State Firearm Sales and Criminal Activity: Evidence from Firearm Background Checks

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The FBI has reported the number of monthly firearm background checks in every state since November 1998. This article uses data on background checks at the state level to explore the relationship between guns and crime. The background checks capture an individual’s intention to purchase a firearm and explain 96% of the variation in gun manufacturing at a national level. Fixed effect negative binomial regressions show a positive, but insignificant, relationship between background checks and violent crimes. Property crimes are negatively related to background checks and statistically significant at the 10% level. The results suggest that gun control policies should be coupled with other initiatives if policy makers intend to reduce gun-related crime.

JEL Codes: K4, K42

1. Introduction

Gun policy is one of the most controversial and intensely debated topics in the United States today. Supporters of the Second Amendment argue that household gun ownership will deter criminals and increase safety. Those in favor of increasing gun control cite heavy gun regulation in countries such as Japan, where guns are rare and there were only 11 firearm-related homicides in 2008 (Fischer 2012). The United States had over 12,000 in that same year.

The research community has been unable to reach a consensus as to whether a relationship between guns and crime exists (NRC 2005). The lack of consensus is partially due to the fact that accurate firearm data are sparse. Survey data on gun ownership are limited by small sample sizes, large geographies, temporary time periods, or some combination of the three. The controversial nature of firearms makes it likely that surveys on gun ownership contain significant biases (Blackman 2003).

Proxy measures for gun ownership are often used by researchers attempting to identify a relationship between guns and crime. Proxies have ranged from stolen gun rates to county-level magazine subscriptions, but one of the more popular proxies in the literature is the fraction of suicides involving a firearm. Using the firearm suicide fraction, researchers have found positive (Cook and Ludwig 2006), negative (Kovandzic et al. 2013), and insignificant (Moody and Marvell 2005) associations between crime and guns. While the variety of conclusions are partially driven by methodological differences, the National Research Council’s (NRC) 2005 report on Firearms and Violence notes that the fraction of firearm suicides suffer from proxy bias and are influenced by a number of factors that are unrelated to firearm ownership.

The NRC (2005) report also states that “the inadequacy of data on gun ownership and use is among the most critical barriers to better understanding gun violence.” This article uses a variable that...
is derived from an automated service to measure gun ownership. The FBI’s National Instant Criminal Background Check System (NICS) has tracked the aggregate number of background checks completed by Federal FirearmLicensed dealers in every state, monthly, since November, 1998. Background check rates are used to explore how guns and crime are related between 2000 and 2012.

The automated nature of background checks are able to overcome some of the empirical concerns, such as survey or proxy bias, that have limited previous research, but it is not a perfect measure of firearm ownership or gun sales in a state. Before directly testing the relationship between background checks and criminal behavior, it is crucial to understand what background checks represent. Initial results comparing background checks to previously used survey data and proxies suggest that background check rates are significantly correlated with cross-sectional measures of gun ownership. Time-series analyses show that background checks have increased noticeably since 2007, but survey data indicate gun ownership levels have remained relatively stable. If one assumes that the survey data are accurate, it is possible that background checks represent a combination of more firearm purchases by existing gun owners and an increase in the supply of guns on unregulated private markets if existing gun owners choose to sell old firearms after new purchases.

Fixed effect negative binomial and panel regression results show that an increase in the background check rate does not significantly change homicide rates using mortality data from the National Center of Health Statistics. When the sample is stratified by method of homicide, race, marital status and location of homicide, the insignificant relationship remains. Background check rates are associated with marginally significant decreases in the rate of gun accidents, and insignificant increases in firearm suicide.

Regressions using crime data from the FBI’s Uniform Crime Report (UCR) show that in most specifications, an increase in a state’s background check rate is positively, but insignificantly related to violent crimes such as murder, robbery, and assault. Background check rates tend to be negatively related to property crimes such as burglary, larceny and motor vehicle theft. Increases in background checks are associated with a decrease in the total crime rate and the relationship is significant at the 10% level. Taking the point estimates at face value, the increase in background checks between 2000 and 2012 are associated with a 3.5% reduction in property crimes.

Despite the extensive empirical work focusing on guns and crime, additional research is needed to better understand whether stricter or looser gun control laws would lead to reductions in crime. Researchers are faced with limited data, as well as a theoretically ambiguous relationship when studying guns and crime. The results using background checks provide policy makers with new information about the potential relationship between firearms and crime. The lack of a strongly significant relationship between guns and crime suggests that guns alone are not able to explain change in criminal behavior.

2. Background

Related Literature

The seminal work on crime in economics was developed by Becker (1968). In his study, Becker introduces a model where criminals make rational decisions based on the expected benefit and cost of a crime. If criminals believe that potential victims are more likely to carry a gun, the
expected cost of crime increases and more guns can reduce crime. If carrying a firearm makes an individual more willing to engage in a conflict, it is possible that more firearms will be associated with higher crime rates. There is empirical support for both a positive and a negative relationship between guns and crime. A common concern inherent in all research on guns is that the availability of firearm data is limited (NRC 2005).

With no concrete data available for gun ownership, papers have relied on a number of proxies. One of the most commonly used proxies for gun ownership is the fraction of suicides involving a firearm (FS/S). Kleck (2004) assumes that the General Social Survey (GSS) is an accurate measure of gun ownership and finds that the FS/S measure is the best cross-sectional proxy of gun ownership. Although, Kleck (2004) cautions against using the FS/S measure in a panel analysis, Cook and Ludwig (2006) show that when a county’s FS/S increases, homicides also increase. Siegel et al. (2013) extend Cook and Ludwig’s (2006) work and draw similar conclusions. Cook (1979) uses city-level FS/S and the fatal gun accident rate in a cross-sectional study and finds that a higher level of FS/S is associated with higher rates of robberies involving guns.

Not all articles that use the FS/S proxy have found a positive relationship between guns and crime. Moody and Marvell (2005) impute GSS gun ownership with the FS/S measure and create a state-level data set from 1977 to 1998. They do not find a significant relationship between guns and crime. Kovandzic et al. (2013) use the FS/S as the dependent variable in the first-stage of a two-stage least squares approach. They find that after instrumenting the county level FS/S with outdoor magazine subscription rates, voting preferences and the number of veterans, counties with higher rates of FS/S are negatively related to criminal activity.

Although the FS/S measure is used often to capture changes in gun ownership, a number of alternative proxies have been used. Researchers find a positive relationship between gun ownership levels and violent crime using the fraction of homicides (Hemenway and Miller 2000; Lester 2000) and robberies (McDowall 1991) that involve a gun to proxy for ownership. Stolzenberg and D’Alessio (2000) measure illegal gun availability with the yearly number of guns stolen in a county. They find that increases in illegal gun availability are associated with increases in violent crime, gun crime and juvenile crime. Kleck and Patterson (1993) create a city-level gun prevalence measure using five different proxies, including the FS/S, and find no relationship between violent crime rates and gun prevalence.

Southwick (1997) uses time-series data on national gun sales from the Bureau of Alcohol, Tobacco and Firearms and finds that suicide increases with gun sales, but other crimes are not related to sales. Duggan (2001) shows that subscription rates to Guns and Ammo are positively related to homicides using a panel of states and counties over time. Duggan et al. (2011) do not find a relationship between gun shows and the number of nearby homicides or suicides, however, Wintemute et al. (2010) question the research design in Duggan et al. (2011). Wintemute et al. (2010) argue that the effect of gun shows on crime can extend beyond the four-week time frame and 25-mile radius placed on the study.

Other articles have used survey measures to directly estimate gun ownership. One of the most commonly used surveys in the literature is the GSS. An appealing property of the GSS is that the same question about gun ownership is asked in every survey since it began. The GSS started in 1972 and was conducted every year until 1993 and has been administered biannually since 1994. A concern about the survey is that it only has an average of 1,500 respondents per year. Because of the lack of observations, the GSS is only appropriate for estimates at the national and census region levels. In addition to the small sample size, survey data may be biased if respondents do not answer questions honestly due to the sensitive political nature surrounding firearm ownership.
Another survey that has been used to measure gun ownership is the Behavioral Risk Factor Social Surveillance (BRFSS 2015). The BRFSS reports state-level estimates of household gun ownership in 2001, 2002, and 2004 and has over 200,000 respondents each year. While the BRFSS is able to provide more information about gun ownership at the state level, the limited number of years makes it less useful for studying long run changes in gun prevalence.

Using the GSS data from 1988 to 1997, Miller et al. (2002) find that homicide rates increase in a census region when the fraction of household gun ownership increases. Miller et al. (2007a) use BRFSS survey data on household gun ownership in 2001 and show that states with higher gun ownership rates have higher homicide rates. With 2004 BRFSS data, Miller et al. (2007b) show that suicide rates are higher in states with higher rates of gun ownership.

Arguably the most controversial work estimating a relationship between firearm access and crime is Lott and Mustard (1997) and Lott (2000). Lott (2000) exploits variation in right-to-carry (RTC) laws and finds that when a state enacts a RTC law, violent crime decreases. This finding has been challenged by a number of researchers (Black and Nagin 1998; Ludwig 1998; Duggan 2001; Ayres and Donohue 2003; Levitt 2004). The NRC (2005) devotes an entire chapter to addressing the controversy surrounding Lott’s (2010) work and concludes that there is not enough evidence to draw strong conclusions about RTC laws and crime.

The lack of reliable firearm data has caused researchers to use a variety of proxies and empirical specifications to get at how gun ownership is related to criminal activity. This research is the first article to use state-level firearm background checks to investigate how firearms and criminal behavior are related. The next sections discuss the firearm background checks in detail and explore the potential relationship between the intention to purchase a firearm and previously used measures of gun ownership.

Firearm Background Checks

Background Information

As part of the Brady Handgun Violence Prevention Act of 1993, the FBI implemented the NICS requiring each potential buyer of a firearm or explosive to go through an instant background check. When a potential buyer purchases a gun from a Federal Firearms Licensee (FFL), the FFL calls an automated service run by the FBI to confirm that the purchaser does not have a criminal record and is eligible to purchase a firearm.1

The number of background checks in each state are reported monthly by the FBI. If all firearm purchases go through a background check and every background check results in a firearm purchase, then the background checks may represent the flow of firearms into a state and capture the change in the state gun stock every month.

There are a number of reasons why the background checks either overestimate or underestimate the number of firearm purchases in a state. The background checks do not capture the movement of guns across state lines. Knight (2013) finds that firearms tend to flow from states with weak gun laws to states with strict gun laws. When this occurs, background checks in states with strong gun laws will underestimate the number of total guns in the state.

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1 There are a number of situations that would cause an individual to be denied a firearm such as being dishonorably discharged from the Armed Forces, having a conviction for domestic violence or being “adjudicated as a mental defective” (FBI 2013).
In some states, gun permits less than five years old can be presented in lieu of a background check. These states run background checks during the permit application process, but not for guns purchased after the permit has been granted. This suggests that the background checks underestimate the number of gun purchases in these 21 states (BATF 2011). In all states, multiple firearm purchases in a single transaction are subject to only one background check, increasing the likelihood of underestimating the increase of guns in the state.

There are also reasons why background checks could overestimate the number of guns purchased in a state. If there are many potential gun buyers who have a background check run on them, but then decide not to purchase a firearm, the measure can overestimate gun purchases. Background checks in Kentucky, severely overestimate the number of gun purchases. Since July, 2006, Kentucky has been running background checks on their concealed weapon permit holders every month. Permit holders do not need to go through a background check when they purchase a gun as they have a check run on them monthly. Because of this change in 2006, background checks in Kentucky increased from 232,589 in 2005 to 1.58 million in 2007. Kentucky is omitted from most of the analysis below due to their significant increase in background checks since 2007.

**Trends in Firearm Background Checks**

Between November, 1998 to December, 2013, there have been over 180 million firearm background checks and approximately 1 million denials. Figure 1 shows the number of annual background checks in the United States beginning in 1999, the first full year that the NICS was in effect. Kentucky is separated from the rest of the states in gray. Kentucky’s background checks increase noticeably, beginning in 2006. Background checks in the rest of the 49 states and the District of Columbia are shown in black in Figure 1. From 1999 to 2007, the background checks ranged between 8.1 and 9.6 million. In 2008, the background checks increased to 10.8 million and reached nearly 20 million in 2013.

There are a number of possible reasons for the sharp increase in background checks. It may be that guns are being purchased in smaller quantities, leading to more background checks from the same individual. Alternatively, FFLs may have become more compliant over time. The
background check typically only takes 2 minutes (NICS 2013), but if FFLs were initially reluctant of this claim, their acceptance over time may explain the pattern in Figure 1. Because background checks are supposed to represent the intention to purchase a firearm, it may also be that the increase in background checks is due to an actual increase in gun sales. In the week following the Sandy Hook Elementary School shooting in Newtown, CT, nearly one million background checks were completed, the most in a week ever (FBI 2015). The fear of future restrictions of firearms may be responsible for the recent increases in background checks (David 2012).

The rate of background checks can vary noticeably across states as a result of differences in gun culture and gun control laws. Table 1 shows the states with the five lowest and five highest background check rates between 1999 and 2012. The background check rate is calculated as the fraction of the state population that receives a background check in a year. The average background check rate in the data set is 0.038, with a minimum rate of 0.000012 (District of Columbia) and a maximum rate of 0.59 (Kentucky). The states with the lowest background check rates, DC, New Jersey, Hawaii, New York and Rhode Island, all have strict gun control laws and the average fraction of the population with a background check in the states is 0.0089.

The states with the highest background check rates, Alaska, West Virginia, Wyoming, Montana, and Kentucky, have significantly higher rates than the low background check rate states, with Kentucky being an outlier. If Kentucky is removed from the high rate group, the average background check rates range from 0.077 to 0.096. Not only is Kentucky’s average rate significantly higher than the rest of the group at 0.26, but it has a relatively large amount of variation ranging from 0.055 to 0.59 and a standard deviation that is nearly the same size as the mean. Background check rates in Kentucky may represent changes in gun purchases, but because of the large measurement error in Kentucky, it makes comparisons to other states misleading.

Table 1. Distribution of Background Check Rates, 1999–2012

<table>
<thead>
<tr>
<th>States</th>
<th>Background Checks/Population</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>0.038</td>
<td>0.042</td>
<td>0.000012</td>
<td>0.59</td>
<td>714</td>
</tr>
<tr>
<td>Five Lowest BGC Rates</td>
<td>0.00089</td>
<td>0.0036</td>
<td>0.000012</td>
<td>0.023</td>
<td>70</td>
</tr>
<tr>
<td>DC</td>
<td>0.00027</td>
<td>0.00027</td>
<td>0.000012</td>
<td>0.00071</td>
<td>14</td>
</tr>
<tr>
<td>New Jersey</td>
<td>0.0053</td>
<td>0.066</td>
<td>0.0042</td>
<td>0.0097</td>
<td>14</td>
</tr>
<tr>
<td>Hawaii</td>
<td>0.0069</td>
<td>0.0021</td>
<td>0.0045</td>
<td>0.013</td>
<td>14</td>
</tr>
<tr>
<td>New York</td>
<td>0.011</td>
<td>0.0027</td>
<td>0.0079</td>
<td>0.017</td>
<td>14</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>0.012</td>
<td>0.0040</td>
<td>0.0089</td>
<td>0.023</td>
<td>14</td>
</tr>
<tr>
<td>Five Highest BGC Rates</td>
<td>0.18</td>
<td>0.18</td>
<td>0.055</td>
<td>0.59</td>
<td>70</td>
</tr>
<tr>
<td>Alaska</td>
<td>0.077</td>
<td>0.018</td>
<td>0.057</td>
<td>0.12</td>
<td>14</td>
</tr>
<tr>
<td>Wyoming</td>
<td>0.081</td>
<td>0.013</td>
<td>0.066</td>
<td>0.11</td>
<td>14</td>
</tr>
<tr>
<td>W. Virginia</td>
<td>0.082</td>
<td>0.014</td>
<td>0.071</td>
<td>0.12</td>
<td>14</td>
</tr>
<tr>
<td>Montana</td>
<td>0.096</td>
<td>0.015</td>
<td>0.079</td>
<td>0.13</td>
<td>14</td>
</tr>
<tr>
<td>Kentucky</td>
<td>0.26</td>
<td>0.23</td>
<td>0.055</td>
<td>0.59</td>
<td>14</td>
</tr>
</tbody>
</table>

Note: Population weighted means of the BGC/POP variable are reported in the first column.
<table>
<thead>
<tr>
<th>Data Source</th>
<th>GSS (1)</th>
<th>BRFSS (2)</th>
<th>FS/S (3)</th>
<th>GSS (4)</th>
<th>BRFSS (5)</th>
<th>FSS (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGC/POP&lt;sub&gt;f&lt;/sub&gt;</td>
<td>0.069*** (0.011)</td>
<td>0.058*** (0.0055)</td>
<td>0.17*** (0.048)</td>
<td>-0.0049 (0.020)</td>
<td>0.0058 (0.0058)</td>
<td>0.0056 (0.026)</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>Year</td>
<td>Year</td>
<td>Year</td>
<td>Year, Region</td>
<td>Year, State</td>
<td>Year, State</td>
</tr>
<tr>
<td></td>
<td>Even years</td>
<td></td>
<td></td>
<td>Even years</td>
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<td></td>
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<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.586</td>
<td>0.564</td>
<td>0.057</td>
<td>0.118</td>
<td>0.309</td>
<td>0.564</td>
</tr>
<tr>
<td>N</td>
<td>56</td>
<td>151</td>
<td>600</td>
<td>56</td>
<td>151</td>
<td>600</td>
</tr>
</tbody>
</table>

Note: Robust standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1. The dependent variable in (1) and (2) is the fraction of households in a region that report owning a gun in the GSS. The dependent variable in (3) and (4) is the fraction of households in a state that report owning a gun in the BRFSS. The dependent variable in (5) and (6) is a state's annual number of suicides involving a firearm divided by total suicides. All regressions are weighted by average population in each entity for the relevant time period. Panel A uses the background check rate as the variable of interest. The reported R<sup>2</sup> in regressions that include region or year fixed effects is the average of the within-group and between-group R<sup>2</sup>'s.
ownership. Before examining the empirical relationship between background checks and crime, it is necessary to understand the possible ways background checks and gun ownership are related. Although reliable data on gun ownership are sparse, previously used estimates of gun ownership can be compared to background checks to gain insight into what background checks represent.

Many previous studies use the GSS estimates of household gun ownership to validate firearm proxies. A main benefit of the GSS is the survey has asked respondents whether they have any guns or revolvers in the home or garage since 1972. However, the GSS is only available at the census region level and small sample sizes have led to unrealistic fluctuations in gun ownership levels.\(^2\) The BRFSS survey contains state level information on gun ownership, but ownership data are only available in 2001, 2002, and 2004. Background check data are available continuously since November, 1998. Despite the concerns surrounding survey-level gun ownership measures, Kleck (2004) uses the GSS to validate the FS/S as a proxy for gun ownership but cautions against using the proxy to measure changes in ownership over time.

Table 2 shows that background check rates are cross-sectionally related to survey-level gun ownership measures and the FS/S proxy. In column 1 of Table 2, the gun ownership rate in a census region is regressed on the background check rate in the census region and time fixed effects for years that the two data sources coincide (even years between 2000 and 2012). The results show that census regions with more background checks tend to report a higher level of gun ownership. In columns 2 and 3, state-level gun ownership data from the BRFSS and the state-level FS/S are used as the dependent variable, respectively. Both regressions show that states with more background checks have higher levels of reported gun ownership.

In columns 4, 5, and 6 entity fixed effects are added to the regressions and the background check rate coefficient becomes insignificant in all specifications. The insignificant results that arise after including entity fixed effects suggest that within-state changes in gun ownership estimates are not related to changes in background check rates.\(^3\) One possible reason for this finding is that an additional background check may represent an increase in gun ownership, but the GSS, BRFSS, and FS/S are not able to accurately capture temporal variation in gun ownership. Hemenway (2004) argues that most of the year-to-year changes in GSS gun ownership levels are “noise” and attempts to assess the validity of temporal gun proxies using the GSS are “essentially worthless.” The FS/S is available in all states over a long period of time, but many factors can drive changes in the FS/S proxy that are unrelated to changes in gun ownership.

The change in state-level background check rates could also be unrelated to changes in gun ownership measures if many firearm background checks are not turning into actual gun purchases. To examine this possibility, manufacturing information from the Bureau of Alcohol, Tobacco and Firearms (BATF 2013) is used. The BATF reports total firearms manufactured in the United States, along with the number of exported and imported firearms. While the manufacturing of guns does not necessarily represent a firearm purchase, the production of firearms will likely be sensitive to the number of guns sold and background checks could represent aggregate increases in equilibrium quantities in the firearm market.

Figure 2 shows how firearm background checks (omitting Kentucky) and net gun manufacturing (firearms manufactured plus imports, minus exports) has changed from 1999 to 2012. The

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\(^2\) Kleck (2015) points out that the gun ownership rate in New England increased from 16.6 to 42.9% between 1982 and 1984, then fell back down to 25.1% in 1985.

\(^3\) Unreported regressions using the lagged background check rate as the independent variable in Table 2 yields the same conclusions as the current background check rate.
two variables move together in most years. In an unreported regression that runs annual net gun manufacturing on annual background checks (omitting Kentucky), one additional background check is associated with a 0.958 increase in guns manufactured in the year. Background checks explain 96.4% of the variation in gun manufacturing, suggesting that background checks represent firearm sales at a national level. Considering the strong correlation between gun manufacturing and background checks, it is unlikely that a significant fraction of background checks are not resulting in additional firearm sales.

Another reason that the increase in background checks may be unrelated to gun ownership estimates is because the background checks are predominantly being carried out by households that already own guns. When an existing gun owner completes a background check and adds to their household stock of firearms, the total number of firearms purchased will increase, but gun ownership level will remain stable.

Alternatively, the existing owner may privately sell old guns on an unregulated private market after purchasing a new firearm. Private sales of firearms are not subject to a background check and only 3164 of the nearly 21 million background checks in 2014 were from private sales. If purchasers of firearms on the private market are reluctant to report owning a gun, background checks on new firearms may represent an increase in firearm sales on the private market, but gun ownership estimates will be relatively stable.

The unregulated private market is a common source of gun acquisition for those who are unable to purchase a firearm legally (Braga et al. 2002). If criminals turn to an unregulated market for firearms and increase demand in the private market, existing gun owners may find private sales lucrative. The lack of accurate data on private firearm sales makes it difficult to estimate the strength of a potential relationship between background checks and criminal firearm purchases on the private market.

Although background checks may not suffer from the same concerns as survey data on gun ownership, an increase in background checks can represent a number of different scenarios. Figure 3 shows the potential channels through which a background check can influence both the gun

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4 In Australia, where guns have been heavily regulated since 1996, prices of semiautomatic weapons on the black market increased by as much as sevenfold between 2012 and 2014 (Tanquintic-Misa 2014).
stock and ownership levels. In the simplest case, italicized in the upper left corner of Figure 3, a background check is completed by a new gun owner, increasing both the gun stock and gun ownership levels. In order for new gun owners to be driving increases in background checks, one must assume that the limited variation in gun ownership levels according to the GSS is not accurate.

Under the assumption that survey data on gun ownership are accurate and ownership levels are stable, increases in background checks are likely driven by existing gun owners. An existing owner that completes a background check and purchases a new firearm can add to his or her household stock of firearms, or maintain his or her stock if old guns are retired. These two scenarios are bolded in the upper right corner of Figure 3.

Existing gun owners can also sell their old firearms on an unregulated private market after completing a background check and purchasing a new firearm, depicted on the bottom half of Figure 3. Background checks are not required in private sales and are rarely carried out. This unlikely scenario is shown in normal font in the bottom left corner of Figure 3. Private sales that take place on the unregulated private market are shown in bolded, italicized font in the bottom right corner in Figure 3. When a background check is associated with a firearm sale on the private market, the background check will still be associated with an increase in the stock of firearms. Gun ownership levels may remain stable if private market buyers are less likely to report owning a gun because they made their purchase in an unregulated market.

Because the exact channel through which background checks are related to firearm activity is unknown, the empirical results below report the aggregate effect of an increase in background checks on crime. If gun ownership rates are increasing with background checks, an additional background check captures a combination of more gun households, more guns per existing gun households and an increase in firearm availability on the unregulated private market. When the gun ownership rates are assumed to be stable, the background checks represent the combined effect of an increase in firearm availability in the private market and existing gun owners adding to their household stock.
Guns and Crime

The uncertainty surrounding what the background checks represent and the ambiguous theoretical relationship between guns and crime make it important to understand the potential ways that background checks can affect crime. Guns and crime can be positively related through a straightforward mechanism. If a crime, such as homicide, rape or armed robbery, is carried out because a criminal has acquired a firearm, eliminating the firearm from the situation will reduce the likelihood of the crime (Zimring 1972; Cook 1979). When background checks are representative of criminals obtaining firearms, a positive correlation between background checks and violent crime is expected.

If changes in the background checks are driven by new gun households or existing households legally adding to their gun stock, the presence of more guns inside a home may lead to an increase in crimes and gun-related outcomes that originate inside the home. Hemenway (2011) cites a number of studies suggesting that women in households with guns are at a greater risk for intimate partner violence (Hemenway, et al. 2002) and intimidation (Azrael and Hemenway 2000). Additional background checks have been found to increase youth firearm suicide (Lang 2013) and may also lead to more accidental firearm deaths. Assuming guns per household have a positive relationship with crimes inside the home, it is possible for additional background checks to increase domestic crimes against females, as well as homicides and accidental gun deaths that occur in the home.

Increases in firearms may also be associated with reductions in criminal behavior. Becker (1968) argues that an increase in the fraction of gun households can increase the expected cost of a crime, possibly deterring criminals from committing crimes at the margin. If the survey estimates of gun ownership levels are not accurate and background checks represent an increase in the number of households owning a gun, background checks may be negatively related to crimes that take place in a victim’s home, such as burglary or robbery.

It is also possible that background checks driven by an increase in the number of guns per existing gun owner can deter criminal activity. The reduction in crime could occur if gun owners are more likely to carry a concealed weapon when they own multiple firearms (Swanson, et al. 2015). When more citizens are carrying concealed weapons, crimes that involve direct contact with the victim may decrease. In this scenario, crimes such as robbery, rape, assault and homicide, would decrease as background checks rise.

Another theory regarding guns and crime is that criminals may be more likely to carry out nonfatal violent crimes when a gun can be used as a credible threat (Cook 1983). A criminal with a gun will presumably be more likely to carry out a crime such as a robbery, because the gun can be used to threaten victims. Victims will be more likely to comply with the criminal if a gun is present, reducing the need for the criminal to physically harm the victim. This potential scenario suggests that when background checks represent firearm acquisitions by criminals on the private market, background checks will be positively related to robbery or burglary, but negatively related to homicide and assault.

Figure 4 summarizes the possible ways that background checks and crime may be related. The first row presents three theories linking guns to crime. The relationship between background checks and crime is dependent on what behavior is driving the increase in background checks, which is noted in the second row. In the final row, the combination of the guns and crime theory and what background checks represent lead to the expected relationship between background checks and crime.
The evidence above suggests that background checks capture gun manufacturing and proxy for the sales of guns in an area. Theoretical predictions about background checks and crime are dependent on whether one believes increases in background checks are driven by changes in household gun ownership levels, more guns per gun household, an increase in firearms on the unregulated private market or a combination of the three possibilities. Empirically investigating which crimes are related to the background checks below will allow for a better understanding of what the checks represent and provides new insight about the relationship between firearm sales and crime.

3. Empirical Strategy and Summary Statistics

Regression Specification

Equation 1 presents a fixed-effects specification relating crime and background checks:

$$\ln\left(\frac{\text{Crime}}{\text{POP}}\right)_{it} = \alpha_0 + \alpha_1 \ln\left(\frac{\text{BGC}}{\text{POP}}\right)_{it} + \alpha_2 \times_{it} + \delta_i + \tau_t + \kappa_{it} + \epsilon_{it}. \quad (1)$$

The natural log of the crime rate per 100,000 in state $i$ in year $t$, $\ln\left(\frac{\text{Crime}}{\text{POP}}\right)_{it}$, is regressed on the natural log of the background check rate, $\ln\left(\frac{\text{BGC}}{\text{POP}}\right)_{it}$. The background check rate is calculated as the total number of background checks in a state-year, divided by the state’s population that year.$^5$ The matrix of time-varying, state-level determinants of crime, $\times_{it}$, contains policing levels, incarceration rates, alcohol consumption per capita, unemployment, income per capita, racial, and age composition. A binary variable equal to 1 when a state allows permit holders to purchase guns without a background check is also included in $\times_{it}$.

State fixed effects, $\delta_i$, account for time-invariant state characteristics that affect the crime rate, including historical attitudes toward crime, baseline levels of crime and possibly gun retirement rates. Gun retirements refer to guns that are broken or discarded. It is possible that the breakdown of guns would lead to an increase in sales, but no information about retirements is available. However, if a state’s retirement rate is relatively constant over time, it will be captured by

---

$^5$ The total background checks include failed background checks because state level information on denials is not available. The inclusion of failed checks is not likely driving the results below since there have been over 214 million background checks completed nationally between December, 1998 and July, 2015. Only 1.2 million background checks led to denials.
year fixed effects. Southwick (1997) assumes that the retirement rate ranges from 2 to 5%. Year fixed effects, \( \tau_i \), control for nationwide trends in crime rates that are common to all states. A state-specific time-trend, \( \kappa_i \), accounts for the overall trend in state \( i \)’s crime rate.

In order for \( \alpha_1 \) to be unbiased, unobserved state-level determinants of changes in the crime rate, \( \epsilon_{it} \), cannot be related to changes in the background check rate. Assuming exogeneity, \( \alpha_1 \) can be interpreted as the expected percentage change in state \( i \)’s annual crime rate associated with a percentage change in the rate of potential firearm sales in the state.

There are many reasons to believe that \( \alpha_1 \) is biased. Kleck (2015) argues that much of the existing research on gun ownership and crime suffers from three main empirical problems. Two of Kleck’s (2015) points, use of an appropriate firearm measure and sufficient control variables, are addressed above. Kleck’s (2015) third concern is that regressions using gun measures as the independent variable may suffer from reverse causality bias. This occurs when law-abiding individuals respond to increases in crime by purchasing guns for self-protection. The simultaneous increase in guns and crime can lead to the conclusion that higher gun prevalence will lead to more crime, when in reality, the increase in crime is not driven by changes in gun ownership.

Kovandzic et al. (2013) use instrumental variables to address the causality problem. Using cross-sectional, county level data in 1990, they proxy for gun ownership with FS/S levels, and instrument the FS/S measure with subscription rates to outdoor and gun magazines, Republican voting rates in the 1988 Presidential election and the fraction of veterans in the county. All instruments are related to the FS/S proxy, but may also be related to crime rates directly. Kovandzic et al. (2013) admit that veterans are more likely to own guns and commit violent crimes, but use the instrument because the bias generated will provide an upper bound on the effect of guns. Overall, their paper highlights the difficulty in finding valid instruments in gun research that will eliminate causality issues.

Other articles (Duggan 2001; Moody and Marvell 2005; Cook and Ludwig 2006) lag the measure of guns to reduce reverse causality concerns. This is sensible as gun purchases yesterday cannot be determined by crime today. Equation 2 lags the background checks in Equation 1 by 1 year:

\[
\ln \left[ \frac{\text{Crime}}{\text{POP}} \right]_{it} = \alpha_0 + \alpha_1 \ln \left[ \frac{\text{BGC}}{\text{POP}} \right]_{it-1} + \alpha_2 X_{it} + \delta_i + \tau_i + \kappa_i + \epsilon_{it}. \tag{2}
\]

Although, the direction of causality can only run from past background checks to future crime, endogeneity concerns are not necessarily eliminated in Equation 2. If background check rates in a state are related over time, the lagged rate may be related to the error term, \( \epsilon_{it} \), in the same way as the nonlagged rate and \( \alpha_1 \) will be biased in the same way as it is in Equation 1. The coefficient of interest, \( \alpha_1 \) is interpreted as the association between changes in the background check rate in the previous year and crime in the following year.

A problem inherent in empirical crime research is that some crimes are relatively rare and least-squares estimation may be inappropriate given the skewed distribution of the data. Osgood (2000) uses crime data in 264 nonmetropolitan counties pooled over a 5-year period to explore the appropriateness of using OLS regressions compared to Poisson and negative binomial regressions. Osgood (2000) finds that Poisson and negative binomial regressions fit crime data more accurately than OLS.

The negative binomial and Poisson regressions are both used in count models and their regression coefficients have the same interpretation. A primary difference between the two models
is that the negative binomial regression allows for overdispersion of the expected outcome. Unre-
ported analyses reject the null hypothesis that there is no overdispersion in the data, suggesting
that the Poisson model is inferior to the negative binomial model in the current setting.

Equation 3 defines the expected mean count of crime, Crime_{it}, in a fixed effect negative bin-
omial model:

\[
\ln\text{Crime}_{it} = \beta_1 \ln \left( \frac{\text{BGC}}{\text{POP}_{it+1}} \right) + \beta_2 X_{it} + \ln \text{POP}_{it} + \theta + \pi_i + \omega_i + \epsilon_{it} .
\]  

(3)

The coefficient on \( \ln \text{POP}_{it} \) is restricted to one, effectively converting the count variable into a
rate variable, \( \ln \left( \frac{\text{Crime}_{it}}{\text{POP}_{it}} \right) \), which is equivalent to the dependent variable in Equation 2 above. The
interpretation of \( \beta_1 \) is different than a standard OLS regression coefficient. When there is a 10%
increase in the lagged background check rate, the crime rate will change by \( e^{(\beta_1 \cdot 0.1) - 1} \) *100
percent.

The expected sign of \( \beta_1 \) depends on what outcome is being measured. As discussed above in
the theoretical section, background checks are highly related to gun manufacturing at a national
level. Assuming a negligible relationship between background checks and levels of gun ownership,
background checks will proxy for the number of guns per gun household. In this case, guns may
be more accessible to all members of a gun household, and \( \beta_1 \) is expected to be positive when gun
accidents and homicides that originate inside the home are used as the dependent variable.

If the background checks capture changes in the fraction of gun households or gun preva-
ience in an area, the relationship between background checks and overall crime is ambiguous.
Crimes that potentially involve direct interactions between criminals and victims, such as rob-
beries, may decrease if criminals are deterred by the increase in gun prevalence. At the same time,
the higher gun prevalence may cause property crimes to increase if criminals substitute toward
cri mes with a lower expected cost.

Background checks could also represent an increase in the supply of guns on the unregulated
market. If more background checks represent increased firearm access for criminals, nearly all
crimes have the potential to be positively related to background checks. However, this particular
behavior cannot be parsed out with the available data.

**Summary Statistics**

Table 3 reports the mean and standard deviation of relevant variables in the analysis. The first
column shows the averages for all states from 1999–2010, while the next two columns show the
averages in states split into high and low background check states. High (low) background check
states have an average background check rate that is greater (less) than the overall median back-
ground check rate of all states.

The average annual background check rate \( \frac{\text{BGC}}{\text{POP}} \) in the data is 0.035. By construction, the
rate in high background check states is significantly higher, 0.057, than low background check
states, 0.025. High and low background check states differ on many other dimensions beyond
background check rates. Low background check states have significantly higher crime rates, per
capita GDP, police rates, alcohol consumption per capita and population. The unemployment
rate is the only control variable in which high and low background check states do not significantly
differ from one another. Controls are included in all regressions below and regressions are carried
out for high and low background check states separately.
The data in Table 3 come from a variety of sources. Homicide rates are from the National Center for Health Statistics (NCHS) mortality files (CDC 2012). The FBI’s UCR publishes violent and property crime rates, annually (FBI 2012). Both the NCHS and UCR report homicide data, but data from NCHS come from state vital registrars and they define homicide as “injuries inflicted by another person with intent to injure or kill by any means.” The UCR obtains data from law enforcement agencies and define homicide as “willful killing of one human being by another.” The data sets closely track one another, but because UCR data are voluntary, NCHS homicide rates are marginally greater than the UCR homicide rates (BJS 2014).

The FBI also publishes Crime in the US annually, which contains information on police employment by state. State population data are from the US Census Intercensal Population Estimates. Per capita GDP is from the Bureau of Economic Analysis (BEA 2013) and state unemployment rates are found at the Bureau of Labor Statistics’ Local Area Unemployment website (BLS 2013). Alcohol consumption per capita information is published by the National Institute on Alcohol Abuse and Alcoholism.

### Table 3. Summary Statistics, 1999–2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>All States</th>
<th>High BGC States</th>
<th>Low BGC States</th>
<th>Significant Difference, High versus Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGC/POP</td>
<td>0.035 (0.035)</td>
<td>0.057 (0.056)</td>
<td>0.025 (0.010)</td>
<td>***</td>
</tr>
<tr>
<td>ln(BGC/POP)</td>
<td>−3.57 (0.68)</td>
<td>−2.99 (0.38)</td>
<td>−3.81 (0.63)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Homicide rate)</td>
<td>1.72 (0.42)</td>
<td>1.69 (0.53)</td>
<td>1.73 (0.36)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Firearm homicide rate)</td>
<td>1.27 (0.52)</td>
<td>1.25 (0.67)</td>
<td>1.28 (0.44)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Nonfirearm homicide rate)</td>
<td>0.64 (0.35)</td>
<td>0.61 (0.39)</td>
<td>0.66 (0.33)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Violent crime rate)</td>
<td>6.10 (0.35)</td>
<td>6.01 (0.41)</td>
<td>6.14 (0.31)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Property crime)</td>
<td>8.11 (0.24)</td>
<td>8.08 (0.23)</td>
<td>8.11 (0.25)</td>
<td>***</td>
</tr>
<tr>
<td>ln(GDP/POP)</td>
<td>10.74 (0.16)</td>
<td>10.66 (0.15)</td>
<td>10.77 (0.15)</td>
<td>***</td>
</tr>
<tr>
<td>ln(UE rate)</td>
<td>1.71 (0.32)</td>
<td>1.68 (0.30)</td>
<td>1.72 (0.34)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Police employment rate)</td>
<td>−5.74 (0.20)</td>
<td>−5.80 (0.23)</td>
<td>−5.71 (0.18)</td>
<td>***</td>
</tr>
<tr>
<td>ln(Alcohol consumption rate)</td>
<td>0.80 (0.13)</td>
<td>0.77 (0.17)</td>
<td>0.81 (0.11)</td>
<td>***</td>
</tr>
<tr>
<td>Population</td>
<td>5,767,162 (6,440,528)</td>
<td>3,561,245 (3,118,454)</td>
<td>7,888,237 (7,933,268)</td>
<td>***</td>
</tr>
<tr>
<td>States</td>
<td>51</td>
<td>25</td>
<td>26</td>
<td>****</td>
</tr>
</tbody>
</table>

Note: Each cell reports the mean and standard deviation of each variable between the years 1999 and 2010. The first column includes all states. The second and third columns groups states based on whether the state has an average background check rate above or below the median background check rate. The final column denotes whether the difference in means between the two groups of states is significant or not, where: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The data in Table 3 come from a variety of sources. Homicide rates are from the National Center for Health Statistics (NCHS) mortality files (CDC 2012). The FBI’s UCR publishes violent and property crime rates, annually (FBI 2012). Both the NCHS and UCR report homicide data, but data from NCHS come from state vital registrars and they define homicide as “injuries inflicted by another person with intent to injure or kill by any means.” The UCR obtains data from law enforcement agencies and define homicide as “willful killing of one human being by another.” The data sets closely track one another, but because UCR data are voluntary, NCHS homicide rates are marginally greater than the UCR homicide rates (BJS 2014).

The FBI also publishes Crime in the US annually, which contains information on police employment by state. State population data are from the US Census Intercensal Population Estimates. Per capita GDP is from the Bureau of Economic Analysis (BEA 2013) and state unemployment rates are found at the Bureau of Labor Statistics’ Local Area Unemployment website (BLS 2013). Alcohol consumption per capita information is published by the National Institute on Alcohol Abuse and Alcoholism.

### 4. Results

#### NCHS Homicide Results

Table 4 presents the results of OLS regressions with fixed effects and fixed effect negative binomial regressions where NCHS homicide rates are the dependent variable. The regressions cover the years 2000–2010, include state and year fixed effects and a linear state trend.
Observations are weighted by the average state population between 1999 and 2010. The \( p \)-value reported in Table 4 is associated with an \( F \)-test where the null hypothesis is that there is not first-order autocorrelation. In all regressions, the null hypothesis cannot be rejected, suggesting that autocorrelation may be present, but clustering at the state level produces consistent standard errors (Wooldridge 2002).\(^6\) All observations from Kentucky are dropped from the analysis, as is New York for the year 2001 because of the unusual increase in homicide due to 9/11.

The first columns of Table 4 show results from OLS regressions. Logged homicide, firearm homicide and non-firearm homicide rates per 100,000 are used as the dependent variable. In all three specifications, the coefficient on the logged background check rate in the previous year is small and insignificant. Specifically, when the lagged background check rate in state \( i \) increases by 10\%, the homicide rate in the state insignificantly increases by 0.0098\%. Increases in alcohol consumption per capita are associated with marginally fewer homicides and nonfirearm homicides. Nonfirearm homicide rates are positively associated with the fraction of males in a state. Homicide and firearm homicide rates increase when states enact policies that allow permits to substitute for background checks.

The last three columns in Table 4 report results from fixed effect negative binomial regressions. The coefficient on logged background check rates in the previous year for all homicides is 0.0015 and insignificant. A 10\% increase in the background check rate is associated with a \( e^{(0.01) \times 100\%} \) or 0.01\% increase in the homicide rate.

The lagged background check rate variable is insignificant, but a number of variables in the negative binomial regressions are significant. Alcohol consumption per capita is negatively related to homicide and nonfirearm homicide rates, similar to the OLS results. The fraction of males in a state is positively related to homicide, firearm homicide and nonfirearm homicide rates. The fraction of males that are 15–19 years old is negatively related to homicide and nonfirearm homicide rates. This result can be partially explained by the positive relationship between homicide and firearm homicide rates and the fraction of 15–19 year old black males in a state. The fraction of black males of all ages is negatively related to firearm homicide and police employment is positively related to all homicide, but only significant at the 10\% level.

The McFadden \( R^2 \) is reported for the negative binomial regressions. The McFadden \( R^2 \) is appropriate for discrete dependent variable models and has a similar interpretation as a traditional \( R^2 \). However, McFadden (1979) notes that the McFadden \( R^2 \) is lower than traditional \( R^2 \)'s and a value between 0.2 and 0.4 represents an “excellent” fit. Regressions using the homicide rate and firearm homicide rate as the dependent variable have McFadden \( R^2 \)'s of 0.200 and 0.284, respectively.

In unreported regressions, the specifications in columns 4, 5, and 6 of Table 4 are rerun lagging the background check rate by one through five years. The only significant finding from the additional regressions is that background check rates four years earlier are positively and significantly related to the homicide rate. Firearm homicide rates and background check rates four years earlier are positively related, but the relationship is only marginally significant.

**NCHS Robustness Checks**

Background checks may differentially influence homicide for specific demographics or locations and potentially cause the insignificant results in Table 4. As discussed above, if background

\(^6\) The results of OLS regressions are not sensitive to clustering.
### Table 4. NCHS Homicide Rates and Background Check Rates, 2000–2010

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>OLS Regression with Fixed Effects</th>
<th>Fixed Effects Negative Binomial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ln(Homicide Rate per 100 K)</td>
<td>ln(Homicide Rate per 100 K)</td>
</tr>
<tr>
<td>ln(BGC/POP)(_{it-1})</td>
<td>0.0098 (0.059)</td>
<td>0.0015 (0.058)</td>
</tr>
<tr>
<td>ln(BGC/POP)(_{it})</td>
<td>0.90 (0.93)</td>
<td>1.41 (0.94)</td>
</tr>
<tr>
<td>ln(UE Rate)(_{it})</td>
<td>-0.13 (0.090)</td>
<td>-0.12 (0.087)</td>
</tr>
<tr>
<td>ln(Police employment rate)(_{it})</td>
<td>0.31 (0.22)</td>
<td>0.39* (0.23)</td>
</tr>
<tr>
<td>ln(Alcohol consumption rate)(_{it})</td>
<td>-0.85* (0.45)</td>
<td>-0.94** (0.48)</td>
</tr>
<tr>
<td>ln(Male pop. 15–19 rate)(_{it})</td>
<td>-1.58 (1.33)</td>
<td>-2.52* (1.45)</td>
</tr>
<tr>
<td>ln(Male pop. 20–24 rate)(_{it})</td>
<td>0.47 (0.80)</td>
<td>0.60 (0.83)</td>
</tr>
<tr>
<td>ln(Black male pop. 15–19 rate)(_{it})</td>
<td>2.72 (1.72)</td>
<td>4.04** (1.70)</td>
</tr>
<tr>
<td>ln(Black male pop. 20–24 rate)(_{it})</td>
<td>-0.51 (0.48)</td>
<td>1.38** (0.59)</td>
</tr>
<tr>
<td>ln(Black male pop.)(_{it})</td>
<td>-0.16 (0.91)</td>
<td>-0.41 (0.56)</td>
</tr>
<tr>
<td>Permit State Binary(_{it})</td>
<td>0.11** (0.043)</td>
<td>0.094* (0.049)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.12 (16.8)</td>
<td>-16.1 (14.4)</td>
</tr>
<tr>
<td>First order autocorrelation test, Prob &gt; F</td>
<td>0.44</td>
<td>0.72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Firearm</th>
<th>Nonfirearm</th>
<th>All</th>
<th>Firearm</th>
<th>Nonfirearm</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>549</td>
<td>548</td>
<td>549</td>
<td>549</td>
<td>549</td>
<td>549</td>
</tr>
<tr>
<td>R(^2)/McFadden R(^2)</td>
<td>0.939</td>
<td>0.957</td>
<td>0.793</td>
<td>0.200</td>
<td>0.284</td>
<td>0.140</td>
</tr>
</tbody>
</table>

Note: Standard errors clustered at the state level are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. All regressions include state and year fixed effects, linear state trends and are weighted by average state population, 1999–2010. Column (2) has one less observation because North Dakota had no firearm homicides in 2008. All regressions omit Kentucky for all years, and New York in 2001 due to the increase in homicide as a result of 9/11. The first order autocorrelation test reports the p-value where the null hypothesis is no first order autocorrelation, or no serial correlation. A McFadden R\(^2\) between 0.2 and 0.4 is suggestive of a good fit.
checks are capturing an increase in the number of guns per gun household, homicides in the home and gun accidents may increase when background checks increase.

Table 5 shows the regression coefficient for the logged background check rates in the previous year when different homicide rates are used as the dependent variable in a negative binomial regression. In panel A, homicide rates are broken down by sex, whether a firearm was used, race and marital status. None of the regressions yield a significant coefficient for a logged background check rates in the previous year.

The first two columns of panel B show how logged background check rates in the previous year are related to homicides that take place inside and outside of the home. Both coefficients are positive, but insignificant. The next two columns examine homicide rates in the subset of high background check and low background check states, similar to the summary statistics table above. In high background check states, lagged background check rate and homicide rates are negatively related, whereas low background check states show a positive relationship between background checks and homicide rates. Both relationships are statistically insignificant.

If an increasing background check rate is associated with more guns per gun household, background check increases may be positively related to gun accidents. However, the results in the fifth column of panel B shows that when background check rates increase by 10%, deaths by gun accidents fall by 2.2%. The result is significant at the 10% level, but caution must be taken when so many hypothesis tests are being performed and only one regression results in a marginally significant relationship. If more background checks do happen to lead to a reduction in gun accidents, an increase in guns would likely have to coincide with an additional safety measures taken by owners.

Background check rates are positively related to firearm suicide rates in the last column of panel B, but the relationship is insignificant ($p = 0.14$). This finding is consistent with the results in Lang (2013), although that analysis uses an OLS framework instead of a count model regression. The point estimate suggests that firearm suicides increase by 0.5% when background checks increase by 10%.

**UCR Crime Results**

The benefit of using homicide data from the NCHS in the previous section is that the detailed data set allows homicides to be analyzed by race, location and marital status. However, the NCHS does not provide information about other types of crimes that may be influenced by a change in background check rates.

The FBI’s UCR publishes annual statistics about state crime rates. Panel A of Table 6 examines the relationship between all violent crime, murder, rape, robbery, and assault and the logged background check rate in the previous year. Rape rates are positively related to lagged background check rates at the five percent level of significance. Violent crime, robbery, and assault are positively but insignificantly related to lagged background check rates. The coefficients in panel A are largely positive with varying levels of significance, but there is not enough evidence to conclude that increases in background checks will increase violent crime.

The first four columns of panel B examine how property crime, burglary, larceny, and motor vehicle theft rates are related to logged background check rates. In the first column, there is a negative and marginally significant relationship between all property crime and logged background check rates in the previous year. The relationship appears to be driven by larceny. In order for the
decrease in larceny to be caused by increases in background check rates, criminals must be responding to an increase in potential firearms by reducing the amount of theft they carry out. This would occur if criminals believe potential victims are observing their actions and are more likely to be carrying a firearm. The coefficients in panel B tend to be negative and additional background checks are unlikely to be positively related to property crimes. In the final column, all crimes are used as the dependent variable and a 10% increase in background check rates in a state are associated with a 0.33% decrease in the state’s crime rate. The relationship is marginally significant.

Before discussing the implications of the regression results above, it is important to recognize that it is possible that the direction of causality runs from crimes to guns, opposite of what has been implied above. Unreported regressions suggest that this is not a significant concern. When background checks are used as the dependent variable and lagged crime rates are the independent variable of interest, the coefficient of interest is insignificant. This is not surprising given that one may expect firearms sales to increase in response to increases in crime, but the substantial increase in background checks after 2007 coincides with a reduction in crime.

5. Discussion

Background checks explain a large fraction of the variation in gun manufacturing and are presumably related to an increase in the equilibrium quantity of guns bought and sold. In the regressions above, an additional background check represents a combination of more gun
households in an area, an increase in firearm purchases by existing gun households and greater availability of guns on the unregulated private market. The results in the previous section show the net effect of all the possible scenarios that can increase background checks. Although the specific reason for a background check cannot be determined, the results above can provide insight into which scenario is most likely driving an increase in background checks.

In order for background checks to represent an increase in firearm acquisitions by criminals on the unregulated private market, one would expect background checks and violent crime to be positively related. The results in Tables 5 and 6 show that there is not a significant relationship between homicide and background check rates. In panel A of Table 6, all violent crimes with the exception of rape are insignificantly related to background checks. Because violent crime does not increase when background checks rise, there is not strong evidence that background checks are related to acquisition of firearms by criminals on the private market. If background checks are correlated with criminals obtaining firearms on the private market, criminals do not observably change their behavior after they purchase a firearm.

Background checks may also represent an increase in levels of gun ownership in a state if new gun households are purchasing firearms. An increase in ownership levels is not expected to increase violent crime if the new owners are purchasing firearms for protection or recreational purposes. A greater fraction of gun households can possibly deter criminals from carrying out property crimes. Panel B of Table 6 shows a negative relationship between background checks and property crimes, suggesting that increases in background checks could represent new gun households and lead to reductions in property crime.

Estimates from the GSS show that gun ownership levels have been relatively stable since 2000. If the GSS estimates are accurate, then increases in background checks are more likely driven by existing gun owners adding to their household stock than new gun households deciding to purchase a firearm. Additional firearm purchases by existing gun owners can also lead to a reduction in both violent and property crime. If criminals associate owners of multiple guns with an increase in the number of concealed weapons being carried, they may be less likely to carry out crimes that directly involve contact with potential victims. The insignificant relationship between violent crime and background checks, along with the negative and marginally significant

<table>
<thead>
<tr>
<th>Crime Type: Violent Crime</th>
<th>Murder</th>
<th>Rape</th>
<th>Robbery</th>
<th>Assault</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(BGC/POP)_{it-1}</td>
<td>0.024</td>
<td>-0.020</td>
<td>0.053**</td>
<td>0.033</td>
</tr>
<tr>
<td>(0.023)</td>
<td>(0.059)</td>
<td>(0.026)</td>
<td>(0.025)</td>
<td>(0.032)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crime Type: Property Crime</th>
<th>Burglary</th>
<th>Larceny</th>
<th>MV Theft</th>
<th>All Crimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(BGC/POP)_{it-1}</td>
<td>-0.041*</td>
<td>-0.0037</td>
<td>-0.040**</td>
<td>-0.040</td>
</tr>
<tr>
<td>(0.023)</td>
<td>(0.033)</td>
<td>(0.019)</td>
<td>(0.043)</td>
<td>(0.020)</td>
</tr>
</tbody>
</table>

Note: Standard errors clustered at the state-level are in parentheses. ** p < 0.05, * p < 0.1. Each cell reports the background check coefficient for a separate negative binomial regression that differs based on the dependent variable. All regressions cover the years 2000 to 2012 and include controls from Table 4, state and year fixed effects, and linear state trends and are weighted by the average state population, 1999-2010. All regressions omit Kentucky for all years, and New York in 2001 due to the increase in homicide as a result of 9/11.
relationship between property crime and background checks in Table 6, are consistent with criminals reacting to an increase in the number of guns per existing gun owner.

Background checks may also increase the likelihood of crimes that originate inside the home. Table 5 shows that homicide rates stratified by demographic characteristics and location are not significantly related to background checks. Gun accident rates and background checks are negatively related, but the level of significance is only at the 10% level. If gun accidents do decrease as background checks increase, the relationship may be driven by gun households taking additional safety measures as the number of guns in the home increases.

The regression results above are consistent with a scenario where background checks either increase gun ownership levels or the number of guns per existing gun owner. Under the assumption that gun ownership levels are stable, increases in background checks appear to be driven by firearm purchases of existing gun owners. An additional background check does not appear to lead to an increase in violent crimes, suggesting that criminal acquisition of firearms and background checks may not be strongly related. This is an important finding for policy makers since the background checks were originally instituted to keep firearms out of the hands of criminals.

Between 2000 and 2012, property crime rates decreased from 3,618 to 2,859 per 100,000, a 21% reduction. Over the same time period, background checks increased 85%. Assuming the results in panel B of Table 6 accurately estimate the causal relationship between background checks and property crime, the increase in firearm sales was responsible for 3.5% of the reduction in property crime. The increase in background checks reduces crime by approximately half as much as the increase in policing levels in the 1990s. Levitt (1997) estimates that 50,000–60,000 additional police officers (14%) were responsible for a 5 to 6% reduction in crime.

One of the limitations in this study, as well as many other studies, is that firearm background checks are aggregated to the state level. An ideal data set would contain information on individuals with and without access to firearms and explore how individual firearm access is related to the likelihood of carrying out a crime or being a victim. Because of this data limitation, the results above are exploring how individual crimes change when a state has more background checks. The positive, but insignificant, point estimates in regressions where violent crime is the dependent variable may be driven by a relationship between gun purchases and a more violent culture. If this is in fact the case, policy makers should respond to increases in background checks by dedicating additional resources to initiatives that have been found to reduce criminal behavior, such as the number of police (Marvell and Moody 1996; Levitt 1997; Corman and Mocan 2000).

6. Conclusion

The lack of an accurate measure of firearms has limited the strength of conclusions in past research examining the relationship between gun ownership and criminal activity. This article uses state level firearm background check rates as a proxy for firearms purchases by new or existing gun households. In the event that existing gun owners sell more guns on the unregulated private market after purchasing a new firearm, the background checks may also capture an increase in guns on an unregulated market. It is not possible to distinguish which scenario is driving the recent increase in background checks, but changes in background check rates are unrelated to changes in estimates of gun-ownership levels. Under the assumption that ownership levels are stable,
background checks represent an increase in firearm purchases by existing gun owners and possibly an increase in the supply of firearms on the private market.

Using a fixed effects negative binomial specification, background checks are insignificantly related to most violent crimes. Property crimes are negatively related to background checks and the relationship is marginally significant. Existing theories of guns and crime predominantly show that increases in the number of guns per household are negatively or insignificantly related to crime. The largely insignificant empirical results suggest that changes in guns per gun household are not strongly related to crimes and any potential deterrent effect cannot be observed without additional information.

Despite the insignificant relationship between background checks and most crimes, the results provide insight about gun policy. Since 2007, the background check rate has nearly doubled, and there has been a substantial increase in gun manufacturing and presumably, sales of firearms. Over the same time period, both property and violent crime rates have decreased. This is not evidence of a causal, negative relationship between guns and crime, but it does suggest that the underlying reason for criminal activity likely extends beyond access to firearms. If policy makers are concerned with reducing violent activity, removing firearms from potential criminals is only one piece of the puzzle.

Background checks are able to estimate firearm sales in a state, but more accurate data on gun ownership are still needed. The results of this study provide evidence that gun purchases by existing firearm households may be driving the increase in firearm background checks. It is possible that the background checks also represent purchases by new gun households or additional firearms on an unregulated private market. Without more accurate data on gun ownership levels and the unregulated market for firearms, confirming the exact relationship between background checks and gun owners will remain difficult. If the FBI was to provide researchers with more details about the origin of firearm background checks, local firearm purchases could be compared with local criminal activity. Even without detailed local background check data, the aggregated background check data is still useful for tracking firearm sales when policy makers tighten or loosen gun laws in their state.

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References


