



The Short-Run Effects of the Great Recession on Crime

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Abstract

The Great Recession had the most severe impacts on the unemployment rates of the racial and ethnic minorities as well as less-educated young men. There were cross-sectional variations of these disproportionate adverse impacts. This study exploits the changes in regional variations of the unemployment rates of unskilled men before and after the Great Recession to explain the sharp fall in aggregate crime rates in the post-recession recovery period. Our 2SLS approach uses plausible exogenous sources of changes in the state employment growth of minimum wage workers induced by the national employment growth of minimum wage workers. We find that changes in regional variations of the unemployment rates of unskilled young men can explain approximately 25% of the fall in the aggregate crime rate in the post-recession expansionary period. Estimating the heterogeneous impacts of unskilled young men by race, we find that the fall in aggregate crime rate was mainly driven by the changes in the unemployment rates of young black men.

Keywords Unemployment rate · Great recession · Unskilled young men · Minimum wage workers

Introduction

A large amount of literature has documented that the Great Recession had severe adverse impacts on key labor market indicators such as the unemployment rate, earnings, labor force participation rate and hours of work. Elsby et al. (2010) show that regardless of what labor market factors we consider, the severity of labor market conditions during the 2008–2009 recession was the worst since the late 1940s. Since the adverse labor market impacts of the Great Recession are heterogeneous among the different groups of workers and vary across different regions, in this study, we investigate how the regional variations in changes of the unemployment rates among different groups affect the aggregate crime rates.

Figure 1 shows the unemployment rates of men and the aggregate crime rates over the period 2005–2015. We note that the unemployment rates of men increased from 5% in early 2008 to 10.1% by 2010. This high value of the unemployment rate of men reached post-World War II highs. DeNavas-Walt et al. (2011) show that during the

recession, the median US income fell by 6% and the poverty rate increased from 12.5 to 15.1%. However, in Fig. 1, we see that the aggregate crime rate marginally declined from 2008 to 2009 and then become relatively stable until 2011; since then, it has been falling at a steady rate. The Great Recession created an adverse shock in the whole economy and in this study we use that exogenous shock to explain the sharp decline in the aggregate crime rates in the post-recession expansionary period.

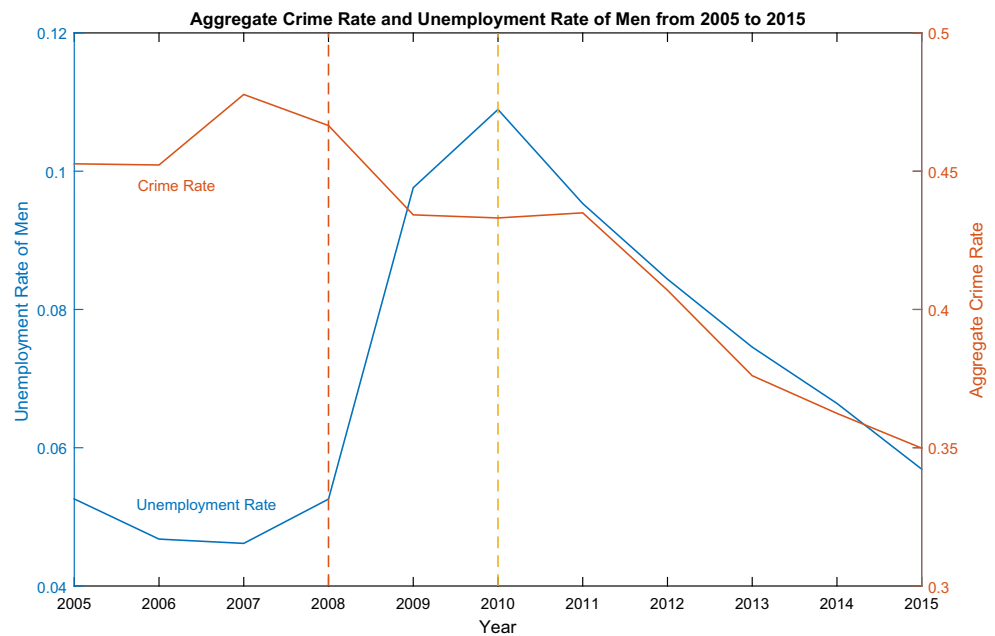
Economists typically conclude that the worsening labor market opportunities are highly positively associated with crime rates since the propensity to commit crime responds to the expected costs and benefits of illegal activity (Becker 1968; Ehrlich 1973; Levitt 1997). In addition, Levitt (2004) shows that such propensity is expected to have more relevance in explaining the pecuniary motive-based property crime. However, in Fig. 2, we see that the property crime rate fell approximately 7% and the violent crime rate fell about 12% during the Great Recession.¹ As expected, Figure 1 shows that the aggregate crime rate and property crime followed similar patterns because the number of property crimes is much greater than the total number of violent crimes. The falling crime rate with a rise in

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¹The upper panel of Fig. 2 shows that during the recession the property crime rate fell from 0.42 to 0.39 and the lower panel indicates that the violent crime fell from 0.055 to 0.048 during the same period.

Fig. 1 Trends of aggregate crime rate and men's unemployment rate, 2005–2015. The left vertical axis measures the unemployment rate of men and the right vertical axis shows the aggregate crime rate which is the sum of property and violent crime rates



the unemployment rate can be reconciled by comparing the long-run trends of the unemployment rate and the crime rate. Gould et al. (2002) show that the crime rate is less cyclical than the unemployment rate. This is why the existing empirical literature has found moderate, but oftentimes inconclusive, evidence that unemployment rates are positively associated with crime.

A large body of literature, including Elsby et al. (2010), Farber (2011), Sierminska and Takhtamanova (2011), and Goodman and Mance (2011), has shown that low-skilled men, blacks, Hispanics, and youth have experienced more employment declines compared to women, whites, prime-aged workers and those with higher education levels. By comparing the five recessions since the late 1970s, Hoynes et al. (2012) show that these disproportionate adverse impacts on racial and ethnic minorities, as well as young less-educated men, are consistent across the last five recessions. Rothstein (2011) shows that a distinguishing feature of the Great Recession is that the post-recession recovery has been relatively slow compared to the historical averages. Kochhar (2011) shows that during the Great Recession, men experienced significantly more job losses compared to women, and hence, in the recovery period, male employment picked up at a relatively faster rate.

Viscusi (1986) shows how the relative perception of riskiness of crime affects the supply of young black males to crime. Lott (1992) argues that a fall in income in the legal sector may induce some workers to seek additional sources of income in possibly less desirable and more dangerous ways. Freeman (1996) investigates how the relative rewards to crime affect the future criminal behavior. Hindelang (1981), Greenberg (1985), Steffensmeier et al.

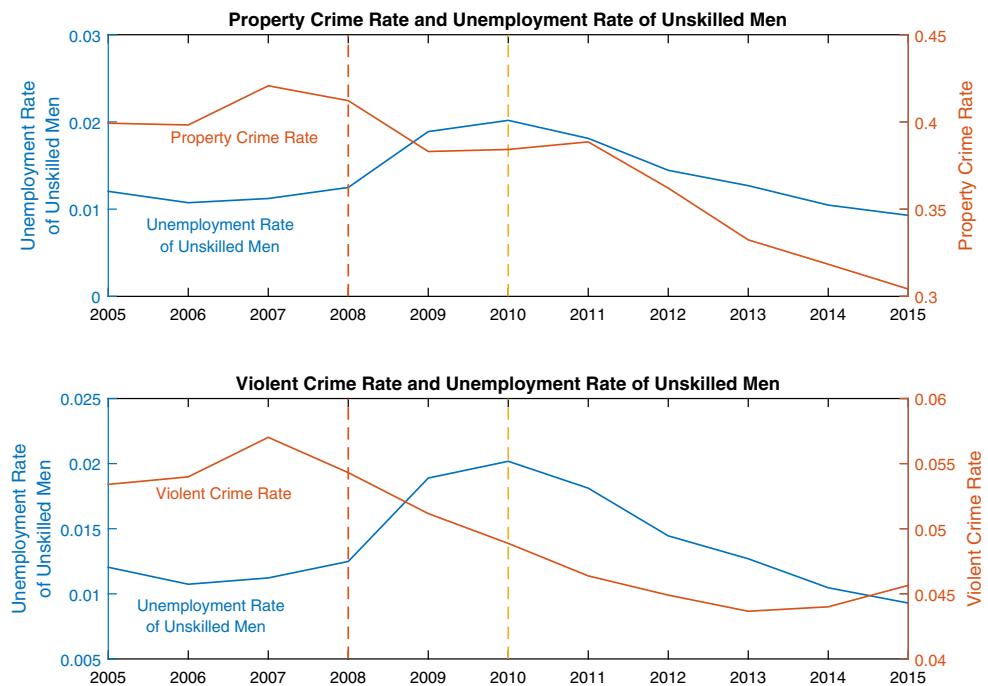
(1998), and Hansen (2003) have shown that unskilled black men have the highest propensity to commit crime of all groups because of lack of labor market opportunities. Grogger (1998) provides a structural model to examine the relationship between wages and crime.

There also exists a large amount of literature including (Cook and Zarkin 1985; Freeman 1987; Juhn et al. 1991; Grogger 1992, 1996); Topel 1993; Wilson 1996; Raphael and Winter-Ember 2001; Levitt 2001; Gould et al. 2002; Machin and Costas 2004; Kling 2006; Holzer 2007; Lin 2008) investigates how different labor market and social factors such as the legitimate employment opportunities, criminal opportunities, crime-related commodities, and responses by the criminal justice system affect unskilled men's increasing involvement in crime.

This paper differs from the existing literature in three ways. First, this study estimates the short-run effects of the Great Recession on crime. Specifically, we examine how regional crime rates responded to the changes in unemployment rates in the local labor markets before and after the Great Recession. Second, instead of focusing on aggregate unemployment rates or general economic conditions that affect crimes, we concentrate on the unemployment rates of unskilled men who are most likely to commit crimes. Furthermore, we estimate heterogeneous impacts of the unemployment rates of unskilled men for three different age groups and race. Third, we establish a causal relationship between crime rates and changes in the unemployment rates of unskilled men induced by the Great Recession.

One of the challenges of establishing a causal connection between the crime rates and unemployment rates of

Fig. 2 Trends of property crime rate, violent crime rate and unemployment rate of men, 2005–2015. In both upper and lower panels, the left vertical axis measures the unemployment rate of unskilled men who are defined as high school dropouts. The right vertical axis in upper panel shows the property crime rate and in lower panel shows the violent crime rate



unskilled men is that both these variables are determined simultaneously. Therefore, we need to address the standard identification problem to estimate the impacts of unemployment rates on crime. Any empirical study that does not address this identification problem may obtain misleading results. Levitt (2001) argues that the instrumental variable approach is a preferable means of identifying the causal relationship between crime and the unemployment rate because simultaneity, omitted variables, and measurement error can all make the OLS estimator highly biased. To the best of my knowledge, Raphael and Winter-Ember (2001), Gould et al. (2002), and Lin (2008) use the instrumental variable estimation method to estimate the causal impacts of the unemployment rates and labor market opportunities on crime.

We identify the causal impact of changes in the unemployment rates of unskilled men induced by the Great Recession on crime rates by exploiting possible exogenous variations in the industry-level state employment growth of minimum wage workers. We use the interaction between a 10-year lag of the industry employment shares of minimum wage workers and national employment growth of minimum wage workers as instruments for the unemployment rates of unskilled men.² The key identifying assumption of our empirical strategy is that conditioned on a set of control variables, the predicted employment growth of each state's minimum wage workers should not affect

the crime rates, except through the unemployment rates of unskilled men. We provide several pieces of evidence to support the validity of this identifying assumption.

Our 2SLS point estimates suggest that changes in the state-level variations of the unemployment rates of unskilled young men due to the Great Recession can explain approximately 25% of the fall in the aggregate crime rates in the post-recession recovery period. Raphael and Winter-Ember (2001) argue that because of simultaneity, omitted variables, and measurement error, the OLS method underestimates the effects of the unemployment rates on crime. Since our 2SLS point estimates are generally more than twice the size of the OLS estimates, these results also confirm the prediction of Raphael and Winter-Ember (2001). Therefore, the main contribution of this study to the literature is to consistently estimate the short-run impacts of the Great Recession on crime that no previous study has yet examined. In addition, consistent with the previous literature, we also find that changes in the unemployment rates of unskilled young black men are driving our results.

The structure of the paper is as follows. Section “**Empirical Approach**” discusses the data and describes the hypothesis of how the Great Recession can affect the crime rates through the regional variations in the unemployment rates of unskilled men. In addition, we also present the econometric model and discuss the construction of the instrumental variables. Section “**Results**” contains our main estimation results for both unskilled men and heterogeneous impacts by age and race. The first stage results of the 2SLS method and all robustness checks are shown in the

²The construction of our instruments is an extension of a strategy developed by Bartik (1991) and then popularized by Blanchard and Katz (1992).

Table 1 Summary statistics of state and demographic level variables (mean and standard deviation)

	2005–2009	2010–2014	Difference		2005–2009	2010–2014	Difference
Crime rate	0.459 (0.038)	0.403 (0.033)	−0.056 (−1.105)	Black	0.109 (0.112)	0.112 (0.107)	0.002 (0.228)
Unemployment	5.485 (2.008)	7.356 (2.008)	1.871 (10.518)	Urban	0.746 (0.180)	0.759 (0.170)	0.013 (0.858)
Poverty	12.405 (3.207)	14.202 (3.394)	1.797 (5.813)	Unskilled Occ	0.918 (0.013)	0.921 (0.011)	0.002 (2.230)
Log population	15.090 (1.035)	15.132 (1.033)	0.041 (0.450)	Female head	0.232 (0.026)	0.235 (0.022)	0.003 (1.295)
Log GDP	12.002 (1.025)	12.148 (1.007)	0.146 (1.619)	Age	39.813 (0.721)	40.521 (0.872)	0.708 (9.987)
State min wage	6.349 (1.075)	7.403 (0.694)	1.054 (13.149)	Family size	3.048 (0.187)	3.029 (0.207)	−0.019 (−1.075)
Migration	0.023 (0.011)	0.019 (0.010)	−0.004 (−4.500)	No of kids	1.005 (0.099)	0.984 (0.109)	−0.021 (−2.309)
Observations	255	255		Observations	255	255	

The summary statistics table reports mean and standard deviations (in parentheses). The numbers in the parentheses of the third and sixth columns denote *t*-statistics. The data are obtained for the period 1980 to 2014 from the Current Population Survey, FBI-Uniform Crime Reporting Program and University of Kentucky Center for Poverty Research. Each year we have 51 observations and a total 510 (= 51 × 10) state-level observations. Annual income and state minimum wages are expressed in 2000 US dollars using the Personal Consumption Expenditures price index

[Appendix](#) section. We show our robustness check results in “[Robustness Checks](#)” and conclude in “[Conclusion](#)”.

Empirical Approach

Data

We have used state-level data for the 2005–2014 period to analyze the short-run impacts of the Great Recession on crime. The data come from three different sources. First, the state-level crime data are collected from the FBI-Uniform Crime Reporting Program. Second, the demographic control variables are constructed from the 5 percent sample of the Current Population Survey (CPS). Third, all state control variables are obtained from the University of Kentucky Center for Poverty Research Welfare Data. We merge these three data sets by state-year indicator variable. Therefore, we have 51 observations in each year and a total of 510 state-level observations for the 2005–2014 period. Annual state income and state minimum wages are expressed in 2000 US dollars using the Personal Consumption Expenditures price index.

Table 1 reports the mean and standard deviation of the merged data. In the left panel, we show state-level variables such as the state minimum wage, inter-state migration, poverty rate, unemployment rate, state income and population. The right panel shows household

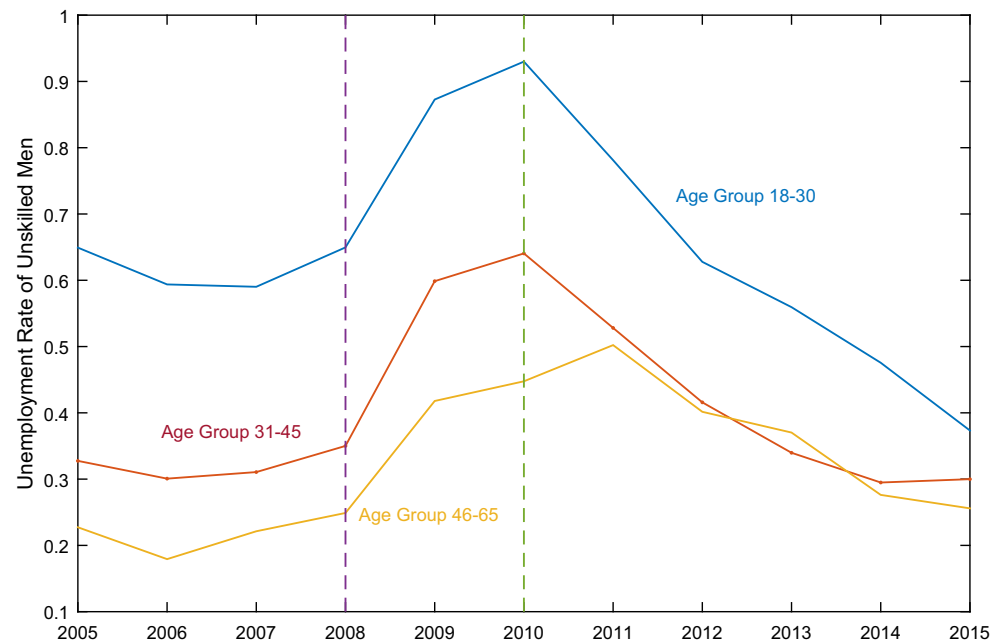
demographic characteristics such as the average age, fraction of black individuals, unskilled occupation, metro area, family size and number of children. The aggregate crime rate indicates the average number of crimes per 1,000 people in a state.³ We note that the unemployment rate of men increased from 5.49 to 7.36 from the 2005–2009 period to the 2010–2014 period, whereas the aggregate crime rate decreases from 0.45 to 0.41 during the same period. We also show these patterns of changes in unemployment rates of men and aggregate crime rates in Fig. 1.

Hypothesis

An extensive body of literature on the recession has already established that the labor market declined during the Great Recession and that the magnitude of the increase in unemployment was the deepest, as well as the longest, since the Great Depression. More importantly, the labor market effects of the Great Recession were not uniform across demographic groups. Hoynes et al. (2012) show that low-skilled men, black, Hispanics and youth have experienced more employment declines compared to women, whites, prime-aged workers and those with higher education

³Following Gould et al. (2002), we do not use any weights because we already use the population of a state to create the dependent variable.

Fig. 3 Unskilled men's unemployment rates by three age groups, 2005–2015. The vertical axis measures the unemployment rate of unskilled men who are defined as high school dropouts



levels.⁴ In Fig. 3, we show the unemployment rates of low-skilled workers for three different age groups from 2005 to 2014. As shown, during the Great Recession, the unemployment rates of the unskilled 18–30 age group increased relatively more than those of the other two age groups of 31–45 and 46–65.⁵

One of the main reasons for the steep decline in the unemployment rates of unskilled men is that a large fraction of unskilled young men work in manufacturing and construction industries, and these industries have higher cyclicity compared to the other industries such as services, transportation, and public administration. Therefore, a significant fraction of the heterogeneity in job loss during the Great Recession can be explained by the nature of the cyclicity of different industries. As expected, Fig. 3 shows that the job recovery of the unskilled unemployed men between the ages of 18 and 30 was relatively higher compared to the other two age groups in the post-Great Recession expansionary period.

The left and middle panels of Fig. 4 show two histogram plots of the state unemployment rates for unskilled

young men during the period 2005–2009 and 2010–2014 respectively. The right panel shows the histogram of the changes in unemployment rates in before and after the Great Recession. As shown, there were substantial regional variations in the job recovery of the unskilled unemployed men of age 18–30 across the states in the post-Great Recession recovery period. We use these changes in cross-sectional variations of unemployment rates in local labor markets to explain the fall in the aggregate crime rates in the expansionary period of the Great Recession.

Econometric Model

To estimate the effects of the unskilled men's unemployment rates on the aggregate crime rates, we follow a differences-in-differences approach that exploits the changes in regional variations of unemployment rates due to the Great Recession.⁶ Our empirical approach is based on the following equation:

$$\log(\text{crime rate}_{st}) = \alpha + \beta_1 u_{mst} + \beta_2 d_t + \beta_3 (u_{mst} \times d_t) + X'_{st} \beta_4 + \eta_s + \tau_t + \varepsilon_{st} \quad (1)$$

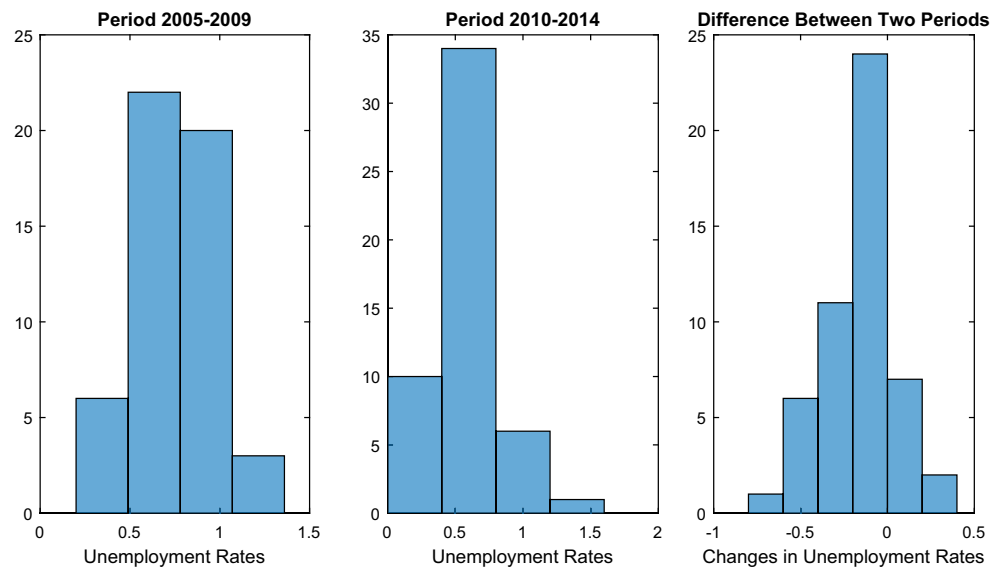
where s denotes the state and t indicates the time period; u_{mst} is the unemployment rate of unskilled men in state

⁴ Using the Current Population Data from 1979–2011, Hoynes et al. (2012) estimate that 1% increase in the state unemployment rate leads to a 1.1% increase in unemployment rate of white men, 1.8% for black men, and 1.25% for Hispanic men. The heterogeneous impacts of state unemployment rate by education show that 1% increase in the state unemployment rate leads to a 1.75% increase in unemployment rate of high school dropouts and 0.4% for college graduates.

⁵ Following the existing literature, unskilled workers are classified as high school dropouts.

⁶ In a similar settings, Card (1992) estimates the effects of the changes in the federal minimum wage on employment by using the regional variations of the share of the teenage employment.

Fig. 4 Histogram of unemployment rates of unskilled young men from 2005–2009, 2010–2014, and the difference between these two periods



s in year t , and d_t is the post-recession time dummy. The vector X_{st} consists of a set of state and demographic control variables. The state-fixed effects η_s measure any time-invariant differences across the different states; τ_t denotes the linear time trend, and ε_{st} are the unobserved local labor conditions that affect crime rates. The coefficient of the interaction term $u_{mst} \times d_t$, β_3 , measures the effects of the Great Recession on crime rates due to the changes in the unemployment rates of unskilled men.

To estimate β_3 in Eq. (1), the simplest strategy is to use the ordinary least squares (OLS) approach. Lin (2008) discusses three different reasons why the OLS estimates of β_3 are likely to be biased. The first and most prominent reason is the omitted variable bias. Raphael and Winter-Ember (2001) argue that if any procyclical crime-related commodity consumption is omitted, then the OLS method would underestimate the true effects.

The second possible reason for the bias in OLS estimators is the simultaneity between crime and unemployment. Cullen and Levitt (1999) show that the OLS method underestimates the effects of unemployment on crime if criminal activity reduces the employability of offenders. Third, the OLS estimates have a downward bias because of a random measurement error in the unemployment rate. To mitigate the omitted variables bias, in this study, we have included a set of state economic variables such as the overall unemployment rate, state income, poverty rate, state minimum wage, and migration rate. In addition, we have used a set of demographic control variables.

Raphael and Winter-Ember (2001) argue that any study that does not address the issues of omitted variable bias

and simultaneity potentially underestimates the effect of unemployment on crime. Therefore, we use the 2SLS estimation method to address the concerns of omitted variable bias and simultaneity. Based on the arguments of Raphael and Winter-Ember (2001), we expect to see that our 2SLS estimates of the unemployment rate of young low-skilled male workers on the crime rate will be positive.

Instrumental Variables

To obtain a consistent estimator, we need to find instrumental variables Z that affect the crime rates through the unemployment rates of unskilled young male workers conditioned on a set of control variables. In addition, Z also need to satisfy the relevancy and exogeneity conditions. Levitt (1997) and Angrist and Krueger (2001) summarize that any instrument should meet the following three criteria: (i) institutional knowledge and economic mechanism of the selection of the instruments, (ii) an over-identification test if more instruments are available than the number of endogenous regressors, and (iii) a test of relevancy condition based on the first stage regression.

Our instruments are based on plausible exogenous sources of state employment growth of minimum wage workers. Following Bartik (1991) and Blanchard and Katz (1992), we interact two sources of variation that are potentially exogenous to the change in crime within each state: (i) the initial industrial composition of minimum wage workers in the state and (ii) the national employment growth of minimum wage workers in each industry. These

instruments are very similar to the Bartik instruments used by Gould et al. (2002) to estimate the effects of the state unemployment rate on crime. The main difference between our instruments and Gould et al. (2002) is that our instruments predict the employment growth for only minimum wage workers by industry in a state instead of predicting the industry-level state employment growth of all workers.

We use this analog version of the Bartik instruments because this modification ensures that our instruments are highly correlated with the employment growth of unskilled male workers. Therefore, we potentially avoid the weak instrument problems by using this modification. The intuition behind the selection of these instruments is that if a state had a relatively large share of minimum wage workers in the manufacturing, construction, retail trade, and personal services industries that were highly affected by the Great Recession, then that state would experience a more significant decline in the employment of minimum wage workers compared to other states. We use these regional variations of changes in minimum wage workers to explain the employment growth of unskilled young male workers in each state.

Since our instruments are the canonical product of the industry employment shares of minimum wage workers and the national employment growth rate of minimum wage workers, the validity of the instruments relies on the exogeneity of the location-specific industry shares of minimum wage workers, not the national growth rate of minimum wage workers. An intuitive argument for this claim is that national industry growth rates avoid correlation with local economic conditions (Autor and Duggan 2003). Therefore, the role of the national employment growth rates of minimum wage workers in our instrument is about relevancy, not exogeneity.

A potential concern for the validity of our instruments is that if some part of the shares of industry-level minimum wage workers depends on the state-specific unobserved labor market conditions that are related to the crime rates of unskilled young unemployed male workers, then our instruments are invalid. Therefore, our instruments will fail the exogeneity condition when the error terms in Eq. (1) are correlated with the industry compositions of minimum wage workers, not because of the national employment growth rate of minimum wage workers. A potential source of correlation between ε_{st} and the regional shares of industry-level minimum wage workers is any omitted variable such as alcohol consumption, availability of drugs, gun possession, gang violence, attitude toward minorities and many other variables that can be potentially correlated with the shares of industry-level minimum wage workers.

To address this concern, we follow a similar approach of Autor et al. (2013) and use a decade lag of the shares

of industry composition of minimum wage workers to identify plausible exogenous sources of state employment growth of minimum wage workers. The intuition of using a 10-year lag is to avoid any potential correlation between the shares of industry composition of minimum wage workers and the crime-related state-specific unobserved labor market conditions. Therefore, our instruments are constructed by estimating the local employment growth of minimum wage workers generated from interacting regional variations in the 10-year lag of industry employment shares with national industry employment growth rates.

Suppose we have K industries, T time periods, and S states, with k , t , and s denoting a particular industry, time, and state. Specifically, to construct our analog version of Bartik instruments, we estimate the predicted change in log employment of minimum wage workers $\hat{B}_{st}$ in a state s between years t_0 and t_1 as

$$\hat{B}_{st} = \sum_{k=1}^K \theta_{sk(t_0-10)} \times \delta_{kt_1} \quad (2)$$

where $\theta_{sk(t_0-10)}$ is the employment share of minimum wage workers in industry k in state s at period $t_0 - 10$. Following the notation from Autor and Duggan (2003), we denote δ_{kt_1} as the national average of log change in two-digit industry k 's employment share. Note that the subscript in δ_{kt_1} indicates that we exclude each state's own industry k employment to calculate the national employment growth.

Angrist and Krueger (2001) suggest that another way we can address the concern that our instrumental variables are correlated with the unobserved determinants of the crime rate that are swept into the second stage residuals is by using an over-identification test since we have 14 instruments and two core endogenous regressors in Eq. (1). Therefore, we perform the Sargan-Hansen over-identification test for each 2SLS model specification and show that we cannot reject the null hypothesis that our instruments are jointly exogenous. In addition, we also perform robustness checks to examine the concern of the validity of our instruments. Following Angrist and Krueger (2001), the last point we need to ensure is whether our instruments are weakly correlated with the unemployment rate of low-skilled young male workers.

In Appendix Table 1, we report the first stage regression results for five different model specifications. The Staiger and Stock (1997) and Stock and Yogo (2001) criterion of a weak instrument is that the F -statistics of the first stage regression is less than 10. Angrist and Pischke (2009) show that the finite sample bias of an IV estimator and the first stage F -statistics value are inversely related and thus, when the F -stat value is close to zero, the bias of an IV estimator

Table 2 The short-run effects of the Great Recession on crime rate through the regional variations in unemployment rates of unskilled men

	(1)		(2)		(3)		(4)		(5)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log(crime rate)										
Unskilled unemployed	0.051	0.071	0.035	0.078	0.047	0.073	0.040	0.109	0.029	0.092
Men $\times$ post recession	(0.033)	(0.056)	(0.035)	(0.054)	(0.040)	(0.057)	(0.037)	(0.075)	(0.041)	(0.067)
Post-Great Recession	−0.218***	−0.247**	−0.166*	−0.233*	−0.203***	−0.248**	−0.169*	−0.275	−0.120	−0.213
	(0.064)	(0.105)	(0.089)	(0.132)	(0.072)	(0.109)	(0.097)	(0.169)	(0.092)	(0.135)
Unskilled unemployed	−1.444	−0.012	0.348	−0.050	−0.982	0.002	1.274	−0.136	1.263	−0.167
Men	(3.329)	(0.062)	(4.064)	(0.196)	(4.092)	(0.085)	(4.462)	(0.257)	(5.017)	(0.258)
Time trend	−0.105	−0.105	−0.131	−0.129	−0.13	−0.123	−0.141	−0.136	−0.181	−0.140
	(0.150)	(0.158)	(0.140)	(0.115)	(0.245)	(0.249)	(0.161)	(0.146)	(0.267)	(0.221)
Poverty and			Yes	Yes			Yes	Yes	Yes	Yes
Unemployment rate										
Log GDP, migration and					Yes	Yes			Yes	Yes
State min wage										
Urban and							Yes	Yes	Yes	Yes
Black										
Demographic controls							Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.938	0.938	0.934	0.934	0.938	0.938	0.934	0.934	0.933	0.934
Sargan test statistics		9.683		4.680		8.516		4.831		2.798
(p value)		(0.720)		(0.982)		(0.744)		(0.994)		(0.999)
No of observations	510	510	459	459	510	510	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

converges to the bias of the OLS estimator. As shown in the column 5, the first stage F -stat value is 27.59, and R^2 is 0.36 for our most robust model specification. Therefore, following the Staiger and Stock (1997) and Stock and Yogo (2001) criterion, we conclude that our instruments are not weak.

Results

In this section, we report our estimation results from a panel sample of 51 states over ten years.⁷ The data and trends of crime rates were discussed in Section 2. In each regression, the post-Great Recession time dummy captures the average changes in aggregate crime rates in the pre- and post-recession periods. The state-fixed effects control the state-level time-invariant unobserved heterogeneity that might be correlated with local crime rates. In addition, in each model specification, we also control for the national time

trend, which allows us to abstract any correlation between the aggregate trend in crime and some other unobserved aggregate determinant of crime. Given the strong positive association between the unemployment rates of unskilled men and the time trend of crime rates, our results will be biased if we ignore the aggregate time trend.

Table 2 reports the estimates of the interaction term of the unemployment rates of unskilled men and the post-Great Recession dummy. We show both OLS and 2SLS coefficients for five different model specifications. Since the first column is our baseline model specification, we do not include any state and demographic controls except the linear time trend. In the second model specification, we include poverty and unemployment rates in addition to the baseline controls because these two variables have direct impacts on the aggregate crime rates. The column 3 model shows how the estimate of β_3 changes condition on three other key state-level variables such as state income, state minimum wage and migration. Similarly, in the column 4 specification, we investigate the robustness of our IV estimator once we include only the demographic controls and leave those three key state-economic variables used in the model 3. The column 5 is our most robust model

⁷Note that we have 51 states because we count District of Columbia a state.

specification in which we use all the state and demographic control variables.

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors that are corrected for a common unobserved factor underlying crime in each state in each year. Both the OLS and 2SLS estimates have the expected signs, but these coefficients are statistically insignificant for all five specifications, as shown in columns 1 through 5. Therefore, we conclude that changes in the regional unemployment rates of unskilled men induced by the Great Recession shock in the local labor markets possibly cannot explain the fall in aggregate crime rates in the post-recession expansionary period.

Hindelang (1981), Greenberg (1985), Steffensmeier et al. (1998), and Hansen (2003), among others, have shown that crime rates vary over sex, race and age groups, and black males between the ages of 18 and 30 have the highest crime rate of all the groups. Although CPS data can be used to determine the unemployment rate by age, sex, and race, the FBI-Uniform Crime Reporting data do not

have the information on state-level crime rates by age, sex, and race. Therefore, we estimate the heterogeneous impacts of the unemployment rates of different subgroups based on age, sex and race on the state-level aggregate crime rates. In Table 3, we investigate the impacts of the unemployment rates of unskilled men between the ages of 18 and 30, who are most likely to commit crimes.

The first column of Table 3 reports both the OLS and 2SLS estimated impacts of changes in the unemployment rates of unskilled young men due to the Great Recession on aggregate crime rates without controlling for any state and demographic variables. Both the OLS and 2SLS coefficients are statistically significant and have the expected signs. Based on the discussion by Raphael and Winter-Ember (2001) and Lin (2008) about three sources of potential bias of OLS estimators, we know that the OLS method underestimates β_3 in Eq. (1) and that the 2SLS point estimate is supposed to be larger than the OLS estimate. We find that this expected result holds for all 5 different model specifications in Table 3.

Table 3 The short-run effects of the Great Recession on crime rate through the regional variations in unemployment rates of unskilled men age 18–30

	(1)		(2)		(3)		(4)		(5)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log(crime rate)										
Unskilled unemployed	0.112**	0.246**	0.102**	0.229**	0.101**	0.245**	0.126*	0.303**	0.108*	0.253**
Men age 18–30 × post	(0.043)	(0.113)	(0.047)	(0.097)	(0.043)	(0.113)	(0.066)	(0.128)	(0.061)	(0.119)
Post-Great Recession	−0.223***	−0.315***	−0.193*	−0.284**	−0.199***	−0.320***	−0.205*	−0.339**	−0.159*	−0.280**
	(0.068)	(0.107)	(0.100)	(0.135)	(0.056)	(0.106)	(0.112)	(0.162)	(0.091)	(0.136)
Unskilled unemployed	−0.078*	−0.049	−0.059	−0.081	−0.075*	0.020	−0.066	−0.172	−0.067	−0.187
Men age 18–30	(0.043)	(0.138)	(0.053)	(0.351)	(0.041)	(0.194)	(0.058)	(0.349)	(0.053)	(0.226)
Time trend	−0.106	−0.105	−0.126	−0.130	−0.137	−0.119	−0.139	−0.132	−0.172	−0.149
	(0.157)	(0.159)	(0.139)	(0.114)	(0.247)	(0.245)	(0.161)	(0.140)	(0.256)	(0.255)
Poverty and			Yes	Yes			Yes	Yes	Yes	Yes
Unemployment rate										
Log GDP, migration and					Yes	Yes			Yes	Yes
State min wage										
Urban and							Yes	Yes	Yes	Yes
Black										
Demographic controls							Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.938	0.938	0.934	0.934	0.938	0.938	0.934	0.934	0.933	0.934
Sargan test statistics		5.165		4.281		8.918		4.339		6.308
(p value)		(0.971)		(0.978)		(0.779)		(0.977)		(0.934)
No of observations	510	510	459	459	510	510	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

Table 4 The short-run effects of the Great Recession on crime rate through the regional variations in unemployment rates of unskilled men age 31–65

	Age group 31–45		Age group 46–65		Age group 31–65	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log(crime rate)						
Unskilled unemployed men 31–45	0.117	0.206				
× Post-Great Recession	(0.086)	(0.199)				
Unskilled unemployed men 31–45	−3.998	−0.326				
	(7.639)	(0.482)				
Unskilled unemployed men 46–65			−0.152	−0.001		
× Post-Great Recession			(0.196)	(0.143)		
Unskilled unemployed men 46–65			22.199	−0.031		
			(21.086)	(0.334)		
Unskilled unemployed men 31–65					0.001	0.055
× Post-Great Recession					(0.057)	(0.070)
Unskilled unemployed men 31–65					4.472	−0.110
					(6.787)	(0.233)
Post-Great Recession	−0.150**	−0.163	−0.015	−0.066	−0.071	−0.121
	(0.071)	(0.125)	(0.075)	(0.082)	(0.080)	(0.103)
Time trend	−0.162	−0.156	−0.198	−0.182	−0.189	−0.165
	(0.234)	(0.239)	(0.273)	(0.253)	(0.270)	(0.239)
State and demographic	Yes	Yes	Yes	Yes	Yes	Yes
Control variables						
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.938	0.934	0.934	0.933	0.934	0.933
Sargan test statistics		3.209		5.413		4.389
(p value)		(0.994)		(0.965)		(0.986)
No of observations	459	459	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The state and demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

In the first column of Table 3, the 2SLS point estimate 0.24 suggests that changes in the regional variations of the unemployment rates of unskilled young men induced by the Great Recession can explain approximately 24% of the fall in aggregate crime rates in the post-recession recovery period. We compare this with the baseline regression in column 1 by adding two control variables, the poverty rate and the national unemployment rate, in column 2 and use three other different control variables, state GDP, the minimum wage rate and the inter-state migration rate, in column 3. In columns 1 to 3, the 2SLS estimates range from 0.22 to 0.25, suggesting that the 2SLS estimate is reasonably stable.

To make a comparison with the column 2 model specification, in column, 4 we add the control variables percentage of urban population, percentage of black

individuals and a set of other demographic variables, and in column 5, we include all the control variables used in columns 1 to 4. Column 5 is our most robust model specification, and the 2SLS point estimate is 0.25. The 2SLS point estimates vary from 0.22 to 0.30 in the five different model specifications. Therefore, the reasonably tight 2SLS point estimates in the five different model specifications suggest that the estimated impact of the changes in the regional variations in unemployment rates of unskilled young men due to the Great Recession on aggregate crimes rates is robust and can explain about 25% of the fall in aggregate crime rates in the post-recession period.

Table 1 shows that the aggregate crime rate per one thousand people fell about 0.056 from 2005–2009 to 2010–2014. Also, Fig. 3 shows that the unemployment rates of young unskilled men fell on average 0.046 (= 0.671 -

Table 5 The heterogeneous short-run effects of the Great Recession on crime rate through the regional variations in unemployment rates of unskilled men age 18–30 by race

	White		Black		Hispanic	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log(crime rate)						
Unskilled unemployed white	0.145*	0.185				
Men 18–30 × post recession	(0.086)	(0.136)				
Unskilled unemployed white	−4.515	−0.048				
Men 18–30	(7.804)	(0.499)				
Unskilled unemployed black			0.103	0.288*		
Men 18–30 × post recession			(0.085)	(0.155)		
Unskilled unemployed black			−2.473	−0.048		
Men 18–30			(9.297)	(0.557)		
Unskilled unemployed hispanic					−0.166	−0.103
Men 18–30 × post recession					(0.101)	(0.158)
Unskilled unemployed hispanic					0.809	−0.302
Men 18–30					(10.833)	(0.649)
Post-recession dummy	−0.129*	−0.149*	−0.084	−0.119*	−0.041	−0.062
	(0.066)	(0.085)	(0.065)	(0.070)	(0.060)	(0.073)
Time trend	−0.194	−0.174	−0.198	−0.170	−0.184	−0.175
	(0.254)	(0.282)	(0.252)	(0.252)	(0.260)	(0.247)
State and demographic	Yes	Yes	Yes	Yes	Yes	Yes
Control variables						
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.933	0.933	0.934	0.933	0.933	0.933
Sargan test statistics		4.384		4.053		2.799
(p value)		(0.986)		(0.991)		(0.999)
No of observations	459	459	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The state and demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

0.625) in the same period. Thus, the Table 3 instrumental variable estimates of β_3 suggest that the changes in regional variations of unemployment rates of unskilled young men in the post-Great Recession recovery period can explain approximately 0.014 ($= 0.056 \times 0.25$) less number of crimes per one thousand individuals in a state. In the post-recession expansionary period, the sharp fall in unemployment rates of unskilled young men mainly occurred in California, Nevada, Oregon, Washington, North Dakota, Utah, Texas, Louisiana, Tennessee, North Carolina, West Virginia, Michigan, New York, Massachusetts, Maine, and New Hampshire.⁸

⁸The full list of changes in unemployment rates by state is shown in the Appendix Table 6.

Since we have more instruments than endogenous regressors, we perform the Sargan-Hansen test over-identification to check the validity of our instruments. The intuition of the Sargan-Hansen over-identification test is that if instruments are exogenous, they should not explain anything about the estimated second stage errors, $\hat{\varepsilon}_{st}^{2sls}$. Since we have 14 instruments and two core endogenous regressors, the Sargan-Hansen test statistics, $nR_e^2 \sim \chi_{dof=12}^2$, should be smaller than the critical value of $\chi_{dof=12}^2$, which is 19.68.⁹ As shown in columns 1 to 5 of Table 3, the Sargan-Hansen test statistics of the

⁹Where n is the number of observations and R_e^2 is the R^2 from the second stage estimated error regression. The two core endogenous regressors are unemployment rate of unskilled men and its interaction term with the post-Great Recession time dummy.

Table 6 The heterogeneous impacts of the Great Recession on property and violent crime rates by metro and nonmetro area

	Property crime				Violent crime			
	Metro		Nonmetro		Metro		Nonmetro	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log of property or violent crime rates by metro and nonmetro								
Fraction of low-skilled unemp	0.321***	0.644***	0.092	0.124	0.266*	0.433*	−0.002	−0.022
Male age 18–30 × post	(0.116)	(0.218)	(0.093)	(0.125)	(0.141)	(0.241)	(0.087)	(0.135)
Post recession dummy	−0.386**	−0.654***	−0.057	−0.084	−0.292**	−0.428**	−0.071	−0.054
	(0.149)	(0.228)	(0.104)	(0.126)	(0.128)	(0.209)	(0.101)	(0.133)
Fraction of low-skilled unemp	−0.157*	−0.440	−0.032	−0.335	−0.119	−0.498	−0.058	−0.094
Male age 18–30	(0.086)	(0.316)	(0.056)	(0.289)	(0.076)	(0.417)	(0.065)	(0.328)
Time trend	−0.089	−0.034	0.062	0.094	−0.101	−0.054	0.176	0.178
	(0.234)	(0.226)	(0.114)	(0.129)	(0.173)	(0.167)	(0.129)	(0.149)
State and demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.940	0.941	0.972	0.972	0.945	0.946	0.958	0.958
Sargan test statistics		2.137		17.392		1.788		13.078
(p value)		(0.999)		(0.182)		(0.999)		(0.441)
No of observations	455	455	456	456	450	450	453	453

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The state and demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

five specifications vary between 4.28 and 8.91. Therefore, we cannot reject the null hypothesis in all five model specifications and decisively conclude that jointly, our instruments are not correlated with the estimated second stage residuals.

Combining the Tables 2 and 3 results, we find that changes in the unemployment rates of all unskilled male workers induced by the Great Recession cannot explain the fall in aggregate crime rates, whereas the regional variations in the unemployment rates of a specific age group, unskilled young men who are more prone to commit crimes, can explain a significant fraction of the downward trend of aggregate crime rates. This finding is consistent with Gould et al. (2002), who establish a causal relationship between the crime rates and the labor market opportunities of young, unskilled men by using the US county-level data for the 1979–1997 period.

To further support this conclusion, in Table 4, we investigate whether changes in unemployment rates induced by the Great Recession of other age groups of unskilled men have any causal impacts on aggregate crime rates. Thus, we divide all other unskilled men into two age groups: 31–45 and 46–65. Since these groupings are arbitrary, we also include a third group, which includes all the unskilled unemployed male workers between the ages of 31 and

65. The first column shows both the OLS and 2SLS estimates of the 31–45 age group, and similarly, the second and third columns report the estimates of the 46–65 and 31–65 age groups, respectively. In all three columns, we report the estimates from our core model specification that includes all the state and demographic control variables. As shown, both the OLS and 2SLS estimates of the interaction terms between the age-specific unemployment rates and the post-recession dummy are statistically insignificant. These findings not only support the Table 3 results but also explain why, in Table 2, we find that changes in the unemployment rates of all unskilled workers cannot explain the fall in aggregate crime rates in the post-recession expansionary period.

Table 5 further investigates the heterogeneous impacts of changes in the unemployment rates of unskilled young men on aggregate crime rates by considering three different races: white, black, and Hispanic.¹⁰ The OLS and 2SLS coefficients from our core model specification for white, black, and Hispanic men are shown in columns 1, 2, and

¹⁰Following Hoynes et al. (2012), we define whites are only Caucasian, blacks are African American and the Hispanic includes both black Hispanic and white Hispanic.

3, respectively. A couple of interesting findings emerge. First, the 2SLS point estimate of the interaction term of unskilled black young men is much higher compared to the coefficients for white and Hispanic unskilled young men. Second, both the OLS and 2SLS coefficients for white and Hispanic unskilled young men are statistically insignificant. These results suggest that the effects of the changes in the unemployment rates of unskilled young men on aggregate crime rates are mainly driven by the racial subgroup of black men. This finding is consistent with Freeman (1996), Wilson (1996), and Raphael and Winter-Ember (2001) since these studies have shown that young unskilled black men are more likely to commit crime due to a lack of labor market opportunities.

In Tables 2–5, we have investigated the causal relationship between changes in unskilled men's unemployment rates induced by the exogenous shock of the Great Recession on the aggregate crime rate. However, the aggregate crime consists of property and violent crimes which are intrinsically very different. Also, the crime rate varies over the geographic area within a state. Therefore, to show the heterogeneous impacts of the Great Recession in both property and violent crime rates, we disaggregate these two types of crime rates by metro and nonmetro counties. The results of the stratified OLS and 2SLS regressions with area-specific property and violent crime rates as the dependent variables are shown in Table 6.

As shown, the OLS and 2SLS coefficients of the interaction term for both property and violent crime rates in the nonmetro area are statistically insignificant, suggesting that the changes in regional variations of unemployment rates of young unskilled men in the post-recession recovery period did not affect the crime rates in the nonmetro area. In contrast, both the OLS and 2SLS estimates of the interaction terms between the unemployment rates of young unskilled men and the post-recession dummy for metro property crime rates are statistically significant even at 1% level. Therefore, the effects of the Great Recession on the state-level aggregate crime rate in the post-recession recovery period is entirely driven by the property crime rates in the metro area.

We further investigate how the changes in the unemployment rates of young unskilled men in the post-recession expansionary period affected different types of property and violent crime rates. Following Gould et al. (2002), we classify the property crime into the following four category: (i) auto theft, (ii) burglary, (iii) larceny, and (iv) arson and the violent crime is disaggregated in four parts: (i) aggravated assault, (ii) robbery, (iii) murder, and (iv) rape. The estimation results for all these eight types of crime rates are reported in Table 7. The upper panel shows results for

the property crime rates and the lower panel for the violent crime rates. Comparing the OLS and 2SLS estimates in both the panels we find that the changes in unemployment rates of young unskilled men induced by the Great Recession affected all four types of property crime rate and only one type of violent crime rate which is aggravated assault. These results are consistent with the previous studies by Raphael and Winter-Ember (2001) and Lin (2008), which also show that unemployment rates mainly affect pecuniary-based property crimes.

To summarize, we find that the Great Recession disproportionately affected the unemployment rates of different racial and age groups and the regional variations of these changes in unemployment rates had a strong impact on the aggregate crime rates in the post-recession recovery period. In addition, this short-run effect of the Great Recession on the state-level aggregate crime rate is entirely driven by the property crime rates in the metro area. Consistent with Hoynes et al. (2012), we also find that young, male, less-educated, workers from ethnic minorities were most affected during the Great Recession. These results raise the question, what public policies should the policymakers consider to protect this most affected group from the macroeconomic fluctuations of a business cycle?

A vast existing literature including Farrington et al. (1986), Levitt and Lochner (2001a), Sampson and Laub (2003), Lochner (2004), Lochner and Moretti (2004), Hjalmarsson (2008), Machin et al. (2011), and Deming (2011) discusses a long-term solution of this issue by raising the educational level of the specific group of individuals who are most likely to commit crime and also improve the quality of public schools. However, we also need to consider some short-run policies such as increase the duration of unemployment insurance program in the recession period on the basis of individual family needs, specific job training based on previous employment, and tax incentives to the employers for hiring racial minorities during the recession.

Robustness Checks

We want to address a potential concern that whether we have measured the actual changes in regional unemployment rates induced by the Great Recession or whether our results are mainly driven by the pre-existing downward trend of the aggregate crime rates. Therefore, we use some fake years for the timing of the Great Recession. Since our sample period starts from 2005, we have separately used 2005–2007 as fake timing for the Great Recession, and the results are shown in Appendix Table 2. As shown, the interaction terms of the fake Great Recession timing and the unemployment

Table 7 The heterogeneous impacts of the Great Recession on different types of property and violent crime rates

	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log of four different types of property or violent crime rates								
	Property Crime							
	Auto Theft		Burglary		Larceny		Arson	
Fraction of low-skilled unemp	0.215***	0.418***	0.166**	0.311**	0.168*	0.363*	0.165**	0.431***
Male age 18–30 × post	(0.074)	(0.133)	(0.073)	(0.141)	(0.088)	(0.182)	(0.071)	(0.117)
Post-recession dummy	−0.324***	−0.492***	−0.121	−0.241*	−0.180	−0.343*	−0.218**	−0.438***
	(0.081)	(0.117)	(0.079)	(0.124)	(0.113)	(0.188)	(0.097)	(0.119)
Fraction of low-skilled unemp	−0.047	−0.642**	−0.079	−0.480**	−0.102	−0.426*	0.005	−0.399
Male age 18–30	(0.054)	(0.293)	(0.059)	(0.231)	(0.069)	(0.237)	(0.068)	(0.343)
State and demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend and state FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.976	0.976	0.978	0.979	0.967	0.968	0.956	0.956
No of observations	458	458	457	457	459	459	454	454
	Violent Crime							
	Aggravated Assault		Robbery		Murder		Rape	
Fraction of low-skilled unemp	0.156**	0.285**	0.176	0.401*	0.258	0.398	0.098	0.131
Male age 18–30 × post	(0.077)	(0.125)	(0.134)	(0.226)	(0.206)	(0.260)	(0.091)	(0.140)
Post-recession dummy	−0.208**	−0.313**	−0.294**	−0.484**	−0.293**	−0.410***	−0.184*	−0.211
	(0.095)	(0.120)	(0.143)	(0.205)	(0.118)	(0.143)	(0.093)	(0.137)
Fraction of low-skilled unemp	−0.096*	−0.322	−0.047	−0.099	−0.097	−0.629	−0.063	−0.206
Male Age 18–30	(0.052)	(0.239)	(0.078)	(0.415)	(0.075)	(0.385)	(0.055)	(0.208)
State and demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend and state FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.975	0.975	0.960	0.960	0.926	0.927	0.969	0.969
No of observations	452	452	444	444	421	421	457	457

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The state and demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

rates of young unskilled men are statistically insignificant for all three years. This is because our estimation results are driven by the changes in cross-sectional variations of the unemployment rates pre- and post-Great Recession, and hence, we miss out on the actual changes in regional variations in the unemployment rates of unskilled young men because of the fake timing.

We have discussed that our instruments are the estimated industry-level state employment growth of minimum wage workers that were generated from the canonical product of a 10-year lag of the industry employment shares of minimum wage workers with the national employment growth rate. We have used a 10-year lag of the industry employment composition to avoid any potential correlation between the industry employment shares of minimum wage workers

and unobserved local labor market conditions that might affect the aggregate local crime rates. A potential concern is whether even the 10-year lag of the industry composition of minimum wage workers is correlated with the unobserved errors in Eq. (1).

To address this concern, we have used a 20-year lag of the industry employment shares of minimum wage workers to estimate the state employment growth of minimum wage workers, and the results are shown in Appendix Table 4. Comparing the estimates from Table 3, we find that the 2SLS point estimates are almost identical in all five model specifications even if we use a 20-year lag of the shares of minimum wage workers to construct our instruments. These results are quite satisfactory since they show that our main estimation results in Table 3 are possibly not driven by

any spurious correlation between unobserved labor market conditions and the industry compositions of minimum wage workers. Therefore, these results also address any potential concerns about the validity of our instruments.

To summarize, we have performed a couple of robustness checks for our baseline estimates, designed to explore the robustness of our 2SLS estimates along a number of dimensions. To examine the validity of our key identifying assumption of the 2SLS estimation method, we use the alternative specification of instruments to address any potential correlations between unobserved labor market conditions and the industry compositions of minimum wage workers in each state. All of these results are reported in the [Appendix](#). The results from these analyses support the validity of our instruments.

Conclusion

In recent times, the Great Recession was the most adverse shock in the economy and hence in local labor markets. Because the effects of the shock were not uniform across local labor markets, they created huge regional variations in unemployment rates in the post-recession recovery period. The main contribution of this study is to exploit these cross-sectional variations in the unemployment rates of unskilled young men to explain the fall in aggregate crime rates in the post-Great Recession expansionary period. Our 2SLS

point estimates rely on possible exogenous sources of state employment growth of minimum wage workers, and we provide several pieces of evidence to address any concern about the validity of our instruments.

The 2SLS point estimate of the interaction term of the unemployment rate of unskilled young men and the post-Great Recession time dummy in the [Table 3](#) core model specification is 0.25. This implies that changes in regional variations in the unemployment rates of young unskilled men induced by the Great Recession can explain an approximately 25% fall of the aggregate crime rate in the post-recession expansionary period. This point estimate is robust across a wide range of model specifications. In addition, we estimate the heterogeneous impacts of the unemployment rates of unskilled young men by race and find that our results are mainly driven by the changes in the unemployment rates of young unskilled black men. These findings suggest that the substantial change in regional variations of the unemployment rates of young unskilled men induced by the Great Recession was a major factor for the steep fall in aggregate crime rates in the post-Great Recession recovery period. We also discuss some potential public policies to protect this most affected group in the future recessions.

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Appendix

Table 8 Appendix Table 1: Demographic characteristics of the unskilled unemployed men of age 18–30 by race

	Year 2005–2009			Year 2010–2014		
	White	Black	Hispanic	White	Black	Hispanic
Education	9.851 (2.038)	10.143 (1.454)	8.621 (2.861)	10.044 (1.781)	10.231 (1.388)	8.914 (2.713)
No of family members	3.316 (1.697)	3.560 (2.066)	3.670 (2.159)	3.510 (1.746)	3.442 (1.843)	4.150 (2.091)
No of children	0.308 (0.805)	0.180 (0.730)	0.448 (0.912)	0.346 (0.810)	0.219 (0.724)	0.453 (0.909)
Married	0.137 (0.344)	0.075 (0.264)	0.263 (0.441)	0.142 (0.349)	0.073 (0.261)	0.235 (0.425)
Urban	0.708 (0.455)	0.868 (0.339)	0.895 (0.307)	0.708 (0.455)	0.839 (0.368)	0.920 (0.272)
No of observation	871	266	467	862	342	548

The summary statistics table reports mean and standard deviations (in parentheses). The data are obtained for the period 1980 to 2014 from the Current Population Survey. Whites are only Caucasian, blacks are African American and both black Hispanic and white Hispanic are included in Hispanic

Table 9 Appendix Table 2: The first stage of the two stage least square regressions

	(1)	(2)	(3)	(4)	(5)
Dependent variable: unemployment rate of unskilled men					
Agriculture, forestry, and fisheries industry	−2.261*** (0.673)	−1.606** (0.733)	−1.392** (0.618)	−0.016* (0.009)	−1.120 (0.822)
Mining industry	0.476 (0.350)	0.380 (0.374)	0.432 (0.326)	0.004 (0.004)	0.483 (0.378)
Construction industry	−2.330** (0.903)	−0.504 (1.069)	−0.836 (0.818)	−0.003 (0.011)	−0.296 (1.004)
Manufacturing industry	−1.616 (1.202)	−1.339 (1.327)	−0.363 (1.186)	−0.011 (0.015)	−0.672 (1.307)
Transportation, communication, and other public utilities industry	−4.901*** (1.613)	1.463 (2.215)	−2.814* (1.552)	0.019 (0.022)	2.022 (2.140)
Wholesale trade industry	0.496 (0.445)	−0.332 (0.478)	0.458 (0.454)	−0.002 (0.004)	−0.066 (0.411)
Retail trade industry	−1.058** (0.407)	−0.732 (0.455)	−0.838** (0.406)	−0.007 (0.005)	−0.690 (0.474)
Finance, insurance, and real state industry	−0.112 (0.294)	−0.237 (0.348)	0.216 (0.296)	−0.002 (0.004)	0.163 (0.381)
Business and repairs service industry	−2.017 (1.465)	2.189 (1.552)	−1.812 (1.549)	0.026 (0.017)	1.684 (1.836)
Personal services industry	−0.232 (1.154)	0.282 (1.125)	−0.883 (1.130)	−0.001 (0.011)	−0.731 (1.092)
Entertainment and recreation Services industry	1.232** (0.568)	0.493 (0.615)	1.263** (0.548)	0.005 (0.007)	0.646 (0.679)
Professional and related services industry	0.001 (0.063)	1.156 (0.854)	0.007 (0.066)	0.010 (0.008)	−0.015 (0.814)
Public administration industry	0.656* (0.353)	0.175 (0.429)	0.158 (0.358)	0.001 (0.004)	−0.066 (0.405)
Active duty military industry	0.148 (0.152)	0.029 (0.138)	0.155 (0.149)	0.000 (0.002)	0.043 (0.156)
State control	No	Yes	Yes	Yes	Yes
First stage F-Stat	4.630	15.410	14.460	23.500	27.590
Adjusted R^2	0.281	0.332	0.338	0.339	0.368
No of observations	510	459	510	459	459

The columns 1 to 5 correspond to the exact model specifications used in Table 3. We do not report the coefficients all state and demographic control variables because of space constraint. Using the CPS two-digit industry code we have 14 industries. Therefore, our instruments consist of predicted two-digit industry employment growth of minimum wage workers in 14 industries

Table 10 Appendix Table 3: Falsification tests by using fake recession years

	Fake recession in 2005		Fake recession in 2006		Fake recession in 2007	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Dependent variable: log(crime rate)						
Unskilled unemployed	−0.094	0.071	−0.161	0.446	0.016	0.246
Men age 18–30 × post fake recession	(0.236)	(0.183)	(0.206)	(0.328)	(0.110)	(0.139)
Post fake recession dummy	0.166	0.202	0.301	0.154	0.033	0.008
	(0.241)	(0.360)	(0.279)	(0.232)	(0.139)	(0.156)
Unskilled unemployed	5.886	−0.323	10.593	−0.482	−3.653	−0.176
Men age 18–30	(20.687)	(0.424)	(15.812)	(0.557)	(7.785)	(0.325)
State controls	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.938	0.934	0.939	0.934	0.938	0.933
No of observations	459	459	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The state and demographic controls are listed in the summary statistics table. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

Table 11 Appendix Table 4: Robustness check by using a two decades lag of industry composition of minimum wage workers to construct instruments

	(1)	(2)	(3)	(4)	(5)
Dependent variable: log(crime rate)					
Unskilled unemployed	0.225*	0.224**	0.243**	0.284**	0.258**
Men age 18–30 × post recession	(0.117)	(0.092)	(0.116)	(0.112)	(0.112)
Post-recession dummy	−0.298***	−0.266**	−0.330***	−0.311**	−0.306**
	(0.104)	(0.100)	(0.112)	(0.129)	(0.137)
Unskilled unemployed	0.069	−0.075	0.202	0.389	0.504
Men age 18–30	(0.126)	(0.311)	(0.195)	(0.314)	(0.439)
Time trend	−0.098	−0.183	−0.104	−0.188	−0.200
	(0.152)	(0.149)	(0.240)	(0.180)	(0.268)
Poverty rate		0.016		0.026	0.029
		0.024		(0.032)	(0.035)
Unemployment rate		−0.043		−0.061	−0.061
		(0.029)		(0.038)	(0.037)
Log GDP			0.608	0.505	
			(0.624)		(0.754)
State min wage			−0.061		−0.049
			(0.052)		(0.071)
Migration			0.534		1.891
			(2.565)		(3.125)
Urban			0.394		0.251
				(1.059)	(1.005)
Black				−0.049	−0.050
				(0.044)	(0.043)
HH Level controls	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.939	0.934	0.938	0.935	0.934
Sargan test statistics	6.679	5.668	7.321	4.826	8.022
(p value)	(0.878)	(0.895)	(0.836)	(0.939)	(0.783)
No of observations	510	459	510	459	459

The table shows the 2SLS estimates of the effects of the Great Recession on crime rates through the regional variations in unemployment rates of unskilled men age 18–30. The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

Table 12 Appendix Table 5: The effects of unemployment rates of unskilled men on property and violent crime rates, 2005–2014

	Property crime		Violent crime	
	OLS	2SLS	OLS	2SLS
Unskilled unemployed	0.113	0.290*	0.047	0.138*
Men age 18–30* post recession	(0.083)	(0.169)	(0.057)	(0.082)
Post-recession dummy	−0.161	−0.337	−0.057	−0.133
	(0.123)	(0.201)	(0.131)	(0.136)
Unskilled unemployed	−0.075	0.671	−0.029	−0.026
Men age 18–30	(0.070)	(0.595)	(0.042)	(0.302)
Time trend	−0.171	−0.208	−0.204	−0.197
	(0.281)	(0.287)	(0.227)	(0.224)
Poverty rate	0.016	0.035	0.011	0.011
	(0.028)	(0.037)	(0.028)	(0.025)
Unemployment rate	−0.019	−0.075	−0.040	−0.041
	(0.015)	(0.048)	(0.037)	(0.039)
Log GDP	−0.408	0.703	−0.274	−0.159
	(0.536)	(1.009)	(0.799)	(0.865)
State min wage	0.018	−0.067	0.021	0.016
	(0.036)	(0.084)	(0.022)	(0.031)
Migration	−0.489	2.412	−0.959	−0.774
	(2.522)	(3.412)	(2.670)	(2.272)
Urban	0.793	0.364	−0.077	−0.104
	(1.088)	(1.068)	(0.981)	(1.031)
Black	−0.040	−0.058	−0.014	−0.014
	(0.042)	(0.048)	(0.016)	(0.016)
Demographic controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.916	0.917	0.924	0.924
Sargan test statistics		10.033		10.050
(p value)		(0.613)		(0.690)
No of observations	459	459	459	459

The numbers in the first parenthesis of each column represent the state-level clustered robust standard errors. The demographic controls are listed in Table 1. The notation * represents the statistical significance levels: * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

Table 13 Appendix Table 6: Changes in unemployment rates of unskilled young men from 2005–2009 to 2010–2014

State	Change in unemployment	State	Change in unemployment	State	Change in unemployment
Alabama	−0.071	Kentucky	0.040	North Dakota	−0.507
Alaska	−0.015	Louisiana	−0.413	Ohio	−0.131
Arizona	−0.029	Maine	−0.313	Oklahoma	−0.092
Arkansas	−0.080	Maryland	−0.124	Oregon	−0.425
California	−0.348	Massachusetts	−0.265	Pennsylvania	−0.332
Colorado	−0.058	Michigan	−0.197	Rhode Island	0.264
Connecticut	0.104	Minnesota	0.003	South Carolina	−0.072
Delaware	0.020	Mississippi	−0.110	South Dakota	−0.082
District of Columbia	−0.732	Missouri	−0.420	Tennessee	−0.507
Florida	0.042	Montana	−0.004	Texas	−0.154
Georgia	−0.245	Nebraska	−0.046	Utah	−0.323
Hawaii	−0.107	Nevada	−0.163	Vermont	−0.081
Idaho	−0.232	New Hampshire	−0.342	Virginia	−0.036
Illinois	−0.033	New Jersey	0.101	Washington	−0.173
Indiana	−0.155	New Mexico	0.085	West Virginia	−0.376
Iowa	−0.242	New York	−0.288	Wisconsin	−0.175
Kansas	0.222	North Carolina	−0.408	Wyoming	−0.050

Table 14 Appendix Table 7: Summary statistics of property and violent crime rates by metro and nonmetro area (mean and standard deviation)

	Metro			Nonmetro		
	2005–2009	2010–2014	Difference	2005–2009	2010–2014	Difference
All	0.381 (0.618)	0.323 (0.513)	−0.058 (−1.076)	0.092 (0.087)	0.085 (0.081)	−0.007 (−0.870)
Property	0.329 (0.526)	0.283 (0.444)	−0.046 (−1.008)	0.082 (0.076)	0.076 (0.072)	−0.006 (−0.797)
Violent	0.046 (0.090)	0.037 (0.068)	−0.009 (−1.157)	0.010 (0.012)	0.009 (0.009)	−0.001 (−1.183)
No of observations	255	255		255	255	

The summary statistics table reports mean and standard deviations (in parentheses). The numbers in the parentheses of the third and sixth columns denote *t*-statistics. The data are obtained for the period 2005 to 2014 from the FBI-Uniform Crime Reporting Program. Each year, we have 51 observations and a total 510 (= 51 × 10) observations

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