Working Paper Series
ISSN 2334-0436

WP201404-01
01 May 2014

# DO U.S. STATE FIREARMS LAWS AFFECT FIREARMS MANUFACTURING LOCATION?

JURGEN BRAUER
Hull College of Business, Georgia Regents University, Augusta, GA, USA and EBA Program, Department of Economics, Chulalongkorn University, Bangkok, Thailand.
Corresponding author <jbrauer@gru.edu>

DANIEL MONTOLIO
Faculty of Economics and Business and Barcelona Institute of Economics (IEB), University of Barcelona, Barcelona, Spain

ELISA TRUJILLO
Faculty of Economics and Business and Barcelona Institute of Economics (IEB), University of Barcelona, Barcelona, Spain

WP 201404-01

**Abstract:**

In addition to federal firearms legislation applicable to all firearms manufacturers operating in the United States, each of the 50 U.S. states has its own state, and sometimes additional municipal, firearms laws. Conceivably, the relative strictness or laxity of these laws influences location decisions by firearms manufacturers. We use diverse datasets covering the period 1986 to 2010 to exploit variations in state firearms laws to study the manufacturing location of well over 2,700 federally licensed firearms manufacturers. We find that state laws do matter for location but so do other variables. In a way, our findings are reassuring. The firearm industry is "just another industry" in that it responds to economic incentives and disincentives, of which relevant state laws are an example: They play but an incremental role at the decision-making margin.

**JEL Classification Codes:** K23, L10, L52, L64, H73

**Key Words:** United States, federal firearms laws, state firearms laws, firearms manufacturing, location analysis.

# DO U.S. STATE FIREARMS LAWS AFFECT FIREARMS MANUFACTURING LOCATION?

## 1. Introduction

In the United States, the legitimate private sector use of handheld firearms for purposes such as collecting, self-defense, hunting, and target shooting, and as work-related equipment in private firms (e.g., private security services) or their use in law enforcement by municipal, state, and federal agencies is discussed with relative rarity in media, academic, and public policy circles. In contrast, their accidental misuse (e.g., in careless firearms discharges) and intentional abuse (e.g., in suicide or crime) receives widespread attention, especially in cases of mass shooting events at public schools or universities or at private venues such as cinemas or shopping malls. For example, a relatively recent such event, on 14 December 2012 inNewtown, Connecticut, resulted in a total of 30 casualties (28 dead and 2 injured) and sparked a major national debate over firearms legislation at the federal and state levels.[1]

The academic literature on firearms misuse and abuse, and on illicit firearms trade, is extensive.[2] Yet there is almost no literature at all on—and hence little understanding of—the supply side of the market: Who are the suppliers? How many are there? How much do they produce? At what cost? What is the product range and how much do manufacturers charge for their products? Where are manufacturers located, and why? What are the industrial organization of, and the degree of competition in, the industry? How concentrated is it? How are its supply and distribution chains organized? Are complements and accessories (e.g., bullets and optics) separate or integrated industries? How do laws and regulations influence industry production decisions and operations?[3]

This paper reports on a study on the relation between U.S. state firearms laws and firearms manufacturing location. In addition to data for a variety of control variables, we collected original data from the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) on the location and size of production runs of over 2,700 federally licensed firearms manufacturers, for the period 1986-2010 (ATF1, n/d) and for a total of 5,953 data points.[4] We also collected three data sets of state firearms laws. The first of these comes from an occasional publication on state firearms-relevant laws and regulations issued by the ATF itself (ATF2, n/d). This covers the data years 1997 to 2010. The second, covering the five data years from 2006 to 2010, comes from a coding of state firearms laws by the Brady Campaign, an "anti-gun" organization (Brady, 2013).[5] The third is an academic coding effort and covers the 30-year data period 1970 to 1999 (Vernick and Hepburn, 2003). Each of these efforts parses state firearms laws according to different selection and coding criteria, only some of which wholly or partially overlap.

Unlike a number of recent studies, ours is based on much more extensive panel data.[6] After statistically controlling for factors such as the size of state populations, labor force unionization rates, industrial wage rates, the share of manufacturing in state economies, and so on, we test for the hypothesis that U.S. states with firearms laws favorable to the industry host a larger number of firearms manufacturers than do those with less favorable laws.[7]While this is a rather straightforward hypothesis, it appears that there is no extant literature testing it statistically, separating out the effect of state firearms laws per se from other factors that might affect firearms manufacturing location. Our statistical findings do suggest that states with relatively lax firearms laws are populated by disproportionately large numbers of firearms manufacturers.

The paper proceeds as follows. Section 2 briefly characterizes the current context in which firearms manufacturers operate in the United States. Section 3 discusses our unique data sets and presents the expected results for our main variables of interest. Section 4 discusses our estimation strategy and presents our actual estimations and results. Section 5 discusses, interprets, and contextualizes our findings.

**2. The current debate**

In the wake of the aforementioned December 2012 Newton, Connecticut, school shooting, a fierce nationwide debate over federal, state, and municipal gun laws ensued. The main issues in the debate were not about firearms manufacturing per se but revolved around stricter regulations in regard to firearms access and usage. Debating points for instance included discussion on stricter background checks and waiting periods for prospective firearms buyers, limits to the types of firearms that civilians might be permitted to purchase, and limits on the types and capacity of firearms magazines (bullet storage casings).[8]

Although the industry succeeded for the most part to keep further restrictive laws off the books, some companies indicated that they should like to move their operations from relatively "gun-unfriendly" to relatively "gun-friendly" states, that is, from states with more restrictive firearms legislation to states with less restrictive laws. State governors from a number of "gun-friendly" states actively recruited in "gun-unfriendly" states to entice firms to move.[9] As a rule of thumb, the former states are northeastern states such as Connecticut and New York and the latter are southern and southwestern states such as South Carolina and Texas. In fact, during 2013, a number of companies did announce either company expansions or moves of their entire operations from northern to southern states. For example, Kahr Arms, a prominent pistol brand owned by Saeilo, Inc., and with corporate headquarters in New York state and manufacturing facilities in Massachusetts and Minnesota, announced that it would locate its new research and development operations in Pike County, Pennsylvania, about 80 miles away from its current headquarters (Pennsylvania being regarded as being more "gun-friendly" than New York). Likewise, PTR-91, Inc. (formerly J L D Enterprises, Inc.) of Farmington, Connecticut, moved its entire operations during 2013 to South Carolina.

From news reports alone it is difficult to determine just why companies start in one state rather than another or why they may move across state lines later on. In the case of PTR-91, for example, news reports (e.g., Ghosh, 2014) suggest that tax incentives and lower operating costs as much as "gun-friendly" laws, or perhaps simply the owner's location "preference", accounted for the company's relocation decision. Take another example: Remington Arms, an exceedingly storied rifle maker with a nearly 200-year-old company history, has been located in Ilion, New York, since 1828.[10] However, in the wake of repeated ownership changes, corporate headquarters moved several times, most recently in 1996 to Madison, North Carolina. Over the years the firm has closed various facilities in the North (e.g., in Connecticut) and generally expanded in the South (e.g., it opened a new firearms production plant in 1997 in Mayfield, Kentucky, and in February 2014 announced an expansion to take place in Huntsville, Alabama). Thus, recent industry talk about Remington possibly closing its aging Ilion, NY, plant and moving to the South altogether may reflect as much a general commercial discussion within the parent companyas a political one having to do with firearms laws.[11]Similarly, from 1995 to 1996 another exceedingly prominent firearms maker, Sturm Ruger& Co. ("Ruger"), while retaining *revolver* and *rifle* production at its Newport, New Hampshire, facility, moved the vast majority of its *pistol* production from Southport, Connecticut, to Prescott, Arizona. The remainder of its

pistol production was moved to New Hampshire and the Connecticut manufacturing operations were closed, although corporate headquarters remain there. On 8 May 2013, Ruger announced the building of a third manufacturing plant, apparently for rifle production (or perhaps for a revival of its shotgun offerings), to be located in Mayodan, North Carolina. Local news media in North Carolina reported that the company was offered several millions of dollars worth of location incentives.[12]And on 29 January 2014, Beretta USA (the U.S. subsidiary of the famous Italian brand) announced that it would open a new production facility in the state of Tennessee, near Nashville, rather than expand its operations at its current Maryland location, just south of Washington, D.C. The company said that its primary selection criterion was related to firearms regulation: "We started our search by looking only at States that have a consistent history of support for and likelihood of future support for Second Amendment rights."[13]

In sum, just why a firearms manufacturer locates in one state or another could be due to manufacturing costs, state incentives, state laws, idiosyncratic owner "preferences", or other factors. This paper employs a quantitative approach to help isolate the effect of state firearms law per se on firearms manufacturers' location.

## 3. Data

Apart from control variables, four main data sets are of relevance, and each deserves careful description to understand its possibilities and limitations. As shorthand, we label the four data sets as follows: (1) ATF/AFMER; (2) ATF/Laws; (3) BC/LC; and (4) V/H.

### *3.1. Firearms Manufacturers (ATF/AFMER)*

The first data set is compiled from copies of the Annual Firearms Manufacturing and Export Report (AFMER), a publication of the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). By law, in the United States every manufacturer of and dealer in firearms must obtain a federal firearms license (FFL). This license is issued for the actual location or premise of firearms manufacture or sale. Thus, for the aforementioned Kahr Arms, the FFL is issued not for its corporate headquarters in New York state, but for its manufacturing sites in Massachusetts (in the town of Worchester, MA, under the license name Saeilo, Inc., which is Kahr's parent company) and in Minnesota (in Pillager, MN, under licensee Magnum Research, a division of Kahr Arms). Also by law, each manufacturer is required annually to report to the ATF the number of firearms released into commerce (direct sales, wholesale, or retail for domestic release or for export, but excluding military sales). At the time of writing, records are available for 1998 to 2012 in PDF format on the ATF's web site. The research reported here extends through the year 2010 only. In addition, through a Freedom of Information Act (FOIA) request we obtained additional annual records reaching back to 1986 so that our manufacturing database includes all reporting firearms manufacturers for the calendar years 1986 to 2010. For each, we know the street address and the number of firearms produced for each type of firearm (pistol, revolver, rifle, shotgun, and miscellaneous firearm).[14,15]

Certain problems can arise in statistical work when using the AFT/AFMER data on firearms manufacturers and their location. The federal firearms license is issued for each premise. Thus, our database includes information on FFLs (federal firearms licensees) at 3,151 locations. However, when a licensee changes its name, say from Arms Mfg, Inc. to Arms Mfg, LLC, a *new* FFL is required. The same location is entered twice, leading to double counting. Likewise, when Remington Arms and therefore its Ilion, NY, plant changed ownership, a *new* FFL was required for the new owners to operate, even as the manufacturing location itself did not change. The

3,151 locations in our data set therefore overstate the actual number of unique and distinct manufacturers.

Table 1. Number of plants per state and year (dependent variable).

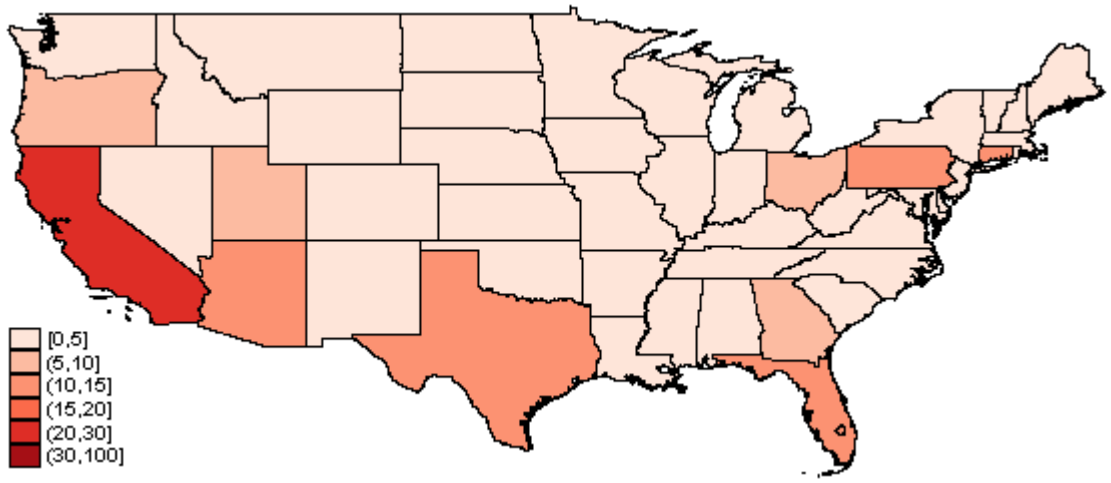
| | 1986 | 1990 | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|---|---|
| ALASKA | 0 | 1 | 0 | 1 | 0 | 1 |
| ALABAMA | 2 | 3 | 4 | 2 | 3 | 11 |
| ARKANSAS | 3 | 5 | 5 | 3 | 7 | 20 |
| ARIZONA | 11 | 12 | 14 | 13 | 24 | 62 |
| CALIFORNIA | 22 | 24 | 16 | 19 | 14 | 27 |
| COLORADO | 3 | 6 | 3 | 3 | 5 | 20 |
| CONNECTICUT | 12 | 10 | 10 | 11 | 16 | 17 |
| DELAWARE | 0 | 1 | 0 | 0 | 0 | 1 |
| FLORIDA | 12 | 19 | 18 | 15 | 25 | 54 |
| GEORGIA | 8 | 7 | 7 | 6 | 11 | 27 |
| HAWAII | 0 | 0 | 0 | 0 | 0 | 0 |
| IOWA | 0 | 0 | 0 | 1 | 1 | 8 |
| IDAHO | 1 | 1 | 6 | 7 | 9 | 23 |
| ILLINOIS | 4 | 8 | 7 | 7 | 10 | 20 |
| INDIANA | 3 | 3 | 3 | 3 | 3 | 17 |
| KANSAS | 1 | 1 | 3 | 3 | 1 | 14 |
| KENTUCKY | 1 | 0 | 2 | 5 | 6 | 15 |
| LOUISIANA | 4 | 2 | 2 | 2 | 2 | 2 |
| MASSACHUSETTS | 4 | 5 | 9 | 6 | 9 | 9 |
| MARYLAND | 3 | 3 | 3 | 6 | 7 | 12 |
| MAINE | 2 | 3 | 2 | 3 | 4 | 7 |
| MICHIGAN | 2 | 6 | 0 | 4 | 5 | 16 |
| MINNESOTA | 3 | 3 | 6 | 8 | 14 | 23 |
| MISSOURI | 1 | 3 | 6 | 11 | 16 | 40 |
| MISSISSIPPI | 0 | 0 | 0 | 1 | 0 | 4 |
| MONTANA | 3 | 5 | 5 | 9 | 8 | 22 |
| NORTH CAROLINA | 0 | 7 | 4 | 5 | 4 | 39 |
| NORTH DAKOTA | 0 | 1 | 1 | 0 | 0 | 0 |
| NEBRASKA | 1 | 2 | 2 | 3 | 3 | 11 |
| NEH HAMPSHIRE | 1 | 2 | 4 | 5 | 6 | 13 |
| NEW JERSEY | 1 | 1 | 0 | 0 | 2 | 2 |
| NEW MEXICO | 3 | 3 | 0 | 1 | 1 | 7 |
| NEVADA | 1 | 5 | 2 | 5 | 7 | 16 |
| NEW YORK | 3 | 6 | 3 | 6 | 7 | 19 |
| OHIO | 6 | 11 | 13 | 16 | 19 | 36 |
| OKLAHOMA | 3 | 4 | 3 | 7 | 12 | 29 |
| OREGON | 7 | 4 | 10 | 6 | 9 | 30 |
| PENNSYLVANIA | 11 | 15 | 12 | 10 | 14 | 35 |
| RHODE ISLAND | 0 | 0 | 0 | 0 | 0 | 1 |
| SOUTH CAROLINA | 0 | 1 | 0 | 5 | 2 | 11 |
| SOUTH DAKOTA | 1 | 2 | 3 | 8 | 6 | 13 |
| TENNESSE | 2 | 9 | 8 | 6 | 8 | 23 |
| TEXAS | 13 | 30 | 24 | 20 | 29 | 93 |
| UTAH | 7 | 6 | 5 | 5 | 12 | 26 |
| VIRGINIA | 0 | 4 | 3 | 1 | 7 | 33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| VERMONT | 2 | 3 | 2 | 4 | 5 | 8 |
| WASHINGTON | 4 | 8 | 9 | 9 | 12 | 20 |
| WISCONSIN | 3 | 4 | 2 | 5 | 8 | 20 |
| WEST VIRGINIA | 1 | 1 | 1 | 3 | 2 | 9 |
| WYOMING | 1 | 2 | 3 | 3 | 3 | 11 |
| **TOTAL** | **176** | **262** | **245** | **282** | **378** | **977** |

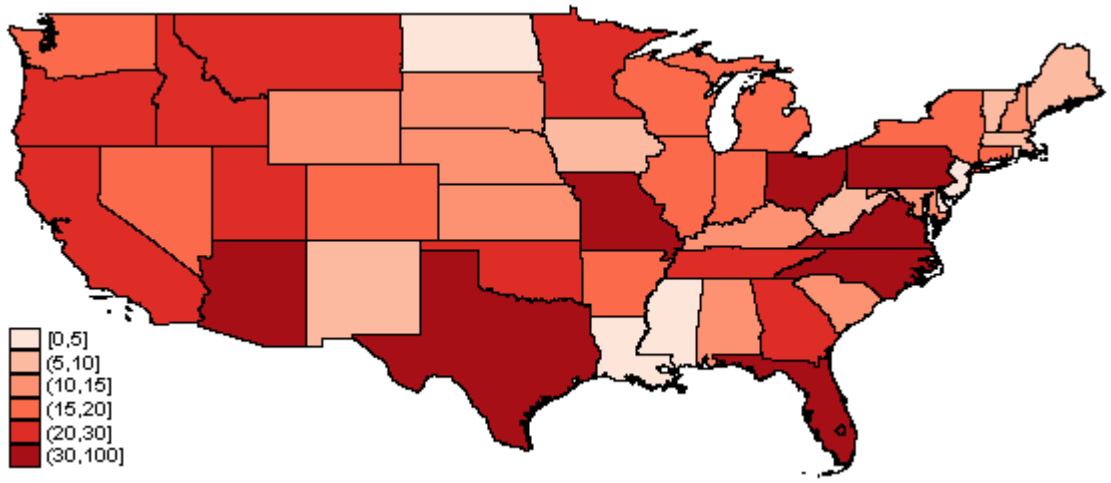
Source: own calculations from Annual Firearms Manufacturing and Export Report (AFMER).

Map 1. Number of firearms plants per state, 1986 and 2010.

1986




2010




Note: To reduce the dimensions of the map, Alaska and Hawaii are not depicted.

For well-known firearms manufacturers, one can make corrections in the data set if one is familiar with ownership changes. But for the vast majority of FFLs, ownership information is not available and judgment calls have to be made of whether or not to treat a specific street address as a genuinely new firearms manufacturing operation or as a continuing operation under a different licensee name. In another example, a firm going by the license name Entreprise Arms Inc. (the unusual spelling is correct) has three FFLs issued for three locations, all in Irwindale, California, and located within 1.7 miles of each other. This appears to be a firm under continuing

ownership, just changing to a different facility within the same part of town. What are three entries in the ATF/AFMER database should, for our purposes, be one. Similarly, from time to time FFLs need to be renewed. Some manufacturers let their license lapse, however. When it is reissued, it is issued with a *new* FFL number and entered in the AFT/AFMER record as a "new" premise even if the location is identical to the prior one.

In the absence of perfect industry knowledge, it is not possible to adjust the ATF/AFMER to the ultimately correct number of firearms manufacturing locations. Given our subjective knowledge, we made adjustments where we could and ultimately retained 5,953 unique data points, corresponding to unique plants or firearms manufacturing establishments across the 25-year span of our data (for a total of 2,721 firms). Table 1 shows the record by state for selected years. For 1986, for instance, California shows 22 firearms plants. In 2010, there were 27.

Map 1 shows the number of manufacturing plant locations per state in 1986 and in 2010. As may be seen, the Northeast, especially Connecticut and Pennsylvania, is more prominently visible in the 1986 map than in the 2010 map; the converse holds for the South and Southwest.

### *3.2. Regulatory variables*

#### *3.2.1. ATF/Laws*

The other three data sets are codings of state firearms laws. The first of these comes from the ATF as well, and we refer to this data set as ATF/Laws. From time to time, the Bureau issues a publication called ATF State Laws and Published Ordinances–Firearms (ATF Publication 5300.5). The 31st edition, for example, refers to 2010-2011 and consists of over 500 densely printed pages. The currency of the state laws and publications, however, varies. For Alabama, for example, the publication is current through the "End of [the] 2010 First Special Session," for California through to the end of the "2009 Regular and Extraordinary Session," for Indiana, through the end of the "2010 Second Regular Session," and so on. A check with the relevant personnel revealed that the ATF itself does not keep a full set of copies of past editions of Publication 5300.5. From various libraries we obtained full or partial copies of Publication 5300.5 for the publication years 1998 (21st ed.), 2000 (22nd ed.), 2001 (23rd ed.), 2003 (24th ed.), 2004 (25th ed.), 2005 (26th ed.), 2006 (27th ed.), 2007 (28th ed.), 2008 (29th ed.), 2009-2010 (30th ed.), and 2010-2011 (31st ed.). While the *publications* are continuous—the twenty-first to the thirty-first editions—there are *data gaps* for 1998 and 2001 (there were no corresponding 1999 and 2002 editions published for those data years). In the case of the 2001 data, the data was indirectly obtained and reconstructed for all states, given the consistency of the values of the relevant regulatory variables for 2000 and 2002. A similar procedure was applied to the 1998 data gap; however, in this case not all the information was recovered. Therefore, for the year 1998 there are some missing observations. Consequently, we decided to perform two sets of estimations, one for the whole sample period (1997-2010) with some missing values, and another for a restricted sample (2000-2010) with all the information for the ATF/Laws regulatory variables.

Moreover, the ATF publishes only a *selection* of state laws and municipal ordinances and, as mentioned, in a number of cases we were able to locate only partial copies of the entire publication. In each case, however, we do have what the ATF refers to as the Ready Reference Table, a state-by-state summary of laws in regard to four specific themes: (1) Does the state impose a waiting period for prospective firearms purchasers (and, if so, for how long)? (2) Does the state require firearms manufacturers and/or dealers residing in their state to carry a state license in addition to the required federal license? (3) Does the state preempt subordinate

municipalities within the state from issuing their own firearms ordinances? And (4) does the state impose limits on the interstate purchase and sale of firearms with immediately neighboring (contiguous) states?

For example, in the 2006 edition of ATF/Laws, the state of Connecticut is listed as having a 2-week-long waiting period for long guns (but not handguns); requires manufacturers and dealers of handguns (but not long guns) to carry a state license in addition to the federal license; has no state laws in regard to preemption of municipal ordinances; and likewise has no provisions in regard to interstate commerce.

Table 2. ATF/Laws data.

| Variable name | ATF name | Description | Values |
|---|---|---|---|
| *purchwait_1* | Purchase waiting period | Refers to the period between application for firearms purchase and allowable receipt or delivery. | 0/1 |
| *purchwait_2* | | | # of hours |
| *state_license* | License: Dealer, manufacturer, etc. | Indicates the existence of State regulation requiring state licenses for firearms dealers or manufacturers. | # of articles in state law |
| *local_preempt* | Local government limits (pre-emption) | Indicates that state jurisdiction overrides subordinate jurisdictions in whole or in part. | 0/1 |
| *Interstate* | Limits to interstate purchase and sale | Also known as "Contiguous State Provisions" indicate legislative limits to interstate purchase and sale enacted by jurisdictions based on the (federal) Gun Control Act. | 0/1 |

As shown in Table 2, we implement coding of these four state law variables in two ways: First, as zero-one binary variables indicating the absence or presence of a state law regarding a firearms purchase waiting period (*purchwait_1*), preemption of local (i.e., municipal) regulation by state law (*local_preempt*), and whether there are state law restrictions on end-user commerce with immediately neighboring states (*interstate*) and, second, as count variables where we count the number of provisions in state law with respect to the variables: purchase waiting period (*purchwait_2*) and state licensing requirements for dealers or manufacturers (*state_license*). For example, for the purchasing waiting period, we code either 0 or 1 or the number of hours (14 days, i.e., 336 hours, for Connecticut, for instance) and we code the number of state laws dealing with licensing (for the year 2005, two for Maryland, for instance, namely Public Safety Act Art. 5-106 and Art. 11-105).

We expected that the *purchwait* variable might carry a negative sign but also that it never should come in with a statistically significant coefficient, and indeed it never did. This variable measures whether in any given year a state imposed a waiting period on end-purchasers and, if so, for how many days (but measured in hours). One would not expect that this should affect the presence of firearms manufacturing in a state. Firearms are sold in a national, indeed global, market and a waiting period requirement in any one state should not affect a manufacturer's

location decision. Likewise, whether state law preempts or permits ordinances at the sub-state level in regard to firearms end-use should not affect manufacturing location. There might be a positive sign on the parameter (preempting additional municipal regulation being favorable to the industry) but, again, in none of our regressions (when run with control variables) did this variable turn up a statistically significant coefficient.

Similarly, one would not expect that whether or not a state restricts firearms commerce with its immediate neighboring states would affect manufacturing location. At first, one might believe that a manufacturer of hunting rifles in Montana, say, might be discouraged by an interstate commerce restriction but the relevant (federal and) state laws would not prohibit the manufacturer from shipping hunting rifles to a neighboring state for sale through dealers there. To illustrate the point: In 2005, the relevant provision in Montana state law reads: "Residents of Montana may purchase any rifle or rifles and shotgun or shotguns in a state contiguous to Montana," and similarly for residents of contiguous states wishing to purchase in Montana (Art. 45-8-341 & 45-8-342). The restriction (or permission) pertains to the end-user, not to the manufacturer. In our regressions, we neither expected nor found a statistically significant sign (in either direction) for this variable. However, for the state licensing variable (*state_license*), we did expect a statistically significant negative sign: The presence of a state license requirement in addition to the federal license requirement would be associated with a smaller number of firearms manufacturers in the state and for years in which the law was in effect. In almost all the regressions we ran, this turned out to be the case, even as state licensing requirements do not seem particularly onerous and most often concern dealers rather than manufacturers.

*3.2.2. BC/LC data*

Another data set that codes state firearms laws comes from the combined effort of the Brady Campaign to Prevent Violence (in Washington, D.C.) and the Law Center to Prevent Gun Violence (in San Francisco, CA).[16]We refer to this as the BC/LC data. Again, the data origin and coding are not ideal for research purposes. Both organizations are "anti-gun," which may be presumed to color their selection and reading of state law, and neither keeps a full set of data on its web site. We obtained the BC/LC State Scorecard sheets for 2007 to 2011—presumably covering the calendar or legislative years 2006 to 2010—through internet searches and also directly from Dr. Eric Fleegler (see Fleegler*et al*., 2013). One difficulty is that the various Scorecards are not fully comparable across years. Thus, the BC/LC data show the same five rubrics for all the years (Curb Firearm Trafficking; Strengthen Brady Background Checks; Child Safety; Guns in Public Places and Local Control; and Ban Assault Weapons) but the rubrics are not divided into headings and subheadings in a consistent way throughout the data span. For example, in the 2007 State Scorecard, the Strengthen Brady Background Checks rubric consists of three categories with a total of 12 subheadings. In 2011, the same rubric consists also of three categories and 12 subheadings—but different ones!

Therefore, like Fleegler*et al*. (2013), we felt that the BC/LC data were not usable in their original scoring and weighting, and we reconstructed the rubrics to obtain consistent measures for the relevant time period (see Table 3). Our *BC/LC_index_1* variable is an aggregate in regard to various measures pertaining to curbing firearms trafficking; *BC/LC_index_2* is an aggregate dealing with the strengthening of background checks; *BC/LC_index_3* is an aggregate capturing child safety provisions; and *BC/LC_index_4* is a measure of regulations regarding firearms use in public places and the degree of municipal control. In creating these index variables, we kept the original BC/LC scores but reweighted them.

Table 3. BC/LC data.

| Variable name | BC/LC rubrics | Description (headings) | Values |
|---|---|---|---|
| *BC/LC_index_1* (traffic) | Curb firearm trafficking | Includes the existence of firearm dealer regulation (12); limits to bulk purchases (5); crime gun identification (10); and reporting of lost or stolen guns (3) | (0,30) |
| *BC/LC_index_2* (checks) | Strengthen Brady background checks | Includes universal background check (17); permit needed to purchase (8) | (0,25) |
| *BC/LC_index_3* (child) | Child safely provisions | Includes child safety locks (6); child access prevention (5) | (0,11) |
| *BC/LC_index_4* (public) | Guns in public placed & local control | Includes no guns allowed in workplace (2); no guns on college campuses (2); not a concealed carrying of weapons (CCW) permit "shall issue" state (2); no state pre-emption (2) | (0,8) |

Note: The values column shows the maximum score that a given state in a given year can obtain. This is the sum of the points assigned to each heading, reflecting an arbitrary weighting given by BC/LC data scorers. In the original BC/LC data there is a fifth rubric, Ban Military-Style Assault Weapons thatdid not show sufficient variability across states and years and was dropped from our estimations. The words in parentheses under the variable names (traffic, checks, child, public) are shorthand expressions to indicate the predominant intent of the law variables captured in each index.

For our version of the BC/LC data, we expect the *BC/LC_index_1* and *BC/LC_index_2* variables to be negatively related to firm location because we believe that both proxy the general regulatory environment that manufactures face when deciding to locate in a specific state. A child access prevention (CAP) requirement, *BC_index_3*, could conceivably affect location, depending on what the specific state law requires. If the law requires the use of an after-market firearms lock, for instance, this would not be expected to affect manufacturers' location. But if a law required a lock to be built into the weapon in the first place, this might affect manufacturing cost and hence location, especially for small-scale manufacturers who may primarily serve the local (state) market. (This is an issue, for instance, in the ongoing debate over "microstamping" a weapon's firing pin, which would add to manufacturing costs.) In practice, child safety provisions are most often aimed at the end-users' home, making the end-user legally responsible for preventing firearms access by children (DeSimone*et al*., 2013). This is thus a consumption-related rather than a production-related variable and we would not expect this variable to be statistically significant in relation to the number of firearms manufacturers located in any given state or year. Finally, *BC/LC_index_4* also relates to the use of firearms (the demand side) and, although the sign might be negative, we do not expect it to significantly affect producer decisions to locate in a specific area.

*3.2.3. V/H data*

Finally, a data set laboriously assembled by Jon S. Vernick and Lisa M. Hepburn (Vernick and Hepburn, 2003) codes state laws from 1970 to 1999 into five major rubrics (State Laws Banning Certain Firearms; Sales and Purchase Restrictions (1); Sales and Purchase Restrictions (2); Possession, Carrying, and Storage Laws; and Sentence Enhancement Laws for Possession or Use of Firearm) with a total of 18 individual variables. As was true for the other data sets, we were unable to obtain an electronic copy of the data set and thus hand-coded all variables from the published paper record. In the Sales and Purchase Restrictions (1) category for example, there are five variables, the first of which asks whether a state license is required to affect a firearms purchase. If not, we coded this as 0; if yes, we coded this as 1 for the year in which the requirement was in effect.[17]

Table 4. V/H data.

| Variable name | V/H rubrics | Description (headings) | Values |
|---|---|---|---|
| *V/H_index_1* (traffic) | Sales and purchases restrictions (2)* | Includes one-gun-per-month law (5); state dealer license and inspection (5); minimum purchase and sale age (5) | (0,15) |
| *V/H_index_2* (checks) | Sales and purchase restrictions (1)* | Includes permit to purchase (2); firearm registration required (2); background checks for sales from dealers (2); background checks for private sales (2) | (0,8) |
| *V/H_index_3* (child) | Possession, carrying and storage laws | Includes child access prevention (4) | (0,4) |
| *V/H_index_4* (ban) | State laws banning certain firearms | Includes "Saturday Night Special" ban (2); assault weapon ban (2) | (0,4) |
| *V/H_index_5* (sentence) | Sentence enhancement laws for possession or use of firearm | Includes mandatory minimum sentence (1); minimum add-on sentence (1) | (0,2) |

Note: * The ordering of the five V/H rubrics has been altered in order to obtain indices comparable to those obtained from BC/LC. The words in parentheses under the variable names (traffic, checks, child, ban, sentence) are shorthand expressions to indicate the predominant intent of the law variables captured in each index.

We then regrouped the 18 V/H variables as follows (see Table 4). A *V/H_index_1* variable refers to the potential for firearms trafficking. It consists of two underlying variables, namely whether there is a state dealer license and inspection requirement, and/or whether there is a one-gun-per-month purchasing limit (note that the state license component of this variable is analogous, but not equal, to a similar variable in the ATF/Laws data set). *V/H_index_2* refers to background check variables in the V/H data set (background checks for sales from dealers; background checks for private-party (non-dealer) sales; permit for firearms purchase required; firearms registration required). *V/H_index_3* refers to child safety laws (just one variable);

*V/H_index_4* refers to bans of certain firearms (assault weapons ban; Saturday Night Specials ban); and *V/H_index_5* refers to the punishment of crime (mandatory minimum sentences).

We expect the statistically significant signs of *V/H_index_1*, *V/H_index_2*, and *V/H_index_3* to be the same as for the corresponding BC/LC variables (*_1*, *_2*, and *_3*). As regards *V/H_index_4*, on firearms bans, we expect it to turn up a statistically significant negative coefficient: Even if a manufacturer can sell military-style weapons in other states, a home-state limitation might be expected to limit the number of home-state manufacturers. Finally, although the sign might be negative, we do not expect that *V/H_index_5*, regarding punishment of crimes committed with a firearm, would adversely affect manufacturers' location in a statistically significant way.

Although coming from different sources, note that there is a reasonable resemblance between the first three indices in our versions of the BC/LC and the V/H data sets. They code for laws aimed at reducing firearms trafficking (*_1*), improving background checks (*_2*), and enhancing child safety (*_3*). We would therefore expect some coherence across the estimates using the BC/LC and the V/H data sets even though they correspond to different time periods. Hence, confronting the results obtained for these two sets of regulatory variables, although obtained for different time periods, allows us to confirm (or not) our hypothesis.[18]

It is worth emphasizing that in all three cases—ATF/Laws, BC/LC, and V/H—the selection and coding of state firearms laws and municipal ordinances is aimed at firearms dealers and end-users, not at manufacturers. All manufacturers are subject to federal and state laws such as Occupational Health and Safety laws, of course, but to our knowledge there are no state laws that specifically target manufacturers for being producers of firearms. What state laws do appear to target (or not) is not *production*, but the *product*, its *sale*, and its *use*. Nonetheless, this is a conjecture. To verify it would require reading the full set of state firearms-related laws rather than the selection available in AFT/AFMER or just relying on the coding of ATF/AFMER, BC/LC, and V/H. That said, neither in our personal observations nor in any talks with firearms manufacturers or federal and state public officials have we encountered state laws and regulations specifically aimed at the manufacture of firearms. Judging from the news media, industry association reports, and individual firearms manufacturing firms, even the industry itself appears merely to refer to the relative degree of restrictions placed on its products, not on their production. In Beretta USA's case, for example, "Gun laws adopted in Maryland last year [2013] ban some of the types of firearms that Beretta manufactures from being bought or sold in the state" (*Washington Times*, 29 January 2014). Nonetheless, laws intended to restrict the product and its distribution may collide with firearms manufacturers' location preferences. If held with sufficient strength, these may then affect location decisions.

### *3.3. Control variables*

All regressions were run first without and then with a variety of control variables.[19] These come in three sets: economic controls, public sector-related controls, and controls for measures of crime (see Table 5, which also shows descriptive data for the other data sets). The economic controls include (1) the logarithm of the total state population (*log_population*) with data taken from the U.S. Census Bureau; (2) the number (also in logarithms) of total manufacturing establishments in a state (*log_est*), measured as the annual average establishment count in private manufacturing industry and taken from the Quarterly Census of Employment and Wages (QCEW), Department of Labor Statistics, U.S. Department of Labor; (3) union membership (*u_member*), measured as the number of employed workers who are union members in private

manufacturing industry and taken from the Current Population Survey (CPS), Outgoing Rotation Group (ORG); and (4) state industrial wage rates (*wage_q*), measured as the total wage location quotient relative to the entire U.S. in private manufacturing industry, taken from the QCEW. We control for these economic factors because it might be expected (1) that states with larger populations host larger numbers of manufacturers per se, including firearms manufacturers, (2) that states with a larger manufacturing base host larger number of firearms manufacturers, (3) that states with high rates of workforce unionization might host fewer firearms manufacturers, and (4) that states with higher industrial wage rates might host fewer firearms manufacturers as well.

Table 5. Descriptive statistics.

| Variable name | Period | Obs. | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| *n_plant (dependent var.)* | 1986-2010 | 1,250** | 7.17 | 8.64 | 0 | 93 |
| *purchwait_1* | 1997-2010* | 686 | 0.25 | 0.43 | 0 | 1 |
| *purchwait_2* | 1997-2010* | 684 | 42.64 | 117.72 | 0 | 720 |
| *state_license* | 1997-2010* | 692 | 1.07 | 2.09 | 0 | 11 |
| *local_preempt* | 1997-2010* | 688 | 0.80 | 0.40 | 0 | 1 |
| *Interstate* | 1997-2010* | 650 | 0.65 | 0.48 | 0 | 1 |
| *BC/LC_index_1* (traffic) | 2006-2010 | 250 | 4.42 | 5.43 | 0 | 22 |
| *BC/LC_index_2* (checks) | 2006-2010 | 250 | 3.02 | 6.07 | 0 | 23 |
| *BC/LC_index_3* (child) | 2006-2010 | 250 | 1.78 | 2.52 | 0 | 9 |
| *BC/LC_index_4* (public) | 2006-2010 | 250 | 4.32 | 1.97 | 0 | 8 |
| *V/H_index_1* (traffic) | 1986-1999 | 700 | 1.95 | 2.77 | 0 | 10 |
| *V/H_index_2* (checks) | 1986-1999 | 700 | 1.36 | 1.97 | 0 | 8 |
| *V/H_index_3* (child) | 1986-1999 | 700 | 0.64 | 1.47 | 0 | 4 |
| *V/H_index_4* (ban) | 1986-1999 | 700 | 0.30 | 0.82 | 0 | 4 |
| *V/H_index_5* (sentence) | 1986-1999 | 700 | 1.29 | 0.58 | 0 | 2 |
| *log_population* | 1986-2010 | 1,250 | 15.03 | 1.01 | 13.02 | 17.43 |
| *log_est* | 1990-2010 | 1,049 | 8.43 | 1.06 | 6.14 | 11.00 |
| *u_member* | 1986-2010 | 1,250 | 0.17 | 0.18 | 0.009 | 1 |
| *wage_q* | 1990-2010 | 1,049 | 1 | 0.39 | 0.16 | 2.10 |
| *taxes_pc* | 1992-2010 | 950 | 1.93 | 0.73 | 0.72 | 12.70 |
| *violent_crimes_pc* | 1986-2010 | 1,250 | 0.005 | 0.002 | 0.00 | 0.01 |
| *property_crimes_pc* | 1986-2010 | 1,250 | 0.039 | 0.011 | 0.02 | 0.08 |

Notes: * 1998 ATF/Laws data is missing for some states. ** 50 states times 25 years yields 1,250 observations.

Regarding public sector-related control variables, we include total state revenue from taxation per capita (*taxes_pc*), with the data taken from the U.S. Census Bureau. A priori, we expect a negative sign with respect to the number of firms operating in a state (the higher the per capita tax burden, the smaller the number of firms). Finally, we also introduce controls that account for the level of crime in a given state; hence, we include variables measuring violent

crimes (*violent_crimes_pc*) and property crimes (*property_crimes_pc*), both per capita and with data taken from the Disaster Center <disastercenter.com/crime/>, which provides access to crime statistics compiled by the Federal Bureau of Investigation. For both crime variables, we expect a negative sign (even firearms manufacturers do not like to live in relatively insecure states) but in neither case would we necessarily expect a statistically significant coefficient.

**4. Estimation methods and results**

We ran regressions with the total number of firearms manufacturing locations per state per year (*n_plant_state*) as the dependent variable.[20] We ran standard OLS as well as Poisson (count data) regressions.[21] In both cases we take into account the panel structure of our data and introduce time and state fixed effects in all the regressions performed. We report in the main text the linear regression results, which are on the whole as good as the Poisson results for estimating average marginal effects (the Poisson results are reported in the Appendix).

Given the inherent uncertainties with the data, our focus lies with the sign and statistical significance rather than with the numerical size of the estimated coefficients, and it is reassuring that our results are consistent both within and across the chosen estimation procedures (see Section 5).

We report two tables of results each for the estimations: (1) for the ATF/Laws data (Tables 6 and 7); (2) for the BC/LC data (Tables 8 and 9); and (3) for the V/H data (Tables 10 and 11). In each case, the first table introduces all the regulatory indices at the same time and the control variables progressively (economic, crime, and public sector controls); the second table reverses this. Except for regression constants, all coefficients that are statistically significant (at the usual levels of 0.01, 0.05, and 0.10) are presented in the tables in **bold type-font**.

Table 6 reports on the matching of ATF/AFMER with ATF/Laws data for 1997-2010 and 2000-2010 (given that the some data for 1998 are missing) and for our control variables. Since the results are not altered by the missing observations for 1998, Table 7 uses the entire 1997 to 2010 time period. The goodness of fit obtained for the estimations with both the ATF/Laws and the BC/LC data is similar at around 0.56 (Tables 6 to 9). A different goodness of fit is obtained for the V/H data (around 0.19). In the latter case (Tables 10 and 11), to cover the 1986 to 1999 time period it was necessary to reduce the number of control variables as the data for some controls are available only as from 1990 and 1992, respectively.

Reading Tables 6 and 7 for our variables of interest, note that the only AFT/Law variable that is statistically significant is *state_license*. As expected, it is negatively related to the number of plants producing firearms in a given state. The other law variables are not statistically significant.

Similarly, the results for the BC/LC data (Tables 8 and 9) show that the only consistently statistically significant regulatory index variable is *BC/LC_index_1* (curb firearm trafficking). Again, as expected, it is negatively related to the number of plants producing in a given state.

The results for the V/H data (see Tables 10 and 11), covering the 1986-1999 data span, show a statistically significant *V/H_index_2* (related to background checks), which is negatively related to the number of firearms plants producing a given state.

As mentioned, all estimations include time and state fixed effects as well as a number of control variables. Regarding the controls, on the whole we obtain the expected results, and they are fairly stable across the estimations. Population seems to play a positive and statistically significant role with respect to the number of plants located in a given state. More populous states may be expected to have correspondingly more entrepreneurs and businesses, including

those producing firearms. Higher state tax revenues (more fiscal pressure) are associated in a negative and statistically significant way to the number of plants producing in a given state. An elevated level of crime seems to play a negative role, if at all, with respect to plant location. Higher rates of unionization and higher industrial wages paid in a given state also seem to play, if at all, an adverse role with respect to the number of firearms plants located in a given state.

Table 6. ATF/Laws. Panel estimates (I).

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | 1997-2010 | | | 2000-2010 | |
| REGULATORY VARIABLES | | | | | | |
| - *purchwait_1* | -0.549 | -1.179 | -1.109 | -0.216 | -1.069 | -1.003 |
| | (1.581) | (1.774) | (1.746) | (1.596) | (1.819) | (1.788) |
| - *state_license* | **-0.864**** | **-0.899**** | **-0.908**** | **-0.850**** | **-0.830**** | **-0.827**** |
| | **(0.357)** | **(0.374)** | **(0.373)** | **(0.356)** | **(0.369)** | **(0.361)** |
| - *local_preempt* | 3.283 | 4.508 | 4.372 | 3.095 | 3.845 | 3.795 |
| | (3.421) | (3.118) | (3.083) | (2.923) | (2.939) | (2.947) |
| - *interstate* | 0.544 | -0.182 | -0.359 | 0.984 | 0.297 | 0.066 |
| | (0.881) | (0.871) | (0.820) | (1.098) | (1.144) | (1.053) |
| ECONOMIC CONTROLS | | | | | | |
| - *log_est* | -11.416 | -3.334 | -2.775 | -19.051 | -10.185 | -8.910 |
| | (10.132) | (10.586) | (10.480) | (12.985) | (12.603) | (12.455) |
| - *wage_q* | -3.092 | -4.162 | -5.505 | -3.860 | -4.937 | -6.559 |
| | (7.340) | (7.601) | (7.696) | (7.886) | (8.085) | (8.152) |
| - *u_member* | -0.156 | -0.054 | 0.101 | 0.293 | 0.385 | 0.488 |
| | (1.208) | (1.271) | (1.246) | (0.863) | (0.842) | (0.797) |
| - *log_population* | **81.347**** | **70.142**** | **67.135**** | **118.945***** | **102.540**** | **98.606**** |
| | **(34.450)** | **(33.012)** | **(32.865)** | **(42.221)** | **(40.358)** | **(40.356)** |
| CRIME CONTROLS | | | | | | |
| - *log_violent_crimes_pc* | | **-8.275***** | **-7.064**** | | **-9.341**** | **-7.855**** |
| | | **(3.013)** | **(2.939)** | | **(3.843)** | **(3.842)** |
| -*log_property_crimes_pc* | | -4.667 | -5.951 | | -7.192 | -8.950 |
| | | (6.433) | (6.342) | | (7.395) | (7.343) |
| PUBLIC SECTOR CONTROLS | | | | | | |
| - *taxes_pc* | | | **-1.740***** | | | **-1.721***** |
| | | | **(0.461)** | | | **(0.470)** |
| constant | -1,119.3** | -1,079.9** | -1,030.4** | -1,625.4*** | -1,528.7*** | -1,472.8** |
| | (485.6) | (456.0) | (456.7) | (591.4) | (559.8) | (559.5) |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 606 | 606 | 606 | 538 | 538 | 538 |
| R-squared | 0.587 | 0.605 | 0.617 | 0.605 | 0.624 | 0.636 |
| Number of states | 49 | 49 | 49 | 49 | 49 | 49 |

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Using *purchwait_2* does not change the reported results. There are 49 states because Hawaii, with no reported firearms manufacturer plants for the whole period (see Table 1), was dropped from the analysis.

Table 7. ATF/Laws. Panel estimates, 1997-2010 (II).

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| REGULATORY VARIABLES | | | | |
| - *purchwait_1* | -0.982 | | | |
| | (1.658) | | | |
| - *state_license* | | **-0.720**** | | |
| | | **(0.343)** | | |
| - *local_preempt* | | | 2.799 | |
| | | | (2.371) | |
| - *interstate* | | | | -0.235 |
| | | | | (0.766) |
| ECONOMIC CONTROLS | | | | |
| - *log_est* | 3.361 | -1.859 | 4.852 | 2.108 |
| | (10.169) | (8.787) | (9.825) | (10.404) |
| - *wage_q* | -3.650 | -2.595 | -2.813 | -4.614 |
| | (7.026) | (6.436) | (6.786) | (8.073) |
| - *u_member* | 0.613 | 0.250 | 0.592 | 0.359 |
| | (1.057) | (0.939) | (1.046) | (1.379) |
| - *log_population* | **48.598*** | **55.046**** | **49.387*** | **58.822*** |
| | **(27.053)** | **(27.056)** | **(27.809)** | **(30.084)** |
| CRIME CONTROLS | | | | |
| - *log_violent_crimes_pc* | **-4.853*** | **-5.115**** | **-5.098**** | **-5.999**** |
| | **(2.473)** | **(2.494)** | **(2.499)** | **(2.855)** |
| - *log_property_crimes_pc* | -4.131 | -3.007 | -4.164 | -4.763 |
| | (209.41) | (201.75) | (205.38) | (228.50) |
| PUBLIC SECTOR CONTROLS | | | | |
| - *taxes_pc* | **-1.870***** | **-1.899***** | **-1.914***** | **-1.878***** |
| | **(0.545)** | **(0.571)** | **(0.587)** | **(0.579)** |
| constant | -787.029** | -838.824** | -817.084** | -938.460** |
| | (375.6) | (377.3) | (386.8) | (420.6) |
| Time Fixed Effects | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 673 | 677 | 673 | 636 |
| R-squared | 0.586 | 0.601 | 0.588 | 0.600 |
| Number of states | 49 | 49 | 49 | 49 |

Note: See Table 6.

Table 8. BC/LC Data. Panel estimates, 2006-2010 (I).

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| REGULATORY VARIABLES | | | | |
| - *BC/LC_index_1* (traffic) | **-0.982*** ** | **-0.848** ** | **-0.980** ** | **-0.988*** ** |
| | **(0.357)** | **(0.370)** | **(0.367)** | **(0.367)** |
| - *BC/LC_index_2* (checks) | -0.569 | -0.805 | -1.020 | -1.011 |
| | (1.916) | (1.598) | (1.783) | (1.787) |
| - *BC/LC_index_3* (child) | 0.536 | **0.801*** | 0.583 | 0.571 |
| | (0.478) | **(0.444)** | (0.400) | (0.403) |
| - *BC/LC_index_4* (public) | -0.415 | 0.093 | -0.036 | -0.045 |
| | (0.578) | (0.527) | (0.523) | (0.516) |
| ECONOMIC CONTROLS | | | | |
| - *log_est* | | -22.198 | -18.977 | -18.387 |
| | | (22.225) | (21.389) | (21.204) |
| - *wage_q* | | -23.208 | -26.266 | **-27.266*** |
| | | (18.079) | (15.782) | **(15.495)** |
| - *u_member* | | -2.012 | -1.528 | -1.312 |
| | | (2.136) | (1.943) | (2.022) |
| - *log_population* | | **180.929** ** | **158.363** ** | **155.304*** |
| | | **(72.523)** | **(75.980)** | **(77.246)** |
| CRIME CONTROLS | | | | |
| - *log_violent_crimes_pc* | | | **-12.226*** ** | **-11.628*** ** |
| | | | **(4.126)** | **(4.249)** |
| - *log_property_crimes_pc* | | | 0.967 | -0.485 |
| | | | (9.592) | (10.054) |
| PUBLIC SECTOR CONTROLS | | | | |
| - *taxes_pc* | | | | -0.516 |
| | | | | (0.317) |
| constant | 17.070*** | -2,513.099** | -2,258.576** | -2,216.591* |
| | (5.606) | (1,059.5) | (1,090.3) | (1,110.2) |
| Time Fixed Effects | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 245 | 245 | 245 | 245 |
| R-squared | 0.486 | 0.559 | 0.587 | 0.589 |
| Number of states | 49 | 49 | 49 | 49 |

Note: See Table 6.

Table 9. BC/LC Data. Panel estimates, 2006-2010 (II).

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| REGULATORY VARIABLES | | | | |
| - *BC/LC_index_1* (traffic) | **-0.677**** | | | |
| | **(0.320)** | | | |
| - *BC/LC_index_2* (checks) | | -0.249 | | |
| | | (1.116) | | |
| - *BC/LC_index_3* (child) | | | 0.345 | |
| | | | (0.397) | |
| - *BC/LC_index_4* (public) | | | | -0.271 |
| | | | | (0.538) |
| ECONOMIC CONTROLS | | | | |
| - *log_est* | -12.195 | -10.281 | -13.248 | -10.690 |
| | (21.089) | (21.520) | (21.726) | (21.569) |
| - *wage_q* | **-27.905*** | **-28.616*** | **-28.924*** | **-29.128*** |
| | **(14.864)** | **(14.900)** | **(14.917)** | **(14.969)** |
| - *u_member* | -1.309 | -1.509 | -1.566 | -1.347 |
| | (1.909) | (1.942) | (1.951) | (2.077) |
| - *log_population* | **147.402*** | **152.257*** | **157.864*** | **151.483*** |
| | **(80.900)** | **(81.929)** | **(79.925)** | **(79.499)** |
| CRIME CONTROLS | | | | |
| - *log_violent_crimes_pc* | **-12.021***** | **-11.226***** | **-10.688**** | **-11.165***** |
| | **(4.161)** | **(4.057)** | **(4.085)** | **(4.163)** |
| - *log_property_crimes_pc* | -1.590 | -2.044 | -1.587 | -1.950 |
| | (10.200) | (10.197) | (9.986) | (10.253) |
| PUBLIC SECTOR CONTROLS | | | | |
| - *taxes_pc* | -0.537 | -0.509 | -0.493 | -0.510 |
| | (0.324) | (0.333) | (0.334) | (0.328) |
| constant | -2,157.229* | -2,242.975* | -2,299.838** | -2,229.807* |
| | (1,149.206) | (1,162.021) | (1,142.707) | (1,123.128) |
| Time Fixed Effects | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 245 | 245 | 245 | 245 |
| R-squared | 0.584 | 0.576 | 0.577 | 0.576 |
| Number of states | 49 | 49 | 49 | 49 |

Note: See Table 6.

Table 10. V/H Data. Panel Estimates, 1986-1999 (I).

| | (1) | (2) | (3) |
|---|---|---|---|
| REGULATORY VARIABLES | | | |
| - *V/H_index_1* (traffic) | 0.158 | 0.159 | 0.154 |
| | (0.110) | (0.110) | (0.110) |
| - *V/H_index_2* (checks) | **-0.459*** | **-0.453*** | **-0.444*** |
| | **(0.261)** | **(0.257)** | **(0.264)** |
| - *V/H_index_3* (child) | 0.013 | 0.018 | 0.013 |
| | (0.132) | (0.132) | (0.142) |
| - *V/H_index_4* (ban) | -0.292 | -0.285 | -0.315 |
| | (0.247) | (0.237) | (0.242) |
| - *V/H_index_5* (sentence) | -0.327 | -0.285 | -0.434 |
| | (1.050) | (1.012) | (0.966) |
| ECONOMIC CONTROLS | | | |
| - *u_member* | | -0.533 | -0.511 |
| | | (0.318) | (0.319) |
| - *log_population* | | -0.546 | -0.691 |
| | | (2.865) | (2.792) |
| CRIME CONTROLS | | | |
| - *log_violent_crimes_pc* | | | -0.866 |
| | | | (0.862) |
| - *log_property_crimes_pc* | | | -0.387 |
| | | | (1.782) |
| constant | 3.553** | 11.775 | 8.144 |
| | (1.620) | (42.902) | (42.160) |
| Time Fixed Effects | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes |
| Observations | 686 | 686 | 686 |
| R-squared | 0.195 | 0.197 | 0.201 |
| Number of states | 49 | 49 | 49 |

Note: See Table 6.

Table 11. V/H Data. Panel Estimates, 1986-1999 (II).

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| REGULATORY VARIABLES | | | | | |
| - *V/H_index_1* (traffic) | 0.162 | | | | |
| | (0.112) | | | | |
| - *V/H_index_2* (checks) | | **-0.505*** | | | |
| | | **(0.268)** | | | |
| - *V/H_index_3* (child) | | | -0.120 | | |
| | | | (0.151) | | |
| - *V/H_index_4* (ban) | | | | -0.437 | |
| | | | | (0.281) | |
| - *V/H_index_5* (sentence) | | | | | -1.024 |
| | | | | | (0.772) |
| ECONOMIC CONTROLS | | | | | |
| - *u_member* | **-0.697*** | -0.635 | -0.693 | -0.658 | -0.597 |
| | **(0.389)** | (0.394) | (0.444) | (0.452) | (0.367) |
| - *log_population* | -0.826 | 0.160 | -0.028 | -0.734 | -0.881 |
| | (2.674) | (2.849) | (2.644) | (2.659) | (2.667) |
| CRIME CONTROLS | | | | | |
| - *log_violent_crimes_pc* | -0.745 | -0.678 | -0.665 | -0.855 | -0.968 |
| | (0.787) | (0.824) | (0.823) | (0.802) | (0.799) |
| - *log_property_crimes_pc* | 0.020 | -0.242 | -0.262 | -0.031 | -0.167 |
| | (1.669) | (1.673) | (1.806) | (1.681) | (1.658) |
| Constant | 11.110 | -2.696 | -0.323 | 9.944 | 12.345 |
| | (40.112) | (42.398) | (39.802) | (39.567) | (39.645) |
| Time Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Observations | 686 | 686 | 686 | 686 | 686 |
| R-squared | 0.178 | 0.190 | 0.175 | 0.178 | 0.180 |
| Number of states | 49 | 49 | 49 | 49 | 49 |

Note: See Table 6.

## 5. Discussion and conclusion

The key table in this paper, Table 12, summarizes all of our empirical findings. Bear in mind that the law variables—ATF/Laws (1997-2010), BC/LC (2006-2010), and V/H (1986-1999)—are not strictly comparable, so that the results should be read primarily downward *within* each of the two-column sets and only secondarily, if at all, *across* them. Reading across, however, is attractive because of the long time-period then covered, 1986 to 2010.

Table 12 is constructed as follows. The first column lists the three sets of law variables, plus the control variables. Then follow three sets of columns, one each for the results of the regressions with each set of law variables. The negative and plus signs indicate the sign of the estimated parameter, taken from Tables 6 to 11. Shaded cells indicated that the parameter is statistically significant. An estimate that meets our a priori expectations receives a single checkmark if the sign is in the expected direction, and a double checkmark if that parameter also is statistically significant.

For the ATF/Laws columns, the law variables conform to our expectations. The state license requirement is associated with a smaller number of firearms manufacturers located in the state. The requirement is not onerous per se but may indicate a stricter regulatory "climate" in the state. The other variables are not statistically significant but go in the direction we would expect except for the interstate commerce with contiguous states variable on which we had no

expectation for the sign, only that it not be statistically significant (which it is not). The signs for the economic, state revenue, and crime variables are for the most part in the expected direction, and several are statistically significant.

Table 12. Summary of results.

| | ATF/Laws (1997-2010) | | BC/LC (2006-2010) | | V/H (1986-1999) | |
|---|---|---|---|---|---|---|
| | Table 6 | Table 7 | Table 8 | Table 9 | Table 10 | Table 11 |
| Law variables entry => | simultaneous | one by one | simultaneous | one by one | simultaneous | one by one |
| *purchwait_1* | - ✓ | - ✓ | | | | |
| *state_license* | - ✓✓ | - ✓✓ | | | | |
| *local_preempt* | + ✓ | + ✓ | | | | |
| *Interstate* | [+] | [-] | | | | |
| *BC_index_1* (traffic) | | | - ✓✓ | - ✓✓ | | |
| *BC_index_2* (checks) | | | - ✓ | - ✓ | | |
| *BC_index_3* (child) | | | [+] | [+] | | |
| *BC_index_4* (public) | | | - ✓ | - ✓ | | |
| *VH_index_1* (traffic) | | | | | + | + |
| *VH_index_2* (checks) | | | | | - ✓✓ | - ✓✓ |
| *VH_index_3* (child) | | | | | [+] | [-] |
| *VH_index_4* (ban) | | | | | - ✓ | - ✓ |
| *VH_index_5* (sentence) | | | | | - ✓ | - ✓ |
| *log_est* | - ✓ | + | - ✓ | - ✓ | x | x |
| *wage_q* | - ✓ | - ✓ | - ✓✓ | - ✓✓ | x | x |
| *u_member* | + | + | - ✓ | - ✓ | - ✓ | - ✓ |
| *log_population* | + ✓✓ | + ✓✓ | + ✓✓ | + ✓✓ | - | - |
| *-log_violent_crimes_pc* | - ✓✓ | - ✓✓ | - ✓✓ | - ✓✓ | - ✓ | - ✓ |
| *-log_property_crimes_pc* | - ✓ | - ✓ | - ✓ | - ✓ | - ✓ | - ✓ |
| *taxes_pc* | - ✓✓ | - ✓✓ | - ✓ | - ✓ | x | x |

Note: Summary of results from the linear estimates (Tables 6 to 11). Cells shaded in grey indicate statistically significant estimates. "x" indicates not used. […] indicates that we had no expectation on the direction of the sign (nor expected statistical significance).

For the BC/LC columns, recall first that the law variables are *composites*, constructed from several underlying variables (see Table 3). The *BC/LC_index_1* (traffic) variable is statistically significant and in the expected direction (negative) and is a summary measure intended to capture the existence of state-level firearms dealer regulation; the imposition of limits to bulk firearms purchases; laws to assist crime gun identification; and a reporting requirement for lost or stolen firearms. Together they appear aimed at curbing firearms trafficking. While no legitimate firearms manufacturer would object to this on a per se basis, at the perceptual level such efforts do indicate a less "gun-friendly" state climate for the firearms industry. The remaining law and control variables are all in the expected direction (where we had expectations).

The V/H index variables, like their BC/LC "cousins", are composites (see Table 4). Here, the traffic variable consists of state legislation to restrict firearms sales to one firearm per month; a state dealer license and inspection requirement; and the imposition of a minimum age for the

purchase and sale of firearms. In our estimations, the sign points in the opposite direction to what we expected but the coefficient for the index is not statistically significant. The other law index variables all point in the expected direction (where we had an expectation), and one is statistically significant. For the control variables, the results also are as expected except for the population variable, the sign of which goes in the opposite direction of what we expected but is not statistically significant in any case.

One observation that seems puzzling at first is that the *traffic* index for the BC/LC data shows the expected negative sign and is statistically significant, whereas for the V/H data it is not statistically significant (and positive). Similarly, although both carry the expected negative sign, the *check* index variable for the BC/LC data (state universal background check requirement and state permit needed to purchase a firearms) is not statistically significant while a similar check index variable for the V/H data (state permit needed to purchase a firearm; firearm registration required; background checks for sales from dealers; background checks for private sales) is statistically significant. In other words, in one case the traffic index is significant and the check index is not (BC/LC); in the other case we have the opposite result (V/H). The difference in the years covered may explain this: Federal-level background checks were introduced only as of November 1998. Thus, in the V/H data (1986-1999), state-level background checks were the only kind of checks conducted and might be expected to carry a significant negative coefficient on the parameter; in contrast, the BC/LC state-level data for 2006-2010 are additional to federal background checks and might not be expected to make much of an additional impact in terms of manufacturers' location decisions. And as regards the traffic index variables, the potential for firearms trafficking would seem to have mattered more in the 2000s (BC/LC) than it mattered in the 1970s to 1990s (V/H).

Taken as a whole, for the vast majority of our variables our results conform to the expectation that more "lax" firearms law is associated with larger numbers of firearms manufacturers located in a given state and year, 1986 to 2010. The laws that our variables capture are not primarily about production; instead, they are about the product (e.g., bans), its distribution (e.g., state license for dealers), its monitoring (e.g., firearm registration; purchase restrictions), and its end-use (e.g., child access prevention; sentencing laws). They would thus seem to capture a given state's overall "attitude" and hence business "climate" for current or prospective firearms manufacturers and might be seen to influence a firearms manufacturer's "preference" to locate in one state or another. If this is the correct interpretation of our findings, then both sides in the debate—"pro" and "con"—should be pleased with our results: Both might argue "I told you so: Laws matter!" The scholarly point of course is that to the best of our knowledge we now have not only a first-time quantitative, empirical confirmation that laws matter but a hint about the direction in which further tightening or relaxation of relevant law "should" go.

Apart from limitations pertaining to the underlying data (such as quality, coverage, coding, and indexing choices, which would not be easy to redress in any subsequent research), one might think of one technical, econometric problem in our work: endogeneity. Statistically speaking, our equations imply that law is the "cause" and location is the "consequence." It would seem possible for the reverse to be true, that location (or rather presence) is the "cause" that induces a "consequent" change in law. Yet this is not convincing because the laws we track are, once more, not about production but about the (potential and actual misuse and abuse of the) product. Moreover, given our annual data, endogeneity drives on the statistical presumption of a fairly quick action—reaction pattern, from law to location and from location to law. Neither is likely to

be true in practice. Our ATF/AFMER database tells us that, once located in one state, it is exceedingly rare for a firearms manufacturer to move its entire operation to another state, and our statistical procedure is careful in that it only measures location per se, *not the movement* of manufacturers from one location to another. The PTR-91 example referred to in Section 2 is exceptional. Instead, the norm is given by the other examples, Kahr Arms, Remington Arms, Ruger, and Beretta USA: State locations can atrophy over time as companies gradually shift production toward expansions that are undertaken in new states.

The re/location process is slow and historical and it is as wrapped up with the economic control variables, especially the cost of doing business (e.g., taxation, unionization, wage rates, and competition for qualified workers given the existing manufacturing base in a state) as it is wrapped up with firearms law. In fact, as exemplified by the automotive industry, it is common knowledge that the U.S. manufacturing base has slowly shifted out of the country's Northeast region to the Midwest, South, and Southwest (from "rustbelt" to "sunbelt"). As the market share of U.S.-brands has declined, its spatial concentration, focused on Detroit, Michigan, has declined as well. Conversely, non-U.S. brands haven chosen to locate in the Midwest and the South.[22]

In a way, our findings then are reassuring. The firearm industry is "just another industry" in that it responds to economic incentives and disincentives, of which relevant state laws are an example: They play but an incremental role at the decision-making margin. And in this regard, even the PTR-91 example fits the bill: News reports spoke as much of the economic incentives offered as of the "gun-friendly" culture that induced the company to move from Connecticut to South Carolina in 2013.[23]

**Acknowledgements**

We thank Mr. Mario Barrera, Ms. Angela Mediavilla, and Mr. SergiSansano for assistance with data entry. We thank Dr. Eric Fleegler of the Boston Children's Hospital, Dr. David Hemenway (Harvard University), Dr. Philip J. Cook (Duke University), and Mr. Sam Hoover, staff lawyer at the Law Center, San Francisco, for assistance with data searches. Daniel Montolio acknowledges financial support from grant 2009SGR102 (Catalan Government). Jurgen Brauer acknowledges support from the Chair in Markets and Industrial Policy at the Barcelona Institute of Economics (IEB), University of Barcelona, for a visiting fellowship in May 2012 in Barcelona, Spain

---

[1] It is worth noting that, as of 9 January 2014, at least a further 31 school shootings have been recorded in the United States with a total of 62 casualties (26 dead and 36 injured). See http://en.wikipedia.org/wiki/List_of_school_shootings_in_the_United_States#2010s [accessed 12 January 2014].

[2]Of the ample literature see, e.g., Cook and Ludwig (2000); Hemenway (2004).On illicit trade, see, e.g., McDougal*et al*. (2013).

[3] As from the 1960s and into the early 1980s, economic historians debated the role of firearms manufacturing within the "American System of Manufacture," that is, its role in the advent of mechanization and mass production with interchangeable parts in the 1800s. Industries that worked with metals and revolving parts such as agricultural implements (e.g., reapers), sewing machines, clock making, bicycles, locomotives, and firearms played a prominent role as precursors to the rise of industrialization (see, e.g., Habakkuk, 1962; Rosenberg, 1963; Howard, 1979; Smith Merritt, 1973; Hounshell, 1984). For more recent, industrial organization type of work, see Hall*et al*. (2008) and, especially, Brauer (2013).

[4] That is, more than 2,700 addresses spread over 25 years give us nearly 6,000 data points.

[5] To be precise, the Brady Campaign to Prevent Violence (Washington, D.C.) produces its annual "State Scorecard" in conjunction with the LawCenter to Prevent Gun Violence (San Francisco, CA). The reports were published in

2007, 2008, 2009, 2010, and 2011 but appear to refer to the years 2006 to 2010, respectively. (In December 2013, an updated version was published, referring to the year 2013.) In addition, Mayors Against Illegal Guns (MAIG, 2010) produced a one-time effort to code state laws.

[6]See, e.g., Fleegler, *et al*. (2013); Kahane (2013); Knight (2013); Lanza (2013).

[7] Note that we do not test for factors that may induce manufacturers to *move* from one state to another. We only test for actual presence, not for changes in the presence of firearms manufacturers.

[8] A summary of firearms control proposals being debated is provided by Krouse (2013).

[9] A journalistic summary with examples is Ghosh (2014).

[10] This is the same Remington that also originated Remington typewriters, sewing machines, cash registers, and electric shavers, pointing to the metals and revolving parts origin of the industry. These divisions have long since been spun off and are no longer associated with Remington Arms.

[11] Remington Arms, LLC, is a division of Remington Outdoor Company, Inc., formerly Freedom Group, Inc., which also owns a variety of other firearms brands, ammunition, accessories, and other interests. Location decisions presumably reflect not just the economic interests of the Remington Arms division alone but of the conglomerate at large.

[12] "Ruger has been made eligible for up to $9.46 million in performance-based incentives from the state's Job Development Grant. There also could be about another $4 million in state incentives related to employee training and infrastructure construction, as well as $1.79 million in local incentives." Richard Craver, *Winston-Salem Journal*, 6 November 2013 <http://www.journalnow.com/business/business_news/local/article_69d18da6-4705-11e3-b38c-0019bb30f31a.html>.

[13] Jeff Reh, Member, Beretta USA Board of Directors: "Around March 2013 the Beretta family decided to expand its manufacturing and business operations outside Maryland, where Beretta U.S.A. is located. We started our search by looking only at States that have a consistent history of support for and likelihood of future support for Second Amendment rights. We then reduced this list of States further by looking at traditional business-related factors such as tax rates, cost of living, cost of doing business, availability of white and blue collar workers, traditions of high-level manufacturing in the area, the quality of local educational institutions, availability of job recruitment, screening and training, and so forth." See http://www.beretta.com/en-us/transcript-of-jeff-rehs-speech-on-new-plant-in-tennessee/. Also see the 29 January 2014 *Washington Times* news account at http://www.washingtontimes.com/news/2014/jan/29/beretta-announces-tennessee-plant-says-its-not-lea/#ixzz2rzAntvLW

[14] One caution: The phrase "released into commerce" is not necessarily equal to "production". The manufacturers do not in fact report their actual annual production. This is because production into inventories is not counted. In contrast, sales *from* inventories are counted. For example, suppose manufacturer ABC produced 1,000 firearms in 2009, sold 900, and put the remaining 100 into inventory. For 2009 it would report to the ATF 900 firearms "released into commerce," not 1,000. Suppose, moreover, that ABC produced 1,500 firearms in 2010, but sold 1,600 (1,500 produced plus 100 from the prior year's inventory). For the year 2010 ABC would report to the ATF sales of 1,600, not 1,500. Incidentally, as reporting compliance has been spotty in the past, it is also known with certainty that hundreds of thousands of firearms go altogether unreported (see Brauer, 2013, for details and estimates of unreported production).

[15] We know from Brauer (2013) that firearms manufacturing is highly stratified into pistols, revolvers, rifles, and shotguns. By far the vast majority of manufacturers produce in only one of the four segments. It is therefore possible that state firearms laws affect manufacturers' location decisions in different ways (e.g., pistol use appears to be more heavily regulated than rifle use) but we have run our regressions only across all types of firearms produced.

[16] As of this writing, the Brady Campaign is at www.stategunlaws.org and the Law Center at www.smallgunlaws.org [both accessed on 15 January 2014].

[17]Vernick and Hepburn (2003) themselves attach extensive cautions to their coding, far too numerous to repeat or even summarize here, and we urge readers to read their original work to understand inherent data limitations.

[18] Note that even though we do not compute a single aggregate index across all the BC/LC and V/H data, respectively, we did retain the variable weights assigned by the respective original scorers.

[19] There is a broad economic literature dealing with the determinants of industrial location (for a recent survey, seeArauzo-Carod,*et al*., 2010). It generally focuses on the main determinants of firms' location decision by observing the number of new firms/plants in a given location. This is then modeled with a discrete choice model

with factors shaping the agent's decision and the factors related to the set of alternatives (locations) from which the choice is made. Although we focus on the number of existing plants in a given state,rather than the number new plants,our estimates take the usual determinants of industrial location into account. Broadly speaking, these are neoclassical factors (such as agglomeration economies, market structure, or labor force characteristics) and institutional factors (such as public sector intervention).

[20] Note that we focus throughout the paper on the analysis of the impact of the regulatory environment on the *number of firms (plants)* producing in a given state. We also performed regressions using the *number of firearms produced*. As might be expected, we found no statistically significant results of the regulatory variables on production levels: State laws seem to affect the decision to locate, not the level of production once the location is chosen (these regressions are not reported here but are available upon request).

[21] The Poisson estimates are performed as a robustness exercise, given the nature of our dependent variable. As explained, our dependent variable is simply an observation about the number of firms located in, say, Florida. It could well be the case that those firms have been located there since the 1960sbut decided to engage in firearms production only in, say, 1993. Hence, the Florida plant located there in the 1960s and not when we observe, through the ATF/AFMER record, that the firm is there. What we explain is the number of firms located in state *x* in period *y*; we do not observe the decision to move to state *x* in period *y*.

[22] Thus, foreign nameplates opening plants as from the 1980s onward are located as follows: Toyota (in IN, KY, MS, TX); Honda (AL, IN, OH); Nissan (MS, TN); Fuji Heavy Industries (i.e., Subaru) (IN); Mitsubishi (IL); Volkswagen (TN); Hyundai (AL); Kia (GA); BWM (SC); and Daimler (i.e., Mercedes-Benz) (AL).

[23]This paper examines potential economic connections between state firearms law and firearms manufacturing location. Other research examines other aspects such as health and public safety of relatively lax or strict state firearms law: See, e.g., Webster, Crifasi, and Vernick (2014).

**References**

Arauzo-Carod, J.M., D. Liviano-Solis, M. Manjón-Antolín. 2010. "Empirical Studies in Industrial Location: An Assessment of Their Methods and Results". *Journal of Regional Science*. Vol. 50, No. 3, pp. 685-711.

[ATF1] Bureau of Alcohol, Tobacco, Firearms, and Explosives.Various years.*Annual Firearms Manufacturing and Export Report*. (AFMER.) Washington, D.C.: U.S. Department of Homeland Security. Bureau of Alcohol, Tobacco, Firearms, and Explosives.

[ATF2] Bureau of Alcohol, Tobacco, Firearms, and Explosives.Various years.*State Laws and Published Ordinances*—Firearms. Washington, D.C.: U.S. Department of Homeland Security. Bureau of Alcohol, Tobacco, Firearms, and Explosives.

[Brady] Brady Campaign to Prevent Violence. 2013. "2013 State Scorecard." See <http://bradycampaign.org/?q=2013-state-scorecard> [accessed 12 January 2014].

Brauer, J. 2013. "The US Firearms Industry: Production and Supply." Working Paper 14. Geneva: Small Arms Survey.

Cook, P.J., J. Ludwig. 2000. *Gun Violence: The Real Costs*. Oxford: Oxford University Press.

DeSimone, J., S. Markowitz, and J. Xu. 2013. "Child Access Prevention Laws and Nonfatal Gun Injuries." *Southern Economic Journal*. Vol. 80, No. 1, pp. 5-25.

Dube, A., O. Dube, and O. García-Ponce. 2013. "Cross-Border Spillover: U.S. Gun Laws and Violence in Mexico." *American Political Science Review*. Vol. 107, No. 3, pp. 397-417.

Fleegler, E.W., L.K. Lee, M.C. Monuteaux, D. Hemenway, and R. Mannix. 2013. "Firearm Legislation and Firearm-Related Fatalities in the United States." *JAMA Internal Med*. 6 March 2013.

Ghosh, P. 2014. "Southern Exposure: As Gun Sales Surge, Northeast Manufacturers Fleeing for Dixie."*International Business Times*. 10 January 2014. <http://www.ibtimes.com/southern-exposure-gun-sales-surge-northeast-manufacturers-fleeing-dixie-1533842> [accessed 13 January 2014].

Habakkuk, H.J. 1962. *American and British Technology in the Nineteenth Century: The Search for Labour-Saving Inventions*. Cambridge, UK: Cambridge University Press.

Hall, P, S Markowski, J Brauer. 2008. "The U.S. Small Arms Industry: Profit, Proliferation, Performance." *Asteriskos: Journal of International and Peace Studies*. Nos. 5/6, pp. 41-62.

Hemenway, D. 2004. *Private Guns, Public Health*. Ann Arbor, MI: The University of Michigan Press.

Hounshell, D.A. 1984. *From the American System to Mass Production, 1800-1932*. Baltimore, MD and London: The Johns Hopkins University Press.

Howard, R. 1979. "Interchangeable Parts Reexamined: The Private Sector of the American Arms Industry on the Eve of the Civil War." *Technology and Culture*. Vol. 19 (October), pp. 633-649.

Kahane, L.H. 2013. "Understanding the Interstate Export of Crime Guns: A Gravity Model Approach." *Contemporary Economic Policy*. Vol. 31, No. 3, pp. 618-634.

Knight, B. 2013. "State Gun Policy and Cross-State Externalities: Evidence from Crime Gun Tracing." *American Economic Journal: Economic Policy*. Vol. 5, No. 4, pp. 200-229.

Krouse, W.J. 2013. "Gun Control Proposals in the 113th Congress: Universal Background Checks, Gun Trafficking, and Military Style Firearms." Report 42987 (7 June 2013). Washington, D.C.: Congressional Research Service.

Lanza, S.P. 2013. "Targeting Gun Violence: Can We Reduce Gun Deaths and Not Loose Jobs?" University of Connecticut.*The Connecticut Economy*. Summer 2013, pp. 5-7.

[MAIG] Majors Against Illegal Guns. 2010. "Trace the Guns: The Link between Gun Laws and Interstate Gun Trafficking." September 2010.

McDougal, T., D.A. Shirk, R. Muggah, and J.H. Patterson. 2013. "The Way of the Gun: Estimating Firearms Traffic Across the U.S.-Mexico Border." IGARAPÉ Institute, Rio de Janeiro, and Trans-Border Institute, School of Peace Studies, University of San Diego, CA.

Rosenberg, N. 1963. "Technological Change in the Machine Tool Industry, 1840-1910." *Journal of Economic History*. Vol. 23, No. 4, pp. 414-443.

Smith Merritt, R. 1973. "John H. Hall, Simeon North, and the Milling Machine: The Nature of Innovation among Antebellum Arms Makers." *Technology and Culture*. Vol. 14, pp. 573-591.

Vernick, J.S. and L.M. Hepburn. 2003. "State and Federal Gun Laws: Trends for 1970-99," pp. 345-410 in J. Ludwig and P.J. Cook, eds. *Evaluating Gun Policy: Effects on Crime and Violence*. Washington, D.C.: The Brookings Institution.

Webster, D., C. KercherCrifasi and J.S. Vernick. 2014. "Effects of the Repeal of Missouri's Handgun Purchaser Licensing Law on Homicides." *Journal of Urban Health,* March.

## Appendix

Table A1. ATF/Laws. Poisson estimates, 1997-2010.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| REGULATORY VARIABLES | | | | |
| - *purchwait_1* | 0.024 | 0.010 | -0.004 | 0.009 |
| | (0.178) | (0.137) | (0.139) | (0.137) |
| - *state_license* | -0.046 | **-0.042*** | **-0.043*** | **-0.044*** |
| | (0.030) | **(0.025)** | **(0.025)** | **(0.024)** |
| - *local_preempt* | -0.040 | 0.095 | 0.116 | 0.100 |
| | (0.058) | (0.081) | (0.081) | (0.084) |
| - *interstate* | -0.093 | -0.038 | -0.046 | -0.054 |
| | (0.121) | (0.109) | (0.108) | (0.106) |
| ECONOMIC CONTROLS | | | | |
| - *log_est* | | 0.282 | 0.379 | 0.327 |
| | | (0.630) | (0.612) | (0.607) |
| - *wage_q* | | -0.969 | **-1.002*** | **-1.063*** |
| | | (0.596) | **(0.589)** | **(0.596)** |
| - *u_member* | | **-0.138*** | -0.138 | -0.131 |
| | | **(0.083)** | (0.084) | (0.083) |
| - *log_population* | | **2.506***** | **2.267***** | **2.114**** |
| | | **(0.854)** | **(0.862)** | **(0.857)** |
| CRIME CONTROLS | | | | |
| - *log_violent_crimes_pc* | | | -0.191 | -0.151 |
| | | | (0.203) | (0.210) |
| - *log_property_crimes_pc* | | | -0.166 | -0.171 |
| | | | (0.329) | (0.334) |
| PUBLIC SECTOR CONTROLS | | | | |
| - *taxes_pc* | | | | -0.125 |
| | | | | (0.076) |
| Time Fixed Effects | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 607 | 606 | 606 | 606 |
| Number of states | 49 | 49 | 49 | 49 |

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A2. BC/LC data. Poisson estimates, 2006-2010.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| REGULATORY VARIABLES | | | | |
| - *BC/LC_index_1* (traffic) | -0.028 | -0.030 | -0.029 | -0.029 |
| | (0.041) | (0.036) | (0.036) | (0.036) |
| - *BC/LC_index_2* (checks) | -0.094 | -0.087 | -0.087 | -0.088 |
| | (0.076) | (0.071) | (0.072) | (0.073) |
| - *BC/LC_index_3* (child) | 0.009 | **0.022*** | 0.017 | 0.017 |
| | (0.012) | **(0.013)** | (0.013) | (0.014) |
| - *BC/LC_index_4* (public) | 0.001 | 0.017 | 0.017 | 0.018 |
| | (0.016) | (0.018) | (0.018) | (0.020) |
| ECONOMIC CONTROLS | | | | |
| - *log_est* | | -0.706 | -0.459 | -0.449 |
| | | (0.490) | (0.612) | (0.628) |
| - *wage_q* | | **-1.558**** | **-1.635***** | **-1.637***** |
| | | **(0.636)** | **(0.615)** | **(0.611)** |
| - *u_member* | | **-0.263***** | **-0.257***** | **-0.258***** |
| | | **(0.086)** | **(0.084)** | **(0.083)** |
| - *log_population* | | **5.883***** | **5.410***** | **5.408***** |
| | | **(1.807)** | **(1.734)** | **(1.749)** |
| CRIME CONTROLS | | | | |
| - *log_violent_crimes_pc* | | | -0.039 | -0.038 |
| | | | (0.251) | (0.251) |
| - *log_property_crimes_pc* | | | -0.321 | -0.320 |
| | | | (0.327) | (0.327) |
| PUBLIC SECTOR CONTROLS | | | | |
| - *taxes_pc* | | | | -0.003 |
| | | | | (0.058) |
| Time Fixed Effects | Yes | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes | Yes |
| Observations | 240 | 240 | 240 | 240 |
| Number of states | 48 | 48 | 48 | 48 |

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A3. V/H Data. Poisson estimates, 1986-1999.

| | (1) | (2) | (3) |
|---|---|---|---|
| REGULATORY VARIABLES | | | |
| - *V/H_index_1* (traffic) | 0.024 | 0.030 | 0.030 |
| | (0.042) | (0.038) | (0.038) |
| - *V/H_index_2* (checks) | **-0.073*** ** | **-0.069*** ** | **-0.069*** ** |
| | **(0.021)** | **(0.021)** | **(0.021)** |
| - *V/H_index_3* (child) | -0.009 | -0.002 | -0.002 |
| | (0.019) | (0.019) | (0.021) |
| - *V/H_index_4* (ban) | -0.041 | -0.052 | -0.053 |
| | (0.036) | (0.033) | (0.033) |
| - *V/H_index_5* (sentence) | -0.043 | -0.064 | -0.067 |
| | (0.139) | (0.123) | (0.124) |
| ECONOMIC CONTROLS | | | |
| - *u_member* | | -0.079 | -0.078 |
| | | (0.062) | (0.061) |
| - *log_population* | | **-1.043*** | **-1.049*** |
| | | **(0.576)** | **(0.582)** |
| CRIME CONTROLS | | | |
| - *log_violent_crimes_pc* | | | -0.050 |
| | | | (0.217) |
| - *log_property_crimes_pc* | | | 0.034 |
| | | | (0.244) |
| Time Fixed Effects | Yes | Yes | Yes |
| State Fixed Effects | Yes | Yes | Yes |
| Observations | 672 | 672 | 672 |
| Number of states | 48 | 48 | 48 |