Wilson Hypothesis (eliminating racial differences in the sex ratio, incarceration, and unemployment transitions) closes more than 80% of the racial-marriage gap.

Finally, we find that changes in incarceration policies, such as decreased term lengths, leads to increases in marriage within the black population. None of our experiments are meant to be interpreted as normative judgements, as we neither model decisions leading to incarceration nor any negative externalities arising from those decisions. Nonetheless, it is important to understand how labor market characteristics and incarceration policies affect marriage formation. There are several ways to extend the model developed here. In particular, the trends in inter-racial marriage and questions about how incarceration and unemployment are affecting fertility and investment in children are left for future research.

References

[1] Angrist, Josh. 2002. "How do sex ratios affect marriage and labor markets? Evidence from America's second generation." *The Quarterly Journal of Economics* 117, no. 3: 997-1038.

[2] Autor, David, David Dorn and Gordon Hanson. 2018. "When Work Disappears: Manufacturing Decline and the Falling Marriage Market Value of Young Men." *American Economic Review: Insights,* forthcoming.

[3] Badel, Alejandro. 2010. "Understanding Permanent Black-White Earnings Inequality." mimeo.

[4] Baicker, Katherine, and Mireille Jacobson. 2007. "Finders Keepers: Forfeiture Laws, Policing Incentives, and Local Budgets." *Journal of Public Economics*, 91(11): 2113-2136.

[5] Banks, Ralph Richard, 2011. *Is Marriage for White People? How the African American Marriage Decline Effects Everyone.* Dutten: New York.

[6] Batistich, Mary Kate, and Timothy N. Bond, 2018. "Symptoms Before the Syndrome? Stalled Racial Progress and Japanese Trade in the 1970s and 1980s." mimeo.

[7] Bayer, Patrick and Kerwin Kofi Charles. 2018. "Divergent Paths: A New Perspective on Earnings Differences Between Black and White Men Since 1940." *The Quarterly Journal of Economics*, 133(3): 1459-1501.

[8] Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." *Journal of Political Economy*, 78: 169-217.

[9] BJS. 1981. "Prisoners in 1980." US Dept of Justice and Office of Justice Programs and United States of America and Journal: Bureau of Justice Statistics Bulletin, 3.

[10] Burdett, Kennett, Ricardo Lagos, and Randall Wright. 2003. "Crime, Inequality and Unemployment." *American Economic Review*, 93(5): 1764-1777.

[11] Carneiro, Pedro, and James J. Heckman. 2003. "Human Capital Policy." *In Inequality in America: What Role for Human Capital Policies?*, ed. James J. Heckman, Alan B. Krueger and Benjamin M. Friedman. Cambridge, MA: MIT Press.

[12] Carneiro, Pedro, James J. Heckman, and Dimitriy V. Masterov. 2005a. "Labor market discrimination and racial differences in premarket factors." *The Journal of Law and Economics* 48.1: 1-39.

[13] Carneiro, Pedro, James J. Heckman, and Dimitriy V. Masterov. 2005b. "Understanding the sources of ethnic and racial wage gaps and their implications for policy." *Handbook of employment discrimination research*. Springer, Dordrecht. 99-136.

[14] Caucutt, Elizabeth M, Nezih Guner, and John Knowles. 2002. "Why do Women Wait? Matching, Wage Inequality, and the Incentives for Fertility Delay." *Review of Economic Dynamics*, 5(4): 815-855.

[15] Charles, Kerwin Kofi, Erik Hurst, and Mariel Schwartz. 2018. "The transformation of manufacturing and the decline in us employment." *NBER Macroeconomics Annual 2018*, volume 33. University of Chicago Press.

[16] Charles, Kerwin Ko, and Ming Ching Luoh. 2010. "Male Incarceration, the Marriage Market, and Female Outcomes." *The Review of Economics and Statistics*, 92(3): 614-627.

[17] Chetty, Raj, Nathaniel Hendren, Maggie R. Jones, and Sonya R. Porter. 2018. "Race and Economic Opportunity in the United States: An Intergenerational Perspective." National Bureau of Economic Research Working Paper 24441.

[18] Chetty, Raj, and Adam Szeidl. 2007. "Consumption commitments and risk preferences." *The Quarterly Journal of Economics*, 122(2): 831-877.

[19] Chiappori, Pierre-Andre, Bernard Fortin, and Guy Lacroix. 2002. "Marriage market, divorce legislation, and household labor supply." *Journal of Political Economy* 110(1): 37-72

[20] Chiappori, Pierre-André, Sonia Oreffice, and Climent Quintana-Domeque. 2016. "Black-White Marital Matching: Race, Anthropometrics, and Socioeconomics." *Journal of Demographic Economics*, 82(4), pp.399-421.

[21] Chiappori, Pierre-André, Monica Costa Dias and Costas Meghir. 2017. "The Marriage Market, Labor Supply and Education Choice." Working Paper.

[22] Congressional Budget Office. 2013. *Growth in Means-Tested Programs and Tax Credits for Low-Income Households.* Washington-DC.

[23] Copen, Casey E., Kimberly Daniels, Jonathan Vespa, and William D. Mosher. 2012. "First Marriages in the United States: Data From the 2006–2010 National Survey of Family Growth" *National Health Statistiscs Report*, Number 49, Centers for Disease Control and Prevention-National Center for Health Statistics.

[24] Cunha, Flavio, James J. Heckman, Lance J. Lochner, and Dimitriy V. Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." In *Handbook of the Economics of Education*, ed. Eric A. Hanushek and Frank Welch, 697–812. Amsterdam: North-Holland-Elsevier.

[25] Doepke, Matthias and Michele Tertilt. 2016. "Families in Macroeconomics." *Handbook of Macroeconomics,* ed. John B. Taylor and Harald Uhlig, Vol. 2b, 1789-1891. Elsevier.

[26] Elliott, Diana B., Kristy Krivickas, Matthew W. Brault, and Rose M. Kreider. 2012. "Historical Marriage Trends from 1890-2010: A Focus on Race

Differences." Paper Presented at the Annual Meeting of the Population Association of America, San Francisco, CA, May 3-5, 2012. Available at https://www.census.gov/hhes/socdemo/marriage/data/acs/index.html.

[27] Fernandez, Raquel, and Joyce Cheng Wong. 2014. "Divorce Risk, Wages and Working Wives: A Quantitative Life-Cycle Analysis of Female Labour Force Participation." *The Economic Journal*, 124(576): 319-358.

[28] Fernandez, Raquel, and Richard Rogerson. 2001. "Sorting and Long-Run Inequality." *The Quarterly Journal of Economics*, 116(4): 1305-1341.

[29] Fryer, Roland G. 2011. "Racial Inequality in the 21st Century: The Declining Significance of Discrimination." in *Handbook of Labor Economics*, David Card and Orley Ashenfelter (eds.), Volume 4, Part B, 2011, Pages 855–971

[30] Gayle, George-Levi, Limor Golan, and Mehmet A Soytas. 2016. "What Accounts for the Racial Gap in Time Allocation and Intergenerational Transmission of Human Capital?" Mimeo.

[31] Goussé, Marion, Nicolas Jacquemet, and Jena-Marc Robin. 2017. "Marriage, Labor Supply, and Home Production." *Econometrica*, 85 (6): 1873-1919

[32] Goodwin Paula Y., William D. Mosher, and Anjani Chandra. 2010. "Marriage and cohabitation in the United States: A statistical portrait based on Cycle 6 (2002) of the National Survey of Family Growth". *Vital Health Statistics* 23(28), Centers for Disease Control and Prevention-National Center for Health Statistics.

[33] Greenwood, Jeremy, Nezih Guner, Georgi Kocharkov, and Cezar Santos. 2016. "Technology and the Changing Family: A Unified Model of Marriage, Divorce, Educational Attainment and Married Female Labor-Force Participation." *American Economic Journal: Macroeconomics*, 8(1): 1–41.

[34] Greenwood, Jeremy, Nezih Guner and Guillaume Vandenbroucke. 2017. "Family Economics Writ Large." *Journal of Economic Literature*, 55(4): 1346-1434.

[35] Guler, Bulant and Amanda Michaud. 2018. "Dynamics of Deterrence: A Macroeconomic Perspective on Punitive Justice Policy." Mimeo.

[36] Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura. 2012. "Taxation and Household Labour Supply." *Review of Economic Studies*, 79(3): 1113-1149.

[37] Guner, Nezih, Christopher Rauh, and Gustavo Ventura. 2018. "Means-Tested Transfers in the US: Facts and Parametric Estimates." Mimeo.

[38] Hamilton, Brady E., Joyce A. Martin, Michelle J.K. Osterman, Sally C. Curtin, and T.J. Mathews. 2015. "Births: Final Data for 2014". National Vital Statistics Report Volume 64, Number 12. National Center for Health Statistics-National Vital Statistics System.

[39] Huggett, Mark, Gustavo Ventura, and Amir Yaron. 2011. "Sources of Lifetime Inequality." *The American Economic Review*, 101(7): 2923.

[40] Imrohoroglu, Ayse, Antonio Merlo and Peter Rupert. 2000. "On the Political Economy of Income Redistribution and Crime," *International Economic Review* 41: 1-25.

[41] Keane, Michael P, and Kenneth I Wolpin. 1997. "The Career Decisions of Young Men." *Journal of Political Economy*, 105(3): 473-522.

[42] Keane, Michael P, and Kenneth I Wolpin. 2010. "The Role of Labor and Marriage Markets, Preference Heterogeneity, and the Welfare System in the Life Cycle Decisions of Black, Hispanic, and White Women." *International Economic Review*, 51(3): 851-892.

[43] King, Miriam, Steven Ruggles, Trent Alexander, Sarah Flood, Katie Genadek, Matthew B Schroeder, Brandon Trampe, and Rebecca Vick. 2010. Integrated public use microdata series, current population survey. Minneapolis: University of Minnesota.

[44] Kling, Jefrey R. 2006. "Incarceration Length, Employment, and Earnings." *The American Economic Review*, 96(3): 863-876.

[45] Kreider, Rose M. and Renee Ellis. 2010. "Number, Timing, and Duration of Marriages and Divorces: 2009." *Population Reports*, P70-125, U.S. Census Bureau, Washington, DC.

[46] Krinsky, Itzhak, and A. Leslie Robb. 1986. "On approximating the statistical properties of elasticities." *The Review of Economics and Statistics*, 715-719.

[47] Lichter, Diane K., McLaughlin, George Kephart and David J. Landry. 1992. "Race and the Retreat From Marriage: A Shortage of Marriageable Men?" *American Sociological Review,* 57(6): 781-799

[48] Lofstrom, Magnus and Steven Raphael. 2016. "Crime, the Criminal Justice System, and Socioeconomic Inequality." *Journal of Economic Perspectives*, 30(2): 103-26.

[49] Lochner, Lance. 2004. "Education, Work, and Crime: A Human Capital Approach,"*International Economic Review* 45: 811-43.

[50] Low, Hamish, Costas Meghir, Luigi Pistaferri, and Alessandra Voena. 2018. "Marriage, Labor Supply and the Dynamics of the Social Safety Net." National Bureau of Economic Research Working Paper 24356.

[51] Llull, Joan. 2018. "Immigration, Wages, and Education: A Labour Market Equilibrium Structural Model." *The Review of Economic Studies*, 85(3): 1852-1896.

[52] McLanahan, Sara, and Gary Sandefur. 2009. *Growing up With a Single Parent: What Hurts, What Helps.* Harvard University Press.

[53] Sara McLanahan, Laura Tach, and Daniel Schneider. 2013. "The Causal Effects of Father Absence." *Annual Review of Sociology*, 39: 399-427.

[54] Moynihan, Daniel Patrick. 1965. "The Negro family: The Case for National Action." Office of Policy Planning and Research United States Department of Labor.

[55] Murray, Charles A. 1984. *Losing ground: American Social Policy*, 1950-1980. Basic Books.

[56] Neal, D., 2004. "The measured black-white wage gap among women is too small." *Journal of Political Economy*, 112(S1), pp.S1-S28.

[57] Neal, Derek and William R Johnson. 1996. "The Role of Premarket Factors in Black-White Wage Differences." *The Journal of Political Economy*, 104(5): 869-895.

[58] Neal, Derek and Armin Rick. 2014. "The Prison Boom and the Lack of Black Progress after Smith and Welch." National Bureau of Economic Research Working Paper 20283.

[59] Neal, Derek and Armin Rick. 2016. "The Prison Boom and Sentencing Policy." *The Journal of Legal Studies*, 45(1), 1-41.

[60] Oppenheimer, Valerie Kincade. 1988. "A Theory of Marriage Timing." *American Journal of Sociology*, 563–591.

[61] Pettit, Becky, and Bruce Western. 2004. "Mass Imprisonment and the Life Course: Race and Class Inequality in US Incarceration." *American Sociological Review*, 69(2): 151-169.

[62] Prescott, Edward C. 1986. "Theory Ahead of Business Cycle Measurement." *Federal Reserve Bank of Minneapolis Quarterly Review* 10 (4): 9–22

[63] Raley, R. Kelly, Megan M. Sweeney, and Danielle Wondra. 2015. "The growing racial and ethnic divide in US marriage patterns." *The Future of children/Center for the Future of Children, the David and Lucile Packard Foundation*, 25(2), p.89.

[64] Rauh, Christopher, and Arnau Valladares-Esteban. 2018. "Wage and Employment Gaps over the Lifecycle - The Case of Black and White Males in the US." mimeo.

[65] Regalia, Ferdinando, and José-Víctor Ríos-Rull. 2001. "What Accounts for the Increase in the Number of Single Households?". Mimeo.

[66] Santos, Cezar, and David Weiss. 2016. "Why Not Settle Down Already? A Quantitative Analysis of the Delay in Marriage." *International Economic Review*, 57(2), 425-452.

[67] Scholz, John Karl, Robert Moffitt, and Benjamin Cowan. 2009. "Trends in Income Support." In *Changing Poverty, Changing Policies*, Maria Cancian and Sheldon Danziger (editors), pages 203-41, New York, NY: Russell Sage Foundation.

[68] Seitz, Shannon. 2009. "Accounting for Racial Differences in Marriage and Employment." *Journal of Labor Economics*, 27(3): 385-437.

[69] Sommer, Kamila. 2016. "Fertility choice in a life cycle model with idiosyncratic uninsurable earnings risk." *Journal of Monetary Economics*, 83: 27-38.

[70] Storesletten, Kjetil, Christopher Telmer, and Amir Yaron. 2004. "Consumption and Risk Sharing over the Life Cycle." *Journal of Monetary Economics*, 51(3): 609-633.

[71] Sumter, Melvina T. 2005. "Religiousness and Post-Release Community Adjustment in the United States, 1990-1998." Inter-university Consortium for Political and Social Research (ICPSR).

[72] Voena, Alessandra. 2015. "Yours, Mine, and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?" *American Economic Review*, 105 (8): 2295-2332

[73] Waldfogel, Joel. 1994. "Does Conviction have a Persistent Effect on Income and Employment?" *International Review of Law and Economics*, 14(1): 103-119.

[74] Western, Bruce. 2006. *Punishment and Inequality in America.* New York, NY: Russell Sage Foundation.

[75] West, Heather C, William J Sabol, and Sarah J Greenman. 2010. "Prisoners in 2009." *Bureau of Justice Statistics Bulletin*, 1-37.

[76] Wilson, William Julius. 1987. *The Truly Disadvantaged*. Chicago, IL: University of Chicago Press.

[77] Wolfers, Justin, David Leonhardt, and Kevin Quealy. 2015. "1.5 million missing black men." The New York Times. April 20.

[78] Wong, Linda Y. 2003. "Why do only 5.5% of Black Men Marry White Women?" *International Economic Review*, 44(3): 803-826.

[79] Wood, Robert G. 1995. "Marriage rates and marriageable men: A test of the Wilson hypothesis." *Journal of Human Resources*: 163-193.

Appendix

This Appendix is meant for online publication.

A Value functions

In this Appendix, we define the start-of-the-period value functions that we use in Section 4.

A.1 Start-of-the-Period Values

In order to construct the expected value for a woman of being single or married to a specific match next period, we need to incorporate how both her and her match's uncertainty evolve. To this end, it is helpful to note that, given the definition of $\mathcal{S}_f^S = (x, q, \varepsilon)$, $V_f^S(\mathcal{S}_f^S, \lambda) = V_f^S(x, q, \varepsilon, \lambda)$.

Consider first a single woman who is currently employed. Next period, she can lose her job with probability δ^x. Then she is non-employed next period and has a value function of $V_f^S(x, q, \varepsilon, \lambda = u)$. Note that when a person is non-employed, it does not matter what his or her wage shock is. If she keeps her job, which happens with probability $1 - \delta^x$, she draws a new wage shock according to $\Upsilon_f^x(\varepsilon'|\varepsilon)$, and enjoys $V_f^S(x, q, \varepsilon = \varepsilon', \lambda = e)$. As a result, for a single woman who is employed at the start of the period, i.e. $\lambda = e$, the expected value of remaining single is given by

$$EV_f^S(x, q, \varepsilon, \lambda = e) = \delta^x V_f^S(x, q, \varepsilon, \lambda = u) + (1 - \delta^x) \sum_{\varepsilon'} \Upsilon_f^x(\varepsilon'|\varepsilon) V_f^S(x, q, \varepsilon = \varepsilon', \lambda = e). \quad (4)$$

A single woman who is currently non-employed, on the other hand, receives a job offer with probability θ^x and draws a wage shock from $\widetilde{\Upsilon}_f^x(\varepsilon'_f)$. If she does not receive a job offer, then she is non-employed next period. Therefore, for a single woman who is non-employed the expected value of remaining single is given by:

$$EV_f^S(x, q, \varepsilon, \lambda = u) = \theta^x \sum_{\varepsilon'} \widetilde{\Upsilon}_f^x(\varepsilon') V_f^S(x, q, \varepsilon = \varepsilon', \lambda = e) + (1 - \theta^x) V_f^S(x, q, \varepsilon, \lambda = u). \quad (5)$$

A single woman who is currently employed can also match with a potential partner next period. Again recall that given the definitions of $\mathcal{S}_f^S = (x, q, \varepsilon)$ and $\mathcal{S}_m^S = (z, \lambda, \varepsilon)$, $EV_f^M(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) = EV_f^M(x, q, \lambda_f, \varepsilon_f; z, P, \lambda_m, \varepsilon_m; \gamma, \phi)$. For a single woman who is currently employed, the expected value of being married to a type-$(z, \lambda_m, \varepsilon_m, P)$ man with match qualities γ and ϕ is then given by

$$\begin{aligned} & EV_f^M(x, q, \varepsilon_f, z, \lambda_m, \varepsilon_m, \gamma, \phi, \lambda_f = e, P) \quad (6) \\ = \; & \delta^x \sum_{\varepsilon'_m, \lambda'_m} \Pi^z(\lambda'_m, \varepsilon'_m | \lambda_m, \varepsilon_m) V_f^M(x, q, \lambda_f = u, \varepsilon_f; z, P', \lambda'_m, \varepsilon'_m; \gamma, \phi) \\ & + (1 - \delta^x) \sum_{\varepsilon'_f, \varepsilon'_m, \lambda'_m} \Upsilon_f^x(\varepsilon'_f | \varepsilon_f) \Pi^z(\lambda'_m, \varepsilon'_m | \lambda_m, \varepsilon_m) V_f^M(x, q, \lambda_f = e, \varepsilon_f; z, P', \lambda'_m, \varepsilon'_m; \gamma, \phi), \end{aligned}$$

where

$$P' = \begin{cases} 1 \text{ if } \lambda'_m = p \\ P \text{ otherwise} \end{cases},$$

with V_f^M defined as in Section 4.3 in the main text. Note that for a single woman, the expected value of being married is determined both by the labor market transitions of her potential husband, $\Pi^z(\lambda'_m, \varepsilon'_m | \lambda_m, \varepsilon_m)$, as well as her own labor market transitions, δ^x and $\Upsilon_f^x(\varepsilon'_f | \varepsilon_f)$.

Finally, for a single woman who is currently non-employed, the expected value of being married to a type-$(z, \lambda_m, \varepsilon_m, P)$ man with match qualities γ and ϕ is given by

$$\begin{aligned} & EV_f^M(x, q, \varepsilon_f, z, \lambda_m, \varepsilon_m, \gamma, \phi, \lambda_f = u, P) \quad (7) \\ = \; & \theta^x \sum_{\varepsilon'_f, \varepsilon'_m, \lambda'_m} \widetilde{\Upsilon}_f^x(\varepsilon'_f) \Pi^z(\lambda'_m, \varepsilon'_m | \lambda_m, \varepsilon_m) V_f^M(x, q, \lambda_f = e, \varepsilon_f; z, P', \lambda'_m, \varepsilon'_m; \gamma, \phi) \\ & (1 - \theta^x) \sum_{\varepsilon'_m, \lambda'_m} \Pi^z(\lambda'_m, \varepsilon'_m | \lambda_m, \varepsilon_m) V_f^M(x, q, \lambda_f = u, \varepsilon_f; z, P', \lambda'_m, \varepsilon'_m; \gamma, \phi), \end{aligned}$$

where

$$P' = \begin{cases} 1 \text{ if } \lambda'_m = p \\ P \text{ otherwise} \end{cases}.$$

Then the value of being a single woman at the start of the period, equation (1) in the main text, is then given by:

$$
\begin{aligned}
\widetilde{V}_f^S(x,q,\lambda_f,\varepsilon_f) \;=\;& (1-\kappa^x)EV_f^S(x,q,\lambda_f,\varepsilon_f)+ \\
& \kappa^x\varphi_f^x \sum_{P,\lambda_m,\varepsilon_m,\gamma,\phi} \max\{EV_f^M(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\
& I_m(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi), \\
& EV_f^S(x,q,\lambda_f,\varepsilon_f)\}\Gamma(\gamma)\Theta(\phi)\Omega(z,P,\lambda_m,\varepsilon_m|z=x)\} \\
& +\kappa^x(1-\varphi_f^x) \sum_{z,P,\lambda_m,\varepsilon_m,\gamma,\phi} \max\{EV_f^M(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\
& I_m(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi), \\
& EV_f^S(x,q,\lambda_f,\varepsilon_f)\}\Gamma(\gamma)\Theta(\phi)\Omega(z,P,\lambda_m,\varepsilon_m)\}.
\end{aligned} \tag{8}
$$

A.2 Start-of-the-Period Value for a Single Man

For a single man it is easier to define the start-of-the-period value functions conditional on whether he is in prison.

A.2.1 If in prison

If a single man is in prison, his current state is given by $\mathcal{S}_m^S = (z, \lambda = p, \varepsilon)$, and $P = 1$ (i.e. he has a criminal record), and it doesn't matter what his wage shock is as he does not work. Next period, with probability π_{pu} he is released as an unemployed person and $\lambda' = u$, while he becomes employed with probability π_{pe}. In that case, he starts working at the lowest wage shock ε_1. Finally, with the remaining probability, π_{pp}, he stays in the prison. If a man moves to unemployment or employment from prison, he remains single for one period, before he participates again in the marriage market. Therefore, his continuation value is simply given by

$$
\widetilde{V}_m^S(z,p,\varepsilon,1) = \pi_{pu}V_m^S(z,u,\varepsilon,1) + \pi_{pe}V_m^S(z,e,\varepsilon_1,1) + (1-\pi_{pu}-\pi_{pe})V_m^S(z,p,\varepsilon,1). \tag{9}
$$

A.2.2 Not in prison

A single man, who is not in the prison, meets a single woman, draws γ and ϕ, and decides whether to get married. His decisions are based on expected values of being single and married.

The expected value of being a single man is given by

$$EV_m^S(z,\lambda,\varepsilon,P)=\sum_{\varepsilon',\lambda'}\Pi^z(\lambda',\varepsilon'|\lambda,\varepsilon)V_m^S(z,\lambda',\varepsilon',P'), \tag{10}$$

with

$$P'=\begin{cases}1 \text{ if } \lambda'=p\\ P \text{ otherwise}\end{cases}.$$

The expected value of being married to a woman who is employed at the start of the period is:

$$\begin{aligned}&EV_m^M(x,q,\varepsilon_f,\lambda_f=e;z,P,\lambda_m,\varepsilon_m;\gamma,\phi) \qquad (11)\\ =\;&\delta^x\sum_{\varepsilon'_m,\lambda'_m}\Pi^z(\lambda'_m,\varepsilon'_m|\lambda_m,\varepsilon_m)V_m^M(x,q,\varepsilon_f,\lambda_f=u;z,P',\lambda'_m,\varepsilon'_m;\gamma,\phi)\\ &+(1-\delta^x)\sum_{\varepsilon'_f,\varepsilon'_m,\lambda'_m}\Upsilon_f^x(\varepsilon'_f|\varepsilon_f)\Pi^z(\lambda'_m,\varepsilon'_m|\lambda_m,\varepsilon_m)V_m^M(x,q,\varepsilon'_f,\lambda_f=e;z,P',\lambda'_m,\varepsilon'_m;\gamma,\phi),\end{aligned}$$

with

$$P'=\begin{cases}1 \text{ if } \lambda'_m=p\\ P \text{ otherwise}\end{cases}.$$

Finally, the expected value of being married to a woman who is non-employed at the start of the period is defined as:

$$\begin{aligned}&EV_m^M(x,q,\varepsilon_f,\lambda_f=u;z,P,\lambda_m,\varepsilon_m;\gamma,\phi) \qquad (12)\\ =\;&\theta^x\sum_{\varepsilon'_f,\varepsilon'_m,\lambda'_m}\widetilde{\Upsilon}_f^x(\varepsilon'_f)\Pi^z(\lambda'_m,\varepsilon'_m|\lambda_m,\varepsilon_m)V_m^M(x,q,\varepsilon'_f,\lambda_f=e;z,P',\lambda'_m,\varepsilon'_m;\gamma,\phi)\\ &(1-\theta(x))\sum_{\varepsilon'_m,\lambda'_m}\Pi^z(\lambda'_m,\varepsilon'_m|\lambda_m,\varepsilon_m)V_m^M(x,q,\varepsilon_f,\lambda_f=u;z,P',\lambda'_m,\varepsilon'_m;\gamma,\phi),\end{aligned}$$

where again

$$P'=\begin{cases}1 \text{ if } \lambda'_m=p\\ P \text{ otherwise}\end{cases}.$$

Then, the start-of-the period value function for a single man can be written as

$$
\begin{aligned}
\widetilde{V}_m^S(z,\lambda,\varepsilon,P) \;=\;& \varphi_m^z \sum_{\lambda_f,\varepsilon_f,\gamma,\phi} \max\{EV_m^M(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\
& I_f(x,q,\lambda_f,\varepsilon_f;x,P,\lambda_m,\varepsilon_m;\gamma,\phi), EV_m^S(z,\lambda,\varepsilon,P)\} \\
& \Gamma(\gamma)\Theta(\phi)\Phi(x,\lambda_f,\varepsilon_f|x=z)\} + \qquad (13) \\
& (1-\varphi_m^z) \sum_{\lambda_f,\varepsilon_f,\gamma,\phi} \max\{EV_m^M(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi) \\
& I_f(x,q,\lambda_f,\varepsilon_f;z,P,\lambda_m,\varepsilon_m;\gamma,\phi), \\
& EV_m^S(z,\lambda,\varepsilon,P)\}\Gamma(\gamma)\Theta(\phi)\Phi(x,\lambda_f,\varepsilon_f)\},
\end{aligned}
$$

where, $\Phi(\mathcal{S}_f^S,\lambda_f)$ is the endogenous distribution of single women.

A.3 Indicators for Marriage

For a single man who is contemplating marriage, the indicator function is defined as

$$
I_m(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi,) = \begin{cases} 1, & \text{if } EV_m^M(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi,) \geq EV_m^S(\mathcal{S}_m^S,P) \\ 0, & \text{otherwise.} \end{cases}
$$

Similarly for women, we have

$$
I_f(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi,) = \begin{cases} 1, & \text{if } EV_f^m(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi,) \geq EV_f^s(\mathcal{S}_f^S,\lambda_f) \\ 0, & \text{otherwise.} \end{cases}
$$

A.4 Start-of-the-Period Value for a Married Woman

Now consider the value of being married at the start of a period for a married women. Given the state $(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi)$, a married woman decides whether to stay married. She will do this before she observes her and her partner's new labor market status. Her problem is then given by:

$$
\widetilde{V}_f^M(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi) = \max\{EV_f^M(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi)I_m^d(\mathcal{S}_f^S,\mathcal{S}_m^S,\lambda_f,P;\gamma,\phi), EV_f^S(\mathcal{S}_f^S,\lambda_f)-\eta\},
$$

where $EV_f^S(.)$, the expected value of being single, is defined above by Equations (4) and (5), and her expected value of continuing with the current marriage, $EV_f^M(.)$, is defined by Equations (6) and (7). Note that $I_m^d(.)$ indicates whether her husband wants to continue the current marriage. If she decides to divorce, then she suffers the utility cost η.

A.5 Start-of-the-Period Value for a Married Man

Similarly, given the state $(\mathcal{S}_f^S, \mathcal{S}_m^S, \gamma, \phi, \lambda_f, P)$, a married man has to decide whether to stay married. He makes this decision based on the following comparison

$$\widetilde{V}_m^M(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) = \max\{EV_m^M(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) I_f^d(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi), EV_m^S(\mathcal{S}_m^S, P) - \eta\},$$

where $EV_m^S(.)$ is defined by Equations (9) and (10), and $EV_m^M(.)$ is defined by Equations (11) and (12). Note that $I_f^d(.)$ indicates whether his wife wants to stay married. A married man who is in prison can decide to continue his marriage if his wife agrees. If he or his wife decide to divorce, then he is a single man the next period. He is a single man in prison or is released and enters into the labor market.

A.6 Indicators for Divorce

For a married man who is contemplating a divorce, the indicator function is given by

$$I_m^d(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) = \begin{cases} 1, \text{ if } EV_m^M(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) \geq EV_m^S(\mathcal{S}_m^S, P) - \eta \\ 0, \text{ otherwise.} \end{cases}$$

Similarly for women, we have

$$I_f^d(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) = \begin{cases} 1 \text{ if } EV_f^M(\mathcal{S}_f^S, \mathcal{S}_m^S, \lambda_f, P; \gamma, \phi) \geq EV_f^S(\mathcal{S}_f^S, \lambda_f) - \eta \\ 0, \text{ otherwise.} \end{cases}$$

Note that these are identical to singles' indicators, except for the fact that divorce involves a one-time utility cost η.

B Survey of Inmates in State and Federal Correctional Facilities

In this Appendix, we present further details on our sample from the Survey of Inmates in State and Federal Correctional Facilities (SISCF). Table B1 summarizes key characteristics for state (left columns) and federal (right columns) prisoners that entered prison within the last twelve months. As in our quantitative study, we restrict the sample to 25-54 year olds. The average age is 36 for both state and federal prisoners, while the average sentence length is substantially longer in federal prison (nine vs. six years). While in state prison the sample is nearly balanced in terms of race, in federal prison inmates are predominantly black (63%). In terms of education, in state prison 36% did not complete high school, 52% completed at most high school, 10% have some college education, while 3% have completed college. Federal prisoners, on average, are more educated than state prisoners.

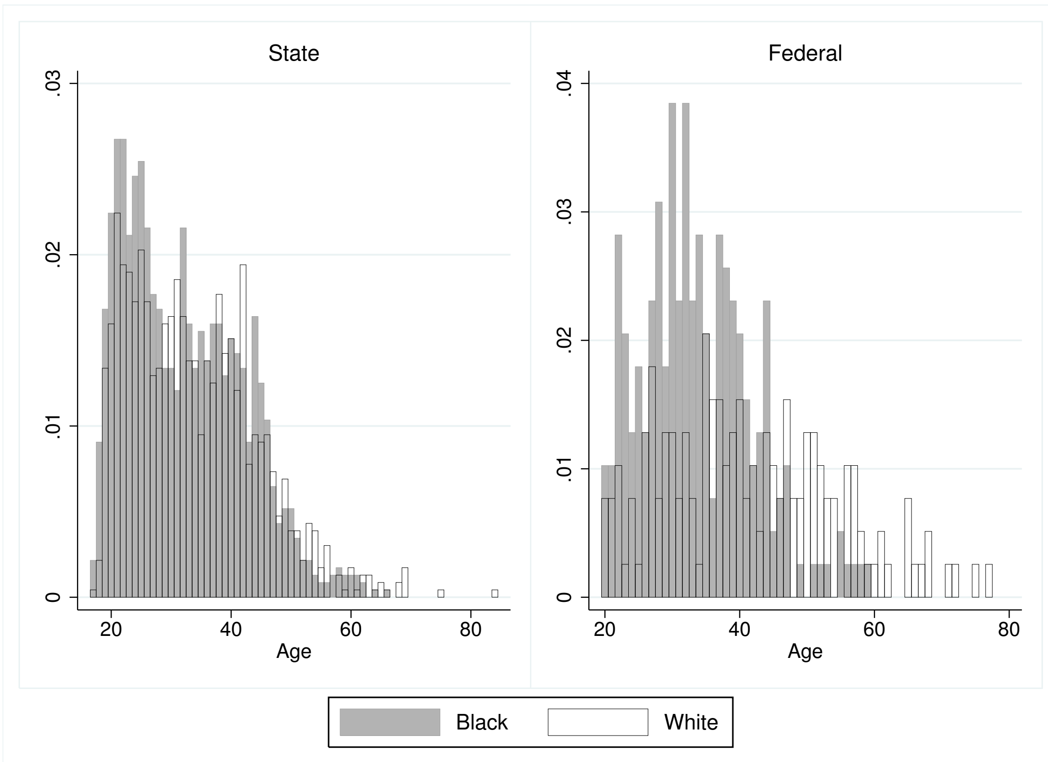
Table B1: Descriptive statistics of inmate sample

	State		Federal	
	Mean	[SD]	Mean	[SD]
Age	36.07	[7.53]	35.71	[7.21]
Sentence (years)	6.37	[9.13]	9.38	[8.06]
Race				
White	.48	[.5]	.37	[.48]
Black	.52	[.5]	.63	[.48]
Education				
<HS	.36	[.48]	.19	[.39]
HS	.51	[.5]	.56	[.5]
SC	.1	[.30]	.17	[.37]
C	.03	[.18]	.08	[.27]
Observations	1652		311	

Notes: About 14% (86%) of the total inmate population is held in federal (state) prison.

One common fallacy is that predominantly young men enter prison. Figure B1 plots the age distribution of male inmates that report having entered into prison within the last twelve months. The gray bars represent the share of black men, whereas the white bars represent the share of white men by age. The left panel displays the distribution for state and the right panel for federal prison. It is important to note that only about 14% of the prison population are in federal prison. The probability of entering into prison seems to be declining with age and nearly tampers off above the age of 60. However, it also becomes apparent that a substantial fraction of recent new entries into (state) prison are in their forties for both black and white men, and the age distribution, in particular in state prisons, is rather uniform between ages 20 and 50.

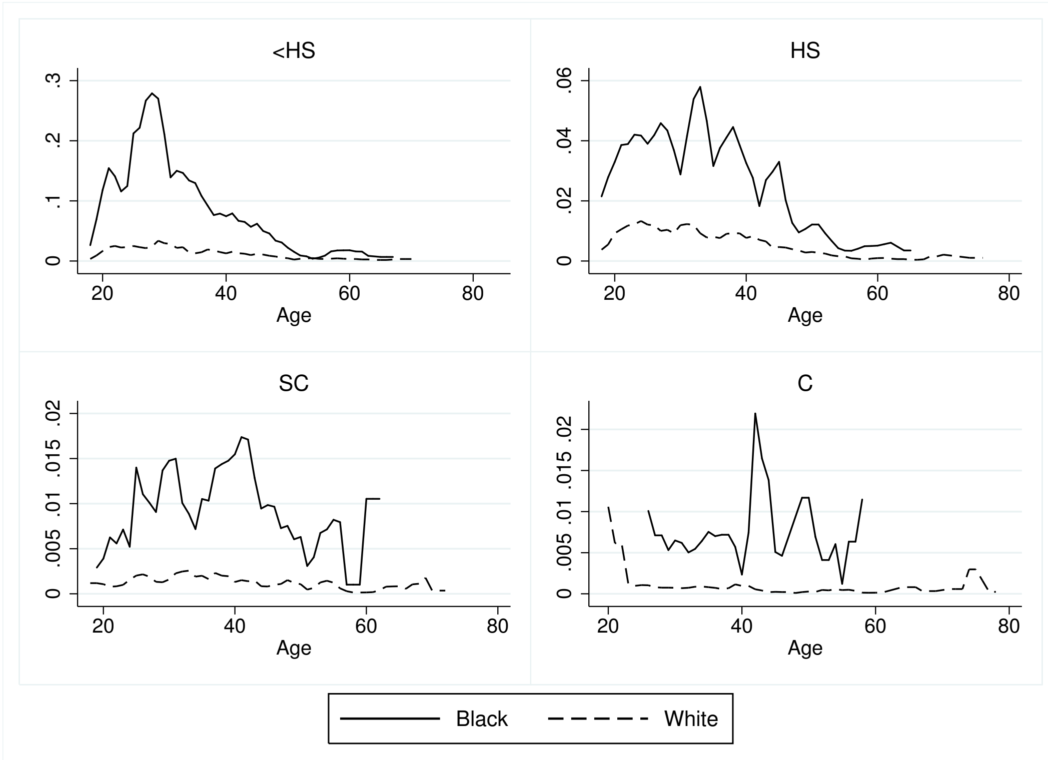
Figure B1: Age distribution of inmates by race that entered prison within last year (2004)



In Figure B2, we plot the probability of transitioning into prison at a given age by race and education using the methodology described in Section 5.1. Each panel is dedicated to one of the levels of education, while the solid line refers to black men and the dashed line to white men. It becomes apparent that black men are more likely to transition into prison than white men at all ages within each level of education.

In Figure B3 we plot the distribution of sentence lengths for black men (gray bars) and white men (white bars) for state (left) and federal (right) inmates in our restricted sample. In state prison the modal sentence length for black and white men is two years and more than 50% have sentences of less than five years. In federal prison we see that, in particular for black men, the share of inmates with lengthy sentences is higher. Almost 10% of black inmates face sentences of more than 25 years and about 30% of at least 10 years. For white

Figure B2: Probability of transitioning into prison by age, education, and race (2004)



inmates these shares are less than half of what they are for black inmates.

The distribution of offenses by race is displayed in Figure B4. For black men in state prisons (black bars in left panel) the most frequent offense is drug trafficking, followed by burglary, armed robbery, and aggravated assault. For white men in state prison (white bars in left panel), the three most frequent offenses are burglary, theft, and driving under the influence of alcohol. In federal prison (right panel), the three most frequent offenses for black men are cocaine/crack trafficking, offenses involving illegal possession of weapons, and drug trafficking. For white men, drug trafficking, weapon offenses, and trafficking of controlled substances are the most frequent offenses.[40]

[40]In many cases the type of illegal drug is not specified. Surprisingly, cocaine and crack are bunched in the same category even though under mandatory sentence lengths under federal law the sentencing disparity was 100:1 for crack versus cocaine in 2004. For black men, crack is likely to be the dominant substance within the crack/cocaine category. For white men, methamphetamines and "crystal meth" are likely to be the dominant substances within the controlled substances category.

Figure B3: Sentence distribution of inmates by race that entered prison within last year (2004)

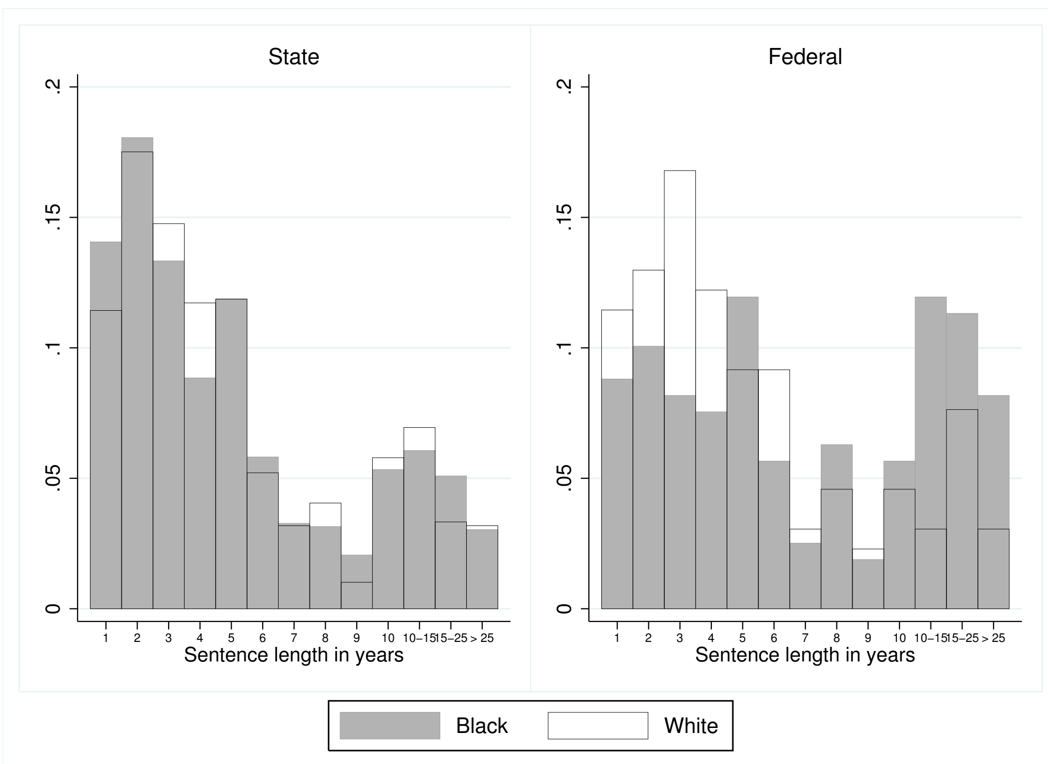
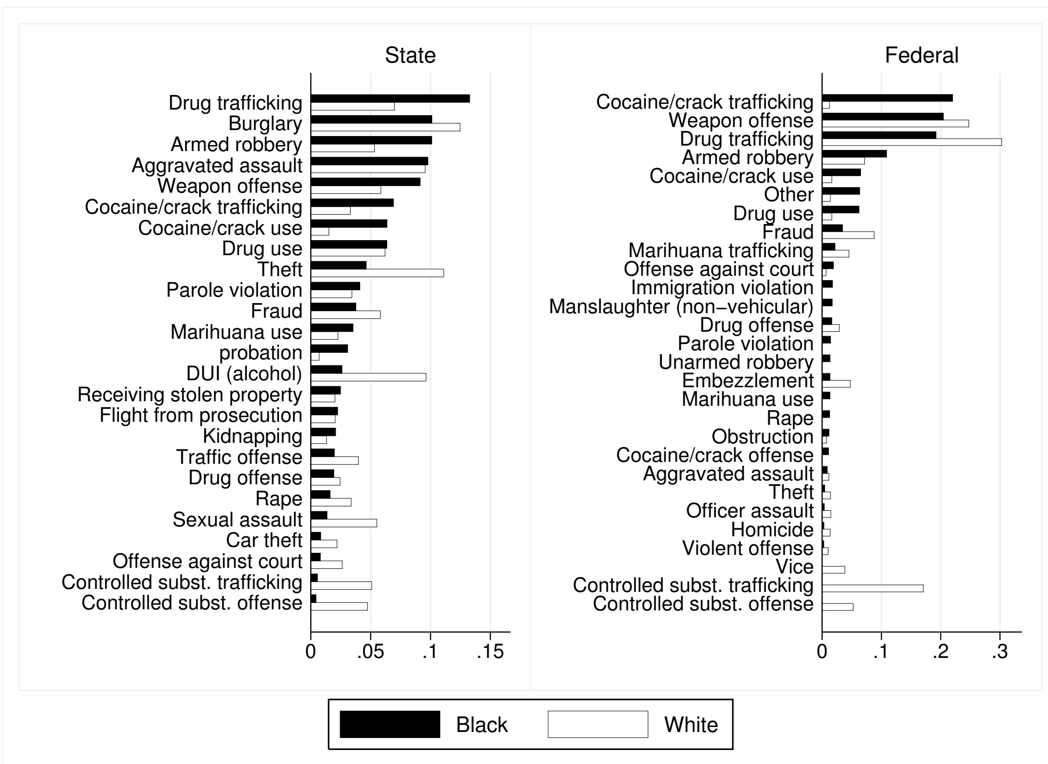


Figure B4: Offenses of inmates by race that entered prison within last year (2004)



C Transitions

In this Appendix, we present wage transitions, initial wage draws for men and women, and full transition matrices for men.

Table C1: Wage Transitions, Men

		Black					White				
		ε_1	ε_2	ε_3	ε_4	ε_5	ε_1	ε_2	ε_3	ε_4	ε_5
$<$ HS	ε_1	.209	.313	.239	.164	.075	.361	.234	.197	.102	.107
	ε_2	.076	.418	.271	.138	.098	.094	.484	.206	.123	.093
	ε_3	.057	.208	.371	.201	.163	.051	.178	.445	.224	.101
	ε_4	.038	.173	.269	.375	.144	.025	.101	.198	.501	.175
	ε_5	.008	.093	.217	.217	.465	.033	.071	.133	.179	.584
HS	ε_1	.385	.294	.161	.095	.065	.464	.251	.134	.085	.067
	ε_2	.128	.418	.229	.145	.081	.123	.481	.216	.11	.071
	ε_3	.072	.183	.389	.217	.139	.058	.162	.482	.204	.094
	ε_4	.063	.123	.212	.389	.213	.041	.099	.187	.51	.162
	ε_5	.048	.13	.131	.224	.467	.038	.088	.119	.191	.564
SC	ε_1	.392	.267	.122	.136	.083	.459	.268	.127	.084	.062
	ε_2	.134	.39	.192	.159	.126	.108	.509	.216	.103	.064
	ε_3	.088	.174	.419	.204	.115	.066	.167	.471	.214	.082
	ε_4	.067	.15	.19	.388	.205	.046	.097	.169	.516	.171
	ε_5	.06	.129	.131	.225	.454	.047	.077	.094	.172	.609
C	ε_1	.403	.266	.162	.097	.071	.518	.239	.113	.085	.046
	ε_2	.176	.403	.195	.131	.096	.136	.49	.211	.109	.055
	ε_3	.105	.197	.352	.223	.123	.073	.166	.452	.228	.081
	ε_4	.062	.121	.179	.429	.208	.052	.091	.167	.522	.168
	ε_5	.057	.082	.13	.209	.522	.043	.069	.102	.209	.577

Table C2: Wage Transitions, Women

		Black					White				
		ε_1	ε_2	ε_3	ε_4	ε_5	ε_1	ε_2	ε_3	ε_4	ε_5
< HS	ε_1	.365	.282	.200	.094	.059	.392	.265	.114	.136	.093
	ε_2	.104	.377	.251	.126	.142	.120	.427	.201	.160	.091
	ε_3	.042	.170	.420	.231	.137	.075	.175	.410	.253	.087
	ε_4	.052	.117	.240	.403	.188	.044	.118	.169	.504	.165
	ε_5	.043	.148	.174	.113	.522	.054	.099	.127	.203	.517
HS	ε_1	.310	.268	.149	.134	.139	.456	.241	.138	.108	.057
	ε_2	.110	.400	.205	.161	.124	.117	.456	.230	.135	.061
	ε_3	.068	.234	.353	.213	.132	.060	.135	.480	.219	.076
	ε_4	.049	.157	.207	.394	.193	.051	.105	.190	.501	.153
	ε_5	.070	.169	.140	.191	.429	.044	.099	.126	.238	.493
SC	ε_1	.346	.210	.198	.156	.091	.450	.246	.146	.104	.055
	ε_2	.175	.392	.186	.166	.082	.121	.457	.230	.132	.059
	ε_3	.080	.250	.362	.225	.083	.072	.174	.462	.218	.074
	ε_4	.043	.153	.185	.403	.216	.048	.102	.191	.504	.155
	ε_5	.068	.114	.117	.203	.498	.036	.078	.108	.223	.555
C	ε_1	.377	.266	.178	.103	.075	.483	.264	.124	.085	.045
	ε_2	.175	.385	.246	.124	.069	.141	.478	.223	.104	.053
	ε_3	.113	.194	.329	.232	.132	.075	.177	.464	.206	.077
	ε_4	.071	.133	.210	.409	.177	.048	.095	.183	.496	.179
	ε_5	.054	.099	.150	.165	.533	.043	.070	.095	.225	.566

Table C3: Initial Wage Shocks Coming Out of Unemployment

		Black					White				
	Educ.	ε_1	ε_2	ε_3	ε_4	ε_5	ε_1	ε_2	ε_3	ε_4	ε_5
Women	< HS	.110	.362	.178	.209	.141	.181	.316	.204	.173	.127
	HS	.210	.299	.219	.156	.115	.316	.310	.178	.112	.085
	SC	.221	.351	.188	.137	.103	.301	.292	.181	.118	.108
	C	.304	.240	.179	.118	.160	.353	.219	.162	.141	.125
Men	< HS	.184	.218	.299	.126	.172	.212	.320	.138	.193	.138
	HS	.230	.302	.159	.183	.127	.267	.256	.203	.158	.117
	SC	.196	.314	.209	.150	.131	.305	.210	.234	.171	.080
	C	.310	.239	.197	.120	.134	.354	.241	.171	.131	.104

Table C4: Full Transition Matrix for Men

Educ.		Black							White						
		P	U	ε_1	ε_2	ε_3	ε_4	ε_5	P	U	ε_1	ε_2	ε_3	ε_4	ε_5
<HS	P	.67	.206	.124	0	0	0	0	.67	.186	.144	0	0	0	0
	U	.085	.771	.026	.031	.043	.018	.025	.015	.793	.041	.061	.026	.037	.026
	ε_1	.085	.137	.283	.22	.155	.073	.046	.015	.088	.352	.238	.102	.122	.083
	ε_2	.085	.137	.081	.293	.195	.098	.111	.015	.088	.108	.384	.181	.144	.082
	ε_3	.085	.137	.033	.132	.326	.18	.106	.015	.088	.067	.157	.368	.227	.078
	ε_4	.085	.137	.04	.091	.187	.313	.146	.015	.088	.04	.106	.152	.452	.148
	ε_5	.085	.137	.034	.115	.135	.088	.406	.015	.088	.049	.089	.114	.182	.464
HS	P	.67	.206	.124	0	0	0	0	.67	.186	.144	0	0	0	0
	U	.03	.733	.054	.071	.038	.043	.03	.007	.686	.082	.079	.062	.049	.036
	ε_1	.03	.1	.27	.233	.13	.117	.121	.007	.053	.429	.226	.129	.102	.054
	ε_2	.03	.1	.095	.348	.178	.14	.108	.007	.053	.11	.429	.217	.127	.058
	ε_3	.03	.1	.059	.204	.307	.186	.115	.007	.053	.057	.155	.451	.206	.071
	ε_4	.03	.1	.043	.137	.18	.343	.168	.007	.053	.048	.098	.179	.471	.144
	ε_5	.03	.1	.061	.147	.122	.167	.373	.007	.053	.041	.094	.118	.224	.463
SC	P	.67	.206	.124	0	0	0	0	.67	.186	.144	0	0	0	0
	U	.01	.665	.064	.102	.068	.049	.043	.002	.631	.112	.077	.086	.063	.03
	ε_1	.01	.081	.314	.191	.18	.142	.082	.002	.046	.428	.234	.139	.099	.052
	ε_2	.01	.081	.159	.356	.169	.15	.074	.002	.046	.115	.435	.22	.126	.056
	ε_3	.01	.081	.073	.227	.329	.204	.075	.002	.046	.068	.166	.44	.208	.07
	ε_4	.01	.081	.039	.139	.169	.366	.196	.002	.046	.046	.097	.182	.48	.148
	ε_5	.01	.081	.062	.104	.106	.185	.453	.002	.046	.034	.075	.103	.213	.529
C	P	.67	.206	.124	0	0	0	0	.67	.186	.144	0	0	0	0
	U	.005	.643	.109	.084	.069	.042	.047	.001	.522	.169	.115	.082	.062	.05
	ε_1	.005	.05	.356	.252	.169	.097	.071	.001	.025	.47	.257	.121	.083	.043
	ε_2	.005	.05	.166	.364	.233	.117	.065	.001	.025	.138	.465	.217	.102	.052
	ε_3	.005	.05	.106	.183	.312	.219	.125	.001	.025	.073	.172	.453	.2	.075
	ε_4	.005	.05	.067	.125	.199	.387	.167	.001	.025	.047	.092	.178	.483	.174
	ε_5	.005	.05	.051	.093	.142	.156	.504	.001	.025	.042	.068	.093	.219	.552

D Identification

In this Appendix we present the changes in moments in response to changes in parameters.

D.1 Random matching

In the following Tables D1-D4 we show how moments change when setting matching to random, i.e. $\varphi_m^{z,r} = 0 \; \forall \; z, r$.

Table D1: Fraction Married with Random Matching(model vs (data))

	Education	Black	White
Women	<HS	.16 (.21)	.51 (.53)
	HS	.32 (.31)	.60 (.65)
	SC	.38 (.35)	.62 (.65)
	C	.58 (.42)	.67 (.68)
	All	.36 (.34)	.60 (.67)
Men	<HS	.19 (.25)	.45 (.48)
	HS	.39 (.38)	.57 (.58)
	SC	.51 (.47)	.61 (.62)
	C	.60 (.53)	.68 (.69)

Table D2: Marriage Dynamics for Women with Random Matching (model vs (data))

Married by	20	25	30	35	40
Black	.05 (.05)	.28 (.24)	.45 (.47)	.58 (.58)	.69 (.64)
White	.10 (.14)	.46 (.48)	.67 (.74)	.80 (.84)	.87 (.89)

Duration	1 year	3 years	5 years	10 years
Black	.90 (.92)	.76 (.81)	.66 (.73)	.50 (.51)
White	.95 (.95)	.86 (.86)	.80 (.78)	.69 (.64)

Table D3: Assortative Mating by Race and Education with Random Matching (model vs (data))

Black				
	Wife			
Husband	<HS	HS	SC	C
<HS	**.001 (.018)**	.013 (.039)	.015 (.013)	.034 (.004)
HS	.015 (.029)	**.179 (.245)**	.145 (.126)	.122 (.063)
SC	.016 (.005)	.104 (.070)	**.078 (.117)**	.075 (.067)
C	.015 (.002)	.069 (.027)	.052 (.046)	**.066 (.128)**
White				
	Wife			
Husband	<HS	HS	SC	C
<HS	**.001 (.013)**	.014 (.025)	.013 (.008)	.023 (.002)
HS	.015 (.019)	**.127 (.205)**	.096 (.095)	.133 (.055)
SC	.010 (.004)	.077 (.070)	**.059 (.089)**	.083 (.065)
C	.016 (.001)	.122 (.042)	.090 (.068)	**.121 (.240)**

Table D4: Labor Market and Marital Status with Random Matching (model vs (data))

		Blacks				
Educ	Marital St.	Men (Stock)			Women (Transition)	
		E	U	P	EE	UU
< HS	Single	36 (.29)	.43 (.43)	.21 (.28)	.79 (**.80**)	.84 (**.84**)
	Married	.48 (.57)	.34 (.29)	.18 (.14)	.77 (.83)	.85 (.86)
HS	Single	.57 (.56)	.34 (.32)	.09 (.12)	.87 (**.88**)	.76 (**.76**)
	Married	.70 (.78)	.24 (.18)	.06 (.04)	.87 (.91)	.77 (.71)
SC	Single	.72 (.71)	.24 (.22)	.04 (.07)	.89 (**.90**)	.68 (**.68**)
	Married	.81 (.85)	.17 (.13)	.02 (.02)	.88 (.90)	.70 (.70)
C	Single	.81 (.82)	.17 (.16)	.02 (.02)	.95 (**.96**)	.50 (**.49**)
	Married	.89 (.92)	.10 (.07)	.01 (.01)	.93 (.95)	.56 (.65)

		Whites				
Educ	Marital St.	Men (Stock)			Women (Transition)	
		E	U	P	EE	UU
< HS	Single	.60 (.54)	.36 (.38)	.06 (.08)	.85 (**.85**)	.85 (**.85**)
	Married	.71 (.75)	.26 (.23)	.03 (.02)	.78 (.86)	.88 (.84)
HS	Single	.79 (.74)	.19 (.22)	.03 (.04)	.92 (**.92**)	.76 (**.76**)
	Married	.86 (.90)	.12 (.10)	.02 (.00)	.86 (.91)	.81 (.79)
SC	Single	.85 (.82)	.15 (.17)	.00 (.01)	.93 (**.93**)	.70 (**.70**)
	Married	.91 (.92)	.09 (.07)	.00 (.01)	.87 (.92)	.76 (.76)
C	Single	.93 (.89)	.07 (.11)	.00 (.00)	.95 (**.96**)	.53 (**.52**)
	Married	.96 (.96)	.04 (.04)	.00 (.00)	.87 (.95)	.64 (.75)

D.2 Changes in Moments in Response to a Shift in a Parameter

In the following Figures D1-D5 we show heatmaps where the shade of cell corresponds to the strength of the change in the moment specified on the y-axis in percentage terms in response to a 0.5 standard deviation increase in the parameter specified on the x-axis. The bluer (redder) a cell, the stronger the decrease (increase).

Figure D1: Changes in Marriage Rates in Response to Changes in Parameters

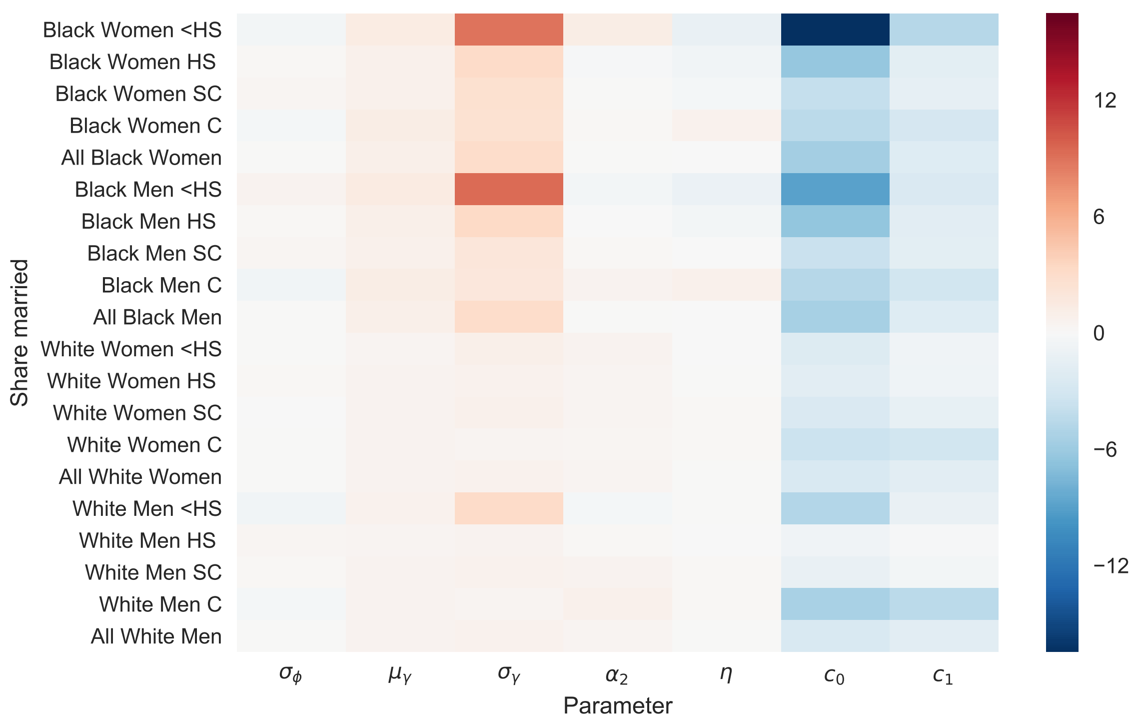


Figure D2: Changes in Marriage by Employment Transitions amongst Women in Response to Changes in Parameters

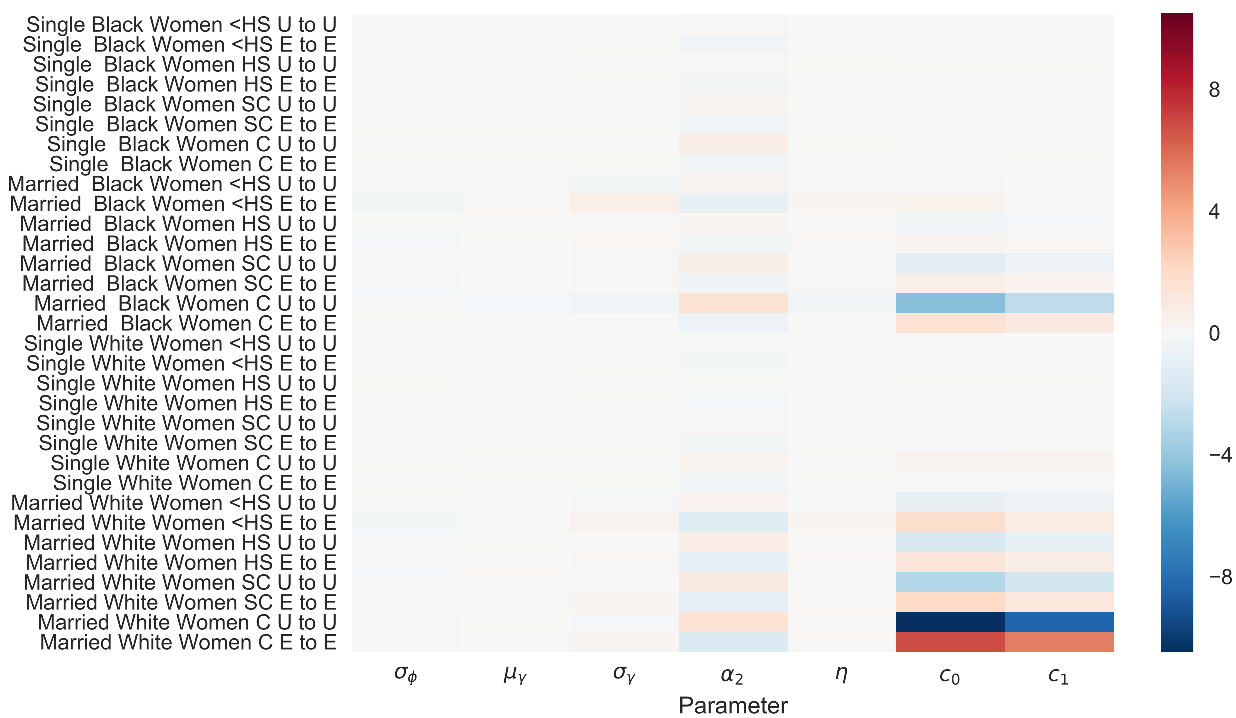


Figure D3: Changes in Marriage by Employment Status amongst Men in Response to Changes in Parameters

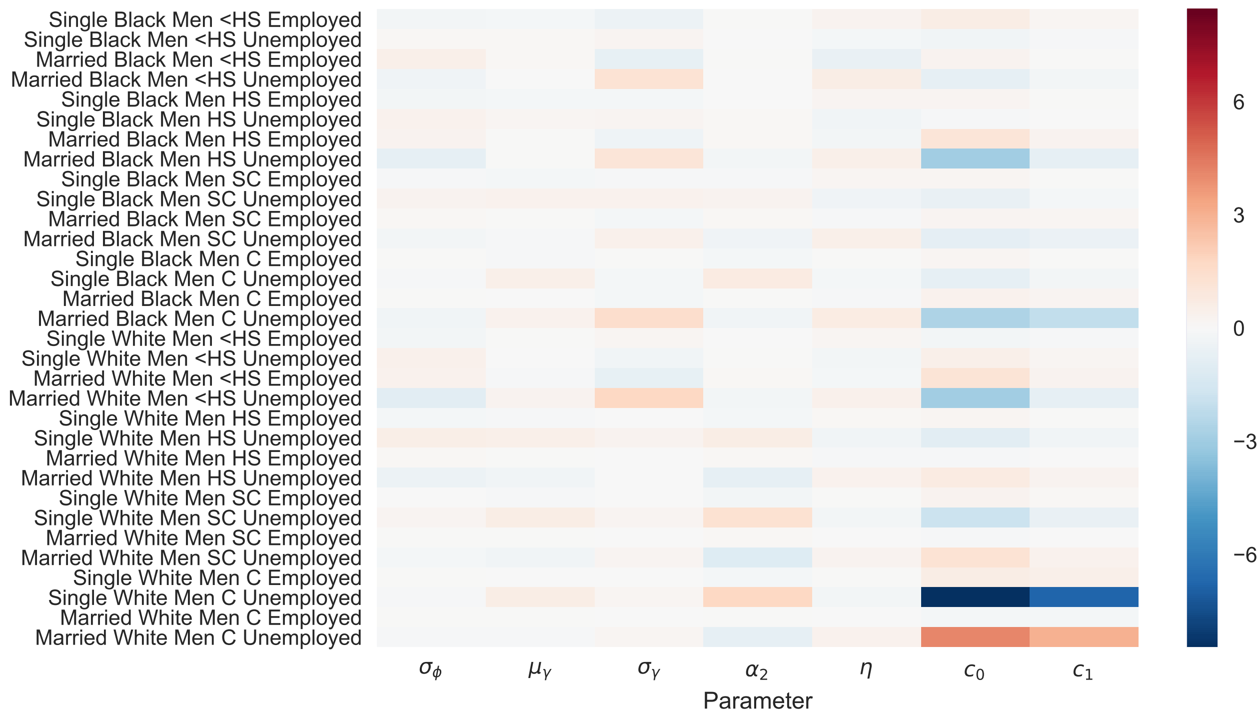


Figure D4: Changes in Marriage Dynamics in Response to Changes in Parameters

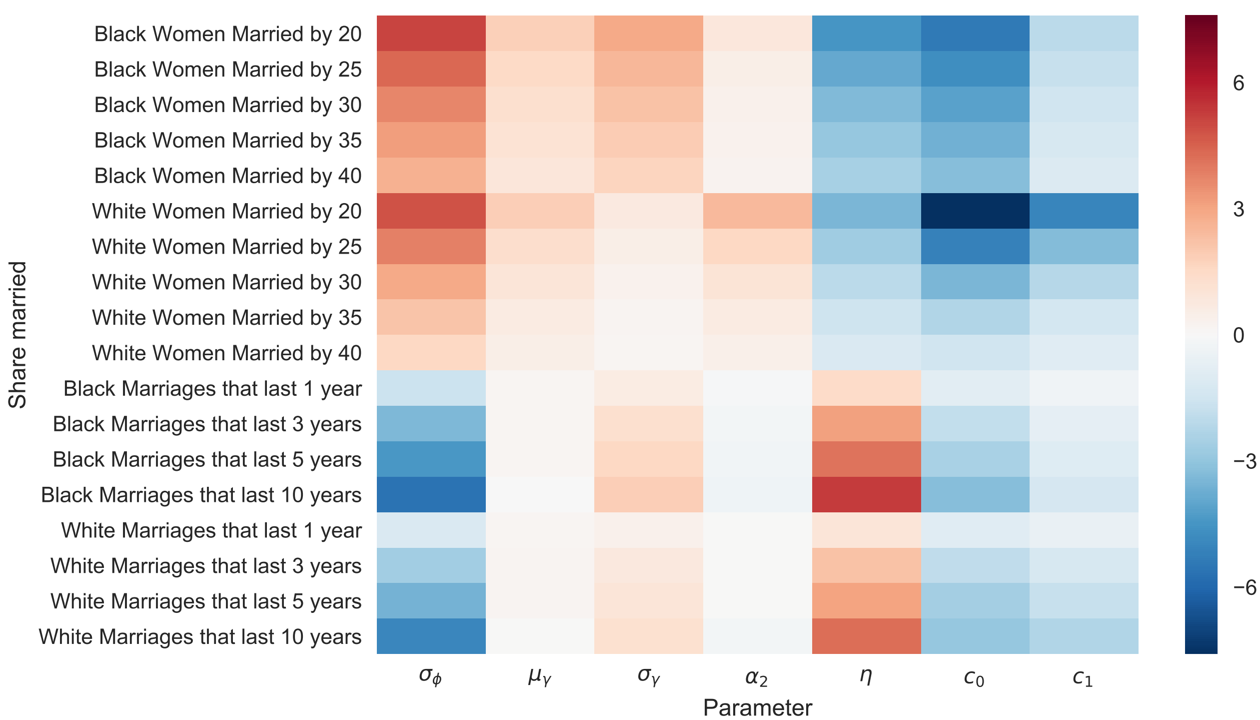
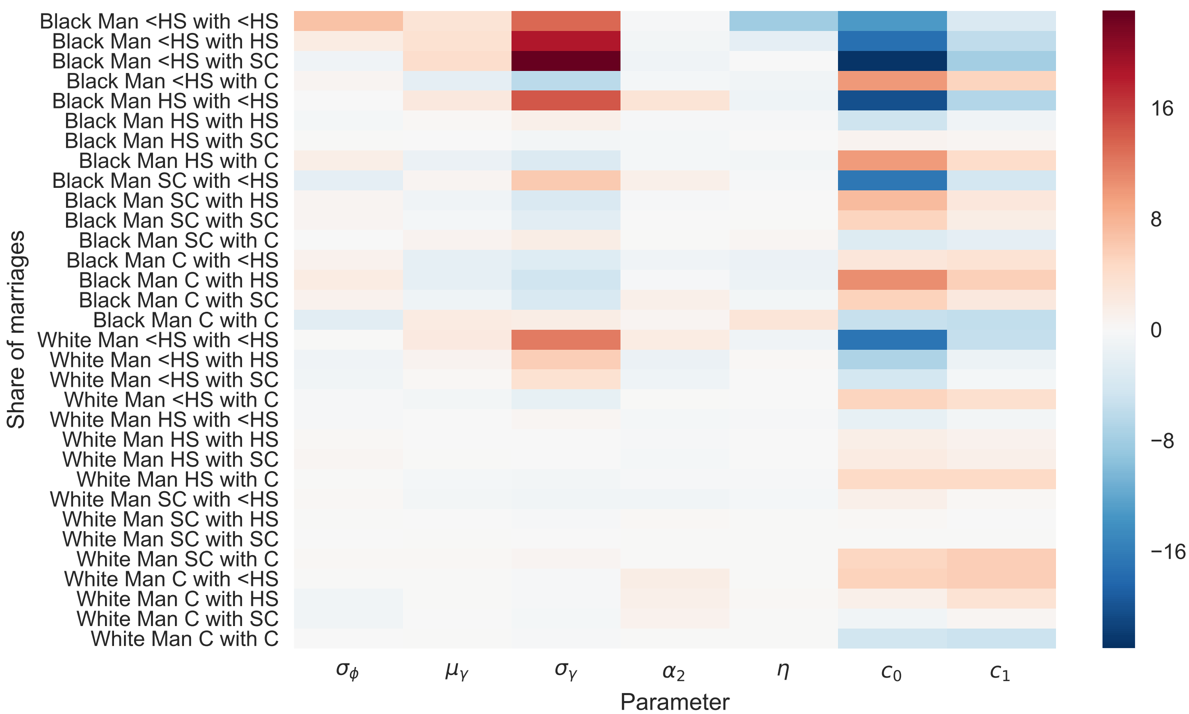


Figure D5: Changes in Marital Sorting in Response to Changes in Parameters



E Counterfactual Prison Transitions

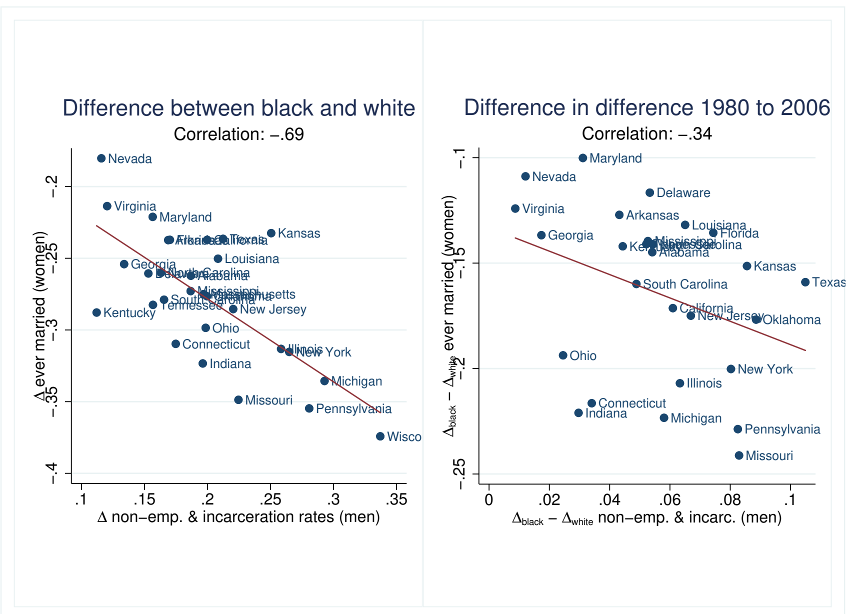
In this Appendix, we present the counterfactual prison transitions used in Section 7.1.

Table E1: Probability of Going to Prison When Removing Drug Charges

Education	High Scenario	Low Scenario
< HS	.0516	.0632
HS	.0177	.0215
SC	.0057	.0066
C	.0031	.0041

F Additional Figures

Figure F1: Black-White Differences in Incarceration plus Unemployment versus Marriage (left panel), Changes between 1980 and 2006 Incarceration plus Unemployment versus Marriage (right panel)



Notes: The x-axis shows the difference of black and white men in 2006 in the incarceration plus non-employment rate in the left panel. The right panel shows the corresponding difference in difference from 1980 to 2006 on the x-axis. The y-axis shows the difference in 2006 in ever married black and white women in the left panel. The right panel shows the corresponding difference in difference from 1980 to 2006 on the y-axis.