More Guns Lead to More Crime: Evidence from Private Equity Deals

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Abstract

Using private equity (PE) deals in gun retail chains and comparing individual stores within a county and year, I study if higher gun supply due to profit maximization motives leads to higher crime. I create a granular and novel dataset that matches guns used in crime to firearms licensed stores (FFLs) to parent retail chains to investors. I find that PE-backed FFLs sell more guns traced to homicides, assaults, and robberies. PE-backed dealer stores are less likely to be inspected and are more likely to see an increase in gun law violations. I conduct various robustness tests to argue for the use of PE deals as a gun supply shock. My findings indicate that cost-saving strategies and weak gun law enforcement result in marginal gun sales to criminals as opposed to law abiding citizens.

Keywords: Private Equity, Private Equity in Gun Dealers, Private Equity in Gun Manufacturers, Homicide, Assault, Robbery, Handguns

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1 Introduction

It has been widely documented in the literature and statistical reports by the CDC and FBI that violent crimes in the US are positively correlated to gun prevalence (e.g., Duggan 2001, Cook and Ludwig, 2006, Wiebe et al. 2009, Parker et al. 2011, Siegel, Ross, and King, 2014). However, the causal underlying relationship between gun prevalence and crime is not clear. Higher gun supply can lead to decrease in crime if the marginal buyer is a lawful citizen trying to defend themselves,[1] or it can lead to increase in crime if the marginal buyer is a criminal.[2] The first argument is based on the defensive gun thesis, that means armed citizens reduce criminals' incentive to commit crimes due to the larger risk of becoming the victim (Wright and Rossi 1994; Nagin 1998; Levitt 2002). Whereas, the second argument reflects the thesis that criminals have increased access to a tool of their trade. On top of this, increase in crime can generate higher demand for guns. Studies which analyze the effect of gun ownership on homicide rates face the challenge that the level of gun ownership/gun law changes depend(s) on the (expected) demand of guns in that area. Without a distinction of supply from demand both arguments are in line with the positive correlation of gun prevalence and crime rates in the US. Apart from the sign of the supply effect, the mechanism that drives the change in crime rates is unclear.

To inform this debate, I view this problem from a finance perspective. Specifically, I make use of the observation that private equity (PE) firms are heavily invested in gun retailer chains. It is well understood by now that one of the ways private equity works is by sharpening the incentives to maximize profits in the firms that are takeover targets (Kaplan and Strömberg, 2009; Boucly et al., 2011). Considering PE as a shock to the profit maximizing incentives of firms can help to distinguish supply from demand in the gun

[1] Among the articles that are supportive of the more gun "availability", less crime thesis: Bronars and Lott (1998), Bruce, and Mast (2001), Moody (2001), Mustard (2001), Kovandzic, Schaffer, and Kleck (2013).

[2] Among the articles that are supportive of the more gun "availability", more crime thesis: Black and Nagin (1998), Dezhbakhsh and Rubin (1998), Duggan (2001), Cook and Ludwig (2006), Siegel, Ross, and King (2014).

market. Work that has looked at the supply side effects of PE has found positive implications for product quality, employees, and consumers (Davis et al. 2014; Agrawal and Tambe 2016; Bernstein and Sheen 2016; Cohn, Nestoriak, and Wardlaw 2021; Davis et al. 2021; Gornall et al. 2022; Fracassi et al., 2022). In the context of news, prison system, education, and healthcare, studies have shown negative effects of PE on local news, treatment of prisoners, student and patient outcomes (Ewens et al. 2020, Swanson and Katzenstein 2021, Eaton, Howell and Yannelis 2020, and Gupta et al. 2021). The aim of this paper is to understand the relationship between gun supply and crime in the presence of profit maximization motives of gun suppliers.

In this paper, I use detailed store level crime gun data from chain retail gun dealers in the US of recovered firearms in Pennsylvania, matched to PE investments. I critically rely on four datasets, namely i) 69,763 individual gun crime traces of recovered firearms by law enforcement in Pennsylvania between 1980-2019 to 2,396 federal firearms licensed dealer shops (FFLs) that are part of a retail chain and 413 manufacturers. To construct a panel data set I only consider dealers with multiple traces to crime guns. The Pennsylvania gun tracing data paints the clearest picture of Pennsylvania crime guns and crime gun sources since the late 1990s (US ATF, 2000).[3] The second data source I match to the Pennsylvania dealers with crime gun traces is ii) PE transactions compiled by PitchBook Inc., a leading market intelligence firm. In addition, I match iii) 782 compliance inspection reports by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) to the FFLs of the Pennsylvania gun tracing data, and iv) yearly data of firearm sales by county in Pennsylvania provided in the Pennsylvania State Police Firearms Annual Reports between 1999 and 2019.

To use PE as a supply shock there is certainly a concern of selection. For my analyses, I focus on the store and on county level to analyze the effect of PE investment in the retail

[3]While I proxy guns used in a crime from a dealer with recovered firearms I find that, for example, recovered crime guns used in homicides are correlated by 72 percent with homicides caused by guns according to data from the CDC between 1999-2019.

chain. (1) Considering that the average PE firm buys a retail chain with 87 stores/FFLs across the US reduces the concern of store selection. For example, Sportsman's Warehouse, which was acquired by Seidler Equity Partners in 2009, consists of 146 sores in the US. Figure 1 shows the geographic distribution in the United States, at zip code levels, of gun dealer stores whose guns were traced to crime guns recovered by law enforcement in Pennsylvania from 1980-2019. (2) Apart from the visual evidence that PE-backed and non-PE backed stores are in geographically similar locations I also formally test evidence of store selection. To be precise, I estimate linear probability models where the dependent variable is measured at the store level and equals one if a PE investment was made in the chain retailer. (3) As a robustness test, I estimate the same models on a separate sample of independent (single store) gun dealers. As opposed to independent single store gun dealers, I find no evidence of selection of a store when the investment was made in the retail chain. (4) In addition, to separate between the selection of targets from the treatment effect of PE investment I use leave-one-out difference-in-differences event study plots which tests for pre-trends. I find no pre-period differences between a store of a PE-backed retailer chain and a non-PE-backed gun dealer store that could explain the increase in traces to violent crimes after PE investment. (5) I include year times county fixed effects in all main estimations where the dependent variable is measured at the dealer store level to control for demand effects. In estimation models where the dependent variable is the number of gun sales in a PA county I include year and county fixed effects seperately given the insufficient number of degrees of freedom on the county level preventing the multiplication of the unit and time fixed effects. To account for varying demand in guns across counties I control for socioeconomic variables, from the American Community Survey, which are annual median household income, the share of the population that are white, that are renters rather than home-owners, and that are below the Federal poverty line.

I first focus on sales of gun dealer stores in Pennsylvania aggregated at the county level between 1999-2019. Since PE-backed retail chain gun dealers are privately held for the

majority of the sample period sales data is not publicly available at the store level. I test for changes in sales of firearms in a county after versus before PE ownership in the retail chain of a store in that county relative to all other PA counties that have not (yet) had a store of a PE-backed retail chain in Pennsylvania. I find a significant positive effect of PE buyouts on sales of handguns at the county level - increase by 11.3%, and positive but no significant effect on sales of longguns. This finding mitigates remaining concerns that PE infusion could lead to a price drop in the sale of handguns, which changes preferences of buyers to purchase handguns instead of longguns. Such a change in preferences would reflect a drop in demand for longguns after PE investment, which I don't find. In addition, I do not find evidence that PE-backed dealer stores capture market share from counties that lack PE-backed dealers. To test this, I aggregate the county level gun sales data in Pennsylvania at the state level and find more handgun sales after the acquisition of a gun dealer retail chain by a private equity firm. The increase in overall gun sales at the state level also comes along with an increase in crime gun sales stemming from low cost manufacturers post PE-backing which reflects a decrease in average gun sale price and supports the evidence of a supply effect from PE infusion.

Second, I test whether more handgun sales lead to more or less violent crimes. Instead of estimating the effect of sales instrumented by PE in a county on violent crimes I analyze the effect of PE investment on supply of crime guns traced by law enforcement and recovered in Pennsylvania at the store level. Conducting a reduced form analysis allows for more granular observations and better control of demand effects. If treatment effects are the same among the compliers and non-compliers an intention to treat analysis can be considered "conservative" because the effect of the assigned treatment is biased towards the null. Specifically, I test for changes in guns traced to violent crimes from a gun dealer store after versus before PE ownership in the retail chain relative to gun dealer stores with PA recovered crime guns that have not (yet) come under PE ownership.

Based on the difference-in-difference design on the store level, I find that there is an 11% increase in guns sold and traced to homicides, which is a 35% increase relative to the mean.[4] Guns sold and traced to assaults increase by 22%, guns sold and traced to robberies by 16%, and the use of recovered handguns (pistols, revolvers, and derringers) by 21%. While these results indicate that an increase in gun supply has a negative effect on crime the question remains "why" or what the underlying mechanisms are that drive these results. I address the "why" part in two steps.

First, I test whether the marginal gun from dealer stores in Pennsylvania is sold to a criminal versus a noncriminal conditional on sales in the county. Specifically, I analyze the effect of PE investment on supply of crime guns traced by law enforcement and recovered in Pennsylvania at the store level while controlling for the level of sales at the county level. I find that private equity has a positive impact on the marginal gun sold and traced to homicides, assaults and robberies. To more directly test whether the marginal gun is sold to a criminal, I focus on the time-to-crime ratio as a dependent variable. A shorter time-to-crime is an indicator that the gun was purchased with the intend to be used in a crime rather than with the intent of homeowners trying to defend themselves against attack. I find that time-to-crime of recovered guns significantly drops post PE deal, on average by 3 years, which is 40% of the mean after a PE firm invested in the gun dealer. In addition, I find that the effect of private equity on the number of traces to a specific type of crime drops when controlling for gun sales. This finding suggests that the proportion of criminal activity related to gun sales is actually higher in PE-backed dealer stores and support the argument that private equity investment results in increased gun consumption, which in turn leads to more crimes.

Second, I look at reasons why I observe more guns sold and traced to criminals as opposed to law abiding citizens post PE investment. Literature has shown that private equity

[4] In case of stolen guns or rare occasions where the date of purchase of the crime gun is missing I subtract the average time-to-crime from the recovery date of a dealer as a proxy for the sales date.

is associated with aggressive cost cutting and revenue growth (e.g., Davis et al. 2014 and Gompers et al. 2016, Fracassi, Previtero, and Sheen 2022). Although I don't observe wages at retail stores or gun sale prices I observe gun manufactures. That allows me to differentiate between crime guns stemming from high cost manufacturers (such as Glock) versus low cost manufacturers (such as Hi-Point). I find that traced crime guns from "budget" manufacturers are significantly more likely to be sold post PE investment than from high-end manufacturers. This indicates that the documented volume growth drives revenue growth rather than an increase in prices —related to Fracassi, Previtero, and Sheen (2022) in the consumer product market. Growth in the number of gun sales instead of an increase in prices / shift to a higher-end product strategy appears to contribute to marginal sales to criminals who on average tend to prefer cheaper guns (see, e.g., Kooper 2013). In addition, I find that common ownership of the PE firm in the manufacturer or professional ties to the manufacturer —which are deemed to provide cost advantages (Burt, 1997, Nahapiet and Ghoshal, 1998) —explain about 30% of the positive effect on sold and recovered crime guns.

At last, I test whether weak gun law enforcements/regulatory arbitrage besides cost saving strategies could be an additional mechanism. Therefore, I look at changes in reported gun law violations of a gun dealer store before versus after PE investment in the retail chain as compared to non-PE backed gun dealer stores in the same county and year. I find that PE-backed gun dealer stores show less reported violations in connection with missing firearms, while violations of missing identification checks and failures to report firearm sales increase by 16-23%. Despite increased evidence of misconduct I do not find that gun dealers are more likely to get their license revoked after PE investment. As a matter of fact, I find that FFLs are less likely to be inspected after a PE firm invests. These findings provide additional support for the "why" part of the gun crime question, indicating that cost savings and regulatory loopholes due to weak gun law enforcement direct the supply effect.

The remainder of the paper is organized as follows. Section 2 puts the paper into context of the literature. Section 3 discusses the data. Section 4 provides some summary statistics and linear probability models. Section 5 describes my empirical framework. Section 6 presents the results, and section 7 concludes.

2 Literature Review

In this section, I discuss three research areas that I build on and which provide important assumptions for my analysis: (1) The relationship between firearm "availability" and violent crimes. (2) What is the intersection of media, regulation, and profit maximization in the gun market? (3) Has private equity become a substitute of bank lending to small and mid-sized businesses following the credit crisis in 2008?, and (4) how does private equity maximize investment payoffs?

Gun prevalence and violent crime. In the United States, firearms are manufactured or imported and sold directly to the public through FFLs that include pawn shops, and chain retail stores, such as Dick's Sporting Goods and Bass Pro Shops. The road of a gun to a violent crime can make its way through transfers via straw purchases, thefts, illicit transactions from unlawful gun dealers (Alper and Glaze 2019; Chesnut et al. 2017; Fontanarosa and Wintemute 2000; Webster, Vernick, and Hepburn 2001; Wintemute 2010, 2017). In the last decade, several studies found an increase in the prevalence of gun ownership to be associated with an increase in violent crime (e.g., Cook and Ludwig 2006, Zeoli and Webster 2010, Parker et al. 2011, Kovandzic, Schaffer, and Kleck 2013, Siegel, Ross, and King 2014). Most of these studies that analyze the effect of gun ownership face the challenge that level of gun ownership depends on the (expected) demand of guns in that area. The concern is, if law abiding citizens acquire guns when crime rates are rising then the same pattern of evidence would be expected, but it would be crime rates impacting gun

prevalence, not the reverse (see e.g., Kovandzic, Schaffer, and Kleck 2013). Another concern is the proxy of gun prevalence measures with, e.g., the fraction of suicides committed by firearms (FSF). More specifically, expected socioeconomic changes in an area could be correlated with lagged FSF and violent crimes. Starting with Lott and Mustard (1997), a wide range of literature uses changes in the right-to-carry concealed weapon (RTC) laws. While more recent state panel data literature has broadly concluded that RTC increase violent crime, results appear sensitive to model specifications (Kleck 2021, 2021 National Firearms Survey). In regard to the effect of gun buyback programs -while apparently effective in Australia- studies have questioned the effectiveness in the US (e.g., Sherman 2001). I contribute to that literature by utilizing a novel dataset and supply shock to inform this debate and to provide a better understanding of "why" we observe changes in crime guns.

Media and Regulation. The public typically depends on the media to provide the information necessary to facilitate their analysis and subsequent understanding of it. As a result, members of the viewing or listening audience are likely to interpret emerging issues in the context of the prevailing norms or beliefs as they have been introduced or reiterated by the media (Berger, 2000; Klein, 2003). Thus, the manner in which issues or topics are framed by the media often times has an impact on public opinion, and ultimately, on public policy (Iyengar, 1989). Media coverage has particular influence on the manner in which public health issues such as gun violence are perceived. As a consequence it determines the extent and manner to which the citizenry, and consequently, the regulator will respond to those issues affecting the public's health and well-being (Rousseau, 2009). Despite their rarity, mass shootings receive a considerable amount of attention in the media. They are perceived as reflecting broader issues within society, including gun control, access to mental health care, and the impact of violent media (Schildkraut and Elsass 2016; Schildkraut, Elsass, and Muschert 2016). The continuous coverage of these events also has perpetuated beliefs that mass shootings happen more frequently than is

reality, regardless of the phenomenon's low statistical probability of occurrence (Elsass, Schildkraut, and Stafford 2014; Schildkraut, Elsass, and Stafford 2015). In contrast, the majority of general homicides is not presented by the media due to the overabundance of incidents (Chermak 1995; Pritchard and Hughes 1997). Mirrowing the media coverage, the government has focused on the sale and delivery of assualt weapons. For example, Illinois became the ninth state since 2004 to implement an assault weapons ban shortly after a gunman legally purchased a semiautomatic rifle and killed seven people in Highland Park, a northern Chicago suburb. In 2020, the most recent year for which the FBI has published data, handguns were involved in 60% of the US gun murders. Rifles - the category that includes guns sometimes referred to as "assault weapons" - were involved in 3% of firearm murders. The remainder of gun homicides involved other kinds of firearms or those classified as "type not stated".[5] I contribute to this literature by studying the intersection of regulation and profit maximization in the US gun market.

Private equity and the funding gap. Not all small or mid-sized businesses that would benefit from investment are able to access external funds. This resulting inefficiency in capital access is commonly referred to as a "funding gap" (Servon, Visser, and Fairlie, 2011). According to National Small Business Association 2017 Year-end Economic Report, one in four small business is unable to access needed financing (National Small Business Association, 2017). It is well known that regulations introduced after the financial crisis have resulted in a reduction of lending activity to the small and mid-sized business sector (see, e.g., Chen, Hanson and Stein 2017, Brown, Kenyon, and Robinson 2020). Chen, Hanson and Stein (2017) show that small and mid-sized business lending by the four largest banks -Bank of America, Citigroup, JPMorgan Chase, and Wells Fargo- fell sharply relative to others in 2008 and remained depressed through 2014. While lending at other banks slowly recovered it still was not at its pre-crisis level by 2014, according to the authors.

[5]https://www.pewresearch.org/short-reads/2023/04/26/what-the-data-says-about-gun-deaths-in-the-u-s/

Rapid development over the last three decades of other private capital markets including PE buyout funds, venture capital (VC), and growth capital funds have resulted in these vehicles now regularly deploying more than $100 billion in new capital each year (Brown, Kenyon, and Robinson 2020). The rapid growth of private equity has also resulted in businesses avoiding public markets and accessing an ever-growing pool of institutional private capital (Ewens and Farre-Mensa 2020). Braun et al. (2023) find that smaller deals have historically outperformed larger deals. PE firms have been buying smaller companies, often with just a $1 million EBITDA, also according to industry insiders. For example, private equity firms such as Footprint Capital or Incline Equity Partners are specialized in investments of family-owned companies. With respect to morally criticized industries – such as weapons manufacturers, gun dealers, or the fossil fuel industry – the funding gap is more pronounced due to adaptations of ESG reform policies in recent years (Stevenson 2023). I contribute to this literature showing that private capital does not shy away from "disdained" industries in need of funding such as the gun business.

Private equity and profit maximization. This paper contributes to studies of PE's impact on target firm value, product quality, and PE's track record of finding and exploiting market vulnerabilities. It is well-known that private equity is associated with high-powered incentives to maximize firm value (Kaplan and Stromberg, 2009; Boucly et al., 2011; Bernstein et al., 2019). While these incentives could spurn operational changes (Biesinger et al., 2020), increases in leverage (Axelson et al., 2013), or simply reflect more focus on deal selection (Guo et al., 2011; Acharya et al., 2013), there is a large body of evidence that PE firms actively intervene in portfolio company management.

Part of this work has found largely positive implications for product quality, employees, and consumers (Davis et al. 2014; Agrawal and Tambe 2016; Bernstein and Sheen 2016; Davis et al. 2021; Gornall et al. 2022; Fracassi et al., 2022). In industries underlying severe information and market frictions, such as news, prison system, education, and healthcare,

studies have shown negative externalities (Ewens et al. 2020, Swanson and Katzenstein 2021, Eaton, Howell and Yannelis 2020, and Gupta et al. 2021). For example, in healthcare a market dysfunction exists for patients in an emergency who have no choice of provider or because they reasonably (but incorrectly) assume that the physicians at an in-network facility will also be in-network (see Hall et al. 2016). Physician staffing companies owned by PE seem to make strategically use of this market failure to increase revenues, staying out-of-network to charge higher out-of-network rates,"balance billing" patients for the difference between their list charges and what insurance paid, or using the threat of surprise billing to demand higher in-network rates from health plans (see Cooper et al. 2020). In PE-backed prisons market frictions appear to have an adverse effect on rehabilitation by keeping prisoners in while keeping the public out (Hart, Shleifer, and Vishny 1997).

I add to this literature by focusing on an industry with limited public data: the gun industry. To my knowledge, this paper offers the first detailed analysis of PE's impact on homicides and other violent crimes over the last 40 years.

3 Data

3.1 Crime Gun Trace Data

In this study I use the most comprehensive and detailed crime gun trace data since the 1990s' which was made publicly available. In August 2021, former Attorney General Josh Shapiro of Pennsylvania released 186,000 crime guns from over 250 law enforcement agencies in his state as part of an anti-gun crime initiative. The raw data, downloaded from the Pennsylvania Gun Tracing Analytics Platform in August 2021, includes a row for every individual trace and 95 columns reflecting the variables that are known about that trace, such as information about the gun, the crime to which its recovery is related, the date of

purchase, the law enforcement agency conducting the trace, the possessor of the gun at the time it was recovered, the county in which it was purchased, and dates of purchase and recovery. While the raw data does not include the names of the FFLs it includes the phone number of the firearm dealer, so that I was able to cross-reference those phone numbers with the ATF's published lists of FFLs in the United States. The ATF publishes a list of FFLs monthly; I used the January list for each year available between 2014 and 2020. Guns traced prior to 2014 will return a dealer name only if the dealer appears in the 2014-2020 ATF lists with the same phone number. For phone numbers that did not return a match, I used reverse directory, internet, and other searches to find the associated dealer. Ultimately, a portion of the phone numbers could not be matched to a dealer name. To construct a panel data set I only consider dealers with multiple traces to crime guns. The final dataset includes 69,763 individual gun crime traces of recovered firearms in Pennsylvania to 2,396 firearm dealer stores and 413 manufacturers between 1980-2019 (Table 1).

About 19% of those gun dealers linked to gun crime traces are PE-backed. While the majority of crime guns in the sample stems from Pennsylvania dealers 30% of the traces are linked to out-of-state dealers, and 20% of all traces are paired with a "time-to-crime" rate of less than a year, which is the period of time between a firearm's first retail sale and law enforcement's recovery of the firearm in connection with a crime. The "time-to-crime" rate is considered a strong indicator that a gun dealer is supplying firearms to illegal gun traffickers. For a crime gun to be traced to a dealer, local law enforcement agencies can enter the make, model, caliber, and serial number of a specific firearm into the ATF's eTrace system, allowing them to follow the flow of that firearm from its legal construction or importation by a manufacturer/importer, to a federally licensed firearms dealer, and finally to the firearm's original purchaser.

The Pennsylvania gun tracing database has limitations in such that not all guns recovered by law enforcement are traced, and many guns that are used in crimes are never recovered by law enforcement. In addition, neither all Pennsylvania police agencies participate in eTrace nor include all variables about the crime or recovery in the data they share. Despite these limitations, the Pennsylvania gun tracing data paints the clearest picture of Pennsylvania crime guns and crime gun sources since the late 1990s (US ATF, 2000).

Since January 17, 2023 Michelle A. Henry was appointed to the role of Pennsylvania Attorney General and replaced Josh Shapiro. The detailed crime gun dataset has been removed from the Pennsylvania Attorney General's website and is now in part publicly accessible in aggregated form on the Pennsylvania Gun Tracing Analytics Platform.[6]

3.2 ATF Compliance Inspection Reports

Another piece to the puzzle are ATF compliance inspection reports. The Bureau of Alcohol, Tobacco, Firearms and Explosives inspects licensed gun dealers and manufacturers each year, but what happens in those investigations is rarely revealed to the public. The inspection reports from the ATF were made public through a Freedom of Information Act lawsuit, and are available on the website of The Trace which is an American non-profit journalism outlet devoted to gun-related news in the United States.[7] This database includes and builds upon the documents used in investigations conducted by USA Today and The Trace in 2021, The New York Times, the San Francisco Chronicle, and others. It is the largest searchable database of ATF Inspection Reports ever released to the public. The records include 2,212 ATF compliance inspection reports of 130,525 active federal firearms licensees from 2014-2018, where the ATF took administrative action against FFLs found to be in violation of the law. Those actions include issuing a warning letter or more severe

[6]https://www.attorneygeneral.gov/gunviolence/pennsylvania-gun-tracing-analytics-platform/
[7]https://projects.thetrace.org/inspections/

remedy for cited violations of gun laws. Each report includes dates of any inspections conducted for this FFL in the past which can date back before 2014. As part of the inspection history reports also include the previous inspection(s) results, e.g. a warning letter, and if there was found to be a violation of the law the cited violation, e.g. sale or transfer of a firearm to a prohibited person. The history of violations per FFL is important to create a panel dataset and to analyze the effect of PE ownership with dealer and year fixed effects. I merged my previously discussed crime gun trace data with ATF compliance inspection reports data. For analyzes on the gun law violations I only include violations of dealers with multiple violations, matched to my gun tracing data, to construct a time series.

Despite this being the largest publicly available database of ATF compliance inspection reports it has limitations, in such that if a store isn't in the database it doesn't mean it hasn't been inspected or cited for violations. Inspections that fall outside this window of time or don't meet the criteria won't appear in the data. The ATF redacted the reports to remove some key information, including the names of some gun store employees and ATF officials, and the number of times a business was cited for a specific violation. Inspections where no violations were found, and ones where inspectors identified violations but did not issue any penalty, are not included.

3.3 Private Equity Deal Data

My primary source of data on private equity transactions is a proprietary list of deals compiled by PitchBook Inc., a leading market intelligence firm. To create the list, I search PitchBook for all U.S. federal firearms licensees investments through 2019 that involved a private equity sponsor. I merge the targets, which are retail chains (or for robustness analysis independent stores), of these deals, which are stores of retail chains, to the Crime Gun Trace data using the company, and in some cases merged by hand, and manually verify this information. In the manual verification process, I supplement my data regarding

the identities of PE backed gun dealers from news articles and other data sources, such as Preqin and CapitalIQ. This step is especially important since PE firms often invest in a gun dealer chain through a portfolio company, e.g., Gander Mountain was acquired by Camping World which was a portfolio company of Crestview Partners II at that time. In sum, I identify 455 gun dealer store-PE firm pairs. Stores of chain retailers typically have individual federal firearms licenses. That means, a PE investment in a chain retailer with two stores would create two dealer-PE firm pairs.

I supplement the PE investments in dealers with PE investments in gun manufacturer also using PitchBook data. If a PE firm is not invested in a supplying gun manufacturer I manually check whether managing directors are connected across PE firms where one PE firm is invested in the gun dealer an the other is invested in the gun manufacturer using BoardEx. BoardEx provides details on senior managers working for PE firms, such as the start and end date. I define two directors as connected if they were at the same PE firm at the same time prior to working at a PE firm that invests in the dealer chain and another that invests in the manufacturer at the time of observation. Personal connections formed through common education or work experience provide an effective channel for information exchange, allowing transmission of knowledge, ideas, or private information (El-Khatib, Fogel, and Jandik 2015). Connected directors could be in a better position to obtain low-cost private information (Burt, 1997, Nahapiet and Ghoshal, 1998) from their network contacts to aid in bidding and negotiation. Recent studies confirmed that connections allow CEOs to efficiently gather and control private information and facilitate value-creating acquisition decisions (Cai and Sevilir 2012, El-Khatib, Fogel, and Jandik 2015).

Measured by number of FFLs invested in, the most active private equity firms in my sample are BlackRock, KKR, Goldman Sachs Capital Partners, J.W. Childs Associates, Crestview Partners, Oak Investment Partners and Palm Beach Capital. For the majority of

the deals I observe, the PE firm obtains majority ownership of the gun dealer or gun dealer chain via a holding company. PE-backed dealers also include gun dealers that received private debt or some form of growth capital injection from a PE firm.[8] As pointed out before, the investment can be direct or indirect through an existing portfolio company. For example, the acquisition of Cabela's by Bass Pro in 2016 was backed up with a $1.8 billion purchase of preferred stocks by Goldman Sachs Capital Partners in Bass Pro. Crestview Partners' portfolio company Camping World acquired Gander Mountain at a bankruptcy auction for an estimated $35.4 million a year after Crestview purchased Camping World.

Based on PitchBook data I am also able to identify limited partners that invested in gun dealers through PE funds. The most active limited partners providing money to my sample FFLs are California Public Employees' Retirement System (CalPERS), California State Teachers' Retirement System (CalSTRS), Indiana Public Employees' Defined Benefit Account (PERF DB), Illinois Municipal Retirement Fund (IMRF), Lauderhill Police Officers' Pension Fund, and the John A. Hartford Foundation (JAFH).

I follow the same matching procedure applied to PE firms for banks providing loans to FFLs. I was able to identify 398 gun dealer-bank pairs. PE-backed status takes precedence over bank loan investment status; that is, if a gun store received private equity, I call it PE-backed and ignore any subsequent bank loans.

3.4 Firearm Sales Reports

While I don't observe the number of total guns sold per individual FFL in a year I create a measure of average guns sold per year on the county level in Pennsylvania. I use information provided in the Pennsylvania State Police Firearms Annual Reports between 1999 and 2019. These reports include the number of FFLs in each county, the number of handguns,

[8]While there is very little research on PE debt is appears that this market is different from the bank loan and syndicated loan markets. It seems that rates reflect risk premiums that are more like equity risk premiums (Block et al. 2023).

rifles, licenses to carry a gun, and Sportsman's firearm permits.

4 Descriptive Statistics and Targeting

Figure 1 shows the geographic distribution in the United States, at zip code levels, of gun dealer stores whose guns were traced to crime guns recovered by law enforcement in Pennsylvania from 1980-2019. PE-backed dealer stores (red dots) are noticeably in similar locations as non PE-backed dealer stores (blue dots).

Figure 2 plots the distribution of traceable crime guns by recovery year. I find traces to both PE-backed and non-PE backed gun dealer stores in every year of the sample, though I note an increasing proportion of PE-backed dealers after the credit crisis in 2008. As discussed in section 2, the visible increase in traces to PE-backed dealers since 2008 is attributable to post-financial-crisis regulation which placed increase capital requirements on the global banking system. The increase is even more noticeable in recent years after adaptations of ESG reform policies by many banks. As banks retreated, PE funds stepped in to meet the capital needs of small to mid-sized gun dealers.

Table 2 complements Figure 2 to show that traces increased over time for different sample splits, such as traces to in-state/out-of-state dealers and traces to handguns. Over time traces with a time-to-crime rate of less than one year and increasing traces to violent crimes. While the increases of traces over the years could be attributable to advanced technology of law enforcement agencies to recover and record crime guns it also indicates an increase in gun violence over the years, which is in line with U.S. gun death reports by the Pew Research Center.[9]

[9]https://www.pewresearch.org/short-reads/2023/04/26/what-the-data-says-about-gun-deaths-in-the-u-s/

Panel A of Table 3 provides statistics of PE investments into parent retail chains of FFLs with recovered crime guns in Pennsylvania. The majority of deals are large cap ($>$ \$1b), as shown in column of Table 3. Small cap deals ($<$ \$25m) are also quite common. These comprise deals in smaller chain retailers, such such as Atlantic Tactical. While the average deal size for large cap is about \$3 billion the deal size in the small cap sector averages \$100 million. Not surprisingly, large (small) cap deals are mainly made by large (small) PE firms as shown in column (5). Panel (B) of Table 3 provides some detail on which PE firms invest in gun dealers sorted by number of crime gun traces. Deals into gun dealers with large number of traces are primarily made by large and prominent PE firms, such as Goldman Sachs Capital Partners, Oak Investment Partners, J.W. Childs Equity Partners, and KKR, but also smaller firms, such as Palm Beach Capital or Long Point Capital.

Last, Table 4 provides descriptive statistics of PE backed and Non-PE backed dealers. The average number of traces per dealer is higher for PE backed dealers compared to non-PE backed dealers (which reflects the post PE effect on violent crime guns). PE-backed gun dealers typically contract with less manufacturers which could reflect closer ties to these manufacturers. The time-to-crime rate is lower for PE backed dealers compared to non PE backed dealers which is an indication that these gun dealers are supplying firearms to illegal gun traffickers.

4.1 Predictors of Private Equity Investments

Table 5 displays estimates of a linear probability model where the dependent variable is a binary indicator that equals one if I observe a PE investment in a gun dealer store in year t and zero otherwise. In Panel A of Table 5 I consider dealer stores of retail chains in the U.S. whose guns from the store were traced to crimes in Pennsylvania and that were inspected by the ATF in the previous year. Column 1 includes covariates but no fixed effects. Columns 2-4 introduce fixed effects. Across all specifications, I only find

that common ownership of the PE firm in the manufacturer or professional ties to the manufacturer is significantly related to the probability of a PE investment in the next year. As pointed out in section 3, PE connections to suppliers seem to provide cost advantages by obtaining low-cost private information. While I find no selection of dealer stores of retail chain dealers I test whether this is also the case for a sample of independent single store dealers, such such as Capital Pawn, B & B Pawn and Gold, or Big Rock Sports (Table 5, Panel B). In contrast to no evidence of selection apart from common ownership in the manufacturer of stores of retail chains, I find that more counts of missing firearm violations in the previous year are significantly related to the probability of a PE investment in the next year. More counts of missing firearms are consistent with PE firms targeting gun dealers with inefficient operation, such as lack of security. In addition, I find a strong positive relationship between an investment in a gun dealer if the PE firm is also connected to the manufacturer. Finally, my results show a significantly positive correlation between PE investment and gun dealers located in states with lower quality of gun law enforcement (column 4). That implies that PE's regulatory arbitrage appears to have been part of the acquisition thesis. I proxy the quality of gun law enforcement by shortage #ATF agents per division/# FFLs per division in 2012 based on a review of ATF's Federal Firearms Licensee Inspection Program conducted by the U.S. Department of Justice Office (US DOJ 2013). Since I only observe these variables in year 2012, I run a cross sectional regression of my binary PE investment dependent variable for 2013 and 2014 combined on independent variables observed in year 2012.

Table 6 reports results for the subsample of Pennsylvania counties where I observe records of sold handguns, rifles, number of licenses to carry, and sportsman's firearm permits at the county level. This subsample sheds light on the question whether PE firms target counties with higher demand for more easily concealable weapons or counties with higher demand for firearms less likely to be used in crimes, such as rifles. As before on the store level for investments in retail store chains, in Panel A of Table 6, I only find that

PE firms are more likely to invest in counties where the PE firms have common ownership with or ties to the manufacturer and the gun chain retailer. I find more selection effects for PE investments in independent single store gun dealers - although statistically significance drops notably with sample size.

5 Empirical Strategy

For each type of crime a dealer's gun was used in, I present three difference-in-difference regression estimates: one that compares the post-PE investment to the pre-PE investment period (1) on the PA county level (since I don't observe gun sales at the store level) (2) on the store level of all US dealers stores with guns traced to crimes in PA (since I observe sold and recovered crime guns at the store level), and (3) one that estimates the dynamic effect for each year around the PE investment at the store level. Approaches (2) and (3) include county $\times$ year fixed effects to absorb demand effects, while approach (1) includes year fixed effects and county fixed effects separately, since multiplying the unit and time fixed effect would lead to more parameters to estimate than available observations. To control for changes in demand in tests where I observe gun sales at the county level I include socioeconomic variables, from the American Community Survey. I compare the county of the gun dealer store after versus before private equity investment in the chain retailer to other counties that did not (yet) receive PE investment. The first regression model on the county level is:

$$\begin{aligned} \text{Log Gun Sales PA county}_{ikt} &= \beta(\text{PE}_i \times \text{Post Deal}_{ikt}) + \gamma' \textbf{Socioeconomic Variables}_{kt} \\ &+ \text{Year FE} + \text{County FE} + \epsilon_{ikt} \end{aligned} \tag{1}$$

where i indexes the retail dealer chain, k indexes the the county in PA of the specific store, t indexes time, Gun Sales$_{ikt}$ is the outcome variable, that means the log of gun sales in PA

county. The control group consists of all counties in PA that have not (yet) been treated. The second difference-in-difference specification is:

$$y_{ijt} = \beta(\text{PE}_i \times \text{Post Deal}_{it}) + \text{Year FE} + \text{Gun Dealer FE} + \text{Year} \times \text{County FE} + \epsilon_{ijt} (2)$$

where, y_{ijt}, is the outcome variable for gun dealer store j of retailer chain i in time t, such as the log number of guns traced to a certain crime, e.g., log number of guns used in homicides. Since the outcome/recovery might have occurred post purchase date I consider time t to be the date of purchase of the crime gun. By doing so, I'm not attributing a gun that was sold before PE investment and recovered afterwards to a PE backed dealer.[10] Post Deal$_{it}$ is a binary variable that equals one for years after the gun dealer chain i was acquired by a private equity firm. Thus, the coefficient of interest β represents the relative differences of private equity investment. The control group consists of gun dealer stores with PA recovered crime guns that have not (yet) been treated. I cluster standard errors by gun dealer.

The dynamic differences-in-differences specification in equation 2 follows a standard event-study design as in Autor (2003) and Almond et al. (2011). This approach separately estimates coefficients β_s for each year s around PE investment using the following equation:

$$y_{ijt} = \sum_{s=-20}^{20} \beta_s \mathbf{1}(t = s) + \text{Year FE} + \text{Gun Dealer FE} + \text{Year} \times \text{County FE} + \epsilon_{ijt} \quad (3)$$

where $\mathbf{1}(t = s)$ is an indicator that is one in year s relative to the PE deal year for gun dealer j, and zero otherwise. I fully saturate the model to account for all years before and after the deal date. The omitted category is $\mathbf{1}(t = -1)$, reflecting the year prior to the deal. I show

[10] In case of stolen guns or rare occasions where the date of purchase of the crime gun is missing I subtract the average time-to-crime from the recovery date of a dealer as a proxy for the sales date. Results remain qualitatively unchanged if I drop these observations.

the results graphically by plotting the coefficients β_s for the years immediately around the PE deal.

In line with Kirti and Sarin (2020) and Ewens, Gupta, Howell (2022), I use the dynamic event study approach (equation 3) providing support for the interpretation that the involvement of PE drives outcomes presented in section 6 rather than sample selection.

6 Results

6.1 Private Equity Effects on Gun Sales

While I do not observe total sales of guns from gun dealer stores I am able to test the PE effect on total sales of handguns versus rifles at the county level for Pennsylvania FFLs, obtained from Pennsylvania State Police Firearms Annual Reports. Table 7 uses equation 1 to analyze the effect of private equity on the log number of reported purchased firearms in the county of the Pennsylvania gun dealer store. First, Table 7 Panel A column 1 shows that there is a an 11% (i.e., exp(0.105)-1 since I report exponential coefficients) increase after a PE deal in the total number of handguns sold by FFLs in the corresponding county, while I find no significant increase in sales of rifles. This finding mitigates remaining concerns that PE infusion could lead to a price drop in the sale of handguns, which changes preferences of buyers to purchase handguns instead of longguns. Such a change in preferences would reflect a drop in demand for longguns after PE investment, which I don't find. I also find a significant positive effect on the number of licenses to carry in the county where a gun dealer has been targeted by PE.[11]

[11]Most states issue permits to carry a concealed handgun for lawful protection to an applicant who is over twenty-one years of age, who passes a fingerprint-based background check and safety class (see, e.g., Kopel 2009).

In addition, I do not find evidence that PE-backed dealer stores capture market share from counties that lack PE-backed dealers. To test this, I aggregate the county level gun sales data in Pennsylvania at the state level and compare handgun and rifle sales before and after the acquisition of a gun dealer retail chain by a private equity firm. Figure 3 shows that total sales of handguns, in line with Table 7, increases at the state level after a PE firm invested in a retail chain with gun dealer stores in Pennsylvania counties. While visual evidence does not supports a simple shift of market share between counties, such a shift would still reflect a supply effect at least at the county level. The increase in overall gun sales at the state level also comes along with an increase in crime gun sales stemming from low cost manufacturers post PE-backing (see section 6.4) which reflects a decrease in average gun sale price and supports the evidence of a supply effect from PE infusion.

6.2 Private Equity Effects on Gun Crimes

Considering the evidence that PE affects supply of guns, the main question is, how do gun sales affect gun crime? Instead of estimating the effect of sales instrumented by PE in a county on violent crimes I analyze the effect of PE investment on supply of crime guns traced by law enforcement and recovered in Pennsylvania at the store level. Conducting a reduced form analysis allows for more granular observations and better control of demand effects. While I proxy guns used in a crime from a dealer with recovered firearms I find that, for example, recovered crime guns used in homicides are correlated by 72 percent with homicides caused by guns according to data from the CDC between 1999-2019.

Table 8 uses equation 2 to analyze the effect of private equity on the log number of traces to a specific type of crime. I find that there is an 11% increase in guns sold and traced to homicides in PA from a US PE-backed dealer store after investment, which is a 35% increase relative to the mean. Guns sold and traced to assaults increase by 22% (Panel A column 2), guns sold and traced to robberies increase by 16% (Panel A column

3), and the sale of handguns traced to crimes by 21% (Panel A column 5).[12] Handgun means pistol, revolver, or derringer. In contrast to rifles handguns are easier to conceal and are typically linked to violent crimes (see Wintemute, Cook, and Wright 2005). I find no effects on guns sold illegally. This can be explained by observing one trace report per crime gun. Based on conversations with law enforcement agents, a more severe crime is the one that is typically brought to record. That means, if a gun was purchased illegally and used in a homicide it would appear as a homicide and not as illegal possession in the database.

To address the still potential concern of selection of gun dealer stores by PE firms, Figure 4 Panels A-E presents the event study differences-in-difference results. The identifying assumption here is that PE targets and control gun dealers would continue on parallel trends in the absence of the PE deal. I find no pre-trends (β_s is not statistically different from 0 for s < 0), and PE ownership delivers quick changes. This is consistent with the identifying assumption. Within a year of taking over, PE firms increase their portfolio gun dealers' sales of crime guns by an average of 5.1 percentage points per year (Panel A). Effects are also positive on sold guns traced to homicides (Panel B), assaults (Panel C), and robberies (Panel D) and appear in the years immediately following the deal. There is no notable upward trend for illegal guns. The event study supports the notion that the effects observed in Table 8 are unlikely to be driven by pre-existing trends in crime gun changes, and instead can be attributed to changes to PE operations beginning in the years after the deal.

[12] As an example of the interpretation, in the case of traceable homicides I calculate the effect as (EXP(0.105) - 1)=11%.

6.3 Private Equity And The Marginal Buyer

While previous results indicate that an increase in gun supply has a negative effect on crime the question remains what the underlying mechanisms are that drive these results. Despite the evidence that private equity investment in a chain retailer store as a proxy for a supply shock increases the sale of guns that are traced to violent crimes in PA, which are highly correlated with the overall rate of homicides in the US as reported by the CDC, it remains unclear what channel leads to more violent gun crime. Therefore, I analyze whether the marginal gun from dealer stores in Pennsylvania is sold to a criminal versus noncriminal conditional on sales in the county. This tests provides insights into the supply to the type of buyer, that is, whether a gun was sold in an unscrupulous manner. Specifically, I analyze the effect of PE investment on supply of crime guns traced by law enforcement and recovered in Pennsylvania at the store level while controlling for the level of sales at the county level.

Table 9 reports the results. Based on the difference-in-difference design on the store level, I find that conditional on sales, private equity has a positive impact on guns sold and traced to homicides, assaults and robberies. More specifically, Table 9 shows that there is an 4.3% increase in guns sold and traced to homicides in PA from a US PE-backed dealer store after investment, conditional on sales. The marginal gun sold and traced to assaults increases by 5.5% (column 2), the marginal gun sold and traced to robberies increases by 4.3% (column 3), and the sale of handguns traced to crimes by 8.5% (column 5). I find no statistically positive effect on guns sold illegally conditional on sales in line with Table 8, which can be explained by observing one trace report per crime gun. To more directly test whether the marginal gun is sold to a criminal, I focus on the time-to-crime ratio as dependent variable in column 6. A shorter time-to-crime is an indicator that the gun was purchased with the intend to be used in a crime rather than with the intent of homeowners to defend themselves against attack. I find that time-to-crime of guns post

deal significantly drops, on average by 1-2 years, which is 20% of the mean after a PE firm invested in the gun dealer. This is a strong indicator that PE facilitates the supply of firearms to illegal gun traffickers and creates a negative externality in gun supply.

Results in Table 9 also illustrate that the proportion of criminal activity related to gun sales is actually higher in PE-backed dealer stores. In comparison to Table 8, the effect of private equity on the number of traces to a specific type of crime drops when controlling for gun sales (Table 9). These findings support the argument that private equity investment results in increased gun consumption, which in turn leads to more crimes.

6.4 Private Equity And Budget Crime Guns

To support the argument of a PE supply effect, ideally one would want to observe gun prices along with gun sales data. Literature has shown that private equity is associated with aggressive cost cutting and revenue growth (e.g., Davis et al. 2014 and Gompers et al. 2016, Fracassi, Previtero, and Sheen 2022). Although I don't observe wages at retail stores or gun sale prices I observe gun manufactures. That allows me to differentiate between crime guns stemming from high cost manufacturers (such as Glock) versus low cost manufacturers (such as Hi-Point). More specifically, I define the following manufacturers as high cost manufactures: Beretta, CZ, FN, Glock, Heckler & Koch, SIG Sauer, Walther Arms, Wilson Combat, Smith & Wesson, Bersa, Colt, Canik, IWI, Ruger, Springfield, and Steyr. The remaining manufacturers are defined as low cost. Using the differences-in-differences specification in equation 2, I find that traced crime guns from "budget" manufacturers are significantly more likely to be sold post PE investment than from high-end manufacturers (Table 10). The positive effect remains significant among recovered homicide budget guns, assault budget guns, and robbery budget guns. This indicates that the documented volume growth drives revenue growth rather than an increase in prices —related to Fracassi, Previtero, and Sheen (2022) in the consumer product

market. Sales growth instead of an increase in prices / shift to a higher-end product strategy appears to contribute to marginal sales to criminals who on average tend to prefer cheaper guns (see, e.g., Kooper 2013).

6.5 Private Equity And Ties With Manufacturers

Apart from looking at gun brands, I test whether ties of PE firms to gun manufacturers can explain part of the increase in gun sales or/and sales of crime guns. The idea here is that common ownership and ties to manufacturers create potential advantages in negotiations which could help the dealer in selling more guns. As described in section 3.3, I define a tie of a PE firm with a manufacturer either if the PE firm has common equity with the gun dealer chain and a supplying manufacturer or if a manging director of the PE firm invested in the dealer and a managing director of the PE firm invested in the manufacturer worked at the same PE firm prior to the deal. I first turn to the effect on sales in a PA county post PE deal. That means, in Panel A of Table 11 I rerun all models of Panel A and include common ownership/ties to manufacturer fixed effects. Ties to the manufacturer explain about 30% of the PE effect on gun sales. This result is consistent with the notion that PE firms are able to reduce costs along the supply chain which spurs more gun sales.

Next, I add common ownership/ties to manufacturer fixed effects in Panel B of Table 11 to analyze the effect on sold crime guns. As described in section 3, I define a PE firm connected to the gun manufacturer if a manging director of the PE firm invested in the dealer and a managing director of the PE firm invested in the manufacturer worked at the same PE firm prior to the deal. I find that investment or connectivity to the supplying manufacturer explains 35% of the increase in guns traced to homicides (Panel A column 1), 39% of guns traced to assaults (Panel A column 2), 49% of guns traced to robberies (Panel A column 3), and 38% of handguns traced to crimes in PA (Panel A column 5) that are sold post PE deal. PE connections to suppliers seemingly provide cost advantages that

explain a notable percentage of increase in violent crimes.

6.6 Private Equity Effects on Violations of Gun Laws

In the previous sections I was able to provide evidence that post buyout the marginal gun is sold to criminals rather than law abiding citizens and that one mechanism appears to be cost cutting and sales growth. While this finding is in line with evidence that it's more likely to sell guns to criminals if they are cheaper (see also Kooper 2013) it still raises the question how a potentially previously convicted criminal is able to purchase a gun in the first place. Based on reports that FFLs rarely get inspected by the ATF and licenses are seldomly revoked I explore the hypothesis that regulatory arbitrage could be a concern of gun supply. Hence, I match my gun tracing data to ATF compliance inspection reports detailing FFLs who have been issued a warning letter or more severe remedy for cited violation of gun laws, as outlined in section 3. I only include violations of dealers with multiple violations to observe a time series.

Table 12 reports estimates for the dealer's specific gun violations as the log number of violations at inspection in Panel A. Since the inspection period is typically one year I am measuring the violations at the end of the inspection period but use the date at the start of the inspection period in my panel data. In that case I'm not attributing a violation to a PE investment if the PE firm invested in the dealer close to the end of the inspection period but the violation occurred at the beginning. I include socioeconomic variables, from the American Community Survey, to control for changes in demand as described earlier. I find that PE investments are accompanied by a significant increase in violations for failures to report sales of firearms, failures to check ID, and straw purchase violations. I do not find any significant effect on violations of sales to prohibited purchasers, and there is a significant decline in violations of missing firearms. Overall the number of violations increases by 30% of the mean (Panel A column 1).

Panel B of Table 12 reports estimates of linear probability models. It shows that PE investment is negatively correlated with an ATF inspection (column 1), results in less repeated violations (column 2), and has no effect on licenses being revoked (column 3).

Combining these results with the evidence on gun crimes, presented in section 6.2, it appears that the PE-backed dealers reduce gun sale standards, potentially due to wage cuts and less trained stuff (in line with Amess and Wright 2007, Davis et al. 2014) which could facilitate the sale to criminals through regulatory loopholes of weak enforcement of existing gun laws.

While a wide range of literature has shown evidence of PE firms inducing high-powered profit maximizing incentives in takeover targets I test whether these effects can be observed by other types of funding. That means, I look at outcomes related to bank lending. While banks have been severing ties with the gun industries since the financial crisis bank loans overall still represent a common form of financing in my sample. In sum, I find that PE impacts gun crimes in ways that are not mirrored by bank loans, suggesting my results do not simply reflect scale of operations. Results are reported in the Appendix.

7 Conclusion

Based on research in the last decade there still seems to be a debate on the causal relationship between gun prevalence and violent crime in the US. A concern is that measures of gun supply face the challenge of correlation with (expected) demand of guns in the same geographical area. I propose a new measure of supply shock, which are PE investments in chain gun retailers. Using such deals and comparing individual stores within a county and year, I study (1) if higher gun supply due to profit maximization motives leads to higher crime, and (2) plausible mechanisms that drive the increase in crime rates.

I use the most comprehensive and detailed crime gun trace data since the 1990s' and provide the first evidence that the influx of PE into gun dealers increases the sales of guns, that PE-backed FFLs sell more guns traced to homicides, assaults, and robberies, and that the number of recovered crime guns with a lower time-to-crime rate increase post PE deal. Furthermore, I find evidence that gun law violations increase after PE investment in gun dealers without corresponding increase in revoked licenses. These findings provide additional support for the "why" part of the gun crime question, indicating that cost-saving strategies as well as regulatory loopholes due to weak gun law enforcement direct the supply effect on crime guns. The combination of cost cutting strategies, as for example, portfolio company staffing and weak gun law enforcement appears to be a futile ground for crime.

According to Milton Friedman, a political process should implement laws to constrain firms' behavior, and firms in turn should be left free to maximize shareholder returns within these confines. In essence, he argues that it is better to ask a zookeeper to cage a lion than it is to ask a lion to refrain from eating the other animals in the zoo (De Bettignies and Robinson 2018). Related to Friedman's view, George Stigler explained how regulated companies or interest groups distort regulation in their favor against the public interest. To some extent, my analysis is an explication of Friedman's and Stigler's original analyses, to address the gun crime question in the U.S. While my findings suggest that the infusion of high-powered profit maximizing incentives by PE firms increase the sale of guns used in violent crimes PE itself cannot be viewed as a benefit or a cost without a careful examination of the root causes of the underlying inefficiencies that give rise to negative externalities.

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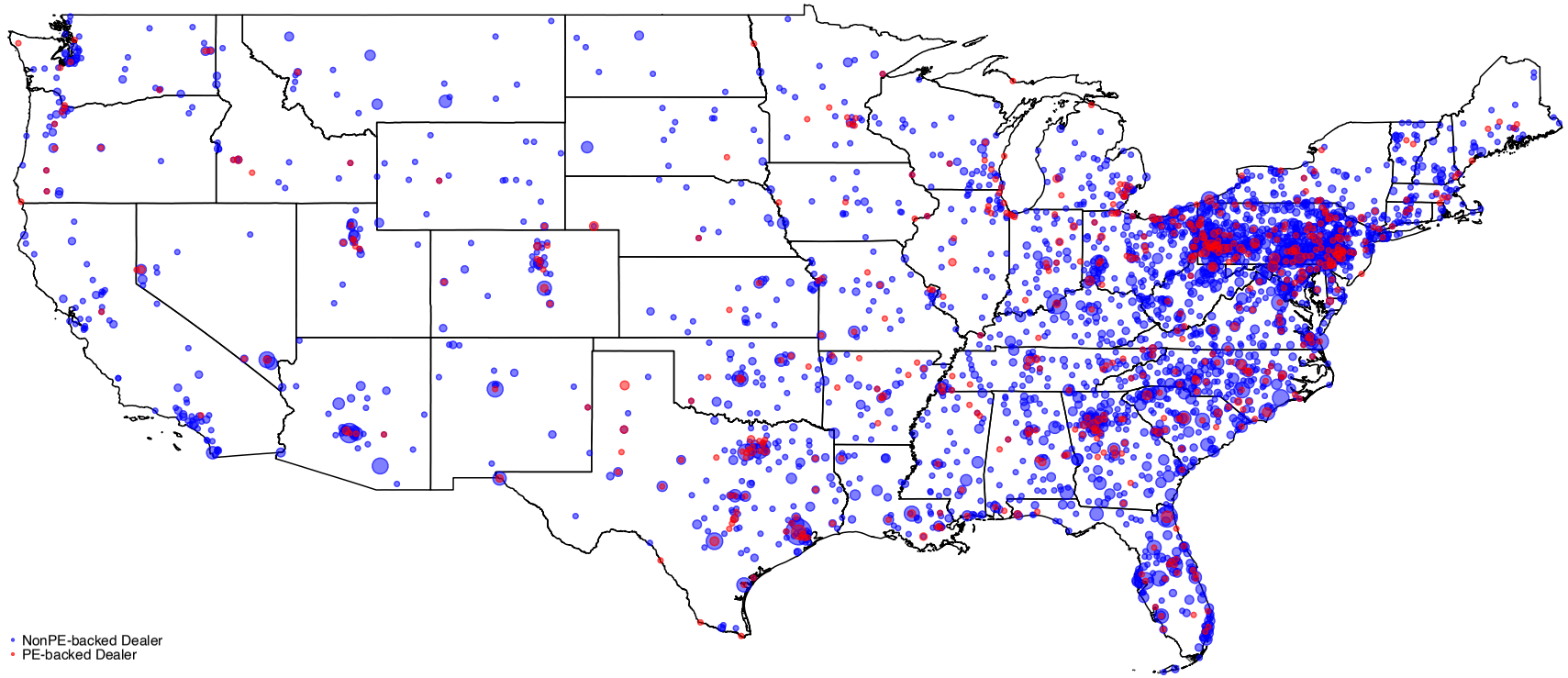
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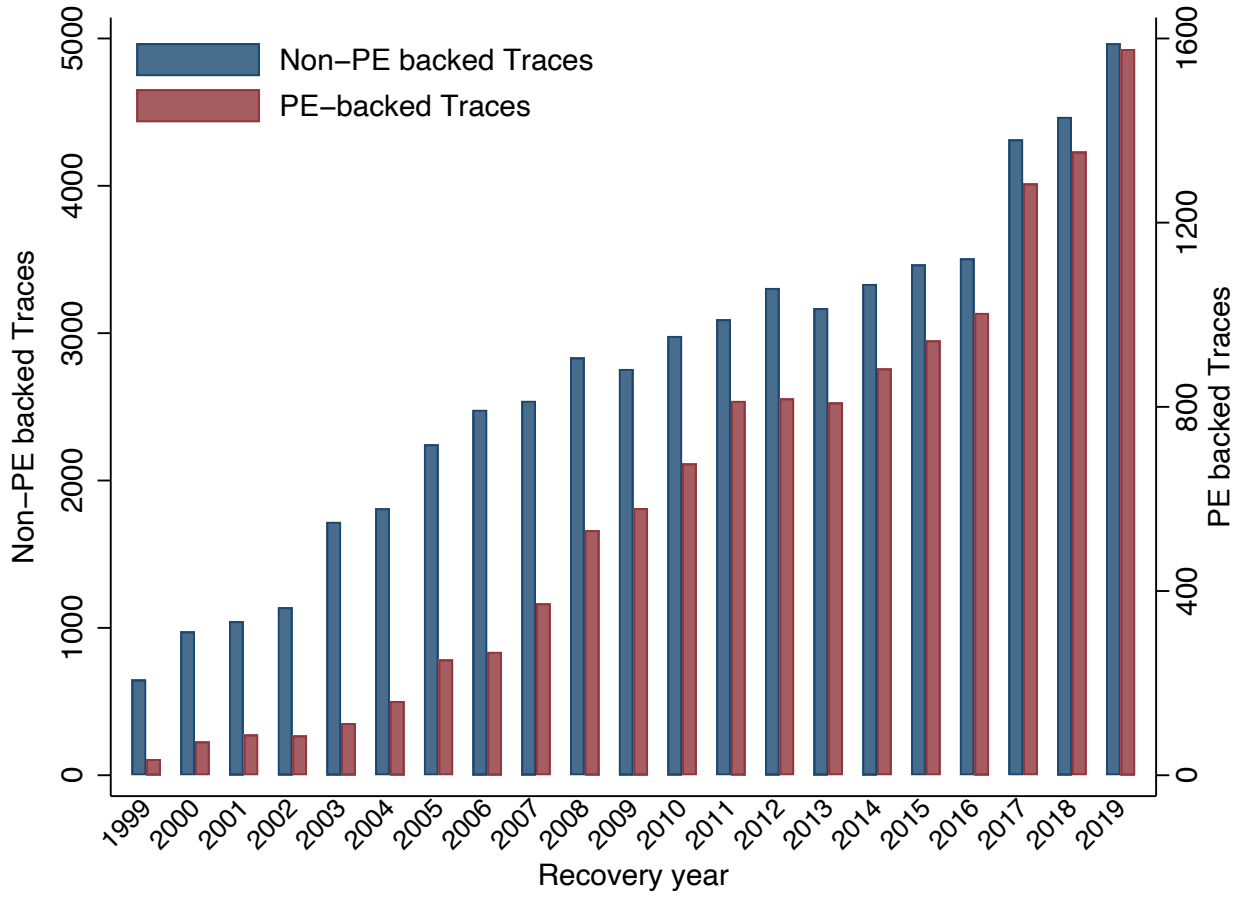
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Figure 1: Distribution of Firearm Dealers by Private Equity Ownership in the US



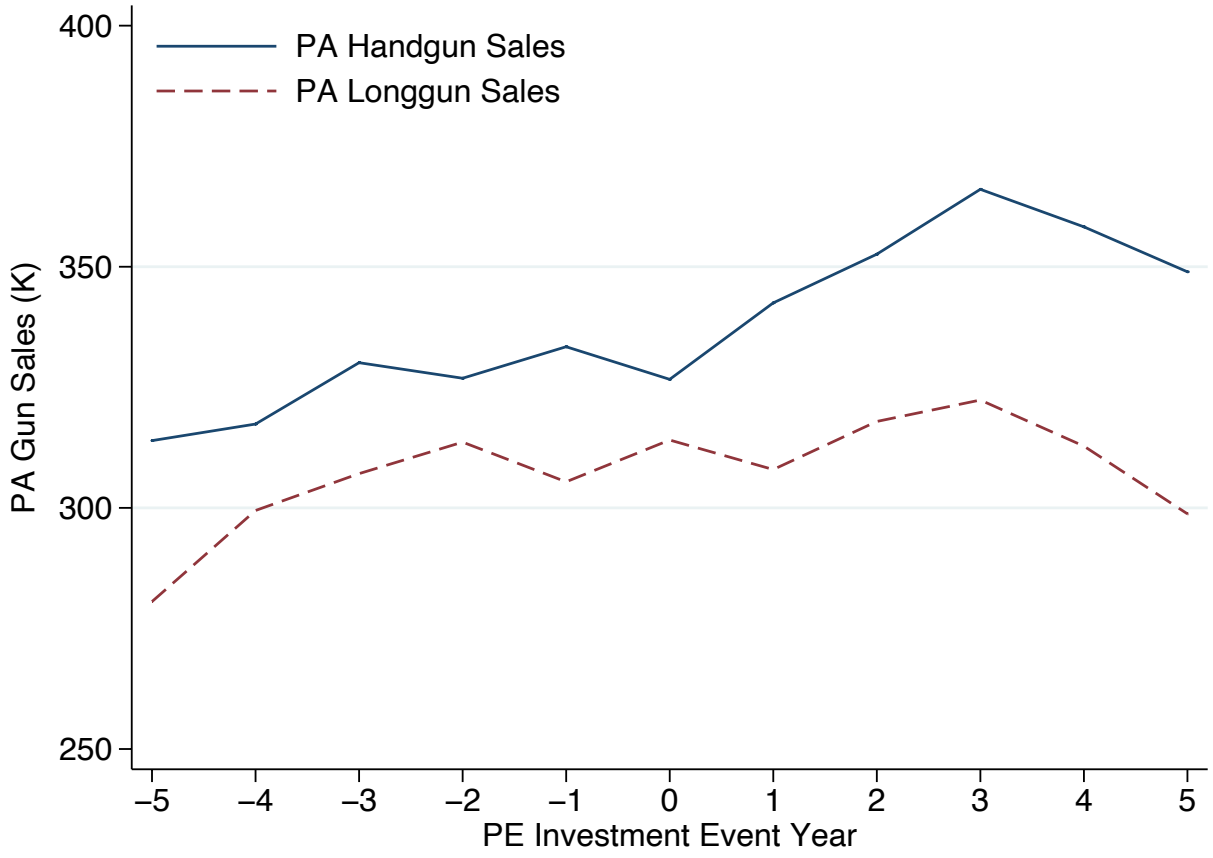
Note: This map shows the distribution of PE-backed and Non-PE backed firearm dealers in the US that have multiple traces to crime guns recovered in Pennsylvania between 1980-2019. While my sample also includes licensed gun dealers in Alaska, Hawaii, and US territories they are not shown in this map for simplicity of illustration.

Figure 2: Traces from PE- and Non-PE backed Gun Dealers



Note: This figure shows the total traces to crime guns after 1998 from PE- and Non-PE backed licensed gun dealers over time in my sample.

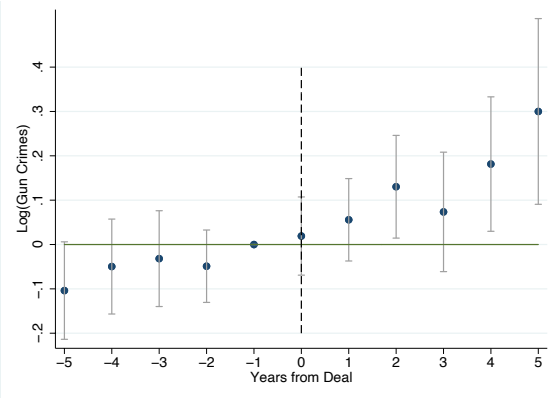
Figure 3: Total Gun Supply in Pennsylvania at the State Level around PE Firm's Investment



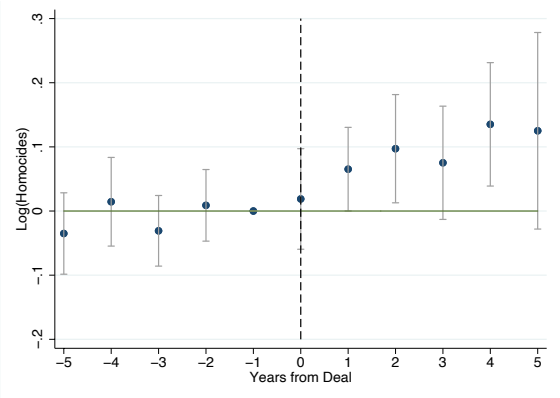
Note: This figure shows the total sales of guns (handguns and rifles) at the state level of Pennsylvania, following the acquisition of gun dealer retail chain by a private equity firm. The state level sales are aggregated from county level gun sale data which was obtained from Pennsylvania State Police Firearms Annual Reports. Pre-event years comprise sales of counties only with gun dealer store that are not (yet) PE-backed.

Figure 4: Difference-in-differences Event Studies of Private Equity Infusion

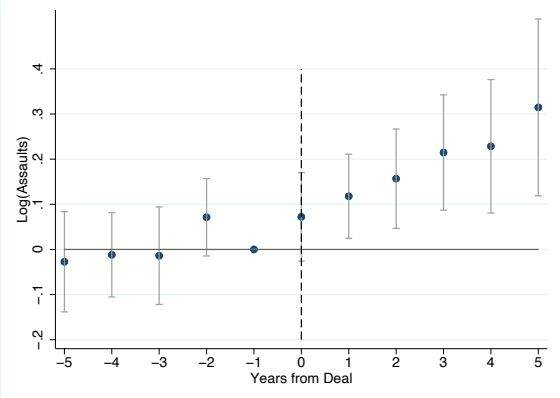
(a) **Panel A:** All Crime Guns



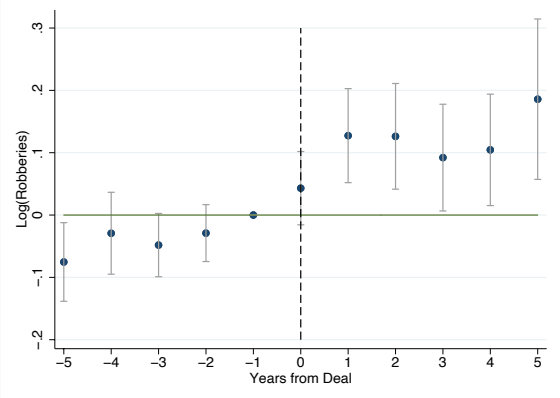
(b) **Panel B:** Homicides



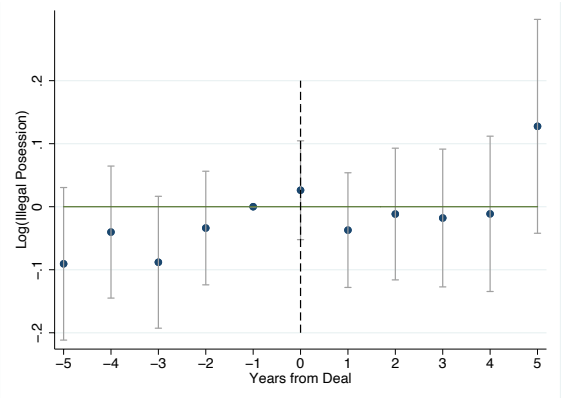
(c) **Panel C:** Assault



(d) **Panel D:** Robbery



(e) **Panel E:** Illegal Guns



Note: This figure presents the differences-in-differences event studies around the time a gun dealer experiences a private equity investment. I leave out the year before the deal (-1). Each blue point in the figure represents a coefficient β_s, obtained by estimating the equation: $y_{ijt} = \sum_{s=-20}^{20} \beta_s \mathbf{1}(t = s) +$ Year FE + Year $\times$ County FEGun Dealer FE $+ \epsilon_{ijt}$, where $\mathbf{1}(t = s)$ is an indicator that is one in year s relative to the PE deal year for gun dealer j of retail chain i, and zero otherwise. Only coefficients for the years immediately around the buyout are shown in the graph. y_{ijt}, is the log number of guns sold at time t by gun dealer i, which are traced to crimes, that means, log number of all crime guns traced to the dealer (Panel A), guns used in homicides (Panel B), assaults (Panel C), robbery (Panel D), and illegal possession (Panel E). Standard errors are clustered by gun dealer, and 95% confidence intervals are shown.

Table 1: Summary Statistics of Gun Trace Data

This table presents characteristics of Pennsylvania's gun trace data. I only consider dealers with multiple traces and whose phone number could be matched to a licensed gun dealer in the ATF's published list of FFLs that are part of a gun dealer chain. The final dataset includes 69,763 individual gun crime traces of recovered firearms in Pennsylvania to 2,396 firearm chain dealer store and 413 manufacturers between 1980-2019.

	Observations
Traces	69,763
— To In-state dealers	49,808
— To Out-of-State dealers	19,955
— Time-to-Crime less 1 yr	13,765
— Handgun	58,239
— Homicide	2,266
— Homicide with handgun	1,851
— Assault	7,812
— Assault with handgun	6,640
— Robbery	3,749
— Robbery with handgun	3,325
— Illegal possession	13,704
— To White purchaser	33,140
— To Black purchaser	19,026
— To Asian purchaser	664
— To Hispanic purchaser	2,246
— To Other race purchaser	14,687
— To Male purchaser	46,575
— To Female purchaser	9,308
— To Unknown gender purchaser	13,880
LEAs	221

Table 2: Distribution of Crime Gun Traces over Time

This table presents the distribution of crime gun traces over time. I consider total traces and split traces based on different characteristics.

Recovery Year	Traces	To In-state d.	To Out-state d.	Time-to-Crime ($\leq$1yr)	Handgun	Homocide	Assault	Robbery	Illegal
1980	1		1		1	1			
1982	1		1		1				
1985	2		2		2	1			
1988	3		3		2				1
1989	2		2		2	2			
1990	3	1	2	1	1	1			
1992	3		3		3				1
1993	3	1	2		1				
1994	10	5	5	1	9	3	3		
1995	36	20	16	8	26	6	6		
1996	103	62	41	25	77	7	14	2	12
1997	81	43	38	14	75	10	5	1	5
1998	87	43	44	21	71	9	10	4	11
1999	684	426	258	170	629	34	122	29	59
2000	1049	743	306	171	966	49	145	34	56
2001	1131	847	284	217	1035	50	161	36	164
2002	1226	888	338	248	1112	43	171	51	196
2003	1830	1219	611	352	1662	65	223	66	296
2004	1974	1281	693	405	1753	86	244	247	328
2005	2497	1578	919	464	2171	131	338	444	391
2006	2749	1768	981	510	2348	101	305	331	450
2007	2906	1937	969	543	2524	141	323	450	611
2008	3356	2228	1128	576	2755	117	457	602	753
2009	3333	2233	1100	539	2622	99	375	292	688
2010	3669	2500	1169	646	2916	129	424	114	790
2011	3898	2689	1209	703	3057	79	439	131	782
2012	4116	2960	1156	866	3275	102	468	114	879
2013	3966	2842	1124	833	3226	125	423	92	876
2014	4215	3152	1063	845	3313	119	501	122	794
2015	4410	3328	1082	900	3449	141	511	133	812
2016	4501	3379	1122	969	3707	122	465	105	896
2017	5588	4173	1415	1281	4722	197	534	142	1202
2018	5798	4472	1326	1192	4870	127	575	102	1175
2019	6532	4990	1542	1265	5464	169	570	105	1476
N	69763	49808	19955	13765	57847	2266	7812	3749	13704

Table 3: PE Investments in Crime Gun Dealer Chains

This table presents PE investments in dealers of crime gun dealer chains recovered in Pennsylvania between 1980-2019. Panel A separates investments by size, based on the definition by PtichBook. PitchBook defines the small cap market for PE as companies that have less than $25 million in PE backing, $25 million to $1 billion in PE backing for the middle market, and above $1 billion for the large cap market. I refer to deal size as the size of the investment into the parent company of an FFL. "Size of Deal" refers to the investment in the parent company. "PE firm AUM (m)" shows the average AUM of PE firms invested in crime gun dealers for each size category. Panel B presents details on the top 5 PE deals in my sample, ordered by the number of traces, based on my dataset of 69,763 individual gun crime traces of recovered firearms in Pennsylvania. I set the PE indicator to turn on in the year following the deal year.

Panel A: Investments by Size

	Fraction of Deals (%)	Avg. Size of Deal (m)	Median Size of Deal (m)	Avg. PE firm AUM (m)
Large Cap (> $1b)	43%	2,876	1,680	850,684
Mid Cap ($25-1b)	18%	145	55	5,817
Small Cap (<$25m)	36%	1.4	0.8	538
Growth Capital	3%	100	96	12,120

Panel B: Top 5 PE Deals by Traces

#	Target Name	Private Equity Firm(s)	Deal Year	Number of Traces
1	Gander Mountain	CCMP, Pamlico Capital, Crestview Partners	1996, 2017	1847
2	Cabela's	Goldman Sachs Capital Partners	2016	1484
3	Dick's Sporting Goods	Oak Investment Partners	1999	1123
4	Bass Pro Shops	J.W. Childs Equity Partners, GS Capital Partners	1998, 2016	503
4	Sportsman's Warehouse	Seidler Equity Partners	2009	265
5	Academy Sports + Outdoors	KKR	2011	211

Table 4: Summary Statistics of Crime Gun Traces to PE backed and Non-PE backed Dealers

This table presents characteristics of crime gun traces to PE backed and Non-PE backed dealer stores between 1980-2019. The top columns report the mean, standard deviation, min, p25, median, p75, and max of the characteristics for traces to PE backed dealers, and the bottom columns report the mean, standard deviation, min, p25, median, p75, and max of the characteristics for traces to Non-PE backed dealers. The distance of gun dealer to purchaser and the distance of gun dealer to recovery is reported in miles.

	PE backed Dealers						
	Mean	SD	Min	p25	Median	p75	Max
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Traces per dealer	60.831	188.635	2	2	4	13	1247
Traces per manufacturer	59.317	217.724	1	1	4	23	1804
Traces per LEA	234.230	860.158	1	2	9	25	6170
Manufacturers per dealer	24.981	27.409	1	10	19	44	87
Time-to-Crime (yrs)	2.632	2.481	0.866	0.921	2.762	6.307	36.447
Distance dealer to purchaser	23.796	107.686	0	0	5.439	13.360	2481.287
Distance dealer to recovery	120.247	268.234	0	0	17.276	176.721	4918.731
	Non-PE backed Dealers						
Traces per dealer	21.6821	155.13	2	2	4	9	3188
Traces per manufacturer	188.259	721.851	1	1	3	26	9300
Traces per LEA	332.480	1009.29	1	3	12	61	11546
Manufacturers per dealer	47.261	32.493	1	10	32	66	118
Time-to-Crime (yrs)	6.126	7.189	0.271	1.101	3.421	8.515	65.005
Distance dealer to purchaser	37.717	106.539	0	5.281	12.503	28.626	2053.422
Distance dealer to recovery	159.093	314.791	0	12.503	31.932	202.032	3346.268

Table 5: Predictors of Private Equity Investment in PA and Out-of-state Stores

This table reports coefficients of linear probability models where the dependent variable is *PE backed dealer*, a binary variable equal to one if a PE firm invested in a retail chain of a licensed gun dealer store (Panel A) or an independent single gun dealer store (Panel B) that year (columns 1-3), and in the years 2013 and 2014 (column 4). That means, the level of observation is the gun dealer store. After this transition, the gun dealer store is no longer tracked. I consider Pennsylvania and out-of-state dealer stores with multiple gun traces and gun law violations. The independent variables in Panel A are *Log(Missing) t-1*, the log of missing guns violations in the previous year, *Ties With Manufacturer*, a binary variable equal to one if the invested PE firm has common ownership in or professional ties to the manufacturer, *Log(# Violations) t-1*, the log of the number of gun law violations in the previous year, *Log (# Repeated Violations) t-1*, the log of the number of repeated gun law violations the previous year, *Log (# ATF agents/# FFLs 2012*, the log of the ratio of # ATF agents/# FFLs 2012 for each of the 25 field divisions in FY 2012 based on the U.S. Department of Justice Office's review of ATF's Federal Firearms Licensee Inspection Program of April 2013. "Year FE", and "Dealer FE" are fixed effects for the year, and FFL, respectively. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: Store of Chain Retailer

	(1)	(2)	(3)	(4)
Log(Missing) t-1	0.148	0.148	0.218	0.218
	(0.124)	(0.133)	(0.177)	(0.237)
Ties With Manufacturer	0.052***	0.093***	0.093***	0.052***
	(0.015)	(0.018)	(0.018)	(0.017)
Log(# Violations) t-1	-0.017	-0.010	-0.001	-0.001
	(0.016)	(0.016)	(0.013)	(0.013)
Log (# Repeated Violations) t-1	0.830	0.830	-0.930	-0.932
	(0.606)	(0.611)	(0.779)	(0.748)
#ATF agents/# FFLs 2012				0.057
				(0.044)
Year FE	No	Yes	Yes	Yes
Dealer FE	No	No	Yes	No
Observations	782	782	782	143
Adj. R^2	0.273	0.175	0.653	0.616

Panel B: Independent Single Store

	(1)	(2)	(3)	(4)
Log(Missing) t-1	0.117***	0.131**	0.084**	0.143**
	(0.025)	(0.070)	(0.046)	(0.070)
Ties With PE Manufacturer	0.041***	0.097***	0.091***	0.054
	(0.017)	(0.017)	(0.017)	(0.046)
Log(# Violations) t-1	-0.027	-0.093***	-0.076***	-0.035
	(0.016)	(0.029)	(0.024)	(0.027)
Log (# Repeated Violations) t-1	-0.743	-0.645	-0.655	-0.841
	(0.713)	(0.671)	(0.639)	(0.722)
#ATF agents/# FFLs 2012				-0.034**
				(0.016)
Year FE	No	Yes	Yes	Yes
Dealer FE	No	No	Yes	No
Observations	124	124	124	58
Adj. R^2	0.565	0.624	0.850	0.463

Table 6: Predictors of Private Equity Investment in PA County

This table reports coefficients of linear probability models where the dependent variable is *PE backed dealer*, a binary variable equal to one if a PE firm invested in a retail chain of a licensed gun dealer store in a Pennsylvania county (Panel A) or an independent single gun dealer store in a Pennsylvania county (Panel B) that year (columns 1-4). That means, the level of observation is the Pennsylvania county. After this transition, the county is no longer tracked. I consider Pennsylvania counties with dealer stores that have multiple gun traces and gun law violations. The independent variables in Panel A are *Log*(*Missing*) *t-1*, the log of missing guns violations in the previous year, *Ties With Manufacturer*, a binary variable equal to one if the invested PE firm has common ownership in or professional ties to the manufacturer, *Log*(*# Violations*) *t-1*, the log of the number of gun law violations in the previous year, *Log* (*# Repeated Violations*) *t-1*, the log of the number of repeated gun law violations the previous year. "Year FE", and "County FE" are fixed effects for the year, and PA county, respectively. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: County of Store of Chain Retailer

	(1)	(2)	(3)
Log(Missing) t-1	0.155	0.167	0.174
	(0.106)	(0.108)	(0.135)
Ties With Manufacturer	0.027**	0.031**	0.030*
	(0.012)	(0.014)	(0.016)
Log(# Violations) t-1	-0.160	-0.158	-0.142
	(0.132)	(0.121)	(0.122)
Log (# Repeated Violations) t-1	-0.133	-0.155	1.544
	(0.135)	(0.135)	(1.143)
Year FE	No	Yes	Yes
County FE	No	No	Yes
Observations	480	480	480
Adj. R^2	0.479	0.477	0.712

Panel B: County of Independent Single Store

	(1)	(2)	(3)
Log(Missing) t-1	0.146*	0.146*	0.074
	(0.077)	(0.077)	(0.150)
Ties With Manufacturer	0.032*	0.032*	0.091
	(0.016)	(0.015)	(0.053)
Log(# Violations) t-1	-0.069	-0.069**	-0.099*
	(0.042)	(0.032)	(0.054)
Log (# Repeated Violations) t-1	-0.579*	1.579	0.573
	(0.253)	(1.353)	(0.563))
Year FE	No	Yes	Yes
County FE	No	No	Yes
Observations	104	104	104
Adj. R^2	0.536	0.536	0.756

Table 7: Private Equity Investment and Gun Sales At PA County Level

This table shows the effect of private equity buyouts on the *log number of reported purchased firearms in the county of the Pennsylvania gun dealer* (columns 1 and 2), and the *log number of issued licenses to carry in the county of the Pennsylvania gun dealer*. Handgun means pistol, revolver, or derringer. Each cell in the first row presents the coefficient obtained by estimating equation 1 including county fixed effects, year fixed effects, and controls for socioeconomic variables, from the American Community Survey, which are annual median household income, the share of the population that are white, that are renters rather than home-owners, and that are below the Federal poverty line. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

	(1) Sales Handguns	(2) Sales Longguns	(3) LTC
Post Deal × PE	0.107** (0.053)	0.077 (0.049)	0.062* (0.034)
Year FE	Yes	Yes	Yes
County FE	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes
Observations	630	630	630
Adj. R^2	0.516	0.449	0.465

Table 8: Private Equity Investment and Number of Crime Guns

This table shows the effect of private equity buyouts on the *log number of guns traced to a specific type of crime*. Handgun means pistol, revolver, or derringer. Each cell in the first row presents the coefficient obtained by estimating equation 1. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

	(1) Traced Homocide Guns	(2) Traced Assualt Guns	(3) Traced Robbery Guns	(4) Traced Illegal Guns	(5) Traced Handguns
Post Deal × PE	0.105***	0.199***	0.149***	0.002	0.189***
	(0.037)	(0.050)	(0.031)	(0.036)	(0.063)
Year FE	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes
Year × County FE	Yes	Yes	Yes	Yes	Yes
Observations	69,763	69,763	69,763	69,763	69,763
Adj. R^2	0.278	0.501	0.390	0.508	0.455
Mean of Dep. Variable	0.190	0.227	0.210	0.347	0.974

Table 9: Private Equity Investment and The Marginal Crime Gun

This table shows the effect of private equity buyouts of retail chains with stores in PA on the *log number of guns traced to a specific type of crime* from a store in PA controlling for the level of sales in the PA county. That means, the level of observation is a single store from a retail chain. Handgun means pistol, revolver, or derringer. Each cell in the first row presents the coefficient obtained by estimating equation 2 including a control for the level of sales in the PA county. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

	(1) Traced Homocide Guns	(2) Traced Assualt Guns	(3) Traced Robbery Guns	(4) Traced Illegal Guns	(5) Traced Handguns	(6) Time-To-Crime
Post Deal	0.042***	0.054*	0.042**	0.054	0.082***	-1.492***
$\times$ PE	(0.011)	(0.031)	(0.032)	(0.017)	(0.024)	(0.362)
Log(Gun	0.213***	0.223**	0.267**	0.277***	0.274***	-1.221**
sales county)	(0.166)	(0.109)	(0.148)	(0.090)	(0.092)	(0.612)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Yr $\times$ County FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	49633	49633	49633	49633	49633	49633
Adj. R^2	0.601	0.858	0.774	0.780	0.801	0.505
Mean of Y	0.645	0.852	0.866	0.768	1.452	7.432

Table 10: Private Equity Investment and Budget Crime Guns

This table reports coefficients of linear probability models where the dependent variable is *"budget" gun*, a binary variable equal to one if the recovered crime gun (crime is defined as stated in each column) stems from a "budget" gun manufacturer, as defined in section 6.4, and zero otherwise. Each cell in the first row presents the coefficient obtained by estimating equation 1. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

	(1) All Traced Budget Guns	(2) Traced Homocide Budget Guns	(3) Traced Assualt Budget Guns	(4) Traced Robbery Budget Guns
Post Deal × PE	0.070***	0.062**	0.068**	0.046*
	(0.016)	(0.031)	(0.032)	(0.025)
Year FE	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes
Year × County FE	Yes	No	No	No
Observations	69,763	2,266	7,812	3,749
Adj. R^2	0.612	0.603	0.582	0.822
Mean of Dep. Variable	0.612	0.616	0.620	0.563

Table 11: Private Equity Investment With Ties to Manufacturer

Panel A of this table shows the effect of private equity buyouts on the *log number of reported purchased firearms in the county of the Pennsylvania gun dealer* (columns 1 and 2), and the *log number of issued licenses to carry in the county of the Pennsylvania gun dealer*, with common ownership/ties to manufacturer fixed effects. Panel B of this table shows the effect of private equity buyouts on the *log number of guns traced to a specific type of crime* with connected manufacturer fixed effects. Handgun means pistol, revolver, or derringer. Each cell in the first row presents the coefficient obtained by estimating equation 1 including county fixed effects, year fixed effects, and controls for socioeconomic variables, from the American Community Survey, which are annual median household income, the share of the population that are white, that are renters rather than home-owners, and that are below the Federal poverty line. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: Gun Sales At PA County Level

	(1) Sales Handguns	(2) Sales Longguns	(3) LTC
Post Deal × PE	0.076**	0.065	0.051*
	(0.039)	(0.050)	(0.028)
Year FE	Yes	Yes	Yes
County FE	Yes	Yes	Yes
Ties With Manu. FE	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes
Observations	630	630	630
Adj. R^2	0.542	0.448	0.485

Panel B: Number of Crime Guns

	(1) Traced Homocide Guns	(2) Traced Assualt Guns	(3) Traced Robbery Guns	(4) Traced Illegal Guns	(5) Traced Handguns
Post Deal × PE	0.070***	0.126***	0.078***	0.063	0.120***
	(0.021)	(0.046)	(0.028)	(0.051)	(0.038)
Year FE	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes
Year × County FE	Yes	Yes	Yes	Yes	Yes
Ties With Manufacturer FE	Yes	Yes	Yes	Yes	Yes
Observations	69,763	69,763	69,763	69,763	69,763
Adj. R^2	0.338	0.547	0.423	0.511	0.535
Mean of Dep. Variable	0.190	0.227	0.210	0.347	0.974

Table 12: Private Equity Investment and Violations of Gun Laws

This table shows the effect of private equity buyouts on the violation of gun laws. The dependent variable in Panel A is the *log of the dealer's number of total gun law violations at inspection* (column 1), the *log of the number of violations for failures to report sales of firearms at the start date of the dealer's inspection period* (column 2), the *log of the number of violations for missing firearms at the start date of the dealer's inspection period* (column 3), the *log of the number of violations of sales to prohibited purchasers at the start date of the dealer's inspection period* (column 4), the *log of the number of violations of straw purchases at the start date of the dealer's inspection period* (column 5), and the *log of the number of violations to check ID of the purchaser at the start date of the dealer's inspection period* (column 6). Each cell in the first row of Panels A and B presents the coefficient obtained by estimating equation 2. Since the inspection period is typically one year I am measuring the violations at the end of the inspection period but use the date at the start of the inspection period in my panel data. In that case I'm not attributing a violation to a PE investment if the PE firm invested in the dealer close to the end of the inspection period but the violation occurred at the beginning. In Panel B, I report coefficients of linear probability models where the dependent variable is *Inspection* (column 1), a binary variable equal to one if a licensed gun dealer was inspected by the ATF that year, *Repeated Violations* (column 2), a binary variable equal to one if a licensed gun dealer was found to have repeated violations at inspection, *Revoked* (column 3), a binary variable equal to one if a licensed gun dealer had their license revoked. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: Number of Violations

	(1) Violations	(2) Failure to Report Firearm	(3) Missing	(4) Prohibited	(5) Straw	(6) No ID
Post Deal × PE	0.352**	0.184**	-0.208***	0.018	0.140**	0.202***
	(0.160)	(0.107)	(0.071)	(0.061)	(0.089)	(0.063)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	782	782	782	782	782	782
Adj. R^2	0.397	0.546	0.664	0.669	0.547	0.526
Mean of Dep. Variable	1.174	0.597	0.284	0.191	0.208	0.343

Panel B: Dealer Store Inspection Outcome

	(1) Inspection	(2) Repeated Violations	(3) Lisence Revoked
Post Deal × PE	-0.399***	-0.441***	-0.024
	(0.042)	(0.037)	(0.022)
Year FE	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes
Observations	782	782	782
Adj. R^2	0.537	0.592	0.026

Appendix

Table A1: Predictors of Bank Loan

This table reports coefficients of linear probability models where the dependent variable is *Dealer Bank Loan*, a binary variable equal to one if a bank loan was issued to a licensed gun dealer that year (columns 1-3) , and in the years 2013 and 2014 (column 4). After this transition, the gun dealer is no longer tracked. In Panel A, I consider Pennsylvania and out-of-state dealers with multiple gun traces and gun law violations. The independent variables in Panel A are *Log*(*Missing*) *t-1*, the log of missing guns violations in the previous year, *Ties With Manufacturer*, a binary variable equal to one if the invested PE firm is connected to the manufacturer, *Log*(*# Violations*) *t-1*, the log of the number of gun law violations in the previous year, *Log* (*# Repeated Violations*) *t-1*, the log of the number of repeated gun law violations the previous year, the log of the ratio of # ATF agents/# FFLs 2012 for each of the 25 field divisions in FY 2012 based on the U.S. Department of Justice Office's review of ATF's Federal Firearms Licensee Inspection Program of April 2013, and *Log* (*# Shortage of ATF Investigator Staff for field division*), the log of the number of the difference between needed and existing ATF investigator staff for each of the 25 field divisions in FY 2012. The additional independent variables are, *Log*(*Handguns in County*) *t-1*, the log of reported purchased or transferred handguns (pistols, revolvers, or derringers). in the county of the Pennsylvania gun dealer in the previous year, *Log*(*Longguns in County*) *t-1*, the log of reported purchased or transferred rifles in the county of the Pennsylvania gun dealer in the previous year, *Log*(*LTC in County*) *t-1*, the log of licenses to carry firearms issued as reported by county sheriffs' offices in the previous year, and *Log*(*SFP in County*) *t-1*, the log of Sportsman's Firearm Permits issued by the County Treasurer's Office. "Year FE", and "Dealer FE" are fixed effects for the year, and FFL, respectively. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: Pennsylvania and out-of-state Dealers

	(1)	(2)	(3)	(4)
Log(Missing) t-1	-0.017	-0.028	-0.027	-0.028
	(0.019)	(0.053)	(0.052)	(0.019)
Log(# Violations) t-1	-0.051***	-0.094***	-0.089***	-0.055***
	(0.010)	(0.017)	(0.018)	(0.009)
Log (# Repeated Violations) t-1	-0.034**	-0.069*	-0.065*	-0.028**
	(0.016)	(0.037)	(0.038)	(0.014)
Strict Law State	-0.035	0.013	0.022	-0.040
	(0.027)	(0.037)	(0.041)	(0.025)
#ATF agents/# FFLs 2012				0.009
				(0.008)
Year FE	Yes	No	Yes	No
Dealer FE	No	Yes	Yes	No
Observations	390	390	390	109
Adj. R^2	0.013	0.034	0.033	0.005

Panel B: Pennsylvania Dealers

	(1)	(2)	(3)	(4)
Log(Missing) t-1	-0.119	-0.121	-0.119	-0.121
	(0.079)	(0.080)	(0.079)	(0.079)
Log(# Violations) t-1	-0.056*	-0.053*	-0.054*	-0.055*
	(0.030)	(0.027)	(0.029)	(0.029)
Log(Handguns in County) t-1	-0.015			
	(0.021)			
Log(Longguns in County) t-1		-0.033		
		(0.037)		
Log(LTC in County t-1)			-0.004	
			(0.018)	
Log(SFP in County t-1)				-0.015
				(0.020)
Year FE	No	Yes	No	Yes
Observations	123	123	123	123
Adj. R^2	0.368	0.276	0.364	0.369
Mean of Dep. Variable	0.252	0.252	0.252	0.252

Table A2: Bank Loan and Number of Crime Guns

This table shows the effect of a bank loan on the *log number of guns traced to a specific type of crime*. Handgun means pistol, revolver, or derringer. Each cell in the first row presents the coefficient obtained by estimating equation 1 with a bank loan instead of PE investment. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

	(1) Traced Homocide Guns	(2) Traced Assualt Guns	(3) Traced Robbery Guns	(4) Traced Illegal Guns	(5) Traced Handguns
Post Deal × Bank	0.075	0.139*	0.118	0.021*	0.167**
	(0.046)	(0.076)	(0.039)	(0.012)	(0.074)
Year FE	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes	Yes	Yes
Observations	14,391	14,391	14,391	14,391	14391
Adj. R^2	0.276	0.498	0.386	0.507	0.734
Mean of Dep. Variable	0.190	0.227	0.210	0.347	0.974

Table A3: Bank Loan and Violations of Gun Laws

This table shows the effect of a bank loan on the violation of gun laws. In Panel A, the dependent variable is the *log of the dealer's number of total gun law violations at inspection* (column 1), the *log of the number of the dealer's violations for failures to report sales of firearms at inspection* (column 2), the *log of the number of the dealer's violations for missing firearms at inspection* (column 3), the *log of the number of the dealer's violations of sales to prohibited purchasers at inspection* (column 4), the *log of the number of the dealer's violations of straw purchases at inspection* (column 5), and the *log of the number of the dealer's violations to check ID of the purchaser at inspection* (column 6). Each cell in the first row of Panel A presents the coefficient obtained by estimating equation 1 with a bank loan instead of PE investment. Since the inspection period is typically one year I am measuring the violations at the end of the inspection period but use the date at the start of the inspection period in my panel data. In that case I'm not attributing a violation to a bank loan if the bank issued a loan to the dealer close to the end of the inspection period but the violation occurred at the beginning. In Panel B, I report coefficients of linear probability models where the dependent variable is *Inspection* (column 1), a binary variable equal to one if a licensed gun dealer was inspected by the ATF that year, *Repeated Violations* (column 2), a binary variable equal to one if a licensed gun dealer was found to have repeated violations at inspection, *Revoked* (column 3), a binary variable equal to one if a licensed gun dealer had their license revoked. I use * to denote significance at the 10% level, ** to denote significance at the 5% level, and *** to denote significance at the 1% level. Standard errors are clustered by FFL.

Panel A: Number of Violations for

	(1) Violations	(2) Failure to Report Firearm	(3) Missing	(4) Prohibited	(5) Straw	(6) No ID
Post Deal × Bank	0.251*	0.161*	0.096	0.027	0.022	0.109
	(0.144)	(0.090)	(0.112)	(0.086)	(0.140)	(0.111)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	782	782	782	782	782	782
Adj. R^2	0.381	0.547	0.654	0.671	0.544	0.501
Mean of Dep. Variable	1.174	0.597	0.284	0.191	0.208	0.343

Panel B: Probability of Licensed Gun Dealer's

	(1) Inspection	(2) Repeated Violations	(3) Revoked
Post Deal × Bank	-0.055	-0.359	-0.032
	(0.059)	(0.269)	(0.061)
Year FE	Yes	Yes	Yes
Dealer FE	Yes	Yes	Yes
Socioeconomic Controls	Yes	Yes	Yes
Observations	330	330	330
Adj. R^2	0.433	0.490	0.302